Intersectionality-informed
Quantitative Research: A Primer
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Intersectionality-informed Quantitative Research: A Primer

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Background

Over the years, intersectionality has emerged as a major theoretical and research paradigm across multiple disciplines. While qualitative techniques are the most common choice for those applying intersectionality (Hankivsky & Grace, 2014; Hunting, 2014), quantitative scholars are beginning to apply the paradigm as well (Bowleg, 2008; Dubrow, 2010; Hancock, 2007, 2014; Hankivsky, 2012; Veenstra, 2011). This has also corresponded with an increased use of intersectionality-informed analyses in mixed methods research (Grace, 2014). Nevertheless, there are limited resources on how to operationalize intersectionality within quantitative research (Hankivsky, 2012; Hankivsky & Cormier, 2009), particularly with respect to how to quantitatively examine intersectional differences between multiple social categories (Spiering, 2012).

A number of factors have hampered the development of quantitative analysis in intersectionality research, including issues of data availability, sample sizes, and interpretive limitations of quantitative techniques (Bauer, 2014; Dubrow, 2008; Kohlman, 2006; Scott & Siltanen, 2012). Traditionally, quantitative researchers have sought to address issues of social inequity by investigating individual axes of inequity (e.g., ‘race’, gender, class, sexuality) and considering only potential interconnectedness between axes. Most quantitative research to date has examined issues of social and health inequities through other approaches, such as sex-and-gender based analyses and determinants of health frameworks (Hankivsky & Cormier, 2009). However, as this primer demonstrates, intersectionality offers a distinct and innovative way for quantitative researchers to understand and conceptualize health and social inequities as rooted in the structural drivers of society and every day experiences of individuals (Hankivsky, 2012; Veenstra, 2011).

To illustrate the possibilities and challenges of intersectionality-informed quantitative research, this primer will discuss examples from the areas of mental health promotion and suicide prevention, family violence and boys’ and men’s health.
The Application of Intersectionality in Quantitative Research

Most quantitative research to date has incorporated intersectionality by examining categories of differences (Bauer, 2014; Dubrow, 2010; Hancock, 2007; McCall, 2005; Veenstra, 2011). Two common approaches used in quantitative research to examine differences in demographic groups are the additive (or unitary) and the multiplicative approach (Dubrow, 2010). Traditional quantitative methods utilize the additive approach in regression analyses to examine the individual effects of various factors (e.g., demographic variables) on a given outcome when controlling for other variables in the model. An intersectionality-informed analysis incorporates both approaches in its analytical framework, emphasizing the need to apply the multiplicative approach in the later stages of analysis. As discussed below, on its own, the additive approach is limited to understanding the intersecting and co-constitutive nature of demographic categories. In an intersectionality-informed analysis, the additive approach is incorporated as an initial ‘baseline’ model, upon which further analyses are applied using multiplicativity to account for the conditional effects of intersecting categories on a social outcome.

Additive Approach

The additive approach assumes that demographic variables (e.g., age, gender, sex, ethnicity, class) have additive effects (Bauer, 2014; Dubrow, 2008). LeVasseur illustrates this by providing an example of the social identity of a youth who is male, Hispanic and a sexual minority. He offers the following equation to reflect the relationship between social identity, bullying, and suicide attempts:

\[ Y = a + b_1 x_1 + b_2 x_2 + b_3 x_3 + b_4 x_4 + e \]

In this equation, \( x_1 \) is reported bullying in the past year, \( x_2 \) is sexual minority status, \( x_3 \) is race (categorized as a dummy variable for Hispanic race), \( x_4 \) is gender (dichotomized as male vs. female), and the outcome variable, \( Y \), is suicide attempts. This approach assumes that these categories are mutually exclusive, overlooking their intersecting and co-constitutive nature (Weber & Parra-Medina, 2003). Bowleg (2008) discusses the challenges of the additive approach for intersectionality researchers, with different implications in the context of primary data collection and secondary data analysis.

