



STANDARDS RESEARCH

Canadian Women's Experiences with Personal Protective Equipment in the Workplace

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Executive Summary

Nearly 50 years ago, researchers and worker advocates drew attention to the problems women have finding appropriately sized and sufficiently protective personal protective equipment (PPE). Despite these early efforts – and evidence that poorly designed and poorly fitting PPE can potentially lead to serious injury or death – women continue to be differentially impacted by workplace hazards.

This report is aimed at gaining a better understanding of the extent to which physical differences are taken into account in the development of PPE and PPE standards for men and women. This report synthesizes the findings of a review of the scientific and grey literature, an environmental scan of PPE regulations, key informant interviews, and a survey of nearly 3000 Canadian women who use PPE in their daily job functions.

Key findings include:

- Research shows that anthropometric differences exist between the sexes and that women are not merely scaled-down versions of men. The significance of this is two-fold: (a) protective clothing and other PPE that are designed based on men's proportions cannot be simply scaled down linearly to fit women; and (b) good quality anthropometric data representative of the contemporary working population are critical for the inclusive design of PPE.
- Canadian regulations do not consistently require that selected PPE provide protection appropriate to the hazards and that it fit the user properly.
- There is no consistency in the PPE standards and editions that are referenced in regulations across the country.
- Functional fit and comfort are two of the most important parameters in the design and usage of PPE. Canadian women identified these factors – along with trust that their PPE will protect them and allow them to move around to do their job – as key to satisfaction with their PPE. However, a significant number of women reported experiencing one or more problems with their PPE.
- The three most common problems the Canadian women surveyed have with their PPE are that
 - a. it does not fit properly (50%);
 - b. it is uncomfortable to wear (43%); and
 - c. the selection of women-specific PPE is inadequate (35%).

To try and address these issues, women are paying out of pocket to source PPE with a better fit or that is specifically designed for women, and modifying or altering their PPE for safety, comfort, and improved fit.

- The Canadian women surveyed reported that
 - a. they use PPE that is the wrong size at least some of the time (58%);
 - b. they don't wear all the required PPE at work because of issues with fit (28%); and
 - c. they use a workaround to make their PPE fit (38%).

Workarounds included using rubber bands, safety pins, and/or duct tape to shorten fall-arrest gear, secure work gloves, shorten sleeves, and prevent their pant legs from tripping them. Nearly 40% reported experiencing an injury or incident that they perceived to be related to their PPE.

Although PPE is considered to be the last line of defence and should only be used where other control measures are not practicable, PPE is widely used by employers because it is a simple and inexpensive way to control exposure or the PPE may provide supplementary protection where other controls are not adequately protective. For these reasons, it is paramount that the PPE fits *each* worker properly, that it provides maximal and effective protection, and that the workers can trust it to protect them and prevent injury.



"Research shows that the gendered and sexual division of labour has an impact on the health and safety of workers and on their risk of occupational injury and disease"

1 Introduction

A report recently published by the Standards Council of Canada (SCC), entitled "When One Size Does Not Protect All: Understanding Why Gender Matters for Standardization", specifically highlighted personal protective equipment (PPE) standards. The report noted that because PPE standards are largely based on male anthropometry, they are not equally protective or equally effective for men and women [1]. This research project was undertaken in response to the findings of the SCC report, as well as articles in the occupational health and safety (OHS) and mainstream media about (a) the problems that health care workers had with ill-fitting PPE during the COVID-19 pandemic; and (b) how women in many industries (but particularly in construction) may not be protected from workplace hazards because much of the available PPE has been designed for men [2].

Research shows that the gendered and sexual division of labour has an impact on the health and safety of workers and on their risk of occupational injury and disease [3-13]. The biological attributes that distinguish women from men (such as sex hormones, body size and composition, respiratory rates, etc.) influence how chemicals are absorbed, distributed, stored, and

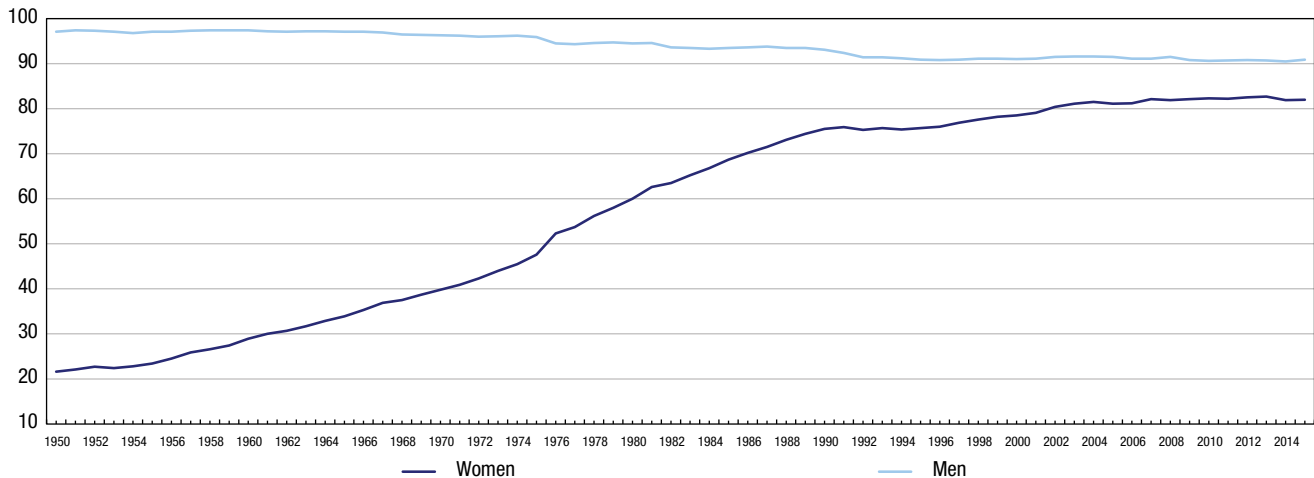
metabolized in the body, as well as the biologically active dose and the type of effects experienced following exposure [11, 12, 14, 15]. These sex differences in toxicokinetics¹ and toxicodynamics² mean that (a) men and women respond differently to chemical, physical, and biological exposures [11, 12, 14-17]; and (b) men and women in the same occupation can be differentially affected by the same level of exposure to chemical or biological agents [11, 12, 17-25].

One of the fundamental worker protections enshrined in OHS legislation around the world is the right to a safe work environment. Where risk cannot be avoided, OHS regulators generally require that the risk be reduced or managed via technical measures (i.e., engineering controls), organizational measures (i.e., administrative controls), or personal measures (i.e., PPE, behavioural change) [26]. However, with the exception of some initiatives in the European Union [13, 27-29] and the Gender Responsive Standards Initiative spearheaded by the United Nations Economic Commission for Europe (UNECE) [30-32], sex and gender³ differences are rarely considered in the design and implementation of OHS legislation, policies, systems, and preventive measures or in the standards-development process. As a result, the health, safety, and well-being of women may be at greater risk than that of men [1].

¹ Refers to the movement and fate of a chemical or biological agent into, through, and out of the body – specifically, its absorption, distribution, metabolism, and excretion. The toxicokinetics of a particular agent are influenced by the route of exposure (i.e., inhalation, absorption, ingestion) and by organ functions.

² Refers to the biochemical, physiological, and molecular effects that a chemical or biological agent has on the body.

³ Although the terms "sex" and "gender" are two distinct concepts (see Section 3.1 for definitions), the literature often uses these terms interchangeably. In this report, the author also uses "sex", "gender", or "sex/gender" interchangeably, depending on which was referenced in a given citation.

Figure 1: Canadian Labour Force Participation Rates, 1950–2015 (by sex, ages 25–54) [33]

Note: Data covering the period of 1950 to 1965 exclude Newfoundland and Labrador.

Source: Statistics Canada, Labour Force Survey, CANSIM table 282-0002 and custom tabulations.

1.1 Labour Force Participation of Women in Canada

In July 2018, Statistics Canada released a report entitled “Women in Canada: A Gender-based Statistical Report”. One chapter of this report was dedicated to comparing the labour market experience of women with that of their male counterparts and exploring, where relevant, how these experiences have evolved over a 65-year period from 1950 to 2015 [33]. This analysis revealed that 6 million women between the ages of 25 and 54 participated in the labour market in 2015 and that women’s participation rate in the workforce had steadily increased from 21.6% in 1950 to 82.0% in 2015 [33]. Figure 1 illustrates how women’s participation in the labour force has steadily trended upward since 1950, while men’s has trended slightly down from 97.1% in 1950 to 90.9% in 2015 [33].

Based on data collected in a recent monthly survey, Statistics Canada estimates that 9.3 million women, aged 15 and older, were participating in the labour market in March 2022; of these, 6.9 million (74%) were employed full-time and 2.4 million (26%) were employed part-time [34]. The participation rate of women in the workforce declined during the COVID-19 pandemic, from 61.2% in March 2019 to 59.0% in March 2020. The participation rate for women in the Canadian workforce stood at 61.4% in March 2022, up from 60.6% in March 2021 [34].

Despite the increasing participation of women in the workforce since the 1950s, the labour force continues to be extensively segregated by sex and gender, both across and within occupations and industries [3, 4, 9, 35]. A 2020 study examining the distribution of labour by sex and gender across occupations in the Canadian workforce between 1991 and 2016 found that between 40% and 60% of job categories in at least one census since 1991 are either “mostly men” or “mostly women” [3]. Across the six censuses examined, higher proportions of women were employed in education, health care, and administration, while higher proportions of men were employed in repair, construction, and transportation occupations [3]. Table 1 shows the top ten occupations in Canada that comprised 90% of one sex/gender in 1991 to 2016.

The study also found that while the Canadian labour force had grown between 1991 and 2016, there was “an increasing sex/gender divide in the number of workers for trades, transportation, equipment operator; health; education, law, & social, community, government services; natural applied sciences; and sales and service” [3]. The authors noted little to no change in the trend towards parity (i.e., equal representation of men and women) for most occupations over the study period, except for occupations in “management” and “trades, transport and equipment operator” (which showed a narrowing gap) and “education, law, and social, community and government services” (which showed a widening gap in favour of women) [3].

Table 1: Top Ten Highly Segregated Occupations in Canada, 1991–2016 (adapted from [3])

Occupational Title (4-Digit National Occupational Classification [NOC] code)	Average no. of workers / census*	Proportion, %
Occupations Dominated by Men		
Motorcycle, all-terrain vehicle, and other related mechanics (7334)	7591	99.0
Bricklayers (7281)	17 504	98.8
Heavy-duty equipment mechanics (7312)	40 364	98.7
Drillers and blasters – surface mining, quarrying, and construction (7372)	3034	98.7
Elevator constructors and mechanics (7318)	3936	98.6
Steamfitters, pipefitters, and sprinkler system installers (7252)	20 243	98.6
Heating, refrigeration, and air-conditioning mechanics (7313)	18 012	98.5
Plumbers (7251)	39 308	98.5
Construction millwrights and industrial mechanics (7311)	69 275	98.5
Railway carmen/women (7314)	3562	98.5
Occupations Dominated by Women		
Medical administrative assistants (1243)	36 618	98.5
Dental assistants (3411)	26 432	98.4
Dental hygienists and dental therapists (3222)	16 598	97.2
Early childhood educators and assistants (4214)	167 730	96.4
Dietitians and nutritionists (3132)	7984	94.3
Home child care providers (4411)	134 290	94.1
Court reporters, medical transcriptionists, and related occupations (1251)	6924	94.1
Receptionists (1414)	139 289	93.8
Registered nurses and registered psychiatric nurses (3012)	241 475	93.6
Administrative assistants (1241)	438 585	93.4

*The average number of workers across all censuses in which the occupational field appears.

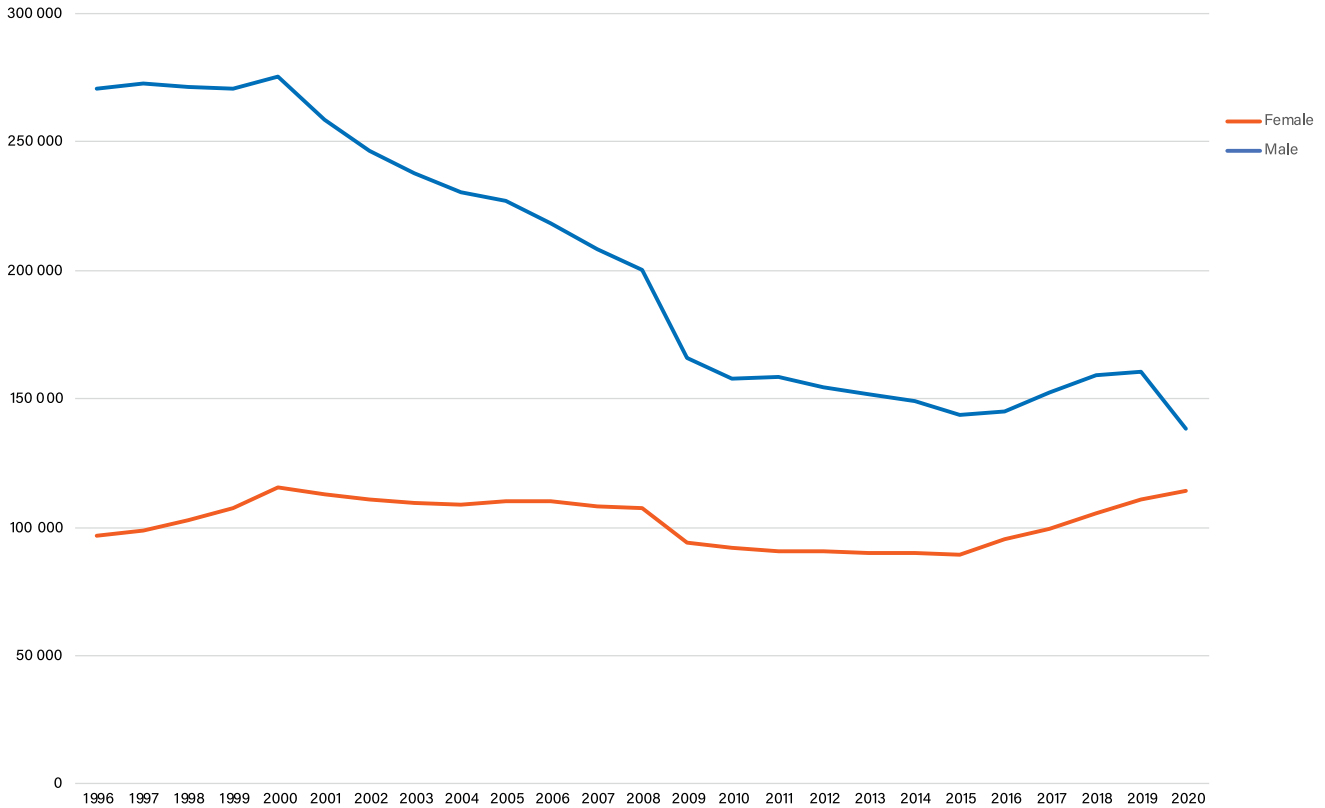
1.2 Lost-time Injury Claims Rate for Women in Canada

Provincial and territorial workers' compensation authorities in Canada collect data on the number of work-related injuries and diseases accepted for compensation under the workers' compensation acts in their respective jurisdictions. Each year, these workers' compensation boards and commissions submit data on lost-time claims and fatalities to the Association of Workers' Compensation Boards of Canada (AWCBC).

To enable comparisons for certain key indicators across jurisdictions, the AWCBC combines these data into the National Workplace Injury Statistics Program (NWISP), a data repository with information on work-related, accepted lost-time injury claims, occupational diseases, and fatalities across 20 major industries and 10 major occupational groups [36]. Summary NWISP data are publicly available via an annual statistical report⁴ and other data visualization tools published on the AWCBC website. Specific, customized data can be requested via an online form. To get a sense of the trends in the

⁴ This report includes historical statistics for lost-time claims (dating from 1982) and fatalities (dating from 1993), by jurisdiction; and jurisdictional statistics on lost-time claims and fatalities cross-tabulated by gender, age group, nature/source of injury or disease, part of body, event or exposure, occupation, and industry. For comparative purposes, these cross-tabulated data are presented over a three-year time span.

Figure 2: Number of Accepted Lost-time Claims in Canada, by Sex, (1996–2020)



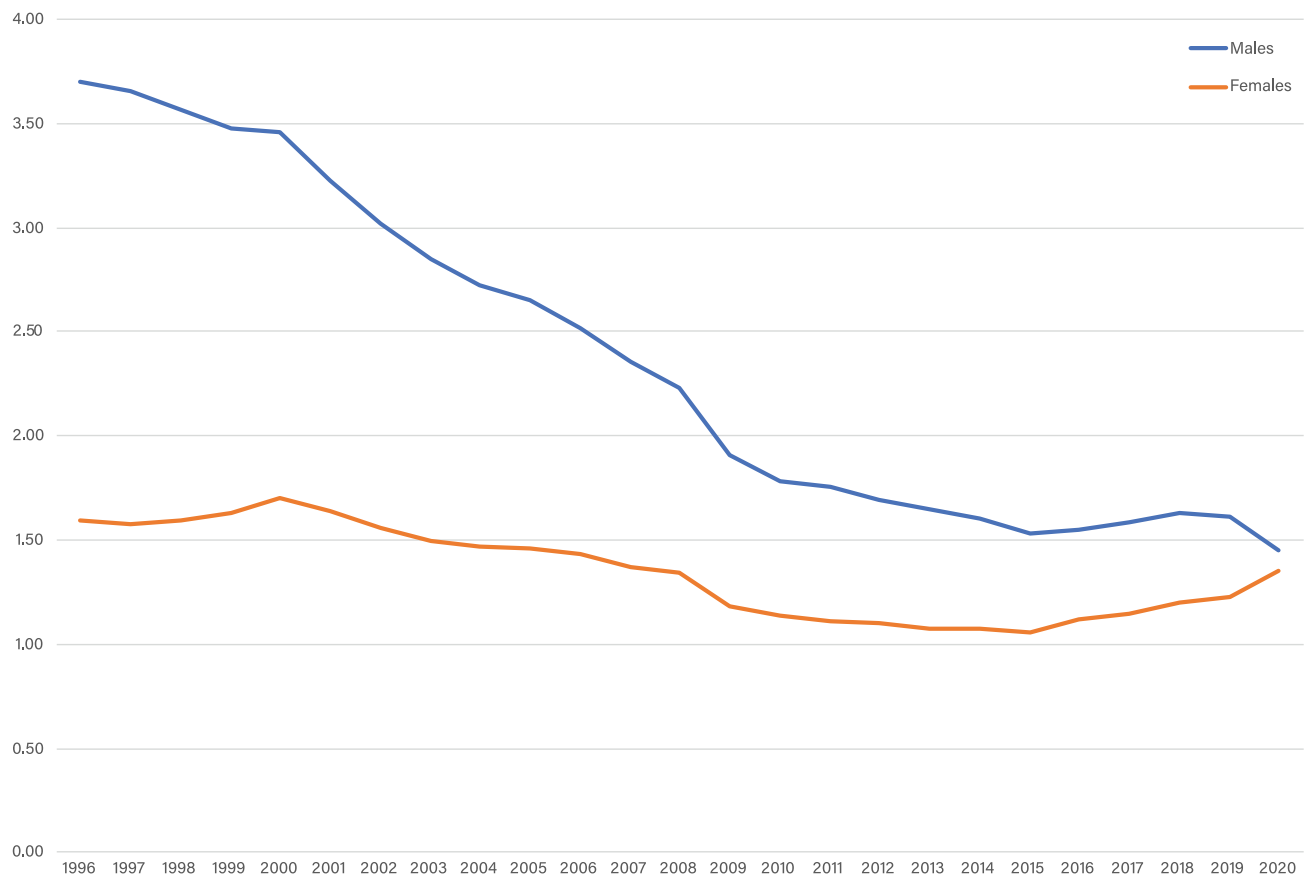
number and rate of accepted lost-time claims in Canada among women vs men, sex-disaggregated data were requested from the AWCBC for the years 1996 to 2020.

Between 1996 and 2020, there were 7 620 010 accepted lost-time claims in Canada. Of these, males accounted for 5 026 089 (or 65.9%), while females accounted for 2 561 988 (or 33.6%).⁵ Figure 2 plots the trend in the number of accepted lost-time claims, by sex, over the 24-year period. The overall number of accepted lost-time claims has trended down for men, but remained comparatively level for women. Between 1996 and 2020, the number of accepted lost-time claims for women increased from 97 056 to 114 349.

Sex-specific work-related lost-time claims rates were calculated by dividing the total number of lost-time claims accepted for each sex in Canada between 1996

and 2020 by the total number of men and women estimated (by Statistics Canada) to be employed in a given year. These rates, which were calculated per 100 workers, are plotted in Figure 3. As the figure shows, the lost-time claims rate for men has declined by approximately 61% over the 24-year period, from 3.70 to 1.45 per 100 workers between 1996 and 2020. The lost-time claims rate for women in the same period declined by 15%, from 1.59 to 1.35 per 100 workers. The lost-time claims rate for both sexes reached its lowest point in 2015, after which it began increasing. Among men, the rate increased between 2015 and 2018 (from 1.53 to 1.63 per 100 workers) and then started to decline again. Among women, the rate has continued to increase, from 1.06 to 1.35 per 100 workers between 2015 and 2020 – an increase of nearly 28% (compared to a 5% decrease among men over the same period).

⁵ An additional 31 933 claims were either not coded or were unknown. These accounted for approximately 0.4% of the total number of claims accepted in this period.

Figure 3: Lost-time Claims Rate in Canada, per 100 workers, by Sex (1996–2020)

2 Purpose and Methods

2.1 Purpose

This research was aimed at gaining a better understanding of the extent to which gender differences are considered in the overall design and manufacture of PPE, specifically with respect to standards development and OHS regulations. The specific purpose of this research report was to:

1. find existing academic literature on sex- and gender-related anthropometrics in the design of PPE;
2. examine if and how jurisdictions are addressing the unique PPE needs of women in the workforce;
3. examine how well PPE is perceived to meet the safety performance and functional needs of Canadian women through key informant interviews

and a survey of women in the workforce who use PPE in their daily job functions; and

4. provide recommendations on how to better address the needs of women in the standards-development process and in the design of PPE more generally.

2.2 Methods

Beginning in September 2021, the following activities were undertaken to achieve the project's objectives: (a) a review of the scientific and grey literature; (b) an environmental scan of OHS regulations governing PPE use in Canada and selected international jurisdictions; (c) key informant interviews; and (d) a survey of Canadian women using PPE in their daily job functions.

2.2.1 Review of the Scientific and Grey Literature

With the assistance of a health sciences librarian at the University of British Columbia, an iterative strategy was developed to search five bibliographic databases⁶ of scientific (i.e., peer-reviewed) and grey literature. Initial search terms included “personal protective equipment” and “personal protective device” in combination with terms such as “sex factors”, “sex”, “gender”, and “anthropometric” and other terms to do with specific types of PPE (“ear protective devices”, “ear muff”, “head protective devices”, “hard hat”, “protective clothing”, “gloves, protective”, “gloves, surgical”, “respiratory protective devices”, “masks”, “respirators”, and “N95 respirators”).

The initial searches yielded more than 1000 potential articles. To narrow the results, the searches were rerun with additional search terms such as “occupation”, “workplace”, “design”, “comfort”, “fit”, “size”, and “size differences”. This resulted in the retrieval of 167 articles. Searches of the references cited within all retrieved articles identified another 20 articles. All 187 articles were downloaded and assessed for eligibility.

The titles and abstracts of the 187 retrieved articles were initially screened for relevance to the project. Where the titles and abstracts did not yield sufficient information, the full text of the articles were screened. No restriction on publication date was imposed, although only those papers published in English were included. Following the removal of duplicates (n=45), a full text review was undertaken of the remaining 142 articles. Articles were restricted to those that focused on anthropometric sex or gender differences in the design of PPE. Excluded were commentaries or letters to the editor, studies about protective devices that were non-occupational or designed for children, studies evaluating PPE effectiveness or efficiency, articles examining compliance with PPE usage, and interventions involving PPE. Based on these criteria, an additional 72 articles were excluded, leaving 70 articles for qualitative review.

2.2.2 Environmental Scan

The environmental scan sought to identify regulations, guidelines, and standards governing the use of PPE in the workplace. The scope was delineated by the

following terms: “personal protective equipment”, “PPE”, and/or “protective device”. Within each jurisdiction scanned, the starting point for the search was the official website of the organization with responsibility for OHS (i.e., the “regulator”). Using the hyperlinks and search engines located within the regulator’s official website, relevant documents and webpages to do with PPE were downloaded and/or bookmarked.

All relevant statutes in Canada (as well as any related regulations, policies, and guidelines) were examined to identify any reference to PPE. Where a policy instrument seemed relevant to the project, the wording of the applicable section was extracted verbatim and recorded in an Excel spreadsheet. A series of tables were developed to summarize the identified regulatory requirements, examine similarities and differences between jurisdictions, and identify any gaps in the regulatory approaches adopted and implemented. A subset of these tables is included in Appendix A.

While Canadian jurisdictions were the primary focus, the scan also included the following jurisdictions: Australia, the European Union, and the United States (specifically, the Occupational Safety and Health Administration). In addition to the OHS statutory frameworks, the catalogues of relevant standards development organizations were also scanned to identify PPE standards relevant to the project.

2.2.3 Key Informant Interviews

To enrich our understanding of how well PPE is perceived to meet the safety performance and functional needs of Canadian women, we conducted key informant interviews. Potential key informants were invited via email to participate, and those who self-selected were contacted to arrange an interview via Zoom. Prior to the interview, the key informants were provided with background information on the project’s objectives and the list of interview questions. The questions were designed to (a) gain an understanding of the key informant’s role in relation to the selection and use of PPE in the workplace; and (b) elicit and gather perspectives on the issues that women might face when selecting and using PPE, what could be done to address those issues, who has a role in addressing the issues, and what could be done to promote a gender-sensitive approach in the standards-development process.

⁶ MEDLINE (Ovid), PubMed, Web of Science, Google Scholar, NIOSHTIC.

Thirteen individuals from across Canada were interviewed. All had experience in regulating, procuring, or designing PPE; all but one were women, many of whom had lived experience of the difficulties in finding appropriate PPE. Key informants represented the federal government, provincial and territorial OHS regulators, industry and/or industry health and safety associations, designers of PPE for women, and a former representative of organized labour (an occupational hygiene specialist) who had published on women and PPE issues in the 1980s.

Each 60-minute interview was recorded in Zoom, transcribed using Otter voice meeting note software, and analyzed for common themes using Quirkos qualitative data analysis software. Before each interview began, consent to participate in the interview and for the interview to be recorded for transcription and data analysis purposes was obtained from each participant. See Appendix B for the interview guide.

2.2.4 Survey of Canadian Women

A confidential online survey was conducted of Canadian women working in sectors where workers are required to wear PPE. These sectors included, but were not limited to, construction, health care, energy and utilities, mining, forestry, and manufacturing. The primary goals of the survey were to (a) gather information on women's experience using PPE in the workplace; and (b) examine their perceptions of how well the PPE they use in their work meets their needs (in terms of safety performance and functionality).

The survey was drafted iteratively and in collaboration with the Project Team. The findings of the literature review and the environmental scan informed the development of the online questionnaire, and specific questions were included to allow comparison across the findings of similar surveys conducted in other jurisdictions (e.g., cross-sectional surveys of women in the construction sector in Washington State and New York [10, 37], and longitudinal surveys of women in multiple sectors in the United Kingdom [38, 39]).

To recruit participants, unique survey links were sent to 28 agencies and associations across Canada. These included, for example, sectoral trade associations, labour unions, women's trade and apprenticeship associations, OHS trade magazines, and industry health and safety associations. Recruitment continued to grow via word of mouth and

snowball sampling methods over the period of time that the survey remained open. Of the 28 unique links provided, survey responses were collected via 21 (see Appendix C).

Before starting the survey, participants were screened for eligibility. Only those who identified as women (i.e., cis-female, nonbinary, transgender woman (male-to-female) or transgender man (female-to-male)) and those who wear PPE at work were eligible to complete the survey. Throughout the survey period, regular updates were provided on the numbers of completed surveys received by survey link, by sector, by geographical region, by type of PPE worn, by size of employer, and by ethnicity. This allowed the Project Team to monitor recruitment and tailor the recruitment strategy as needed, thereby ensuring the survey sample was as diverse and representative as possible.

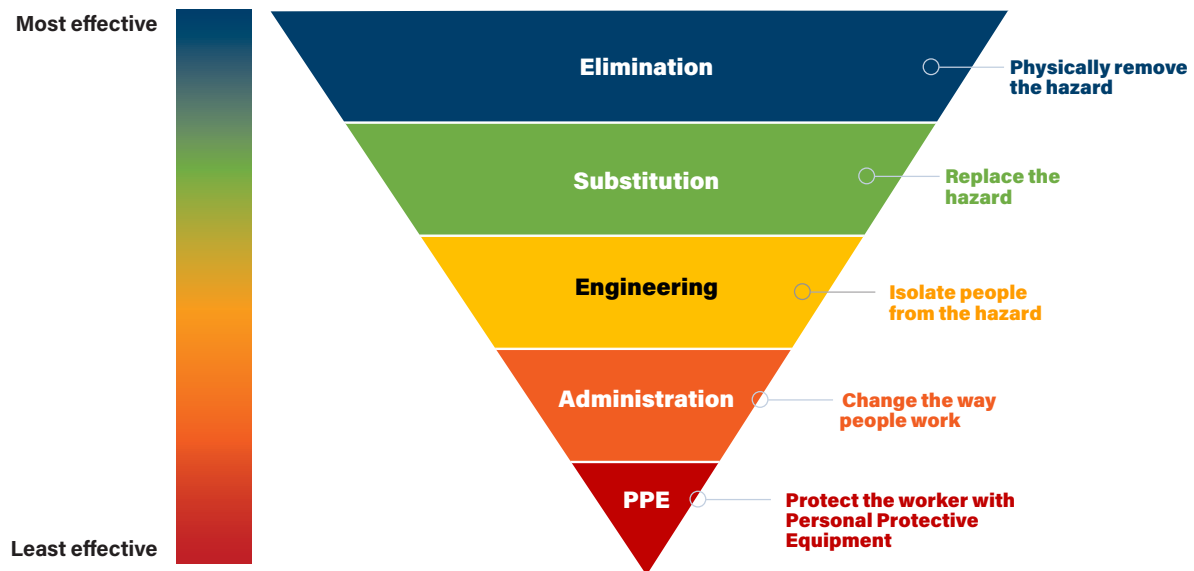
The survey, which took approximately 12 minutes to complete, was open for 2 months (January and February 2022). More than 7 500 women completed all or a portion of the survey. A total of 2 752 usable responses were collected and analyzed. To preserve anonymity and confidentiality, no unique identifiers were collected and no individual survey results were provided to the research collaborators. At the completion of the survey, a detailed summary of the aggregate findings (i.e., a "topline" report) was provided, along with a database of the raw, anonymized data.

3 Definitions and Key Concepts

3.1 The Difference Between Sex and Gender

Although often used interchangeably, the terms "sex" and "gender" are two distinct (albeit inter-related) concepts [40-49]. "Sex" is a biological concept that encompasses the biological and physiological attributes that distinguish female from male from intersex from hermaphrodite (e.g., anatomy, genetics, hormones) [40, 42, 46, 48, 50]. Examples of sex differences include different reproductive organs, variations in body size and shape, differences in the proportion of fat to muscle, and differences in the types and levels of hormones circulating in the body [49].

"Gender" is generally viewed as a dynamic social and cultural construct that encompasses the range of societal factors that shape identities, roles, behaviours,

Figure 4: Hierarchy of Controls (adapted from NIOSH [59])

stereotypes, norms and attitudes, and power relationships [40-42, 46, 48-51]. Because it is influenced by temporal shifts in the contexts that create gender norms (which may be social, cultural, or environmental), the concept of gender is considered to be subtle, multi-faceted, and fluid [45, 47]. Both sex and gender are social determinants of health, and both appear to play important roles in how policies, programs, and practices are implemented and in how they are taken up [43, 47].

3.2 Personal Protective Equipment

PPE is any type of equipment designed and worn on the body by workers to protect against physical, mechanical, chemical, and biological hazards in the workplace [52-55]. Categories of PPE include fall-arrest gear (i.e., body belts, harnesses, lanyards), protective clothing (i.e., welding leathers, chemical-resistant coveralls, heat-resistant clothing, high-visibility safety apparel), hand protection (i.e., chemical- or heat-resistant gloves), eye and face protectors (i.e., safety glasses or goggles, face shields), foot and leg protection (i.e. steel-toed boots or shoes), head protection (i.e., hard hats), hearing protection (i.e., earplugs, earmuffs), and respiratory protection (i.e., half-face and full-face respirators, surgical masks) [52-54, 56].

As shown in Figure 4, PPE is one element in the “hierarchy of controls.” This hierarchy, which is widely used by OHS regulators and practitioners, ranks control measures in order from most to least effective: elimination, substitution, isolation (e.g., separating workers from the hazard, either by distance and/or enclosure), engineering controls (e.g., ventilation), administrative controls (e.g., changes in work practice), and PPE. Controls are first selected from the top of the hierarchy, choosing the methods considered to be more effective and protective, and working progressively down the hierarchy to those methods that are considered increasingly less effective and protective.

Because using PPE shifts the onus of protection onto the individual worker, PPE is considered the last line of defence [26, 57-59]. Although often seen as a simple and inexpensive way to control exposure, PPE should only be used in situations where other control measures (such as substitution, elimination or ventilation) are not practicable or do not adequately protect against the hazard [59-62]. In some jobs (e.g., asbestos abatement, hazardous waste removal, health care), certain types of PPE must be worn continually [61, 63].

The overall goal of a PPE program should be to provide maximum protection with minimum discomfort [60, 62,

64, 65]. To ensure that appropriate PPE is selected and workers are adequately protected, hazards must be identified and risks thoroughly assessed [52, 60, 62]. This entails considering workplace risks and hazards, potentially affected parts of the body, the nature of the work being performed, the degree of physical effort required to perform work tasks, workplace conditions, the length of the work shift and the duration of time that PPE must be worn (i.e. compatibility), the physical comfort of the PPE (e.g., weight and how it fits), whether the PPE interferes with other PPE that must be worn, whether the tasks being performed have particular requirements that the worker must be able to see and to communicate clearly, and whether the PPE will introduce new hazards or put the worker at a greater level of risk [52, 60, 62, 64].

Poorly designed and poorly fitting PPE can contribute to workers being injured in the workplace. For example, ill-fitting respirators can expose workers to airborne contaminants, oversized protective clothing can interfere with workers' mobility and present a tripping hazard, and oversized gloves can be caught in machinery or expose skin to chemicals [65-69]. Between the mid-1970s and 1990, several researchers and worker advocates published articles that drew attention to the specific difficulties that women have finding appropriately sized and sufficiently protective PPE and highlighted the actions that designers and manufacturers, governments, standards development organizations, and testing and certification organizations need to take to improve the design and availability of PPE for women [63, 67-75]. Despite these early efforts to focus attention on the growing importance of women in the workforce and the need for PPE designed specifically for women, many PPE standards continue to be based on male anthropometry and, as a result, may not be as effective or protective for female workers [1].

4 Research into the Design of PPE for Women

Very little research has been undertaken examining the difficulties women have finding suitable PPE. The relatively few studies published are predominantly focused on women in construction and the building trades [10, 37, 54, 76-78], firefighting [79-85], military [86-

88], health care [89, 90], mining [91], and law enforcement [92]. Some, but not all, incorporate anthropometric assessments and address the design of PPE for women; others are qualitative, survey-based studies that examine factors to do with PPE access and usability.

4.1 Anthropometry

Anthropometry is the branch of ergonomics that involves the study and systematic measurement of variability in the human body [82, 91, 93, 94]. Anthropometric data, which are systematically collected in a representative sample of the population, use specialized equipment to capture the static and dynamic variability in humans by sex, age, geographical location (around the world, within countries), occupation, etc. [93, 95-97]. Examples of anthropometric data include dimensions (e.g., standing height, sitting height), proportions (e.g., waist-to-hip length), and shape, as well as measurements of strength (e.g., grip, pinch, and torque strength), mobility, flexibility, and working capacity [93, 98].

Anthropometric data are used to design workspaces and products (such as PPE, tools, or objects) to fit the needs of the user, not make the user fit the workspace or the product [93, 96, 97, 99]. Thus, they are a crucial element in the prevention of work-related injuries, permanent and partial disabilities, and fatalities [100].

Physical measurement data are generally collected in one, two, or three dimensions using direct manual measurements, photogrammetric methods, and body-scanning methods [98, 100]. The easiest and least expensive method is direct manual measurement, which utilizes traditional tools (like flexible measuring tapes, calipers, measuring boards, and rulers) to generate one-dimensional anthropometric data (e.g., linear measurements and circumferences). Photogrammetric methods use multi-camera systems to simultaneously collect two-dimensional images of the surface of the human body from different angles. These methods have been used to design hand protection for firefighters [101].

Over the past two decades, anthropometric data have been captured in three dimensions, directly and indirectly, using (a) electromechanical probes or electromagnetic sensors to manually collect data from body landmarks, and (b) three-dimensional body-scanners to obtain a picture of the entire body surface

[98]. Three-dimensional body-scanning methods have been used in the past decade to improve the design of fall-arrest harnesses [102].

The collection of representative anthropometric data is expensive and time-consuming and, as a result, there can be tremendous variability in the quality and quantity of anthropometric data for different populations [93, 103]. While some countries have undertaken national anthropometric or sizing surveys, most of the comprehensive anthropometric datasets in existence were collected on military, not civilian, populations [93, 103]. Direct comparison of these datasets was historically difficult because data collection methods varied greatly and were not always described in detail, raw data were often not available, datasets were distributed in databases around the world, data were referenced in multiple languages, and there were no standardized descriptions of measurements [103].

To address these limitations, an international group of experts developed the World Engineering Anthropometry Resource (WEAR)⁷, a searchable web-based subscription service that provides access to more than 68 international datasets containing one-dimensional body measurements of nearly 128 000 people (as well as data from the Civilian American and European Surface Anthropometry Resource [CAESAR] North America dataset and the Anthropometric Survey of US Army Personnel [ANSUR]) and a dataset containing more than 13 200 three-dimensional body scans (with corresponding one-dimensional data measured with standardized techniques⁸) [104]. Other online sources of free anthropometric data include the US National Health and Nutrition Examination Survey (NHANES) and ANSUR I and II. ANSUR datasets can be accessed via the Open Design Lab⁹ at Penn State University, and NHANES body measures can be downloaded from the National Center for Health Statistics¹⁰.

Canada collects the following anthropometric data on a representative sample of Canadians aged 3 to 79 in

ten provinces via the Canadian Health Measures Survey (CHMS): standing height, weight, waist circumference, and neck circumference [105]. These data have been collected on a two-year cycle since 2007; the most recent cycle of the survey was January 2018 to December 2019, and the next cycle is scheduled for fall 2022 to fall 2024 [105]. Statistics Canada publishes the results of the CHMS in a variety of formats, including summary statistics, articles and reports, journals and periodicals, infographics, and data tables [105]. Comprehensive data tables for Cycles 1 and 2 (2007 to 2009 and 2009 to 2011, respectively) are archived (but are publicly available) on the Statistics Canada website.¹¹ Statistics Canada has published some of the data from Cycle 6 (January 2018 to December 2019), including data on the anthropometry measures of the household population.¹² A file with the entire set of anthropometric data collected between 2009 and 2019 (i.e., in all cycles of the survey) can be downloaded from Statistics Canada's website.¹³

4.2 Anthropometric Differences Between Women and Men

Data collected in surveys around the world clearly show anthropometric differences between the sexes and reinforce that women are not merely smaller, scaled-down versions of men [82, 93, 94, 99, 106, 107]. This is illustrated, for example, by the findings of a population-based, civilian study that used data from a multinational anthropometric survey completed in the early 2000s by the United States Air Force Research Laboratories [99]. The CAESAR project was the first to collect three-dimensional data of human morphology in addition to traditional one-dimensional measurements [99, 108]. The purpose of the survey was to characterize the body shape and size of the adult population in four NATO countries: Canada, Italy, Netherlands, and United States [99, 108]. These countries had been selected because, of the NATO countries, they had the largest population

7 See <https://bodysizeshape.com/>.

8 International Organization for Standardization (ISO), CAESAR North America, ANSUR.

9 <https://www.openlab.psu.edu/>.

10 <https://www.cdc.gov/nchs/nhanes/search/datapage.aspx?Component=Examination>.

11 Cycle 1 data tables are available at <https://www150.statcan.gc.ca/n1/en/catalogue/82-623-X> and Cycle 2 data tables at <https://www150.statcan.gc.ca/n1/en/catalogue/82-626-X>.

12 A summary table, which can be customized by sex, statistics (mean and percentiles), and reference period (2009 to 2019) is available at <https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1310031901>.

13 A ZIP file can be downloaded at <https://www150.statcan.gc.ca/n1/tbl/csv/13100319-eng.zip>.

Table 2: Sixteen Anthropometric Measures that Differentiate the Sexes (adapted from [99])

Anthropometric measure	Mean (Standard Deviation)*					
	North America		Italy		The Netherlands	
	Males	Females	Males	Females	Males	Females
Waist back length‡	481 (35)‡	399 (28)‡	468 (30)‡	405 (30)‡	475 (36)‡	401 (29)‡
Bust point breadth‡	236 (27)‡	187 (23)‡	217 (20)‡	183 (21)‡	230 (25)‡	206 (26)‡
Hip breadth, sitting‡	382 (36)‡	408 (46)‡	359 (25)‡	375 (29)‡	382 (29)‡	416 (38) ‡
Ankle circumference	269 (15)	240 (15)	263 (13)	238 (12)	267 (16)	246 (16)
Bi-lateral femoral epicondyle breadth, sitting	463 (55)	361 (64)	449 (46)	350 (48)	427 (59)	340 (53)
Chest circumference‡	1040 (109)	958 (124)	958 (79)‡	890 (80)‡	1015 (102)‡	998 (119)‡
Chest girth (chest circumference at scye)‡	1055 (96)	921 (100)	978 (71)‡	854 (60)‡	1022 (85)‡	943 (88)‡
Neck base circumference	468 (30)	410 (27)	475 (21)	425 (21)	489 (36)	441 (33)
Weight‡	86 (18)	69 (18)	73 (11)‡	58 (9)‡	84 (16)‡	73 (16)‡
Triceps skinfold	13 (7)	24 (10)	13 (7)	21 (7)	10 (5)	19 (8)
Bi-lateral humeral epicondyle breadth, sitting	561 (53)	475 (57)	557 (45)	469 (39)	562 (49)	496 (49)
Shoulder breadth‡	496 (36)‡	430 (35)‡	459 (27)	405 (23)	472 (29)	431 (31)
Radiale-styilion length, right‡	265 (17)‡	237 (15)‡	265 (14)	239 (14)	265 (17)	239 (16)
Waist circumference (“preferred”) ‡	914 (125)	789 (135)	843 (83)	752 (78)	918 (109)‡	845 (131)‡
Knee height	562 (31)	509 (28)	541 (26)	497 (24)	558 (35)	514 (28)
Sitting height	926 (40)	865 (36)	908 (35)	855 (30)	945 (41)	887 (38)

Notes: *All measurements in millimetres, except weight, which is in kilograms.

