STANDARDS RESEARCH

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

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RSI Day Weekly Webinar Series

Occupational Health Clinic for Ontario Workers

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Overview of today's talk

- Definitions and key concepts: sex vs. gender, anthropometrics
- Background and context: why is this an issue?
- Overview of the project
- Key findings from the literature review and environmental scan
- What we learned from Canadian women about their experiences with PPE in the workplace
- Recommendations that emerged from the project

Sex *vs*. Gender

Sex

- **biological** concept
- biological and physiological attributes that distinguish female from male from intersex from hermaphrodite

Examples:

- different reproductive organs
- variations in body size and shape
- differences in the proportion of fat to muscle
- differences in the types and levels of hormones circulating in the body

Gender

- **social/cultural** construct, **identity**
- societal factors that shape identities, roles, behaviours, stereotypes, norms and attitudes, and power relationships

Examples:

- Cis-female
- Cis-male
- Transgender
  - Female-to-male (FTM)
  - Male-to-female (MTF)

Anthropometrics

Anthropometrics: branch of ergonomics that involves the study and systematic measurement of variability in the human body

Static & Dynamic Measurements: dimensions, proportions, shape, strength, mobility, flexibility, working capacity

Data is collected in 1, 2 or 3 dimensions via:

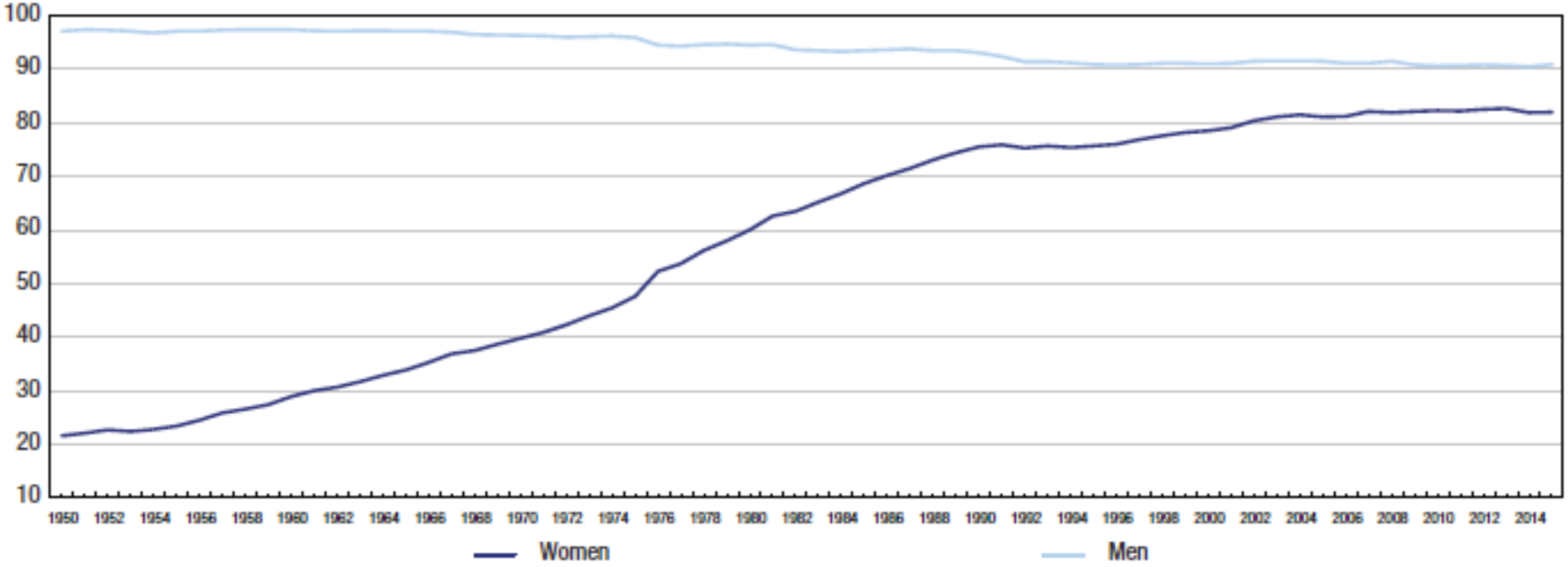
- Direct manual measurement
- Photogrammetric methods
- Scanning methods

Anthropometrics

- Collection of representative data is expensive and time-consuming
  - tremendous variability in data quality and quantity
- Some countries have undertaken national surveys
  - most collected on military, not civilian, populations
  - Canada collects limited data via Canadian Health Measures Survey
- Sources of anthropometric data
  - World Engineering Anthropometry Resource (WEAR)
  - US National Health and Nutrition Examination Survey (NHANES)
  - Anthropometric Survey of US Army Personnel (ANSUR)

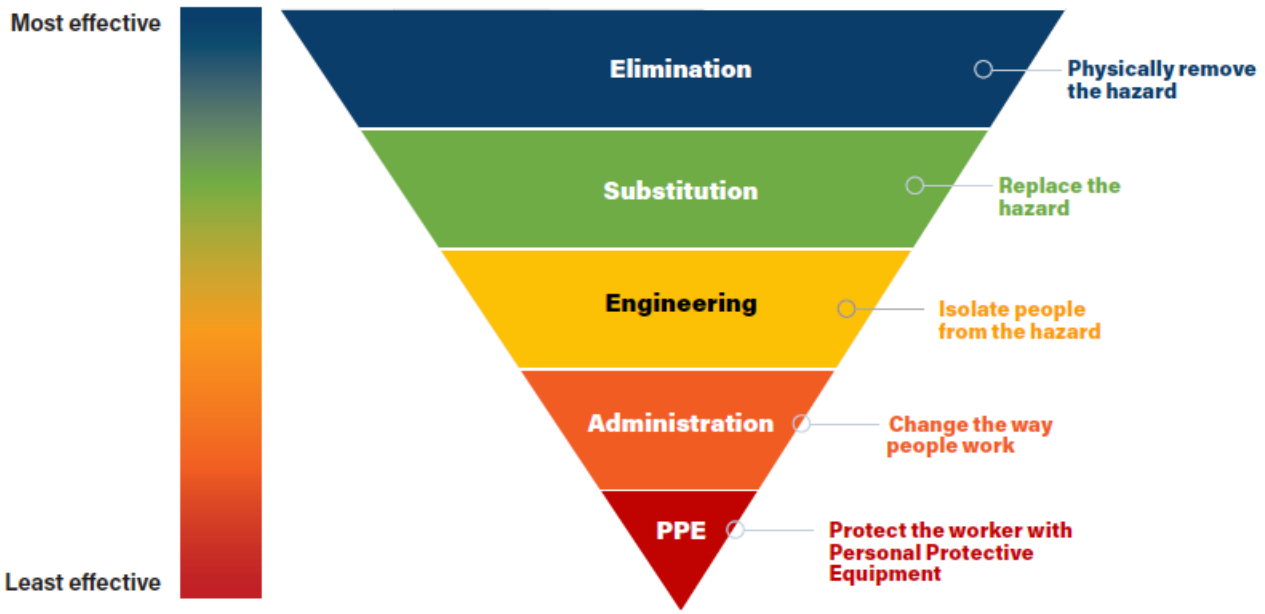
Why is this an issue?