Primary Data Collection

In her study, Bowleg (2008) examined the relationship between stress and discrimination through primary data collection. Questionnaires used as surveys for data collection often utilize common validated scales that are based on single axes of discrimination
(e.g., a respondent’s race). Bowleg overcame the challenges of using data with pre-defined and separated categories of social identity by tailoring her survey questionnaire to prompt respondents to “check all that apply” on factors that describe the basis for the discrimination they experienced. The respondents, therefore, had the option of selecting multiple answers (e.g., race, sex, gender, sexual orientation). Bowleg’s strategy enables research to probe beneath single identity factors and discover other identity markers that may be present and contributing to advantage and disadvantage when analyzing and interpreting data (Hankivsky, 2012). This encourages researchers to think about how social problems and policy outcomes are determined by a complex set of dimensions (Scott & Siltanen, 2012).

**Secondary Data Analysis**

Data that has been collected based on pre-defined, mutually-exclusive variables can be problematic during analysis due to a priori assumptions that have been made regarding how inequity dimensions are isolated from each other (Bowleg, 2008). For example, Barnshaw and Letukas (2010) utilized data from the Urban Men’s Health Study (UHMS) to empirically examine the relationship between the ‘down low’, (defined as: “men who have sex with men but identify as ‘heterosexual’ or ‘straight’”), visible minority status (Black and Hispanic), and high-risk sexual behaviour. Their data contained a race variable categorized as White versus Non-White, and their Non-White group contained Black and Hispanic respondents. This pre-defined, aggregated race variable, however, did not allow for the investigation of differences among and between visible minority groups, or how men can experience race differently with respect to their gender, sexual identity, and social location.

**Multiplicative Approach**

In this approach, two-way and three-way (or more) interaction terms of demographic categories are used to account for the conditional effects of intersecting categories on a social outcome (Bauer, 2014; Dubrow, 2008). This approach can be summarized by the following equation in multiple regression analyses:

\[
Y = a + b_1 x_1 + b_2 x_2 + b_3 x_3 + b_4 x_4 + b_5 (x_1 x_2) + b_6 (x_1 x_3) + b_7 (x_1 x_4) + b_8 (x_2 x_3) + b_9 (x_2 x_4) + b_{10} (x_3 x_4) + b_{11} (x_1 x_2 x_3) + e
\]

Contrary to the additive approach, the effects of the variables are not mutually exclusive. Researchers applying an intersectionality-informed analysis use the multiplicative approach in addition to the additive model to examine, for example, how women can experience intimate partner violence differently depending on their location in the class structure (e.g., poor socioeconomic gradient vs. working class), the race structure (e.g.,
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White vs. visible minority), and in structures of immigration status (e.g., immigrant vs. non-immigrant) (CRIAW, 2006; Hancock, 2007; Hankivsky, 2009; Veenstra, 2011). Determining the multiplicative effects of inequity related to gender, race, class, and immigration status can help identify policy issues and social problems around family violence, and can contribute to the development of socially relevant and inclusive policy solutions (Scott & Siltanen, 2012).

For the most part, then, quantitative researchers conceptualize categories differently from one another, and these conceptualizations impact the kinds of research questions developed and the way analyses are performed. McCall (2005) describes these categorizations in relation to intersecting aspects of social identities. Traditional quantitative methods have examined inequities across multiple levels using existing categorical groupings (e.g., male vs. female, White vs. visible minority), and analyze such differences on the premise that the individual components of these intersections (e.g., being female or identifying as a visible minority) have social meaning (McCall, 2005). However, other scholars argue that these social categories provide little meaning for understanding how individuals live and experience society (McCall, 2005). This anti-categorical approach postulates that society is too complex to be defined and reduced to specific categories. It assumes, for example, that gender, ethnicity and class have no valid effect individually, and only have social meaning when accounted for simultaneously (i.e. their effect is conditional on their intersections) (McCall, 2005).

