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This article is a commentary on a study published in this issue by Levine et al. (2019). They reported that the relation they observed between sex-related discrepancies in success on standardized tests and health outcomes is significant only in males. We suggest that this finding has important implications for educators and future research and we examine possibilities related to sex differences in school achievement. We also offer arguments suggesting that it is premature to propose a causal explanation for the results presented by Levine and colleagues, given that crucial conditions to establish such causality are not met in their studies. We conclude with a proposal for a study that could potentially determine whether the temporal ordering required to establish causality arises in the relation between health outcomes and the sex-related discrepancies.
Implications for School Achievement and Causality: A Commentary

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Abstract

This is a commentary on a paper published in this issue by Levine et al. (2019). They reported that the relation they observed between sex-related discrepancies in success on standardized tests and health outcomes is significant only in males. We suggest that this finding has important implications for educators and future research and we examine possibilities related to sex differences in school achievement. We also offer arguments suggesting that it is premature to propose a causal explanation for the results presented by Levine and colleagues given that crucial conditions to establish such causality are not met in their studies. We conclude with a proposed study that could potentially determine whether the temporal ordering required to establish causality arises in the relation between health outcomes and the sex-related discrepancies.

*Keywords:* Health outcomes; sex differences; school achievement
Implications for School Achievement and Causality: A Commentary on Levine et al. (2019)

Levine et al. (2019, this issue) presented two studies showing a negative relation between health outcomes and the discrepancy between the proportion of females to males who met or exceeded grade level expectations on standardized test performance. The crucial finding is that this relation emerged only in males, not in females. Among others, the strength of their results are reflected in the fact that the findings apply to several measures of health outcomes and they generalize across two disparate samples. From this perspective, the implications of these findings for sex differences in school achievement should be taken seriously. Accordingly, this commentary will consider some of these implications.

Levine et al. (2019) also argue that it is the discrepancy in the success of females compared to males in standardized tests that causes the observed differences in health outcomes (not the other way around). They suggest that disparity in girls and boys performance undermines the latter’s trust in their teacher and classmates; reduces their sense of belonging in school as well as perceived status; increases their stress related to attending school; and gives rise to poor health outcomes. Although they offer solid arguments to support this view, this commentary will also consider potential alternative accounts or confounding variables that undermine a causal conclusion at this point. Finally, this commentary will cover possibilities to provide an empirical study of causality in the relation between health outcomes and the females to males discrepancy in successful test scores.

Implications for Education

Although the study by Levine et al. (2019) concerns a broad measure of school success as defined by the proportion of students of each sex that meets or exceeds grades standard, one has to wonder how school grades might fit in the findings of a relation between this variable and
health outcome in males only. As a way to provide some information on this question, we scoured through the papers sampled by Voyer & Voyer (2014) in their meta-analysis of school grades and highlighted those that had even a remote relation with health factors. Therefore, we considered papers that made a clear mention of health, but also those that might be indirectly related to health outcomes such as class attendance, alcohol consumption, and stress. With these criteria we identified only 7 papers (accounting for 8 samples) of relevance from the 369 samples retrieved in the Voyer and Voyer meta-analysis. These studies are listed in Table 1, along with a brief summary of their method and results.

Examination of Table 1 shows that the type of studies and their results are quite disparate. Nevertheless, a few conclusions can be drawn. In particular, males tends to drink more than females, reflecting poorer health habits. This finding fits with the report from Yopp Cohen, Brownell, and Felix (1990) that females tend to have better food habits than males in a sample of individuals from Grade 3 to Grade 12. The research in Table 1 also supports the idea that missing fewer classes promotes better grades, falling in line with meta-analytic results from Credé, Roch, and Kieszczynka (2010). However, the studies sampled in Table 1 are contradictory concerning which sex misses more classes, although those reporting more absence for males find their results corroborated in the meta-analysis by Credé et al. Finally, only one study examined directly sex differences in health-related symptoms, suggesting report of more symptoms by females than males (Olds & Shaver, 1980), but it did not examine how symptoms might relate to grades. Essentially, these few studies do not allow clear conclusions on potential implications of the findings reported by Levine et al. (2019) for school grades. However, these authors’ findings clearly suggest that the relation between health issues and sex differences in school achievement as measured by grades requires a close empirical look. The paucity of research examining this
relation constitutes a glaring gap in the literature that requires attention in future work. **In fact,** Levine et al. pointed out that investigating how disparities in test scores might relate to disparities in grades would constitute an important future direction for research in this area.

