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To cite this article: D. J. Janson, V. Dhokia, K. Banks, J. H. D. Rodohan & B. C. Clift (08 Oct 2024): Personal protection equipment: pockets, perceptions and equity – the untold truth of PPE: a reflexive thematic analysis, International Journal of Occupational Safety and Ergonomics, DOI: [10.1080/10803548.2024.2404748](https://doi.org/10.1080/10803548.2024.2404748)

To link to this article: <https://doi.org/10.1080/10803548.2024.2404748>

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# Personal protection equipment: pockets, perceptions and equity – the untold truth of PPE: a reflexive thematic analysis

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## ABSTRACT

Personal protective equipment (PPE) is worn in a range of industrial environments by women and men alike. However, the majority of PPE is designed around male anthropometrics and the impacts of this on women are largely undocumented. Reflexive thematic analysis was used to develop themes from in-depth interviews with 30 women working in diverse roles in industrial environments, around their experiences of wearing PPE. Four themes developed: 'There's nothing here for me'; 'Collateral damage'; 'Organisational culture and the burden of responsibility'; and 'Personally protective women'. The findings significantly expand upon previous literature concerning: the reduced range of PPE available for women when compared with men; considerable fit and comfort issues; and physical, day-to-day and health-related consequences. This work evidences the increased PPE-related burden on women, and demonstrates fundamental links between women wearing ill-fitting or inappropriate PPE and their reduced sense of belonging, confidence and morale.

## KEYWORDS

personal protective equipment; reflexive thematic analysis; women; gender; safety

## 1. Introduction

The use of personal protective equipment (PPE) is widespread in industrial environments. From safety footwear to hi-visibility (hi-vis) jackets, vests and trousers, these products exist as an often legally required last line of defence, for those working in potentially dangerous environments. Many of these environments, such as construction and manufacturing, have historically been male-dominated, with women making up less than 16.5% across the engineering workforce in the UK in 2021 [1]. Whilst men and women are now carrying out equivalent or equal roles, the level of their PPE provision is not equivalent [2,3]. Although there are now products designed and marketed for women [4], key items of PPE are often designed around men's anthropometrics [5–7] with safety footwear, e.g., being manufactured on men's lasts [8]. PPE is also not available as abundantly for women as for men, and the onus is often placed on minority groups to source their own products [9]. Worldwide, there are regulations governing the provision and certification of PPE [10–15]; however, these do not advise best practice. In the UK, e.g., PPE standards are dictated by the 'Personal Protective Equipment at Work Regulations' [16]. It is notable that these state that PPE is not suitable unless 'it is capable of fitting the wearer correctly' yet the problems for women users persist.

This qualitative study involves semi-structured interviews with women ( $n = 30$ ) across a range of industries, subsequently utilizing reflexive thematic analysis (RTA) [17–19] to unearth the effect that imbalanced PPE availability, supply and design has on women and to consider opportunities for improvements within the industry.

## 2. Background

It is intuitive that ill-fitting or uncomfortable PPE could hamper or reduce workers' productivity [20]. Whilst the literature indicates that problems can be experienced by both women and men, women are disproportionately disadvantaged by the lack of availability of women's fit PPE. A significant study by the Trades Union Congress [6] in 2017 established that PPE can impede women's ability to work, with 57% of women using PPE reporting being 'significantly hampered', with further studies such as Oo and Lim's [21] survey of 636 Australian construction workers confirming this to be the case.

There are many discrete examples of the ways in which women are hampered. In a study focused on female firefighters, Wang et al. [22] recognized that PPE can hinder mobility and reduce workers' ability to carry out their role due to its bulky nature; helmets were oversized and also affected visual performance as they were prone to moving when the wearer was looking around. McKinney et al.'s [23] study agrees that firefighter turnout coats and pants need improving and should serve to 'empower' women, with findings from the same group being supported by Sokolowski et al.'s [24] study, which agreed that female firefighters were hampered in their work and that improved PPE could lead to 'establishing equality with their male counterparts'. When considering safety footwear, a 2019 survey uncovered that women were significantly more uncomfortable in their safety footwear than men [8] and studies have also shown how women's gait changes as a result of wearing safety footwear [25].

Considering the non-physical impacts, Wagner et al. [26] found links between women construction workers and their self-efficacy and job satisfaction, and Onyebeke et al. [27]

reported that inappropriate PPE for female construction workers had ramifications for ‘safety, productivity, and the employer–employee relationship’ (p. 1038). Focus groups with 19 US tradeswomen in 2015 continued the theme that women were being provided with inappropriate PPE, leading to safety issues and a ‘workplace culture that minimises women’s needs’ (p. 4) [28].

Gender-based PPE issues do not just affect women working in male-dominated or industrial environments. Parlak et al. [29] found that 100% of operating room nurses ( $n = 35$ , including 29 women) stated fit and function issues with their eye protection. Janson et al. [5] found that women felt significantly less safe than their male peers when wearing PPE during the COVID-19 pandemic, as a result of ill-fitting PPE.

These issues are not new. In 1996, Goldenhar and Sweeney [30] introduced commentaries from women who had been given oversized (men’s) welding jacket and gloves, with the potential impact of getting injured as a result. Since then, as indicated, the situation appears to persist, with literature disclosing discrete issues experienced by women, such as being hampered in their roles, across a range of separate roles and industries. However, many studies do not disaggregate data by sex or gender, or have limited input from women due to the gender imbalance in many industrial environments. There is also limited literature regarding the non-physical impact of inappropriate PPE, other than the aforementioned studies [26–28]. The current research brings together the experiences of women from across a range of male-dominated industries and, as such, aims to fill a significant gap in the literature, connecting common cross-industry complex themes, developed from the specific physical and emotional impacts on women, as a result of purchasing, wearing and working in their PPE.<sup>1</sup>

### 2.1. Author positionality

One of the authors, a white woman in her mid-forties, has spent around 20 years working in a range of male-dominated

industries and has had experience of wearing PPE throughout this period. It is recognized that this author’s experience influenced the development of the research question.

## 3. Research question

The following research question was developed based on relevant literature and the authors’ experience. The question focuses upon women working in industrial, male-dominated environments:

- What are women’s experiences wearing PPE in industrial environments?

