

**How to account for sex and gender in occupational health and safety research:
are mixed methods the answer?**

Dr. Nicole Gerarda Power^a, Dr. Johanne Saint-Charles^b, Dr. Christine Knott^a

^aDepartment of Sociology, Memorial University of Newfoundland, St. John's, Canada,

^bDépartement de communication sociale et publique, UQÀM, Montreal, Canada

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Corresponding author:

Dr. Nicole Gerarda Power, Department of Sociology, Memorial University, St. John's,
Newfoundland and Labrador, Canada A1C 5S7

npower@mun.ca

709-864-6914

Abstract: OHS research has tended to measure the impact of occupational exposures and ergonomic interventions on male bodies and in a limited range of male-dominated occupations. To correct for this, researchers are encouraged to account for sex and gender in health research. It is not clear however how researchers should go about doing this. Taking OHS literature as a case study, in this paper, we argue that while mixed methods approaches alone do not produce analyses of sex or gender that move beyond reproducing binary comparisons or essentializing difference, combined with critical theoretical frameworks that engage in dialogic analysis, mixed methods have the potential to offer a complex and sophisticated understanding of the relationship between sex and/gender and OHS.

Key Words: gender, sex, occupational health, mixed methods

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Introduction

There is growing acceptance for the integration of sex and gender into programs of health research. Indeed, national health-funding bodies in Canada, the United States and Europe increasingly encourage or require researchers to consider sex or gender in funding applications (CIHR 2014; Johnson 2014; Schiebinger et al., 2011-2015). The push for such integration emerges from critiques of historical medical practices that focus on the male body (e.g., excluding women from clinical trials, using animal models that use male rodents) and that ignore the ways in which cultural meanings of gender and systems of gender inequality impact the research process (Greaves 2009; Ritz et al., 2013). Research on occupational health and safety (OHS) has not escaped criticism of sexist practices (Kjellberg, 1998; Messing et al., 2003; Messing & Stellman, 2006; Niedhammer et al., 2000; Teiger, 2006; Zahm et al., 1994; Zahm & Blair, 2003). OHS research has tended to measure the impact of occupational exposures and ergonomic interventions on male bodies and in a limited range of male-dominated occupations, the assumption being that men tend to do work that presents bodily risk while women's work is relatively safe. The result has been both an underestimation of the negative impact of work processes on women's bodies and in occupations understood as women's work, and a misunderstanding of the effects of exposures and interventions on women's and men's bodies. At the same time, there has been little attempt to understand the gendered mechanisms that underlie men's OHS, such as the gender expectations that make doing dangerous work normative for some men (Stergiou-Kita et al., 2015).

This growing body of critical research is exposing the damaging health impacts of such sexist research and clinical practices, making clear that sound health knowledge must be based on research that pays attention to sex and gender. It is less clear precisely how researchers should

go about doing this. The main methodological responses to this omission have been to control for sex or to stratify by sex, comparing men and women (Alexanderson, 1998; Dumais, 1992; Messing, 1992; Niedhammer et al., 2000; Punnett & Herbert, 2000). Both approaches have been criticized for applying overly simple conceptual constructs (e.g., sex as a biological binary consisting of male and female categories) (Fausto-Sterling, 2012), and ignoring the complex relationship between sex and gender (e.g., how sex differences in exposure may be explained by gender divisions of labour rather than reduced to biological sex) (Messing, 2003) and their intersection with other variables, including ethnicity, age, sexuality, class, disability and so on (Hankivsky & Cormier, 2009). This complexity requires an approach that is able to capture the biological and socio-cultural dimensions of sex and gender, as well as their relationship to each other. This is no small task, compelling researchers to reconcile, at times, different ways of seeing, measuring and interpreting a problem. Mixed methods approaches that combine qualitative and quantitative methods may offer a way to deal with some of this complexity, with proponents suggesting that mixing offers the potentiality of explanatory power and generalizability (Brennen, 2005; Creswell & Clark, 2007; Greene, 2007; Johnson et al., 2007).

Taking OHS research as a case study, in this paper we examine the ways in which studies that use mixed methods integrate and consider sex and gender, and assess the degree to which mixed methods contribute to a more sophisticated analysis of the complex relationship between sex and/or gender, and OHS. First we briefly review some of the limitations of how sex and gender are used in OHS research and highlight a methods problem that emerges from this literature. Then we discuss mixed methods as a possible approach for addressing this problem. Next, we describe our search and sampling strategy. We proceed with our findings, where we present the range of conceptual approaches to sex and gender and the range of mixed methods.

And finally, we discuss the effectiveness of mixed methods in capturing the complexity of sex and gender and the implications for the production of strong health knowledge and evidence-based policy. This study builds on the work of the Working Group on Mixed Methods, which is part of the Canadian Institutes of Health Research (CIHR) funded Team in Gender, Environment and Health (<http://geh.ges.uqam.ca/en/>). The overall aim of this interdisciplinary Team's work is to develop new approaches to study environmental and occupational health that integrate sex and gender.