The intersectionality perspective moves beyond the additive, categorical approach traditionally used by quantitative researchers and considers the complex relationship between mutually constituting factors of social location and structural disadvantage (Grace, 2013; Hankivsky et al., 2012). This approach prompts researchers to acknowledge that the experience of race, class, gender and sexuality differs for individuals depending on their social location in the structures of race, class, gender and sexuality (Veenstra 2011).

To illustrate: in the context of boys’ and men’s health, Barnshaw and Letukas (2010) describe how members of the gay community experience and engage in different levels of high-risk sexual behaviour based on their race/ethnicity. In this study, race is categorized as White versus non-White (Hispanic and Black). At the same time, the researchers move beyond this category to consider other intersecting social categories and locations that influence gay men’s engagement in high-risk sexual behaviour, such as class (indicated by income as a marker of socioeconomic positioning), urban settings (e.g., the type of city respondents identified living in), and sense of belonging and familiarity in the gay community. These factors are seen as working together to influence how gay men between
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and within different racial groupings experience and engage in risky sexual behaviours (Barnshaw & Letukas, 2010).

How to Apply Intersectionality in Quantitative Research

This section of the primer draws from several existing resources (CRIAW, 2006; Hankivsky & Cormier, 2009; Morris & Bunjun, 2007), as well as an intersectionality-informed framework developed by Spiering (2012), which summarizes the steps that can be taken to quantify differences in positioning and test interaction effects across social groups. Spiering’s framework, presented below, describes three steps required to quantify differences: through classification, description and drawing inferences (correlation). This framework embraces an approach in which all relevant social identity variables are considered, including multi-level factors that contribute to complex inequities among groups and individuals (Hankivsky et al., 2012; Scott & Siltanen, 2012).

Importantly, the key principles of intersectionality should be at the forefront throughout all phases of the research process (Hankivsky, 2014). This will ensure avoidance of additive lists and a priori primacy of singular categories of social identity, and instead bring attention to the multi-level processes and systems that shape existing health and social inequities (Hankivsky, 2012; Hankivsky et al., 2012).

Pre-Analysis Stage

Defining the Research Question

While there is no prescribed way of conducting intersectionality-informed research, at the onset of a project it is important for researchers to provide a definition of intersectionality that will frame their study (Hankivsky, 2012). Next, when developing an intersectionality-informed research question, researchers must consider which categories will be included. This involves asking: “Who is being studied? Who is being compared to whom and why, and whether the research is framed within the current political, societal or cultural context” (Hankivsky, 2012; Hankivsky & Cormier, 2009; Lorber, 2006). Traditional quantitative techniques in research question and hypothesis formulation would empirically test for associations between a given factor and outcomes of interest, seldom considering contextual factors. While sex- and gender-based analyses and social determinants of health perspectives have been applied in traditional quantitative methods, they seek to investigate social and health inequities and focus on single factors (e.g., gender, sex, socioeconomic status) and outcomes. These approaches in traditional quantitative methods limit the understanding of the complex ways in which individuals live and experience health and other outcomes in society (Hankivsky, 2012; Veenstra, 2011).
An intersectional approach moves beyond traditional approaches to studying social and health inequities by looking past single categories of analysis (e.g., gender, sex, race). The intersectional approach also considers the interaction between different aspects of social identity, and the impact of macro-level processes and systems of oppression and domination (Hankivsky, 2014; Hankivsky et al., 2012). For example, Barnshaw and Letukas (2010) sought to empirically examine whether Black men’s sexual behaviour is riskier than that of White men. They investigated high-risk sexual behaviour among Black men. Their research question was framed and rationalized within multiple contexts for the social position of Blacks in the United States, including the present context, as well as historical, cultural, political, societal and situational contexts. This required contextualizing factors such as the impact of stigma and cultural misperceptions, marginalization of Black sexual minorities, historically rooted racism, and disparities in health outcomes for Black men. An exhaustive consideration of such historical and current issues is necessary early in the research process in order for their contributions to be properly accounted for in the analysis and interpretation phase.