Labour Force Participation by Sex (1950-2015)



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.

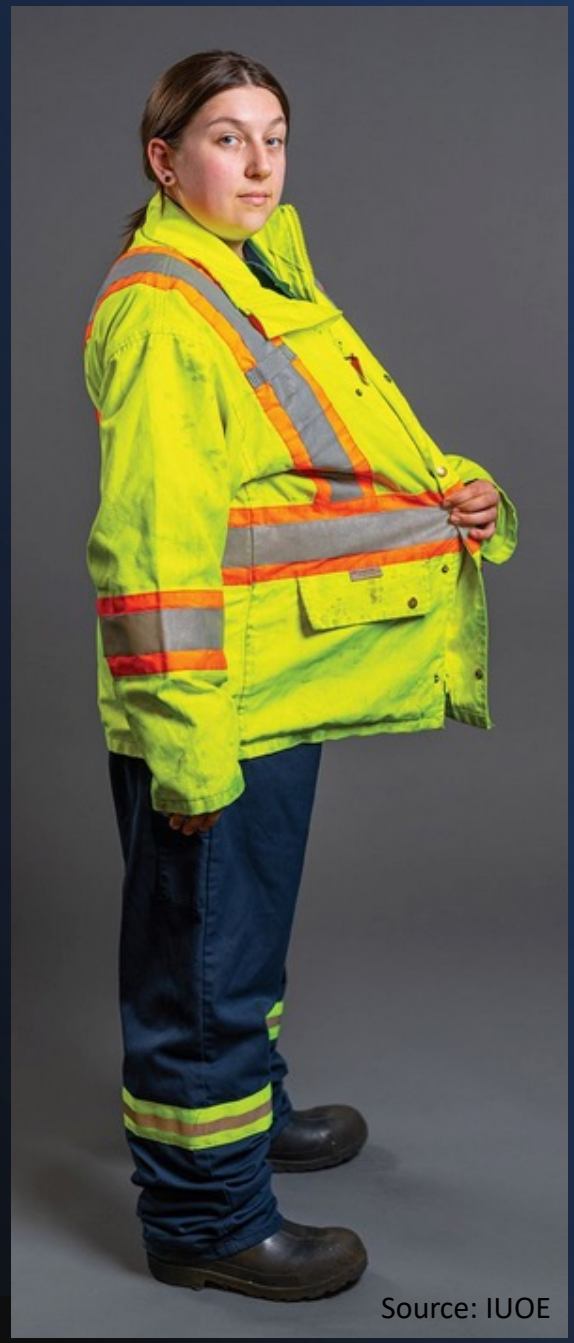
Why is this an issue?



- PPE often seen as simple and inexpensive way to control exposure
- Certain types of PPE must be worn continually in some jobs
- Poorly designed and poorly fitting PPE can contribute to workers being injured in the workplace

Why is this an issue?

- Women report a range of issues with fit, comfort, and availability
  - Ill-fitting protective clothing, gloves, and boots
  - Loose or poorly fitting safety harnesses; limited range of available sizes
  - Increased exposure to safety hazards
  - Lowered productivity
  - Lack of integration between different types of PPE
- Inadequate fit → women adjusting or altering PPE
- “Women-specific” PPE does not offer same functionality and level of protection


Source: IUOE

Overview of the Project

The use of sex- and gender-related anthropometric data in the design of PPE

How jurisdictions address the unique PPE needs of women in the workplace

Perceptions of how well PPE meets safety performance and functional needs

Literature Review

Purpose: to examine if academic literature exists on anthropometrics related to gender in the design of PPE

Methods:

- 5 bibliographic databases
- Initial search: >1000 articles
- Final search: 167 articles
- Snowballing search: 20 articles
- Total screened: 187 articles
- Full text review: 142 articles
- Qualitative review: 70 articles

Search Terms

Initial Terms:
"personal protective equipment" and "personal protective device" in combination with terms such as "sex factors", "sex", "gender", "anthropometric", and a range of terms related to 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")

Additional Terms:
"occupation", "workplace", "design", "comfort", "fit", "size", "size differences"

Anthropometrics & PPE Design

Respirator design

- Critical design parameters: fit & comfort
- Historically based on military anthropometric surveys
- Significant differences in facial dimensions by sex and gender

Protective Clothing

- Critical design parameters: functional fit & freedom of movement
- Across a range of body dimensions, females were smaller than males and had a lower waist-to-hip ratio

Fall-Arrest Harnesses

- Critical design parameters: fit & comfort
- NIOSH: based on body dimensions and the harness sizing scheme in place at the time of study, approximately 25% of men and 30% of women would not be able to find a well-fitting harness
- Canadian study: for a given combination of body mass and stature, the charts did not select the same size of harness

Literature Review – Key Findings

- Anthropometric differences exist between the sexes
  - Women are not merely smaller, scaled down, versions of men
- PPE continues to be designed for “all workers” based almost entirely on male anthropometry
- Few studies are women-specific
- Survey-based studies: range of issues with fit, comfort, and availability
  - Limited range of available sizes, increased exposure to safety hazards, lowered productivity, lack of integration between different types of PPE
- Lost-time injury statistics: sex and gender differences in rates of injury and disease
  - Lack of research on how inadequate, ill-fitting, or poorly designed PPE contributes to these observed differences

Environmental Scan

Purpose: to identify policy instruments governing the use of PPE in the workplace

Methods:

- 14 Canadian jurisdictions, 3 international jurisdictions
  - Australia, United States, European Union
- Sources of information: official website of OHS regulator, OHS legislation portals (e.g., CanLii)
- 12 cross-cutting tables
  - examine similarities and differences
  - identify gaps in regulatory approaches

Scope of the Scan

Search Terms:
"personal protective equipment", "PPE", "protective device"

Policy Instruments:
OHS statutes and regulations, policy documents, practice guidelines