‡Measures relevant to the design of protective clothing, such as coveralls. These cells are also highlighted in grey:

(Canada, United States), they were the most ethnically diverse (Canada, United States), they had the tallest population (Netherlands), and their citizens are among the shortest in stature (Italy) [99, 108].

The research study analyzed 97 of the anthropometric measurements collected during the CAESAR project; of these, 38 had been collected manually using tape measures and calipers, and 59 had been collected from three-dimensional whole body scans [99]. To identify the anthropometric measures that best distinguish the sexes, the researchers performed a stepwise discriminant function analysis¹⁴ with three sets of measurements: those deemed to be relevant in distinguishing between the sexes, those deemed to be relevant in the design of a neck-down protective coverall, and those deemed to be relevant to the design

of a seated workstation. Of the 97 anthropometric measurements collected in the original CAESAR project, only 16 showed up in the discriminant function analysis as significant contributors.

Table 2 lists the mean and standard deviation of these 16 measurements across the three populations studied. Of these, 11 were relevant to the analysis of overall differences between the sexes, 9 were relevant to the design of the neck-down coverall, and 6 were relevant to the design of a seated workstation. In examining overall differences between the sexes, the research team found hip breadth to be a highly distinguishing characteristic. In other words, women are proportionately larger in the hips than men despite being smaller in most ways. In examining measurements relevant to the design of a neck-down coverall (highlighted in light grey and

¹⁴ A statistical procedure similar to a multivariate ANOVA (analysis of variance) that (a) tests whether there are differences between groups, and (b) determines the minimum number of variables needed to describe these differences.



"Anthropometric data are used to design workspaces and products (such as PPE, tools, or objects) to fit the needs of the user, not make the user fit the workspace or the product."

marked with a ‡ in Table 2), the research team found little overlap between male and female anatomical proportions. The significance of this finding is that coveralls and other similar types of protective clothing, including lower-body garments, that are designed based on men's proportions cannot be linearly scaled down to fit women. If male-proportioned protective clothing is simply scaled down to fit a woman's stature (i.e., her natural height in an upright position), her shoulder breadth or upper chest circumference, the clothing will likely be too tight in the hips. In other words, "women are not scaled down men" [99].

In the early 2000s, researchers at the National Institute for Occupational Safety and Health (NIOSH) analyzed data from the third National Health and Nutrition Examination Survey (NHANES III) to learn more about anthropometric differences between US occupational groups. This study, which was undertaken in response to increasing demands for safer machinery and more protective PPE, found significant differences in measurements of body size and other body segments of some occupational groups [109]. For example, female workers in agriculture and manufacturing were found to have larger waist circumferences than female workers in other occupations, and female workers in protective services (i.e., firefighters, police, and guards) were 4 cm taller and more than 10 kg heavier than women in all other occupations [109].

Other studies have also found significant differences in body measurements between female and male

firefighters, particularly in waist-to-hip proportions [81, 82, 84, 106, 110, 111]. In building an anthropometric database of Brazilian air force pilots, women were found to be larger than men in "hip breadth, sitting", but smaller than men in six dimensions considered critical for cockpit design [112]. A subsequent comparison of Brazilian and US air force pilots found that the Brazilian pilots (males and females) were statistically smaller than US pilots on five of the dimensions considered critical for cockpit design [113]. Other studies that collected anthropometric measurements of female miners in South Africa [91], female law enforcement officers [92, 114], and female soldiers [87, 115] found similar sex differences. Across all of these studies, the researchers highlighted the problems these anthropometric differences create for women's safety in the workplace and concluded that there is a need for female-specific design changes to improve the fit and usability of PPE.

4.3 Anthropometrics and PPE Design

The critical importance of anthropometrics in the design of effective PPE was a central theme of the literature reviewed. Anthropometric data have been used in the design of uniforms [116], respirators [117-119] and some other types of PPE [102, 104, 120]. The normative data historically used to size and fit PPE were generated by the military, much of it in the 1950s and 1960s [117]. Concerns about the reliance on decades-old data, as well as questions about the applicability of military data to civilian populations, have led to a burgeoning area of research examining anthropometric differences in

occupational groups outside the military, much of it with the purpose of addressing the problems women and racialized workers have with PPE and other aspects of workplace design.

This section of the report highlights what the literature says on the use of anthropometric data in the design of respirators, protective clothing, and fall-arrest harnesses.

4.3.1 Use of Anthropometric Data in the Design of Respirators

Research has shown that fit and comfort are two of the most important parameters in respirator design and usage [121]. Variations in the shape, size, and surface features of a human head and face can result in (a) improper respirator fit which, in turn, results in inadequate or ineffective protection from contaminated air; or (b) facial discomfort and/or injury from contact pressure between the respirator and the face.

In the United States, respirators for use in the workplace are certified by NIOSH in accordance with the requirements of *42 Code of Federal Regulations Part 84 (42 CFR 84)*¹⁵ [122]. Historically, the fit test panels used for respirator research, design, and certification were developed by the Los Alamos National Laboratory (LANL) and were based on anthropometric survey data collected in the 1960s from US Air Force personnel [117-119]. For full-face respirators, the fit test panels were defined by face length and face width, while those for half-mask respirators were defined by face length and lip width [118].

Because of changing demographics in the US population, as well as concerns that military data were not representative of civilian populations, in the early 2000s NIOSH undertook a series of studies examining the relationship between facial dimensions and respirator fit. These studies led to the development of anthropometric databases, the development of two new respirator fit test panels,¹⁶ and the development of digital three-dimensional headforms with more representative facial features for testing the quality of fit of half-face and full-face respirators [117, 119, 123, 124]. One of the

respirator fit test panels developed by NIOSH uses face length and face width, similar to the panel used by the LANL; the other uses a set of ten facial dimensions (i.e., bigonial breadth, bizygomatic breadth, head breadth, interpupillary distance, menton–sellion length, minimum frontal breadth, nasal root breadth, nose breadth, nose protrusion, and subnasale–sellion length) [119].

In Canada, CSA Z94.4.1:21, *Performance of filtering respirators* (which is intended to support a national respirator certification program) provides performance requirements for powered and non-powered air-purifying respirators that filter particulate matter¹⁷ and sets out requirements for selection of human subjects for fit testing [125, 126]. Based on the updated anthropometric data from NIOSH published in 2007 [119], facial dimensions for fit testing are defined by face length (i.e., between the menton and sellion landmarks) and face width (i.e., between the zygomatic arches) and are set out in informative Annex D (Table D.1) [125].

Of particular relevance to this report is a 2010 study that found statistically significant differences in facial anthropometric dimensions by gender, by race/ethnicity, and by age [127]. This study also found that gender affects face size and shape characteristics more than race/ethnicity [127]. Specifically, the researchers found that women have smaller measurements than men for all 21 anthropometric dimensions collected, and that women have overall smaller faces and shorter and narrower faces than men [127]. Only three dimensions (nasal root breadth, weight, and body mass index) did not significantly differ between the two genders [127]. The researchers also found that construction workers had significantly different facial features than workers employed in manufacturing, firefighting, health care, law enforcement, and other occupations [127]. The authors concluded that gender is a critical variable in determining respirator sizes and that respirator design (i.e., of face seals, internal respirator surface, and volume) would benefit from occupational anthropometric studies [127].

¹⁵ 42 CFR 84 includes provisions for approval of self-contained breathing apparatus (SCBA), gas masks, supplied-air respirators, air-purifying particulate respirators, chemical cartridge respirators, special use respirators (i.e., vinyl chloride respirators), and closed-circuit escape respirators.

¹⁶ Respirators designed to fit these panels were expected to accommodate more than 95% of US civilian workers employed at the time of the study.

¹⁷ CSA Z94.4.1:21 does not address respirators with filters for gas/vapour removal, respirators that operate in the atmosphere-supplying mode, or equipment that does not provide Level 1 Protection (as defined in CAN/CSA-Z94.4-18, *Selection, use, and care of respirators*).

More recently, studies using anthropometric data have been published on (a) surveys undertaken in China [128], Taiwan [129], Iran [130], and Korea [131] to elucidate differences in head and face shape; (b) the development of headforms more representative of the civilian workforce [132, 133]; (c) three-dimensional modelling of the human head [134]; (d) the design of a customized face seal for a half-piece respirator using three-dimensional laser scanning [121]; and (e) the effect of pregnancy upon facial anthropometrics and respirator fit testing [135].

A recent study examining the experience of 100 female mineworkers in South Africa identified the need for self-contained breathing apparatus (SCBA) designed based on women-specific anthropometric data [91]. Researchers surveyed the workers on their level of pain or discomfort when wearing an SCBA, collected 27 anthropometric measurements, derived two indices (body mass index and waist-to-hip ratio), and compared the results to ISO/CD 16900-5.2, *Respiratory Protective Devices – Methods of Test and Test Equipment – Part 5: Breathing Machine/Metabolic Simulator/RPD Headforms/Torso, Tools and Transfer Standards* and ISO/TS 16976 2:2015, *Respiratory Protective Devices – Human Factors – Part 2: Anthropometrics* [91]. The majority (97%) reported discomfort or pain while wearing the SCBA on their belt during work, with 48% indicating that they experienced discomfort and 20% indicating that they experienced pain all or most of the time [91]. The anthropometric assessment revealed that most of the reference values were larger than the average measurements of the women studied, but that for eight of the anthropometric measures, the study sample had higher average values than the reference values (head circumference, nose breadth, chest circumference, waist breadth, waist circumference and hip circumference, along with body mass index and waist-to-hip ratio) [91]. In the practical ergonomics assessment, the researchers found that workers experienced the highest strain when the SCBAs were being worn and in use [91]. Based on their findings, the researchers concluded that the anthropometric data used in the design of SCBAs do not appear appropriate for women.

4.3.2 Use of Anthropometric Data in the Design of Protective Clothing

Functional fit and freedom of movement are critical parameters in the design of protective clothing [55]. Functional fit is determined by four key factors: garment design, garment construction, garment fit, and garment size [55]. Freedom of movement is measured by the degree to which the design of the garment maximizes the worker's range and extent of movement while they are performing key tasks [55]. Both require that body shape and other anthropometric dimensions be taken into account. Some investigators have (a) noted that while research on protective clothing exists, there is a lack of studies that consider sex and anthropometric differences; and (b) recommended that anthropometrics based on appropriate modelling approaches be used to inform the design of protective clothing and PPE [102, 120]. The lack of well-fitting personal protective clothing has been identified as one of the key problems facing female firefighters [80, 82], law enforcement officers [92] and soldiers [86-88, 136].

Anthropometric studies of firefighters, using traditional measurement methods and three-dimensional body scans, have found significant differences between male and female firefighters when wearing base layers (i.e., t-shirts and shorts) and when wearing turnout ensembles¹⁸ [81, 84, 111]. Across a range of body dimensions, females were smaller and had a lower waist-to-hip ratio¹⁹ than males [81, 84, 111]. This has implications for the selection of turnout gear. Because the gear is designed for those with a waist-to-hip ratio closer to 1, women may select a larger waist size to accommodate their hips, wearing pants that are oversized in both the waist and thigh areas [84]. Similarly, female firefighters choose a larger turnout jacket to accommodate the bust area, leading to excessive bulk in the shoulders and arms [84]. Across study designs that include questionnaire-based surveys, traditional anthropometric measurements, and three-dimensional scans of female firefighters while in and out of gear, researchers have found that women experience poor overall fit, reduced mobility, and increased exertion because of their gear [81, 82, 84, 106, 110, 111].

¹⁸ Firefighters' pants and clothing ensemble that consists of three components: a moisture barrier, a thermal liner, and an outer shell. [NFPA 1971 – Standard on Protective Ensembles for Structural Fire Fighting and Proximity Fire Fighting](#) describes the performance requirements for the individual components and [NFPA 1851 – Standard on Selection, Care, and Maintenance of Protective Ensembles for Structural Fire Fighting and Proximity Fire Fighting](#) describes the requirements for selection, care, and maintenance of the turnout gear.

¹⁹ A lower waist-to-hip ratio means the waist circumference is smaller than the hip circumference.

In addition to the mobility and exertion issues caused by ill-fitting equipment, evidence shows that looser protective clothing traps more air than clothing with a proper fit and that the volume of trapped air has a significant influence on the protective clothing's thermal and vapour resistance [55, 83, 137], which could make the turnout gear less protective. Across the literature reviewed, researchers consistently concluded that there is a strong need to develop female-specific turnout gear and that the gear should be based on anthropometric data.

In a comparison of anthropometric measurements of firefighters with the general population, researchers at NIOSH found important differences in size and physique for both male and female firefighters. On average, male firefighters were heavier and had larger upper body measurements²⁰ than men in the general population; female firefighters were significantly taller than women in the general population and also had larger upper body measurements²¹ [111].

In four studies undertaken on female soldiers in Australia, researchers (a) examined whether body armour met their fit and functional requirements [88]; (b) explored the soldiers' perceptions of how the design of body armour affected its fit, form, and function and of how the body armour was issued [86]; (c) investigated whether they experienced bra-body armour integration issues, breast discomfort, and breast injuries and whether any issues, discomfort, or injuries were associated with breast size [136]; and (d) investigated the effect of body armour on mobility and task performance [87]. Like most PPE, body armour systems have been historically designed for male soldiers and are procured in a limited range of sizes. Undersized body armour might not be sufficiently protective and oversized body armour negatively affects performance and mobility. Most of the female soldiers who participated in the surveys reported that their body armour was too big, didn't fit properly, hindered their mobility, and interfered with their performance of tasks [86, 88]. Female soldiers reported problems with fit (e.g., poor integration of the body armour with other components of their combat ensemble, limited adjustability), form (e.g., length of the body armour restricting range of motion, interfering with other components of the combat ensemble, or causing general discomfort), and

function (e.g., body armour causing nerve pain at the neck, compression of the chest and breasts, pain in the shoulders and lower back) [86]. Of those surveyed about bra integration or breast discomfort/injuries (n=97), approximately one-fifth reported integration issues between their bra and body armour, two-thirds reported breast discomfort while wearing body armour, and one-quarter reported experiencing a breast injury as a result of wearing body armour [136]. The researchers found that a smaller prototype body armour system increased range of motion and decreased interference while performing dynamic tasks [87]. Based on these studies, the researchers concluded that female soldiers would benefit from a body armour system designed on dimensions relevant to female bodies (i.e., smaller torso, accommodation for female breasts).

4.3.3 Use of Anthropometric Data in the Design of Fall-arrest Harnesses

At its simplest, a fall-arrest harness consists of five straps: a back strap, a chest strap, a front (or cross-front strap), a thigh or crotch strap, and a hip strap [138]. Four key factors affect the fit of a full-body fall-arrest harness to a worker's body: the location of the harness ring; the torso angle of suspension (measured between the torso centre line and the harness vertical suspension line); the strap configuration fit (i.e., the shoulder strap location in relation to the neck base and acromion, and the angle between the thigh strap and the sagittal plane); and the size (weight and stature) and shape of the human body [120, 139, 140]. Because of their body shape, many workers require different harness sizes for different parts of their body – for example, a short individual may find that a small harness fits them well in the torso, but is too tight at the hips or belly [138]. An incorrectly sized harness puts workers at a higher risk of suspension trauma after a successfully arrested fall [138]. Suspension trauma, also known as “harness-induced pathology”; is a potentially fatal reduction of return blood flow from the legs to the heart and brain as a result of the human body being held motionless in a vertical position for a long period of time [141].

Research conducted by NIOSH in the early 2000s revealed that commercial harness sizing systems and designs were based on anthropometric data extrapolated

²⁰ Chest circumference, waist circumference, and bideltoid breadth.

²¹ Waist circumference and bideltoid breadth.



"Because of their body shape, many workers require different harness sizes for different parts of their body – for example, a short individual may find that a small harness fits them well in the torso, but is too tight at the hips or belly."

from studies conducted in the 1970s and 1980s on military service-age males [120, 139]. As the demographics of the working population had changed over time to include more female workers and a wider range of body weights and sizes, manufacturers of full-body harnesses adapted their sizing systems and designs to accommodate the needs of an increasingly diverse workforce [139]. In the absence of up-to-date anthropometric data on the civilian population, manufacturers tended to rely on their customers' anecdotal information, and some attempted a "one-size-fits-all" approach to simplify selection and reduce costs [139].

In a 2007 study evaluating harness sizing schemes and anthropometric criteria for harness design, NIOSH researchers found that, based on body dimensions and the harness sizing scheme in place at the time, approximately one-quarter of men and nearly one-third of women would not be able to find a well-fitting harness [120]. Based on their findings, the researchers suggested an alternative system of two sizes for women and three sizes for men instead of the four unisex systems available at the time of the study [120].

Building on these findings, the same research team undertook another study with the goal of developing a harness sizing scheme that optimizes the number of harness sizes and strap lengths to accommodate diversity in the US working population [139]. Using the results of their 2007 study [120], anthropometric data on human torso sizes and shapes from the CAESAR project database (see Section 4.2 Anthropometric Differences

Between Women and Men for a description of the CAESAR project), and criteria on harness adjustability obtained from harness manufacturers, the research team identified an improved harness sizing scheme for vest-type harnesses (four sizes each for men and women) and for overhead-style harnesses (three sizes for men and four sizes for women) [102, 139].

In a 2012 study of men and women with construction experience, the researchers found that harness fit affected suspension tolerance time and that certain body characteristics were associated with decreased suspension tolerance time [138]. In general, static harness fit was worse for women than for men, with women having a higher fail rating than men (35% versus 15%, respectively), a finding that was consistent with previous research [138].

A 2018 Canadian study compared harness size recommendations generated by using the selection charts of three manufacturers [142]. The researchers found that (a) for a given combination of body mass and stature, the charts did not select the same size of harness; and (b) the sizes were not consistent from one manufacturer to the next. Subsequent tests with 20 female volunteers found that, after selecting a harness from the manufacturer's chart (based on anthropometric measurements) and adjusting the harness according to the manufacturer's instructions, 40% needed a larger or smaller harness [142]. Based on their findings and observation that the most pertinent measures for harness selection are waist belt circumference and the

vertical circumference of the torso, the researchers recommended that sizes be standardized across manufacturers and that selection charts be based on anthropometric measures (either stature, body mass, and waist belt circumference; or stature and waist belt circumference) [142].

5 Sex-based Regulatory Considerations for PPE

OHS legislation and regulations are policy instruments intended to establish a minimum level of protection for all workers or for those in specific industries. Typically, the OHS legislative and regulatory framework incorporates general duty clauses, as well as hazard-specific requirements, and sets out the parameters for enforcement and compliance (which, depending on the hazard, may be mandatory or voluntary, performance-based²² or prescriptive²³). Because the intent of OHS regulatory frameworks is to protect all workers, the language used in statutes, regulations, policies, and guidelines tends to be gender neutral. In most jurisdictions around the world, there is no explicit recognition of sex or gender differences in the OHS regulatory framework and, as a result, risks are not assessed through this lens and the mitigation of risk does not take into account sex- or gender-specific needs [29]. Canada is no exception.

5.1 PPE Regulations in Canada

5.1.1 General Duty Clauses

All Canadian jurisdictions have general duty clauses in their OHS regulations that workers must wear PPE in specific circumstances or when required by the regulations. However, at the time of this environmental scan, the OHS regulations across Canada were not consistent in terms of the requirements (a) imposed on specific workplace parties to provide or make available PPE (Tables A-1 to A-3, Appendix A); or (b) governing the selection, use, and maintenance of PPE (Table A-4, Appendix A).

- **Employer Responsibilities (Table A-1, Appendix A):** Of the 14 Canadian jurisdictions, nine explicitly specify that employers must ensure that PPE is provided. Of these, seven stipulate that the employer must provide PPE at no cost to the worker (British Columbia, Saskatchewan, Manitoba, Quebec, Yukon, Northwest Territories, and Nunavut). Eleven jurisdictions require employers to ensure that workers are appropriately trained in the use of PPE and that they understand the risks and limitations. Only seven jurisdictions include language that the employer must ensure that the PPE is suitable and a proper fit (Alberta, Saskatchewan, Manitoba, Newfoundland and Labrador, Nova Scotia, Northwest Territories, and Nunavut). Manitoba is the only jurisdiction that requires the employer to ensure that the PPE both fits the worker correctly and can be used without adverse effect to the worker's health or safety. Four jurisdictions (Saskatchewan, Manitoba, Northwest Territories, and Nunavut) require the employer to make alternate arrangements if the PPE will not effectively protect the worker and/or a hazard, danger, or discomfort to the worker arises from wearing the PPE. Six jurisdictions require employers to immediately repair or replace PPE that is returned due to defects or failure to provide the intended protection (Saskatchewan, Manitoba, Yukon, Northwest Territories, Nunavut, and the federal government).
- **Worker Responsibilities (Table A-2, Appendix A):** Three of the 14 jurisdictions (British Columbia, Manitoba and Yukon) require workers to provide certain types of PPE: clothing for protection against the natural elements, general purpose work gloves, and appropriate footwear (including safety footwear). British Columbia is the only jurisdiction with a requirement that all workers provide their own safety headgear. Every jurisdiction requires workers to wear PPE provided by their employers and/or required by regulation; ten require workers to report to their employer if their PPE is defective or if it fails to provide the intended level of protection; five state that workers must not use PPE that does not perform the function for which it is designed (Alberta, New Brunswick, Prince Edward Island, and Yukon); four require workers to take reasonable steps to prevent damage to PPE (Saskatchewan, Manitoba, New Brunswick, Northwest

22 A performance-based regulation is goal-oriented. It establishes the end point and allows the employer to identify the most suitable means of achieving it.

23 A prescriptive regulation specifies the end point and the means to achieve it.

Territories, and Nunavut); and one requires that workers not make ineffective²⁴ any PPE that regulations or their employer require them to use (Ontario).

- **Supervisor Responsibilities (Table A-3, Appendix A):** Six jurisdictions impose duties on supervisors regarding PPE. Supervisors in British Columbia, Alberta, Manitoba, Ontario, Newfoundland and Labrador, and Yukon must ensure that required PPE is properly worn. Only British Columbia requires supervisors to ensure that appropriate PPE is available to workers.
- **Selection, Use, and Maintenance of PPE (Table A-4, Appendix A):** Seven jurisdictions (British Columbia, Alberta, Newfoundland and Labrador, Yukon, Northwest Territories, Nunavut, and the federal government) include language in the OHS regulations governing the selection, use, and maintenance of PPE. Five stipulate that the PPE must not be a hazard to or endanger the worker. Four of the five expressly state that PPE selected for use in the workplace must provide effective protection (British Columbia, Newfoundland and Labrador, Yukon, and the federal government) and that it must be compatible with other PPE (British Columbia, Newfoundland and Labrador, and Yukon). British Columbia and Yukon stipulate that alternative PPE must be used if the PPE provided is a greater hazard to the worker. The federal government requires that PPE be safely and properly fitted to the worker, in accordance with the manufacturer's instructions, by a qualified person.

5.1.2 Regulations for Specific Types of PPE

In addition to the general duty clauses described in Section 5.1.1, every Canadian jurisdiction has requirements governing how specific types of PPE are to be provided to, and used by, all workers covered under their mandate. Seven specific categories of PPE are regulated: head protection; eye and face protection; limb, body, and hand protection (i.e., protective clothing and gloves, high-visibility and distinguishing apparel); respiratory protection; foot and leg protection; fall-protection systems (i.e., full-body harnesses and body belts); and flotation devices (i.e., life jackets). The requirements most relevant to this research report are summarized

in Appendix A, Tables A-5 through A-11. As these tables illustrate, Canadian jurisdictions do not consistently require that selected PPE provide protection appropriate to the hazards and that it fit the user properly; nor are the regulations consistent in referencing the standards with which the PPE must comply.

- **Head Protection (Table A-5, Appendix A):** Nine jurisdictions require that workers wear head protection that is appropriate to the hazards; three require that workers wear "approved" industrial head protection. Two jurisdictions require that workers provide their own head protection: British Columbia requires that all workers provide their own safety headgear, and Manitoba requires that workers on construction sites provide the protective headwear that they are required to wear under the regulations (see Table A-2). Manitoba's regulations also set out that the employer has no obligation to pay for PPE or to repair or replace defective PPE in workplaces where the worker is required to purchase their own PPE. Ten jurisdictions specify that the protective headwear must meet the requirements of CAN/CSA-Z94.1, *Industrial protective headwear*, although the specific version of the referenced standard varies. Similar inconsistency is seen in the versions of the ANSI standard referenced.
- **Eye and Face Protection (Table A-6, Appendix A):** Nine jurisdictions require that employers provide eye and face protection that is appropriate to the hazards; three require that workers wear "approved" eye or face protection to eliminate or reduce the risks.²⁵ Four specify that the eye protection must fit the worker properly; three of these also specify that the face protection must fit the worker properly. Ten jurisdictions specify that the eye and face protection must meet the requirements of CAN/CSA-Z94.3, *Industrial eye and face protectors*, although the specific version of the referenced standard varies.
- **Limb, Body, and Hand Protection (Table A-7, Appendix A):** Eleven jurisdictions include requirements that employers must provide and/or that workers must wear PPE to protect limbs, body, and hands if they are exposed to hazards that damage the skin and/or hazards that pose a danger to the worker's hands, arms, legs, or torso. Two specify that

²⁴ The meaning of "ineffective" in this context is not defined in the Occupational Health and Safety Act nor in the [Guide to the Occupational Health and Safety Act](#).

²⁵ The Northwest Territories and Nunavut define "approved" to mean the following: (a) approved by an agency acceptable to the Chief Safety Officer for use under the conditions prescribed by the agency; (b) approved conditionally or otherwise by a certificate of the Chief Safety Officer; or (c) approved by the Chief Safety Officer in a code of practice approved and issued under subsection 18(3) of the Safety Act.

workers must wear “approved” protective clothing if there is a risk of injury to the skin.²⁵ Seven jurisdictions have language that explicitly requires that workers wear properly fitting PPE. One jurisdiction (Manitoba) references CAN/CSA-W117.2-12 (R2017) in the regulations for this type of PPE. Seven jurisdictions have requirements for hand protection PPE that are directly relevant to this report. Of these, three specify that the employer must provide suitable and properly fitted hand or arm protection, and one specifies that the worker must wear suitable and properly fitted hand or arm protection. Prince Edward Island has language in its regulations that requires the employer to ensure that workers wear PPE to prevent hand or arm injuries, *except when the PPE introduces equal or greater hazards [emphasis added]*.

▪ **Respiratory Protection (Table A-8, Appendix A):**

Although all Canadian jurisdictions require that respirators be fit tested, the specifics of these regulations were only included in the environmental scan if they were considered relevant to the design and fit of a respirator on the female face. Of the 14 jurisdictions, three specify that the employer must provide respiratory PPE that is the proper size for the worker’s face, two specify that the employer must ensure that other PPE does not interfere with the respirator seal, and one requires that fit tests be performed (a) whenever there are changes to the user’s physical condition that could affect fit; and/or (b) with other PPE that must be worn at the same time as the respirator and that could interfere with respirator fit. Five specify that the respirators provided must be NIOSH-approved or certified; one specifies that respiratory protective equipment must meet the requirements set out in CSA Z94.4.1, *Performance of filtering respirators*; and ten specify that respirators must be selected, adjusted, used, and cared for in accordance with CAN/CSA-Z94.4, *Selection, use, and care of respirators*, although the version of the specified standard varies.

▪ **Foot and Leg Protection (Table A-9, Appendix A):**

Eleven jurisdictions require that footwear must be appropriate or suitable to the hazards; of these, two set out that the worker is responsible for providing their own safety footwear (British Columbia and Manitoba). Manitoba’s regulations further clarify that the employer has no obligation to pay for PPE or

to repair or replace defective PPE when the worker is required to provide PPE. However, the Manitoba regulations require the employer to provide safety footwear in certain circumstances (i.e., when the worker’s feet may be endangered by hot, corrosive, or toxic substances). Nine jurisdictions specify that safety footwear must meet the requirements of CSA Z195, *Protective footwear* or the accompanying guideline²⁶. British Columbia is the sole jurisdiction with an OHS guideline that describes the factors that need to be considered in a hazard assessment to determine if high heels will interfere with the worker safely performing their work. British Columbia’s guideline clarifies that high heels are not appropriate in the workplace if the potential exists for slipping, tripping, uneven terrain, reduced ankle protection and foot support, and musculoskeletal injury.

▪ **Fall Protection Systems (Table A-10, Appendix A):**

Eleven jurisdictions have requirements for fall-protection system elements that are directly relevant to this report. Six jurisdictions require the employer to ensure that full-body harnesses are properly fitted to the worker; three of these also require the worker to ensure that a full-body harness is properly adjusted to fit securely before use. Three jurisdictions have explicit requirements that the components of a fall-protection system must be compatible (Alberta, New Brunswick and the federal government). New Brunswick is the sole jurisdiction in Canada that explicitly requires that the owner, the employer, and the contractor ensure that a full-body harness is designed and rated by manufacturer for the worker’s body type. Ten jurisdictions specify that a full-body harness must meet the requirements of CSA Z259.10, *Full body harnesses*²⁷; nine of these specify that a body belt must meet the requirements of CSA Z259.1, *Body belts and saddles for work positioning and travel restraint* although the version of the specified standard varies.

▪ **Flotation Devices (Table A-11, Appendix A):**

Twelve jurisdictions have requirements for buoyancy PPE that are directly relevant to this report. Seven require that life jackets or personal flotation devices (PFDs) have sufficient buoyancy to keep a worker’s head above water; one requires the provision of “appropriate PFD with required buoyancy”; and four require the provision of buoyancy PPE that is appropriate to the circumstances or hazards. Nova Scotia and

²⁶ As shown in Table A-9, the regulations in some jurisdictions incorrectly identify the standard and the guideline as CAN/CSA Z195.

²⁷ As shown in Table A-10, the regulations in some jurisdictions incorrectly identify this standard as CAN/CSA Z259.10.

Prince Edward Island are the sole jurisdictions that explicitly state that the buoyancy PPE provided must be appropriate for the weight of the person wearing it. Eight jurisdictions indicate that the PPE must meet the requirements of a particular standard or be approved by a specific organization (e.g., Transport Canada). Of these, four reference *CAN/CGSB 65.7-M88 Life Jackets, Inherently Buoyant Type* and three reference *CAN/CGSB-65.11-M88 Personal Flotation Devices*. According to the Standards Council of Canada (SCC) website, both of these standards have been withdrawn²⁸ and *CAN/CGSB 65.7-M88* has been superseded by *CAN/CGSB-65.7-2007*.

5.1.3 Occupation-specific PPE Regulations

Eight jurisdictions have firefighter-specific PPE regulations and one has health care-specific PPE regulations (**Table A-12, Appendix A**).

- **Firefighters:** Of the eight jurisdictions with firefighter-specific regulations, four require that the employer provide, and that the worker use, approved PPE “appropriate to risk and adequate to protect health and safety”. Nova Scotia and New Brunswick require that protective coats and trousers must fit properly (a) in sleeve length, coat length, chest girth, waist girth, trouser inseam length and crotch rise; and, (b) to prevent unsafe conditions resulting from poor integration of PPE. Six jurisdictions reference *NFPA 1971 Standard on Protective Ensembles for Structural Fire Fighting and Proximity Fire Fighting*, although the specific edition referenced varies by jurisdiction.
- **Health Care Workers:** Ontario is the sole jurisdiction with regulatory requirements governing PPE in health care. Its regulations specify that health care PPE must be a proper fit and appropriate to the circumstances.

5.2 PPE Regulations in Selected International Jurisdictions

5.2.1 European Union

The European Union (EU) has a Directive on the use of PPE and a Regulation on its design and manufacture [143, 144].

- **Directive 89/656/EEC – Use of Personal Protective Equipment:** This Directive, which was first issued in November 1989, sets out the minimum requirements governing the use of PPE in the workplace. The Directive defines PPE to mean “all equipment designed to be worn or held by the worker to protect him against one or more hazards likely to endanger his safety and health at work, and any addition or accessory designed to meet this objective”. The Directive sets out the employer’s obligations to ensure that PPE complies with relevant requirements on the design and manufacture of PPE. The Directive specifically excludes PPE worn or used by emergency and rescue services, by the military, police, and other public order agencies, and for road transportation. Also excluded are sports equipment, self-defence or deterrent equipment, and portable devices used to detect and signal risks and nuisances [143].

Under the Directive, employers must select PPE that is appropriate to the risk, that doesn’t create any additional risk(s) to the worker, that corresponds to existing workplace conditions, that is compatible with other PPE the worker may be required to wear, and that is in good working order and hygienic condition. Appropriate PPE must be provided free of charge and, prior to selection, the employer must undertake a risk assessment to confirm that the intended PPE complies with the Directive’s requirements. In addition, the employer must take into account “ergonomic requirements and the worker’s state of health” and ensure that the PPE fits the wearer correctly after any necessary adjustments. Including the United Kingdom (which was a Member State until January 31, 2020), 24 EU countries have promulgated national laws implementing this Directive.

Annexes I, II, and III of the Directive were amended in 2019 to update outdated rules and to align risk classifications with those set out in Regulation 2016/425 (see next bullet for description) [145]. Annex I (which lays out a framework to guide the risk assessment to determine the need for PPE) was amended to take into account new types of workplace risks. Annex II (which provides a non-exhaustive list of the types of PPE available and the risks they protect against) was amended to take into account new types

28 <https://www.scc.ca/en/standardsdb/standards/3566> and <https://www.scc.ca/en/standardsdb/standards/3567>

of workplace risks and to include examples of PPE currently available on the market. Annex III (which provides a non-exhaustive list of activities and sectors that may require the provision of PPE) was amended to ensure that the terminology and risk classifications used in all three annexes and in Regulation 2016/425 were consistent. Member States were given until November 20, 2021 to comply with the amendments.

- **Regulation (EU) 2016/425 – Personal Protective Equipment:** This Regulation (which was introduced in 2016 and became effective on April 21, 2018) sets out requirements for the design and manufacture of PPE sold and used in the EU [144]. This Regulation defines PPE as “(a) equipment designed and manufactured to be worn or held by a person for protection against one or more risks to that person’s health or safety; (b) interchangeable components for equipment referred to in point (a) which are essential for its protective function; (c) connexion systems for equipment referred to in point (a) that are not held or worn by a person, that are designed to connect that equipment to an external device or to a reliable anchorage point, that are not designed to be permanently fixed and that do not require fastening works before use” [144]. The Regulation does not apply to PPE used by the armed forces or law enforcement organizations, on seagoing vessels or aircraft, by drivers and passengers of motorcycles and mopeds, for self-defence (except sporting activities) or private uses (e.g., to protect hands against dishwashing) [144].

Under the Regulation, PPE must meet the essential health and safety requirements laid out in Annex II. Namely, it must provide adequate protection against the risks it is intended to protect against (which are laid out in Annex I of the Regulation); it must be designed with ergonomic principles in mind; it must be designed and manufactured so as to not create another risk to the wearer; its materials must not adversely affect the health and safety of the user; its points of contact with the user’s body must not cause excessive irritation or injury; its use must not result in actions that might put the user at risk; and it must be designed and manufactured to provide adequate protection while taking into account factors related to comfort and effectiveness [144].

Section 1.3 of Annex II sets out the specific design and manufacturing requirements that apply to PPE comfort and effectiveness.

- **Adaptation to User Morphology:** Section 1.3.1 requires that PPE be designed and manufactured “in such a way as to facilitate its correct positioning on the user and to remain in place for the foreseeable period of use, bearing in mind ambient factors, the actions to be carried out and the postures to be adopted”. It further specifies that “it must be possible to adapt the PPE to fit the morphology of the user by all appropriate means, such as adequate adjustment and attachment systems or the provision of an adequate range of sizes”.
- **Lightness and Strength:** Section 1.3.2 requires that PPE must be “as light as possible without prejudicing its strength and effectiveness” and that it must also provide adequate protection against the risks it is intended to protect against and be capable of withstanding environmental factors under normal conditions of use.
- **Compatibility of Different Types of PPE Intended for Simultaneous Use:** Under Section 1.3.3, manufacturers of multiple types and models of PPE (that are intended to be worn simultaneously on adjacent parts of the body) must ensure that these PPE are compatible.

Some of the other sections of the Annex relevant to this research report include:

- **PPE Incorporating Adjustment Systems:** Section 2.1 sets out that adjustment systems must be designed and manufactured so that after the PPE has been adjusted, the systems cannot, under normal conditions of use, come undone unintentionally.
- **PPE Enclosing the Parts of the Body to be Protected:** Section 2.2 requires that PPE be designed and manufactured to minimize perspiration, or be equipped with a way to absorb it.
- **PPE for the Face, Eyes, and Respiratory System:** Section 2.3 requires that the PPE be designed to minimize any restriction of the user’s face, eyes, field of vision, or respiratory system.
- **PPE Which May be Caught Up During Use:** Section 2.5 requires that if under normal conditions of use, a user could be put at risk by the PPE being caught up in moving objects, the PPE must be “designed and manufactured in such a way that a constituent part will break or tear, thereby eliminating the danger”.
- **PPE Incorporating Components Which Can be Adjusted or Removed by the User:** Under Section 2.9, any PPE components that “can be attached, adjusted or removed by the user for replacement purposes” must be “designed and manufactured so that they can be easily attached, adjusted and removed without tools”.

5.2.2 Australia

In Australia, “model” work health and safety (WHS) laws are developed by Safe Work Australia for implementation by relevant state and territorial authorities. These model laws (which consist of the statute, the regulations, and codes of practice) are intended to create a “balanced and nationally consistent framework to secure the health and safety of workers and workplaces” and only apply when promulgated into law by the respective jurisdiction.²⁹ Regulations governing the provision and use of PPE in the workplace are in Chapter 3 (“General Risk and Workplace Management”) of the Model WHS Regulations [146, 147]. Under Section 35 of the WHS Regulations, duty holders³⁰ must work through the hierarchy of controls when managing risks to health and safety. The Model Code of Practice that provides guidance on how to achieve compliance clarifies that PPE is the least effective in the hierarchy and that PPE should only be used as a backup to supplement other control measures higher up in the hierarchy, as an interim measure until the risk can be controlled by more effective means, or when no other practical control measures are available [146].

Sections 44 through 47 set out the requirements that apply when PPE is used to control risks that cannot be controlled by other means [147]. These include:

- the duty holder’s obligations to provide the worker with: (a) PPE that is appropriate to the hazard, is suitably sized and fitted (and reasonably comfortable) for the worker, is in good working order (i.e., clean and hygienic, and maintained, repaired, or replaced as necessary); and (b) information, training, and instruction in the proper use, wearing, storage, and maintenance of PPE;
- the duty holder’s obligations to provide PPE to persons other than workers and to ensure that the person uses or wears it;
- the worker’s obligations to: (a) use or wear any PPE provided to them, in accordance with any information, training, or reasonable instruction provided; (b) not intentionally misuse or damage the PPE; and (c) inform the duty holder when their PPE is damaged, defective, or in need of cleaning or decontamination; and

- the obligations of persons other than workers to wear PPE provided in accordance with any information, training, or reasonable instruction provided.

Also included in these sections are the maximum penalties³¹ to be levied in the event of noncompliance by individuals or corporations, as well as a notation that under Section 273 of the *WHS Act*, a person conducting a business or undertaking must provide PPE to workers at no extra charge [147].

5.2.3 United States

At the federal level, responsibility for making and enforcing the regulations governing the design, provision, and use of PPE in the workplace falls under the authority of the Occupational Safety and Health Administration (OSHA). PPE requirements are addressed in three specific OSHA standards: 29 CFR 1910 – General Industry; 29 CFR 1915, 1917, 1918 – Maritime Industry; and 29 CFR 1926 – Construction Industry [148]. OSHA Standard 1910.132 sets out the general requirements that apply to the provision, use, and maintenance of PPE in general industry. The standard requires that all PPE be of “safe design and construction for the work to be performed”; that a hazard assessment be performed to select PPE that “properly fits each affected employee”; that defective or damaged PPE not be used; that the employer provide training to each worker required to wear PPE; and that the employer provide the PPE at no cost to the worker (except in limited circumstances). Where the worker provides their own PPE, the standard imposes an obligation onto the employer to ensure that the PPE is adequate for the hazard and that it is properly maintained and sanitized [149]. Similar requirements are found in OSHA Standard 1915.152 for the Maritime Industry and in OSHA Standard 1926.95 for the Construction Industry [150, 151].

In addition to the general requirements, Standard 1910 Subpart I includes specific requirements for eye and face protection, respiratory protection, head protection, foot protection, electrical protective equipment, hand protection, and personal fall protection systems [152, 153]. Similarly, Standard 1915 Subpart I sets out specific

²⁹ All jurisdictions, except Victoria, have implemented the model laws as their own WHS laws.

³⁰ Under the Work Health and Safety Act, duty holders include persons conducting a business or undertaking; designers, manufacturers, importers, suppliers, and installers of plants, substances, or structures; officers, such as company directors; workers; and other persons present at the workplace.

³¹ For example, the maximum penalty under Section 44 is \$6000 AUD for an individual and \$30 000 AUD for a corporate entity.



"Qualitative studies of female construction workers in North America, Europe, and Australia have identified a number of issues with the fit, comfort, and availability of PPE "

requirements for eye and face protection, respiratory protection, head protection, foot protection, hand and body protection, lifesaving equipment, personal fall arrest systems, and positioning device systems [154]; Standard 1926 Subpart E sets out criteria for occupational foot protection, head protection, hearing protection, eye and face protection, respiratory protection, safety belts, lifelines and lanyards, safety nets, and equipment for working over or near water [155]; and, Standard 1926 Subpart M sets out requirements for fall protection (i.e., personal fall arrest and positioning device systems) [156]. Under OSHA laws, many of these categories of PPE must meet (or be equivalent to) ANSI standards [148].