The difficult task of integrating sex and gender in OHS research

Scholars have pointed to modest growth in the research on women and OHS (e.g., Messing et al., 2003; Messing & Stellman, 2006), and more recently on men's OHS using a gender perspective (e.g., Stergiou-Kita et al., 2015). At the same time, a number of key limitations in OHS research that considers sex and gender persist. In this section we review three interconnected limitations, and draw attention to a methodological problem that emerges from this literature.

First, where sex and gender are accounted for there tends to be an unacknowledged presupposition that sex and gender are unproblematic, binary categories, meaning that there are two sex categories (male and female) and two gender categories (men and women). This presupposition underpins research methods that control for gender or sex and compare results by gender or sex, which in turn produce circular and essentialist explanations (i.e., that the differences found between men and women are because they are men and women). The problem with reductionist explanations produced using routine statistical analysis (e.g., multivariate regression) is that they neglect how sex or gender may be "a proxy for exposure-related variables" (Messing et al., 2003, p.623). Messing & Stellman (2006, p.158) write:

For example, many studies that include women state that they “control” for gender rather than considering gender, sex, and associated covariates and confounders in the conceptual framework of the study. Male–female comparisons of outcomes are often made with no reference to the many exposure parameters that are associated with gender, leaving the impression that female sex alone makes women more (or less) vulnerable to various occupational health outcomes such as accidents, sick building syndrome, carpal tunnel syndrome, and stress.

It follows then that women’s and men’s OHS are mediated by socially and culturally constructed experiences (e.g., gendered divisions of labour, gendered divisions within the same job category) that shape exposure. Likewise, approaches that exclude contextual factors risk reducing socially and culturally produced phenomenon to biology.

This brings us to the second limitation, that is the presumption that biological sex is somehow pure, objective and immutable, and indeed trumps gender. OHS research tends to assume in advance that sex and gender categories are binary (i.e., sex is biological and gender is social) or that gender is an outcome of sex, so that in the end they are the same – gender being considered as a more encompassing concept that includes social considerations on top of the biological ones. Both conceptualizations are challenged by intersexual, transgender and queer studies (Butler, 1990; Fausto-Sterling, 2012; Hird, 2000). To illustrate, a potential problem in biomedical research is the use of correction factors based on sex-typing. Correction factors may obscure contextual factors contributing to the sex difference in the very thing being measured (e.g., metabolism or resting heart rate) or produce the difference that is being investigated (Messing et al., 2003, p.624), making sex comparisons problematic at best. Underpinning such research methods is the presumption that sex categories (i.e., male and female) are dimorphic *and* that sex and gender are discrete categories, meaning that the biological category sex is distinguishable from culturally constructed gender. This latter presumption appears less and less credible, given the weight of recent work illustrating not only how culture shapes sex development, but how sex itself is a culturally produced category to explain or account for

gender (Butler, 1990; Frost, 2014; Rubin, 2012). The point here is that OHS research rarely attempts to capture this complexity, and instead tends towards reduction.

Third, a focus on comparisons between men and women obscures within group differences, the ways in which other variables (e.g., class, ethnicity) interact with sex and gender, and how organisational and contextual factors structure particular outcomes. Härenstam (2009) has argued for organisational multilevel analysis and cluster analysis as possible solutions to these problems. Multilevel analysis allows for an examination of how the workplace and broader context produces different health outcomes for men and women as opposed to reducing differences to sex itself, while cluster analysis enables an examination within group categories to capture the complex interactions between gender, class, ethnicity and so on.

The tendency to reduce the complexity of sex and gender in OHS research may in part reflect disciplinary and methodological practices. Similar reductionist perspectives, including the quasi-absence of sex or gender considerations, have been identified with regards to health and safety prevention in the workplace (Calvet et al., submitted). Arguably, the separation of biological/biomedical and social sciences in OHS research limits our understanding of the complex relationship between sex and gender. A growing, albeit slowly, body of interdisciplinary literature on sex/gender and OHS is being established, and indeed encouraged by funding agencies like Canadian Institutes of Health Research. Though, as Messing & Stellman (2006, p.153-4, 157) find in their review, the social sciences are doing a better job than the natural and biomedical sciences of meaningfully integrating sex and gender in OHS analysis, as well as doing more women-focused OHS studies. On the one hand, the conceptual tools for examining the relationship between sex, gender and OHS may be more readily available to scholars in the social sciences, where there is a rich tradition of examining the ontological and

epistemological bases of the concepts sex and gender, as well as engaging in qualitative methods that seek to develop a contextualized understanding of social phenomenon. Some OHS scholars (Messing et al., 2003, p.625) have called for the integration of qualitative methods at various stages of quantitative research to mitigate some of the problems by the reductionist binary view of sex and to help determine which variables to prioritize in quantitative studies. On the other hand, social sciences scholars may not have the expertise to collect biological specimens or interpret ergonomic mechanisms that are necessary for understanding the bodily impacts of exposures.