**Research Design**

**Classification**

When designing a research study, it is important to consider which categories are relevant before data collection, and what the presumed makeup of each category would be after the data are collected (Hancock, 2007; Hankivsky, 2011). Spiering (2012) describes this as classification – a crucial step at the pre-analysis stage of intersectionality-informed research during which different groups of people are distinguished in order to understand the different social positions that individuals occupy. Since many large comparative datasets, such as the Canadian Community Health Survey (CCHS) and the European Social Surveys, provide binary (Yes/No) information about the sex of an individual, a sex-based variable is created by deriving this information to compare women and men. These comparative datasets also provide data on other demographic variables that can be utilized to further investigate differences between other social identities.

Kohlman (2006) argues that traditional quantitative analysis does not portray the personal narratives typically captured among respondents using qualitative methods. For instance, in quantitative research, many demographic questions ask for a “Yes” or “No” answer, and are coded as 1 vs. 0 respectively (Kohlman, 2006). Using Kohlman’s work on sexual harassment as an example, this method of collecting and coding data – which consists of working with pre-defined categories – limits the ability to thoroughly understand the multifaceted interactions of gender, class and race that influence the sexual harassment experienced by women and men in the workforce.
To overcome such challenges, Spiering (2012) suggests using detailed classification to create numerous categories. This is done by checking for differences across social identity variables, and creating an intersectional identity matrix that crosses each variable so that each subgroup is uniquely classified. For instance, to understand the social position of a Black woman and man with respect to intimate partner violence, it is important to consider that differences exist between being White and Black, and that these differences may be experienced differently for men and women. Therefore, four groups (Black woman, Black man, White woman, and White man) need to be distinguished and classified, not two. This intersectionality-informed method of classifying social groups moves beyond traditional approaches of data coding and categorizing (e.g., 1 vs. 0 for women and men) and enables the researcher to probe beneath the data to discover other potentially important, interacting factors that may be present and contributing to situations of advantage and disadvantage (Hancock, 2007; Hankivsky, 2012; Veenstra, 2011). This method of classification can be problematic when working with a limited sample size. A challenge remains in balancing the number of categories (e.g., Black woman, Black man, White woman, and White man) and maintaining adequate statistical power in the analyses.

While there are no set rules for addressing such issues, the following guide can assist in meeting some of these challenges. First, there is no pre-set definition of sample size needed to construct categories and intersections, since this is determined by the variables created and the statistical procedures used to analyze them. To create a sufficient sample size, such as from the Canadian Community Health Survey (CCHS), one can:

1. limit the number of intersections (e.g., only gender, race and class), and the content of intersections, i.e. create only those that have sufficient size to analyze with cross-tabulations, correlations and other such statistical procedures;
2. pool the CCHS across multiple survey waves, i.e. “pooling time”;
3. harmonize different datasets, i.e. “pooling surveys” such as CCHS and the Canadian Health Measures Survey; and
4. if not interested in doing cross-country comparisons (e.g., Canada and the United States), pool countries within one survey wave, i.e. “pooling countries”.

While increasing the sample size can improve statistical power, another way to address the challenges of multiple categories is to increase the conventional alpha level from $p < 0.05$ to a higher cut-off, such as $p < 0.10$, in the regression analyses.
Data Collection
The current literature on the application of intersectionality in quantitative analyses relies largely on cross-sectional survey data. Much of what is known about the application of intersectionality in the quantitative analysis of datasets, specifically cross-sectional surveys, concerns post-data collection. A challenge for researchers is that the data were not designed for an intersectionality-informed analysis (i.e. the intersectional approach was applied post-data collection). Nonetheless, current datasets, such as the CCHS, are well suited for the application of an intersectionality-informed analysis. For example, the CCHS assesses sexual orientation by distinguishing between bisexuals, homosexuals, and heterosexuals, and is large enough to produce multiple categories of race (Veenstra, 2011). It is important to note that qualitative intersectionality research is needed in the form of mixed-methods research to inform quantitative study design, the kinds of interactions one can explore, and which research questions to investigate (Grace, 2014; Hunting, 2014). The use of qualitative research allows for greater understandings of people’s lived experience of complex inequities, and how policies and programmes can most effectively respond to a variety of experiences and needs (Bauer, 2014; Hunting, 2014; Scott & Siltanen, 2012).