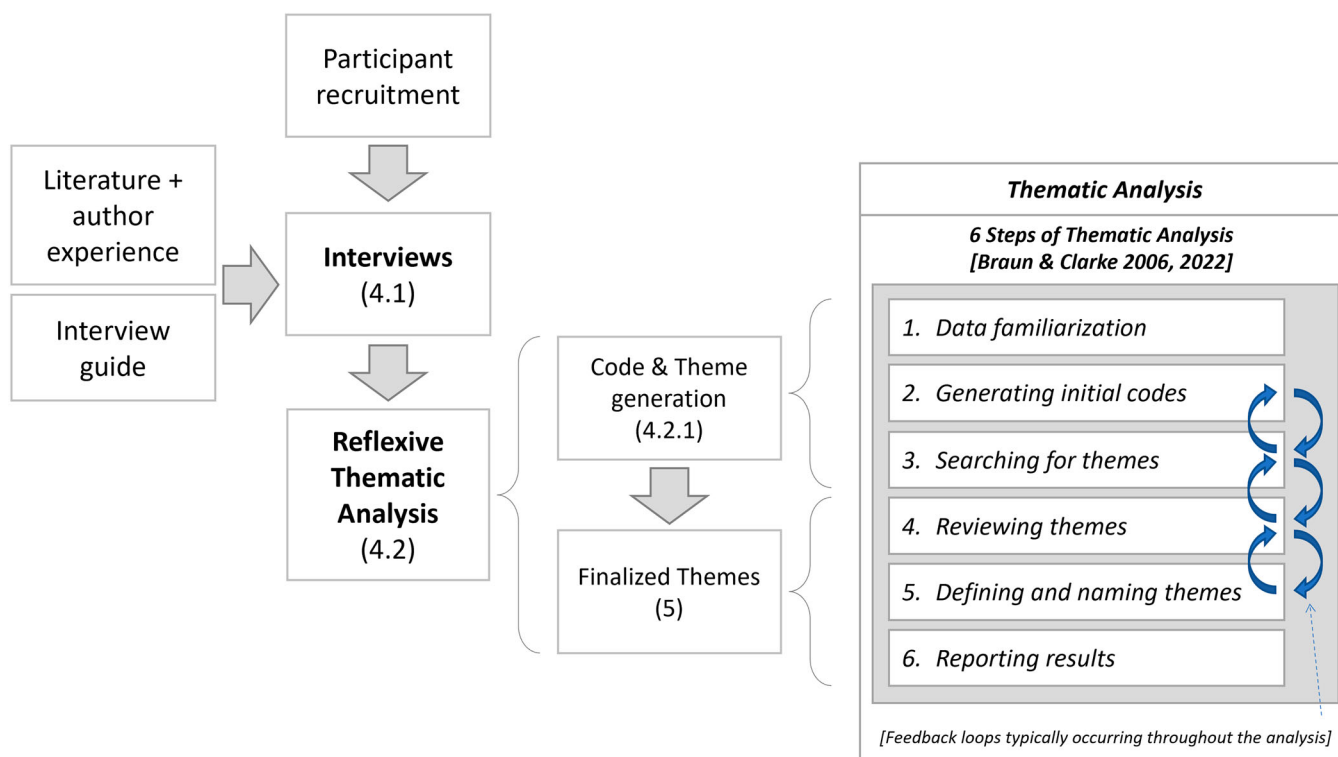
This broad question aimed to cover if and how PPE might affect productivity, or hamper women in their work. Is their sense of belonging affected by inappropriate PPE or do they feel treated differently? Were they uncomfortable (either physically or emotionally) as a result of their PPE?

### 3.1. Scope

The scope of this study is limited to women wearing PPE in their working environment – the industry was not specified. There were no limitations around the frequency or duration of wearing PPE, or the type of PPE that was worn, with the exception that the participants must regularly wear PPE.

## 4. Methodology

The decision to pursue qualitative research, instead of a mixed-methods or quantitative study, stems from the aim to capture the ‘complexity of the situation’ [31]. In pursuit of rich data based on women’s experiences, a constructivist epistemological approach was adopted. The methods deployed consisted of online semi-structured interviews and a ‘reflexive’ approach to thematic analysis (TA), or RTA of the data [19]. A summary



**Figure 1.** Methodology, incorporating reflexive thematic analysis (RTA) [17].

of the methodology is illustrated in Figure 1 and discussed in detail in the following.

#### 4.1. Interviews

For recruitment, purposive and snowballing methods were used to meet demographic requirements. Advertising via LinkedIn targeted participants who:

- are women;
- have at least 1 year of experience in industry (e.g., manufacturing, transport, oil and gas, construction, water industry);
- regularly use safety footwear and clothing.

Applicants were directed to a short eligibility questionnaire to filter self-selected participants. This comprised demographic questions such as contact information and sex, and project-specific questions such as time in the industry and years wearing safety footwear. The eligibility questionnaire aided the research process as it narrowed down the initial 73 respondents to 30 participants. Reasons for ineligibility included not being female, not currently wearing PPE (experience was historic) or not wearing safety footwear. This sample size is in line with Cresswell's [32] recommendations of 25–30 participants for TA, with Braun and Clarke [33] deducing that 6–16 interviews will reach code saturation. The participants were all women based in the UK and predominantly employed full-time, and their industry and job titles/roles are presented in Table 1.<sup>2</sup>

All 30 interviews were conducted online via video call for accessibility, consistency and related COVID-19 restrictions. Each interview was conducted by one of two interviewers. Interviews were semi-structured to allow participants to share their experiences more fluidly, rather than a more rigid, structured approach. An interview guide is included in Supplemental data, indicating the interview outline and possible probes. All interviews were recorded, transcribed verbatim and anonymized, as per the consented process.

#### 4.2. Reflexive thematic analysis

Upon completion of the interviews, data analysis of interview transcripts was undertaken using RTA. This method was adopted as RTA can help establish not only the distinct interpretation but, more so than 'non-reflexive' TA [17], can also uncover any hidden or surreptitious phenomena [34]. RTA permits the use of both inductive and deductive analysis, with both being used in this study. The authors' prior knowledge and experience contributed towards deductive aspects in the analysis and were an active input in the development of the themes, and as such the role that the researchers played in the analytical process is acknowledged [19,35].

##### 4.2.1. Coding and theme generation

Inductive coding was employed to foster the richness of participants' experiences, with progressive iterations and refinements of the codes to monitor alignment with the research question. A combination of semantic and latent coding was utilized. However, deductive coding was also utilized stemming from prior research, knowledge and experience.

In line with Braun and Clarke's [17] six-phase approach, an iterative method was adopted. Coding was carried out by three of the authors, with cross-referencing to ensure reliability and

**Table 1.** Participants' industries and job titles/roles.

| Participant | Industry             | Job title/role                         |
|-------------|----------------------|----------------------------------------|
| 1           | Transport            | Project manager                        |
| 2           | Transport            | HSEQ manager                           |
| 3           | Civil/construction   | HSEQ manager                           |
| 4           | Manufacturing        | Research project manager               |
| 5           | Health and safety    | Consultant                             |
| 6           | Civil/construction   | Director                               |
| 7           | Manufacturing        | Production engineer                    |
| 8           | Transport            | Train driver                           |
| 9           | Ecology              | Consultant                             |
| 10          | Oil and gas/offshore | SHE-Q engineer                         |
| 11          | Transport            | Senior transport planner               |
| 12          | Civil/construction   | Director                               |
| 13          | Ecology              | Principal ecologist                    |
| 14          | Oil and gas/offshore | Applications engineer                  |
| 15          | Manufacturing        | Environment, safety and health advisor |
| 16          | Ecology              | Protected species officer              |
| 17          | Consultancy          | Regional project technical lead        |
| 18          | Civil/construction   | Monitor                                |
| 19          | Transport            | Head of a research department          |
| 20          | Consultancy          | HSSE manager                           |
| 21          | Public sector        | Health, safety and well-being lead     |
| 22          | Education            | Research technician                    |
| 23          | Civil/construction   | Director                               |
| 24          | Civil/construction   | Project manager                        |
| 25          | Research             | Research fellow                        |
| 26          | Civil/construction   | Civil engineer                         |
| 27          | Water                | Senior process engineer                |
| 28          | Ecology              | Associate ecologist                    |
| 29          | Water                | Hydraulic engineer                     |
| 30          | Water                | Civil engineer                         |

Note: HSEQ = health, safety, environment and quality; HSSE = health, safety, security and environment; SHE-Q = safety, health, environment and quality.

consistency of interpretation, and with an appreciation that no two people will code a single data set completely consistently. A fourth author served as an independent sounding board for reliability and consistency.