This review of some of the difficulties involved in considering sex/gender in OHS research suggests, among other things, a methodological problem. In other words, *how* we collect data, by this we mean the researcher's choice of methods and categorical constructs, shapes what we know about men's and women's health and safety. Given the different ontological and epistemological bases of qualitative and quantitative methods, mixed methods are increasingly seen as a way of resolving some of the limitations of relying on one approach. In relation to accounting for sex/gender, mixed methods could offer a way to both interrogate the gender/sex difference problem while offering observations about the extent of a phenomenon.

Potential methodological strategy: Mixed methods

While there are different ways to define mixed methods approaches, there is fairly strong agreement that mixed methods requires a combination of quantitative and qualitative methods in the realisation of a study or a program of studies (Johnson et al., 2007; Hesse-Biber, 2010), in contrast to “multi-methods” or “multiple methods” approaches that consist of using multiple qualitative methods *or* multiple quantitative methods (Brewer & Hunter, 2006). Arguments in

favour of mixed methods approaches highlight the breadth and depth of understanding and corroboration that comes from combining quantitative and qualitative methods (Creswell, 2003; Denzin, 2010; Johnson et al., 2007), as well as the ability to capture multi-dimensional and multi-level lived realities (Greene, 2008; Mason, 2006). Mixed methods approaches, it is suggested, can bring a contextualized understanding to empirical observation. And yet, there are epistemological and ontological tensions between the two approaches that are difficult to resolve; for example, quantitative research is often assumed to reveal reality through objective measurement, while qualitative research tends to see reality as reflexively co-constructed.

Related to ontological and epistemological differences among researchers using mixed methods, in practice, research designs vary in terms of the timing of methods, being sequential or concurrent and in the degree of embeddedness of the methods. For the purpose of our analysis we have retained a typology largely inspired by Creswell & Plano Clark (2007) and Mongeau (2008). Explanatory sequential designs conduct quantitative methods first, followed by qualitative methods in order to explain the quantitative findings. Exploratory sequential designs lead with qualitative methods in order to develop appropriate questions or variables for the quantitative methods. In parallel concurrent designs, quantitative and qualitative methods addressing a particular issue are carried out independently and it is at the analysis stage where the researchers aim to triangulate or make sense of conflicting findings. Integrated or embedded concurrent designs, on the other hand, insert qualitative items or techniques within a quantitative method or vice versa (e.g., open ended questions in a quantitative questionnaire, selecting interview participants from a questionnaire sample). Embedded concurrent mixed methods designs are used to clarify some aspect of a quantitative measure or to corroborate quantitative results through qualitative methods (Creswell & Plano Clark, 2007; Greene et al., 1989; Johnson

et al., 2007; Mongeau, 2008).

Table 1: Mixed methods typology

	Phases	Useful for
Explanatory QUAN → QUAL	Sequential	Exploring “why”
Exploratory QUAL → QUAN	Sequential	Elaborating instruments
Embedded QUAN(qual) QUAL (quan)	Concurrent one set is secondary	Supporting / clarifying results
Triangulation / Convergent QUAN + QUAL [QUAN + qual] [QUAL + quan]	concurrent	Comparing / validating / confronting / corroborating results

Note: Adapted from Creswell & Plano Clark, 2007 and from Mongeau (2008)

In this paper we ask: what is the relationship between different conceptualizations of sex/gender and the particular kind of “mixing”, and what does this mean in terms of what we learn about women’s and men’s OHS?

Our search strategy

The objective of this narrative review is to identify to what extent, within the OHS literature, mixed methods research is able to overcome the conceptual and “gender difference” limitations in the larger body of scholarship. Five multi-disciplinary databases are included in the search: Scopus, PubMed, Sociological Abstracts, Web of Science and Academic Search Premier. These databases were chosen because they provide comprehensive coverage of social science, humanities, health sciences, occupational health and medical literature. The point of such an inclusive search is to cast a wide enough net to catch the occupational health literature that would

focus on sex and/or gender, and use some type of mixed method. Thus multiple combinations of key works were used, such as:

- [“mixed methods” OR “multi-methods” OR “multiple methods” OR quantitative AND qualitative]
- [health OR safety OR well-being]
- [work* OR occupation* OR employ* OR job]
- [gender OR sex]

The searches were limited to: abstract and keywords, English, peer-reviewed journal (article), from year 2000 to 2014. In addition, we conducted a search of the *Journal of Mixed Methods*, which resulted in only one article.