However, researchers can improve dataset design and collection to make datasets more amenable to intersectionality-informed analysis. Improvements include:

a. ensuring the dataset is large enough to construct at least three-way intersections;
b. oversampling disadvantaged groups;
c. including population groups that are currently excluded in national surveys, such as the CCHS (e.g., exclusion of Indian Reserves, incarcerated individuals and refugee populations from the sampling process of the survey sample); and
d. refining the questionnaire to capture greater detail of social identity groups.

For example, the CCHS contains a question on immigration status, which asks whether or not the respondent was born in Canada. The questionnaire should be further refined to capture additional information such as type of immigrant (i.e. refugee vs. non-refugee).

Analysis and Interpretation
A two-stage analytical strategy is commonly used to model the main effects of inequities in social identities (additive approach), followed by the statistical interactions between effects (multiplicative approach) in regression analyses informed by intersectionality (Bauer, 2014; Veenstra, 2011). This type of analytical strategy enables the researcher to determine whether two-way, three-way or four-way statistical interactions...
(i.e. intersections) between axes of inequity contribute to explaining variability in a given outcome above and beyond the traditional additive approach to social and health inequities (Bauer, 2014; Veenstra, 2011).

**Stage 1 Analysis: Additive**

**Description**
Descriptive analyses should be provided for the overall study sample and subgroups (Bauer, 2014; Spiering, 2012). From an intersectionality perspective, this enables the researcher to quantify differences in social positioning within an identity group (e.g., Black women) to better understand differences among individuals and social groups (Spiering, 2012). LeVasseur, Kelvin and Grosskopf (2013) analyzed suicide attempts related to bullying, and intersections between race, gender and sexual orientation among New York City youths. The intersecting aspects of the youths’ social identities were described overall and separately based on their experiences of bullying in the past year (Table 1).

**TABLE 1—Descriptive Statistics of New York City Youth Overall and Separately by Experiences of Bullying: 2009 New York City Youth Risk Behavior Survey**

<table>
<thead>
<tr>
<th></th>
<th>Total (%)</th>
<th>Bullied, No. (%)</th>
<th>Not Bullied, No. (%)</th>
<th>OR (95% CI)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total</strong></td>
<td>11,448</td>
<td>1,281 (11.2)</td>
<td>10,207 (88.8)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Suicide attempt</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>1,015</td>
<td>211 (21.9)</td>
<td>720 (71.5)</td>
<td>2.98 (2.40, 3.69)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>No</td>
<td>9,433</td>
<td>1,064 (11.3)</td>
<td>8,369 (88.7)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Sexual minority</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>961</td>
<td>158 (16.4)</td>
<td>742 (77.4)</td>
<td>1.96 (1.56, 2.46)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>No</td>
<td>9,487</td>
<td>903 (9.5)</td>
<td>8,584 (90.5)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>5,549</td>
<td>503 (11.1)</td>
<td>4,746 (83.6)</td>
<td>0.99 (0.81, 1.21)</td>
<td>.915</td>
</tr>
<tr>
<td>Female</td>
<td>5,899</td>
<td>768 (10.7)</td>
<td>5,125 (89.3)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Ethnicity</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hispanic</td>
<td>4,947</td>
<td>566 (11.4)</td>
<td>4,381 (88.6)</td>
<td>1.18 (1.00, 1.39)</td>
<td>.051</td>
</tr>
<tr>
<td>Not Hispanic</td>
<td>6,491</td>
<td>724 (11.4)</td>
<td>5,767 (88.6)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. CI = confidence interval; OR = odds ratio.