6 Experience of Women with PPE in the Workplace

6.1 Survey-based Studies of Women and PPE

Qualitative studies of female construction workers in North America, Europe, and Australia have identified a number of issues with the fit, comfort, and availability of PPE [10, 37, 38, 54, 76-78, 157-159]. These include ill-fitting protective clothing, gloves, and boots (i.e., too large, too long, too bulky); loose or poorly fitting safety harnesses; limited range of available sizes (i.e., employers tend to provide one-size-fits-all equipment); increased exposure to safety hazards (i.e., gloves that are too big being caught in machinery, tripping on outerwear that is too long); lowered productivity (i.e., having to frequently stop work to tighten PPE that was too loose); and a lack of integration between different types of PPE.

Inadequate fit often leads workers to adjust or alter their PPE [10, 37]. Some examples described in the literature include leaving the chest straps open on a fall-arrest harness to accommodate breasts, cutting bottoms of coveralls and outerwear to shorten them, and wearing elastic bands around rubber boots to keep them on the feet. The limited range of sizes procured by their employers have often led to female workers purchasing their own PPE at their own expense, even though they reported that some of this PPE did not offer the same functionality and level of protection as construction-grade equipment. The people tasked with procuring PPE are often unaware of the problems that women have with ill-fitting PPE or about the existence of PPE in sizes that fit women; this lack of awareness was found to be a key factor in the lack of availability for women [78, 160]. The authors of a recent study that assessed PPE needs for women in health care noted similar issues [90].

6.2 Survey of Canadian Women's Experience with Their PPE

A survey was posted online in January and February of 2022 to gather information from Canadian women on their experience of using PPE in the workplace and their perceptions of how well the PPE they use in their work meets their needs in terms of safety performance and functionality. The original goal was to have 1000 women from across a number of sectors, geographical regions, and age groups complete the survey. More than 7500 women started the online survey, and 2752 completed it. Only fully completed surveys were included in the analysis.

6.2.1 Demographics of Survey Respondents

Individual respondents' demographic information (e.g., age, sector and jurisdiction in which they worked, membership in a trade, employment in the private vs. public sector, residence in rural vs. urban communities, level of education, total annual household income, ethnicity) was collected as was information about the size of their organization and the number of years they had been working at their organization.

Based on the data, the survey sample represents a diverse cross-section of women in Canada. Respondents were 18 to 69 years old and were employed in a wide range of sectors across Canada. Responses were from all provinces and territories, although the relative proportion of responses was lower for women in the North (Northwest Territories, Nunavut, and Yukon), Saskatchewan, and some of the Atlantic provinces. Responses were approximately evenly split between women who lived in an urban setting and those who lived in a rural one, and women who worked in the public vs. the private sector. Nearly 60% of respondents reported that they were paid hourly. Approximately one-quarter of the respondents reported being in a trade, and just under half reported having a university degree³² or professional designation³³. Respondents were predominantly cis-female (98%) and White or of European ancestry (76%).

- **Age:** A total of 2696 women stated their age. Responses were grouped into four broad age categories: 18 to 25, 26 to 39, 40 to 59, and 60 to 70+. The average age of the respondents was 40.8 years. Women between 40 and 59 accounted for 44% of the responses, women between 26 and 39 for 40%, women between 18 and 25 for 10%, and women older than 60 for 7%. When the data were further stratified, women aged 30 to 39 accounted for the highest percentage of responses (30%), followed by women aged 40 to 49 (25%), 50 to 59 (19%), 18 to 25 (10%), 26 to 29 (10%), and 60 and above (7%).
- **Sector of Employment:** A total of 2689 women provided information on the industrial sector in which they worked. Responses were grouped into eight broad categories: manufacturing, construction, health care, the service sector, transportation, natural resources, utilities, and emergency services. Industries related to the service sector accounted for the highest proportion of responses (33%), followed by health care (19%), construction (18%), natural

resources (13%), transportation (11%), manufacturing (7%), utilities (7%), and emergency services (3%). Some women identified in more than one category.

Of the 2681 women who responded when asked whether they worked in the private or public sector, 49% indicated that they worked in the public sector and 43% that they worked in the private sector, with 8% preferring not to specify. Of those who indicated that they were public sector workers, just over two-thirds worked for a provincial government and one-third for the federal government (34% and 15% of the overall total, respectively).

- **Geographical Region:** A total of 2684 women answered the question of where they lived. To allow for sufficient numbers for regional comparisons, responses were grouped as follows: Alberta, British Columbia, East (New Brunswick, Newfoundland and Labrador, Nova Scotia, and Prince Edward Island), Manitoba and Saskatchewan, North (Northwest Territories, Nunavut, and Yukon), Ontario, and Quebec. Ontario accounted for the highest number of responses (28%), followed by British Columbia (19%), Quebec (17%), East (12%), Alberta (12%), Manitoba and Saskatchewan (10%), and North (1%). Of the provinces grouped into "East", Nova Scotia accounted for the highest number of responses (5% of the overall total), followed by New Brunswick (4%), Newfoundland and Labrador (2%), and Prince Edward Island (1%).
- **Size of Organization and Tenure of Employment:** Survey participants were asked how many years they had worked with their current organization, and to the best of their knowledge, how many full-time and part-time workers their organization employed in Canada. Participants were given eight options for size of organization (1–5, 6–19, 20–49, 50–99, 100–499, 500–999, 1000–5000, and >5000) and six options for years of employment (<1 year, 1–2 years, 3–5 years, 6–10 years, 11–20 years, and 20+ years).

Responses were stratified into two categories for size of organization (1–499 and 500+) and tenure of employment (<6 years and ≥6 years). The majority of respondents worked for organizations with more than 500 employees across Canada (60%), and more than half of the respondents had worked with their organization for more than six years (52%). Nearly two-thirds of those with more than six years of tenure had worked with their organization for more than ten years. The average size of the organization was 2900

³² Includes undergraduate, graduate, or post-graduate degree.

³³ Includes accounting, legal, physician.

employees across Canada and the average length of employment with the organization was 8.9 years.

- **Membership in a Trade:** Of the 2681 women who answered this question, 24% indicated they were a member of a trade. Of these, approximately half were in a Red Seal Trade³⁴ and half were in another trade. The proportion of women who indicated they were a member of a trade varied by sector, from 13% employed in emergency services to 53% employed in construction.
- **Highest Level of Education:** Respondents were asked to select their highest level of education from a menu of seven options: high school or less, some college, college diploma, some university, university degree, graduate or post-graduate degree, and professional degree (e.g., accounting, legal, physician, etc.). Data were stratified into two categories: "less than university" (high school or less, some college, college diploma, some university), and "university or higher" (university degree, graduate or post-graduate degree, and professional degree). Of the 2682 women who answered this question, 58% had "less than university" education and 42% had "university or higher" education.
- **Minority Status:** Before completing the survey, participants were asked to indicate their ethnicity and whether they were a member of (or if they identified with) a selected minority or marginalized group. Response options were as follows: White/European ancestry; Indigenous/First Nations/Métis; minority ethnicity/race; member of a religion that experiences discrimination; member of the LGBTQ2S+ community; having a physical or mental health challenge/neurodiverse; learned English/French as a second/third+ language (i.e., non-mother tongue or first language); other; or prefer not to answer. Of the 2666 women who answered this question, 76% were White/European ancestry, 10% were a minority ethnicity/race, 6% were Indigenous/First Nations/Métis, and 2% "other"; 6% preferred not to answer. Responses to the remaining options broke down as follows: member of a religion that experiences discrimination (2%), member of the LGBTQ2S+ community (6%), having a physical or mental health challenge/neurodiverse (5%), learned English/French as a second/third+ language (8%).

6.2.2 Types of PPE Canadian Women Wear

The survey asked a series of questions designed to elicit information on whether participants wear PPE in their workplace, what types of PPE they wear, and who sources it. Results showed that (a) women wear every type of PPE, but that the specific type of PPE worn varies by sector; and (b) very few women report that they wear PPE designed for women. Nearly half of the respondents reported that their usual PPE is designed to be unisex, and just over one-third reported that their usual PPE is designed for men. All percentages are rounded to the nearest integer.

6.2.2.1 Types of PPE Worn

Participants were asked whether, in their day-to-day duties at work, they wear any of the following PPE: head protection, eye and face protectors, hearing protection, respiratory protection, hand protection, foot and leg protection, protective clothing, fall-arrest gear, general consumer grade masks,³⁵ or other. A total of 2752 women reported that they wear one or more types of the PPE listed (Figure 5), most often eye and face protectors (66%), respiratory protection (57%), protective clothing (52%), foot and leg protection (52%), and hand protection (50%). Respondents who selected "other" were asked to specify the type of PPE worn. Examples of "other" PPE that respondents wore included high-visibility vests; Kevlar sleeves, jackets, and shin pads; medical gowns and gloves; and welding masks. Respondents reported wearing multiple types of PPE, and the results show a large overlap in PPE use (see Table 3).

6.2.2.2 Types of PPE Worn by Sector

The types of PPE that women report wearing vary by sector (Table 4). In some cases, the range was relatively wide; in others, relatively narrow. For example, the percentage of respondents who reported wearing head protection ranged from 11% for those in health care to 82% for those in construction and utilities. In contrast, the percentage of respondents who reported wearing respiratory protection ranged from 41% for those in manufacturing and transportation to 76% for those in the emergency services, while those who reported wearing fall-arrest gear ranged from 1% for those in health care to 41% for those in construction. These findings are not surprising given the different hazards and risks inherent in these sectors.

³⁴ Designated trades that are governed by regulations under provincial and territorial apprenticeship, certification and trade qualification statutes.

³⁵ As shown in Figure 5, nearly half of the women who completed the survey indicated that they wear general consumer grade masks (49%). This finding reflects the time at which the survey was conducted (i.e., during the Omicron wave of the COVID-19 pandemic). Respondents were not included in the analysis if consumer grade masks were the only PPE they wore.

Figure 5: Types of PPE Worn by Survey Respondents (n = 2752)

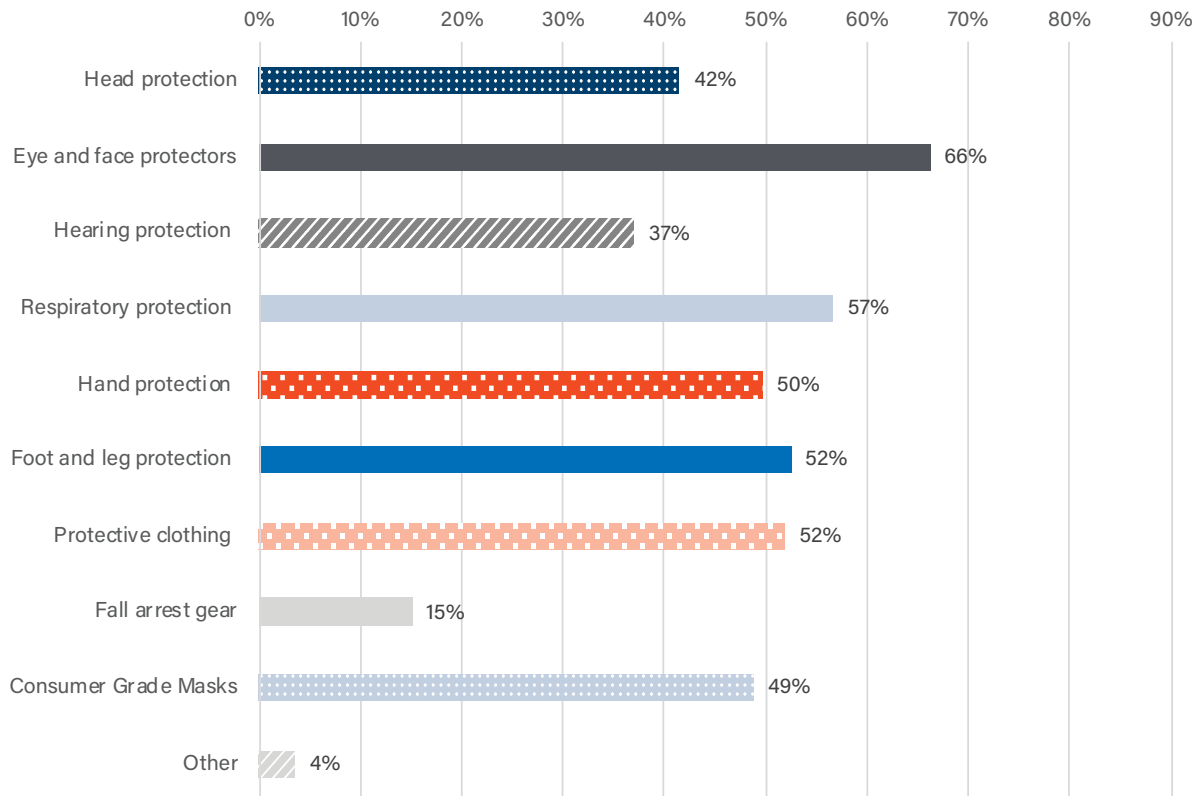


Table 3: Proportions of Survey Respondents Who Reported Wearing More Than One Type of PPE

	TOTAL	Head	Eye/ Face	Hearing	Respiratory	Hand	Foot/ Leg	Clothing	Fall
Total number	2752	1143	1822	1019	1560	1367	1444	1428	414
Head protection, %	42	—	55	81	38	63	70	64	93
Eye and face protection, %	66	88	—	88	67	81	79	82	92
Hearing protection, %	37	72	49	—	36	57	63	58	86
Respiratory protection, %	57	52	58	56	—	58	49	57	71
Hand protection, %	50	75	61	77	51	—	68	70	86
Foot and leg protection, %	52	88	63	89	45	72	—	75	93
Protective clothing, %	52	80	64	82	52	7	74	—	88
Fall-arrest gear, %	15	34	21	35	19	26	27	26	—
Consumer-grade masks, %	49	65	54	68	43	62	65	60	75
Other, %	4	4	4	4	3	3	3	4	4

Table 4: Types of PPE Worn by Survey Respondents, by Sector

	TOTAL	Manu	Const	Health	Service	Trans	NatRes	Util	Emerg
Total number	2752	194	501	535	929	316	361	181	89
Head protection, %	42	41	82	11	22	47	74	82	65
Eye and face protection, %	66	67	86	76	51	48	83	83	84
Hearing protection, %	37	46	66	7	20	48	72	70	60
Respiratory protection, %	57	41	51	75	59	41	52	55	76
Hand protection, %	50	61	72	39	35	54	74	63	70
Foot and leg protection, %	52	63	87	14	35	72	86	83	79
Protective clothing, %	52	47	74	41	33	72	79	73	72
Fall-arrest gear, %	15	11	41	1	5	20	19	31	30
Consumer-grade masks, %	49	57	62	24	43	63	64	64	64
Other, %	4	2	2	5	4	3	4	7	4

Legend: Manu = Manufacturing, Const = Construction, Health = Health care, Service = Service sector, Trans = Transportation, NatRes = Natural Resources, Util = Utilities, Emerg = Emergency Services

6.2.2.3 Percentage of Women Wearing PPE Designed for Women

Survey participants were asked whether their usual PPE was designed for men or for women. Five response options were provided: men, women, unisex, don't know, or not applicable. Of the 2750 women who answered this question, only 6% reported that their usual PPE is designed for women, while 48% reported that their usual PPE is designed to be unisex and 35% reported that their usual PPE is designed for men.

By type of PPE, the percentage of women who reported that their usual PPE is designed for women ranged from 4% (eye and face protection, hearing protection, respiratory protection, fall-arrest gear) to 6% (foot protection). Across sectors, the percentage of women who reported that their usual PPE is designed for women ranged from zero (for those in emergency services) to 11% (for those in manufacturing). By sector, of women who reported wearing PPE designed for women, less than 5% were employed in transportation or natural resources; 6% in construction or utilities; 7% in health care; and 8% in the service sector.

6.2.3 Level of Satisfaction Canadian Women Have with Their PPE

To elicit information on how satisfied women were with their PPE, the survey asked a series of questions about how protected they feel when wearing their PPE, how comfortable it is, whether it is meeting their needs, the

key design features or factors that contribute to their level of satisfaction with it, and what improvements they would like to see with their PPE.

6.2.3.1 How Protected Women Feel Wearing Their PPE

Survey participants were asked how protected they felt when wearing their PPE. Four response categories were provided: very protected; somewhat protected; not very protected; or not at all protected. Of the 2748 women who answered this question, 52% reported feeling somewhat protected and 41% very protected, while 6% felt not very protected and 1% not at all protected. Across the different types of PPE, the percentage of women who felt protected by their PPE was relatively consistent, with between 53% and 58% of respondents reporting feeling "somewhat protected" and between 33% and 41% reporting feeling "very protected" for all the types of PPE (see Figure 6). Of the women who wore fall-arrest gear, only 33% reported feeling "very protected" by their PPE and 8% felt "not very protected" by their PPE.

Across sectors, the results varied a little, from 43% to 57% for "somewhat protected", from 34% to 52% for "very protected", and from 2% to 9% for "not very protected". The lowest percentages of women who reported feeling "very protected" by their PPE were in construction (36%), transportation (36%), and emergency services (34%). The lowest percentage of women who reported feeling "somewhat protected" by their PPE was in manufacturing (43%) (see Figure 7).

Figure 6: How Protected Women Feel by Their PPE, by PPE Type (n = 2748)

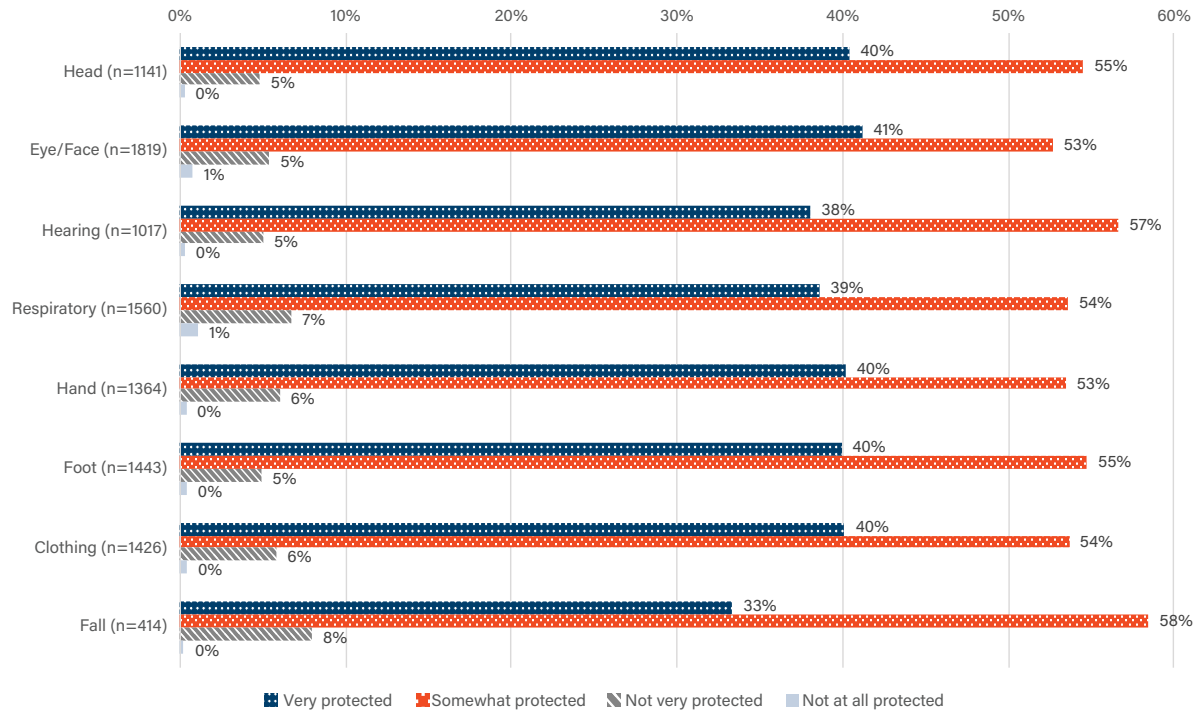
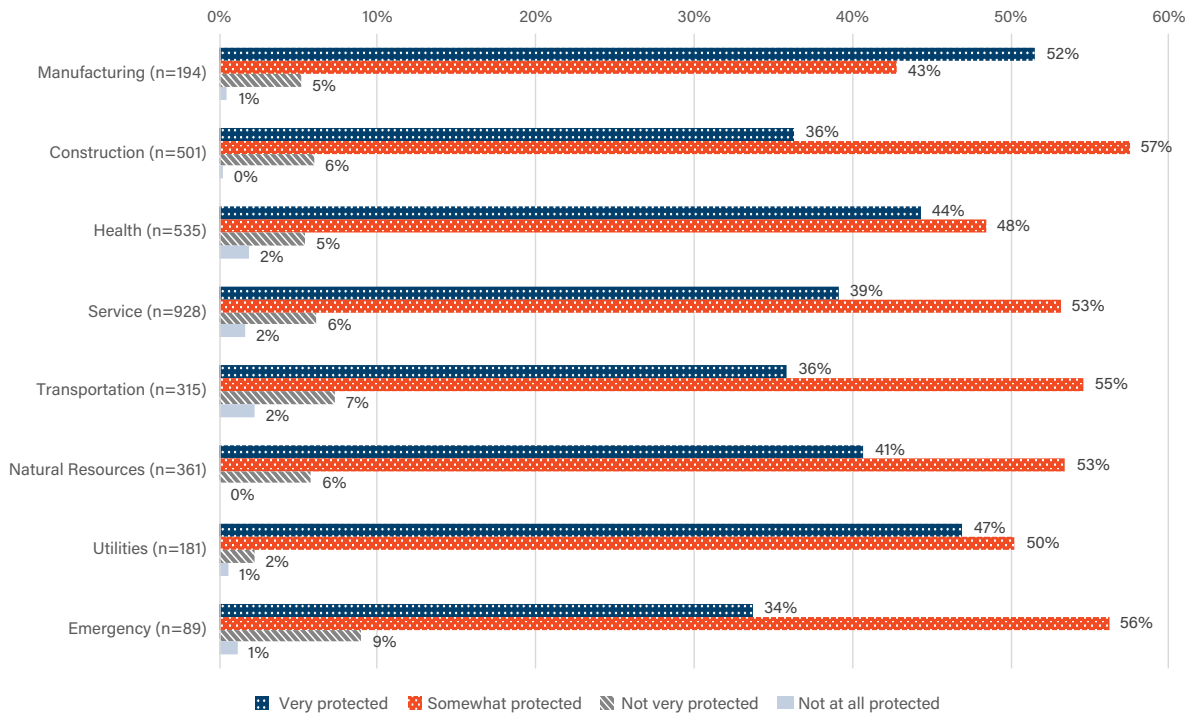


Figure 7: How Protected Women Feel by Their PPE, by Sector (n = 2748)



Participants were also asked, via an open-ended question, to explain their responses. Nearly all responses from the 1% who felt “not at all protected” applied to PPE that workers were required to wear during the COVID-19 pandemic (e.g., masks and shields), and many of the comments questioned the effectiveness of these measures at preventing airborne transmission of the virus. Many of the responses from the 6% who felt “not very protected” applied to the fit and quality of the PPE they were required to wear. Specific examples given were ill-fitting gloves, safety glasses, protective clothing, and respiratory protection as well as the problems they encountered finding PPE that fit and didn't put the respondents at risk of injury. PPE fit and quality were also raised by the 52% who felt “somewhat protected”, with several respondents commenting on how PPE is designed for men and many stating that PPE doesn't fit them properly.



“Because the PPE does not fit well, I tend to get caught on stuff. Railings, door knobs, any sharp corners. Length of coveralls creates a tripping hazard, and sleeves that are either too long or too wide and ill-fitting gloves make everything feel very awkward.”

—Survey respondent who felt “somewhat protected” by her PPE

British Columbia, Transportation

6.2.3.2 How Comfortable Women Find Their PPE

Survey participants were asked how comfortable their PPE is. Five response categories were provided: very comfortable; comfortable; uncomfortable; very uncomfortable; or not applicable. Of the 2742 women who answered this question, 35% indicated that their PPE was “uncomfortable” and 7% that it was “very uncomfortable”. Only 8% said that their PPE was “very comfortable” and 49% that it was “comfortable”.³⁶ By type of PPE, half of the respondents who wear fall-arrest equipment indicated that it was either “uncomfortable”

(44%) or “very uncomfortable” (6%). Similar overall levels of dissatisfaction were seen for head protection (47%), eye and face protection (47%), and protective clothing (47%) (see Figure C-1, Appendix C).

By sector, women employed in manufacturing and the service sector were more likely to find their PPE comfortable. Nearly three-quarters of women in manufacturing found their PPE either “very comfortable” (12%) or “comfortable” (62%), while two-thirds of women in the service sector found their PPE either “very comfortable” (9%) or “comfortable” (53%). Women in emergency services were least likely to find their PPE comfortable, with 1% finding it “very comfortable” and 44% “comfortable”. Approximately 40% of women in construction, transportation, and natural resources, utilities, and emergency services found their PPE “uncomfortable”. Sectors with the highest percentages of women describing their PPE as “very uncomfortable” were the health care (10%), transportation (9%), and emergency services (11%) sectors (see Figure C-2, Appendix C).

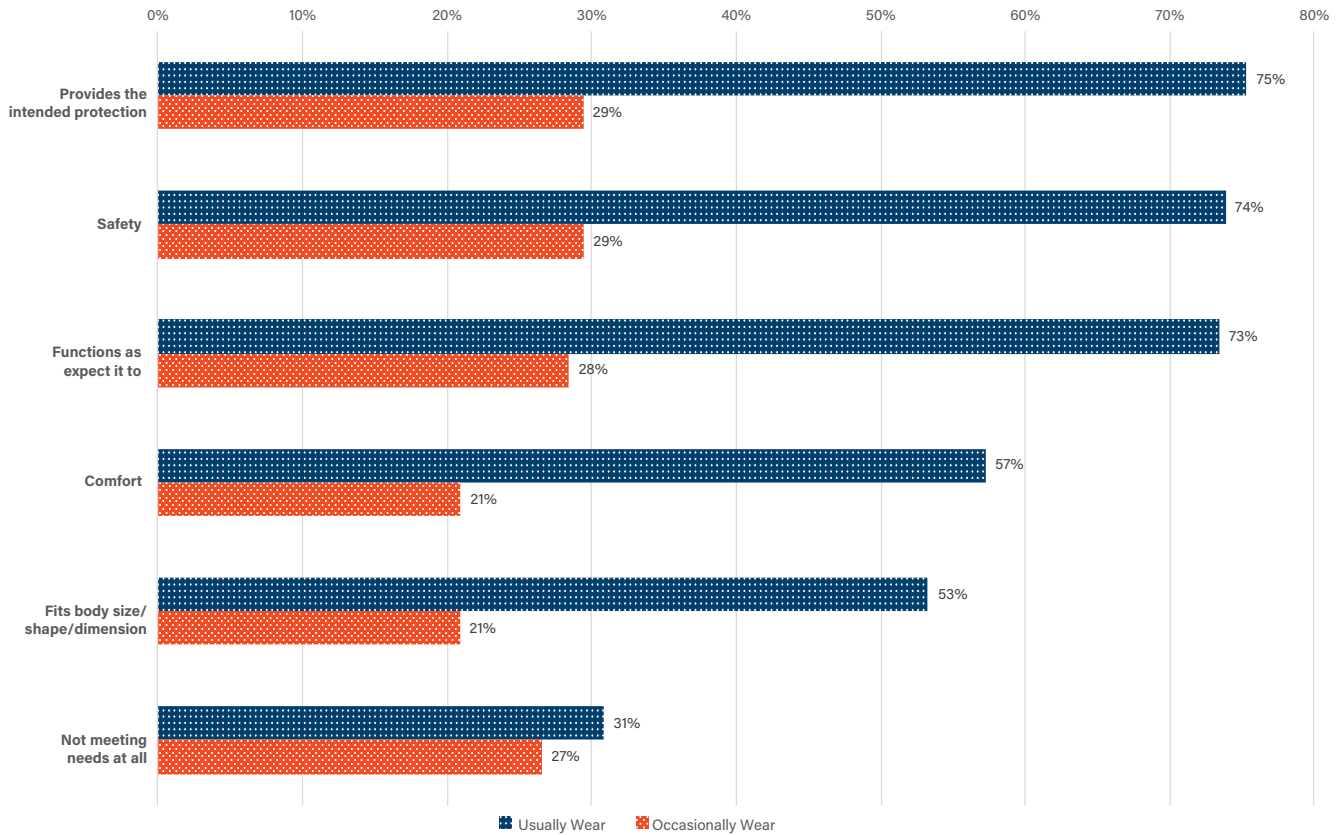
6.2.3.3 Does Women's PPE Meet Their Needs?

Survey participants were asked to think about the PPE they “usually” wear and the PPE they “ever” (or occasionally) wear and to indicate whether it was meeting their needs with regard to safety, comfort, fitting their body/shape/dimensions, providing the intended protection, functioning as expected, or whether it was not meeting their needs at all. A total of 2752 women answered this question, and their responses were stratified into two categories: PPE that is usually worn vs. PPE that is occasionally worn.

As shown in Figure 8, approximately three-quarters of the respondents indicated that they thought their *usual* PPE provides the intended protection (75%), is safe (74%), and functions as expected (73%). By comparison, under one-third of the respondents felt that their *occasional* PPE met these needs. Just over half felt their *usual* PPE met their needs in terms of comfort or fit (57% and 53%, respectively), while under one-quarter felt that their *occasional* PPE met these needs. Nearly one-third of the respondents indicated that their *usual* PPE did not meet their needs at all; more than one-quarter felt the same about their *occasional* PPE.

36 1% selected “not applicable”.

Figure 8: Percentage of Women Who Find Their PPE Meets Their Needs (n = 2752)



- Usual vs. Occasional PPE, by PPE Type:** Figures C-3 and C-4 in Appendix C show these findings by type of PPE. Across all types of PPE, between 51% and 57% of respondents found their *usual* PPE comfortable; between 41% and 54% indicated that it fit their body size, shape, or dimensions; and between 27% and 32% felt it did not meet any of their needs. The types of PPE that women reported as being least likely to fit were head protection, hearing protection, and fall-arrest gear. Respondents most frequently indicated that fall-arrest gear, respiratory protection, eye and face protection, and hand protection did not meet any of their needs (see Figure C-3, Appendix C).

Across all types of PPE, between 16% and 21% of respondents indicated that their *occasional* PPE was comfortable or that it fit their body size, shape, or dimensions; and between 27% and 34% felt it did not meet any of their needs. The types of PPE that women reported as being least likely to fit were fall-arrest gear and protective clothing, followed by hand protection, foot and leg protection,

respiratory protection, hearing protection, eye and face protection, and head protection. Fall-arrest gear, protective clothing, and hearing protection were the three types of occasional PPE that respondents most often described as not meeting any of their needs (see Figure C-4, Appendix C).

- Usual vs. Occasional PPE, by Sector:** Figures C-5 and C-6 in Appendix C show these findings by sector. Across sectors, between 51% and 64% of respondents found their *usual* PPE comfortable; between 40% and 66% felt that it fit their body size, shape, or dimensions; and between 22% and 39% felt it did not meet any of their needs. Sectors in which women found their usual PPE the least comfortable were emergency services, natural resources, transportation, utilities, and construction – the same sectors where women reported their PPE as least likely to fit. The three sectors with the highest percentage of women who described their usual PPE as not meeting any of their needs were health care, emergency services, and transportation (see Figure C-5, Appendix C).

Across sectors, between 12% and 22% of respondents found their *occasional* PPE comfortable; between 15% and 25% felt it fit their body size, shape, or dimensions; and between 16% and 33% felt it did not meet any of their needs. Women found their occasional PPE the least comfortable in emergency services, followed by natural resources, transportation, health care, construction, utilities, manufacturing, and the service sector. The sectors in which women reported their occasional PPE as least likely to fit were emergency services, transportation, and utilities. The highest proportions of women who reported their PPE as not meeting any of their needs were in construction, natural resources, utilities, manufacturing, and the service sector (see Figure C-6, Appendix C).

6.2.3.4 Factors that are Key to Women's Satisfaction with Their PPE

Survey participants were asked to select, from a list, which factors were key to their satisfaction with their PPE. Ten multiple-choice response options were offered along with an "other" input field for participants to write in additional comments. A total of 2717 women answered this question in full. As shown in Figure 9, the factors women most often chose as being key to their satisfaction were feeling safe and trusting that their PPE will protect them (66%); being able to do their job or move around (64%); comfort (64%); and acceptable fit (61%).

Figures C-7 and C-8 in Appendix C show these findings by type of PPE and by sector. By type of PPE, approximately three-quarters of women identified "does not impact ability to do job or move around" as key to their satisfaction with their fall-arrest gear (80%), hearing protection (78%), head protection (75%), foot and leg protection (75%), and protective clothing (73%) (see Figure C-7).

By sector, approximately three-quarters of women employed in emergency services (79%), construction (76%), and natural resources (71%) identified "feeling safe and trusting that their PPE will protect them" as key to their satisfaction with their PPE (see Figure C-8). Similarly high percentages were seen for "comfortable to wear" for women employed in transportation (71%), natural resources (72%), and utilities (72%); and "does not impact ability to do job or move around" for women employed in construction (76%), transportation (73%), natural resources (76%), utilities (77%), and emergency services (70%).



I don't care if it looks ugly. I don't care if it's not comfortable. It has one job and that is to protect me to where I am safe to go home to my family after work. It is not doing that.

—Manitoba/Saskatchewan, Transportation



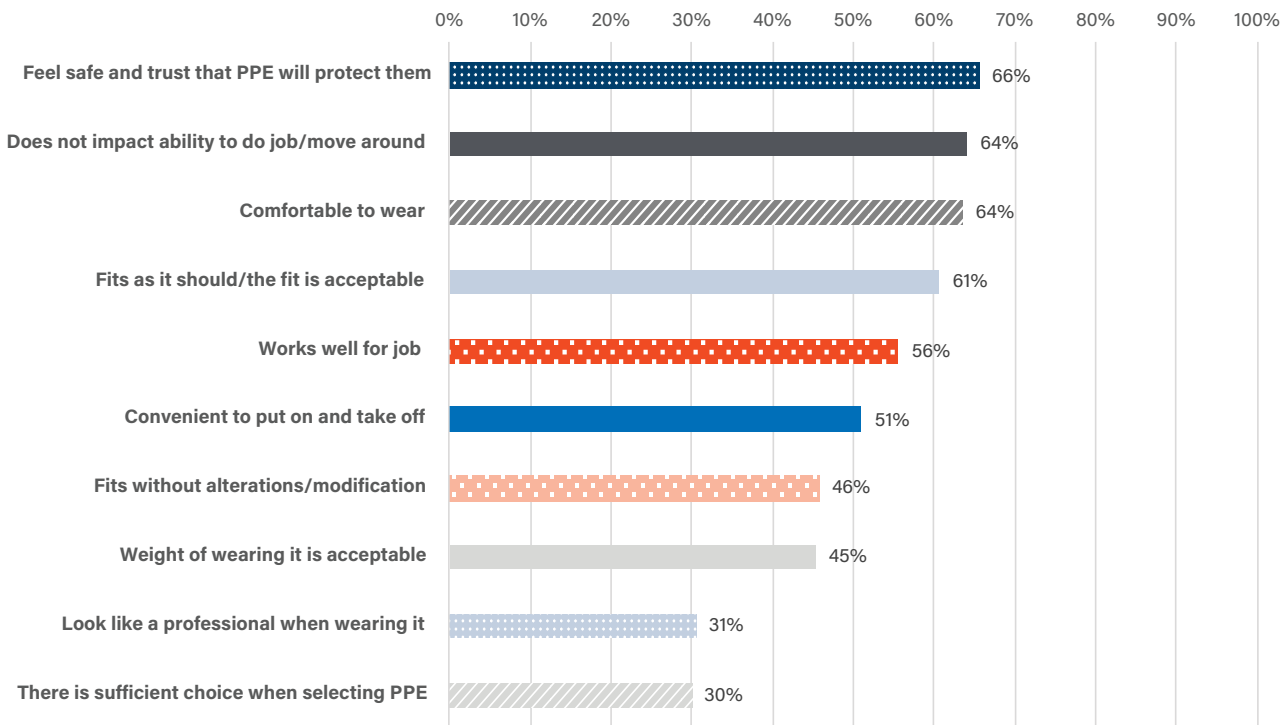
Doesn't add hazards (i.e., excess material hindering body movement or potentially becoming caught in moving components; doesn't cause chafing with repeated wear, etc). Also, some women are fine with pink PPE, but for some of us it just adds to the difficulty in being taken seriously in the workplace.

—British Columbia, Natural Resources

6.2.3.5 Key Improvements that Women Would Like with Their PPE

Survey participants were asked, via an open-ended question, whether there were any key improvements they would like to see with their PPE. In total, 2259 women from across all sectors and using all types of PPE shared their thoughts and suggestions on how their PPE could be improved. Responses were themed and coded into eight categories: access and availability, comfort, cost, design, fit, quality, selection, and sizing. The most frequently mentioned areas for improvement were design (19.7% of responses), sizing (17.2%), fit (16%), selection (9.5%), and comfort (6.7%). Women flagged issues such as needing coveralls and outerwear that would allow them to go to the bathroom without having to completely disrobe, more breathable fabrics that would allow them to better regulate their body temperature, and more lightweight PPE that would minimize strain on the back, legs, neck, and head. A sample of their verbatim responses is provided in Appendix D.

Figure 9: Factors that Women Report are Key to Satisfaction with Their PPE (n = 2717)



6.2.4 Problems Canadian Women Report Having with Their PPE

To identify the problems that women have with PPE, the survey asked a series of questions about what they perceive isn't working, whether they had had any negative experiences with their PPE, whether they had ever been injured or had an illness caused directly or indirectly by their PPE, and whether they had worn PPE while they were pregnant, breastfeeding, or menopausal.

6.2.4.1 Women are Hampered at Work by Their PPE

The survey asked women to what extent their PPE hampered them at work. Four response categories were provided: significantly; sometimes; occasionally; and not at all. Of the 2728 women who answered this question, 85% reported that they were significantly hampered (13%), sometimes hampered (43%), or occasionally hampered (28%) at work by their PPE. Figures C-9 and C-10 in Appendix C show these data by type of PPE and by sector. By type of PPE, between 86% and 93% of women have been significantly, sometimes, or occasionally hampered by their PPE. Across all types

of PPE, there is relatively little variation within each of the response categories. The highest percentages of women reporting that their PPE hampered them at work were those who wear fall-arrest gear (93%) and hand protection (90%) (see Figure C-9).

By sector, between 79% and 92% of women reported being significantly, sometimes, or occasionally hampered by their PPE. The highest percentages were among women employed in emergency services (92%), construction (90%), natural resources (88%), health care (87%), and transportation (86%). Looking only at the results for "significantly hampered", the highest percentages were among women employed in transportation (16%), emergency services (16%), health care (15%), and natural resources (14%) (see Figure C-10).

6.2.4.2 Women Need to Repeatedly Adjust Their PPE

Survey participants were asked how often they adjust their PPE, be it tucking in a shirt that is too loose, pulling up pants that are too big, or tightening a respirator or goggles. Five response categories were provided: each

time they put the PPE on; after a few hours of work; every hour; more than once per hour; and constantly adjusting as they work. Of the 998 participants who answered this question, 45% said that they had to adjust their PPE each time they put it on and 55% that they had to adjust their PPE at least once per shift. Overall, 24% said that they had to adjust their PPE after a few hours of use and 17% that they were constantly adjusting it as they worked. Just under 10% indicated that they adjusted their PPE either every hour (8%) or more than once per hour (7%).

The pattern of the findings is relatively similar between the different types of PPE, with the exception of respiratory protection (see Figure C-11, Appendix C). While approximately 20% of women reported needing to constantly adjust other types of PPE as they work, only 15% of women who wear respiratory protection reported doing so. This may be because respiratory protection is the only type of PPE with consistently mandated requirements for fit testing. The only other notable difference in the findings is the slightly higher percentage of women who reported adjusting their fall-arrest gear, on average every hour (10%) or more than once per hour (9%).

By sector, there is no consistent pattern in the findings (see Figure C-12, Appendix C). Higher than average percentages of women employed in emergency services (32%) and utilities (20%) reported constantly adjusting their PPE at work. Similarly, 16% of women in manufacturing and 12% of women in utilities reported having to adjust their PPE every hour; 13% of women in emergency services reported having to adjust their PPE more than once an hour; and more than one-quarter of women in health care (29%), manufacturing (28%), the service sector (26%), and construction (20%) reported having to adjust their PPE after a few hours of work. This repeated need to adjust their PPE throughout the workday suggests that the PPE that women wear is interfering with their productivity. It also raises questions about how effectively protected from workplace hazards women workers *actually* are.