The total result was 668 articles. The abstracts of the 668 articles were read, and duplicates or articles that did not meet the study criteria were removed (e.g., articles that used the term “work” to describe a “body of work” or “literature of work” or to “work with” something or someone, without a discussion of OHS). This process reduced our sample to 60 articles.

Table 2: Search results

Database/Journal	Search Results	Relevant to Research Question
Scopus	357	51
Pubmed	145	23
Sociological Abstracts	27	9
Web of Science	2	1
Academic Search Premier	136	25
Journal of Mixed Methods	1	0
Total	668	60 (Minus Duplicates) Final N=48

Power and Knott independently and sequentially read each of the sixty articles, and coded each of the articles based on the type of mixing, use of sex and/or gender, and general findings. This

process identified twelve articles that did not meet our criteria. One article was removed because it is not an academic paper (Tempel et al., 2005). Three articles used quantitative methods with what they called qualitative variables (e.g., gender, occupational classifications) (Johnsen et al., 2008; Kevorkyan et al., 2011; Lucini et al., 2011); two use multiple qualitative methods (Heravian et al., 2012; Van Blerk 2007); two articles present only qualitative findings of a mixed methods study (Chan et al., 2009; Richter et al., 2014), and another, only quantitative findings of a mixed methods study (Liao et al., 2011). One article is a quantitative study only (Guo et al., 2014). Another article (Patterson et al., 2012) describes a method to test intervention effectiveness, but does not describe a study that has implemented the method. Finally, Rees et al. (2009) is excluded because of its focus on an aspect of curriculum designed for first year medical students. Thus in total 48 articles meet our search criteria.

Our findings

Description of the articles

Of the 48 articles meeting our inclusion criteria, only two (Oyefara, 2007; Williams, 2003) are single-authored. The articles reviewed focus on a limited range of job categories or work environments, with sex workers making up approximately 40% (N=19) of the workers examined in the sample (see Table 3). Articles focusing on health and care professionals make up the next largest category, followed by articles focusing on migrant workers, farm workers, and informal or unpaid work respectively.

Table 3: Occupation examined in each article

Type of work/er	Articles	N
Sex workers	Basuki et al.; Benoit et al.; Busza & Baker; Collumbien et al., Folch et al.; Handlovsky et al.; Liao et al.; Lutnick & Cohan; Mayhew et al.; Mimiaga et al.; Nemoto et al. 2008; Nemoto et al. 2013; Oyefara; Palinkas et al.; Reisner et al.; Semini et al.; Ulibarri et al.; Uy et al.; Yi et al.	19
Health and care professionals	Bernabeu-Wittel et al.; Kim & Motsei; Phillips et al.; Pisarski & Bohle; Prajapati et al.; Sakellaropoulos et al.; Stone et al.	7
Migrant workers	Grzywacz et al. 2005; Grzywacz et al. 2007; Im & Meleis; Organista et al.; Reid et al.; Zúñiga et al.	6
Farm workers	Cole et al.; Judd et al.; Kubik & Moore 2002; Kubik & Moore 2005; Orozco et al.	5
Informal/unpaid work	Bryson et al.; Munga & Gideon; Stevenson et al.; Strazdins & Broom	4
Transportation/crew	Cunha et al.; Thomas et al.; Williams	3
Military	Ames et al.; Anastario et al.	2
Teachers	Durksen & Klassen	1
Police Officers	Lonsway & Alipio	1

Given the overrepresentation of articles focusing on sex workers, it is not surprising that the type of OHS issue most discussed is sexual risk; followed by psychological health and wellbeing; alcohol and drug abuse; discrimination, harassment and violence; and working conditions, ergonomics, and injury (see Table 4).

Table 4: Type of OHS examined in each article

Type of OHS	Articles	N
Sexual risk	Anastario et al.; Basuki et al.; Benoit et al.; Busza & Baker; Collumbien et al.*; Handlovsky et al.; Liao et al.; Mimiaga et al.; Nemoto et al. 2008; Nemoto et al. 2013; Organista et al.; Oyefara; Palinkas et al.*; Reisner et al.; Thomas et al.; Yi et al.	16
Psychological health & wellbeing	Durksen & Klassen; Kubik & Moore 2002; Kubik & Moore 2005; Phillips et al.; Stevenson et al.; Strazdins & Broom; Uy et al.;	8
Alcohol/drug abuse	Ames et al.; Collumbien et al.*; Mayhew et al.; Palinkas et al.*; Ulibarri et al.; Zuniga et al.	6
Discrimination/ harassment/ violence	Kim & Motsei; Lonsway & Alipio; Lutnick & Cohan; Sakellaropoulos et al.; Stone et al.; Williams	5
Work conditions/ ergonomics/ injury	Bernabeu-Wittel et al.; Cunha et al.; Pisarski & Bohle; Prajapati et al.; Reid et al.	5
Access to health care services	Folch et al.; Munga & Gideon; Semini et al.	3
Work-life balance	Bryson et al.; Grzywacz et al. 2005; Grzywacz et al. 2007	3
Exposure to pesticides	Cole et al.; Orozco et al.	2
Reproductive health	Im & Meleis; Zúñiga et al.	2
Suicide	Judd et al.	1