Drawing Inferences – Correlation

Spiering (2012) presents several factors that researchers must consider and implement during analysis in order to investigate correlations between certain identities, such as sex, age, and ethnicity, and an outcome of interest (e.g., health). First, one must test for structural differences in position through inclusion of all available identity variables in their statistical model (e.g., multiple regression models). To illustrate: variables such as sex, ethnicity and income should be included as explanatory variables in the model, each producing a regression coefficient, as seen in traditional quantitative analyses. To be consistent with an intersectionality-informed analysis all relevant corresponding identities should be incorporated into social analysis of groups (Hankivsky et al., 2012). At this stage of the analysis, the researcher is encouraged not to discard an axis of inequity before investigating its potential relevance to the problem being investigated. For example, LeVasseur et al. (2013) conducted descriptive and univariate logistic regression analyses using data from the New York City Youth Risk Behavior Survey. As summarized in Table 1, youths who reported having attempted suicide in the past year were more likely to report having been bullied. Sexual minority youths were also more likely to report bullying, but there was no statistically significant difference by gender or ethnicity. Despite the lack of statistical significance, all variables were included in their unadjusted and adjusted logistic regression models. As seen in Table 2, there was no statistically significant difference in gender in the unadjusted model; however, all social identity variables were included in the adjusted model (Table 2). This enabled LeVasseur and colleagues (2013) to explore meaningful interactions between social identity groups in their next stage of analysis at the multiplicative stage.


This first model provides the ‘baseline’ model against which subsequent approaches will be compared by estimating additive effects through the aforementioned standard multiple multiple regression equation:
In this equation, $X_1$ is reported bullying in the past year, $X_2$ is sexual minority status, $X_3$ is race (categorized as a dummy variable for Hispanic race), $X_4$ is gender (dichotomized as Male vs. Female), and the outcome variable, $Y$, is suicide attempts. Veenstra (2011) argues that this initial additive approach in regression modelling addresses the principles of simultaneity and directionality. Simultaneity suggests that all identities make significant contributions to these models before and/or after controlling for another, while directionality, in this example, implies that non-White Hispanics, sexual minorities, and individuals who reported being bullied in the past year will manifest greater odds of suicide attempts. Such a process enables the researcher to determine the independent influence and significant variables that are theoretically important to an intersectionality-informed analysis, and isolating these variables from other factors that may influence the outcome measure (LeVasseur et al., 2013; Scott & Siltanen, 2012; Veenstra, 2011).

**Stage 2 Analysis: Multiplicative**

**Quantifying Differences in Effects**

Individuals identifying with different social positions/groups will experience different effects in outcome and are impacted differently by factors being tested. In order to incorporate intersectionality, one must allow different identities to intersect with one another by using interaction terms to allow each category of the variable to have its own regression coefficient to produce two- or three-way interactions (e.g., gender, sex, ethnicity) (Spiering, 2012; Veenstra, 2011). Here, multiplicativity implies that social inequity identities should interact meaningfully with one another as predictors of a given outcome (e.g., suicide attempts among youths). That is, statistical interactions between inequity variables of gender, ethnicity/race, and sexual minority status should manifest significant effects above and beyond their main effects seen in the additive models (Veenstra, 2011). In this model, interaction terms are added as additional variables to the main effects model and controlled for in the following equation:

$$Y = a + b_1 X_1 + b_2 X_2 + b_3 X_3 + b_4 X_4 + (b_5 X_1 X_2) + (b_6 X_1 X_3) + (b_7 X_1 X_4) + (b_8 X_2 X_3) + (b_9 X_2 X_4) + (b_{10} X_3 X_4) + (b_{11} X_1 X_2 X_3) + e$$