6.2.4.3 Women Report Multiple Issues with Their PPE

The survey asked participants to select from a list any possible issues they had experienced with their PPE. Thirteen multiple-choice response options were provided along with an “other” input field for participants to write additional comments. The response options provided were informed by the findings of the literature survey and

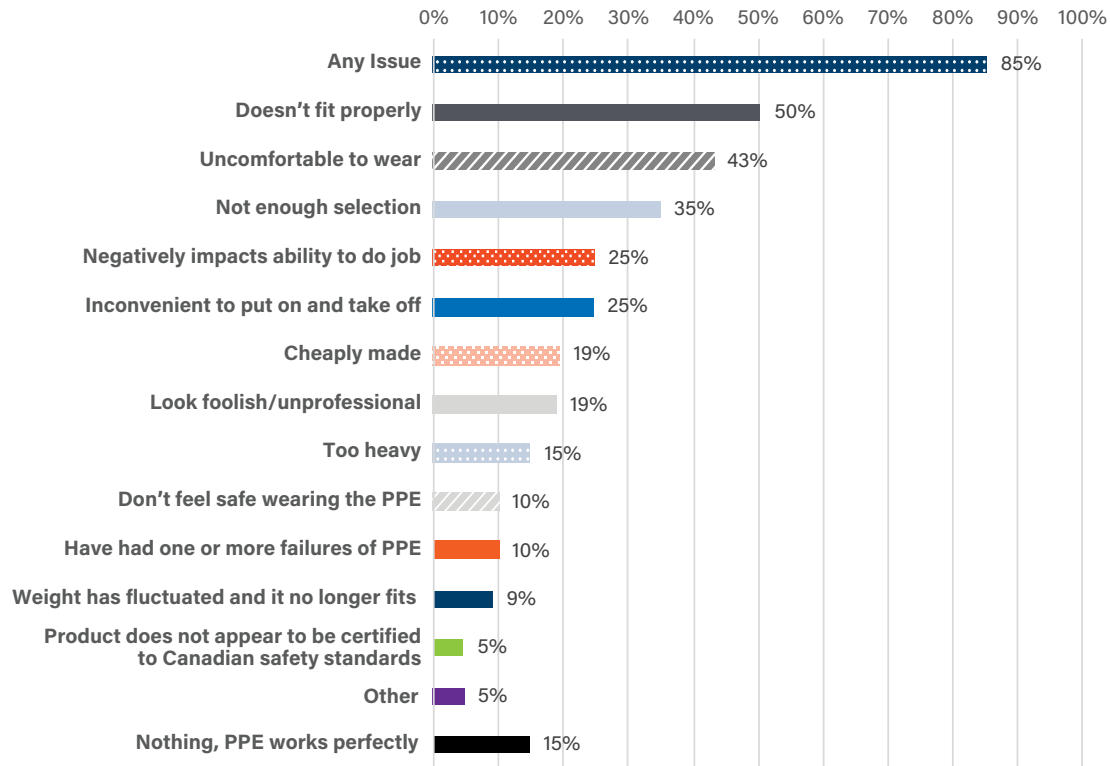
included fit, comfort, selection, impact on mobility, impact on capacity to function in the job, and quality. Of the 2675 women who answered this question, 85% reported one or more issues with their PPE (Figure 10), most often that it does not fit properly (50%), that it is uncomfortable to wear (43%), and that there is not enough of a selection (35%). One-quarter of the respondents indicated that their PPE negatively impacted their ability to their job and was inconvenient to put on and take off (and negatively impacted their ability to meet their physical needs, such as using the bathroom).



Comfort and proper fit, having to wear men's clothing never works perfectly. Pants don't fit in the hips and are either too tight and uncomfortable or too loose and slipping down. Low crotches in men's pants inhibits full leg range of motion, limits my ability to step up onto work platforms and climb scaffolding. The limited availability of work clothing means I don't have professional looking clothing for client meetings.

—British Columbia, Construction

Across the types of PPE, between 85% and 94% of the 2675 respondents reported having one or more issues with their PPE, with the highest percentages among women who wear fall-arrest gear (94%), hearing protection (92%), and head protection (91%). Of those using hand protection, foot and leg protection, and protective clothing, 90% reported one or more issues. Figure C-13 in Appendix C shows the distribution of responses for the most frequently cited issues, by type of PPE. Fit was cited as an issue by 75% of those wearing fall-arrest gear and by 69% of those wearing head and/or hearing protection. Comfort was an issue for half of those who wear fall-arrest gear and between 45% and 47% of those wearing all other types of PPE. Of those wearing fall-arrest gear, 41% reported that it was inconvenient to put on and take off/negatively impacted their ability to meet their physical needs and 39% reported that it made their job harder to do/negatively impacted their ability to do their job. A lack of selection

Figure 10: Percentage of Women Reporting One or More Issues With Their PPE (n = 2675)

was also cited as an issue for those wearing fall-arrest gear (55%), hearing protection (51%), head protection (50%), foot and leg protection (49%), and protective clothing (46%) (results not shown).

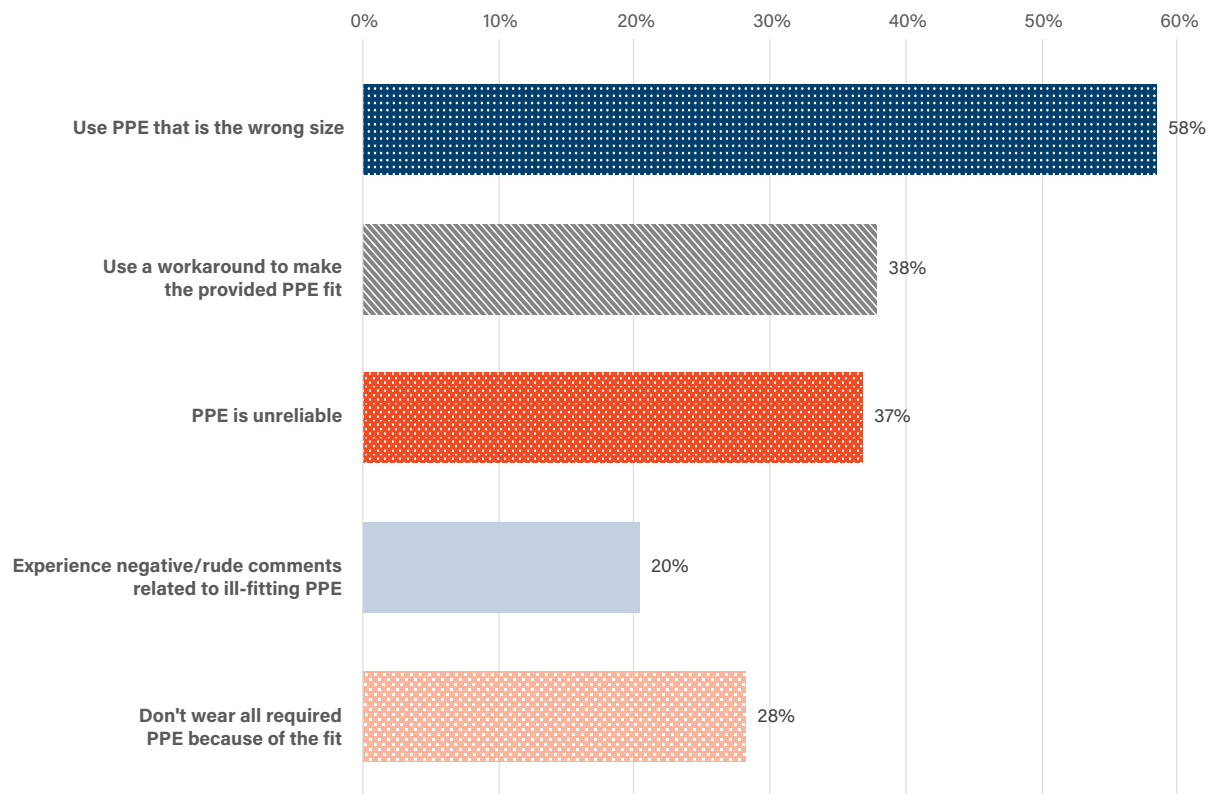
Across sectors, between 78% and 92% reported one or more issues with their PPE, with the highest percentages among women in construction (92%), emergency services (92%), transportation (91%), utilities (90%), and natural resources (89%). Figure C-14 in Appendix C shows the distribution of responses for the most frequently cited issues, by sector. More than 60% of women in construction, transportation, natural resources, utilities, and emergency services mentioned issues with fit. Between 40% and 54% of women in emergency services, utilities, construction, health care, and transportation, natural resources, and the service sector found their PPE uncomfortable. More than 40% of women in emergency services reported that their PPE made their job harder to do and negatively impacted their ability to do their job. Between 30% and 40% of women in utilities, transportation, construction, emergency services, and natural resources indicated

that their PPE was inconvenient to put on and take off and negatively impacted their ability to meet their physical needs (e.g., going to the bathroom).

6.2.4.4 Women Report Negative Experiences with Their PPE

Survey participants were asked about the types and frequency of negative experiences they had had with their PPE. Response categories were as follows:

- Type of Negative Experience:** Use PPE that is the wrong size; use a workaround to make the provided PPE fit (e.g., using duct tape/rubber bands on loose gloves); PPE is unreliable (i.e., breaks or tears due to fit and quality issues); experience negative or rude comments related to ill-fitting PPE; and PPE not worn because of the fit;
- Frequency:** Always (i.e., every day); mostly (i.e., at least once per week); sometimes (i.e., at least once per month); rarely (i.e., once every few months or less); or never.

Figure 11: Percentage of Women Reporting Negative Experiences with PPE (n = 2675)

To get an overall sense of women's experiences with these issues, responses with a frequency of "always", "mostly", or "sometimes" were combined into a single frequency of "at least sometimes". The overall percentage of women who reported negative experiences with their PPE "at least sometimes" are summarized in Figure 11. The findings by type of PPE and by sector are shown in Figures C-15 and C-16 in Appendix C.

- Overall, nearly 60% of women reported using PPE that is the wrong size at least some of the time (Figure 11). Approximately 70% of those who wear head protection, hearing protection, protective clothing, or fall-arrest gear (Figure C-15) reported using PPE that is the wrong size. Similarly, approximately 70% of those working in construction, transportation, natural resources, and emergency services (Figure C-16) indicated using PPE that is the wrong size.
- Overall, 37% described their PPE as unreliable, and 38% reported using a workaround to make the provided PPE fit at least some of the time (Figure 11). Approximately 40% of those who wear hand protection, respiratory protection or fall-arrest gear (Figure C-15) and more than 40% of those who work in health care and transportation (Figure C-16) say their PPE is unreliable at least some of the time. More than 50% of those who wear fall-arrest gear (Figure C-15) and more than 40% of those employed in construction, transportation, natural resources, and utilities (Figure C-16) report using a workaround to make their PPE fit. Examples of types of workarounds that women report using include rubber bands and/or duct tape to secure work gloves and to shorten sleeves and pant legs. (See Section 6.2.5.3 for additional information on the extent to which women modify their PPE and their reasons for doing so.)
- Nearly one-third of women indicated that, at least sometimes, they don't wear all the required PPE at work because of issues with fit (Figure 11), from 28% for those who wear respiratory protection to 39% for those who wear fall-arrest gear (Figure C-15). Nearly 40% of women in construction and just over 30% of those in emergency services reported not wearing all their required PPE (Figure C-16).

- One in five women reported experiencing negative or rude comments, at least some of the time, because of ill-fitting PPE (Figure 11). More than 25% of those who wear head protection or fall-arrest gear (Figure C-15) or who are employed in manufacturing, construction, and emergency services (Figure C-16) reported experiencing negative or rude comments at least some of the time.



I don't wear my PPE because it impacts my ability to work safely and efficiently. I would wear it if it fit me as well as it fits my male counterparts.

—British Columbia, Construction

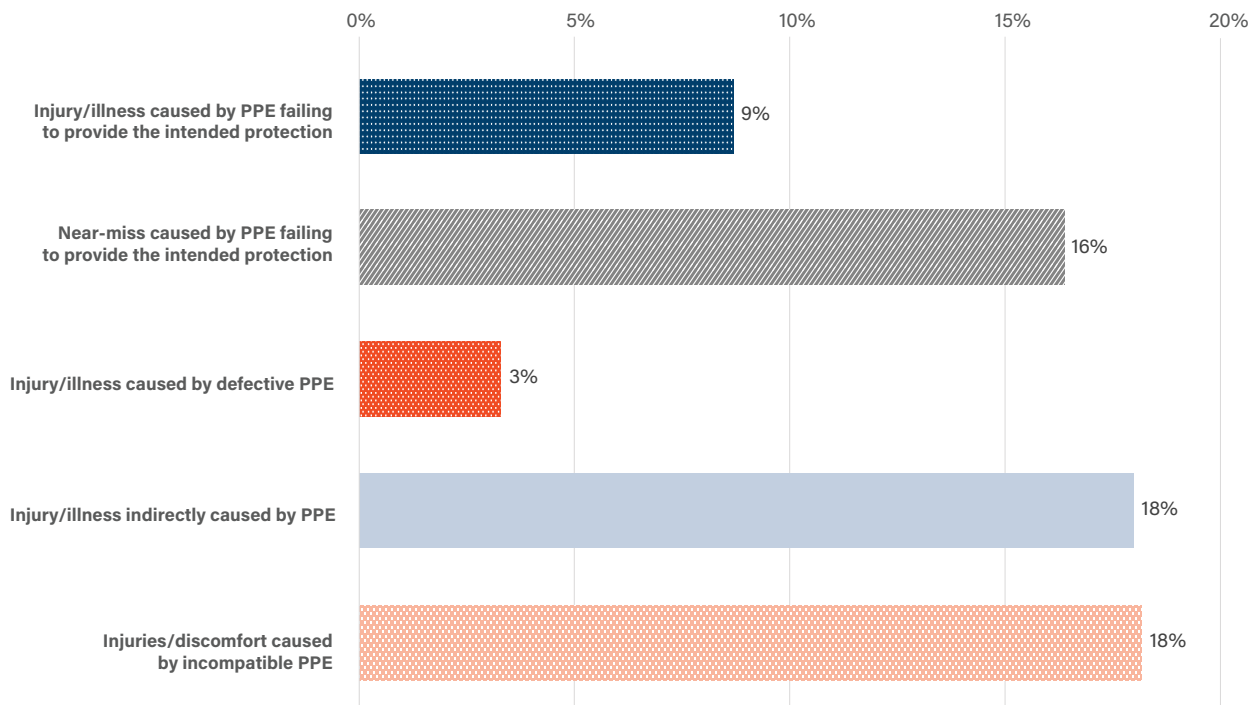
6.2.4.5 Women Perceive Their PPE as Contributing to Injury or Illness

To assess whether Canadian women in the workforce perceived their PPE as directly or indirectly contributing to a workplace injury or illness, survey participants were

asked whether they had ever experienced an injury or illness caused by their PPE failing to provide the intended protection (due to, for example, improper fit); a near-miss incident caused by their PPE failing to provide the intended protection (due to, for example, improper fit); an injury or illness caused by defective PPE; an injury or illness indirectly caused by their PPE (including, for example, bruising, blisters, urinary tract infections from not going to the bathroom to avoid removing PPE); an injury or discomfort caused by different types of PPE not being compatible with each other (for example, a respirator interfering with the proper fit of a hard hat or goggles); an injury caused by another factor not related to a PPE malfunction; or no workplace injury. Of the 2635 women who answered this question, 54% indicated that they had never had a workplace injury; 11% had had an injury caused by a factor unrelated to a PPE malfunction; and 39% had had an incident they perceived to be related to their PPE. Figure 12 shows the distribution of responses for the 1028 women who fell into this latter category.

The findings by type of PPE and by sector are shown in Figures C-17 and C-18 in Appendix C. Across all types of PPE, women reported experiencing (a) injuries, illnesses, or near-miss incidents they perceived to be

Figure 12: Percentage of Women Who Perceive their PPE as Contributing to Injury or Illness (n = 1028)



caused by their PPE failing to provide the intended protection; (b) injuries they perceived to be caused by defective PPE; (c) injuries or illnesses that they perceived to be indirectly caused by their PPE; and (d) injuries or discomfort that they perceived to be caused by incompatible PPE (Figure C-17).

- For all types of PPE except eye and face protection and respiratory protection, more than one in ten women reported experiencing an injury or illness they perceived to be caused by their PPE failing to provide the intended protection. The highest percentage was for women who wear fall-arrest gear (17%).
- More than one in five women who wear fall-arrest gear (32%), hearing protection (26%), head protection (24%), protective clothing (24%), hand protection (23%), and foot and leg protection (22%) reported experiencing a near-miss incident they perceived to be caused by PPE failing to provide the intended protection.
- Across all types of PPE, between 3% and 5% of women reported experiencing an injury or illness they perceived to be caused by defective PPE.
- More than one-quarter of women who wear fall-arrest gear (36%), head protection (28%), hearing protection (28%), hand protection (25%), and protective clothing (25%) reported experiencing an injury or illness they perceived to be indirectly caused by their PPE.
- More than one in five women who wear any type of PPE reported experiencing an injury or discomfort caused by PPE incompatibility, from 21% for respiratory equipment to 35% for fall-arrest gear.

The percentage of women who reported experiencing (a) injuries, illnesses, or near-miss incidents they perceive to be caused by their PPE failing to provide the intended protection; (b) injuries they perceive to be caused by defective PPE; (c) injuries or illnesses they perceive to be indirectly caused by their PPE; and (d) injuries or discomfort they perceive to be caused by incompatible PPE varied both across and within sectors (Figure C-18).

- More than one in ten women employed in emergency services (14%), construction (13%), transportation (12%), and natural resources (11%) reported experiencing an injury or illness they perceived to be caused by their PPE failing to provide the intended protection.
- More than one in ten women employed in any sector – and more than one-quarter of women in construction (25%), transportation (27%), and

emergency services (27%) – reported experiencing a near-miss incident they perceived to be caused by their PPE failing to provide the intended protection.

- The percentage of women who reported experiencing an injury or illness they perceived to be caused by defective PPE ranged from 2% of those employed in utilities to approximately 5% of those employed in manufacturing, construction, health care, and emergency services.
- More than one in five women employed in emergency services (29%), construction (28%), natural resources (just under 25%), transportation (21%), and utilities (21%) reported experiencing an injury or illness they perceived to be indirectly caused by their PPE.
- More than one-quarter of women employed in construction (30%), natural resources (26%), and emergency services (33%) reported experiencing an injury or discomfort they perceive to be caused by PPE incompatibility.



I have been burned hundreds of times by having sleeves and pant legs that are not long enough to provide coverage when I'm in awkward positions (I'm a steamfitter and welder). I literally have become an expert at being burned and maintaining my welding arc because it happens so often. My boobs are covered in tiny scars.

—Ontario, Construction



Because my hands are small my glove has gotten stuck between a container and a stacker and almost had the tractor trailer driver drive off with my hand stuck in the glove.

—British Columbia, Transportation

6.2.4.6 Specific Life Events and PPE

To gauge their experience of wearing PPE during female-specific life events such as pregnancy, breastfeeding, and menopause, survey participants were asked whether they have worn PPE during any of these life events, and if so, whether (a) they were accommodated with properly designed and comfortable PPE; (b) their PPE was altered or modified, either by or for them; and (c) their employer protectively reassigned them.

Of the 2697 participants who answered the question about whether they had worn PPE during pregnancy, breastfeeding, or menopause, 12% had worn PPE during pregnancy, 6% while breastfeeding, and 21% during menopause.

- **Pregnancy:** The percentage of women who reported wearing PPE during pregnancy ranged from 12%, for respiratory protection, to 18%, for head protection, hearing protection, and fall-arrest gear. The percentage of women who reported wearing PPE while pregnant ranged from a low of 8% in the service sector to a high of 22% in utilities. Of women who reported wearing PPE while pregnant, the highest percentages were employed in utilities (22%), manufacturing (19%), and natural resources (17%).
- **Breastfeeding:** The percentage of women who reported wearing PPE while breastfeeding ranged from 5%, for respiratory protection, to 10%, for fall-arrest gear. The highest percentages were employed in manufacturing (11%), followed by emergency services (10%) and utilities (9%).
- **Menopause:** The percentage of women who reported wearing PPE during menopause was relatively consistent across types of PPE, from 18% for fall-arrest gear to 22% for protective clothing. By sector, the percentage of women who reported wearing PPE during menopause ranged from a low of 15% in construction to a high of 30% in transportation.

In response to a question about whether they were (a) provided with properly designed and comfortable PPE during these life events, or (b) whether alterations were made to their PPE, either by them or for them, 90% of women who have worn PPE during menopause and 78% of women who have worn PPE during pregnancy or while breastfeeding said “no, not really” or “no, none whatsoever”



Huge issues with wearing safety glasses and hard hats while having hot flashes. They would fog up and I couldn't see a thing. Also needing to wear FR [fire-resistant] clothing which doesn't breathe well would bring on severe hot flashes to the point where I was soaking through clothing and needing to drink excessive amounts of water to keep hydrated, which wasn't always available.

—Ontario, Utilities

- Of the women who wore PPE during pregnancy, 6% said they were provided with properly designed and comfortable maternity PPE, 7% said that some alterations or modifications in their usual PPE were made for them, and 9% altered or modified their PPE themselves. The highest percentage of self-made alterations or modifications were of respiratory protection (11%), foot and leg protection (12%), and protective clothing (12%); and by women employed in emergency services (31%), transportation (14%), and the service sector (11%).
- Of the women who wore PPE while breastfeeding, 5% said they were provided with properly designed and comfortable breastfeeding-specific PPE, 12% said that some alterations or modifications in their usual PPE were made for them, and 6% altered or modified their PPE themselves. The highest percentage of self-made alterations or modifications were of foot and leg protection (6%) and protective clothing (6%); and by women employed in utilities (18%).
- Of the women who wore PPE during menopause, 2% said they were provided with properly designed and comfortable menopause-specific PPE, 3% said that some alterations or modifications in their usual PPE were made for them, and 5% altered or modified their PPE themselves. The highest percentage of self-made alterations or modifications were of fall-arrest gear (11%) and by women employed in construction (9%) and emergency services (9%).



I ended up having a miscarriage but at the time while my belly was growing, I had to purchase larger pants out of my own pocket. I was also fretting about how I would be unable to wear my own coveralls soon so I thought if I grew bigger I would be wearing belly extenders or leggings, both of which I would have been uncomfortable to mention to a supervisor to be reimbursed.

—Ontario, Construction

To gauge the impact of wearing PPE during these life events, participants were asked whether the PPE that was available to them caused them to make a change in their work circumstances. Eight response categories were provided: stop working; take on less work; change role; call in sick to avoid the humiliation caused by ill-fitting PPE; take maternity leave earlier than planned; stay in the same job but perform less productively than previously; ask employer to reassign them; or continue working as usual. Of the 815 women who answered this question, 61% continued working as usual and 22% reported that they were less productive at their job, 11% took on less work, 6% took maternity leave earlier than planned, and 5% stopped working altogether.

The percentages of women who changed some aspect of their job was relatively consistent across all types of PPE (Figure C-19, Appendix C), but variations were seen across sectors of employment (Figure C-20, Appendix C). For example, women employed in emergency services were more likely to ask to be reassigned, change their role, take on less work, or take maternity leave earlier than planned. Women employed in construction were also more likely to take on less work.

6.2.5 How Women Respond to Problems with Their PPE

To examine how women respond to the problems they have with PPE, the survey asked a series of questions about whether they sourced their own PPE, how much they were spending on PPE (if they sourced it themselves), and whether they ever had to make modifications or alterations to their PPE (and if yes, how frequently they had to do so).

6.2.5.1 Women Supply Some or All of Their PPE

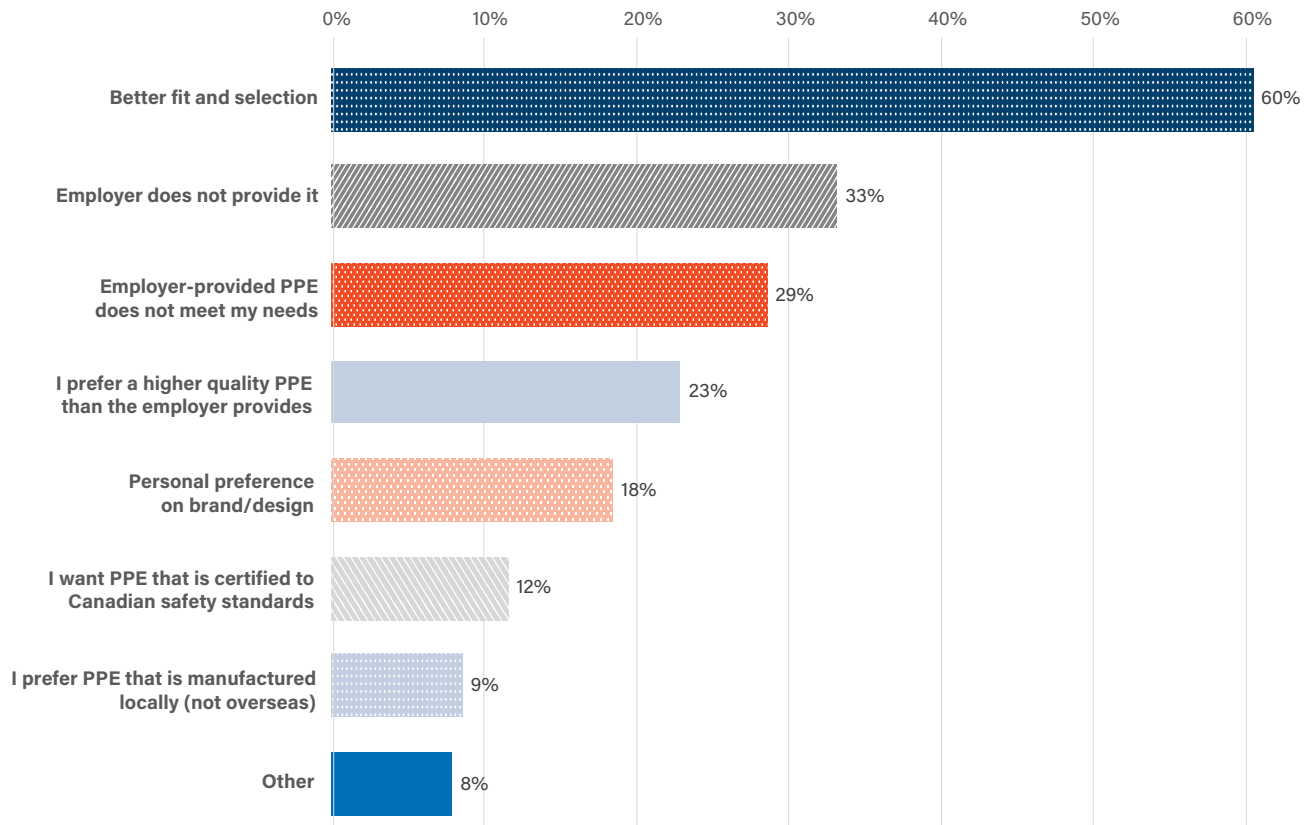
Survey participants were asked whether they sourced, purchased, and/or provided their own PPE. Four response options were provided: “my employer provides exactly what I need”; “my employer provides all the PPE, but there are reasons that I supplement with my own”; “my employer provides some PPE, I need to supply the rest”; “or I supply all my PPE”. A total of 2745 participants answered this question.

Overall, 46% of the respondents indicated that their employer supplied all the PPE they needed; 44% that they either chose to supplement or that they needed to supply some of their PPE; and 10% that their employer provided no PPE. Among the survey respondents who supply some or all of their PPE (n=1440), the five types of PPE that women most often supplied for themselves were fall-arrest gear (80%), hearing protection (69%), head protection (68%), foot and leg protection (68%), and protective clothing (62%). Women employed in all sectors reported that they either supplied some or all of their PPE, but most often in construction (74%), transportation (71%), natural resources (69%), emergency services (61%), and utilities (55%).

To gain a better understanding of why women might supply their own PPE, those who indicated that they supplied all or some of their PPE were asked what their main reasons were for sourcing their own PPE. Response options included: “employer does not provide it”; “employer-provided PPE does not meet my needs”; “prefer a higher quality PPE than employer provides”; “better fit and selection”; “personal preference on brand/design”; “prefer PPE that is manufactured locally (not overseas)”; and “want PPE that is certified to Canadian safety standards”. An option was also provided to capture reasons not listed (“other”). Across all metrics, the primary reason women gave for sourcing their own PPE was “better fit and selection”, with 60% of the 1440 women who indicated that they sourced their own PPE citing this reason (Figure 13).

By type of PPE, the percentage of women who cited fit and selection as their primary reason for sourcing their own PPE ranged from 63% (respiratory protection) to 71% (hearing protection, fall-arrest gear), with the highest percentages reported for hearing protection and fall-arrest gear (71% each), head protection (70%), and hand protection (69%). By sector, the percentage of women ranged from 50% (service sector) to 75%

Figure 13: Reasons Women Source Their Own PPE



(emergency services), with the highest percentages seen in emergency services (75%) and natural resources (74%), followed by construction, transportation, and utilities (67% each).

6.2.5.2 Women Pay out of Pocket for PPE

Women who sourced their own PPE were asked how much they spend on PPE for their jobs. Five response options were provided: "less than \$10 per month"; "\$10 to \$20 per month"; "\$21 to \$100 per month"; "more than \$100 per month"; and "large one-time purchase". Those who selected the last option were asked to enter an approximate amount. Of the 1440 respondents who indicated that they sourced their own PPE, 1426 answered this question. Overall, 72% of the women who sourced their own PPE reported that they purchase PPE monthly and 28% make a large one-time purchase. On average, the amount spent per month was \$33.30. This translates to just under \$400 per year. Those who reported making a large one-time purchase spent between \$100 and \$700 per year.

As shown in Figures C-21 and C-22 in Appendix C, the percentage of women who spend money each month or make a large one-time purchase varies by the type of PPE being purchased and by sector. By type of PPE (Figure C-21), the percentage of respondents who make monthly PPE purchases ranged from 62% (women who wear fall protection) to 76% (women who wear respiratory protection). The respondents reported spending on average each month from \$33.70 to \$44.80, with the highest average amount spent by women on fall protection (\$44.80), head protection (\$40.30), and hearing protection (\$40.00). The percentage of women making a large one-time purchase ranged from 24% (for respiratory protection) to 38% (for fall-arrest gear).

By sector, the largest percentages of women making monthly expenditures were employed in health care and the service sector, while those making a large one-time purchase were in transportation, natural resources, and emergency services (Figure C-22). Across the sectors, the average amount spent per month ranged from

\$28.80 to \$42.00, with the highest average amount spent by women employed in construction (\$42.00), natural resources (\$39.10), and emergency services (\$38.50).

6.2.5.3 Women Modify or Alter Their PPE

Survey participants were asked whether they made any temporary or permanent alterations or modifications to their PPE. Four response categories were provided: temporary modifications (e.g., taping gloves or boots); permanent alterations (e.g., cutting sleeves that are too long, sewing); both of these (i.e., temporary and permanent alterations); or none of these (PPE fits without modification or alteration). Of the 2636 women who answered this question, more than half indicated that they had made some kind of temporary (24%) or permanent alteration (14%), or a combination of both (14%) to their PPE.

Across the different types of PPE, between 51% and 75% of women reported that they modify or alter their PPE (see Figure C-23, Appendix C). Women who wear fall-arrest gear were more likely to report making temporary modifications (31%) than women who wear other types of PPE, although nearly one-third of women who wear hearing protection (29%), hand protection (29%), head protection (28%), eye and face protection (28%), and protective clothing (28%) reported making temporary changes to these PPE. Approximately one in five women who wear head protection (20%), hearing protection (19%), and fall-arrest gear (19%) reported making permanent alterations to their PPE. Similar percentages were seen for women who reported making temporary *and* permanent changes to their fall-arrest gear (24%), hearing protection (21%), head protection (20%), and foot and leg protection (19%).

Across the sectors, between 46% and 68% of women report that they modify or alter their PPE (Figure C-24, Appendix C). More than one-quarter of women employed in utilities (30%), natural resources (29%), construction (28%), and transportation (26%) reported making temporary modifications to their PPE. Approximately one in five women employed in transportation (21%), construction (19%), and emergency services (19%) reported making permanent alterations to their PPE. Similar percentages of women in construction (21%), natural resources (19%), transportation (18%), and utilities (17%) reported making temporary *and* permanent alterations to their PPE.



Tape fall arrest harness. Choke lanyard to make shorter. Climb lift railings. Wear improperly to avoid injury.

—Ontario, Service Sector



Tape cardboard to my chest to avoid the rubbing of the male harness on my nipples. Tie wrapped to shorten the length when it could go no smaller.

—Ontario, Construction



I've had to pull up the coveralls so that the crotch wasn't at my knees and tape them around the waist so I don't trip on the crotch walking up stairs and climbing ladders. I've had to tape the wrists as well to prevent the sleeves from hanging over my hands. I usually just bring my own coveralls which over the years has cost me literally thousands of dollars as my coveralls are required to be FR material.

—Ontario, Construction

Respondents who indicated that they temporarily modified or permanently altered their PPE were asked whether they did so for safety, comfort, fit, or all of the above. Of the 1362 women who answered this question, 14% indicated that they did it for safety reasons, 20% for reasons of comfort, 25% for improved fit, and 41% for all three reasons. Figures C-25 and C-26 in Appendix C display these findings by type of PPE and by sector.

- The percentage of women who reported modifying or altering their PPE for safety reasons was consistent across all types of PPE (Figure C-25), but varied

from a low of 8% for women employed in emergency services to a high of 17% for women employed in manufacturing (Figure C-26). Those more likely to report modifying their PPE for safety reasons were employed in manufacturing (17%), health care (16%), and transportation (16%).

- The percentage of women who reported modifying or altering their PPE for comfort ranged from a low of 10% for fall-arrest gear to a high of 19% for respiratory protection equipment (Figure C-25). By sector, more than one in five women employed in manufacturing (30%), health care (33%), the service sector (26%), and transportation (20%) altered their PPE to improve its comfort (Figure C-26).
- The percentage of women who reported modifying or altering their PPE to improve fit was relatively consistent and close to the overall average of 25% of respondents (Figure C-25), with the highest percentage reporting modifying or altering foot and leg protection (30%). By sector, the percentage of women who modified or altered their PPE to improve fit ranged from 18% in health care to 26% in natural resources (Figure C-26).
- Across all types of PPE, more than 40% of women reported modifying or altering their PPE for safety, comfort, and improved fit. Approximately half of women who wear fall-arrest gear (53%), hearing protection (49%), protective clothing (48%), and head protection (47%) cited all three of these reasons for why they modified their PPE (Figure C-25). As Figure C-26 illustrates, this reason was given by more than half of the women employed in emergency services (60%) and utilities (56%) and by just under half of the women employed in construction (49%) and natural resources (48%).
- Across all types of PPE and sectors, women report making the following kinds of alterations or modifications: cutting and sewing pant legs, sleeves, and vests; using rubber bands, safety pins, and/or duct tape to secure work gloves, shortening sleeves, ensuring that pant legs don't drag or act a tripping hazard, and shortening fall-arrest gear; wearing extra pairs of socks to improve boot fit; adding extra fabric to the sides of shirts; etc.

Of those who modify their PPE, almost two-thirds said they felt either much safer (14%) or somewhat safer (48%), while more than one-third said they either felt no

change (33%) or less safe (5%). Figures C-27 and C-28 in Appendix C display these findings by type of PPE and by sector. By type of PPE, more than half of the women who wear protective clothing (51%), fall-arrest gear (51%), head protection (50%), and hearing protection (50%) indicated that they felt somewhat safer and nearly 10% of the women who wear fall-arrest gear indicated that they felt less safe after they modified or altered their PPE (Figure C-27).

By sector, just under one-quarter of the women employed in manufacturing (22%) reported feeling much safer after they modified or altered their PPE (Figure C-28). Approximately half of the women employed in construction (53%), utilities (51%), emergency services (49%), and natural resources (48%) reported feeling somewhat safer after they modified their PPE.



Pray that it fits me that day. Female bodies fluctuate in weight often I find. Even moderate weight changes alter the fit of PPE. Especially rain pants and jackets.

—British Columbia, Construction

7 Key Gaps and Challenges

Despite scientific evidence that anthropometric differences exist between men and women, PPE continues to be designed for “all workers” based almost entirely on male anthropometry. In reality, what this means is that most PPE standards are not gender neutral, but “gender blind”. The interjurisdictional variation in the regulations governing the provision and usage of PPE – and in their enforcement – could lead to gaps in the equitable protection of all workers. For women, these inequities are further compounded by the underlying assumption that legislation and regulatory requirements that are gender neutral are equally protective of all workers. Research on the gendered and sexual division of labour – and its impact on occupational health and safety – reinforce the need to pay attention to gender differences in exposures and hazards as well as the unique needs of each sex in mitigating those hazards and risks.



“Most PPE standards are not gender neutral, but “gender blind””

7.1 Gap #1: Lack of Canadian-specific Anthropometric Data

Anthropometric surveys conducted around the world clearly show that women are not merely smaller, scaled-down versions of men. This has been shown in population-based studies and in studies of specific occupational groups. Studies of occupational groups have found that anthropometric differences exist between the general population and workers, and between certain occupational groups (e.g., construction workers vs. firefighters). The significance of these research findings is two-fold: (a) protective clothing and other PPE that are designed based on men's proportions cannot be simply scaled down linearly to fit women; and (b) good quality anthropometric data that are representative of the contemporary working population are critical for the proper design of PPE.

At present, Canada collects a limited amount of anthropometric data on a representative sample of Canadians via the Canadian Health Measures Survey (CHMS). In addition, certain federal government departments have developed their own anthropometric datasets for internal uses. However, like most countries around the world, Canada has not undertaken a national anthropometric survey of the general population; nor has it undertaken a national sizing survey of the Canadian workforce. This lack of Canada-specific anthropometric data (for both the general and working populations) is a critical information gap for Canadian designers and manufacturers of PPE for women. Should such a

national anthropometric or sizing survey be undertaken, the data collection strategy should be informed by the recommendations of the *Sizing Up Australia* project [97, 100, 103, 161-164], as well as by relevant international standards.

7.2 Gap #2: Lack of Consistent PPE Regulations

The environmental scan identified some significant differences and inconsistencies in how PPE is regulated under existing Canadian OHS regulatory frameworks. These differences are found in the general duties imposed on the various workplace parties to provide or make available PPE, as well as the PPE-specific and occupation-specific regulations. For these regulations, Canadian jurisdictions do not consistently require that selected PPE provide protection appropriate to the hazards and that it fit the user properly; nor are they consistent in the standards that the PPE must comply with. Unlike Australia and the European Union, Canadian jurisdictions do not explicitly set out any requirements for the design and manufacture of PPE that is sold and used in Canada.

Key informants affiliated with OHS regulators were asked how or if gender issues were being “mainstreamed” into workplace inspections and enforcement of the PPE regulations. While all acknowledged that equity, diversity, and inclusion (EDI) initiatives were strategic priorities for their organizations, no organization has yet incorporated a gender lens into (a) the training of the

inspectorate, (b) how inspections are planned or carried out, (c) the identification and assessment of risk, or (d) the development and implementation of OHS legislation, prevention policies, and programs.

7.3 Gap #3: Lack of Women-specific PPE

Although PPE is considered the last line of defence and should only be used in situations where other control measures are not practicable, it is widely used by employers because (a) it is a simple and inexpensive way to control exposure, and/or (b) it provides supplementary protection when other controls are not adequately protective (e.g., during asbestos abatement, hazardous waste removal, etc.). For these reasons, it is paramount that the PPE fits *each* affected worker properly and provides maximal and effective protection, and that the workers can trust that their PPE will protect them from exposure and help prevent them from being injured.

The review of the scientific literature showed that functional fit and comfort are two of the most important parameters in the design and usage of PPE. These factors – along with trust that their PPE will protect them and being able to move around to do their job – were identified by Canadian women as key to their satisfaction with their PPE.

The findings of the survey illustrated that dissatisfaction with available PPE is not isolated to a small subset of the workforce. While only women were surveyed and therefore direct comparisons with the experiences of men cannot be made, more than 80% of the nearly 3000 Canadian women who completed the survey reported that they experience one or more problems with their PPE – with the three most common being that their PPE doesn't fit properly, that it is uncomfortable to wear, and that there isn't enough of a selection. To try and address these issues, women across Canada are (a) paying out of pocket to source PPE with a better fit and selection; and (b) modifying or altering their PPE for safety, comfort, and improved fit. Many women highlighted the inequity of having to source their own PPE when their male co-workers do not, and many reported being injured or experiencing near-miss incidents because their PPE didn't fit or failed to provide the intended protection, because it was defective, or because it was incompatible with other PPE that they are required to wear.

Among the most concerning findings of this project are that (a) more than half of Canadian women surveyed report that they use PPE that is the wrong size at least some of the time; (b) nearly one-third indicated that they don't wear all the required PPE at work because of issues with fit; and (c) just under 40% say that they use a workaround to make their PPE fit. Workarounds included using rubber bands, safety pins, and/or duct tape to shorten fall-arrest gear and to secure work gloves, shorten sleeves, and prevent their pant legs from being a tripping hazard. While women employed in all sectors expressed frustration and dissatisfaction with their PPE, those employed in construction, transportation, natural resources, utilities, and emergency services were most likely to (a) wear PPE that is the wrong size, (b) not wear all the required PPE, or (c) use a workaround to make their PPE fit. Note that these are all sectors where women have been reported to be at higher risk for serious injuries [165].

Key informants confirmed the findings of the literature review and echoed what we heard from the survey participants – that fit, comfort, and selection are the three most common problems that women identify as having with PPE. When asked what could be done to address these issues, key informants indicated that all stakeholders have a role:

- **Government:** develop, implement, and enforce tighter, more consistent regulations that reference the standards; incorporate a gender lens in the assessment of risk; train inspectors to recognize when PPE is not adequately protecting women; and require PPE-focused inspections.
- **Standards development organizations:** standardized sizing, data-informed design, better documentation of data used, explicit recognition of sex and gender differences in standards, tighter standards for manufacturers of PPE.
- **Manufacturers and suppliers:** make a broader range of sizes that fit both men and women, determine how to produce many different sizes more economically.
- **Workplace representatives:** source a wider range of size options, apply explicit gender-inclusive procurement requirements to all sourcing, provide measurement data (specific to worker populations) to suppliers and manufacturers as part of procurement process, advocate for better-fitting PPE.

7.4 Gap #4: Lack of Information About Sex and Gender Differences in Occupational Injury/Illness Incidence

Although there has been a dramatic increase in the participation rate of women in the labour force in Canada and elsewhere since the 1950s, relatively little research has been undertaken to examine sex and gender differences in the rates of occupational injury and illness. Lost-time injury statistics from Canada and other jurisdictions around the world show that while men have substantially higher rates of occupational injury than women overall, significant differences remain between male and female workers in the incidence of occupational injuries and that women in certain industrial sectors or occupations are at a higher risk of certain types of injuries and illnesses than men [13, 18, 165-177]. For example, the literature on the incidence rates of compensable occupational injuries and illnesses report that women have higher rates than men of psychological injuries³⁷ [167]; musculoskeletal injuries of the upper extremities (i.e., hand, shoulder, wrist), lower extremities (i.e., hip, knee, ankle), neck, and back [166, 169, 170, 178-180]; injuries requiring first aid, medical treatment, or restricted work [168, 169]; and acute, chronic or cumulative injuries (e.g., fractures, surface wounds, burns, sprains/strains, cumulative trauma, mental stress, poisoning) [169]. Several studies reported that, compared with their male counterparts, female workers experienced higher rates of injuries associated with falls on the same level [166, 174, 178, 181]. Researchers have also found that, for the same type of injury, women lose more work days and have longer disability durations than men (i.e., they are slower to return to work and, as a result, their claims costs are higher) [12, 169, 170, 182, 183].