Digital transcripts of the interviews were pragmatically cleansed; all coders familiarized themselves with three of the transcripts during an initial review. Codes were generated individually by the three coders and then collectively discussed to identify consistencies and inconsistencies amongst the group. Where both a semantic interpretation and a latent interpretation were possible, data were double coded. Indeed, it was possible for different coders to interpret the data as either semantic or latent, and both were valid and captured. After reviewing 24 of the transcripts, no new codes were produced, indicating a saturation of data. However, for completeness, and in order to capture any additional content for themes unrelated to the research questions, the remaining transcripts were also reviewed and coded. More than 120 codes were generated by the three coders, which was consolidated to 85 following a cross-coder review, with 53 of these being relevant to this study.

From the richness of data gathered, it was necessary to develop sub-themes, rather than moving directly to themes. Sub-themes were developed based on information gathered throughout the data collection process, from the literature review to code generation. Collected data were subsequently revisited, with the sub-themes in mind, to verify whether

the sub-themes accurately represented the data. Sub-themes were redefined, amended or combined to form four overarching and interrelated themes that were directly related to the research question: 'There's nothing here for me'; 'Collateral damage'; 'Organisational culture and the burden of responsibility'; and 'Personally protective women'. The names and content of themes were re-assessed for clarity and impact, with further review against the data to identify suitable representative data extracts.

## 5. Results

Four interconnected themes were developed and further broken down by sub-themes as detailed in Figure 2. The sub-themes were developed from the 53 relevant codes:

- Theme 1: 'There's nothing here for me' focuses on the fact that when women require PPE, firstly, they may not be able to identify an appropriate product range due to the general lack of availability of PPE for women. In addition, where products are available, there is a high probability that they will not fit.
- Theme 2: 'Collateral Damage' explores the impacts of PPE that does not fit women – how this impacts their everyday lives, their roles and their health.
- Theme 3: 'Organisational culture and the burden of responsibility' considers how organizations could address some of the issues that women face via their culture and inherent processes, but in fact often exacerbate the situation. The burden is often shifted to women to source their own, or 'make do' with the standard offering.
- Theme 4: 'Personally Protective Women' highlights the behaviours that women undertake to protect themselves as individuals and as a group, and can present both mentally and/or physically.

Each of these themes will now be discussed in detail, with representative quotes from participants.

### 5.1. *There's nothing here for me'*

#### 5.1.1. *Range*

Women recognized that there was a clear difference between the PPE on the market for them versus their male peers. Not only was the overall offering reduced and more difficult to find, they reported that the range of job types for women's PPE did not match the men's proposition and, also included a disproportionate offering for office-based roles. Participant 9, an ecology consultant, e.g., summed up the problems with availability of women's ranges:

Well, you look on websites for PPE and the women's stuff is a lesser range of items and they tend to be work wear rather than site wear so it's more office-based roles rather than construction related. So, you don't get the same breadth of kit.

When considering safety footwear in particular, participants broadly reported that the available range for men far outstripped that for women. When women's footwear was available, ongoing issues were highlighted related to colour and naming. Often, footwear marketed for women had flashes of pink (with many referring to the practice of 'pink it and shrink it' [36]), which women did not look upon favourably, as indicated by Participant 4, a project manager in manufacturing:

One thing that really annoys me is how many of them are pink. So, if you get women's safety shoes, they almost always try and put pink on them and it's just patronising and annoying.

Footwear models were also named or marketed inappropriately, as Participant 6, a director in construction, explained:

There's one boot it's called a vixen and it's got a flash of pink on it and you don't want to have that kind of tag.

For those participants wishing to try and buy women's PPE in person, there are further problems. Participants found that it is generally not stocked in stores, and as such it is usually not possible to try on. Requests to do so were met with dismissive laughter and verbal shrugging.

#### 5.1.2. *Fit*

Women reported that sizing on their PPE was frequently ill-fitting, and they notice that their male peers' was not. Items had been labelled as women's sizes, when in fact they are still based on male anthropometrics and male fit (and are therefore effectively men's clothes rebadged as women's). An engineer working in oil and gas stated:

No, most of it doesn't fit. So, at least some of it now does fit... There are unfortunately some brands that tell you that they are female fits, but they are not. (Participant 10)

Many of the respondents who wore, e.g., high-vis jackets or trousers commented on how the limb lengths were disproportionately long, as discussed with Participant 17, a technical lead in a consultancy:

I ordered the smallest pair of trousers that I possibly could I ended up giving them to someone who's over 6 foot tall because they fitted them.

Also when it comes to hi-vis vests and jackets, these were often simply oversized (for their label) or did not fit female bodies (e.g., sleeve lengths were excessive or if the chest area fitted then the rest did not and vice versa).

Women reported that many retailers offer a 'unisex' fit, but not only does this lead to fit problems, selecting a size can also be challenging. This is especially true for safety footwear and is not a viable offering given the difference in foot and body shapes between females and males [37]. Participants accepted that sizing in PPE is not limited to this industry and some of the issues can be found in other areas, including high street fashion.

Where participants had experience of PPE that fitted both appropriately and not, they reported how much of a positive impact that well-fitting PPE made in terms of being able to complete their day-to-day jobs. Participant 19, head of a research department in transport, explained:

I had my own [PPE] that fitted and, and the fit that worked for the team and [it] was not too tight, not too big but just the one that they felt comfortable in and that were safe; kind of matching those two up together and like it just makes it be different because I can actually do my job without having to roll up my sleeves or having to worry about, um, some, like the shoes not fitting or all of those sort of things.

Also, when women found PPE that was comfortable, they reported retaining it for as long as possible, as they recognized how difficult it could be to find something new that was as appropriate.

Above all, women wanted their PPE to fit and be functional. Where pockets were absent, women wanted them, and where

they existed, practical sizing was necessitated. Many participants advocated that improved sizing labels would be an easy win for manufacturers. Sizes were often found to be 'small', 'medium', 'large', etc. but women's sizing, e.g., 10, 12, 14, etc., would be preferable. Participants also suggested that adjustability would be a key addition, recognizing that even if PPE was provided as a female fit, this would not account for the different shapes and sizes of the female body within sizing brackets. Having stores that held stock of women's PPE was suggested by several participants – to allow women to try on PPE in the same way as their male peers. Ideas around specific PPE improvements focused on reducing the weight and increasing comfort and breathability of safety footwear. Breathability was also mentioned many times in relation to PPE clothing.

## 5.2. Collateral damage'

Women reported clear impacts on their day-to-day routine, their ability to carry out their role, and their short and long-term health as a result of inappropriately fitting PPE.

### 5.2.1. Day to day

To accommodate ill-fitting PPE, women's reports ranged from wearing extra socks and carrying around first-aid items and spare shoes, to wearing different hairstyles, to ensure that out-fits and clothing will fit (physically and aesthetically) with their PPE. Participant 3, a manager in construction, explained:

I'm sure I'm not the only woman woman that gets up in the morning and goes, 'what am I doing today? Am I going to need to put a hard hat on? Oh, I'll have to do my hair differently.

Many women reported having to carry a separate bag to accommodate items such as notepads, which their male counterparts could simply place in their pockets. Participant 10 shared an example:

Everybody on the rig, all the guys, they would put their tally book, so a small slim book that fits in your pocket, they would put it in the back pocket. But because our female, um, coveralls were more fitted so that we could actually properly move, we couldn't actually put the book in the pocket, because otherwise it would just fall out because the pocket was smaller.