Note: Collumbien et al.; Palinkas et al.; are placed in two OHS categories, sexual risk and alcohol/drug abuse

Integration of sex/gender

Each article focuses on OHS related to one of the following sex/gender groupings: men, women, both men and women, and trans and cis gender. Six articles focus on the OHS of men exclusively, 20 on women, 19 on both men and women, and three on both cis (i.e., a person's gender identity and assigned sex are congruent) and trans gender (see Table 5). It is important to note, however, that none of the articles used the label cis to describe research participants, and even in the cases where trans men or women are included, transgender is not theoretically developed. In at least one case (Phillips et al., 2012) where the focus is on cis and trans women's OHS, the study was not aimed at women only, rather the sample and findings reflect occupational sex segregation. Four articles focus on the health and safety of a single sex/gender grouping but include men and women in their sample (Bryson et al., 2007; Judd et al., 2006; Organista et al., 2006; Palinkas et al., 2014).

Table 5: Focus on health of particular sex/gender groups

Focus	Articles	
Men (cis)	Anastario et al.; Judd et al.; Mimiaga et al.; Organista et al.; ; Reisner et al.; Uy et al.	6
Women (cis)	Basuki et al.; Benoit et al.; Bryson et al.; Busza & Baker; Folch et al.; Handlovsky et al.; Im & Meleis; Kubik & Moore 2002; Kubik & Moore 2005; Liao et al.; Lonsway & Alipio; Lutnick & Cohan; Nemoto et al. 2008; Nemoto et al. 2013; Oyefara; Palinkas et al.; Semini et al.; Stevenson et al.; Ulibarri et al.; Yi et al.	20
Trans and cis gender	Collumbien et al.; Mayhew et al.; Phillips et al.;	3
Men and women (cis)	Ames, G. M., et al., Bernabeu-Wittel, M., et al. Cole e al; Cunha, et al; Durksen & Klassen (2012); Grzywacz,et al 2005; Grzywacz, J. G., et al2007; Kim, & Motsei. 2002; Munga,et al; Orozco,et al; Pisarski, & P. Bohle; Prajapati et al; Reid,etal; Sakellaropoulos,et al; Stone et al; Strazdins,et. al; Thomas,et al; Williams; Zúñigaet al	19

How the articles problematize sex and gender varies substantially, and each of the articles falls in to one or more of the following categories: strong problematization, weak problematization, comparative, and no consideration beyond the focus on a sex or gender grouping (see Table 6). Only 7 of the articles (Bryson et al., 2007; Cunha et al., 2014; Im & Meleis, 2001; Kubik & Moore, 2002; Munga & Gideon, 2009; Strazdins & Broom, 2004; Williams, 2003) fall in the first category, explicitly using gender or feminist theory or associated concepts to frame the study and interpret the findings, and only one of these (Im & Meleis, 2001) critically examines gender and sex. For example, Cunha et al.'s article takes as its starting point the recent increase

in the number of women in the male-dominated world of bus driving, and develops a “gender mobility” framework for addressing women’s and men’s OHS. Im & Meleis (2001) examine the relationship between Korean women’s work and menopause, problematizing the ways in which sex and gender are conflated in the wider literature and among their participants. Each of the articles in this set takes as its starting point an examination of the relationship between gender/sex and OHS. The remaining articles in our sample are not focused on this relationship per se, but either consider in some way the relationship between sex/gender and OHS (e.g, one or more finding is related to gender/sex or rates of exposure or outcomes are compared for women and men) or simply study a sex/gender category.

A total of 15 articles (Ames et al., 2007; Anastario et al.,2013; Benoit et al., 2013; Busza & Baker, 2004; Grzywacz et al., 2007; Kim & Motsei, 2002; Kubik & Moore, 2005; Liao et al., 2011; Mayhew et al., 2009; Palinkas et al., 2014; Phillips et al., 2012; Stevenson et al., 2012; Thomas et al., 2013; Ulibarri et al., 2013; Zúñiga et al., 2014) fit into the weak problematization category, making somewhat weaker connections between the social or cultural bases of gender and OHS in order to make sense of one or more findings. For example, Busza & Baker describe and measure the success of an intervention (the introduction of the female condom) aimed at female sex workers in Cambodia. The researchers frame this intervention in terms of the empowerment of female sex workers, but do not develop or frame their analysis in terms of gender power relations. In another article, in order to assess the drinking behaviours of military personnel, Ames et al. use sex-adjusted criteria (i.e., number of drinks by sex) for assessing problematic drinking and draw attention to gender norms as a way to help explain both gender differences and similarities in drinking rates. However, there is no discussion of the military as a masculine institution nor theoretical framing of working in a male-dominated work environment

(even though women were oversampled because of this fact). Anastario et al., on the other hand, are arguing against the hypermasculinity thesis and instead suggest that the sexual health of military men is linked to the organisation of workplace and related habitus, not cultural ideas about gender.