What is not clear from the research is the extent to which these observed sex and gender differences are worker-related, work-related, or some combination of both [167]. In other words, do men and women have different rates of injury because of biological and/or behavioural differences (i.e., worker-related)? Or, do they have different rates of injury because they are differently exposed to hazards in the workplace (i.e., work-related)?

And, if it is the latter, what role does PPE play? While some studies have reported that design is a significant contributor to work-related serious and fatal injuries [184, 185], the literature is sparse on how inadequate, ill-fitting, or poorly designed PPE contributes to observed sex and gender differences in occupational injury rates.

8 Conclusions and Recommendations

Nearly 50 years ago, several researchers and worker advocates drew attention to the specific problems women face in finding appropriately sized and sufficiently protective PPE. At an international conference on occupational ergonomics held in Toronto, Ontario, in 1984, Dr. Jeanne Stellman of Columbia University, New York, concluded her presentation by noting "(t)here is a growing demand for safe, well-fitting, and appropriately designed PPE for women" and made six key recommendations [69]:

1. Manufacturers should (a) incorporate available anthropometric data on female dimensions into the sizing and design of their products, and (b) produce more PPE based on these measurements.
2. More anthropometric studies, particularly of smaller female workers, should be conducted.
3. Manufacturers and designers should (a) seek input from women on their specific needs, preferences, and comfort; and (b) incorporate this into their final designs.
4. Better mechanisms to communicate information to female workers and their employers were required. Buyers and users especially needed information on how and where to obtain PPE that had been designed specifically for women, whether these PPE were properly designed and adequately tested, whether they met the design and certification requirements of relevant standards, and what techniques were required to ensure adequate protection and appropriate fit.
5. Improved standards development and certification procedures incorporating female anthropometry, wherever applicable, should be developed.

37 Some studies refer to these claims as "mental disorder" claims.

6. Women workers needed to (a) be better informed about the importance of high quality, appropriate PPE and (b) communicate their needs to their employers and PPE manufacturers.

Five years later, in a presentation at a one-day conference held in Toronto, Ontario, entitled “Personal Protective Equipment for Women”, Dorothy Wigmore (then a Senior Health and Safety Officer with the Canadian Union of Public Employees) reiterated these recommendations and added the following [73]:

1. Better information on the Canadian context was required – namely, information on the demographics of the Canadian workforce (linked to industry and occupation, if possible); anthropometric measurements of Canadian workers; statistics on the type and amount of PPE used in Canadian workplaces; the prevalence of occupational injuries and illnesses and the role of PPE (or the lack of it); and the standards, designs, and practical approaches used in other countries.
2. Manufacturers and standards development organizations needed to (a) start using anthropometric design methods to address issues of fit, comfort and special needs, and (b) include representatives from the real workforce (i.e., a range of sizes and shapes, ethnicities, sex and gender) on test panels.
3. Standards and certification procedures were needed to address comfort and sizing issues (which could be achieved through the standardization of sizing, fit requirements, and information about permeation and break-through rates), as well as requirements for adjustability and special needs.

These recommendations remain relevant today, more than 30 years after they were first made. The participation rate of women in the Canadian workforce is approximately 20% higher now than it was when these recommendations were first made, and the findings of this project reinforce that there is still a demand for safe, well-fitting, and appropriately designed PPE for women.

Despite these early efforts of researchers and advocates – and evidence that poorly designed and poorly fitting PPE may lead to serious injury or death – women continue to be differentially impacted by chemical, physical, and biological exposures in the workplace. The relative lack of consideration for women's experience with PPE is one contributing reason; another is that OHS regulations and standards have not considered sex and gender differences in the design, implementation, and enforcement of OHS legislation, prevention measures, or standards-development processes. Because much of the women-specific PPE has been designed on the assumption that women are “scaled-down men”, the health, safety, and well-being of women are unnecessarily put at greater risk. Sex and gender needs to be, without delay, mainstreamed into all aspects of OHS legislation, policy, standards development, and practice.



Women's specific shape/sizing – shrinking men's clothing/PPE and calling it “unisex” is not adequate. My “unisex” fire-resistant clothing is constantly too long in the crotch, too large in the shoulders, and too small in the hips; the ill-fitting clothing causes chafing, hinders my movement, and makes me look unprofessional. Head protection, eye protection, gloves, safety boots, etc. are often not available in sizes appropriate for my body (or have very limited availability and are difficult to get in remote locations, or are more costly).

—Ontario, Emergency Services

Appendix A – Cross-Canada Comparison of PPE Requirements

A.1 General Duties and Responsibilities of Workplace Parties

Table A-1: Employer Responsibilities and Duty to Provide

	BC	AB	SK	MB	ON	QC	NL	NS	NB	PE	YT	NT	NU	CA
Must provide PPE required by regulation, at no cost	X		X	X		X					X	X	X	
Must ensure PPE as prescribed are provided					X				X					
Must ensure that PPE fits worker correctly and can be used without adverse effect to worker's safety or health				X										
Must provide appropriate alternate PPE if PPE provided causes allergenic or other adverse health effects	X										X			
Must ensure PPE is in a condition to perform the function for which it was designed		X		X										
Must provide PPE if worker required to work in thermal conditions different from normal work duties			X								X	X	X	
Must ensure that PPE is suitable and adequate and a proper fit for worker			X									X	X	
Must ensure that workers use or wear PPE required by law, regulation, or code		X												
Must ensure that workers wear/use suitable and adequate PPE		X	X	X			X	X				X	X	
Must ensure that PPE provided is used as prescribed	X			X	X						X			
Must ensure that workers required to use PPE are appropriately trained and understand risks and limitations	X	X	X	X	X		X	X	X	X	X			X
Must make appropriate adjustments to work procedures and rate of work to eliminate/reduce danger or discomfort to worker arising from use of PPE			X	X								X	X	
Must provide alternate work arrangements if PPE will not effectively protect worker			X									X	X	
Must ensure that PPE provided to a worker is removed from use or service when damaged			X									X	X	
Must immediately repair or replace PPE returned due to defects or failure to provide intended protection			X	X							X	X	X	X
Must ensure that defective PPE is not used until repaired								X						X
Must ensure that the use of PPE does not itself endanger the worker		X												

Table A-2: Worker Responsibilities and Duty to Provide

	BC	AB	SK	MB	ON	QC	NL	NS	NB	PE	YT	NT	NU	CA
Worker required to provide														
Clothing for protection against natural elements	X										X			
General purpose work gloves	X										X			
Appropriate footwear ¹	X			X							X			
Protective headwear ²	X			X										
Responsibilities of the worker														
Use and wear PPE provided by employer or required to be worn by regulation	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Use PPE in accordance with training and instruction	X	X							X		X			
Inspect or test PPE before use	X	X							X	X	X			
Inform employer or supervisor if PPE defective, malfunctions or fails to provide intended protection ³	X	X	X	X	X				X		X	X	X	X
Must not use PPE that is unable to perform the function for which it is designed		X							X	X	X			
Must take reasonable steps to prevent damage to PPE			X	X					X			X	X	
Must not remove or make ineffective PPE required by regulation or by employer					X									

Notes:

¹ In Manitoba, the responsibility for providing safety footwear is the worker's; but the regulations require that the employer provide safety footwear when the worker's feet may be endangered by hot, corrosive, or toxic substances. Likewise, in British Columbia, a worker is responsible for providing their own safety footwear and, in addition, is also responsible for ensuring it's in a condition to provide the required protection.

² In Manitoba, workers at construction project sites are responsible for providing their own protective headwear.

³ In Saskatchewan, the worker is also required to return such PPE to the employer or contractor.

Table A-3: Supervisor Responsibilities

	BC	AB	SK	MB	ON	QC	NL	NS	NB	PE	YT	NT	NU	CA
Supervisor must ensure														
Appropriate PPE is available to workers	X													
PPE is properly worn when required	X	X		X	X		X				X			
PPE is properly cleaned, inspected, maintained, and stored	X													

Table A-4: General Duties Regarding Selection, Use, and Maintenance of PPE

	BC	AB	SK	MB	ON	QC	NL	NS	NB	PE	YT	NT	NU	CA	
General duties re: selection, use & maintenance of PPE															
Must be selected and used in accordance with recognized standards	X						X				X				
Must provide effective protection	X						X				X				X
Must not create a hazard to or endanger the wearer	X	X					X				X				X
Must be compatible with other PPE	X						X				X				
Must be maintained in good working order and in sanitary condition	X						X					X	X		
Alternative PPE must be used if PPE creates a greater hazard	X										X				
Be safely and properly fitted to worker by qualified person in accordance with manufacturer's instructions															X

A.2 Specific PPE Requirements

Table A-5: Cross-Canada Comparison of Relevant Head Protection Requirements

	BC	AB	SK	MB	ON	QC	NL	NS	NB	PE	YT	NT	NU	CA	
Must be appropriate to hazards		X		X	X	X		X	X	X	X			X	
Approved industrial head protection			X									X	X		
Employer has no obligation to pay for PPE or to repair/replace defective PPE when a worker is required to provide PPE				X											
Must meet requirements of one of following standards															
CAN/CSA-Z94.1-05	X	X		X		X					X				
CAN/CSA-Z94.1-15	X			X					X	X					
CAN/CSA-Z94.1 (latest version)						X	X	X						X	
ANSI/ISEA Z89.1-2003		X		X							X				
ANSI/ISEA Z89.1-2009	X														
ANSI/ISEA Z89.1-2014	X														
ANSI/ISEA Z89.1 (latest version)				X				X						X	
Standard offering equivalent protection									X	X	X				

Table A-6: Cross-Canada Comparison of Relevant Eye and Face Protection Requirements

	BC	AB	SK	MB	ON	QC	NL	NS	NB	PE	YT	NT	NU	CA
Eye and face protectors														
Eye protection must fit worker properly	X	X					X				X			
Face protection must fit worker properly	X						X				X			
Must be appropriate to hazards	X	X		X	X		X	X	X	X	X			
Approved eye or face protector to eliminate or reduce the risks			X									X	X	
Face and eye protection must meet requirements of one of following standards														
CAN/CSA-Z94.3-02		X				X					X			
CAN/CSA-Z94.3-07	X	X												
CAN/CSA-Z94.3-15	X			X					X	X				
CAN/CSA-Z94.3-20						X	X	X						
CAN/CSA-Z94.3 (Annex A)														X
CAN/CSA-Z94.3.1-16				X										
CAN/CSA-Z94.3-99		X				X								
CAN/CSA-Z94.3-92						X								
ANSI/ISEA Z87.1-2015	X													
ANSI Z87.1-2003		X									X			
ANSI Z87.1-1989		X												
Standard offering equivalent protection									X	X	X			

Table A-7: Cross-Canada Comparison of Relevant Limb, Body, and Hand Protection

	BC	AB	SK	MB	ON	QC	NL	NS	NB	PE	YT	NT	NU	CA
Limb and body protection (protective clothing)														
Employer must provide appropriate skin, hand, foot, or body protection if a worker is exposed to a skin hazard ¹	X	X	X	X							X			X
Employer must ensure that adequate protection is worn or used if worker exposed to hazard that may injure the skin								X	X					
Worker must wear properly fitting PPE appropriate to work being done and hazards involved if danger of injury to worker's skin, hands, feet, arms, legs, or torso ²	X	X	X	X			X					X	X	
PPE must be appropriate for the risk			X	X	X	X								
Worker must use adequate protective clothing to provide protection against hazards ³									X	X				
Approved protective clothing if risk of injury to the skin												X	X	

	BC	AB	SK	MB	ON	QC	NL	NS	NB	PE	YT	NT	NU	CA
Protective clothing must meet requirements of one of following standards														
CAN/CSA-W117.2-12 (R2017) ⁴				X										
Hand protection														
Employer must provide suitable and properly fitted hand or arm protection			X									X	X	
Worker must use suitable and properly fitted hand or arm protection			X											
Employer must provide hand PPE appropriate for the risk				X							X			
Worker must use adequate protective gloves or other PPE when handling objects that may injure the hands									X					
Employer must ensure that workers wear PPE to prevent hand/ arm injuries, except when PPE introduces equal or greater hazards										X				

Notes

- ¹ In British Columbia and Yukon, a skin hazard includes substances or conditions likely to puncture, abrade, or otherwise adversely affect the skin or be absorbed by it. In Saskatchewan and Manitoba, skin hazards include sparks, molten metal, and radiation.
- ² In British Columbia and Newfoundland and Labrador, this includes danger of injury, contamination, or infection. In Saskatchewan, this includes substances that could cut, puncture, irritate or abrade the lower body.
- ³ Includes extreme temperature and skin hazards (New Brunswick); acids, caustics, steam, abrasives, hot fluid jets, similar harmful substances (Prince Edward Island).
- ⁴ PPE must meet this standard if there is a risk of skin injury from sparks, molten metal, ionizing or non-ionizing radiation.

Table A-8: Cross-Canada Comparison of Relevant Respiratory Protection Requirements

	BC	AB	SK	MB	ON	QC	NL	NS	NB	PE	YT	NT	NU	CA
Respiratory protection														
Fit test required whenever changes to user's physical condition could affect respirator fit	X													
Fit test performed with other PPE that must be worn at same time as respirator and which could interfere with respirator fit	X													
Employer must provide respiratory PPE that is proper size for worker's face			X									X	X	
Employer must ensure that other PPE does not interfere with respirator seal							X				X			
Must be approved/certified by NIOSH		X			X	X	X							X
Selected, adjusted, used, and cared for in accordance with CAN/CSA-Z94.4 ¹	X	X		X		X	X	X	X	X	X			X
Must meet the requirements of CSA Z94.4.1														X

Notes:

- ¹ British Columbia and New Brunswick reference CAN/CSA Z94.4-93; Alberta and Yukon reference CSA Z94.4-02; Manitoba and Quebec reference CAN/CSA Z94.4-11; Nova Scotia and Prince Edward Island reference the latest version of the standard; Newfoundland and Labrador and Canada do not reference a specific version of the standard.

Table A-9: Cross-Canada Comparison of Relevant Foot and Leg Protection Requirements

	BC	AB	SK	MB	ON	QC	NL	NS	NB	PE	YT	NT	NU	CA
Foot and leg protection														
Leg protection must not unduly restrict worker movement ¹	X													
Footwear must be of a design, construction, and material that allows worker to safely perform their work	X													
Footwear must be appropriate/suitable to hazards ²	XX	X	X	XX	X		X		X		X	X	X	X
Employer must not require a worker to wear footwear that may pose a health or safety risk to the worker		X		X	X									
Employer has no obligation to pay for PPE or repair/replace defective PPE when worker is required to provide PPE				X										
Footwear must meet requirements of one of following standards														
CAN/CSA-Z195-M92	X													
CSA Z195.1-16				X										
CAN/CSA-Z195 ³						X	X							
CSA Z195:14 (R2019) ⁴		X		X					X	X	X			X
ANSI/ISEA Z41-1991	X										X			
BS EN 345:1993	X													
BS EN 346:1993	X													
ASTM F2413-05		X												
Standard offering equivalent protection				X					X	X	X			

Notes:

- ¹ In British Columbia, WorkSafeBC Standard – Leg Protection Devices (which is referenced in the regulations) provides measurement specifications for leg protection worn by workers using chainsaws.
- ² XX indicates jurisdictions where workers must provide their own safety footwear. In British Columbia, a worker is also responsible for ensuring their footwear is in a condition to provide the required protection. In Manitoba, the regulations set out that workers are responsible for providing their own footwear, but that when the worker's feet may be endangered by hot, corrosive, or toxic substances, the employer is responsible for providing safety footwear.
- ³ Quebec references CAN/CSA-Z195-14. Newfoundland and Labrador references CAN/CSA-Z195, without specifying the year in which it was issued.
- ⁴ Prince Edward Island and Canada references CSA Z195, without specifying the year in which it was issued. Alberta and Yukon reference CSA Z195-02. All others reference the version of the standard issued in 2014 and reaffirmed in 2019.

Table A-10: Cross-Canada Comparison of Relevant Fall Protection System Requirements

	BC	AB	SK	MB	ON	QC	NL	NS	NB	PE	YT	NT	NU	CA
Fall protection														
Employer must ensure full body harnesses are properly fitted to worker			X	X			X			X		X	X	
Employer must ensure that full body harness and connected linkage are used, maintained, and adjusted in accordance with manufacturer's specifications				X										
Employer must ensure worker wears and uses full body harness as part of a fall arrest system		X												X
Employer must ensure worker uses body belt only as part of a fall or travel restraint system		X												
Worker must use fall protection system provided by the employer	X													
Worker must wear and use a full body harness ¹	X	X									X			
Worker must wear safety belt, full body harness, or other approved harness ²	X													
Worker must ensure full body harness is properly adjusted to fit securely before use			X									X	X	
Owner, employer, and contractor must ensure that fall protection components are designed with good engineering practices									X					
Owner, employer, and contractor must ensure that full body harness is designed and rated by manufacturer for worker's body type and adjusted to fit the worker									X					
Owner, employer, and contractor must ensure that all components of fall protection system are compatible with one another, the work environment, and the type of work being done									X					
Employer and worker must inspect, as required in the regulation, each component of a fall protection system to determine whether there are any defects or inadequate components									X					
Equipment used for fall protection system must consist of compatible and suitable components, be sufficient to support the fall restraint or arrest forces, and meet and be used in accordance with an applicable CSA or ANSI standard in effect when the equipment was manufactured	X													
Equipment used in a fall protection system must be maintained in good working order	X													
Employer must ensure that all components of a fall protection system are compatible with one another and with environment in which they are used		X							X					
Components must be compatible and used in accordance with manufacturer's instructions														X
Full body harness must meet requirements of one of following standards														
CAN/CSA Z259.10-06 ³		X			X	X			X					
CSA Z259.10-18 ⁴				X			X	X		X				X
CSA-Z259.10-M90									X		X			
ANSI/ASSE Standard Z359.1-2007		X												
CEN Standard EN 361: 2007		X												
Other similar standard											X			

	BC	AB	SK	MB	ON	QC	NL	NS	NB	PE	YT	NT	NU	CA
Body belt must meet requirements of one of following standards														
CSA Z259.1-95											X			
CSA Z259.1-05		X		X	X	X			X	X				
CSA Z259.1 (latest version)								X						X
CSA Z259							X							
ANSI/ASSE A10.32-2004		X												
CEN 358: 2000		X												
Other similar standard											X			

Notes:

¹ In British Columbia and Alberta, a full body harness must be worn for fall arrest.

² In British Columbia, this equipment must be worn for fall restraint.

³ Quebec references CAN/CSA Z259.10, without specifying the year in which it was issued.

⁴ Newfoundland and Labrador and Canada references CSA Z259.10, without specifying the year in which it was issued. Nova Scotia specifies that the full body harness must meet the latest version of the CSA standard.

Table A-11: Cross-Canada Comparison of Relevant Buoyancy PPE Requirements

	BC	AB	SK	MB	ON	QC	NL	NS	NB	PE	YT	NT	NU	CA
Life jackets & personal flotation devices (PFDs)														
Must have sufficient buoyancy to keep worker's head above water	X		X			X		X	X			X	X	
Appropriate PFD with required buoyancy											X			
Must be appropriate or suitable to the circumstances or hazards				X	X		X			X				
Must be of the right size						X				X				
Must be appropriate for weight of person wearing it								X		X				
Must be approved by or meet requirements of one of following														
CAN/CGSB 65.7-M88 ¹	X	X									X			X
CAN/CGSB-65.11-M88	X	X									X			
CGSB 65-GP-14M	X										X			
BS EN 396-1994	X													
ISO 12402						X								
ISO 12402-5 (Part 5)														X
UL 12402-9 (Part 9)														X
Canadian General Standards Board							X							
Transport Canada						X		X	X					
Canadian Coast Guard								X						
US Coast Guard								X						
Other similar/equivalent standards											X			

Notes:

¹ Canada references the 2007 version of the CGSB standard as it existed before its withdrawal in 2016.

A.3 Occupation-specific PPE Requirements

Table A-12: Cross-Canada Comparison of Relevant Occupation-Specific PPE Requirements

	BC	AB	SK	MB	ON	QC	NL	NS	NB	PE	YT	NT	NU	CA
Firefighter PPE														
Employer must provide and worker must use approved PPE that is appropriate to risk and adequate to protect health and safety			X								X	X	X	
Firefighters must wear personal protective clothing appropriate to the hazards to which they may be exposed	X										X			
Firefighter exposed to head injury hazards shall wear head PPE appropriate to circumstance					X									
Protective coat and trousers must fit properly in sleeve length, coat length, chest girth, waist girth, trouser inseam length and crotch rise								X	X					
Protective coat and trousers must fit properly to prevent unsafe conditions resulting from poor integration of PPE								X	X					
Defective items of protective clothing must be repaired or replaced	X													
Firefighters must ensure that personal protective clothing and equipment used is maintained in good condition	X													
Must meet requirements of one of following standards														
NFPA 1971 (1991 edition)	X								X					
NFPA 1971 (2007 edition)		X			X									
NFPA 1971 (latest edition)		X						X			X			
NFPA 1977 (2005 edition)		X												
NFPA 1972 (1992 edition) – headgear	X								X					
NFPA 1974 (1992 edition) – footwear									X					
NFPA 1973 (1993 edition) – handwear									X					
NFPA 1973 (1988 edition) – handwear	X													
CAN/CGSB-155.1-M88	X				X			X	X		X			
CAN/CSA-Z195:14 (R2019) ¹		X						X	X		X			
CSA Z259.1-95 – safety belts & lanyards	X													
CSA Z259.1-05											X			
NFPA 1983 (1995 edition)									X					
NFPA 1983 (latest edition)								X						
Other similar/equivalent standard											X			
Health care PPE														
Must be a proper fit					X									
Must be appropriate to the circumstances ²					X									

Notes:

¹ Alberta references CSA Z195-02.

² O. Reg 67/93 specifies that the following types of PPE must be appropriate in the circumstances: head protection, eye protection, foot protection, flotation device.

Appendix B – Key Informant Interviews

B.1 Organizations/Affiliations of Key Informants

Category	Organization	Jurisdiction
Government – Regulator	WorkSafeBC	British Columbia
Government – Regulator	Ministry of Labour Relations and Workplace Safety	Saskatchewan
Government – Regulator	Ministry of Labour, Immigration, Training and Skills Development ¹	Ontario
Government – Regulator	Department of Labour, Skills and Immigration	Nova Scotia
Government – Regulator	WorkSafeNB	New Brunswick
Industry (Association)	BC Construction Safety Alliance	British Columbia
Industry (Company)	Metro Vancouver	British Columbia
Designer/Manufacturer	Covergalls Inc.	Canada
Designer	RCMP	Canada
Designer/Scientist	Defence Research and Development Canada	Canada
Consulting/Occupational Hygienist	Wigmorising	Canada

Notes:

¹ Formerly Ministry of Labour, Training and Skills Development

B.2 Key Informant Interview Guide

Preliminary questions:

1. Do you consent to participating in this interview for the research we are conducting on the extent to which gender differences are taken into account in the development of standards for personal protective equipment (PPE)?
2. Do you also consent to an audio recording of this interview for transcription and data analysis purposes? (Remind participants that their responses will be treated confidentially – only aggregated information will be reported.)

Some background and context before beginning interview:

I've been contracted by the CSA Group to collect stakeholder feedback on how well personal protective equipment (PPE) is perceived to meet the safety performance and functional needs of Canadian women. In addition to these key informant interviews, we are surveying 1000 women in the workforce who use PPE in their daily job functions and we have conducted a review of the scientific literature, as well as an environmental scan of the regulatory landscape in Canada (as it pertains to PPE). We will use the information we learn from these interviews (and from the entire project) to prepare recommendations for the CSA Group on how they can implement a Gender-based Analysis Plus (GBA+) approach to the improved development of PPE standards.

Questions about key informant's organization and role:

3. What organization do you work with and what is its jurisdiction? What is your role there?

Prompt: Does your role involve how stakeholders select and use personal protective equipment in the workplace?
Does your role involve how regulations and/or policies governing the use of PPE in the workplace are made?

Questions about how well PPE meets the safety and functional needs of Canadian women:

4. What do you (or your organization) consider are the key issues that women might face when selecting and using PPE in the workplace?

5. What could be done to address these issues?

Prompt: What could be done by government? What could be done by a standards-setting agency like the CSA Group? What could be done by manufacturers and suppliers? What could be done by sectoral health and safety associations? What could be done by the workplace parties (i.e., workers, employers)?

6. In your experience, does the PPE that is currently available meet the needs of women in your jurisdiction?

Questions about the application of an equity, diversity, and inclusion (EDI) lens in OHS:

7. Is equity, diversity, and inclusion (EDI) a strategic priority for your organization (i.e., is it mentioned in your organization's strategic plan)?

Prompt: If yes, how are gender issues being "mainstreamed" into OSH and other policy areas?

8. What could the CSA Group do to incorporate gender into the standards-setting process?

9. Is there anything else you'd like to add or do you have any questions for me?

Appendix C – Survey of Canadian Women

C.1 Partner Organizations that Successfully Recruited Participants

Build TogetHER BC

BC Centre for Women in the Trades (BCCWITT)

Canadian Association of Administrators of Labour Legislation –
Occupational Safety and Health Committee (CAALL-OSH)

Canadian Coalition for Green Health Care

Canadian Labour Congress (CLC)

CSA Group community of interest public space

Canadian Union of Public Employees (CUPE)

Helga Ware blog

Infrastructure Health and Safety Association (IHSA)

International Longshore and Warehouse Union (ILWU)

New Brunswick Forestry Network

Nunavut Employees Union (NEU)

Office to Advance Women Apprentices

OHS Canada magazine

Paramedic Association of Canada

Public Services Health and Safety Association (PSHSA)

Unifor

Women in Occupational Health and Safety Society (WOHSS)

Women in Nuclear (WiN Canada)

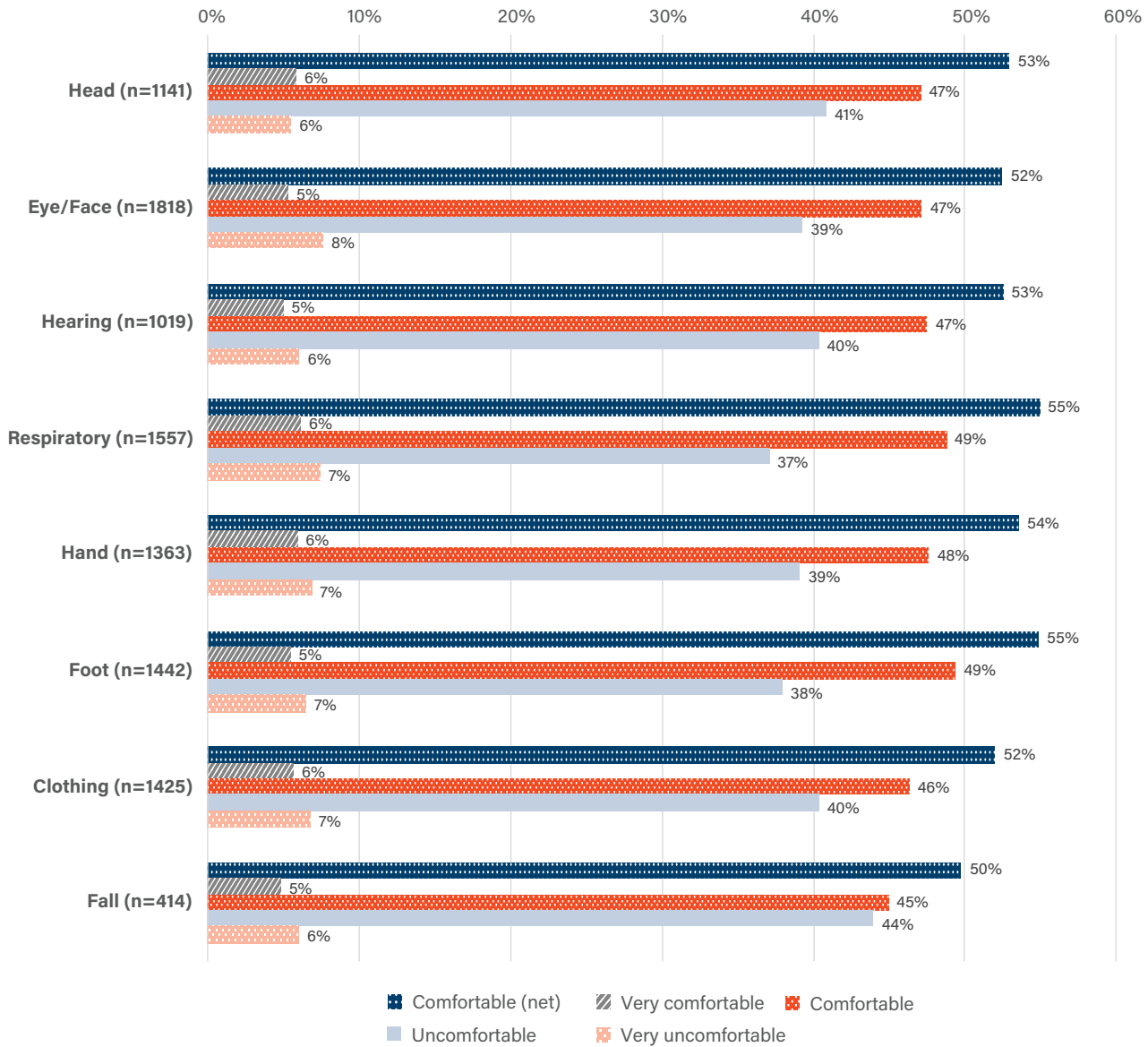
WorkSafeNB

Workplace Safety and Prevention Services (WSPS)

C.2 Selected Survey Findings

C.2.1 How Comfortable is PPE for Women, by Type and Sector

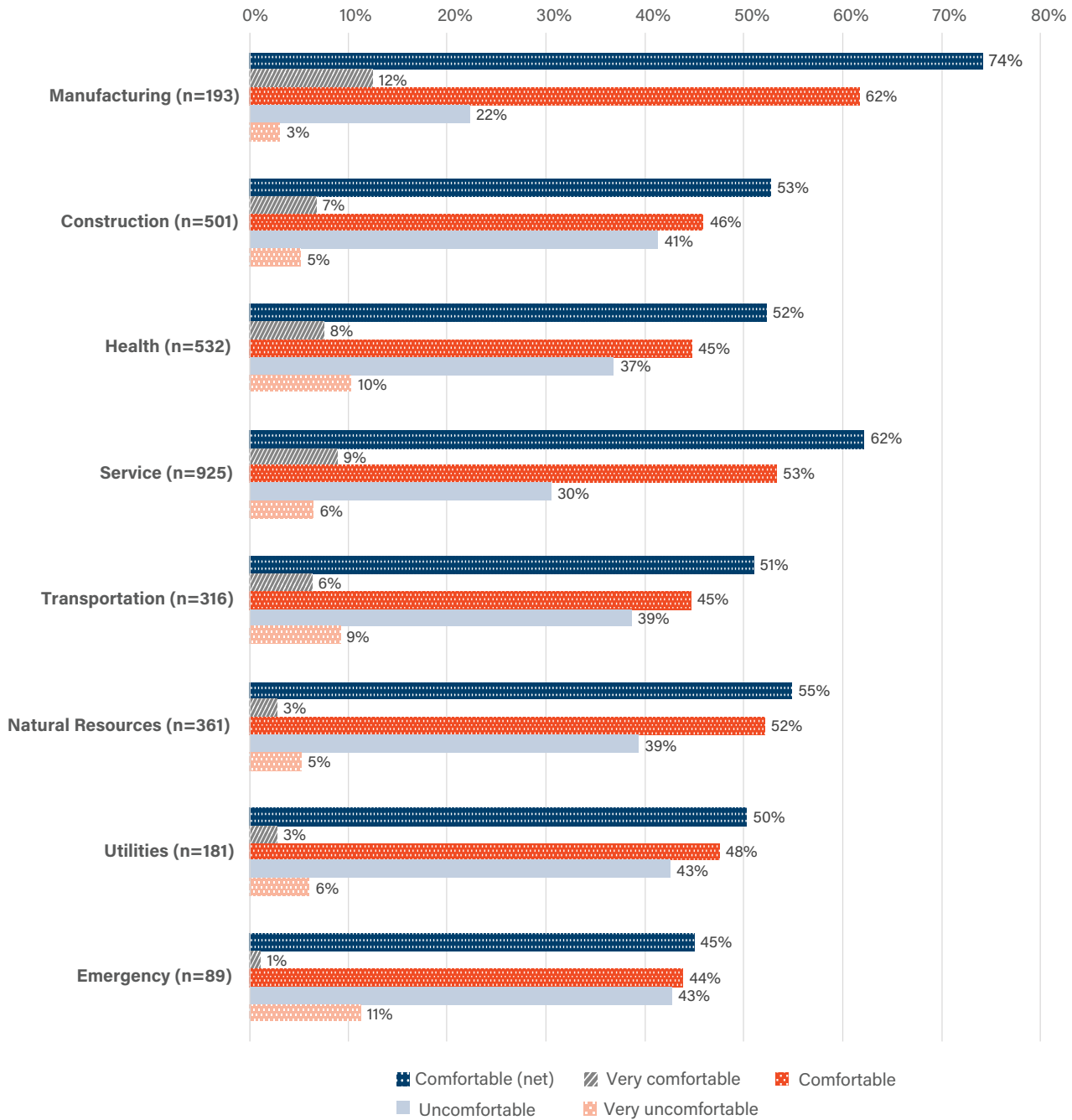
Figure C-1: How Comfortable Do Women Find Their PPE, by PPE Type (n = 2742)



Note:

"Comfortable (net)" is the sum of "very comfortable" and "comfortable".

Figure C-2: How Comfortable Do Women Find Their PPE, by Sector (n = 2742)



Note:

"Comfortable (net)" is the sum of "very comfortable" and "comfortable".

C.2.2 Women Who Report PPE Meets Their Needs, by Type and Sector

Figure C-3: Percentage of Women Whose "Usual" PPE Meets Their Needs, by PPE Type (n = 2752)

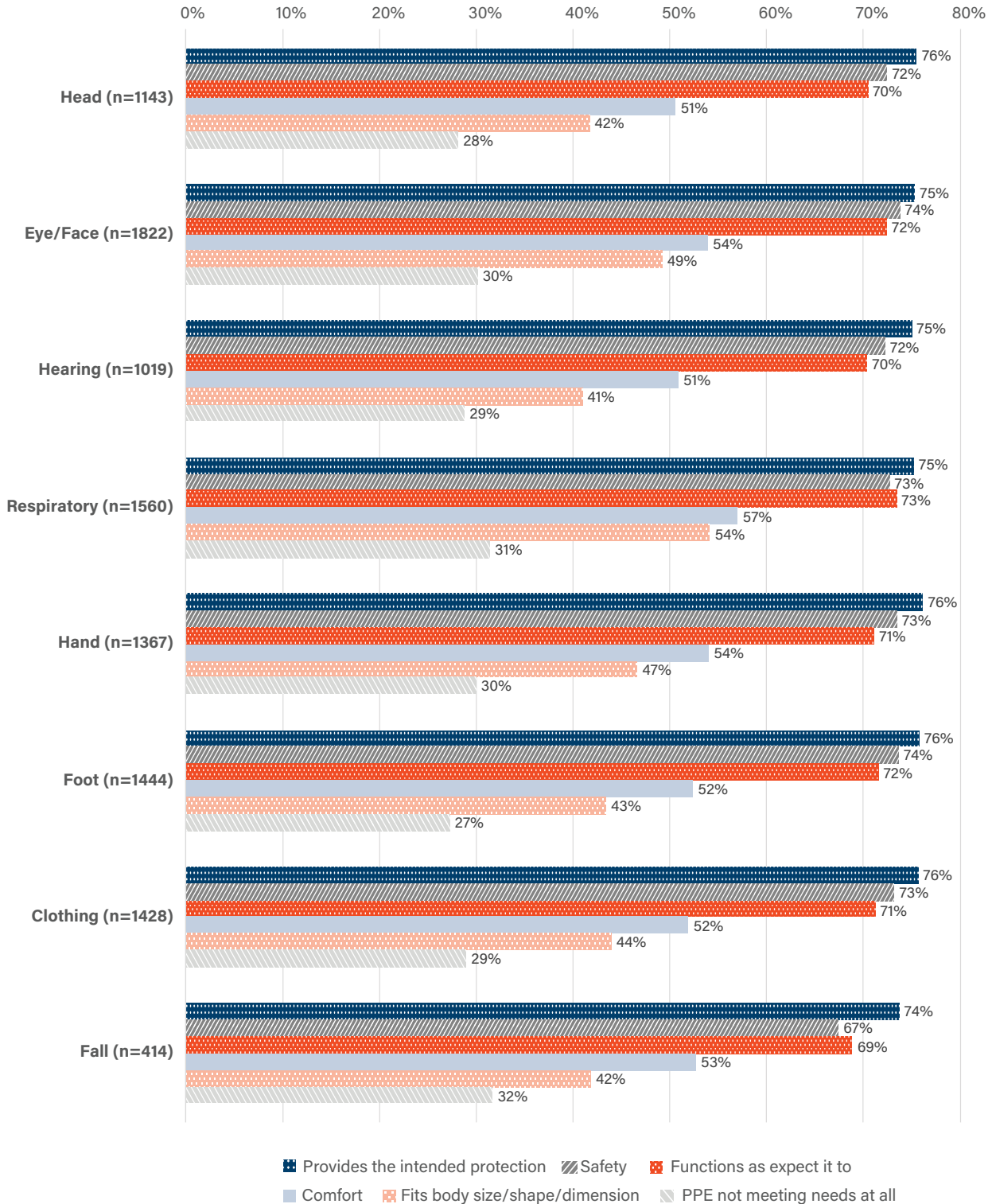


Figure C-4: Percentage of Women Whose "Occasional" PPE Meets Their Needs, by PPE Type (n = 2752)

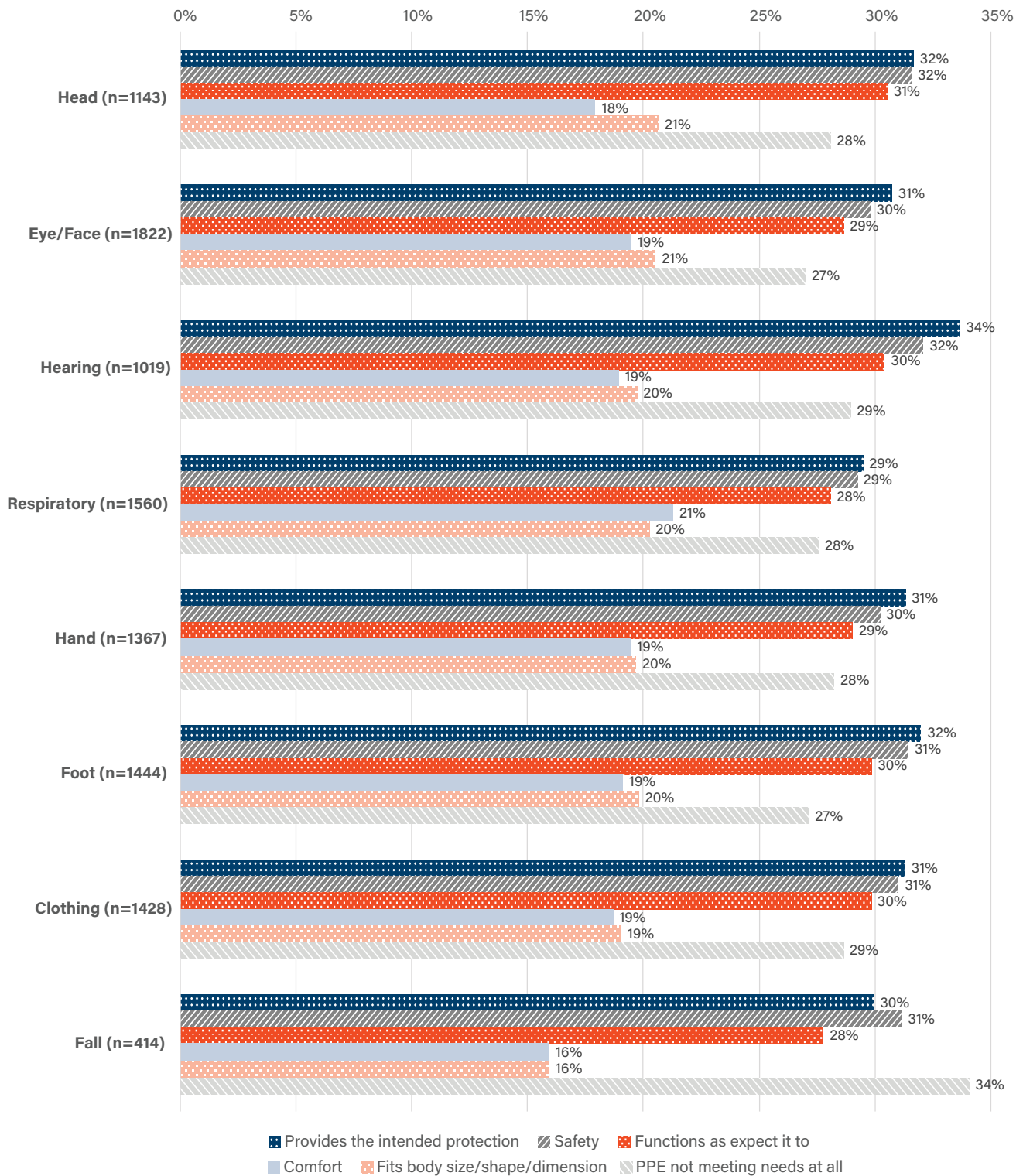


Figure C-5: Percentage of Women Whose "Usual" PPE Meets Their Needs, by Sector (n = 2752)