Categories of PPE:
head protection; eye and face protection; limb, body and hand protection; respiratory protection; foot and leg protection; fall protection systems; flotation devices

Environmental Scan – General Duties

- **Employer duties:** ensure PPE provided (9), provide PPE at no cost (7), ensure workers are trained (10), ensure PPE is suitable and fits properly (6), ensure PPE fits properly and can be used without adverse effects (1), make alternate arrangements if PPE not protective or creates a hazard (4), immediately repair/replace defective PPE (6)
- **Worker duties:** provide certain types of PPE (2), wear PPE provided by employer/required by regulation (11), report defective PPE to employer (9), not use PPE that is unable to perform the function for which it is designed (4), take reasonable steps to prevent damage (4)
- **Supervisor duties:** ensure that PPE is properly worn when required (4), ensure appropriate PPE is available to workers (1)
- **Selection, Use & Maintenance:** not create a hazard or endanger worker (5), must provide effective protection (3), be compatible with other PPE (5), alternatives used if PPE creates greater hazard (2), must be safely and properly fitted by qualified person (1)

*Number of jurisdictions scanned = 14

Environmental Scan – Specific Requirements

- **Head:** workers must wear headwear appropriate to the hazards (8), “approved” protection (2), meet CSA standard (10)
- **Eye & Face:** employers must provide PPE appropriate to hazards (6), workers must wear “approved” protector (2), must fit properly (eyes – 4; face – 2), meet CSA standard (10)
- **Limb, Body, Hand:** employers must provide and workers must wear (9), “approved” protection (2), properly fitting (4), meet CSA standard (1)
- **Respiratory:** fit-testing (14), employer must provide PPE that is proper size for worker’s face (3), other PPE must not interfere with respirator seal (2), fit test performed when changes to user’s physical condition (1), meet NIOSH criteria (3), meet CSA standard (5)
- **Foot & Leg:** appropriate/suitable to hazard (9), worker responsible for providing (2), meet CSA standard (8)
  - Guideline on assessing risk of high heels (1)
- **Fall protection:** properly fitted (5), compatible components (2), meet CSA standard for full-body harness (6) or body belt (5)
- **Flotation:** have sufficient buoyancy to keep worker’s head above water (7), appropriate to hazard/circumstances (2) or weight (1), meet CAN/CGSB standards (life jackets – 4; PFDs – 3)

*Number of jurisdictions scanned = 14

Survey of Canadian women

Purpose:

1. Gather information on women's experience using PPE in the workplace
2. Examine their perceptions of how well their PPE meets their needs

Methods:

- Confidential, online survey conducted by RKI: Research+Knowledge=Insight
- Participants recruited via 21 partner agencies & associations
- Eligibility: only those who identified as women and those who wore PPE at work
- Survey open: January & February 2022
- Total # of usable responses = 2,752

Who Responded?

- **Average age:** 40.8 years (range: 18 to 69 years)
- **Sector of employment:** Service Providers (33%), Healthcare (19%), Construction (18%), Natural Resources (13%), Transportation (11%), Manufacturing (7%), Utilities (7%) and Emergency Services (3%)
  - public sector (49%), private sector (43%), not specified (8%)
- **Size of organization:** > 500 employees across Canada (60%)
- **Tenure of employment:** > 6 years (52%)
  - average length of employment = 8.9 years
- **Membership in a Trade:** 24%
- **Highest level of education:** < Univ (58%), Univ+ (42%)
- **Ethnicity & Minority status:** cis-female (98%), White/European (76%), Indigenous/First Nations/Metis (6%) LGBTQ2S+ community (6%), physical or mental challenges/neurodiverse (5%)

Women wear all types of PPE and often wear multiple types at the same time

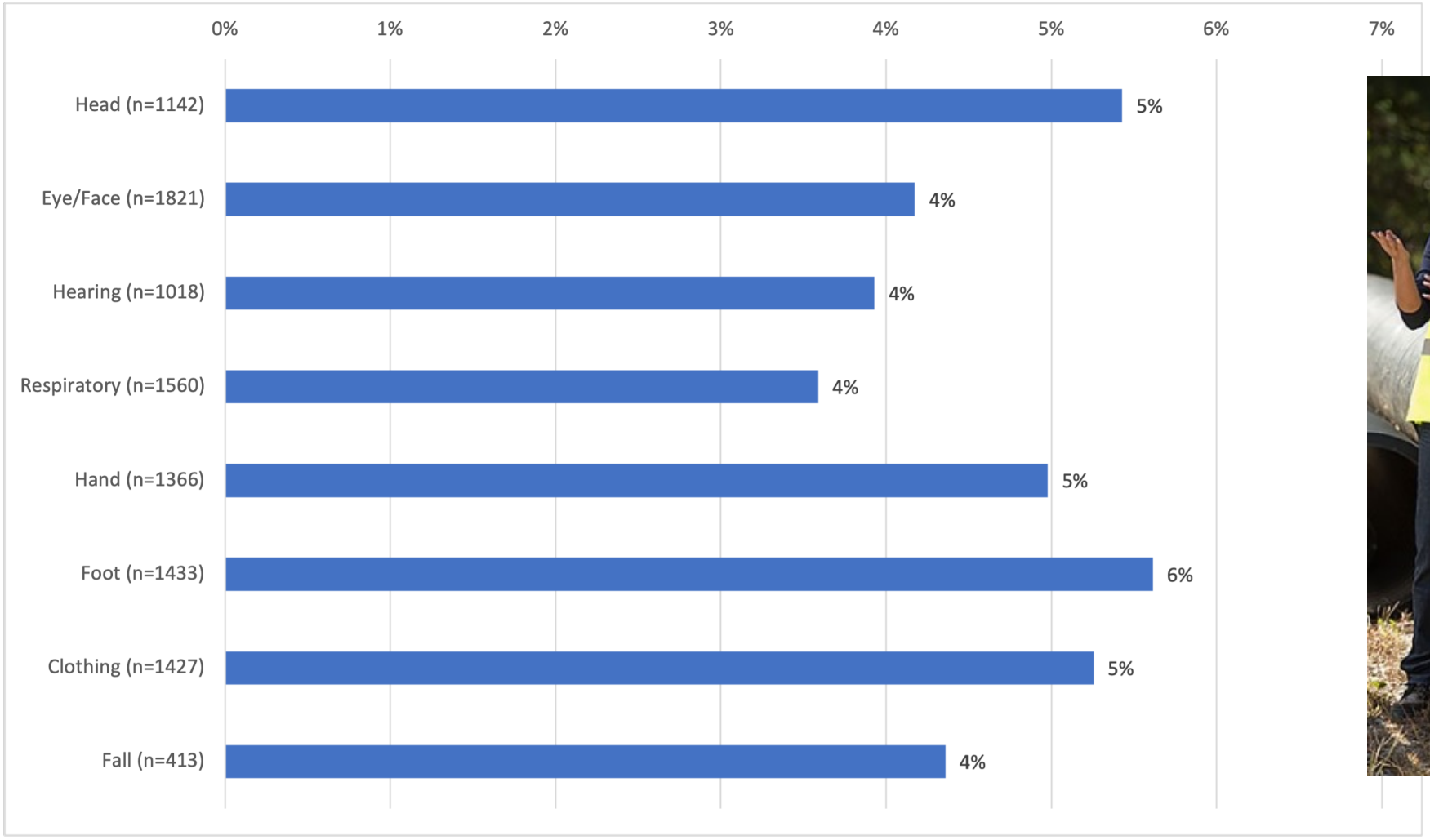
	TOTAL	Head	Eye/ Face	Hearing	Respiratory	Hand	Foot/ Leg	Clothing	Fall
Total number	2752	1143	1822	1019	1560	1367	1444	1428	414
Head protection, %	42	—	55	81	38	63	70	64	93
Eye and face protection, %	66	88	—	88	67	81	79	82	92
Hearing protection, %	37	72	49	—	36	57	63	58	86
Respiratory protection, %	57	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

