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Simpson's Paradox in LGBTQ+ Policy: a Case Study

Florence Ashley[1]

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Abstract

Introduction Simpson's paradox occurs when trends found in the underlying data disappear or are reversed when groups are aggregated. Because reported data are used to guide policymaking, understanding and being able to identify instances of Simpson's paradox is crucial to LGBTQ+ policy.

Method The article offers a theoretical introduction to Simpson's paradox before looking to a recent LGBT poverty study as a case study of the paradox and of its dangers in the context of LGBTQ+ policy. It then offers suggestions for minimizing the impact of the paradox for researchers and data users.

Results The Williams Institute's LGBT Poverty Study reported a much higher percentage of cisgender bisexual women living in poverty compared to other cisgender LGB groups. The rate of poverty was comparable to that of transgender respondents. However, the pattern was absent from age-disaggregated data and arose from the proportionately younger age of cisgender bisexual women in the study.

Conclusion Aggregate statistics and how they are reported may misrepresent the causal relationship between group belonging and outcome.

Policy implications Researchers should seek to minimize the risk of readers falling prey to the paradox by deliberately discussing the impact of confounding variables in the abstract or executive summary of their study, and by varying how they elect to report, represent, and disseminate the information. Policymakers and other data users should be cognizant of and attentive to Simpson's paradox when interpreting studies.

Keywords LGBTQ+ · Policymaking · Simpson's paradox · Statistics · Age · Sexual orientation · Gender

Introduction

In October 2019, the Williams Institute published a report on LGBT Poverty in the United States which showed that bisexual cisgender women were substantially more likely to be poor than other cisgender respondents, with 29.4% of bisexual cisgender women falling under the poverty line—the same as transgender respondents. The second poorest group among cisgender respondents was bisexual cisgender men (19.5%) followed by cisgender lesbians (17.9%) (Badgett, Choi, & Wilson, 2019).

Given the results found in the first figure of the executive summary, which was also foregrounded in social media dissemination, one would be forgiven for thinking that bisexual cisgender women are as poor as transgender people, with whom they share the spot of poorest population based on sexual orientation and gender modality (Ashley, 2021). While true at the population level because bisexual cisgender women are much younger on average, the inference proves misleading at the individual level. At equal age, a transgender person is much more likely to be poor than a bisexual cisgender woman. And while they remain more likely to be poor than cisgender lesbians, the stark jump in poverty rate between bisexual cisgender women and other cisgender groups disappears once age is kept constant.

A major reason for this counterintuitive result lies in the age distribution of bisexual cisgender women, unlike other groups. Bisexual cisgender women are disproportionately young—and thus more likely to be under the poverty line—while the age distribution of other groups is relatively flat. Age acts as a confounder of poverty and bisexual orientation, making bisexual cisgender women appear poorer than they are by virtue of their sexual orientation.

This phenomenon, whereby a statistical trend in underlying groups of data disappears or reverses when the data is combined across groups, is known as Simpson's

✉ Florence Ashley
f.ashley@mail.utoronto.ca

[1] Faculty of Law, University of Toronto, Toronto, Canada

paradox. Far from being a benign phenomenon, it can distort priority-setting in LGBTQ+ policymaking. Because LGBTQ+ groups are prone to significant demographic differences by virtue of the social influences on LGBTQ+ experiences, data about them are particularly susceptible to Simpson's paradox.

In this paper, I offer a case study of Simpson's paradox in LGBTQ+ policy through the Williams Institute study. First, I provide a theoretical introduction to Simpson's paradox. Second, I sketch how the paradox arose in the Williams Institute study. And third, I provide some thoughts on how researchers can help minimize the impact of the paradox on LGBTQ+ policymaking as well as on how journalists, advocates, and policymakers should engage with statistics to avoid distortions in decision-making.

Simpson's Paradox

Simpson's paradox is named after the British statistician Edward H. Simpson, who discussed the disappearance of a trend in underlying data upon aggregating it in a technical 1951 article (Pearl, 2014). The paradoxical aspect of the phenomenon refers to the psychological surprise associated with the banal statistical phenomenon of arithmetic reversal or disappearance. Simpson's paradox appears when the underlying data is weighed differently, typically because of demographic differences.