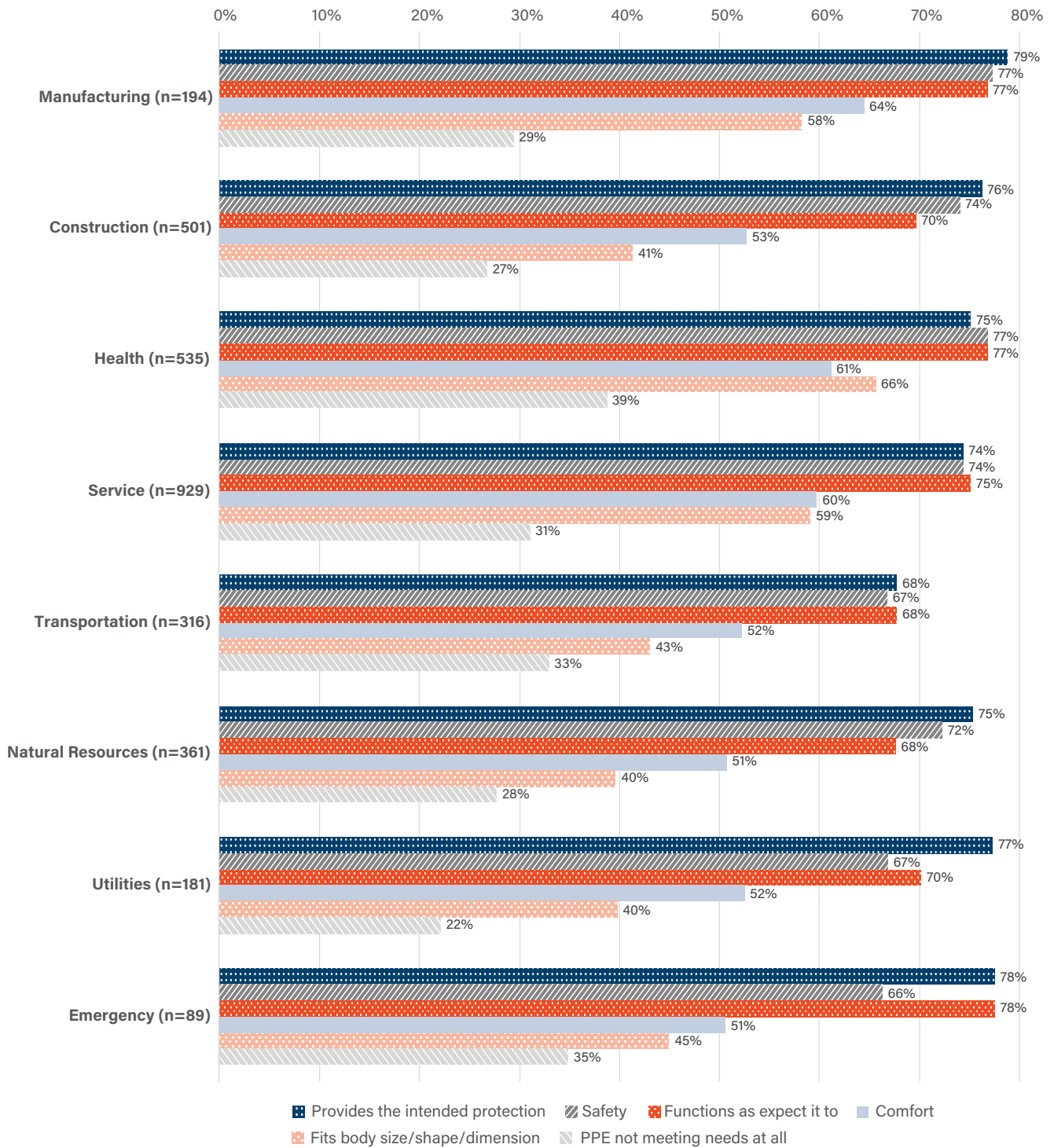
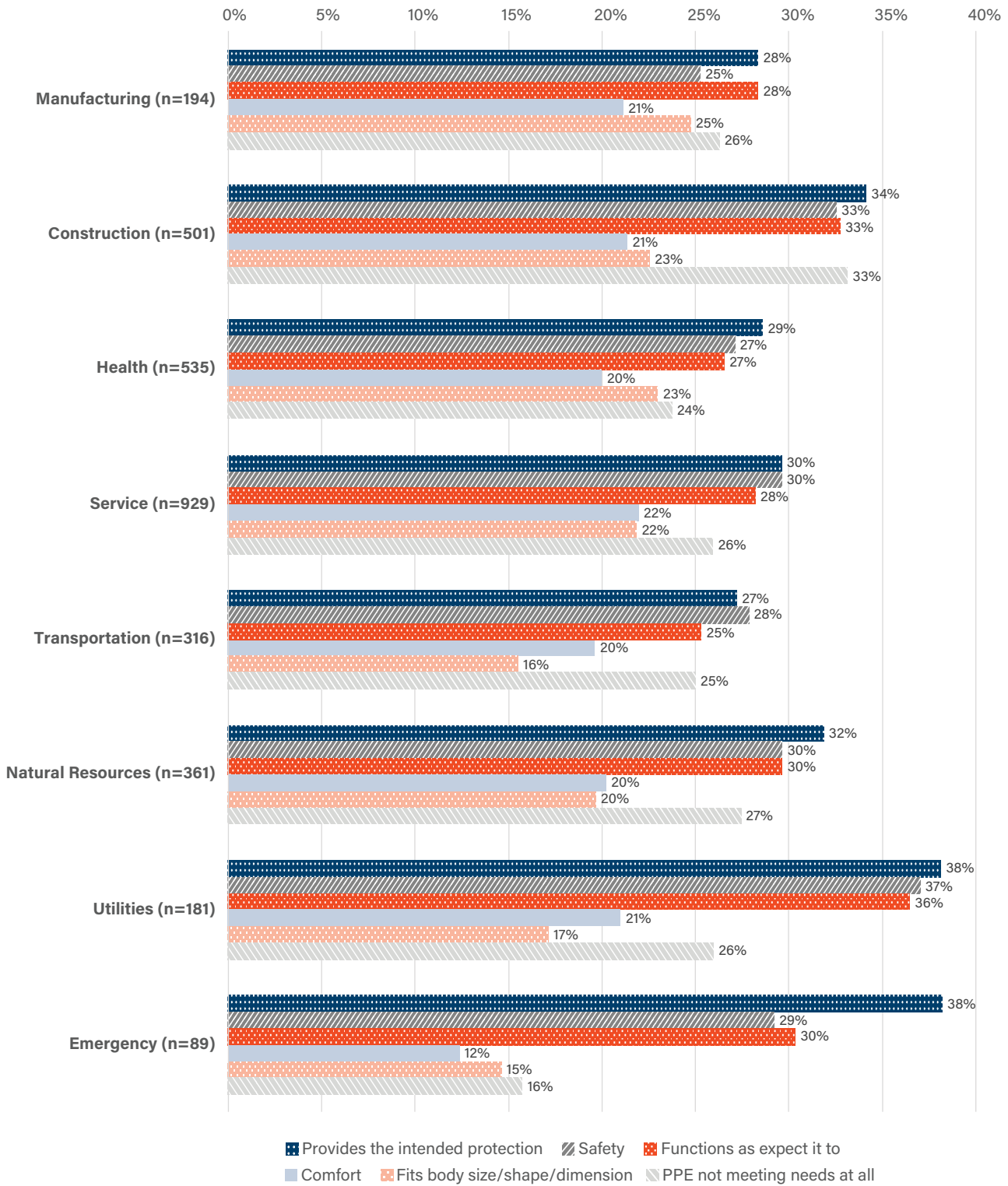


Figure C-6: Percentage of Women Whose "Occasional" PPE Meets Their Needs, by Sector (n = 2752)



C.2.3 Key Factors to Satisfaction with PPE, by Type and Sector

Figure C-7: Factors that are Key to Women's Satisfaction with PPE, by PPE Type (n = 2717)

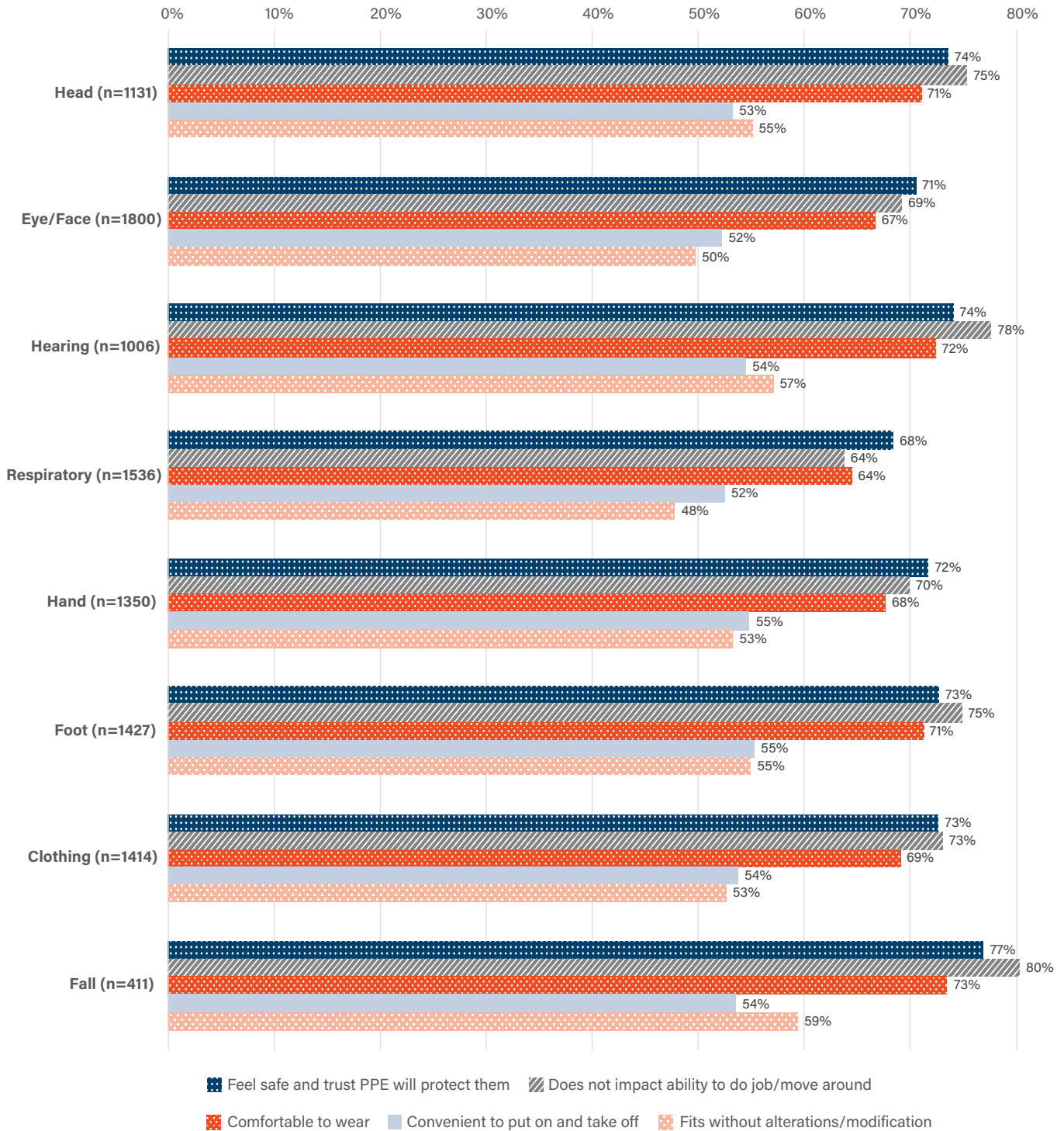
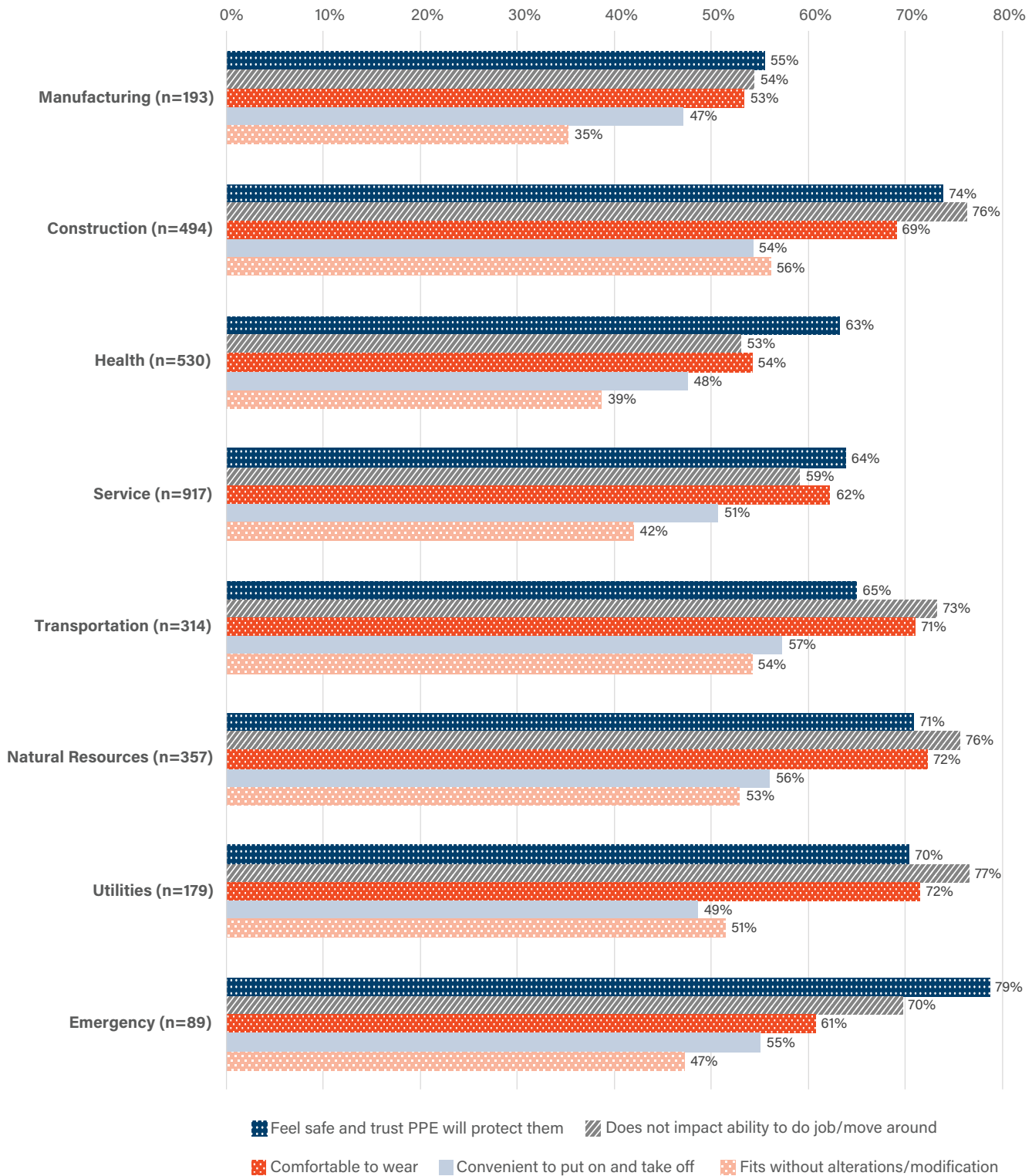


Figure C-8: Factors that are Key to Women's Satisfaction with PPE, by Sector (n = 2717)



C.2.4 Problems Women Have with Their PPE

C.2.4.1 Being Hampered by PPE, by Type and Sector

Figure C-9: Percentage of Women Who Report Being Hampered by PPE, by PPE Type (n = 2728)

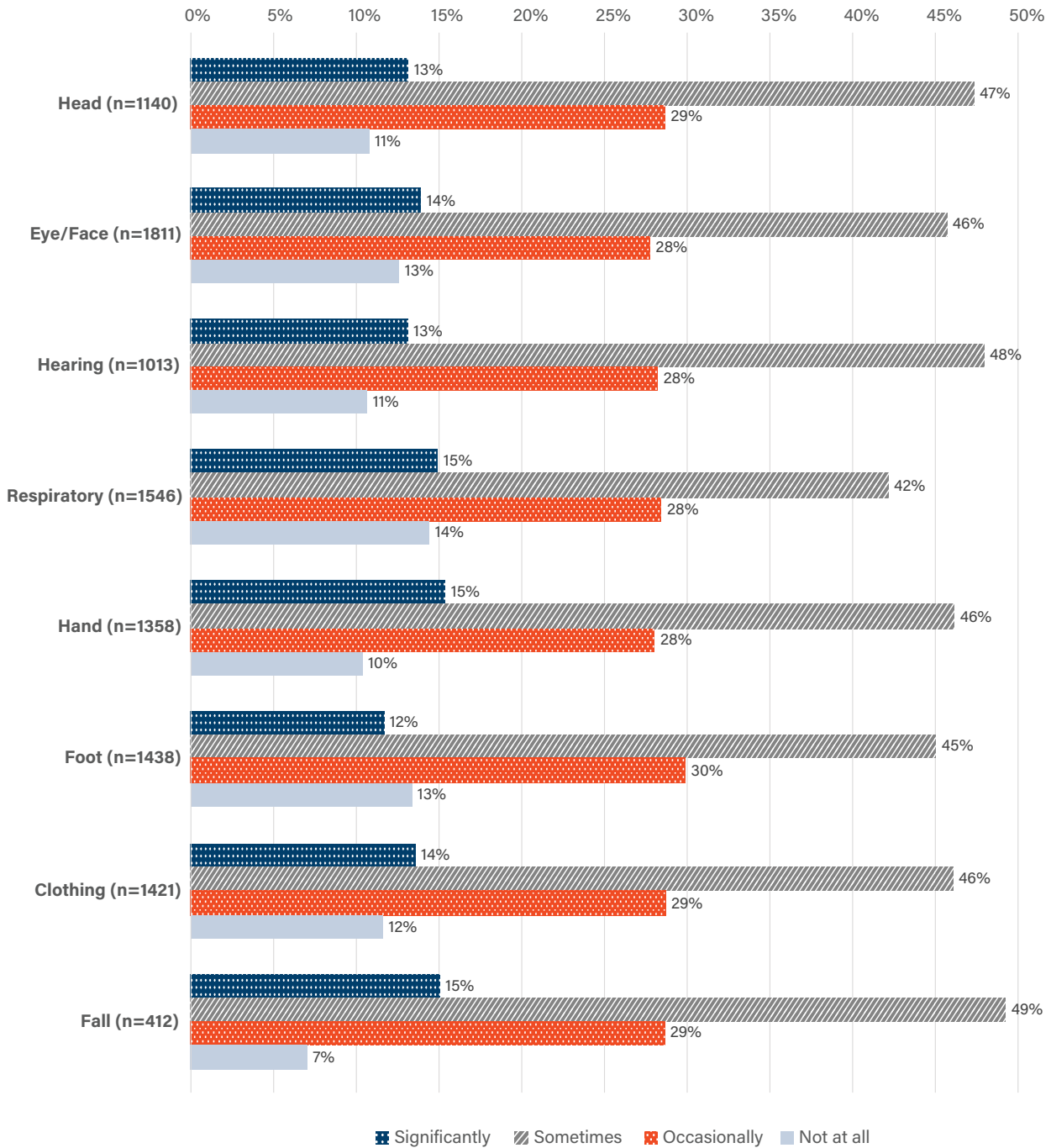
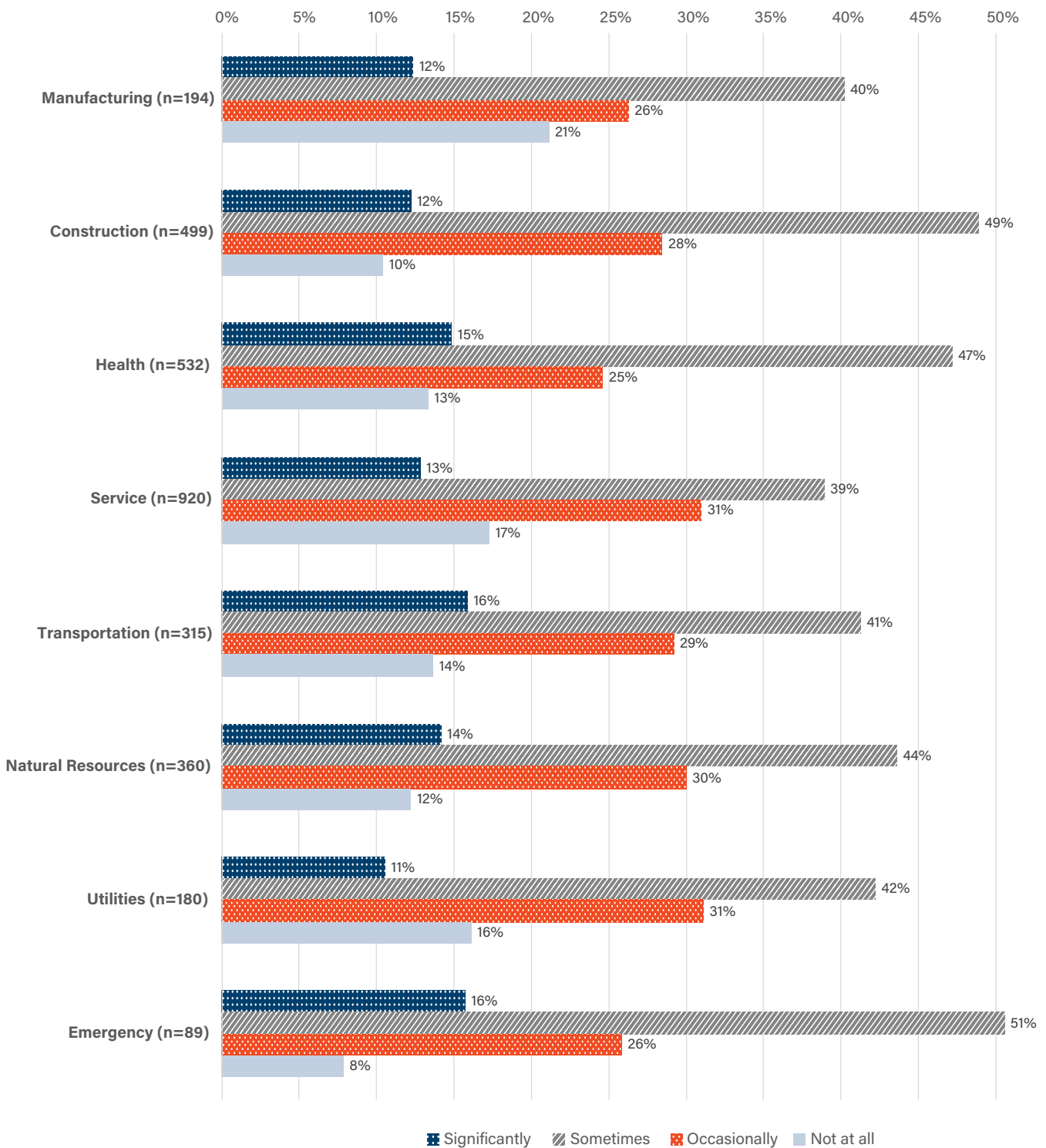


Figure C-10: Percentage of Women Who Report Being Hampered by PPE, by Sector (n = 2728)



C.2.4.2 Having to Repeatedly Adjust PPE, by Type and Sector

Figure C-11: Percentage of Women Who Have to Adjust Their PPE, by PPE Type (n = 998)

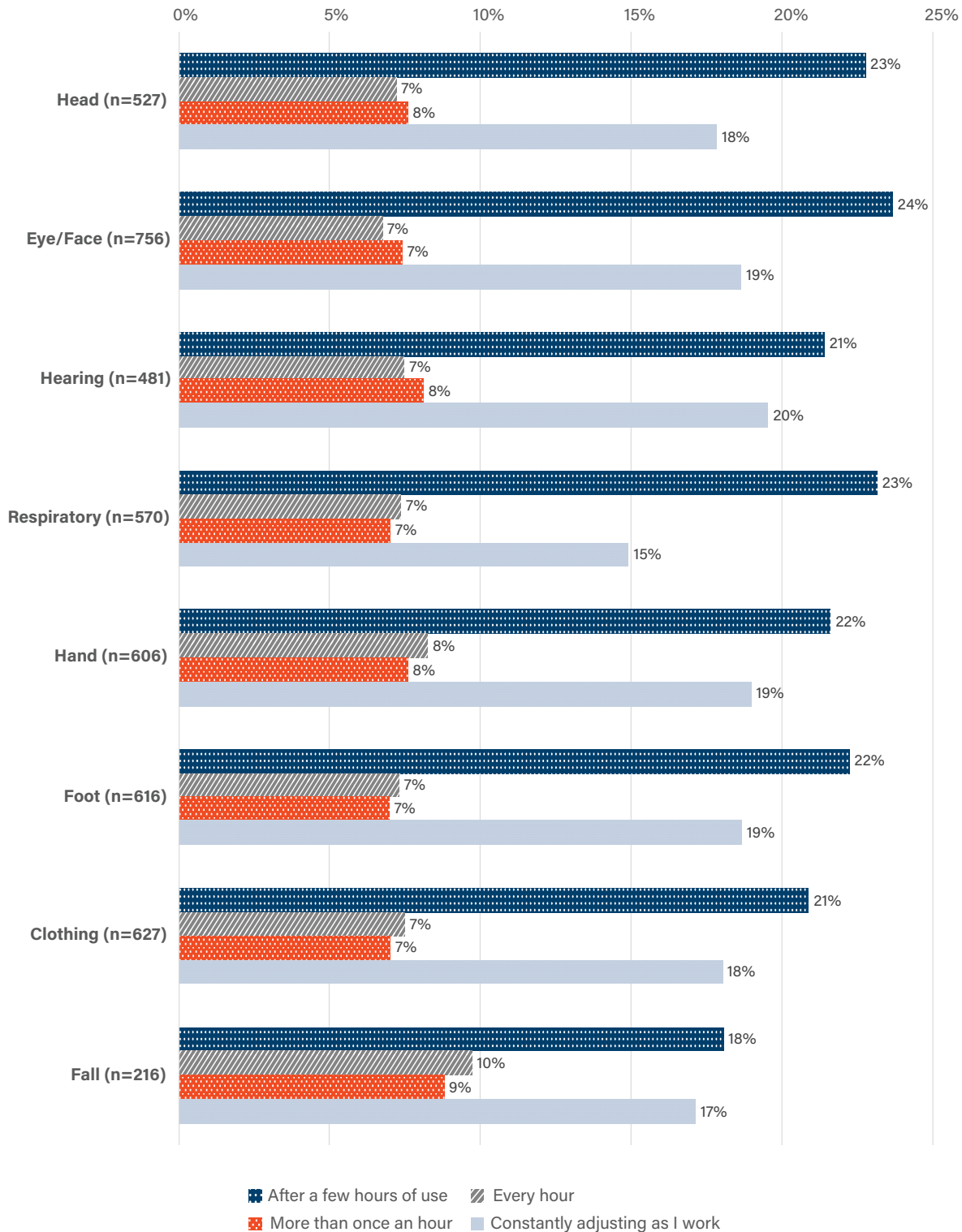
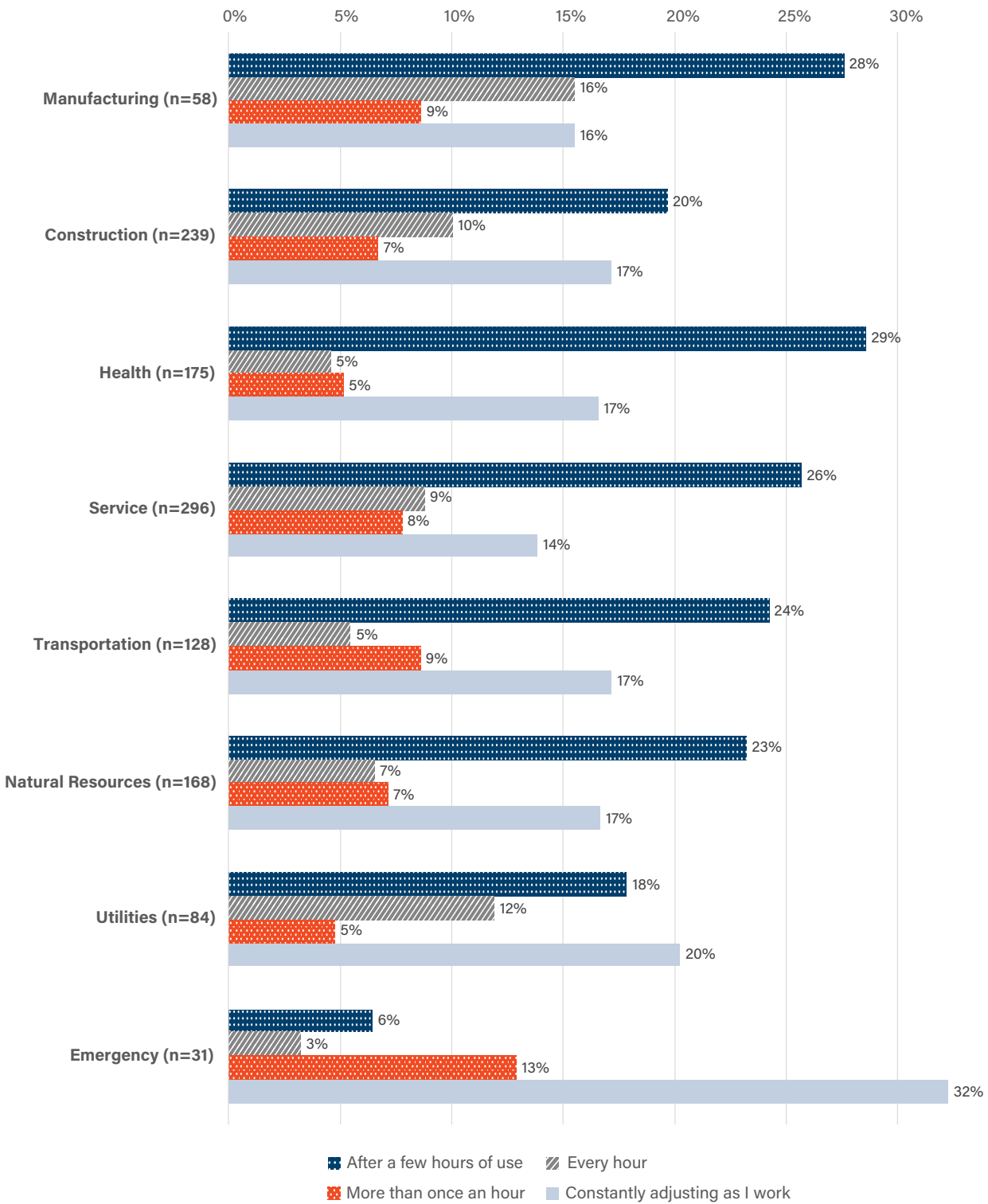


Figure C-12: Percentage of Women Who Have to Adjust Their PPE, by Sector (n = 998)



C.2.4.3 Key Issues Women Have with their PPE, by Type and Sector

Figure C-13: Percentage of Women Who Report One or More Issues with Their PPE, by PPE Type (n = 2675)

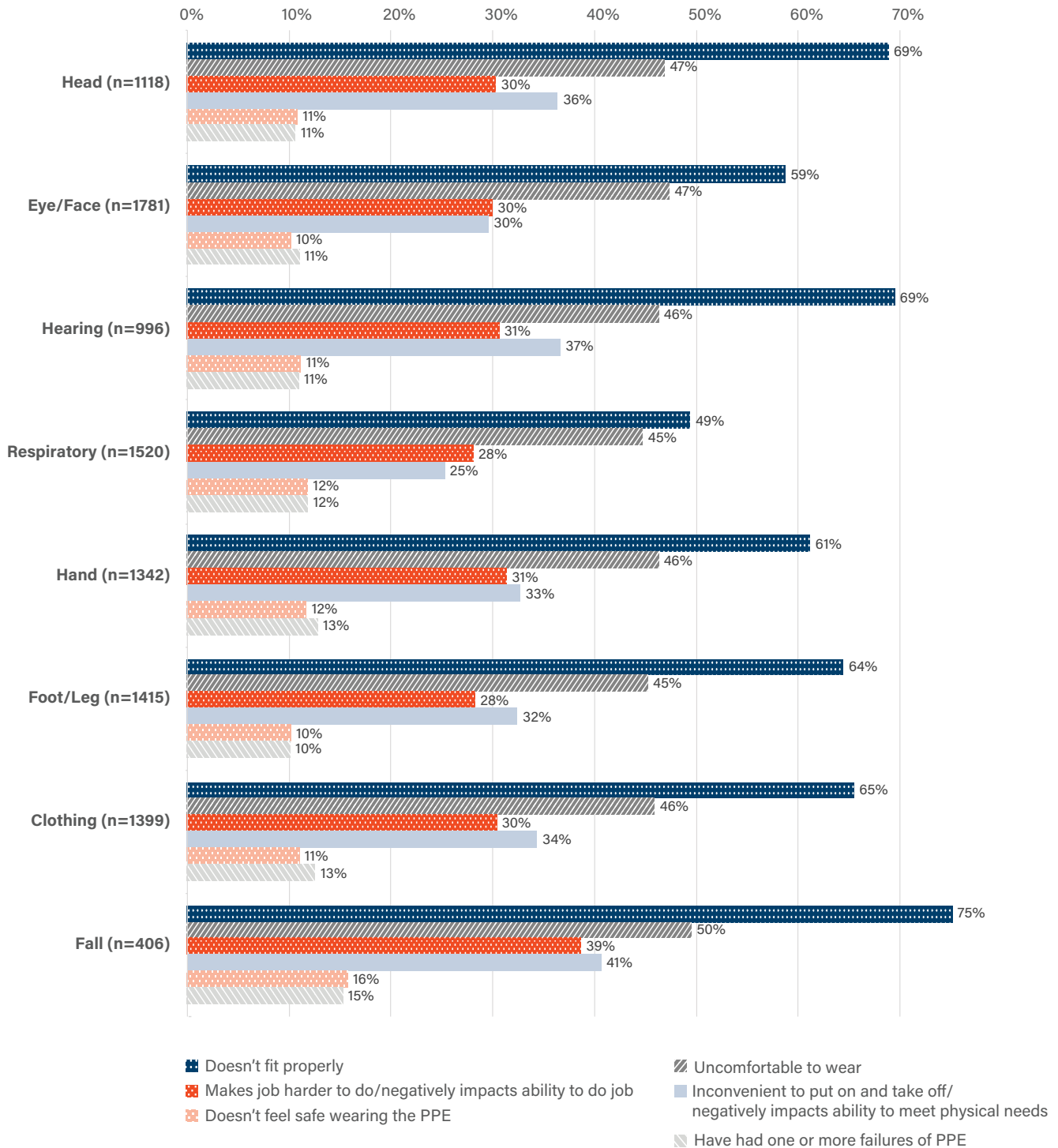
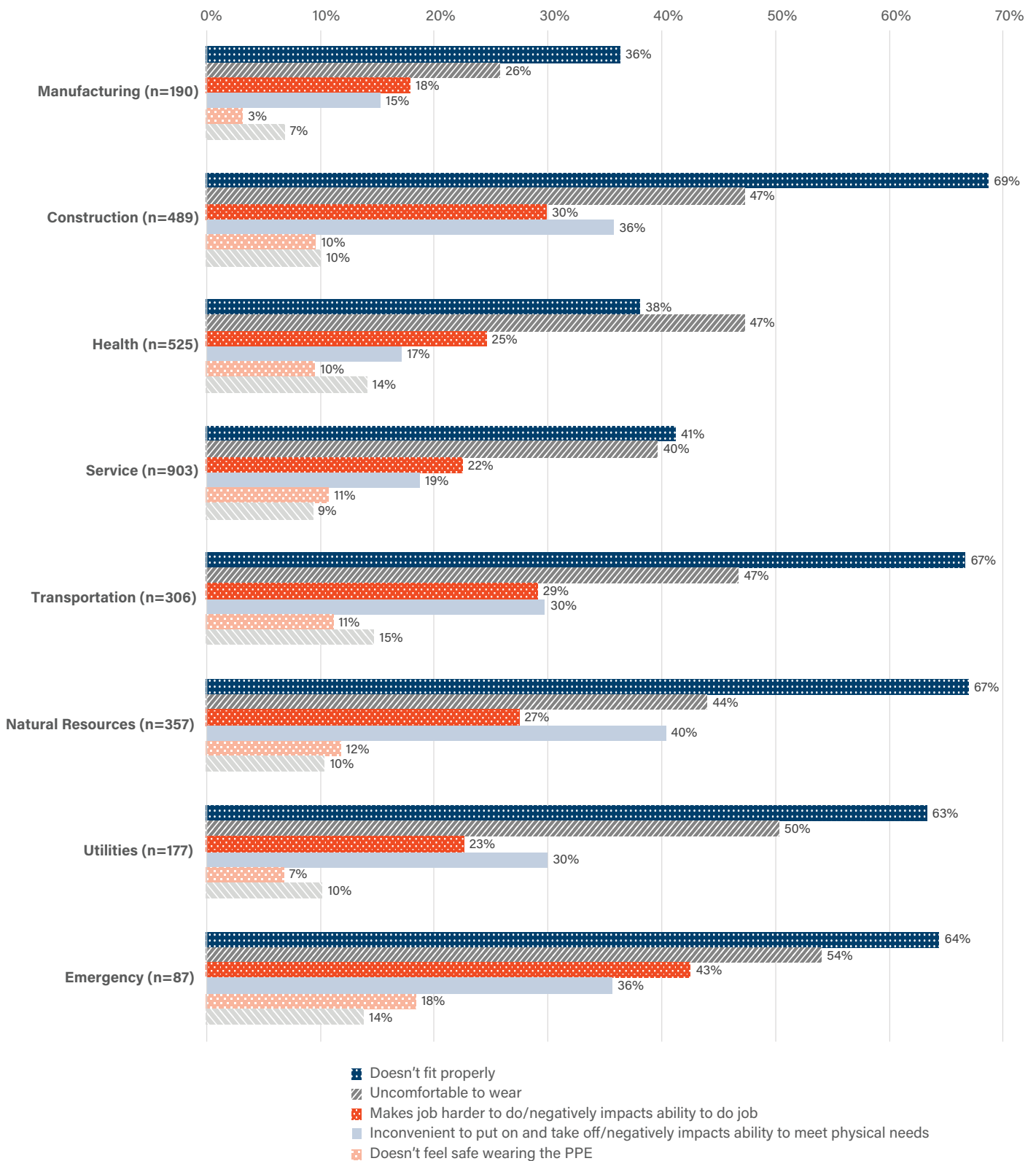


Figure C-14: Percentage of Women Who Report One or More Issues with Their PPE, by Sector (n = 2675)



C.2.4.4 Negative Experiences with PPE, by Type and Sector

Figure C-15: Percentage of Women Who Report Negative Experiences with PPE, by PPE Type

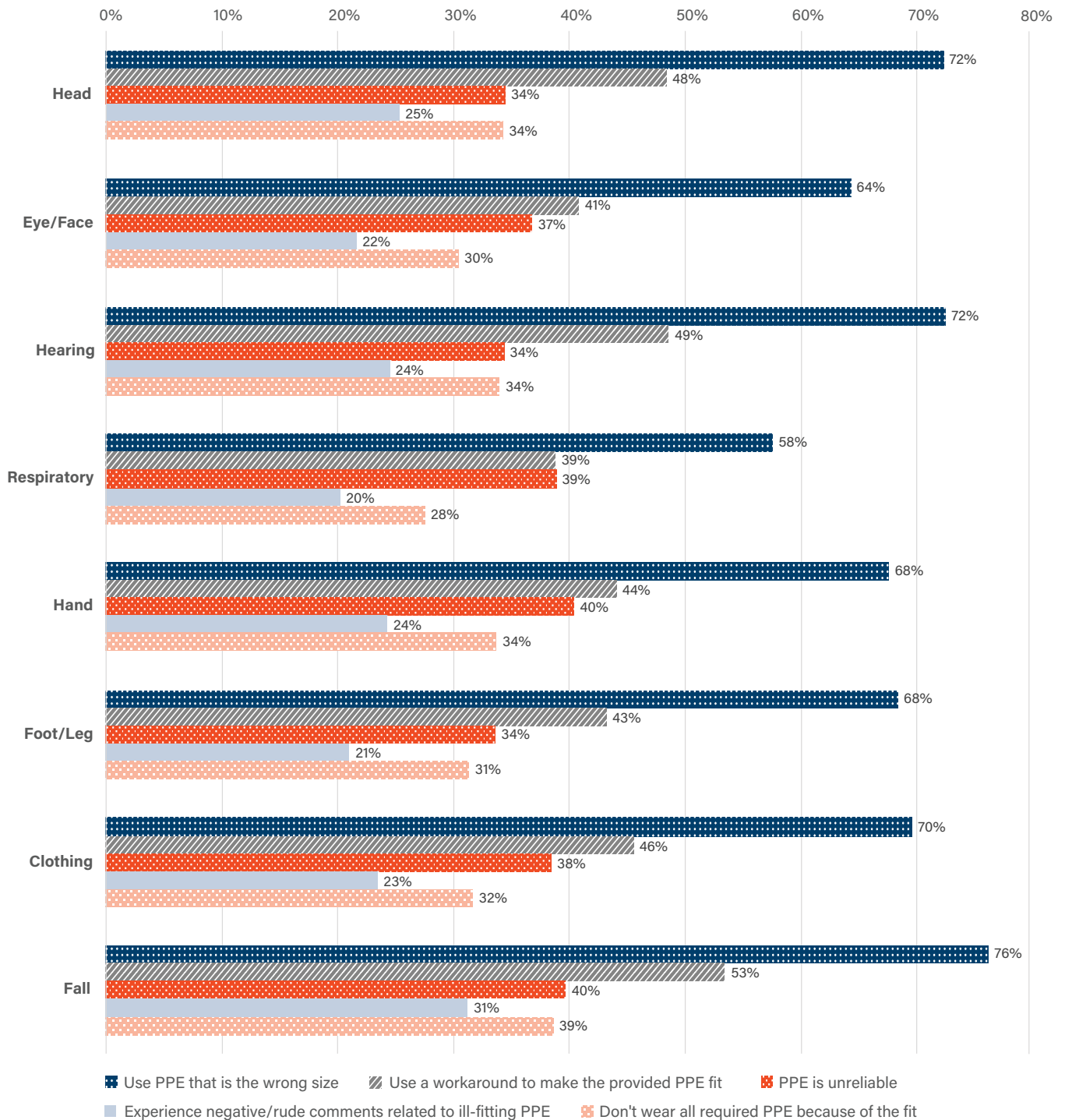
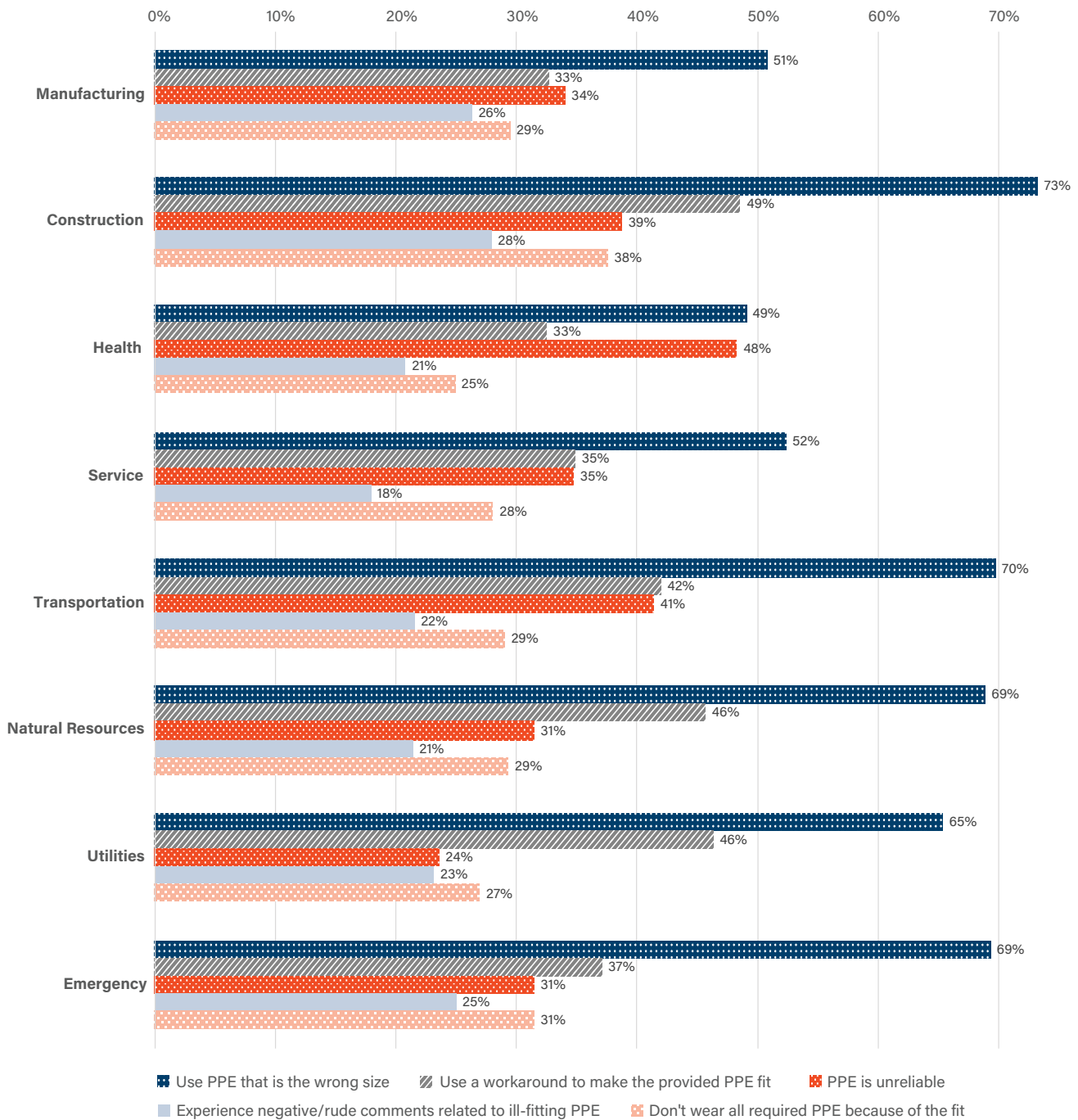