Fifteen of the 48 articles (Ames et al., 2007; Bernabeu-Wittel et al., 2005; Cole et al., 2011; Durksen & Klassen, 2012; Grzywacz et al., 2005; Grzywacz et al., 2007; Munga & Gideon 2009; Orozco et al., 2011; Pisarski & Bohle, 2001; Prajapati et al., 2013; Reid et al., 2014; Sakellaropoulos et al., 2011; Stone et al., 2010; Thomas et al., 2013; Zúñiga et al., 2014) explore gender as difference, offering comparisons between men and women for one or more findings. The nature of comparisons (e.g., extent to which the articles compared findings between men and women and the interpretive lens employed) varies across the articles. For example, Bernabeu-Wittel et al. (2005) report gender differences in their discussion of their quantitative data (e.g., gender is a variable), but do not report on gender in their discussion of the qualitative data. Grzywacz et al. (2007) compare the differential impact between men and women of poultry work on immigrant workers' work-family stress, and while the relationship between gender and OHS is not central to the paper, the authors do interpret gender difference in relation to cultural gender ideologies and divisions of labour. In a study by Sakellaropoulos et al. (2011), the finding that women were more likely to report experiencing workplace violence than men is interpreted by appealing to assumptions about gender difference (e.g., women are more sensitive to aggressive behaviour). The authors' use of workplace aggression theory that does not critically engage gender but instead relies on "commonsense" stereotypes serve to blame young women for the workplace violence they experienced. Finally, in their investigation of how workers in the informal sector accessed and experienced health care services, Munga & Gideon (2009) compare

their quantitative and qualitative findings by gender (men and women) and interpret their findings using a strong gender lens, contextualizing the data in relation to material and ideological gender inequalities.

Finally, 16 of the articles neither compare men and women, nor account for gender or sex; rather they simply happen to be focusing on a group of workers identified by sex/gender. For example, Collumbien et al. examine the health risks of Pakistani sex workers focusing on male and transgender sex workers. Barring the use of “within-gender” categories to describe their sample of men, feminized sex workers and masculinized sex workers, the authors offer no discussion of sex/gender as a way of making sense of their findings from qualitative interviews and quantitative bio-behavioural survey. In their study of condom use among women sex workers, Handlovsky et al. interpret their findings regarding the barriers of use in terms of risk theory, with no consideration of gender.

Table 6: Conceptualization of sex/gender

Use of gender/sex	Articles	N
STRONG problematization of gender	Bryson et al.; Cunha et al.; Im & Meleis; Kubik & Moore 2002; Munga & Gideon; Strazdins & Broom; Williams	7
WEAK problematization of gender	Ames et al.; Anastario et al.; Benoit et al.; Busza & Baker; Grzywacz et al. 2007; Kim & Motsei; Kubik & Moore 2005; Liao et al.; Mayhew et al.; Palinkas et al.; Phillips et al.; Stevenson et al.; Thomas et al.; Ulibarri et al.; Zuniga et al.	15
Comparing men & women	Ames et al.; Bernabeu-Wittel et al.; Cole et al.; Durksen & Klassen; Grzywacz et al. 2005; Grzywacz et al. 2007; Munga & Gideon; Orozco et al.; Pisarski & Bohle; Prajapati et al.; Reid et al.; Sakellaropoulos et al.; Stone et al.; Thomas et al.; Zuniga et al.	15
Neither binary nor problematization of sex or gender	Basuki et al.; Collumbien et al.; Folch et al.; Handlovsky et al.; Judd et al.; Lonsway & Alipio; Lutnick & Cohan; Mimiaga et al.; Nemoto et al. 2008; Nemoto et al. 2013; Organista et al.; Oyefara; Reisner et al.; Semini et al.; Uy et al.; Yi et al.	16

Relationship between types of mixing and consideration of sex/gender

The most common methods used in our sample are surveys, followed by interviews and focus groups in that order. Of the 48 articles only nine (Anastario et al., 2013; Benoit et al., 2013; Durksen & Klassen, 2012; Kim & Motsei, 2002; Lutnick & Cohan, 2009; Mayhew et al., 2009; Stevenson et al., 2012; Yi et al., 2012; Zúñiga et al., 2014) address mixed methods explicitly as a method, meaning that the authors included both a description of each of the methods used *and* a

discussion of how and why the methods were “mixed.” The exploratory sequential type of mixing is the most popular (N=14), followed by integrated or embedded concurrent approaches (N=13), parallel concurrent designs (N=11) and explanatory sequential designs (N=10) (see Table 7). It is important to note that these categorical designations are ours, not the authors as they rarely used this language to describe their methods. We have placed each article in one of the categories; at times there was insufficient information, but we made a judgement call based on a close reading and/or referring to related articles produced by the same authors reporting results from the same study.