Consider the following scenario: my friend and I are taking a class whose final grade is based on two exams. However, the grading scheme for the course was unusual: students could select how much each of the two exams would count for at the beginning of the year. Since I thought my motivation would wane over the semester, I chose to weigh the first exam at 80% of my final grade and the second at 20%. But my friend, who was busier at the beginning of the year, decided that their first exam should count for 40% of their final grade and their second exam should count for 60%. The first exam turned out to be very difficult, and I obtained a grade of 38% whereas my friend scored 34%. The second exam was easier, and I scored 95% whereas my friend obtained a score of 78%. Although I fared better than my friend on both exams, I failed the semester with my final grade of 49.4% while my friend passed with a score of 60.4% because the difficult exam was worth much more of my final grade.

Put in statistical terms, Simpson's paradox arises due to confounding and mediating variables. A confounding or mediating variable (i.e., the weight of each exam) interacts with both the independent (i.e., identity of the person taking the test) and dependent variable (i.e., final score), obscuring the causal relationship between them. As a result, a factor causally related to an outcome may appear unrelated to it while a factor that is causally unrelated to the outcome could appear related to it.

It is important to note that Simpson's paradox bears on the causal relationship between two variables. Simpson's paradox does not tell us that the correlation or association between the two variables is spurious but rather addresses *why* that correlation or association appears. Whether aggregated data subject to Simpson's paradox is misleading depends on the purpose for which it is being used. Going back to the example given, it would be appropriate to use the final test scores to determine who obtained the certification associated with the class. It would not, however, be appropriate to use it to infer who best understands the topic.

The Williams Institute's LGBT Poverty Study

The Williams Institute study on LGBT poverty in the United States reported a poverty rate of 29.4% for bisexual cisgender women, the same as transgender populations—for which they, unfortunately, did not conduct subset analysis based on gender and sexual orientation. The higher poverty rate of bisexual cisgender women existed among both rural and urban populations and across most racial groups.[1] Overall, gay cisgender men (12.1%) were 1.1% less likely to be poor than straight cisgender men (13.4%), who were 4.4% less likely to be poor than straight cisgender women (17.8%), who were 0.1% less likely to be poor than cisgender lesbians (17.9%), who were 1.6% less likely to be poor than bisexual cisgender men (19.5%), who were 9.9% less likely to be poor than bisexual cisgender women (29.4%), whose poverty rates equaled that of transgender people (29.4%).

Comparing these rates, we notice a stark jump between bisexual cisgender women and other cisgender groups. The jump would suggest that there is something particular about bisexual cisgender women that make them much more prone to poverty—indeed, as prone to poverty as transgender people, who are recognized as one of the most marginalized populations in the United States and who are currently leading targets of conservative groups.

Yet, if asked to estimate who is most likely to be poor between two people who are demographically identical except that one is transgender and the other being a bisexual cisgender woman, it would be much more reasonable to guess that the transgender one is more likely to be poor. The only age at which the bisexual cisgender woman is more likely to be poor is 18–24 (37.3% versus 35.6%) with the worst disparity appearing for the 45–54 age range where 25.1% of transgender people are poor versus 12.4% of bisexual cisgender

[1] Bisexual cisgender women reporting a race or ethnicity other than white, Black, and Hispanic had slightly lower poverty rates than cisgender lesbians but remained much more likely to be poor than other groups.

women. When compared with other cisgender groups of the same age, bisexual women remain more likely to be poor, but the huge jump in likelihood of poverty disappears, with the groups' lines on a graph being more evenly spaced and substantially converging at older ages.

The reason for this disparity lies in the age demographics of each adult group. The median age in all other adult groups lies between 35 and 54 years old, whereas it falls in well in the 25–34 age range for bisexual cisgender women, 60.5% of whom are between the ages of 18 and 34. By contrast, only 31.3% of transgender adults are between 18 and 34 years old. Because the study considered age and race separately, I could not reconstruct whether age distributions are similar along racial lines.