Type of PPE that women wear varies 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

Few wear PPE specifically designed for women



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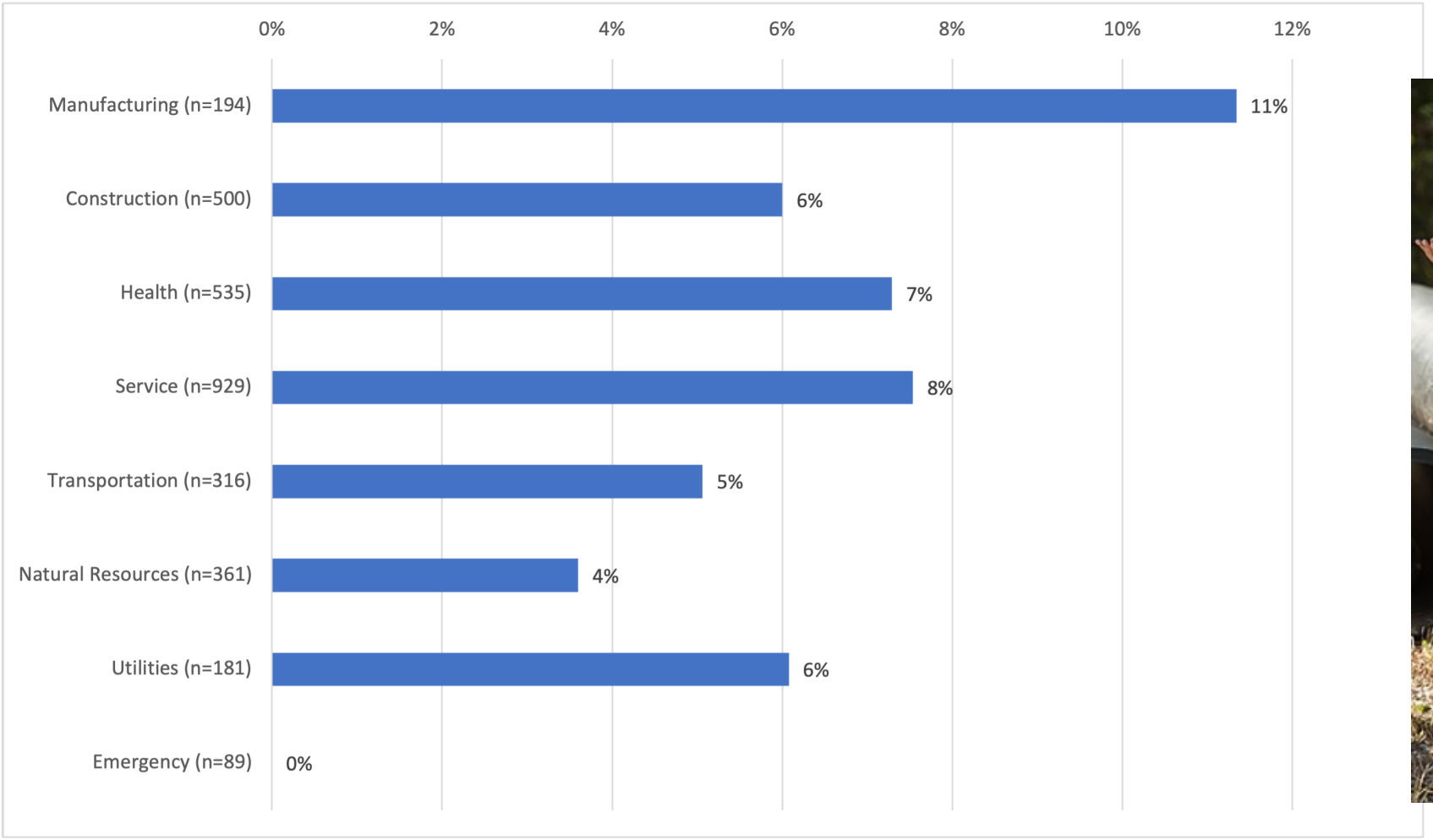
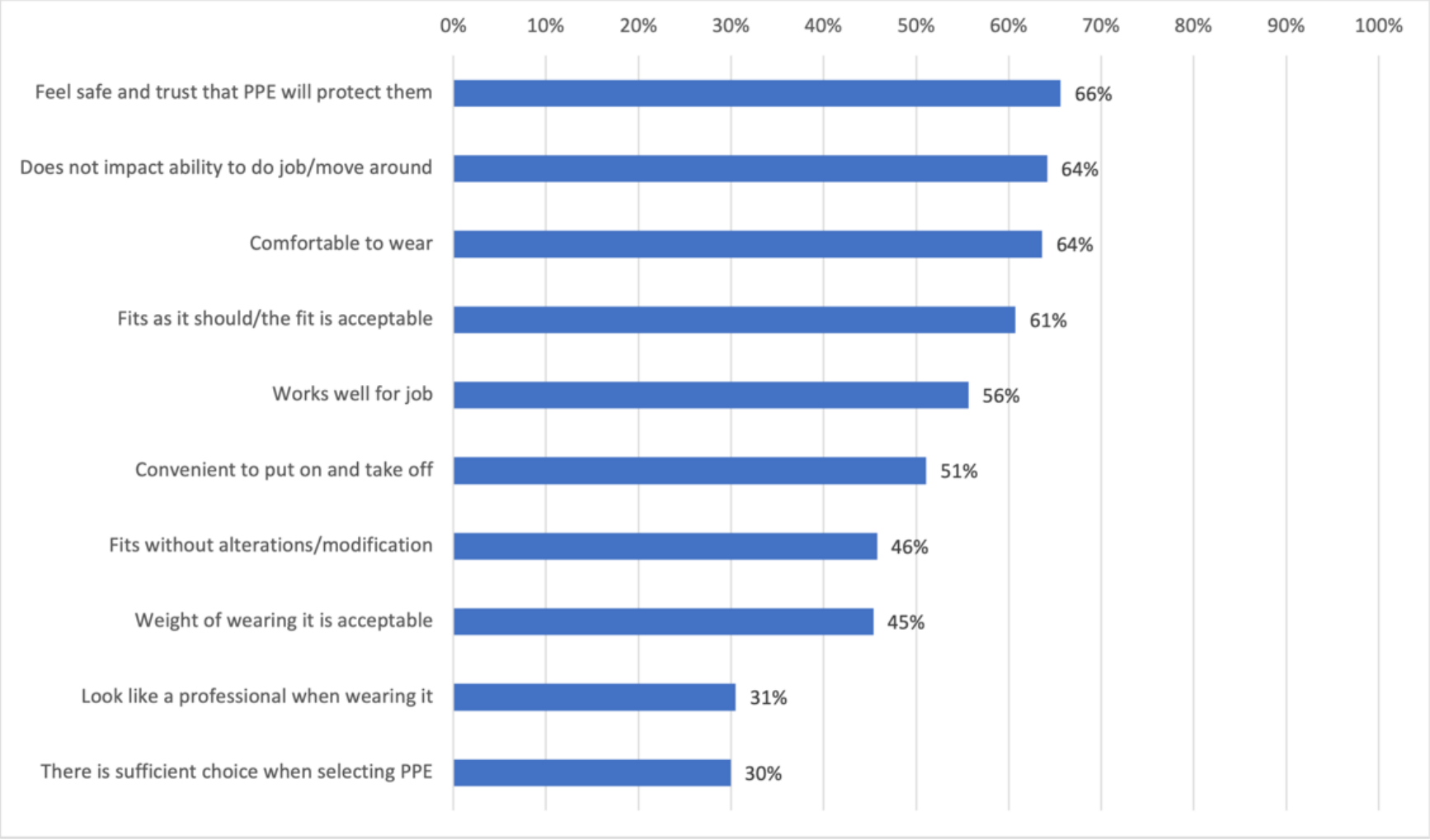