Figure C-16: Percentage of Women Who Report Negative Experiences with PPE, by Sector



C.2.4.5 Experiences of Injury/Illness Related to PPE, by Type and Sector

Figure C-17: Percentage of Women Who Report PPE-related Injuries or Illnesses, by PPE Type (n = 2635)

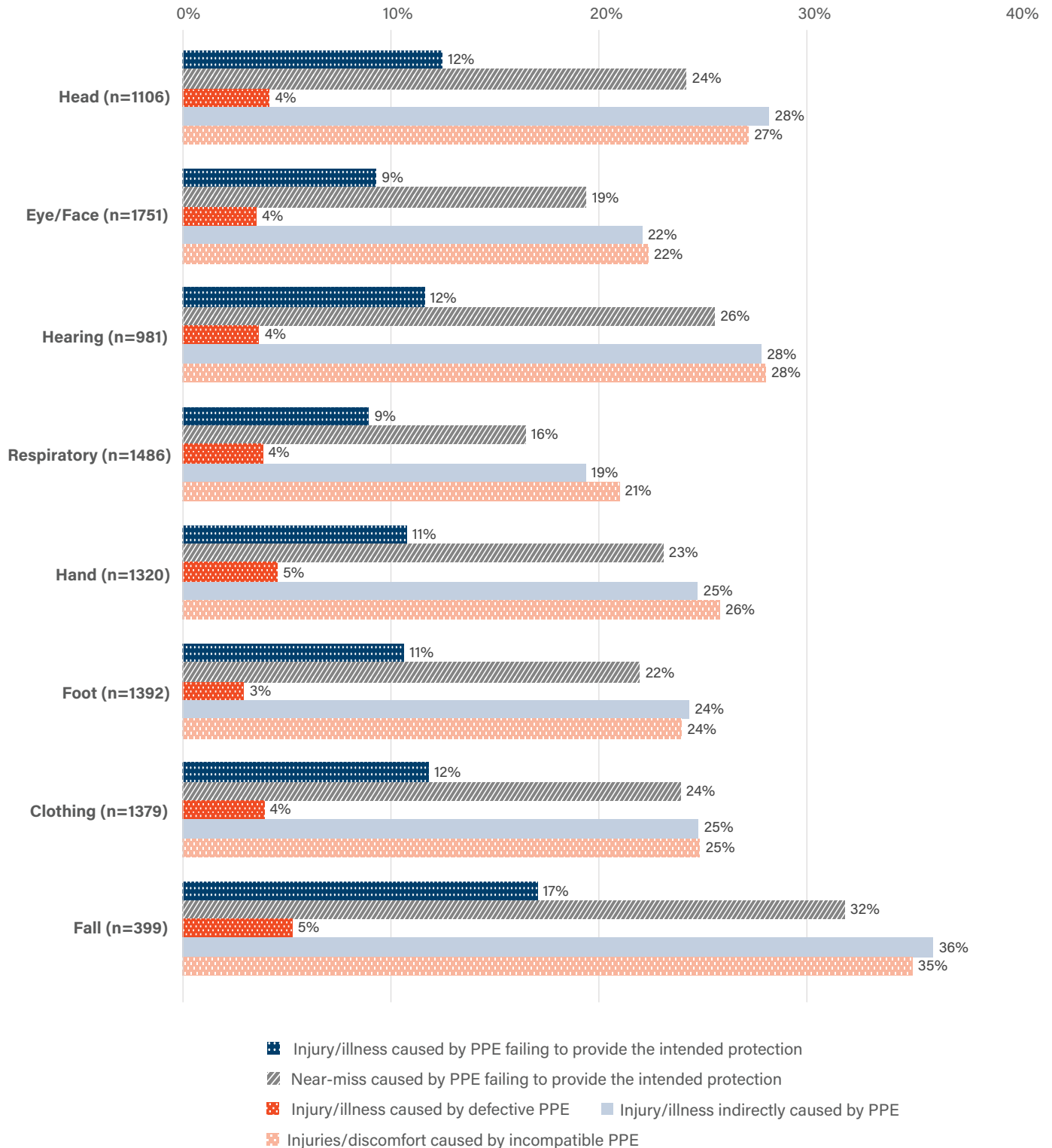
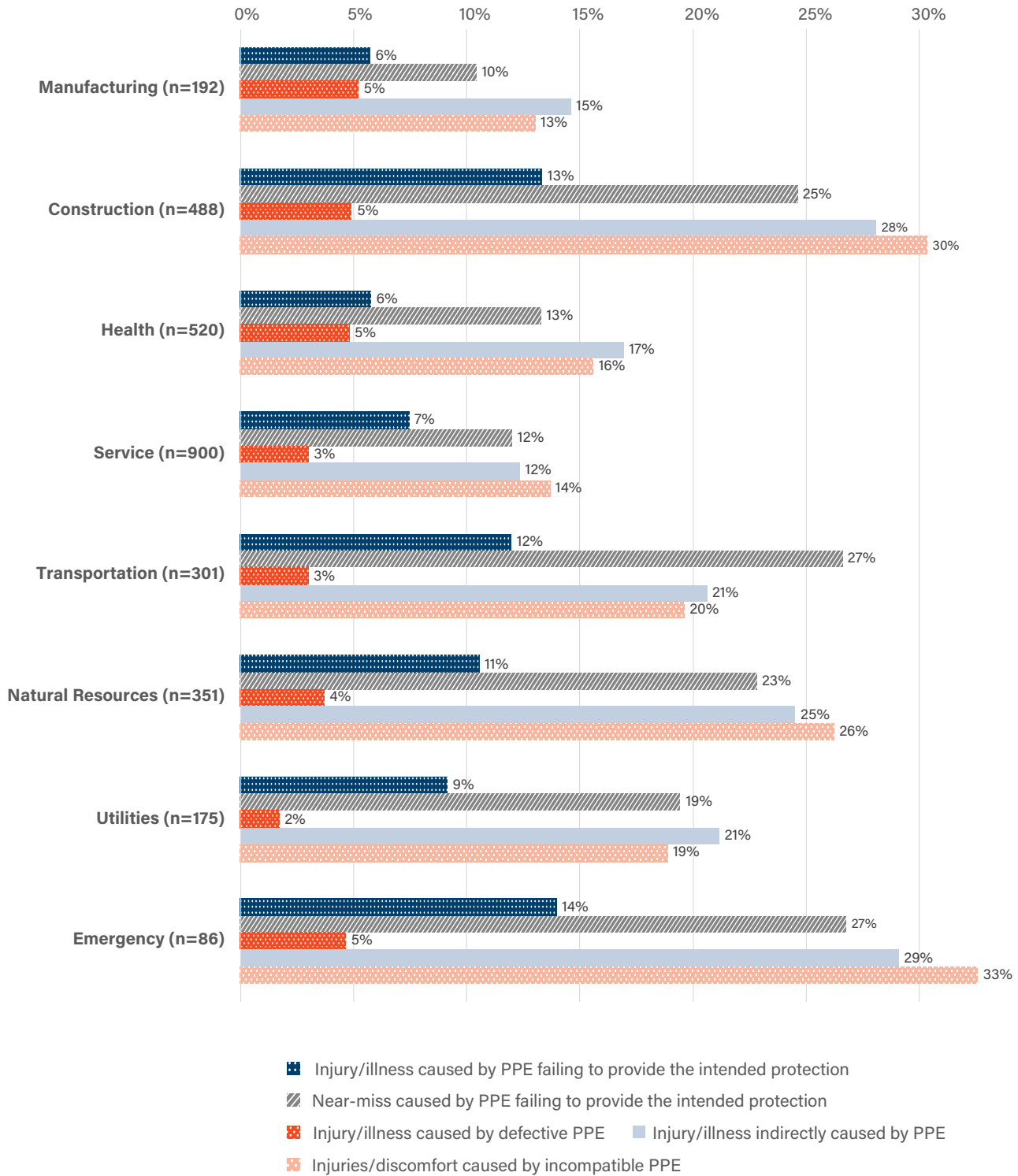


Figure C-18: Percentage of Women Who Report PPE-related Injuries or Illnesses, by Sector (n = 2635)



C.2.4.6 Impact of Wearing PPE During Pregnancy, by Type and Sector

Figure C-19: Percentage of Women Who Altered Their Work During Pregnancy, While Breastfeeding, or During Menopause by PPE Type (n = 815)

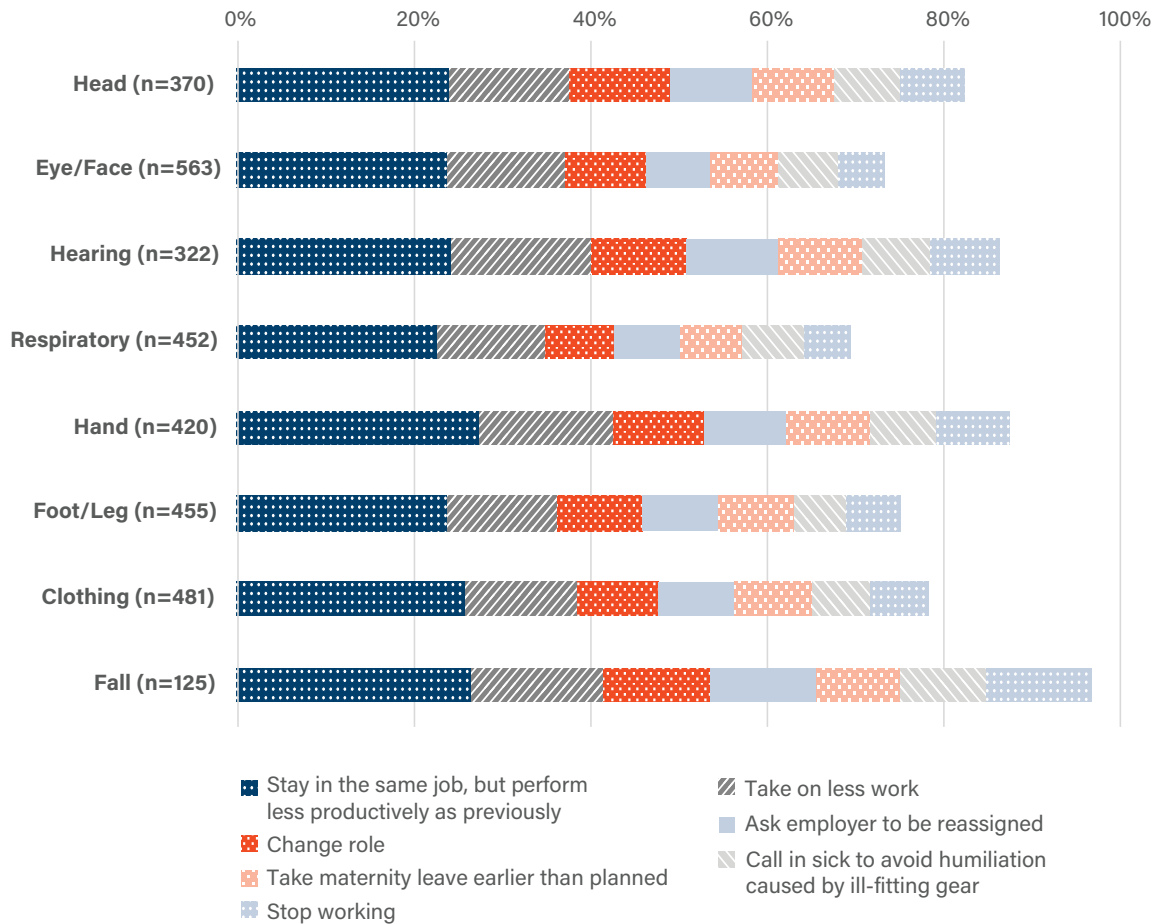
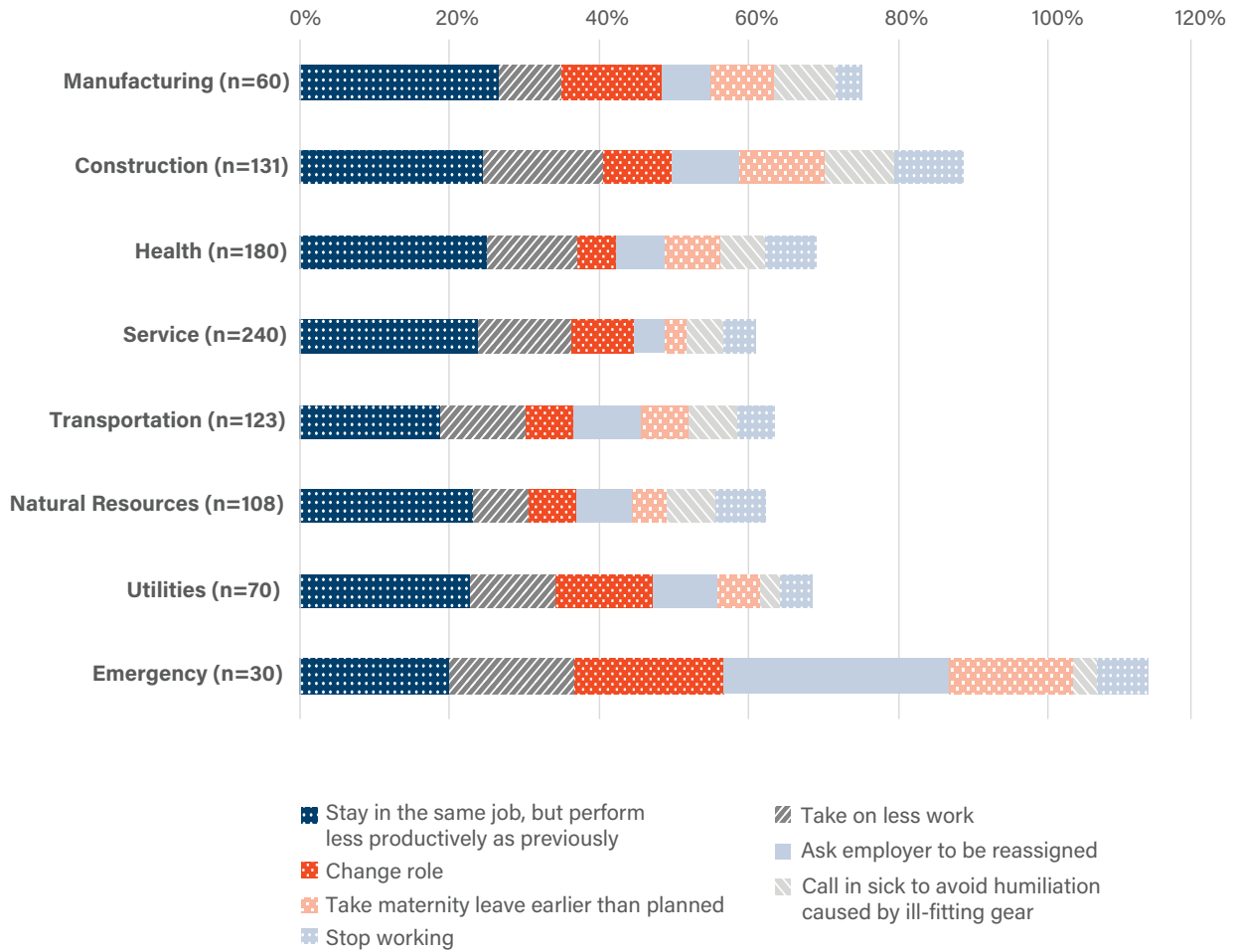


Figure C-20: Percentage of Women Who Altered Their Work During Pregnancy, While Breastfeeding, or During Menopause by Sector (n = 815)



C.2.5 How Women Respond to the Problems They Have with PPE

C.2.5.1 Amount of Money Women Spend on PPE, by Type and Sector

Figure C-21: Percentage of Women Who Purchase PPE Monthly and Amount Spent, by PPE Type (n = 1426)

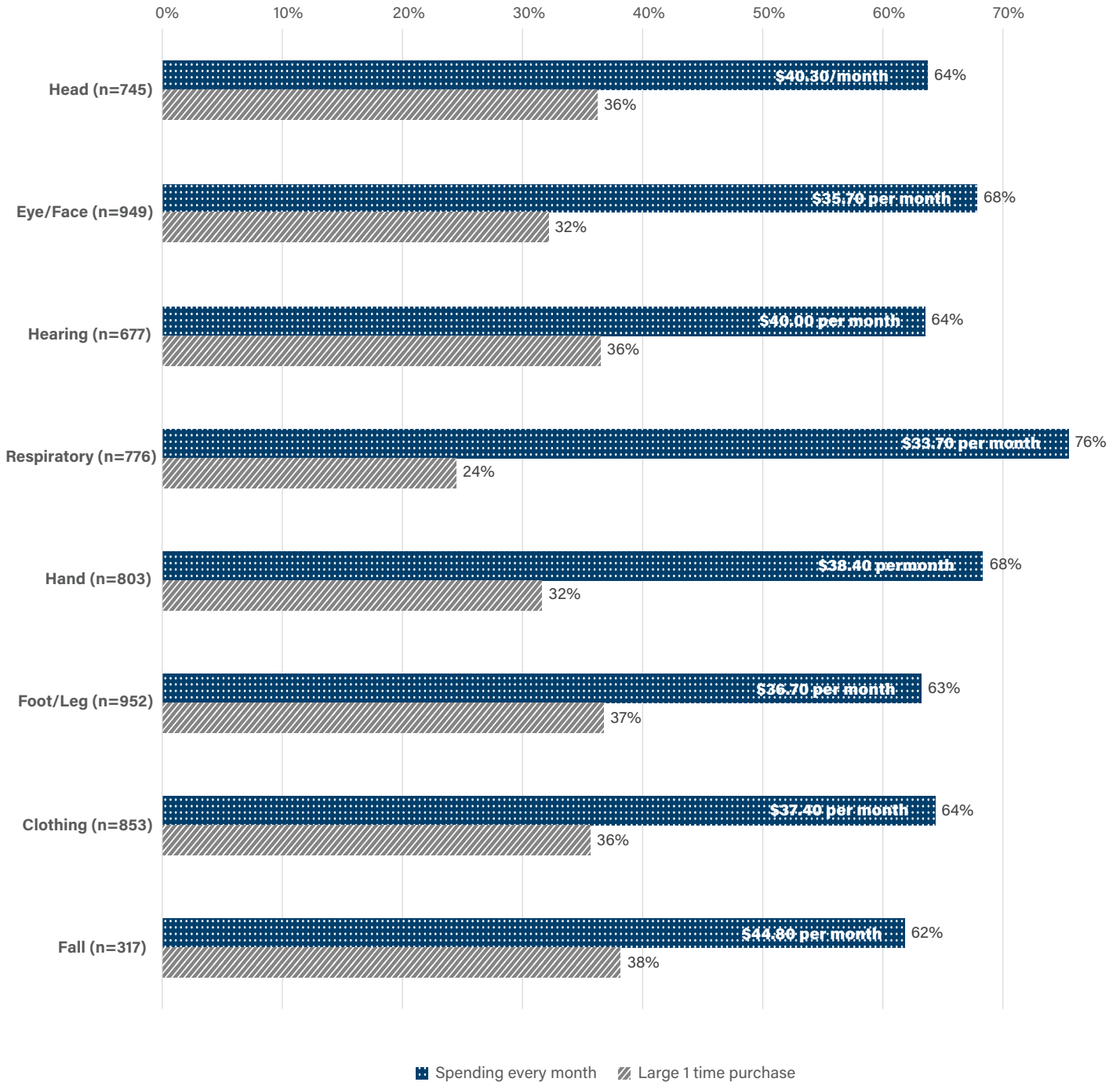
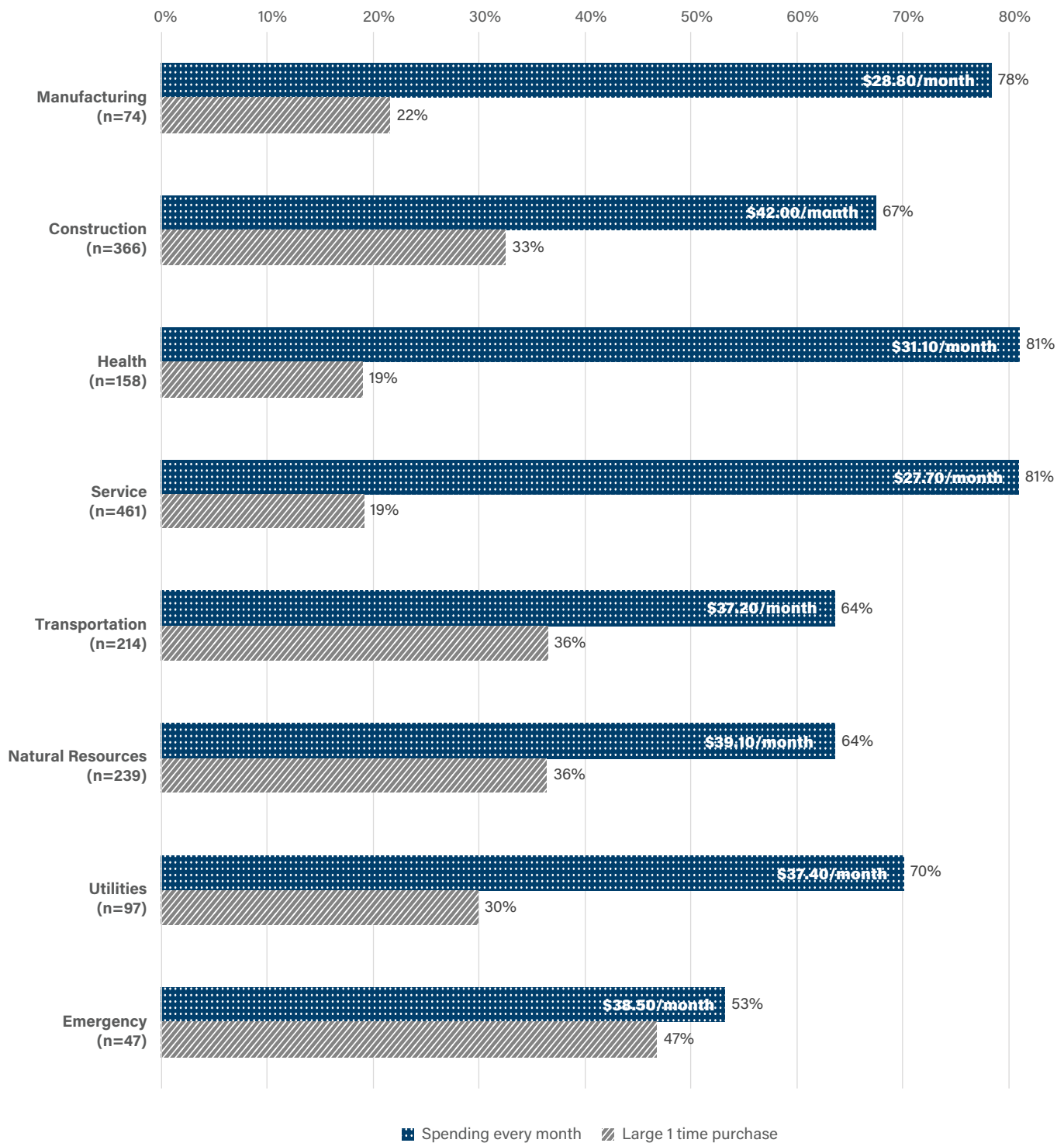


Figure C-22: Percentage of Women Who Purchase PPE Monthly and Amount Spent, by Sector (n = 1426)



C.2.5.2 How Women Modify Their PPE, by Type and Sector

Figure C-23: Percentage of Women Who Alter or Modify Their PPE, by PPE Type (n = 2636)

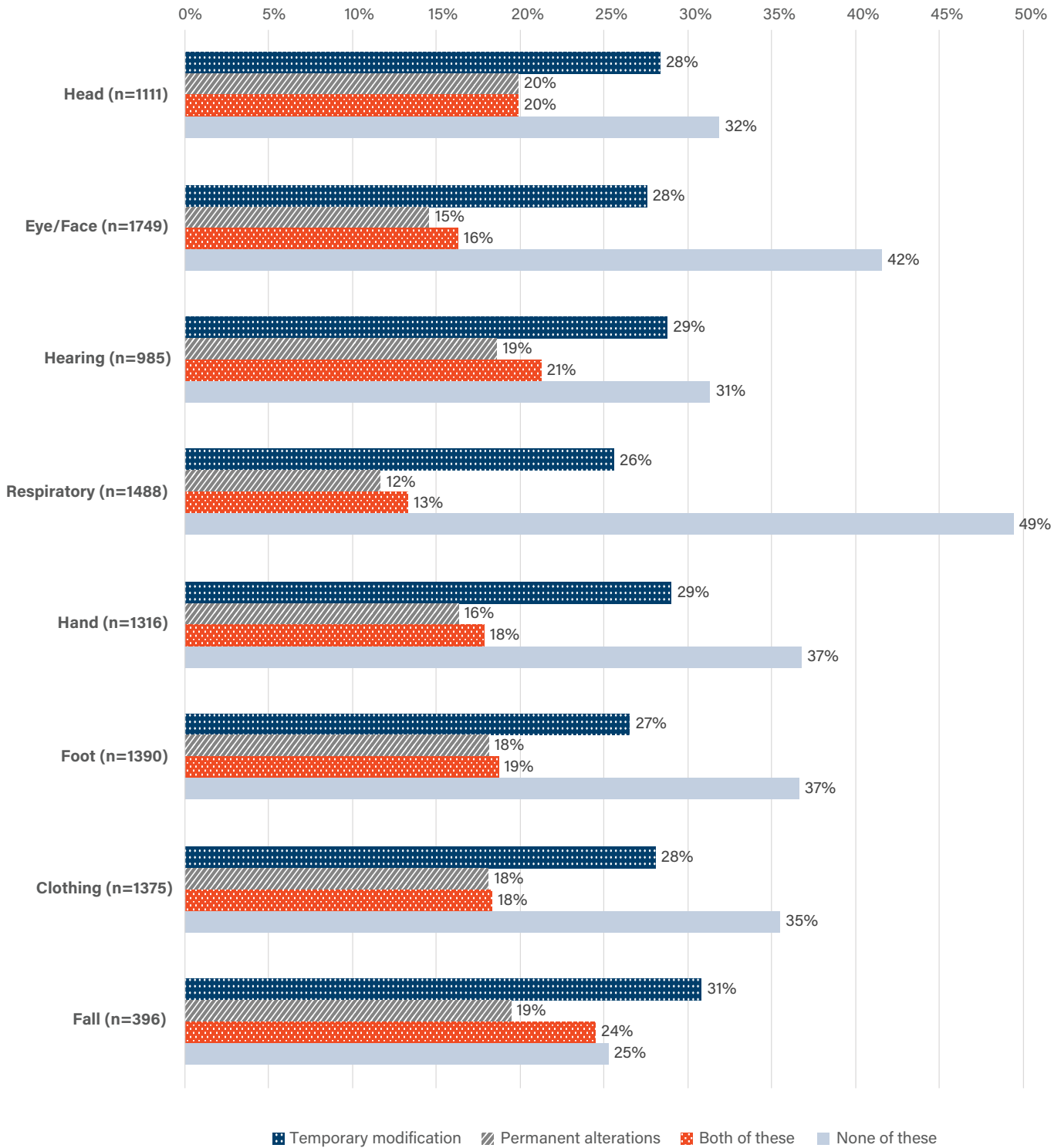
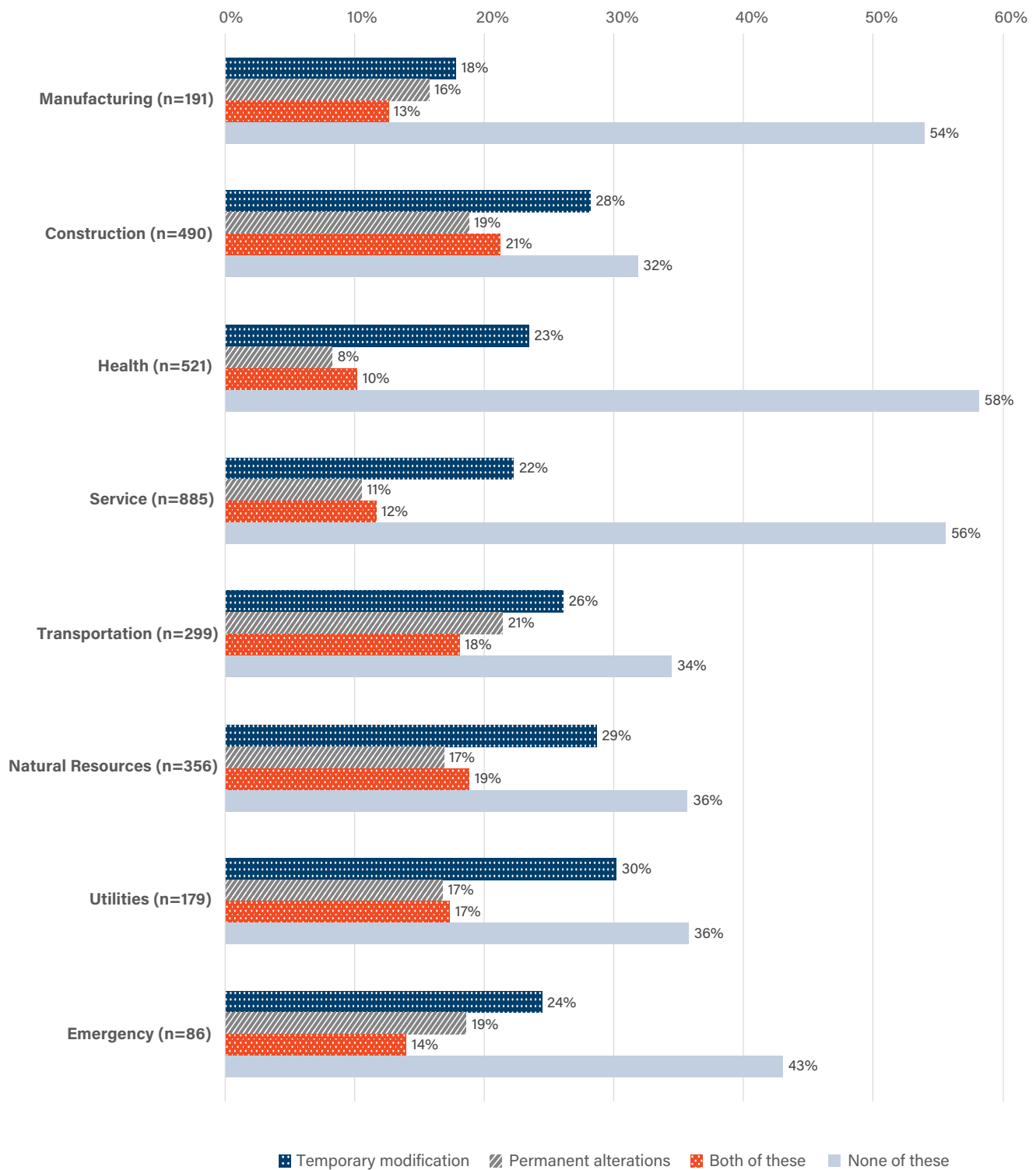


Figure C-24: Percentage of Women Who Alter or Modify Their PPE, by Sector (n = 2636)



C.2.5.3 Why Women Modify Their PPE, by Type and Sector

Figure C-25: Why Women Modify Their PPE, by PPE Type (n = 1362)

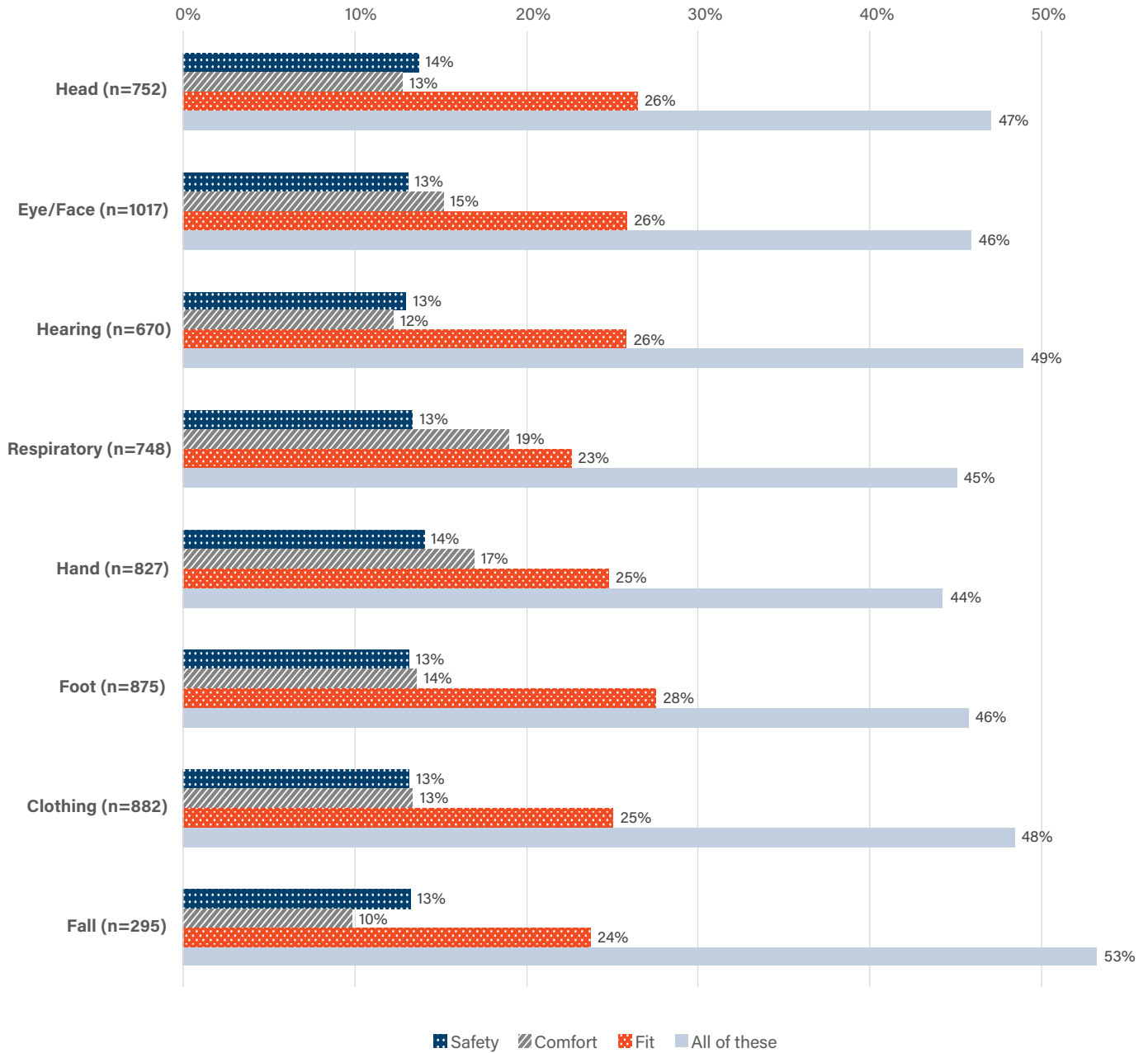
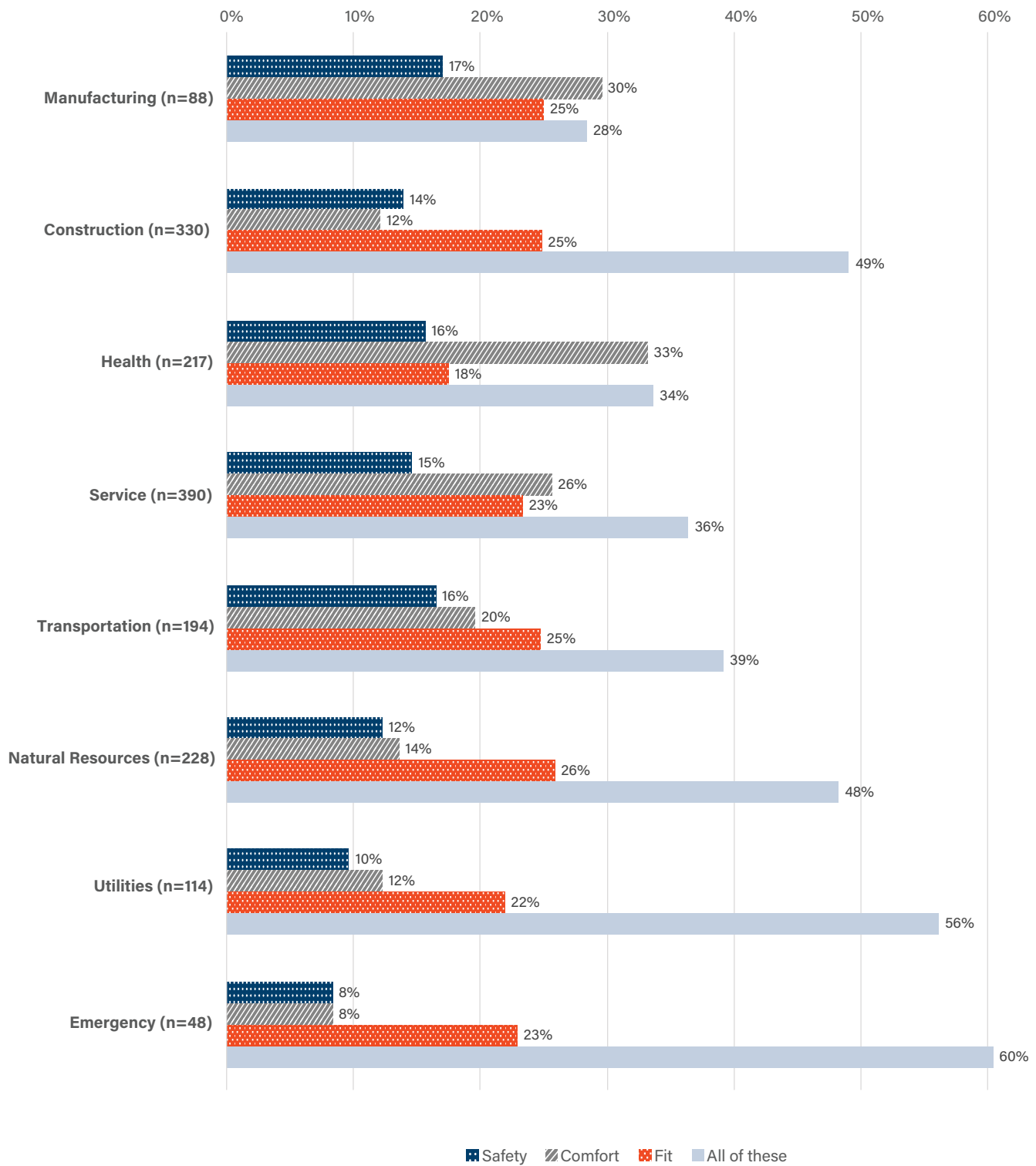