A significant portion of the difference (or similarity) in poverty rates between bisexual cisgender women and other groups is attributable to age. People's salaries tend to increase over their lifespan, leading to generally decreasing poverty rates from one age group to the next. While this trend does not hold true for every age group of a subpopulation—transgender people and bisexual cisgender men have their highest poverty rates between 35 and 44 years old—the overall downward trend is shared by all subpopulations in the report.

If the age demographics of bisexual cisgender women was the same as that of transgender people, their overall poverty rate would be 22.4% instead of 29.4%. If they instead had the same age demographic as cisgender lesbians, their overall poverty rate would be 24.9%. While still noticeably more than the 17.9% of cisgender lesbians or 19.5% of bisexual cisgender men, the jump of 9.9% in poverty rate would be reduced to 5.4% or 2.9%. Controlling for other factors such as race, ethnicity, and urban vs. rural living in addition to age could further alter the trends, though it should be noted that cisgender bisexual women who are Black and Hispanic were substantially more likely to be living in poverty than other cisgender subgroups. Information about mental health is also crucial to contextualizing the results and guiding policy applications. For instance, transgender people and bisexual women are known to experience high rates of anxiety and depression (sometimes due to experiences in the workplace), which can impact employment status in a manner unlikely to be remedied by hiring-level measures (Bauer, Scheim, Pyne, Travers, & Hammond, 2015; Milner et al., 2018; Koh & Ross, 2006). Controlling for race, age, education, disability, language marital status, employment, health, and children, the report found that cisgender bisexual women were 17% more likely and transgender people 38% more likely to live in poverty than cisgender bisexual women.

Although the report should have better explained the impact of age on intra-LGBT disparities and the high poverty rate among bisexual cisgender women, it is not necessarily an error to base policy on the overall percentages reported in the study. Whether data exemplifying Simpson's paradox is misleading depends on the use towards which it is put. Using bisexual cisgender women's overall poverty rate to justify allocating (dis)proportionally greater resources to the unique stigma faced by older bisexual women may not be wise (although I would note that bisexual research and services are currently severely underfunded, so the misrepresentation might be ethically justified by the outcome). Using the data to suggest that bisexual cisgender women are much more oppressed on an individual level would also be questionable (although I am tempted to think that establishing strict hierarchies of oppression is questionable in the first place). If the goal is to analyze the potential impact of anti-poverty measures across different LGBT groups, then using the overall rate may be reasonable.

Poverty rates among LGBTQ+ communities are often used as a metric of oppression attributable to harassment, discrimination, and violence targeting LGBTQ+ people *qua* LGBTQ+. Indeed, it is often a reasonable assumption since LGBTQ+ people are otherwise similar to heterosexual cisgender people. Yet, age is a confounder of both sexual orientation and poverty. Because of the confounding effect of age, overall poverty rates cannot reliably be used as a proxy for harassment, discrimination, and violence—at least when it comes to bisexual cisgender women. While certainly desirable given the prevalence of biphobia, addressing harassment, discrimination, and violence towards bisexual cisgender women would have a smaller effect than might be expected based on their 29.4% overall poverty rate. All other things being equal, equivalent measures targeting transphobia would have a greater impact despite the two groups' shared prevalence of poverty. Furthermore, the report's failure to account for the intersection of race and age means that age-conscious measures could have vastly different outcomes across racial lines.

Understanding the impact of age demographics on the statistics reported by the Williams Institute is crucial to priority-setting and policymaking regarding LGBTQ+ populations. Adequately addressing the needs of bisexual cisgender women (and other LGBTQ+ groups) requires a nuanced understanding of their conditions of social vulnerability.

Addressing the Paradox

The impact of Simpson's paradox and related confounding issues can be minimized by improving data reporting by researchers and journalists, and by teaching policymakers and advocates the need to stay vigilant about Simpson's paradox and its resulting misleading statistics.