Women want PPE that fits, that is comfortable and that keeps them safe



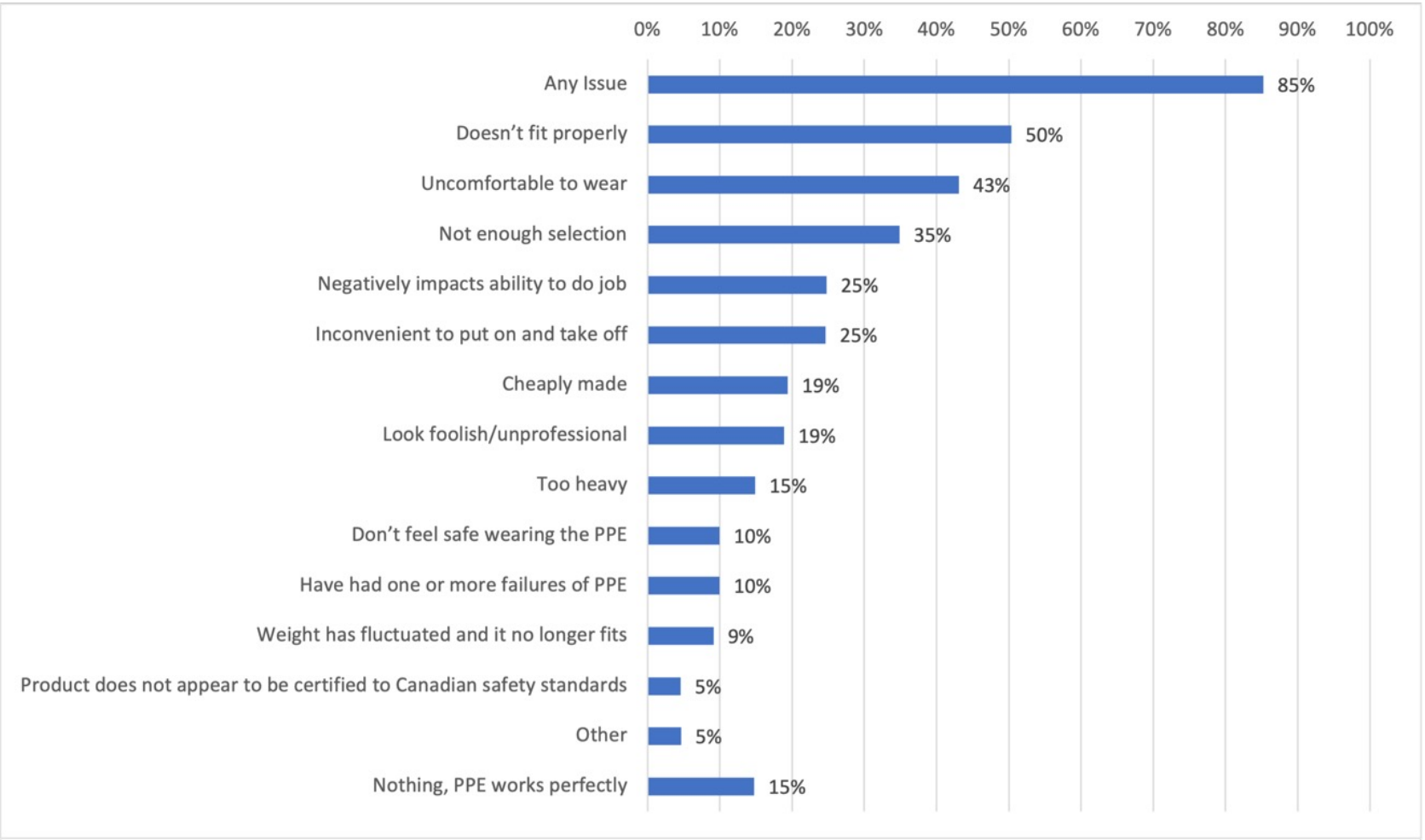
I don't care if it looks ugly. I don't care if it's not comfortable. It has one job and that is to protect me to where I am safe to go home to my family after work. It is not doing that.