In some instances it may not be adequate to address different forms and levels of complexity by conventional two-way interaction terms. Intersectionality analysis emphasizes the need to consider high-order interactions involving multiplicative relations between three or more variables denoted by the following equation:

$$Y = a + b_1 X_1 + b_2 X_2 + b_3 X_3 + b_4 X_4 + (b_5 X_1 X_2) + (b_6 X_1 X_3) + (b_7 X_1 X_4) + (b_8 X_2 X_3) + (b_9 X_2 X_4) + (b_{10} X_3 X_4) + (b_{11} X_1 X_2 X_3) + e$$
Using interactions terms for testing intersectionality involves a few complications. The significance of interaction terms is dependent on the size of the main effects in the additive model. The issue of statistical power becomes problematic because significant tests of interaction terms involve smaller sample sizes than tests of main effects and have less statistical power for a given effect size. While increasing the sample size can improve the chances of discovering statistical significance of interaction terms, one way to partially address the problem of statistical power is to increase the conventional alpha level from $p < 0.05$ to a higher cut-off, such as $p < 0.10$, since some of the variation in the outcome variable explained by the interaction may already be captured by the main effect test. The measurement error in the individual factors becomes compounded in the interaction term creating lesser power of tests of significance for the interactions (Bauer, 2014; Dubrow, 2008; Scott & Siltanen, 2012; Veenstra, 2011).

One can statistically assess contributions to predicted variability in the regression models by examining the value added by the interaction terms through comparison of $R^2$ values or Akaike’s Information Criterion (AIC) as a measure of goodness-of-fit between the additive and multiplicative regression models. This allows the researcher to assess the magnitude of the interacting contributions to explaining variability in the given outcome above and beyond the contributions of the main effects.

For example, in the study conducted by LeVasseur et al. (2013), a significant interaction was indicated by the main effect of bullying not being parallel across strata of sexual minority identity, Hispanic ethnicity and gender (Table 3).

Interactions were tested by assessing a model containing four-way interactions between bullying, ethnicity, gender, and sexuality, including all two- and three-way interaction terms, and comparing this model with three other “nested” models. The first model—the main effects model—is additive (Table 2) (LeVasseur et al., 2013). The second model contained all the two-way interactions between the intersecting identities of interest. The third model contained all the two- and three-way interactions (Table 3). The AIC test was used to measure goodness of fit. The model with the lowest AIC value is deemed best model (LeVasseur et al., 2013). Their results indicated that the model with the four-way interactions had the lowest AIC and therefore this was selected as the best fitting model in their analysis (Table 3). After stratifying by gender, ethnic and sexual minority identities, the association between bullying and suicide attempt was strongest among non-Hispanic sexual minority male youths (OR=21.4, p<0.001), followed by non-Hispanic non-sexual minority female youths (OR=3.4, p<0.001), Hispanic non-sexual minority male youths (OR=3.3, p<0.001) and Hispanic non-sexual minority female youths (OR=2.76, p<0.01). These findings indicate that sexual minority, gender, and ethnic identities interact with bullying in predicting suicide attempts among youths in New York City. The comparison of the additive and multiplicative approaches demonstrates how the intersectional model leads to more accurate predictions of suicide attempts (Bauer, 2014; Hankivsky, 2012; LeVasseur et al., 2013; Veenstra, 2011).

Multi-level analyses

Quantitative researchers applying intersectionality to their analysis are advised to always interpret the data within the socio-historical context surrounding the lived experiences of oppressed and privileged groups (Cole, 2009). Societal factors must then be included when investigating individual positions in a multiple regression analysis. Traditional ecologic models and social determinants of health frameworks consider multiple factors at different levels of society in social and health inequities research, but are limited in addressing the multi-level interacting social locations, forces, factors and power structures that shape and influence human life (Bauer, 2014; Hankivsky et al., 2012). Spiering’s (2012) framework encourages the use of multi-level nested models that incorporate both societal factors and individual characteristics to see if they contribute towards differences in outcome.

