Original research

Identifying occupational health inequities in the absence of suitable data: are there inequities in access to adequate bathrooms in US workplaces?

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ABSTRACT

Objectives Our research questions are often chosen based on the existence of suitable data for analysis or prior research in the area. For new interdisciplinary research areas, such as occupational health equity, suitable data might not yet exist. In this manuscript, we describe how we approached a research question in the absence of suitable data using the example of identifying inequities in adequate bathrooms in US workplaces.
Methods We created a conceptual model that hypothesises causal mechanisms for occupational health inequities, and from this model we identified a series of questions that could be answered using separate data sets to better understand inequities in adequate workplace bathrooms. Breaking up the analysis into multiple steps allowed us to use multiple data sources and analysis methods, which helped compensate for limitations in each data set.
Results Using the conceptual model as a guide, we were able to identify some jobs that likely have inadequate bathrooms as well as subpopulations potentially at higher risk for inadequate bathrooms. We also identified specific data gaps by reflecting on the challenges we faced in our multistep analysis. These gaps, which indicated future data collection needs, included difficulty finding data sources for some predictors of inadequate bathrooms that prevented us from fully investigating potential inequities.
Conclusions We share our conceptual model and our example analysis to motivate researchers to avoid letting availability of data limit the research questions they pursue.

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ Conducting research in interdisciplinary research areas, such as occupational health equity, can be challenging because suitable data often do not exist.

WHAT THIS STUDY ADDS

⇒ We created a conceptual model that hypothesises causal mechanisms for occupational health inequities, which can guide the analyses with less than optimal data.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ Using this approach allows researchers to combine multiple data sources and analysis methods to answer a single research question, expanding the research questions that can be addressed with existing data.

INTRODUCTION

The research ideas we pursue are often dictated by data availability or by prior literature on the research idea. Sometimes, however, we encounter a topic for which the scope of the problem has not yet been described or no suitable data have yet been collected. Although barriers to conducting research in this situation can be substantial, researchers might be able to create new knowledge from existing data to justify further analyses or data collection.

Finding appropriate data is particularly challenging when researchers examine new interdisciplinary topics, such as occupational health inequities (ie, avoidable differences in work-related health outcomes closely linked with social, economic and/or environmental disadvantages).[1] Because the close link between work and 'social, economic, and/or environmental disadvantages' is not well defined, relevant research fields have not been well integrated, and existing health data sets seldom have adequate data for examining the role of work in creating health inequities across population groups.[2] This lack of data likely contributes to the slow development of occupational health inequities as a field of investigation.

We use inequities in adequate bathrooms in US workplaces as an example of an important topic for which appropriate data are not readily available. Based on previous small-scale studies and reports, we suspected that workplace bathrooms are inadequate for some workers, but we had no suitable data sets available to directly estimate if inadequate bathrooms are patterned by type of work or worker characteristics in the US working population.[3–5] Therefore, we developed a conceptual model and used this model to guide analyses that combined multiple data sources to characterise the potential for inequities in adequate workplace bathrooms. This study had two main aims. First, to propose a conceptual model that can guide research into occupational health inequities; second, to apply the conceptual model to an inequity question for which no single data set could provide a suitable answer. To show how this conceptual model can guide research, we outline in detail our strategy and decision-making. We use inadequate workplace bathrooms as an example and investigate potential

inequities across gender, race/ethnicity and education. Through this example, we also identify specific data gaps for further investigation.

Access to adequate bathrooms as an occupational health problem

The US Occupational Safety and Health Administration (OSHA) requires that employers provide bathrooms for their employees and allow them to use bathrooms as needed; however, many workers report using the bathroom at work less frequently than they want to.[4–8] Reasons include no bathrooms in the work location (eg, transit operators), bathroom deficiencies that discourage their use (eg, lack of privacy, uncleanliness, too few toilets, long distances to the bathroom), inability to access available bathrooms (eg, bathrooms cannot be used outside of break times, workers too busy, supervisors denying requests for bathroom use) and perceiving bathrooms as unsafe.[3–6 9–11]

Workers who use bathrooms less frequently than needed are more likely to report urinary tract infection and urinary incontinence than those who use bathrooms as needed.[5 12] Workers with these conditions report lower work productivity and have greater likelihood of work disability, with some workers leaving employment because of their symptoms.[13–15] Further, workers with inadequate bathrooms are at risk for wetting or soiling themselves in the workplace, a distressing and embarrassing event that affects mental health and is an affront to workers' dignity.[3] These studies indicate that having adequate workplace bathrooms is an important occupational health issue.

Adequacy of workplace bathrooms may not be uniformly distributed in the US workforce, but we have found no study that has investigated this question. As previous research on workplace bathrooms has focused on women, particularly healthcare workers, inadequate bathrooms in other worker groups or workplaces are not well described.[16] If we could detect inequities in inadequate workplace bathrooms, we could identify populations at risk and occupations that could benefit from interventions to improve workplace bathrooms.

METHODS

We developed a conceptual model that articulates our hypotheses about the causation of occupational health inequities. Conceptual models for occupational health inequity exist, but few studies have applied these models to their investigations.[17–20] One reason might be that these models include a large number of factors and no single data set contains all variables needed to fully apply these models. Recognising the difficulty that occupational health inequity researchers face in applying conceptual models to their research, we propose a simple model, consistent with previous ones, and focusing on two interconnected mechanisms by which inequities arise: occupational segregation and occupational health inequity (figure 1).