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

Women experience multiple issues with their PPE



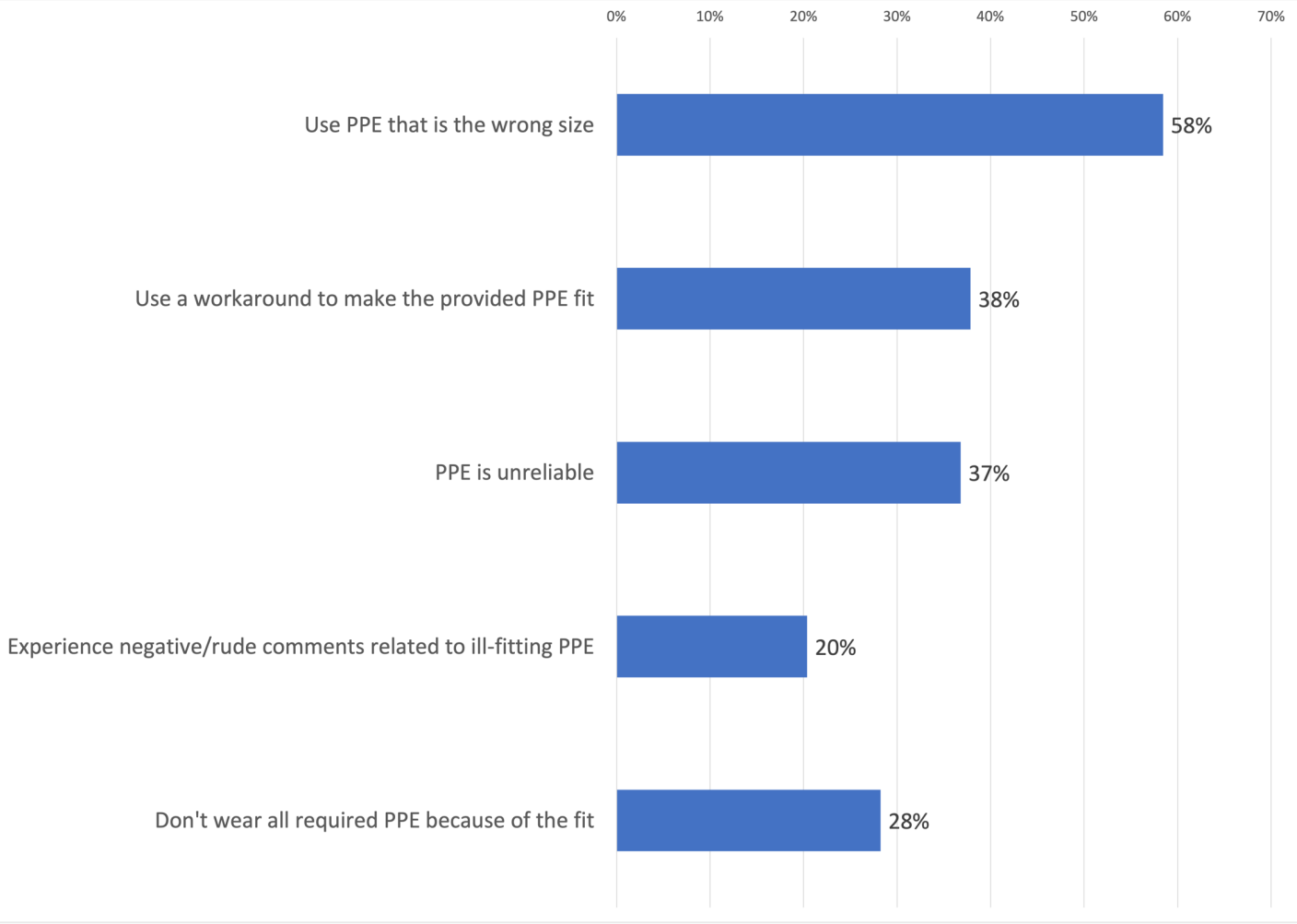
"Because the PPE does not fit well, I tend to get caught on stuff. Railings, door knobs, any sharp corners. Length of coveralls creates a tripping hazard and sleeves that are either too long or too wide and ill fitting gloves make everything feel very awkward."