This can be illustrated by returning to the case of boys’ and men’s health research into the influence of social categories and locations on gay men’s engagement in high-risk sexual behavior. In their study, Barnshaw and Letukas (2010) did not account for multi-level societal policy factors influencing such engagement. However, examples of these factors in multi-level analyses could include the impact of gay marriage legislation in certain US States. The Urban Men’s Health Study was conducted in four metropolitan
areas (Chicago, Los Angeles, New York and San Francisco), and data was cross-sectionally collected on an annual basis. Researchers could conduct cross-contextual comparisons that would evaluate the impact of this policy (through comparison of cumulative years before and after its introduction) across urban settings (cities in states that enacted the legislation versus those that did not) to empirically investigate how policy constructs the relative power and privileges experienced by differently racialized members of the gay community and the ‘down low’ vis-à-vis high-risk sexual behaviour. Table 3 illustrates a hypothetical example of variation in significant race interactions between four multi-level contexts (across multiple urban settings in the United States). To test how policy influences the day-to-day experiences of differently racialized members of the gay community, one could run separate regression models in different years (or cumulative years) before and after legislation and compare relevant dimensions of inequity across model results.

<table>
<thead>
<tr>
<th>Race X education interactions</th>
<th></th>
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<tbody>
<tr>
<td>Black</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OR less than high school</td>
<td>3.280</td>
<td>1.752</td>
<td>2.580</td>
<td>4.850</td>
</tr>
<tr>
<td>OR high school graduate</td>
<td>1.896</td>
<td>1.200</td>
<td>1.950</td>
<td>2.540</td>
</tr>
<tr>
<td>OR some college</td>
<td>1.461</td>
<td>1.390</td>
<td>1.428</td>
<td>2.102</td>
</tr>
<tr>
<td>OR college graduate (ref)</td>
<td>1.000</td>
<td>1.000</td>
<td>1.000</td>
<td>1.000</td>
</tr>
<tr>
<td>White</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OR less than high school</td>
<td>2.133</td>
<td>1.450</td>
<td>1.890</td>
<td>3.504</td>
</tr>
<tr>
<td>OR high school graduate</td>
<td>1.621</td>
<td>1.325</td>
<td>1.450</td>
<td>2.320</td>
</tr>
<tr>
<td>OR some college</td>
<td>1.181</td>
<td>1.120</td>
<td>1.320</td>
<td>1.950</td>
</tr>
<tr>
<td>OR college graduate (ref)</td>
<td>1.000</td>
<td>1.000</td>
<td>1.000</td>
<td>1.000</td>
</tr>
</tbody>
</table>

A multi-level analysis better illuminates how policy constructs the relative power and privileges experienced by individuals with respect to their status, health and well-being (Bauer, 2014; Hankivsky et al., 2012).
Concluding Remarks
Quantitative, qualitative and mixed methods approaches are all required techniques for producing the knowledge needed to understand complex inequities and the differential effects of policies among different groups of individuals (Bauer, 2014; Grace, 2014; Hunting, 2014; Scott & Siltanen, 2012). Despite underlying challenges in dealing with multiple and intersecting dimensions, especially in the context of quantitative research, intersectionality has strengthened the ways in which human life and social inequities are understood. An intersectionality-informed quantitative analysis encourages policy makers to identify social problems and policy issues in a context-informed manner that creates socially relevant, inclusive and effective policy solutions that enhance equality (Bauer, 2014; Scott & Siltanen, 2012). Moreover, developments in quantitative research offer insights into the configuration of inequity that on its own may not be apparent from qualitative research (Bauer, 2014; Grace, 2014; Scott & Siltanen, 2012). In sum, despite the limitations and need for ongoing work, an intersectional perspective has significant potential to transform traditional quantitative research methods in ways that more effectively capture social and health inequities.

References


Hancock, A.M. (2007). When multiplication doesn’t equal quick addition: Examining intersectionality as a research paradigm. Perspectives on Politics, 5(1), 63–78.
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