This is due to women's pockets on their PPE often being smaller than on their male peers' PPE. Some felt that pockets were added for fashion over function and that chest pockets were certainly not functional for women as they made that area look larger, and subsequently attracted unwanted attention.

### 5.2.2. Modifying PPE

There were numerous instances of physically modifying PPE to make it fit or be comfortable. These ranged from temporary solutions such as rolling sleeves or trouser legs up, to wearing additional belts or braces for security, to sewing up PPE garments to make them fit better, as discussed by Participant 3:

| Theme 1<br>There's nothing here for me                                                                                                                                                                                     | Theme 2<br>Collateral Damage                                                                                                                                                                                                                                                       |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>Lack of range for women</i><br><i>'Shrink it and pink it'</i><br><i>Stereotypes</i><br><i>Fit</i><br><i>Pockets</i><br><i>Gratitude when PPE fits</i>                                                                   | <i>Day-to-day impacts</i><br><i>Modifying and adjusting PPE</i><br><i>Health impacts</i><br><i>Hampering work</i><br><i>Pockets (again)</i><br><i>Increased risks</i>                                                                                                              |
| Theme 3<br>Organisational Culture and the burden of responsibility                                                                                                                                                         | Theme 4<br>Personally Protective Women                                                                                                                                                                                                                                             |
| <i>Bearing the burden</i><br><i>Being the burden</i><br><i>Skewed H&amp;S culture</i><br><i>Everyday culture</i><br><i>Procurement vs H&amp;S</i><br><i>Lack of understanding</i><br><i>Lack of provision for visitors</i> | <i>'Just get on with it'</i><br><i>It's better than it used to be</i><br><i>Trivializing the problem</i><br><i>Justifying the problem</i><br><i>Imposter syndrome &amp; belonging</i><br><i>Morale, Capability</i><br><i>Perceptions of professionalism</i><br><i>Standing out</i> |

**Figure 2.** Themes and sub-themes. Note: H&S = health and safety; PPE = personal protective equipment.

I've sown my own hi-vis vests before, so I've, I've turned them up so that they, they, would fit properly, and stitch them with the sewing machine. I've done the same with hi-vis trousers. I've had to turn those up before.

Some women added insoles into footwear to improve comfort. Such modifications (e.g., inserting foreign insoles into safety footwear or sewing up rip-tabs in vests) can render PPE in violation of regulatory standards, thus potentially invalidating the safety of the PPE. Ad hoc modifications when donning PPE also led to women taking longer to change into and out of their PPE. Some participants admitted that the 'faff' (Participant 12, a director in construction) of constantly modifying and correcting PPE can distract them from their work and could ironically reduce safety, e.g., sewn up rip-tabs, whilst providing better fit, can increase the likeliness of hooking onto machines or vehicles.

### 5.2.3. Health impacts

Many participants suffered health issues as a consequence of wearing their PPE, with reports predominantly focused around safety footwear. A key concern was blisters on the feet, often due to the footwear 'slopping around' (Participant 17) the foot due to lack of fit in parts of the foot, even though they were secure around the ankle (with laces). This also caused injury to toenails for some wearers. Twisted ankles also occurred 'because they were so loose [around the foot]' (Participant 10). Participants also found fatigue to be a problem, especially if wearing heavy footwear for hours at a time. Aches and pains were exacerbated when safety footwear was not regularly worn. The more experienced participants went further to attribute wearing safety footwear to longer-term problems, e.g., knee and back struggles. Participant 6 indicated:

I think that my knee troubles that I have now in my 40s are attributed to my boots.

The longer-term effect of blisters and ill-fitting footwear was evident through heel spurs and one woman (Participant 13, a principal ecologist) reported scarring from metatarsal protectors which had dug in and caused injury over a long period of time.

### 5.2.4. Hampering work

In addition to health impacts, participants also reported how PPE might hamper them in or inhibit their work. These impacts were numerous. Those who climbed ladders as part of their everyday work suffered problems due to trouser lengths or the trouser crotch locating between their knees instead of appropriately, thus restricting movement. Participant 5, a health and safety consultant, explicitly linked the problems she experienced back to the fit and availability of her PPE trousers:

You're climbing up and down into, into dumpers and excavators, so you can check the cabs and stuff like that. I was finding I couldn't actually physically lift my leg high enough to get onto the bottom step of the of the dumper, which was ridiculous. Um, I tried bigger sizes, tried different varieties. I must have gone through about six or seven different manufacturers. Uh, and it was, just failing miserably the same problem all the time, even the really, really high-level brands... they haven't got the sizes right and they weren't cut right, if they did.

Expanding this, difficulty climbing and moving around was often reported (e.g., getting in and out of vehicles, such as

forklift trucks), clambering up and down embankments, and navigating building sites. Several participants spoke about how they recognized that their gait was altered when walking, due to their trousers or safety footwear, or both. Manual handling was hampering due to excessive sleeve lengths, hi-vis coats being oversized and therefore cumbersome, and gloves being too large. Many reported the tips of fingers on gloves extending far beyond their fingers, meaning that carrying or grabbing items became dangerous or, in some cases, impossible, as illustrated by Participant 4:

The one that was the biggest problem for me was getting gloves that fitted. 'Cause they had to be the ones that are generally used for welding, so up to 1000 degrees and they just don't make them in small sizes. And I've got really small hands even for a woman. So yeah, I was literally, there was an inch of spare glove at the end of each finger, and I just couldn't pick anything up safely because the ends of the fingers would just bend.

Uncomfortable safety footwear meant that some women were unable to walk for the distances they would like to, or that their role demanded. Overall, participants portrayed irritation and frustration when PPE prevented them from or hindered them in doing their job.

### 5.2.5. Increased risks due to PPE

Some PPE added to the safety risks faced by the wearer. Participants reported getting oversized safety footwear stuck in ladders or footwear leading to trip hazards by not being able to judge foot height when walking on uneven ground. Participant 21, a health and safety lead in the public sector, clearly explained her problems:

I felt like I wasn't lifting my feet properly. You know, I couldn't gauge the distance, which I thought was obviously an issue for climbing up and down stairs. If you can't, because the sole thickness was that, and the size it, it gave you a false security of where your actual footing was on the ladder strips.

Participants talked about the fear of getting clothing caught in workshop equipment and there were regular occurrences of being 'hooked' (Participant 10) by their clothing on door furniture, and there were reports of occasions where PPE had been caught in doors or vehicles and had created trip hazards when trousers were too long. Rolling up trousers that were too long often meant that the high-vis bands leg-bands that were expected to locate at the knee and ankle actually fell at the ankle and beyond the foot, respectively, meaning that the PPE was then not effective in increasing visibility.

In summary, women are significantly disadvantaged in their workplace through the provision of PPE that does not fit; their work is hampered and sometimes made more dangerous, routines are altered and they suffer health issues. There was an overwhelming message that participants would, wherever possible, continue to complete their roles, and as safely as they could, but not always in a manner that they would choose to do so because of adjustments made due to their inadequate PPE. In addition, around half indicated that they would not be wearing their PPE unless they really had to, with some saying that if there was no-one else around they removed PPE that would otherwise 'get in the way' (Participant 16, a protected species officer). Women were frustrated with the status quo and some indicated that they would only wear their PPE only when required to do so to avoid the aforementioned issues.