If we look for interpretations closer to the Levine et al. (2019) data, one implication of their results is that males’ poorer health habits might be tied to their lower expectations of school success. **On this point, we agree with Levine et al. that poor academic achievement might be linked with risky and unhealthy behaviors in boys.** This possibility suggests that the implementation of health education modules promoting healthy habits and a healthy lifestyle early in the curriculum might contribute not only to promoting a healthier population, but also better overall school achievement in both sexes.

**Causality from Correlational Data**

In our reading of this paper, we were struck by the strong statements of causality brought forward by the authors, despite classic teachings that correlational data do not allow causal statements unless three specific conditions are met. As presented in Furlong, Lovelace, and Lovelace (2000), these conditions are:

1- There must be systematic (i.e., significant) association between variables.

2- There must be a time priority or temporal ordering of the variables so that the cause (e.g., sex discrepancy) precedes the effect (health problems).

3 - The relationship between the variables is non-spurious (i.e., not accounted for by a third variable).

At this point, Levine et al. (2019) have only established the first condition, and only for males. In fact, they use the finding that the relation is significant only in boys as support for their
causal claims, pointing out that if health issues “cause” the sex ratio discrepancy, then boys should have more health issues in their sample, a prediction that is not supported by their data. However, this reasoning is flawed because what is at stake is the health by sex interaction, not the main effect of sex. Therefore, the absence of main effect is independent from the interaction.

In reality, findings that the relation is significant in boys but not girls would be better interpreted as reflecting the potential influence of a third variable in the findings. For example, meta-analytic evidence suggests that females use various coping mechanisms such as social support significantly more often than males (Tamres, Janicki, & Heglson, 2002). In addition, social support has been shown to help patients cope with various health conditions (Holt-Lunstad & Uchino, 2015). In fact, Schwarzer and Leppin (1989) concluded from their meta-analysis that the relations between social support and health status is stronger in females than males. This suggests that the greater use of social support in females might mitigate the relation between health outcomes and test performance for them but not for males. Such an influence could fully account for the pattern of results presented by Levine et al. (2019). Therefore, there is a strong possibility that the use of coping strategies such as social support acts as a moderator in the relation between health outcomes and school achievement. Furthermore, Levine et al. (2019) have not really explained why the sex discrepancy would be deleterious to males but offer no positive effects for females, although the latter would be a corollary of their hypothesis. Finally, there is no evidence that their participants had any knowledge of the discrepancy before the fact and Levine et al. did not ask them if they had this knowledge. Therefore, there was no check on the relevance of the sex discrepancy as a plausible causal factor. If participants are not aware of the sex discrepancy on standardized tests in their school, how could it affect their behavior?
In their limitations section, Levine et al. (2019) suggest a possibility for a third variable based on parents’ beliefs but this account implies that parents actually have a clear choice of where they send their children for schooling and that this choice might be guided unconsciously by the goal of achieving negative outcomes. However, we do not believe that parents can easily make this kind of choice in most educational systems. For example, the Chicago Public School system, where the sample from Study 1 was drawn, does offer a choice to parents (see https://cps.edu/Schools/Enroll_in_a_school/Pages/Enrollinaschool.aspx), but sending a child to a school other than the one in their neighborhood requires a special application and that is not likely to be a parent’s first choice. In addition, in the first step of this application process, teachers or students attitudes or performance levels are not offered as sources of information about the schools. Therefore, attended school would be determined for a majority of children by the geographical location of the child’s home. In turn, this factor would be affected by a myriad of factors, many of which would be related to socio-economic status. This latter variable has been associated with negative outcomes on mental and physical health (Quon & McGrath, 2014). Socio-economic status therefore offers a multitude of other variables that could account for the observed health-disparity relation differentiated by sex.

More importantly, the temporal ordering of events is counter-intuitive. Why would one expect health issues to occur as a result of poor tests performance? The reverse reasoning is much more intuitive, especially in view of the fact that health issues are likely to promote class absences, which, as we discussed earlier, clearly have a negative effect on academic achievement. Regardless of these questions, Levine et al. (2019) have not established a time precedence in their data. Such a time precedence might be difficult to establish with a research design such as theirs.
This component of our commentary is not intended to take anything away from the importance of the results reported by Levine et al. (2019). In our view, these findings are crucial in making educators and researchers aware of the influence health outcomes might have on academic performance. The fact that this effect appears to be exaggerated in boys is also very important and it could be seen as a result of a cumulative effect of all the obstacles they already face in school. However, it is premature to single out one possible cause when the existing data do not provide direct evidence of causality and they require further independent replication before they can be considered conclusive. Our suggestion is that we should keep an open mind and pursue further work to elucidate the causes of the effects obtained by Levine et al. because their study does not provide a clearly established cause.