Table 7: Type of mixed methods

Type of mixing	Articles	N
Exploratory sequential designs	Ames et al.; Collumbien et al.; Grzywacz et al. 2005; Grzywacz et al. 2007; Kim & Motsei; Kubik & Moore 2002; Kubik & Moore 2005; Liao et al.; Lutnick & Cohan; Mayhew et al.; Nemoto et al. 2008; Nemoto et al. 2013; Stevenson et al.; Thomas et al.	14
Integrated or embedded concurrent	Basuki et al.; Benoit et al.; Durksen & Klassen; Handlovsky et al.; Im & Meleis; Lonsway & Alipio; Palinkas et al.; Pisarski & Bohle; Sakellaropoulos et al.; Stone et al.; Strazdins & Broom; Williams; Zuniga et al.	13
Explanatory sequential designs	Bernabeu-Wittel et al.; Bryson et al.; Cunha et al.; Folch et al.; Judd et al.; Organista et al.; Oyefara; Prajapati et al.; Reid et al.; Yi et al.;	10
Parallel concurrent designs	Anastario et al.; Busza & Baker; Cole et al.; Mimiaga et al.; Munga & Gideon; Orozco et al.; Phillips et al.; Reisner et al.; Semini, I., et al. Ulibarri et al.; Uy et al.	11

Table 8 combines Tables 6 and 7 in order to present patterns in relationship between type of mixed method and how sex/gender is conceptualized in each article. The most striking observation here is that there is nothing in mixing methods that necessitates a meaningful account of gender or sex in OHS research. Here, the exploratory sequential approach has the strongest association with problematizing gender (N=9), followed by the integrated or embedded concurrent approach (N=6) and the parallel concurrent design (N=5). The explanatory sequential design has the weakest association with problematizing gender (N=2). It is also noteworthy that the proportion of articles that neither problematized gender nor presented binary or comparative findings is spread across the types of mixing. In other words, no one type of mixing was less likely to account for gender.

Table 8: Associations between types of mixed methods and conceptualisations of sex/gender

	Exploratory sequential designs	Integrated or embedded concurrent	Explanatory sequential designs	Parallel concurrent designs
STRONG problematization of gender	Kubik & Moore 2002 N=1	Im & Meleis; Strazdins & Broom; Williams N=3	Bryson et al.; Cunha et al. N=2	Munga & Gideon N=1
WEAK problematization of gender	Ames et al.; Grzywacz et al. 2007; Kim & Motsei; Kubik & Moore 2005; Liao et al.; Mayhew et al.; Stevenson et al.; Thomas et al. N=8	Benoit et al.; Palinkas et al.; Zuniga et al. N=3	N=0	Anastario et al.; Busza & Baker; Phillips et al.; Ulibarri et al. N=4
Comparing men & women	Ames et al.; Grzywacz et al. 2005; Grzywacz et al. 2007; Thomas et al.; N=4	Durksen & Klassen; Pisarski & Bohle; Sakellaropoulos et al.; Stone et al.; Zuniga et al. N=5	Bernabeu-Wittel et al.; Prajapati et al.; Reid et al. N=3	Cole et al.; Munga & Gideon; Orozco et al. N=3
Neither binary nor problematization of sex or gender	Collumbien et al.; Lutnick & Cohan; Nemoto et al. 2008; Nemoto et al. 2013 N=4	Basuki et al.; Handlovsky et al.; Lonsway & Alipio N=3	Folch et al.; Judd et al.; Organista et al.; Oyefara; Yi et al. N=5	Mimiaga et al.; Reisner et al.; Semini et al.; Uy et al. N=4

Discussion

Despite being quite broad in terms of its parameters, our search strategy for peer-reviewed publications produced a limited sample, both in terms of quantity of articles and job type being

investigated, and the analyses in the articles raise questions as to how both mixed methods and sex and gender are conceptualized. In what follows, we consider why our results are limited despite our broad search criteria, as well as why the range of job types represented in our final sample is narrow. Finally, we consider how successfully mixed methods approaches capture the complexity of sex and gender in OHS research reviewed above and the implications for the production of strong health knowledge and evidence-based policy.