### 5.3. Organisational culture and the burden of responsibility'

#### 5.3.1. Bearing and being the burden

Women stated that they were often required to use more onerous processes than their male counterparts when it came to identifying and procuring PPE within their workplace. Sometimes women found that they were the first woman in the organization to require PPE, and as such the problems they met had never before been encountered, or even considered. Many women resorted to buying their own PPE and claiming back the expenses. In a few cases, the process was so onerous that women felt it easier to simply persist with the ill-fitting PPE.

Women also reported not wanting to be a burden on parts of the organization (such as purchasing departments) in finding the appropriate size and fit of PPE. This includes having to repeatedly return non-fitting or unwanted PPE or getting PPE branded separately from other employees (and in addition, being made to feel the burden of [but not incur] the additional cost of doing so). Not wanting to 'make a fuss' was a common narrative as revealed by Participant 7, a production engineer:

It then feels like I'm making more hassle for purchasing because I'm like, well, if I was ordering this online, I would order three different sizes so I could try them on and send back the ones that don't fit. But then for them that's more paperwork and it's more conversations with goods in to get them to send them back and get them collected.

However, in one rare and positive instance, one participant indicated that their manager had proactively given extra PPE budget to women technicians for the PPE as they recognized the difficulties faced.

Some organizations made endeavours to source PPE in different sizes, but often this was not a broad enough range, or sometimes of insufficient quantity or quality. It often took a long time for 'special' sizes to arrive, leaving women without the required PPE for periods of time. Several women (e.g., Participant 19) reported having to share PPE with others due to the lack of availability of sizes, which then impacted on being able to complete their roles:

You could never find something that fitted and so on or you always having to share them so you couldn't go out, you couldn't go out with the people who were best suited to the job.

However, some participants indicated that they themselves did not know what was available to be able to advise or help their organizations.

#### 5.3.2. Unwelcome visitors

Visiting other organizations could also be problematic for women, who would often arrive at sites or factories that had little provision for women, then having to make do with the limited PPE products available. Women were generally wise to this, with many taking their own PPE (especially if working abroad), either voluntarily or at the request of their host, as per Participant 3's experience:

If I don't take my own PPE, still quite often if you go out to a site and they're like, yeah, we've got visitors PPE, you get there and it's only for men.

The culture in some organizations led participants to feel that problems with their PPE would not be taken seriously. This could be due to organizations having little regard for women, or for women's PPE, or due to generic price caps being seen as more important than obtaining the correct PPE. This also

related to practical issues not being considered, e.g., changing areas when specific clothing was required. One woman described how there was no changing area for donning boiler suits as the intention was to simply cover the wearer's existing clothes. However, for a woman in a dress this was not possible and she needed to change, and was singled out to do so in a separate area. There were many frustrating instances of women's changing areas being an afterthought (if available at all). In a related example, Participant 10 described the logistics of dropping off her coverall:

Offshore, on the rigs, obviously all the, when you change out of your coveralls and you need to get them washed, that's obviously done on the rig. Umm, I had to always go into the male locker room and pass by make sure that nobody's indecent or everybody is decent, so I can actually drop off my coverall just for cleaning.

#### 5.3.3. Everyday culture

Finally, it was particularly upsetting for women suffering with poor PPE when men normalized the problem, or in some cases, diminished their experiences. Women accepted that men might also be at risk of ill-fitting PPE and that organizations needed to do better. However, diminishing the experiences of others appeared to correspond to the organization's culture and general treatment of women in that workplace.

Organizationally, it was important that the requirement for PPE that fits was taken seriously, that ordering processes were consistent between women and men, and that women were not singled out or burdened in order to obtain their PPE. The range of PPE available when visiting another organization was felt to be indicative of that organization's safety and inclusivity cultures.

In summary, 'Organisational culture and the burden of responsibility' contributes to the PPE problems experienced by women. However, there was a prevailing notion amongst participants that if organizations took responsibility for providing their employees with appropriate PPE (as legally required in most countries), many issues could be avoided or resolved. For example, working with PPE suppliers that provide proven PPE genuinely for women, and putting processes in place to facilitate women procuring such PPE without feeling like a burden, or being singled out. This clearly only resolves some of the issues for those within organizations but would certainly reduce the disadvantage for many women.

### 5.4. Personally protective women'

#### 5.4.1. Morale, capability and professionalism

In addition to the physical issues, almost all participants spoke about how they felt, or were made to feel, when wearing their PPE. Ill-fitting PPE intensified this. Women in inappropriate PPE felt a number of emotional challenges. The first was lowered morale. Participant 2, a health and safety manager in transport, clarified:

It does affect your morale because you almost feel like a second-class citizen – that your safety isn't as important, that you'll just have to make do. And that's not right.

Women also reported not feeling as capable in their role or being able to direct others to wear appropriate PPE when theirs does not fit, as confirmed by Participant 21:

But if I can't wear my PPE correctly, I can't tell somebody else they're not wearing their PPE correctly.

Participants were somewhat concerned about their physical appearance, mainly by how professional they might look, especially when emotionally they may already be disadvantaged due to the problems already outlined. Participant 17 explained:

I know that probably sounds a bit vain, but I don't feel particularly empowered when I'm wearing it. I also think it looks really unprofessional because I just look like a small child that's been put in dressed up into adult clothing.

#### 5.4.2. *Standing out*

Participants spoke strongly about not wanting to stand out or be highlighted as different. Many felt that they were 'different' enough already, as a woman in a male-dominated environment, so to amplify that was not helpful for them. Participant 14, an oil and gas applications engineer, candidly related:

My coping mechanism is by not standing out. You know, you keep your head down and until you know people you don't try and stand out and things like that, whereas, uh, I mean. You always, they always see you as a woman. I mean, you could be all blokes together. And if a woman walks through, it doesn't matter whether she's pretty, thin, fat. However, it's a woman walking through and they're always going to be noticed.

Some participants conveyed comments from male colleagues in relation to their PPE in particular. This was not prolific (although general sexism and misogyny was more common). Some of those experiencing such issues generally suggested that the younger generation were more aware of how this behaviour is now societally unacceptable. Participants proposed that comments about their PPE were usually not intentionally offensive, but, in general, commenting on their appearance was not welcome.

#### 5.4.3. *Being welcome and belonging*

When considering how PPE affected whether women felt welcome in their environment, or that they belonged, many participants did not feel they did. Participant 10 explained this reasoning in relation to having to purchase her own PPE:

A, why do I need to go into trouble? Because everybody else is, is cared for, if you want. B, why can we not just have more there? Because then if we would have more there, I would actually feel welcome because I didn't feel welcome when I started because nothing was made for me.

Those participants with greater longevity in the field were less concerned with their own feelings of belonging in relation to their PPE but could understand why others would not feel welcome, as noted by Participant 13:

If you're just starting out as somebody who needs that kit [PPE] as a woman, or somebody who identifies as a woman, then you might feel that maybe that's not where you should be. Maybe this isn't the job for you. It could put people off.

It was recognized that in male-dominated industries such as construction and manufacturing, work is being done to address gender imbalance and reduce bias, although lack of appropriate PPE is not helping overcome these issues.