Researchers who authored the Williams Institute report could have anticipated misinterpretations and misuses due to Simpson's paradox by acknowledging the

impact of age on bisexual cisgender women's poverty rate in the executive summary, where the main bar graph is found—and thus where most readers will be led—and in their social media dissemination of the report. Presenting the data differently is also a viable way of avoiding potential misinterpretations. Instead of only presenting simple bar graphs comparing people by gender, sexual orientation, and gender modality in the executive summary, they could have foregrounded the age-differentiated line graphs found later in the report. These line graphs offer a more accurate representation of the poverty prevalent in LGBT communities. Although the executive summary reported odds ratios (e.g., bisexual cisgender women are 17% more likely to be living in poverty than straight cisgender women) controlling for confounding factors, it did not include detailed information on age's impact on the overall rates nor was this information foregrounded by the Institute on social media. Researchers need to be attuned to the fact that journalists, advocates, and members of the LGBTQ+ public will disproportionately rely on the executive summary or abstract of the study, on figures contained towards the beginning of the report or article, and on information featured in social media communications.

Greater familiarity with Simpson's paradox by journalists who report on scientific studies would also ensure that the information is not misreported by making sweeping claims, for instance, about the greater vulnerability of bisexual cisgender women based on overall poverty rates, which may risk downplaying the vulnerability of cisgender lesbians and propagate misconceptions about bisexual cisgender women's needs. Similarly, policymakers and advocates must appreciate the need to look behind surface statistics when setting priorities and elaborating policies and programs. The statistical reality may not support the presumed causal relationship once broken down by subgroup.

Knowledge is not enough to address Simpson's paradox and related confounding issues. People may be aware of the dubious nature of the causal relationship suggested by a statistic, yet still use it in their arguments when it turns out in their favor. While referring to bisexual cisgender women's markedly higher overall poverty rate to acquire funding may be justifiable given the disappointing underfunding of research and programs focusing on bisexual people, exploiting Simpson's paradox in this manner risks legitimating inadequate programming and distorted priority-setting based on superficial uses of statistics. Misusing statistics for beneficial effects only works if statistical literacy is low or if such misuse is broadly tolerated—both suboptimal outcomes. Furthermore, it makes LGBTQ+ advocacy vulnerable to accusations of misbehavior on the part of statistically literate anti-LGBTQ+ voices, which could hinder sustained pro-LGBTQ+ policymaking.

Willful oversight of Simpson's paradox can also trivialize and offend the plight of other members of LGBTQ+ communities. Although it is now widely known that Black trans women are the predominant victims of anti-transgender homicides in the United States, their deaths are frequently instrumentalized by white transgender people to appropriate platforms and advocate for reforms and policies that center their needs, which on many points do not correspond to those of Black trans women and the other trans women of color who are at higher risk of homicide (Boellstorff et al., 2014; Lamble, 2008; Snorton & Haritaworn, 2013). Transgender Day of Remembrance celebrations have been rightly criticized for frequently centering the voices of white trans women (and men) and betraying political commitments that are harmful to Black trans women (Chibbaro Jr., 2017; Gossett, 2015; Stanley & Smith, 2015). In this paper, I was able to discuss the impact of Simpson's paradox in relation to age because the report included poverty rates separated by age. But because age and race were separated, it was not possible to discuss how age-related confounding influenced poverty across racial groups. Integrating an understanding of Simpson's paradox and related confounding issues is crucial to intersectional policy and advocacy that is attuned to the realities of the most marginalized LGBTQ+ people, who are frequently Black or Indigenous, disabled, and/or otherwise multiply marginalized (Carbado, 2013; Crenshaw, 1991). Adequate LGBTQ+ policymaking and advocacy require more than an understanding and awareness of Simpson's paradox and related confounding issues: it also requires that we care enough to put that understanding and awareness into practice.

Conclusions

Confounders are hardly unique to LGBTQ+ research. Yet, LGBTQ+ realities are heavily determined by social factors such as harassment, discrimination, and violence, and LGBTQ+ policy's primary mode of intervention is at the social level. As I hope to have shown through the case study of the Williams Institute LGBT Poverty report, aggregate statistics and how they are reported may misrepresent the causal relationship between group belonging and outcome, distorting priority-setting and policymaking. Researchers should seek to minimize the risk of readers falling prey to the paradox by deliberately discussing the impact of confounding variables in the abstract or executive summary of their study, and by varying how they elect to report, represent, and disseminate the information. Policymakers and advocates should strive to promote policy and advocacy cultures that are not only sensitive to the difficulties posed by confounding and mediating

variables (notably Simpson's paradox) but also accountable to the populations represented by the data.

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