Although the limited results of our search strategy may primarily reflect the paucity of studies using mixed methods and integrating sex/gender in OHS studies, it also seems likely that it reflects a limitation of this review in that it excludes publications that do not refer explicitly to “mixed methods” in the article’s abstract (one of our search criteria), a practice we suspect is common. Indeed it is an omission the authors of this paper have made in their own publications. Such omission may be explained by the fact that while the use of mixed methods is not new, the language used to describe mixed methods emerged fairly recently in academic writing, reflecting a growing intellectual interest in mixed methods as a methodology. Another factor limiting the number of our results may be that the quantitative and qualitative findings of “mixed” research designs are often reported separately, as was the case for some of the papers we did not retain for analysis. This last point raises doubts about how mixed methods are used in practice. In other words, researchers may indeed use qualitative and quantitative methods as part of the research design, but the extent to which the analysis considers both may be limited.

The range of occupational categories is limited in the articles returned by our research strategy. Most notably, sex workers are overrepresented. This could be an artefact of the key words we used (e.g., sex, work) but as these papers meet all other criteria for selection, it is unlikely that this is the sole explanation. Instead, we suggest that sex work is a subset of articles

that focus on informal work more broadly in our sample (informal work is addressed in 34 of the 48 papers, and includes sex work, migrant work, farm work and unspecified informal or unpaid work). Our search strategy, we suspect, resulted in an overrepresentation of informal work in part because of its highly gendered nature (ILO, 2008) and the unique methodological challenges presented by documenting informal work. With regards to the latter point, informal work has been neglected in OHS research more broadly, and therefore calls for the inclusion of more exploratory and qualitative methods in a field of study (OHS) that has traditionally relied more on quantitative methods. Further still, quantitative sampling requirements may not be met with informal work where the size of the population is rarely known and study participants are likely to be difficult to reach. Given these challenges, it is not surprising that there seems to be an association between mixed methods designs and studies on OHS issues related to informal work.

Our findings show that addressing sex and gender in mixed method studies in OHS is being done in various ways and that employing mixed methods does not necessarily lead to analyses of sex or gender that move beyond reproducing binary comparisons or essentializing difference. Our results show that no one type of mixing is associated with producing analysis that captures the complexity of the relationship between sex/gender and OHS. Nor does a focus on a single sex/gender sample or group equate with accounting for gender or sex in a meaningful way. Instead, in most instances, the articles focusing on a single sex/gender sample or group of workers treat this fact as unproblematic. Similarly, some of the articles engaging in comparisons by gender or sex generated findings that reproduce the gender binary (e.g., articles using gender/sex primarily as a demographic variable in both qualitative and quantitative methods), but this was not the only outcome. Where comparisons are interpreted using gender or feminist theory, more nuanced accounts of sex/gender emerged. It is also clear that mixed methods alone

is not sufficient for identifying the salience of sex/gender in relation to OHS. In some cases, gender and sex are not developed as significant points for discussion where it might seem appropriate. For example, in cases where OHS outcomes for women and men are reported in the context of a male dominated work environment, it would make sense, we argue, to ground those results in a discussion of the gendered organisational or industry context, but this is not always the case. In other cases where gender comparisons are made, essentialist explanations are provided where other reasons (e.g., workplace structure) may be more appropriate. The articles that do the best job of overcoming the problem of reproducing binary and essentialist representations of sex/gender are those that take as their starting point an examination of the relationship between gender/sex and OHS, and are guided, not surprisingly, by gender and feminist theoretical frameworks. To be fair, this relationship is not the intended focus of the other articles in our sample; their presentation of findings do, nevertheless, contribute to our knowledge about the relationship between sex/gender and OHS, and do so in a way that reinforces the dominant discourse of sex dimorphism and the privileging of sex (assumed to be biological, and therefore less mutable) over gender (assumed to be cultural, and often emerging from, and therefore secondary to sex). With this in mind, we suggest that researchers and funding bodies alike exercise care in how sex and gender are considered in research proposals and designs. In other words, presenting gender- or sex-related findings without using appropriate conceptual tools may in fact be more harmful than helpful in attempts at devising appropriate and just OHS interventions, especially when they incorrectly identify gendered or sexed bodies as the site of the problem, rather than gendered processes or institutions.

Conclusion

It is our conclusion that a mixed methods approach alone is not enough to ensure meaningful and rigorous consideration of sex and gender in OHS research, nor the production of anti-oppressive health knowledges and equitable interventions. This conclusion is similar to one put forward by feminist scholars (e.g., Hesse-Biber & Leavy, 2007; McCall, 2005) engaged in debates about the androcentric nature of methods and research design more generally. Mason (2006) argues that mixed methods approaches are better able to produce meaningful findings when they are qualitatively driven and dialogic. She is arguing for approach to mixed methods that requires researchers to consider how different methods are able to shed light on different dimensions of the same problem and how these connect or link together when devising an explanation.

Extending a qualitatively driven and dialogic approach to our case study involves consideration in advance the appropriateness of methods for research questions, as well as the ways in which ontological and theoretical framings shape the kinds of OHS questions being asked, as well as the ways in which we make sense of qualitative and quantitative gender- and sex-based findings.

We do not suggest that this is an easy task, but a lot is riding on our getting it right.

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