#### 5.4.4. *Diminishing the issues*

Women were prone to finding ways of diminishing the problems they experienced with their PPE. Firstly, many spoke of how they feel they simply have to 'get on with the job' and work with their PPE as best they can. Notably, a number of participants, when first questioned, stated that they had not experienced problems with PPE. However, it was evident from their further accounts that they unquestionably had, in

spite of their initial assertions. There was a level of acknowledgement between women colleagues that they were in the same position with regards to PPE which in some cases led to camaraderie. Other participants recognized that they saw improvements over the years and there were underlying tones of acceptance of the current position as a result, such as within the following commentary from Participant 25, working in research:

It's, slowly getting better, but you know, I mean, I remember when I went on site in 15 years ago, they didn't have anything below a size 7, you know, boots. But now I know you can buy size 3 and 4 from, you know, standard manufacturers now, which that didn't used to be a thing. So not that that's real progress but you know, because they're awful, but it, it you know it at least some things have changed a bit.

Secondly, participants diminished the problem by seeking to justify the lack of PPE for women, conceding that the PPE industry was not focused on women end users because of the significantly higher ratio of male to female wearers. Many commented that they understood that it might not be financially viable for suppliers to create PPE specifically for women and were accepting of any 'minimum order quantities' they had encountered. However, most participants still recognized the need to improve, including Participant 22, a research technician working in education:

Part of me can almost see why there's less demand for it, because there's less women in engineering and stuff. But the fact that there isn't an option there makes it really difficult, both for new staff coming in and for people already working here.

Thirdly, participants were prone to trivializing or minimizing the problem, as revealed by Participant 17:

They sound like such silly problems really, don't they?

Women did not want to make a fuss over their PPE, especially when other colleagues were in higher risk roles, and felt like they could not necessarily speak out, such as the following example from Participant 1, a project manager in the transport industry:

Because it is an industry where any, every day you could get seriously injured or, or die or that kind of thing, that's why safety so important. Whereas I think then things like me moaning that my PPE with my feet, my feet hurt from my shoes is a bit trivial to them because well, okay cool. But these guys are out on track and they might get hit by train if they've not got the right safety working methods.

#### 5.4.5. *Equity versus equality*

One of the key points made by participants was the concept of equity versus equality. Organizations were treating their workforce 'equally', which might superficially seem appropriate. However, providing women and men with the same PPE (which is fundamentally based around male anthropometrics) does not afford equity across the workforce. It would be a significant improvement to have the same level of PPE, but with the degree of fit and function being appropriate to the wearer. Participant 13, when asked what she might do if she had a 'magic wand', replied:

I would paint the picture that it was that there wasn't a gender issue, that PPE, was meant to fit somebody, to do a job, regardless of whatever gender they were. And that would solve plenty of issues related to the, to PPE.

Within the theme of 'Personally Protective Women', women go out of their way to protect themselves physically, either by modifying their PPE or their behaviour, or simply not wearing

it for longer than necessary. Emotional protection occurs by diminishing the problem in the manner already outlined and avoiding becoming a burden. Additionally, they do not want to stand out or be called out by male peers. Inappropriate PPE in these women's experiences is preventing some women from feeling welcome in their working environments and reducing their sense of belonging. It is also causing frustration, intensified imposter syndrome and reduced confidence, feelings of capability and morale.

## 6. Discussion

The research question in this study focused on identifying and understanding 'women's experiences wearing PPE in industrial environments' and it is clear that most women, as a result of their inappropriate or ill-fitting PPE, feel some or all of the following compared with their male peers: uncomfortable, hampered, burdened, singled out and less welcome. When considering the literature, these feelings are not entirely unexpected, although the pervasiveness of feelings is stark. This section will discuss the data collected and findings in relation to the literature, structured across the four developed themes.

Considering Theme 1, 'There's nothing here for me', the majority, if not all, PPE suppliers do pertain to sell PPE for women. However, there remains a huge discrepancy across the industry between offerings for men and women, with the vast majority of PPE on sale being for men. When browsing websites for women's PPE, it is often found as a sub-category, e.g., when searching for safety footwear, example categories are boots, shoes, trainers, sandals, wellingtons and waders, chef's shoes, women's fit [38]. This can make it difficult to locate PPE, not only for women directly, but for those procuring PPE for organizations. As such, women's dissatisfaction in the range available is not surprising. Women easily explain this by the fact that they are working in male-dominated industries, and as such accept the imbalance of the available range, although when comparing male-dominated industries with female-dominated industries such as healthcare, the same problems with fit prevail [5].

'Collateral Damage' (Theme 2) encompasses the impacts that women experienced through wearing their PPE. Unexpectedly, when questioned directly, women did not feel that their productivity was impacted as a result of their PPE. They spoke proudly of being able to continue to carry out their role effectively, in spite of poor fit, but, as anticipated from the literature outlined in Section 2 [21–24,26,27,30], did acknowledge that they were somewhat hampered in doing so. Therefore, there exists a contradiction, as being hampered in one's role might imply a reduction in effectiveness of carrying out the role, and as such, reduced productivity. It would be helpful to quantitatively evaluate any impact on productivity, as this would help support any business case to justify searching out and spending what is required on women's PPE.

When wearing PPE that did not fit, women were uncomfortable. Physically, their health suffered due to blisters, heel spurs, feet and leg aches and fatigue – all due to wearing safety footwear. They changed daily routines and clothes to accommodate their PPE that day, or modified PPE to fit better, sometimes reducing the effectiveness of the PPE itself in doing so. In all of these actions, women noticed that their male counterparts did not have to undergo such activities.

Organizational culture (Theme 3) held the burden of responsibility, but, ironically, in many cases this had shifted

to the women employed by that organization when it came to identifying and sourcing PPE. Fargo agreed [39], proposing that part of the problem with women and PPE is related to the organizations in which they work. This statement is corroborated by the current study, with interviewees indicating that, in many instances, organizational culture was exacerbating the problems outlined by lack of availability. Many women were treated differently, being expected to either accept the PPE they were given, or to source their own.

The women interviewed clearly articulated how they were implicitly self-protecting in an emotionally demanding industrial environment ('Personally Protective Women' – Theme 4), and the findings of the current study are entirely consistent with literature. For example, as identified by Wilson and VanAntwerp [40], women in engineering are found to describe a workplace where they do not belong and working in a culture where their needs are not catered for [28]. Women are prone to feeling a lack of belonging with a lack of female peers and role models [41]. Many women report imposter syndrome, particularly when working in male-dominated environments [42], and additional burdens placed on women can also reduce the sense of belonging [43]. Building on this correlation, the current study clearly demonstrates a further relationship between PPE and these feelings; it is not simply a resultant of the gender imbalance, the PPE-related scenarios identified in this study enhanced these negative emotions.

As indicated in Section 2, there are a plethora of PPE regulations and policies that have been developed globally over the last 50 years, with many reports highlighting the need for appropriate fit and function. However, the current study highlights that the impact of poor PPE extends beyond the physical fit and function. Women are suffering, as are their careers, and industry will not be able to fully reap the benefits of a diverse workforce if the issues with PPE continue to go unaddressed.

### 6.1. Recommendations to the PPE industry

Based on the findings of this study, there are many specific improvements that could be made to PPE, including adequate pockets, appropriate limb lengths and adjustability, as detailed throughout Section 5 and presented in Table 2. Industry may wish to consider using a 'Hackathon' approach, such as that performed by Kolegraff and Parrotta [44], where 16 participants workshopped the redesign of a hi-vis vest.