Figure C-26: Why Women Modify Their PPE, by Sector (n = 1362)



C.2.5.4 Psychological Impact of Modifying PPE, by Type and Sector

Figure C-27: How Safe Women Feel After Modifying Their PPE, by PPE Type (n = 1357)

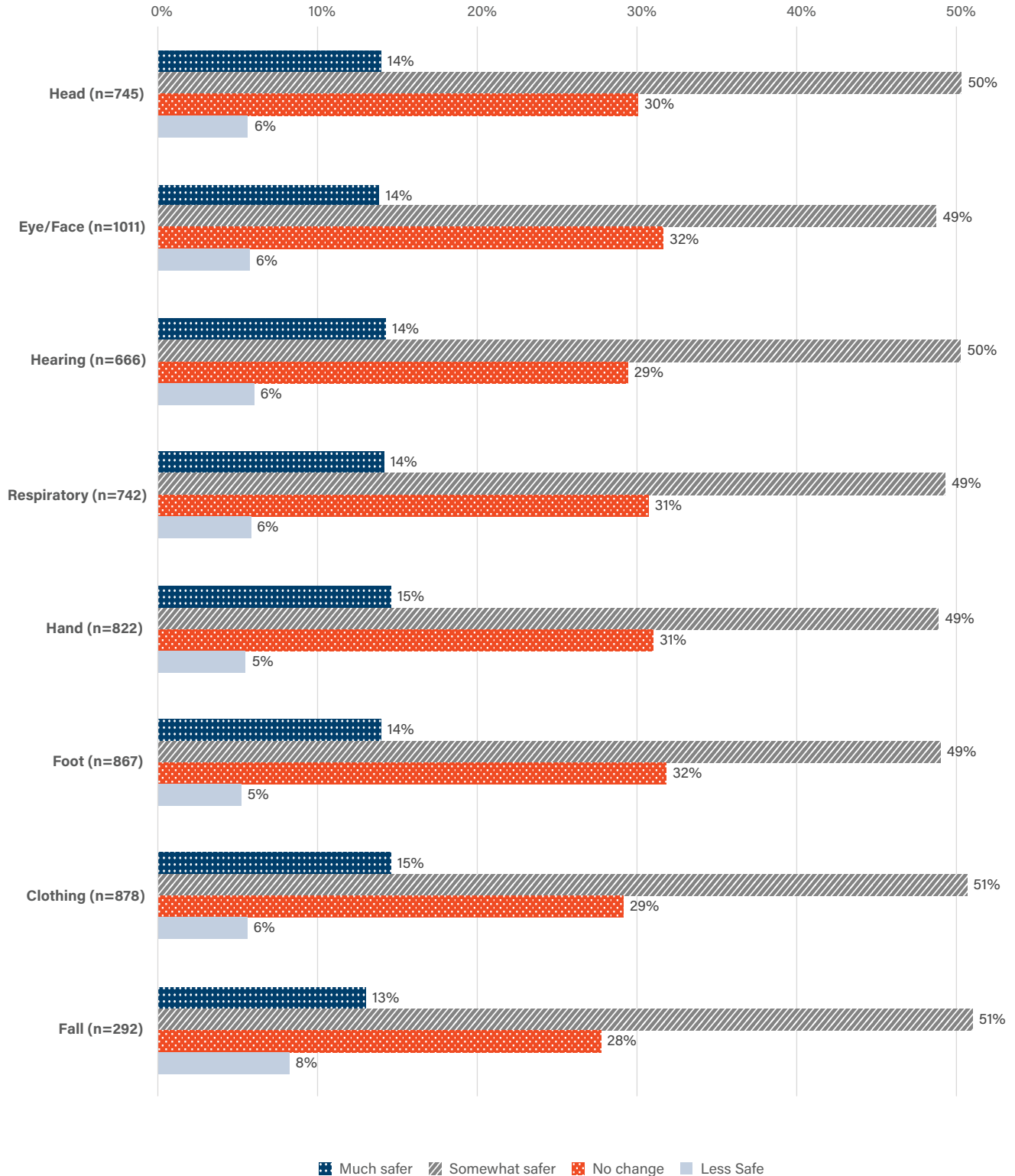
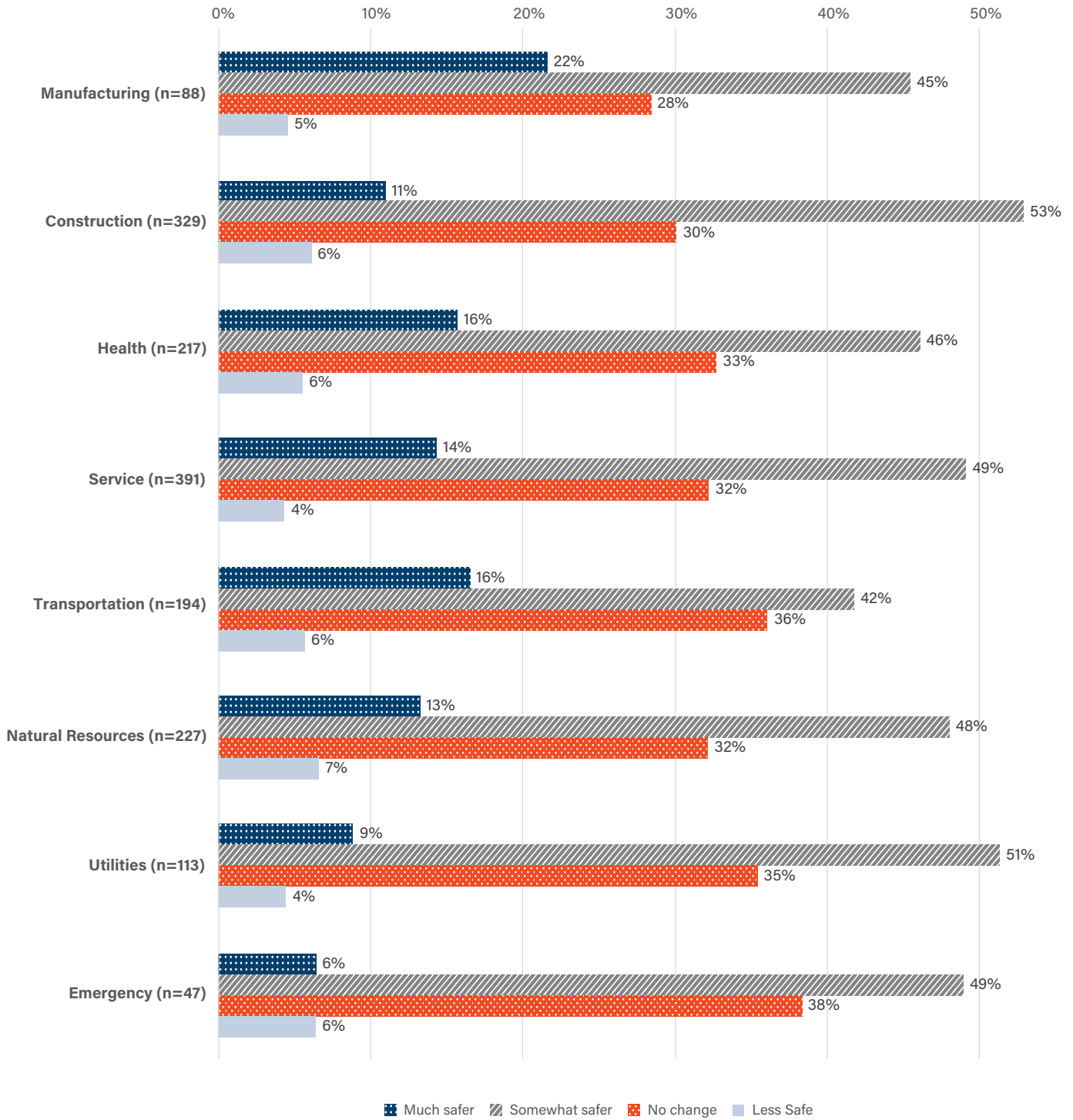


Figure C-28: How Safe Women Feel After Modifying Their PPE, by Sector (n = 1357)



Appendix D – Key Improvements Women Want to see with PPE

The following is a sample of the verbatim feedback received in response to the survey question “What would be a key improvement you would like to see with your PPE?”

D.1 Design, Fit, and Colour

- Designed BY women who work for women who work. Better shapes and sizes WITH NO PASTELS OR PINK COLOURS
- Designed for a better fit with womens bodies. Unisex doesn't work well for some PPE (i.e coveralls) as it makes it too large in some areas and too small in others.
- Don't make women's PPE pink, just normal colours
- Don't shrink it and pink it.
- Especially for clothing, the PPE must fit women shape. We are not build at all like men. Need room where required
- Even though it is custom fit the generalized cuts of the gear is specific to men.
- Everything needs to be slightly smaller or slightly lighter in weight
- Everything not being pink. Having actual options Not being so hard to find appropriate work gear
- Fit and cut – I wear a womens size 30-31 jeans but I'm curvy. I can't even get a mens size 36 to fit properly as either the rise is too short in the crotch, hips fit, but then there's a gap at the top and length is also laughable.
- Fit to smaller people and a variety of sizes. Often when there are options for women it is a 'one size fits all' approach and not all women are made the same size and shape. Just as there is a large selection of PPE sizes to fit men I would like to see the same for women.
- Fits in a way that provides appropriate coverage for the work I actually do, does not regularly fail during usage. Fewer steps in donning/doffing.
- Fits my body without a substantial amount of excess material. Loose is good, having a saggy crotch in pants not allowing me to safely wear a harness is not.
- Fits my chest without being over-sized everywhere else. Women's PPE that has the same features and functionality of the “same” men's PPE. For example - [REDACTED] women's pants are not flame resistant yet the “normal” pants are. Women's pants only have 1 tool belt, yet men's have 2. They charge us more women for worse-quality, less functional clothing. Also – no plus size options in women's clothes.
- PPE that isn't pink!
- Function over form. I do not want a pink pair of pants with no pockets. I want sizes available for me to try on. I want to be able to pay a reasonable price that is equal to the amount a man would pay for his gear.
- Gender neutral colours.
- Gloves and coveralls/boiler suits made for tall slim women. Any items designed for women are too short/small to fit; any design for men that fit in the length are far too bulky and heavy, gloves are impossible to do any tasks with.

- Have options for women and all our sizes and shapes. Never assume we only want to wear pink.
- Have products for smaller petite women, something that fits properly. I can find great boots why can't I get a great hi-vis vest or jacket, or harness. That's unacceptable
- Having gloves that fit my hands but still allowing me to use my hands during any season. Womans work pants are incredibly difficult to find that fit larger bodied women. Either the waist is too low or there is no stretch and I require a lot of mobility while at work.
- Higher quality! A lot of the PPE we're provided is basic/cheap/street quality stuff, rather than actual professional quality PPE.
- I am a 6' tall and strong woman. Men's PPE doesn't fit properly (as I am a woman) However, women's PPE always too short / small.
- I am a short but fit person. It is sometimes difficult to find something that is either too tight in some areas or I'm swimming in it
- I should not have to look like a man to do my job correctly. Pants, shoes and steel toe women's rubber boots in particular are very challenging. This should not be the case, look at the options for women's technical outdoor wear. The options are endless and fit a women's body correctly. We should not have to put up with a lack of options and ill fitting clothing. Proper design is really not that challenging.
- I want it to fit. And be of decent quality. Is that too much to ask?
- I would like to have clothing that fits me both in width and length and not have to cut off 6 inches or more of the legs.
- I would like to have proper fitting PPE, I sometimes feel like a child wearing adult clothing. I am afraid of since of my PPE, due to my shape and gender it can function differently that intended in extreme conditions.
- I would like to see normal coloured women's PPE (not pink) bought for the female workers so that we are comfortable and included. I want PPE that fits my curves properly and isn't too big. It would also be nice to see more selections for women for things like safety boots, we should get the same choices men do
- I would like to see PPE made in sizes for women. I am 5'2 and 120lb. I am not a typical size for a construction worker. I often can not find PPE to fit and when I can something "that will do" it often takes 3+ months to get and I miss out on the learning opportunity.
- It needs to be lighter and not as baggy. It is too heavy in weight.
- It should fit me and be comfortable to wear. Currently it is clunky and doesn't fit my shape. Really bulky and makes going the bathroom difficult
- It should look professional, even stylish in addition being effective to protect me and for my security
- It would be meant to fit a women's body dimensions; as a petite woman even the smallest mens/unisex sizing is too large.
- Items specifically for women so they fit properly. Aren't getting caught, causing trips etc.
- It doesn't have to be pink and floral (fine if some is, some people like that), make stuff that looks the same as men's work wear but with women's measurements
- Key improvement would be to provide PPE that is not focused on using pink and purple or other colors society has deemed as feminine to identify gear that was made for a generic female figure.
- Length. Normal length men's PPE is too short at the inseam. Tall PPE has the crotch hanging to my knees and the bottoms dragging on ground. It can also fit tight around butt/hips

- Lighter weight belly guards/ chest protectors. I have had the same one for 22 years it is heavy. As a women we have chests which is enough without a heavy belly guard also pulling on our shoulders and back and ribs
- Lightweight – clothing is heavy and makes me feel overwhelmed. Make it so that the benefits outweigh the hazards (ie eye protection versus being able to see) - this sounds minimal until you are in a security gate situation – opening doors, walking down stairs and directing traffic. The likelihood of a rock coming up and hitting you in the eye is there but limited. Fogged up goggles while trying to maintain 3 point contact with the stairs and watch for traffic while you can't see and tripping on those same stairs and falling into traffic is much more likely with steamed up goggles.
- Literally ANY improvement. Even when buying womens specific PPE, it is still ill fitting. No gusset, no room for curves. I have a small waist and large hips, everything is a single dimension rectangle and I have to drive significant distances just to discover those. Otherwise I spend twice as much trying and failing to source online from the USA.
- Make thing proportional to female bodies and needs. Not just smaller.
- More choice available. I also want choices that aren't pink and purple, because i don't want to look like a girl, I want to look like a pro. (not to say that girls aren't pros, but why does most of it need to be so feminized?)
- More durable PPE for men and women. Men's are semi durable and cheaply made. Women's PPE is absolutely horrible for durability, almost always wears out in less than half the time men's does and are made even cheaper, yet cost more. Women's PPE (mainly pants, coveralls, overalls, etc.) needs to be made with a different stitching pattern and thicker material in the thighs where they rub together and give out constantly. I am forever mending my pants, coveralls, overalls, etc. to get an extra bit of wear out of them, especially for the pretty penny I pay for them
- More female sizes in high visibility apparel, specifically vests and jackets, that do not include the conventional "hourglass" figure. If you have a "figure", typically women's sizes don't fit well (and you may have to choose a man's size).
- More inclusivity for women, and not just by making things pink.
- More range of stuff for women especially boots, winter gear, also need more range of motion in materials, as well as gloves are a big issue, the only safety glasses I've found that actually protect my face from flying debris, and sparks is mini ztek which are never supplied and 7.00 each to have them scratch and need a new pair. Bibs are something most wear in my industry and are very hard to find appropriate sizing. And I'm tall. Can't imagine how it is for the shorter girls. Biggest thing is work boots that are smaller than a men's 7 that are actually warm.
- More sizing & fit options. Mens sizing is very narrow so if you are curvy or have hips you have to size way up for it to fit so you're drowning in the rest of the garment, most women's stuff have pink, why does it need to be pink! I don't wear pink clothing why do I need pink PPE?
- More styles and options for women. Boots have gotten MUCH better then when I first started buying them 25 years ago, but gloves still leave things lacking. And often, in order for there to be space for breasts, the item is loose and baggy elsewhere, which causes new dangers
- More styles that fit women's bodies. Most specialized work wear only comes in men sizes and most of the times doesn't fit properly.
- More variety in styles and sizes while maintaining arc flash compliance Heavy hard hats push down on safety glasses multiplied by having a mask over your ears makes it uncomfortable after a long work day
- Most women dont want pink PPE. to find a nice style we typically have to go to the mens section. Also womens PPE should not equate skin tight "legging style pants" or overly baggy mens clothing, we just want normal fitting clothing and should not have to choose between sizes too big or the assumption that we are trying to highlight our butts/ other work inappropriate regions

- No more pink anything! More choice, lower prices, better fit. And all body sizes from xxs to xxxxl
- Not every woman wants all her PPE to be pink. I hate having to buy pink PPE simply because there is no other option
- Not everyone likes pink. Not all girls want pink steel toes boots. My safety pants do not fit me at all and are made for someone who is six feet tall. I'm five feet so I must roll. My safety vest is also gigantic.
- Not just ladies cuts for vests, jackets shirts and pants... but also larger sizes. Even if a ladies size is available I cannot use it because they're all very small. The largest sizes most manufacturers make are 16-18 and most times smaller. Forcing me to buy men's sizes. Bad fit makes for looser clothing in certain areas and that's bad around equipment, tools and machines.
- Not just women have small frames, some men as well. Gloves and safety glasses two areas where size matters.
- Not only am I female but I am also on the shorter side. The necks for most PPE are uncomfortable for me. The necks are much too big and way too tall. The neck of my winter coat (employer supplied PPE) covers half my head. Very uncomfortable. Shorter arm and leg lengths would also be great. Some PPE can not be altered without interfering with its protectiveness (think safety reflective striping around the bottom of legs).
- Pour ma physiologie et je suis UNE FEMME pas un homme (For my physique and I am A WOMAN not a man)
Translation
- PPE that is designed to fit a women's body. Women have curves, breasts, hips, thighs, butt. To get PPE designed for men to fit a women's curves it ends up way too big in length and around the waist, leading to excess material where you don't want it that can then get caught in things. PPE for women needs to be designed for women, not for men and then try to make it work. Also facemasks that fit men are too large for most women leaving them loose and gappy, providing no or little protection and the ones for children are too tight and can not be worn for 8 hours.
- Realistic Plus size line for women. The men's lines go to 4XL but are all so long and don't fit in the bust, butt it thighs. Some of the women's lines go to 2XL but are made tiny. We need bigger sizes
- Shape and size to fit women. Waist that's can be cinched Shorter arm length Jackets -with a bit more room around the hips (shoulder to hip ratio for women rather than men). Smaller Viz Vests Lighter steel toed boots
- Since most PPE is still following sizing charts from WWII, it's difficult sometimes to find appropriate PPE. I do not like seeing anything in pink. It makes women stand out even more. Having a good fit with multiple choices is much more important.
- Size and fit. I have a small head and although hard hats can be tightened to fit, the overall size is just too big. I love in a small town and there are only 2 styles of steel toed boots available in women's sizes.
- Size availability, especially gloves and steel toe boots. Also, lots of women's work wear has pink/purple accents, just want plain and neutral like mens options.
- Sizes available for a much broader spectrum of body shapes and sizes, REGARDLESS OF GENDER. There are many men or other genders that are also not being served by standard sizes. The additional sizes should NOT be marketed for WOMEN, but rather for body shape/size to be truly inclusive for all.
- Skinnier gloves made for women's fingers, fall arrest that doesn't pinch between the legs and clips up nicely on the chest. Lighter if possible because it's quite heavy for a small woman to carry around on her back all day. Safety glasses that are not warped and cheap so that you can actually see out of them properly.
- Smaller fit, less ridiculous colours for safety shoes - why must they be pink or entirely masculine and unattractive?
- Smaller high vis vests, PPE that is adjustable for pregnancy. PPE that allows you to use the bathroom without removing all of it.

- Smaller sizes readily available. My rubber steel toe boots are 7. Still too big for my 6.5 but I don't wear them often. Smaller sized PPE doesn't need to be gender specific. Smaller vests don't need to be pink or purple with stitching that accentuates waists. Proper pockets to store wallet and feminine products.
- Smaller sizes. For example, even the smallest high vis jacket (which the safety store special ordered) is much too large for me to actually work in. Fortunately for me, the majority of my work occurs inside. I believe this is because the jacket covered by my employer is a men's jacket and I wear a women's extra small. Additionally, coveralls for women would be lovely. Taking all your clothes off to go pee multiple times a day is very frustrating and I need to empty all my tools from my pockets first thing before each time I go.
- Smaller sizing options. I would also appreciate the PPE designed for women was not all the colour PINK.. some of us would like to just wear PPE, and not be singled out that the only correct fitting PPE is PINK
- Some thing that fits on my hips and my chest so when I bend and kneel it doesn't bind in those places and doesn't hurt my shoulder so much lighter weight would be nice I wear typically 10 to 20 pounds of PPE
- Something that fits my body shape, and is not designed for a box of a person
- Stuff that actually fits women... most PPE stuff on the market is made for women is really only for at home light woodworking and gardening in my opinion. It has never held up in my industrial construction job
- Designed to fit women's body and provide protection where women's bodies are vulnerable.
- Thoughtful and practical design for female body types (fit, cut, pocket placements, self-adjustable).
- Weight reduction; Reduce how much it weighs and how much it impacts or restricts movement.

D.2 Availability / Procurement

- I would like for there to be PPE brought to sites for women, ie. smaller safety glasses(monogoggles, all safety eyewear) and gloves (all varieties), coveralls designed for a womans body. Whenever the men complain they are accommodated, yet somehow the women are just complaining and "being too picky".
- I would like it to come smaller. You can get extra large welding jackets for say \$50 but a size small would be \$100 because they aren't as common
- I would like more variety in my work clothes, pants and overalls and cheaper gloves or gloves that last longer.
- I would like my employer to provide women's fits as they provide men's. Men's fits leave me feeling less professional looking as movement- restricted.
- I would like to have women's specific PPE and workplace policies that ensure continued access to appropriately sized PPE when pregnant.
- I would like to see clothing items available for plus size women with voluptuous figures, as well as the option for those of us who are also petite.
- I would like to see PPE that is available in a variety of sizes and designed for women. Additionally, I feel that the PPE should match the job. It is challenging to do physical work when your gown traps in heat and you can't leave a room unless removing all your PPE to get a drink
- I would like to see that there are womens clothes that are just as easily accessible as is it is to buy men's. Work boots that are fitted for women (narrow foot sizes and smaller) I am not saying that there are no womens boots existing. But there are none like men's boots that have the same quality and time that has been put in to make such high quality boots. However, putting the time and quality and effort in womens boots does not mean for the prices to be any different.

- I would like to walk into a store and have some actual choice, when it comes to women's clothing and boots the options are limited
- If I can find something that fits it isn't in stock or is double or triple the price and less durable than the men's version. Even women's fit clothing doesn't usually accommodate a high hip to waist ratio or full bust so it still ends up being oversized. Helmets often barely fit on the smallest size setting.
- More fitted clothing and options other than coveralls. More options for women's boots that aren't pink. Better sizing charts and the option to swap clothing if initial fitting is off. Winter jackets that are still warm, but not super heavy and awkward to move around in.
- More inclusiveness in sizes/measurements for women. The PPE we are given is only in men's sizes/measurements. If I order based off of my exact measurements; the PPE sent to me will be the closest size that can be found in men's clothing.
- Offer female sizes that are tapered to female bodies. I shouldn't only be offered a mens small when I am a womens small. Something lighter and form fitting around hips and bust
- Should be attributed to an individual and fit right. Should not be available for everyone to use or not use appropriately. Should be free and not be an hassle to get for your size. Basic items that are one size fits all should always be available and we should not have to research or ask for several times. Running out of basic protective items that are one size fits all aren't an event we should run into often.
- Recognition this is a safety issue and not simply a fashion issue. It's an uphill battle with established PPE suppliers, even if your company is on board
- Sizes that fit that are the same cost as the standards available. It takes me months to order in steel toe rubber boots in my size (5 men's is the smallest I can order and they are still a bit big) plus I have to pay more for them
- That manufacturers of PPE don't just make smaller versions of their PPE but take into consideration the difference in body shapes. That in particular includes the chest area. As well as the crotch / groin area.
- The fit is pretty big. It's EXTREMELY difficult and stressfully to find work cloths in my size. I'm 5'1" and 120lb and work as an ICI electrician. Finding canvas clothing for me to wear onsite that matches my co-workers is extremely hard and I never find it in stores. Also I have to wear my hard hat on the tightest setting and it doesn't really hold onto my head properly still. It's awkward to have to specially request a smaller hard hat, they rarely have them on hand.
- To have access and not have to bear the cost.
- To not have to order women's PPE online. I want to touch it, feel it, try it on in the store just like the men can!
- Understanding that there are still significantly more men in my industry than women, having more selection of PPE specific to women would be a huge improvement. Simply taking CSA approved footwear into consideration - I need a boot, not a shoe. The majority of options for women are shoes. Moving into the boot category when you go into a retail store, there are 5 or 6 options to select from in a shorter boot and even fewer in a tall boot. Meanwhile, there is an entire wall of options for men in the same store. Often it comes to a sacrifice of picking the one that will work the best rather than being able to find one that is going to be comfortable and durable.
- Women's PPE should be made to withstand the same conditions as men's. I have done one of the most physically demanding jobs that coal mining has to offer, and had to do it in poorly fitting gear that added unnecessary bulk and weight while hampering my movements.
- Wider range of size options tailored for above or below average body parts. For example, narrow gloves with long fingers, safety glasses for wide heads, narrow ear canal ear plugs.
- Head protection, eye protection, gloves, safety boots, etc. are often not available in sizes appropriate for my body (or have very limited availability and are difficult to get in remote locations, or are more costly).

D.3 Protective Clothing

- Coverallsllllsssss. They do not work for women with any kind of curves. I have to get two sizes bigger than I need (in mens) just to fit over my waist and bottom. But then the legs are way to baggy and too long. An elastic waistband would be such a perfect solution
- Coveralls and winter parkas need to be designed for women, the parkas are men's sizing and bulky. It is very hard to pull coveralls off in a porta potty on a well site.
- Coveralls are horrible for women to use the washroom. We sit. Men stand. The arms always touch the floor and is tough to get off (like dislocating a shoulder so many times a day). Would be really nice to have pant/shirt combo instead. And don't bother with the detachable coveralls....a thick strip of velcro around the waist is bulky, uncomfortable and ruins and undergarments from the abrasive velcro. Same goes with vests. I always have to supply my own because men's Med is the smallest anything comes in. Same for hoodies, jackets etc. The only thing that fits me is the coveralls. I have to remove radio, hoody etc everytime I use the washroom as ladies need to fully peel down covvies. At other mines, I've always had the option of pants/shirt for ladies. But then sometimes "ladies fit" means a big butt and hips and they don't fit proper for some of us smaller ladies.
- Coveralls that allow me to use the washroom more easily without the sleeves touching the floor.
- Coveralls that fit better or be allowed to alter the pair I have signed out. Current ones cover me like a blanket in some areas and the legs are so long they drag on the ground when I walk. They go to get laundered and don't come back to the same person. It would be nice if they had some reflective something on them as well (for safety).
- Coveralls: more diversity in the length of pant legs. I am 5 foot three. I typically wear a small or medium size coverall or bib overalls. The bottom of the pant leg is constantly being walked on, Snagged because it is too long, and generally looks sloppy. I wish I did not have to roll up or duck tape my coveralls around my boots.
- Scrubs that aren't unisex so I don't have to provide my own undershirts because if I bend you can see down my shirt. Maternity options as I am pregnant and nothing they have available fits me. I wear much larger sizes to fit my belly which makes it uncomfortable and looks unprofessional
- Fire resistant outerwear is terrible. It is heavy, much to large and ill fitting
- Fire Resistant Pants, shirts, jackets do not fit properly, especially around the hips. Sleeve length is either too short or too long. I often feel like I'm swimming in my clothes. FR clothing is heavy so the extra unnecessary fabric is burdensome.
- Fire retardant coveralls that fit short women
- Extra sizes. Our chest to waist ratio is often different. But, if you have a bigger chest, you have to choose coveralls that could be much too large for you to accommodate the chest.
- Fitted coveralls with different design to make going to the bathroom easier, boots with a wider range of womens sizes.
- For coveralls (for example), I would like to be able to have a set that isn't too long. In order to for them to fit my hips, they're very long because they're designed for men. Having more choices in boot styles and fit would be nice too. I have women's boots, but there are not many choices.
- Highvis work wear is ALL men's, and mine fits horribly. Its huge in the shoulders but tight on my hips and rides up during the day to my waist constantly.
- Coveralls with zippers for modesty purposes (and it's easier to go to the bathroom). A cut of coverall with more room for boobs and bums.

- Gowns should have snug wrist cuffs. The sleeves are always far too long for me and if the cuffs aren't snug enough they either don't fit comfortably under my gloves or slip over onto my hands. I constantly feel like pushing up my sleeves
- Gowns that don't drag on the floor or against my legs.
- Having coveralls/jackers/parkas that are available in women's sizes. My current pair of overalls is too long (due to the available men's sizes) and must be rolled up. This occasionally limits mobility. Additionally, to find a jacket that can fit over the chest the size of the waist/arms is so long that it becomes impractical.
- Hi Vis Vests that are more tailored. I have to use an XL because anything smaller doesn't fit across my chest, but it is huge everywhere else. So I tend to just wear the hi-vis suspender straps
- High visibility safety apparel fitting to women (torso, shoulder, chest)
- I want a women's vest with decent size pockets that actually lasts. And I want gloves that fit and are actually good for Canadian winter, and also durable.
- I wear a very heavy work vest. There is lots of pockets. I would like there to have more room in the breast area. Also if it was made of a light weight material that is waterproof. It gets very heavy when it is wet.
- I wear coveralls. I'd like a two piece option to make it easier to run to the restroom instead of unzipping and having it all drop to the floor
- I would like to have coveralls that fit around my chest and hips - the ones that do fit there are very long in the arms and leg length.
- I would like female specific spray suits, I am average height but need to wear mens large as the medium has too short arms.
- I would like to see options for women in FR wear. If you log onto any website selling FR workwear there is about one women's option for every 100 men's options. Men's clothing does not account for hips or breasts and usually sits extremely low in the crotch area making it difficult to walk. On top of that my employer picks the most stringent safety codes so when I do find coveralls they are often tested to those only the men's are. For example I reached out to Big Bill because their men's met code but their women's didn't even though they had the same material specifications and they said essentially they just weren't going to spend the money getting both certified but they were the same. My work wouldn't let me purchase them though because they weren't certified.
- I'd like my coveralls to be altered. Or a Fit of coverall to be supplied with extra rom for boobs and bums. Coveralls with zippers for more modesty and ease of going to the washroom. Smaller gloves. Hard hats with ponytail holes
- I'd like to see more variety when it comes to safety vests/ jackets in particular. For example my boss has given me and the guys all the same sized vests and they were stiff and wouldn't give or stretch around the chest area so it made me look funny. I haven't worn it at all so now I do t have a safety vest only a jacket that doesn't fit my breast area as well. I'd like to see vests and jackets with more flexibility and preferably zippers.
- If I can't have "female" shaping, side zippers would be amazing!! Then I wouldn't have to go up a size to fit my hips and then have too much room in the chest/shoulders
- Improved fit in clothing. Better pockets Less velcro Serious safety vest with good pockets n proper fit Hard hats need better design and materials. Rather than coveralls I'd appreciate a functional 2 piece top n bottom. Steel toe boots that breathe. Gloves that fit. End the gouge rip off "corporate pricing" for independent workers and people who buy their own
- Improved sizing and fit, especially for things like high visibility vests and things that are often "one size fits all"

- Lab coats which fit women with hips; I can never button up my lab coat fully, or if I size up the top part is huge on me.
- Ladies coveralls, ladies work gloves, and earplugs that fit properly. Also that you don't have to wait for months for them to be ordered.
- Make butt flaps in all rain gear, winter coveralls, arctic suits, regular coveralls, etc and also provide in women's sizes. And not pink. Women's PPE does not need to be pink.
- We really need to be maternity options for coveralls and labcoats. It is not safe to just size up, it covers your midsection but then is too large everywhere else and snags on things.
- Medical gowns are like raincoats on the inside. They don't breathe and so we sweat a lot. Breathable gowns that still protect would be better.
- More breathable options with equal or better protection for isolation gowns; it is like wearing a hot plastic garbage bag which makes us uncomfortable and can easily cause us to overheat which leads to errors in judgement, lightheadedness, syncope etc. Gowns that are appropriate sizes for women, we are not all an XL and for the more petite women this can cause range of motion issue (tripping hazard, sleeves getting caught)
- My chainsaw pants have adjusting straps but there is too much fabric and even at the tightest it folds out and gets in the way of the saw, I would like smaller tighter pants. Also a smaller highvis it also gets caught
- Pants are not designed well for being fitted to my PPE duty belt. The process for vests should not take so long. gloves are hard to find to be able to fit and perform my job appropriately
- Pants that fit curvy figures shirts that are longer in length
- Pants. Making actual pants for woman's bodies. Nothing ever fits in the hips and waist. We have a uterus not a package between our legs. I usually have to unbutton my pants while driving or sitting because it's so uncomfortable.
- Provide arc flash bras or bras with natural fibres only, more than two would be nice. Arc flash bras that have sizes other than small, medium and large. The sizing assumes if you have a small frame your breasts are also small and vice versa. We have a point system for ordering FR clothing at my place of employment, and the women's clothes cost more points than the men's, so if you want women's clothing you get less than what you actually need for the year. The women's sizes from our FR provider are inconsistent, so for example if you order 3 pairs of size 34 pants, one might be a 34 and the other two might be a 32 and a 38. Women's FR clothing is made with the assumption that women do not have broad shoulders or any muscle mass in their legs or shoulders, so they never fit me anyways.
- Rain gear in women's sizes! And not just light outdoorsy stuff, the heavy duty industrial, wear it on a fishing boat in the ocean kind of stuff. I'm 5'2, nothing fits right, and even if I cut off sleeves and legs, things are so loose and bulky I risk getting caught on everything.
- Shirts made to encompass womens chests, and pants that have space for hips
- Shirts that are a little longer. Cargo pants with pockets on both sides not just one side. Pockets that are useful and you can actually put a wrench or a tampon in without it hanging out. Breathable clothing
- Shorter coverall lengths, shorter torso in coverall so crotch isn't at my knees
- Shorter gowns, masks for smaller faces, gown is not an 3 XL – [REDACTED] protective suits in my size readily not available and not have to get logistics to order my size- I'm 5'3"
- Safety vests that do not get caught on equipment or machinery. Better airflow for temperature regulation. More breathability in fabric selection.

- The coveralls I sometimes wear are not always suitable for me. I am an average size small and the ones that are provided awful. Small in the crotch and long in the legs. Poor design to say the least. My body type is normal and average as I said above. Not sure who design these coveralls.
- The cut is really hard. The crotch is always too load making pants difficult to wear.
- The cut of the clothing is made for men so the leg length and arm length is always too long. It is untimely and cumbersome removing full piece coveralls to use the washroom. The rise in coveralls is often too long and safety jackets are a terrible fit
- The gear needs to fit me like a glove a second skin if you will so I can move quickly when needed at work. It's life and death for us flaggers
- The sides of my Safety Vest are way too wide. There are extra large sizes but not a real small size, it's too lose and it gets stuck everywhere. The standard safety glasses are also big for my face
- Turnout gear better fitting for women. And the width of turnout boot openings for smaller calves. My pants are fairly slim which makes it hard to push down over the openings of the boots.
- Two-piece options for coveralls, and winter gear options in smaller sizes.
- When it comes to lab coats I wear men's sizes which fit better than women's. Women's lab coats are designed with curves that do not match my body shape at all. Have to wear a bigger size of men's because I'm shorter and a bit wider than men. but its a better cover than women's offer. Always have the cuffs rolled up, the body is baggy and long. But not overly sexy feeling like the women's...
- With regards to the [REDACTED] protective type suits. I'd like them to fit better so I don't get hung up on door knocks and other hazards as I walk by. For respirators it would be nice if they designed fit mechanisms that didn't pull your hair or tangle long hair into the tightening straps.
- Woman specific coveralls. Hard hats designed for hair. Even the so. Called female ones are the same shape, different colour. Glasses that don't fall off because my face is the size of a perfectly normal wan. Coveralls I can go to the bathroom in without having to take them off. Boots that are actually made for a woman's feet and not just a smaller version of a mans
- Women's clothing being altered to the right height and with curve embracing contours and materials. Coveralls designed for pregnant women and offered to companies for when women are pregnant and still at work.
- Women's coveralls rather than generic unisex coveralls - so that the crotch isn't halfway down my legs, better electrical protective undergarments - for larger breasted women.
- Women's coveralls would be nice. The ones I wear now are way too large in the fork and hang down a little making it hard to climb or make large steps.
- Womens fit in the standard coveralls we wear - as the [REDACTED] stand out in a crowd and are a heavier material, which is less comfortable in some situations. Men's crotch is often too low making climbing and some maneuvering difficult
- Women's specific shape/sizing - shrinking men's clothing/PPE and calling it "unisex" is not adequate. My "unisex" fire-resistant clothing is constantly too long in the crotch, too large in the shoulders, and too small in the hips; the ill-fitting clothing causes chafing, hinders my movement, and makes me look unprofessional.

D.4 Fall-arrest Harnesses

- Climbing gear is good now but it took a few weeks to get one because what the tool crib had was “unisex” but if someone had breasts at all the straps wouldn’t buckle across there. It would be nice to have future female staff be able to just go to the tool crib and have something that fits instead of the same embarrassment I had.
- Fall protection designed for and tested on women is not only available but required.
- Fall protection harnesses do not fit women properly. My arms slip out easily.
- Harnesses I don’t need to strip down to baselayers to get on in -40.
- Fall arrest harnesses that cross in the front and the back, instead of two parallel chest straps.
- The double lanyards are very heavy. And awkward.
- Unisex should not be a size category for fall arrest
- Weight distribution during strenuous activity. Better placement of shoulder and chest straps for women to avoid crushing the breastbone and making it difficult to breathe! Such as our SCBA straps which do exactly that which is counter productive on a device which is meant to enable us to breathe.
- Easy on and off fall arrest harness for bathroom access. A harness that doesn’t cost more just because it’s labeled female.

D.5 Gloves

- Fingers that fit like a second skin and gloves warm enough in winters.
- Gloves that fit and aren’t pink and purple all the time. I don’t need to stand out anymore then I already do.
- I have no desire to be given pink gloves. Nothing against the colour specifically, but it is just silly to make thinks for women ‘pink’ Also, specifically with gloves, some men have smaller hands and would like the smaller gloves but the colour prevents them from wearing them.
- Glove that can keep our hands warm during winter sampling. Glove become frozen and can’t be moved at all once it’s negative temperatures. And in minus 50 weather it becomes very difficult and painful to sample.
- Gloves in smaller sizes.
- Gloves made for a woman’s hand.
- Gloves that don’t rip.
- Work gloves for adults with almost children’s sized hands and short fingers.
- I would like to see more versatility in gloves more women fit I have to wear bulky gloves and it is hard to find gloves for fine work In my size. also I would like to see more women work boots being made in different styles and fits like mens
- My biggest issue is gloves that fit. I often have to wear too big gloves which means I lose dexterity and have an increased risk of getting my gloves caught. I also struggle with coveralls and ████████ (protective) suits because I have to wear a large size to accommodate my hips and breasts. Then I’m swimming in too long of sleeves and pants, and again have to cuff my coveralls.
- Peut etre trouver des gants qui fait plus respirer les mains (Maybe find gloves that are more breathable for hands) (Translation)
- Gloves that actually fit. Specifically the PVC coated gloves that are good for handling chemicals.

D.6 Eye, Head, and Foot Protection

- Safety glasses that are not oversized. Hard hats that are smaller not just the inside adjustment so the hat is not like a bobble head all day.
- Glasses that fit smaller faces. Hard hats with pony tail holes in the back.
- Eye protection that fits.
- Hard hats - improvement on the insert for comfort Womens gloves for all tasks Safety glasses both everyday and prescription- smaller faces. This is applicable for other nationalities with smaller facial frames
- Hard hats that can adjust smaller for better fit (and not slide around on my head) - safety boots that are smaller but has wider width available (small feet are not the same as narrow feet) - lightweight safety eye glasses for low nose bridges - safety ear plugs for smaller ear canals
- Hard hats that for a bit better. Slide off my head because of my hair as I generally only wear it for short periods of time.
- Hard hats to allow women to comfortably tie hair up which ensures long hair will not get caught on equipment and cause injury in the case of an accident. With current designs it is difficult due to sizing being tailored to larger heads and adjustment dial gets in the way of this. Hard hats to be made for smaller heads to ensure safety requirements are met.
- I would like better working boots. They hurt everybody's feet at my job.
- I would like boots that fits comfortable. Wide enough for my feet but the correct size. Currently I have to wear mens but, as they don't come in a size small enough, I wear a 1/2 size to big. I would also like coveralls that fit properly in the body length. My current ones, that I am used to, hang down mid leg.
- I would like more selection for boots that fit - smaller sizes, but also rain boots that fit wider calves.
- I'd like boot sizes to vary more for women. I am a size 13 ladies and have to wear a size 10 mens because of the lack of availability for sizing in womens boots. The weight difference is significant and I wish different sizes were available
- I would also like improvements to women's footwear. I have big feet and often get sized into men's boots which then are uncomfortable width wise. I really wish a company like ██████ footwear would be approved for use in Canada or another company like that would open in Canada.
- We are only issued CSA-approved boots that come in unisex size. Almost every woman I have worked with has an issue with these boots (including myself) and has to purchase their own. Women have small feet and unisex sizing is still too large.
- My hard hat is HUGE but they seem to only come in standard sizes. When I use the tightener inside, my hard hat wobbles around on my head like I'm a bobblehead.
- Hard hats that can fit braided hairstyles or accommodate Afro hair.
- Prescription safety glasses with built in side shields that are narrow enough to properly protect my eyes. All glasses are too wide for my narrow (child like) face. The safety boots have come a long way in the past few years but still have a ways to go. Men have better selection of better quality made safety toe boots, don't come in small enough sizes for women, and they are very heavy.
- Weight of safety boots for women
- Weight of the boots should be lighter. I am petite with back issues. Heavy boots can give me back pain all day from wearing it even for a few hours.
- For steel toed shoes, it would be nice if the weight wasn't so heavy. My knees hurt after wearing them for extended periods.

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CSA Group Research

In order to encourage the use of consensus-based standards solutions to promote safety and encourage innovation, CSA Group supports and conducts research in areas that address new or emerging industries, as well as topics and issues that impact a broad base of current and potential stakeholders. The output of our research programs will support the development of future standards solutions, provide interim guidance to industries on the development and adoption of new technologies, and help to demonstrate our on-going commitment to building a better, safer, more sustainable world.