Felt "somewhat protected" by her PPE
British Columbia, Transportation

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

Women have negative experiences wearing PPE



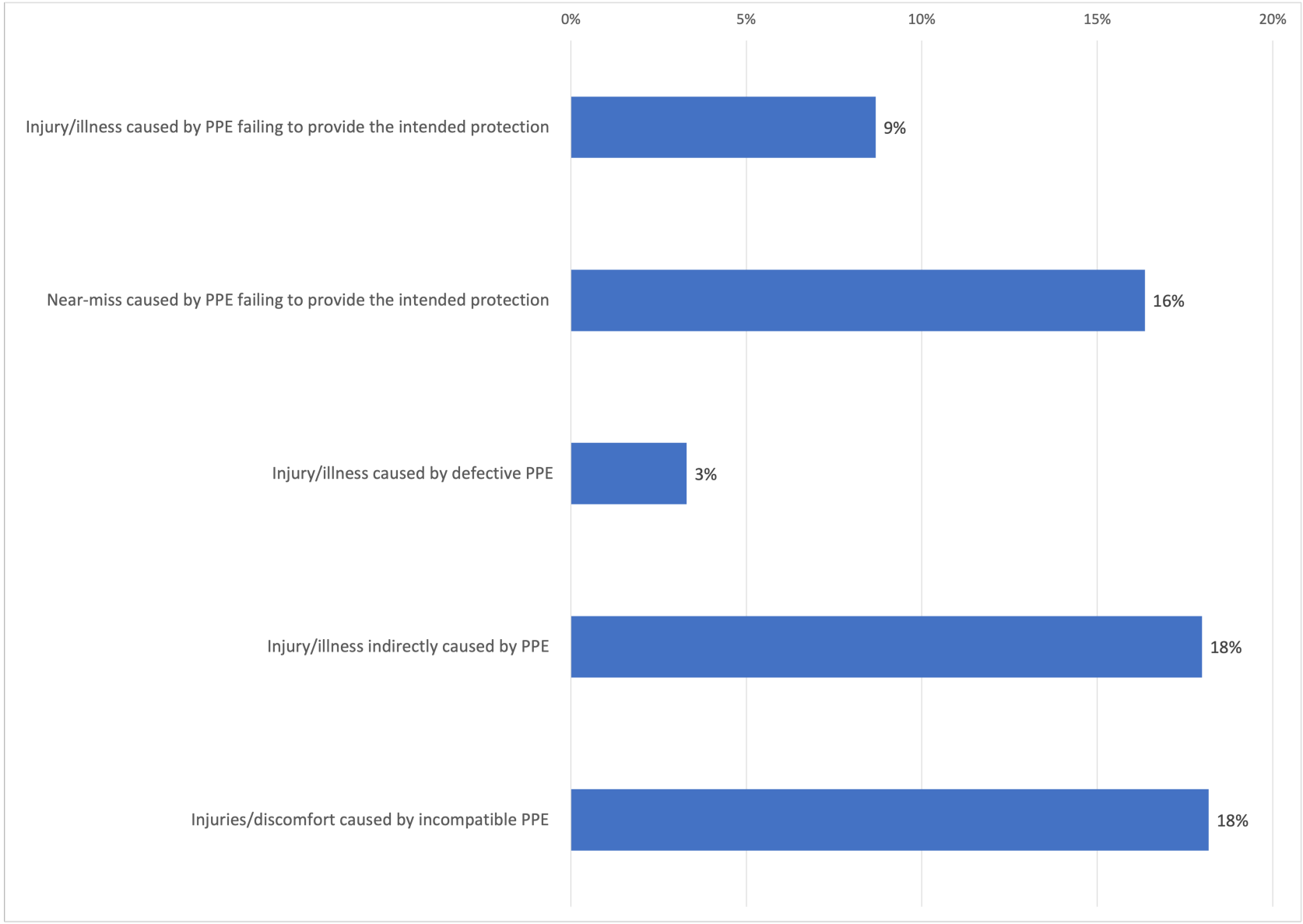
I have been burned hundreds of times by having sleeves and pant legs that are not long enough to provide coverage when I'm in awkward positions (I'm a steamfitter and welder). I literally have become an expert at being burned and maintaining my welding arc because it happens so often. My boobs are covered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

Women perceive that their PPE has contributed to injury or illness



Women perceive their PPE has contributed to injury or illness

I crushed my right foot in a welding shop after asking for safety boots and being told I did not need them. Tripping over [chemical protective] suits that are too long. Skin sensitization due to solvent exposure - the gloves that would protect from the solvent were only available in one size and were far too large. Ear muffs mounted to hard hat would not come in close enough to my head to offer proper seal and therefore offered no hearing protection. They were also very heavy and made my neck and shoulders ache and left me feeling unbalanced. I could not wear plugs as none of those provided fit my ear canal and could not wear regular muffs because I wore a hard hat.

Ontario, Construction

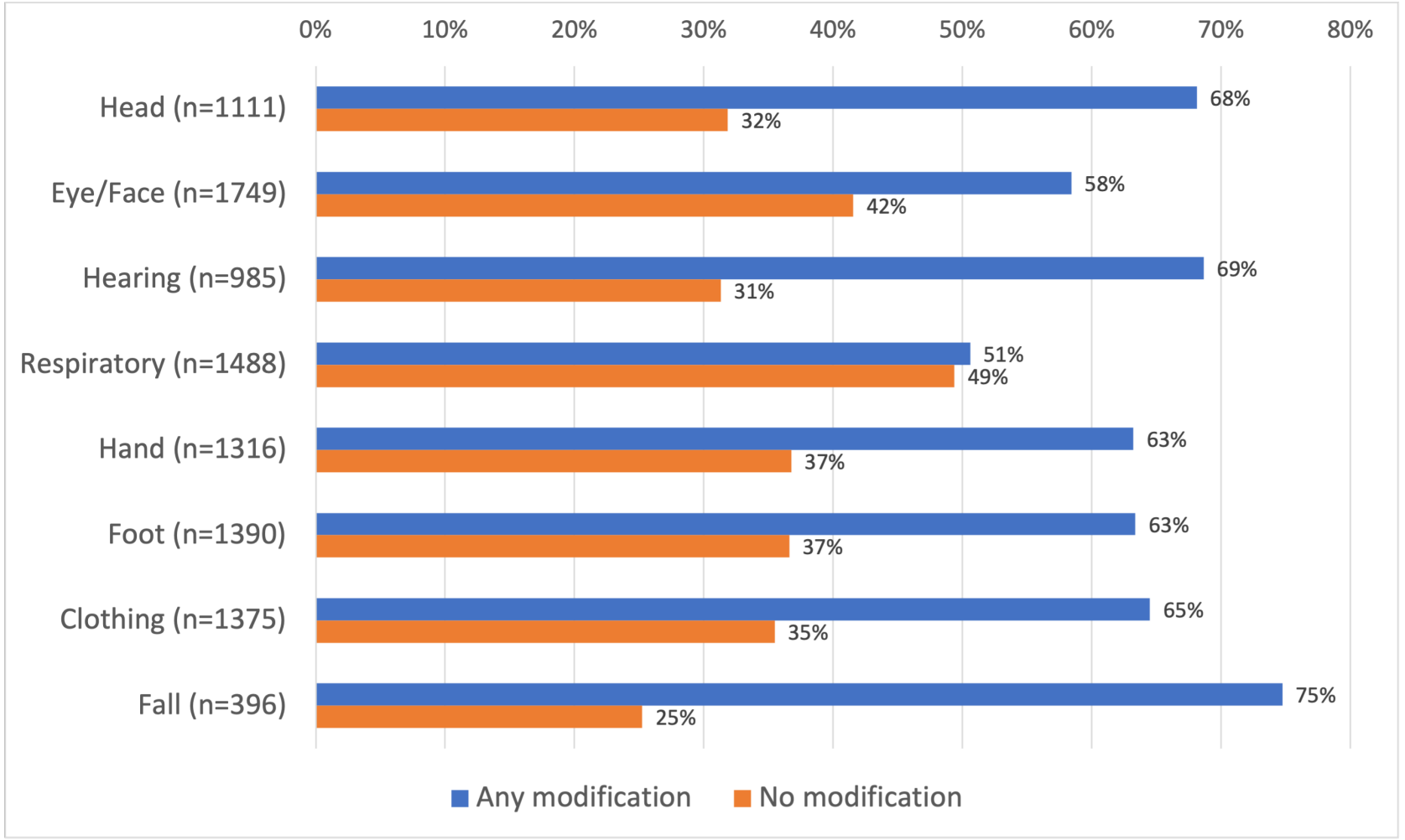
Severe back pain due to ill-fitting SCBA. My helmet pushes down on my faceplate affecting the fit of the facepiece and the up and down movement of my head which affects my range of vision.