However, taking a 'bigger picture' view, the authors recommend the following broad actions within the PPE industry:

- Work with and listen to women to establish what they want and need from their PPE. There are countless examples of ill-thought-out PPE designs. Women need to be involved in the design from an early stage.
- Revisit PPE regulatory standards to ensure that biological anthropometric and gender aspects are recognized and incorporated. This includes better defining 'fit'.
- As was evident when inviting participants to the study, there are a vast range of roles being carried out by women, requiring PPE, that may go unrecognized by the PPE market. The lack of PPE for women is often justified by the gender imbalance; however, across PPE users, this may not be as pervasive as it appears. As such, it is respectfully recommended that the true market share of women users of PPE be determined, with a view to more easily justifying the design and provision of women's PPE.

**Table 2.** Summary of participant recommendations for industry.

| Area      | Recommendations                                                                                                                                                                     |
|-----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Pockets   | Adequate pocket sizes (not scaled down)<br>Remove pockets where not needed (breast pockets)<br>Add pockets for function, not fashion                                                |
| Fit       | Recognize where unisex is not appropriate<br>Appropriate limb lengths<br>Include adjustability without compromising safety<br>Women's fit gloves need to account for finger lengths |
| Selling   | Ensure women's wear is clearly identified<br>Ensure sales personnel are trained to understand the differences and importance                                                        |
| Labelling | Label correctly (do not rebadge men's PPE as women's)<br>Make labels clear (use women's sizing, not small, medium, large, etc.)                                                     |
| Branding  | Take care with naming of products<br>Do more than just pink and shrink<br>Have real women in marketing campaigns                                                                    |
| Other     | Increase breathability<br>Ensure hair and hairstyles can be accommodated                                                                                                            |

Note: PPE = personal protective equipment.

## 6.2. Limitations

Whilst the issues discussed within this study were pervasive amongst participants and the majority of issues resonated across the sample, it is appreciated that not every issue resonated with every participant. There were other potential limitations, as detailed in the following.

### 6.2.1. Scope of study

Further topics raised during the study included maternal PPE, religion or cultural-related PPE design, PPE for menopausal women, PPE for those who do not identify with their biological sex and PPE for those with disabilities. Commentary around these areas was infrequent but important, and the authors do not wish to diminish the magnitude of impact of inappropriate PPE for these groups. Further study is necessary to examine and highlight any issues in more detail.

### 6.2.2. Interviewer bias

Prior to conducting the interviews, the interviewers had no experience of the issues under discussion, wearing PPE nor the industries relating to the interviewees. This was purposely to encourage discovery through inquisitive questioning. However, whilst the interview process resulted in a change in the interviewers' viewpoints, the semi-structured nature of the interviews was intended to minimize the influence of any change.

### 6.2.3. Motivation for participating

Interviewees self-selected for the study (with eligibility criteria applied) and their motivations to be involved were not clear [45]. However, there was an overwhelming sense that participants wanted to help with the research, in order to improve the situation for women in industry in general.

## 7. Conclusions

In this first study of its kind, RTA was used to develop themes from interviews with 30 women working in diverse roles in industrial environments, around their experiences of wearing

PPE. We interviewed 30 women working in industrial environments such as manufacturing, water, construction and transport about their experiences of wearing PPE. RTA of the transcripts facilitated development of four themes. 'There's nothing here for me' discloses the inadequate range of PPE on the market for women, the poor fit experienced by women and the inappropriate stereotypes propagated by practices such as 'shrink it and pink it'. 'Collateral damage' represents the many consequences of ill-fitting PPE, including day-to-day adjustments, work being hampered, short and long-term health impacts and the potential for increased risk from inappropriate or modified PPE. 'Organisational culture and the burden of responsibility' examines how some organizations do not understand the problems faced by women and shift the burden of sourcing appropriate PPE onto the women requiring it, further disadvantaging them. Cultural problems ranged from poor PPE provision for female visitors, to men diminishing the problems of their female colleagues. Finally, 'Personally protective women' explored the admirable resilience of women to persist in their roles, in spite of the barriers faced and often played down.

The findings of this study significantly expand upon reports in earlier literature concerning the physical and day-to-day impacts for women wearing ill-fitting or inappropriate PPE. This work provides the first evidence of the fundamental links between this and women's sense of belonging, confidence and morale. In an era where gender balance is demanded and women are encouraged into historically male-dominated environments, it is vital that the current substandard range of PPE available and provision for women is urgently addressed. In line with the recommendations to industry, further work by PPE manufacturers and regulatory bodies is needed in this important area. Incorporating increasing awareness of the issues faced by women, updating regulatory requirements to better define 'fit' and uncovering the true scale of the female PPE market are essential if progress is to be made in this area, and gender diversity in industrial environments can be authentically addressed.

## Acknowledgements

The authors would like to thank all of the participants for their time and candour. In particular, the authors would like to thank Becky Milsom of Colas Rail with whom the premise for this study was initiated.

## Disclosure statement

No potential conflict of interest was reported by the authors.

## Ethics

This study was reviewed and approved under application number 4432–5746 by the Social Sciences Research Ethics Committee at the University of Bath.

## Funding

This work was supported by the Engineering and Physical Sciences Research Council [grant number EP/R513155/1].

## Supplemental data

Supplemental data for this article can be accessed online at <https://doi.org/10.1080/10803548.2024.2404748>.

## Notes

1. it is recognized that 'women' as a gendered term and 'female' as biological sex have different meanings and any inappropriate usage within this study is unintentional. In particular, the authors have aimed to refer to biology and anthropometrics as female or male, and to other issues involving gender as women and men.
2. Note that some job titles and industries have been simplified to protect anonymity.