**Can We Satisfy our Need for Causality?**

This last point suggests that we still require suggested directions for future work to establish causality empirically in the relation that Levine et al. (2019) uncovered. In fact, these authors suggest one possibility in their paper, proposing a study in which participants would be told about the sex disparities in their school and outcomes such as blood pressure could be measured in a laboratory experiment. Our assumption is that Levine et al. would predict that blood pressure would increase when boys are told that the discrepancy favored females, whereas no effect would be found for female participants. On the surface, this is a plausible suggestion considering findings that simply telling boys that girls are better than them in school has been found to affect performance negatively in reading, writing, and math for 7-8 years old boys, whereas it had no effect on girls’ performance (Hartley & Sutton, 2013). Therefore, it would be plausible to expect that awareness of the sex discrepancy in one’s school might have a similar effect on test performance for boys but not for girls. However, demonstrating such a finding with
tasks unrelated to health would not truly establish causality of a relation of this putative “threat”
effect with health. In fact, using a measure such as blood pressure would also not establish
causality despite its clear link with health. Specifically, blood pressure has been shown to
increase to a similar extent when anxiety and anger are experienced (James, Yee, Harshfield,
Blank, & Pickering, 1986). Essentially, the increase in blood pressure could be equally attributed
to anger at hearing a fact one does not believe (i.e., perceived as a lie) or to anxiety when faced
with a threat to one’s self esteem.

One of the main obstacles to establishing causality with an experimental design here is
that health issues typically manifest themselves in the long term, not in the short term typically
allotted to a single study. From this perspective, it is possible that a systematic longitudinal study
of the effect observed by Levine et al. (2019) would provide a basis to establish causality
because it would provide information about temporal precedence. Of course, this would be a
difficult and lengthy undertaking but it offers some promise.

Conclusions

In conclusion, the two studies conducted by Levine & al. (2019) produced results linking
health outcomes with a school factor relevant to the relative performance of males and females in
standardized tests. This adds to an already long list of factors that relate to school achievement.
Causality in the observed relationship cannot be determined directly from the available data. The
paper by Levine et al. therefore opens the door for more research on a fascinating topic.
References


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doi:10.1080/03075070500340127
Table 1

*Papers Relevant to Health and Health Habits from the Voyer and Voyer (2014) Meta-Analysis*

<table>
<thead>
<tr>
<th>Study</th>
<th>Method</th>
<th>Results and comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ajiboye &amp; Tella (2006)</td>
<td>Investigated class attendance and sex as factors relevant to achievement in a social studies course</td>
<td>High attendance produced higher grades; males obtained better grades; sex differences in attendance not examined</td>
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<tr>
<td>Balsa, Giuliano, &amp; French</td>
<td>Examined the relation between alcohol consumption and grades in high school</td>
<td>Data analyzed separately for males and females. Alcohol consumption was associated with lower grades in males but not females; only the latter group reported academic difficulties. Class attendance negatively related to alcohol consumption in both sexes.</td>
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<tr>
<td>(2011)</td>
<td></td>
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<tr>
<td>Öhlund &amp; Ericsson (1994)</td>
<td>Concerned with the link between class absence caused by illness and elementary school achievement</td>
<td>Girls missed more classes than boys; class absences were associated with lower grades only in girls in grade 5 and in boys in grade 6; the findings were mitigated by birth date</td>
</tr>
<tr>
<td>Olds &amp; Shaver (1980)</td>
<td>Examined the relation among masculinity, femininity, health and academic performance in university students</td>
<td>Females reported more health-related symptoms than males; no sex differences on school grades; relation between symptoms and grades not reported.</td>
</tr>
<tr>
<td>Shields (2001)</td>
<td>Longitudinal study on</td>
<td>Stress and grades negatively related</td>
</tr>
<tr>
<td>Study</td>
<td>Focus</td>
<td>Findings</td>
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<tr>
<td>Singleton (2007)</td>
<td>Stress and its relation with grades in non-persisters (i.e., “drop-outs”) and persisters in first year college</td>
<td>Alcohol consumption negatively related with grades; no sex differences on frequency of drinking but males reported having more drinks than females</td>
</tr>
<tr>
<td>Tiruneh (2007)</td>
<td>Examined the relation between attendance and grades in a university-level political science class</td>
<td>No sex difference on grades; females missed more classes than males</td>
</tr>
<tr>
<td>Woodfield, Jessop, &amp; McMillan (2006)</td>
<td>Two studies exploring the relation between attendance and grades; Study 1 is a large scale longitudinal study whereas Study 2 focused on a small sample survey</td>
<td>Study 1: Males had more class absence and lower grades than females at the end of the four years program; Study 2: No sex differences in self-reported absences but males more likely to under-report absences than are females;</td>
</tr>
</tbody>
</table>