Ontario, Emergency Services

Mostly being caught on loose PPE, limited range of motion causing trips, leaking waterproof gear causing chemical burns, gloves failing during a job, safety glasses that are unusable due to chafing and fogging.

Province not specified, Utilities & Natural Resources

Women are making temporary or permanent modifications or alterations to their PPE



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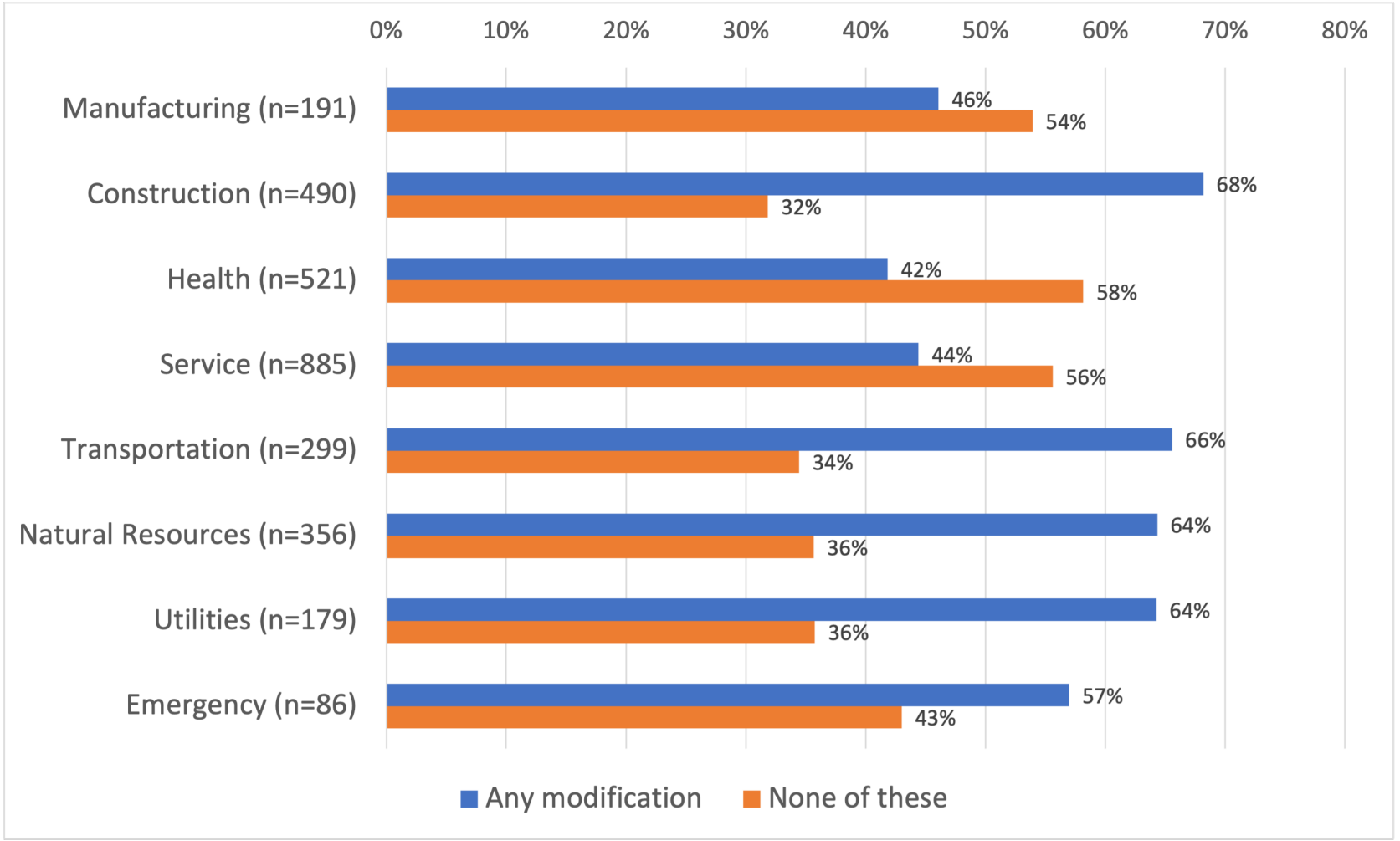

Women are making temporary or permanent modifications or alterations to their PPE

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.

Alberta, Natural Resources

Electrical tape around gloves, cuffs and boots. Wearing thick socks in work boots to fit better.

British Columbia, Construction

Key Findings from the Survey

- > 80% report they experience 1 or more challenges with their PPE
  - PPE doesn't fit properly, PPE is uncomfortable to wear, lack of availability of women-specific PPE
- Significant numbers of women report negative experiences with their PPE
  - 58% report they use PPE that is the **wrong size** at least some of the time
  - 38% say they use a **workaround** to make their PPE fit
  - 28% **don't wear all required PPE** because of issues with fit
  - 20% report receiving **negative or rude comments** from co-workers because of ill-fitting PPE
  - some women report **PPE-related injuries/illnesses**
- Women are paying out of pocket to source their own PPE
- Women are modifying and/or altering their PPE

Summary of Key Findings from Entire Project

- Women are not merely smaller, scaled down men
  - Research shows anthropometric differences between general population & workers and between certain occupational groups
- Lack of Canadian-specific anthropometric data = **critical gap**
  - Need for the creation of an anthropometric database that is specific to Canadian workforce, as well as a national sizing survey
- Gaps and inconsistencies in current PPE regulations
  - Need for better harmonization, better training of inspectorate, incorporation of gender/equity lens into how risk is assessed
- Lack of PPE designed to meet specific needs of women
  - Need for PPE designed for differently sized bodies, based on workforce- and gender-specific anthropometry
- Lack of awareness about what PPE is actually available
  - Need for raised awareness about PPE that is actually designed based on women's specifications

This is not a new issue…

- Dr. Jeanne Stellman (1984): “(t)here is a growing demand for safe, well-fitting, and appropriately designed PPE for women”
- Identified a need for
  - more anthropometric studies, particularly of smaller female workers
  - manufacturers to incorporate anthropometric data on female dimensions into the sizing and design of their products, and produce more PPE based on these measurements
  - improved standards development and certification procedures incorporating female anthropometry

The Last Word…

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

Thank you!

Report available at:
https://www.csagroup.org/article/research/canadian-womens-experiences-with-personal-protective-equipment-in-the-workplace/

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