## References

- [1] Engineering UK. Women in engineering: trends in women in the engineering workforce between 2010 and 2021; 2021.
- [2] Mariani M. Women at Work. *Builder*. 2005;28(9):118.
- [3] PLH. Work boots aren't just for men – women need a great pair of safety footwear too [Internet]. PLH Group; 2017. [accessed 2023 April 01]. Available from: <https://plhgroupinc.com/womens-safety-footwear/>
- [4] Walker J. PPE for women: we've come a long way, Rosie, 'But we still have a ways to go'. International Safety Equipment Association; 2010. p38.
- [5] Janson DJ, Clift BC, Dhokia V. PPE fit of healthcare workers during the COVID-19 pandemic. *Appl Ergon*. 2022;99:103610. doi:10.1016/j.apergo.2021.103610
- [6] TUC. Personal protective equipment and women [Internet]; 2017. [accessed 2023 April 1]. Available from: <https://www.tuc.org.uk/sites/default/files/PPEandwomenguidance.pdf>.
- [7] Milligan J. Inclusive safety: providing tailor-made PPE for women. *Profess Safety J*. August 2019:24–25.
- [8] Janson DJ, Newman ST, Dhokia V. Safety footwear: a survey of end-users. *Appl Ergon*. 2021;92:103333. doi:10.1016/j.apergo.2020.103333
- [9] Flynn MA, Keller B, DeLaney SC. Promotion of alternative-sized personal protective equipment. *J Safety Res [Internet]*. 2017;63:43–46. doi:10.1016/j.jsr.2017.08.004
- [10] Regulation (EU) 2016/425 — safe personal protective equipment. 2016\_425 EU; Apr 2023. [accessed 2024 September 24]. Available from: <https://eur-lex.europa.eu/legal-content/EN/LSU/?uri=CELEX:32016R0425>
- [11] UK Government. The personal protective equipment at work (amendment) regulations 2022. UK Statutory Instruments, 2022 No. 8 2022.
- [12] OSHA Standards: general industry (29 CFR 1910) subpart I [Internet]. [accessed 2024 September 24]. Available from: [https://www.osha.gov/lawsregs/regulations/standardnumber/1910#1910\\_Subpart\\_I](https://www.osha.gov/lawsregs/regulations/standardnumber/1910#1910_Subpart_I)
- [13] Work Health and Safety Act 2011. SL2011-36 Australia [Internet]; 2011. [accessed 2024 April 1]. Available from: <https://www.legislation.act.gov.au/sl/2011-36/current/pdf/2011-36.pdf>.
- [14] Factories Act 1948. Act No. 63 of 1948 India; 1948. accessed 2024 September 24]. Available from: [https://labour.gov.in/sites/default/files/factories\\_act\\_1948.pdf](https://labour.gov.in/sites/default/files/factories_act_1948.pdf).
- [15] Law of the People's Republic of China on Work Safety. Order no. 70 China [Internet]; 2002. [accessed 2024 September 24]. Available from: [https://english.www.gov.cn/archive/laws\\_regulations/2014/08/23/content\\_281474983042179.htm](https://english.www.gov.cn/archive/laws_regulations/2014/08/23/content_281474983042179.htm).
- [16] HSE. The personal protective equipment at work regulations 1992; No 2966, Regulation 4 [Internet]; 1992. [accessed 2023 April 30]. Available from: <http://www.legislation.gov.uk/ukSI/1992/2966/regulation/4/made>.
- [17] Braun V, Clarke V. Using thematic analysis in psychology. *Qual Res Psychol*. 2006;3:77–101. doi:10.1191/1478088706qp0630a
- [18] Braun V, Clarke V. Thematic analysis: a practical guide. Los Angeles (CA): Sage; 2022.
- [19] Braun V, Clarke V. One size fits all? What counts as quality practice in (reflexive) thematic analysis? *Qual Res Psychol*. 2021;18:328–352. doi:10.1080/14780887.2020.1769238
- [20] RPB. Understanding how PPE influences productivity [Internet]; [cited 2022 Feb 22]. [accessed 2024 September 24]. Available from: <https://www.gvs-rpb.com/blog/productivity>.
- [21] Oo BL, Lim THB. Women's accessibility to properly fitting personal protective 19–20 Dec 2019 Johor, Malaysia. The 5th International Conference on Civil and Environmental Engineering for Sustainability 2020. IOP Publishing.
- [22] Wang S, Park J, Wang Y. Cross-cultural comparison of firefighters' perception of mobility and occupational injury risks associated with personal protective equipment. *Int J Occup Saf Ergon*. 2021;27:664–672. doi:10.1080/10803548.2019.1607027
- [23] McKinney E, Morris K, Wu Y, et al. Understanding firewomen's fit problems with their coats and pants and its impact on mobility and safety. *Work*. 2021;69:449–464. doi:10.3233/WOR-213490
- [24] Sokolowski SL, Griffin L, Wu Y, et al. Examination of current U.S. female firefighting personal protective equipment (PPE) sizing and fitting process challenges: an opportunity to improve safety. *Fashion and Textiles*. 2022;9:40. doi:10.1186/s40691-022-00314-8
- [25] Goto K, Abe K. Gait characteristics in women's safety shoes. *Appl Ergon*. 2017;65:163–167. doi:10.1016/j.apergo.2017.06.012
- [26] Wagner H, Kim AJ, Gordon L. Relationship between personal protective equipment, self-efficacy, and job satisfaction of women in the building trades. *J Constr Eng Manag*. 2013;139:04013005. doi:10.1061/(ASCE)CO.1943-7862.0000739
- [27] Onyebekwe LC, Papazaharias DM, Freund A, et al. Access to properly fitting personal protective equipment for female construction workers. *Am J Ind Med*. 2016;59:1032–1040. doi:10.1002/ajim.22624
- [28] Curtis HM, Meischke HW, Simcox NJ, et al. Working safely in the trades as women: a qualitative exploration and call for women – supportive interventions. *Front Public Health*. 2022;9. doi:10.3389/fpubh.2021.781572
- [29] Parlak EA, Ayhan H, Iyigun E. Comparison of operating room nurses' satisfaction and preferences in using personal protective equipment for eye protection in the COVID-19 pandemic. *Int J Occup Saf Ergon*. 2022;29(1):224–229.
- [30] Goldenhar LM, Sweeney MH. Tradeswomen's perspectives on occupational health and safety: a qualitative investigation. *Am J Ind Med*. 1996;29:516–520. doi:10.1002/(SICI)1097-0274(199605)29:5 < 516::AID-AJIM11 > 3.0.CO;2-3
- [31] Tan W. Research methods a practical guide for students and researchers. Singapore: World Scientific; 2017.
- [32] Cresswell JW. Qualitative inquiry and research design: choosing among five traditions. 2nd ed. Los Angeles: SAGE; 2007.
- [33] Braun V, Clarke V. To saturate or not to saturate? Questioning data saturation as a useful concept for thematic analysis and sample-size rationales. *Qual Res Sport Exerc Health*. 2021;13:201–216. doi:10.1080/2159676X.2019.1704846
- [34] Braun V, Clarke V. Reflecting on reflexive thematic analysis. *Qual Res Sport Exerc Health*. 2019;11:589–597. doi:10.1080/2159676X.2019.1628806
- [35] Byrne D. A worked example of Braun and Clarke's approach to reflexive thematic analysis. *Qual Quant*. 2022;56:1391–1412. doi:10.1007/s11135-021-01182-y
- [36] HRNews. Should we tackle the 'Gender PPE Gap'? [Internet]. HRNews; 2017. [accessed 2024 April 30]. Available from: <http://hrnews.co.uk/tackle-gender-ppe-gap/> Last accessed 30/04/2024
- [37] Jurca A, Żabkar J, Džeroski S. Analysis of 1.2 million foot scans from North America, Europe and Asia [Internet]. Nature Publishing Group; 2019 [cited 2020 Feb 3];9. Available from: [www.nature.com/scientificreports](http://www.nature.com/scientificreports)
- [38] PPE Supplies Direct [Internet].
- [39] Fargo C. PPE for women: finding the appropriate Fit. *Prof Saf*. 2013;58:41–42.
- [40] Wilson D, VanAntwerp J. Left out: a review of women's struggle to develop a sense of belonging in engineering. *Sage Open*. 2021;11:215824402110407. doi:10.1177/21582440211040791
- [41] Lewis KL, Stout JG, Finkelstein ND, et al. Fitting in to move forward: belonging, gender, and persistence in the physical sciences, technology, engineering, and mathematics (pSTEM). *Psychol Women Q*. 2017;41:420–436. doi:10.1177/0361684317720186
- [42] Crawford JT. Imposter syndrome for women in male dominated careers. *Hasting Women's Law Journal [Internet]*. 2021;32:18–34. <https://search.proquest.com/docview/>.
- [43] Smith JL, Lewis KL, Hawthorne L, et al. When trying hard isn't natural: women's belonging with and motivation for male-dominated STEM fields as a function of effort expenditure concerns. *Pers Soc Psychol Bull*. 2013;39:131–143. doi:10.1177/0146167212468332
- [44] Kolegraff S, Parrotta K. Safety first means safety fits: a mixed methods analysis of gender and personal protective equipment feminist hackathon. *New Trends in Qualitative Research*. 2023;16:e790. doi:10.36367/ntqr.16.2023.e790
- [45] Rooney L. Researching the impact of female partners on men seeking help for mental health problems – using interviews. SAGE research methods cases part 2. London: SAGE; 2018. doi:10.4135/9781526427861