The first mechanism, occupational segregation, represents various social processes that sort people into certain occupations based on demographic characteristics, as observed by uneven compositions in occupation by gender, race/ethnicity and educational attainment in the US workforce (in our example, we focus on these characteristics because they are the strongest axes of occupational segregation in the US workforce).[21–24] These social processes include gendered expectations and systemic discrimination, among others. For example, as a result of these social processes, men might be more likely than women to work as a roofer. The second mechanism, occupational health inequity, is the existence of avoidable differences in work-related health.[1] In our example of inadequate bathrooms, some occupations have work characteristics—such as outdoor work in a location without nearby bathrooms—that cause inadequate bathrooms for people in these jobs and subsequently affect health; other occupations do not have these characteristics.

The conceptual model demonstrates how occupational segregation and occupational health equity together cause health disparities or inequities across demographic characteristics. For example, if men were more likely to work as a roofer than women, roofers were more likely than other jobs to involve outdoor work far from bathrooms, and having far bathrooms caused bladder problems, then men would have a higher
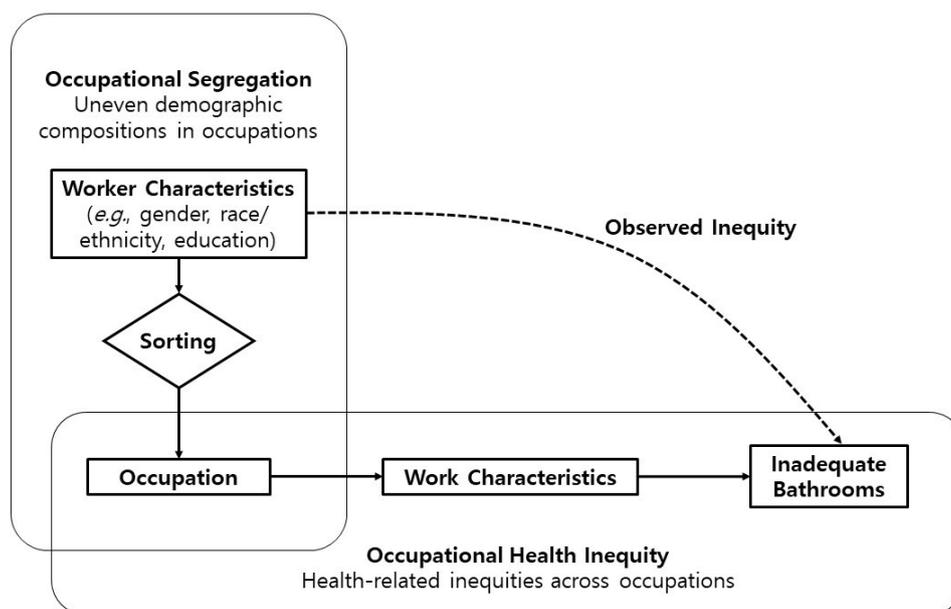

Figure 1 A conceptual model illustrating the mechanisms that cause observed inequities in inadequate workplace bathrooms by worker characteristics: uneven demographic compositions across occupations (ie, occupational segregation) and health-related inequities across occupations (ie, occupational health inequity).

prevalence of bladder problems than women: a gendered health inequity. A key component of our conceptual model is that the second mechanism, occupational health inequity, involves avoidable differences in working conditions. In our example, we could avoid the gendered health inequity in bladder problems by providing roofers portable bathrooms on the job site and frequent breaks to use them. The model therefore suggests solutions to work-mediated health inequities: improving working conditions across occupations. This solution is fully compatible with existing occupational safety and health practices.

When researchers study work-related inequities, a conventional approach is to directly compare the prevalence of work characteristics or health outcomes across gender, race/ethnicity or educational attainment groups; for example, if working men are more likely to report inadequate bathrooms than working women (shown in figure 1 by the direct arrow from worker demographics to inadequate bathrooms). However, our conceptual model recommends against this approach because it fully ignores the true causes of inadequate bathrooms. A person's gender, race/ethnicity or educational attainment is not the cause of inadequate workplace bathrooms. Stated another way, we are not interested in describing how inadequate bathrooms vary by demographic characteristics; rather, we are interested in the role of occupation in mediating relationships between demographic characteristics and inadequate bathrooms. Inadequate bathrooms are typically caused by work-level characteristics, not individual-level characteristics, like having a workspace without bathrooms available or work demands or workplace policies that prevent workers from accessing available bathrooms. An important exception is targeted discrimination or harassment. For example, among transgender or non-binary workers, individual characteristics such as gender identity or expression can be a source of discrimination and improper denial of access to workplace bathrooms.[11] Power dynamics also play a role; supervisors can control workers' bathroom access, and fear of retaliation prevents workers from reporting inadequate bathroom access to management or OSHA.[3 10]

One difficulty in applying conceptual models is that typically no single data set includes all variables in the model. Instead, our model identifies three steps to answer our research question using different data sets if needed (figure 2). We therefore began at inadequate bathrooms and worked through the steps that we hypothesised caused the inequities: work characteristics, occupation and, finally, worker characteristics.

RESULTS

Step 1: link work characteristics to inadequate bathrooms

We found one data set that included both work characteristics and workplace bathrooms: the 2015 American Working Conditions Survey (AWCS).[25] AWCS was an internet-based survey fielded in 2015 to members of the American Life Panel, a sample of 5000 households in the 50 US states, District of Columbia and Puerto Rico who are regularly invited and paid to complete online surveys. We included 1822 members of the American Life Panel who participated in AWCS, were currently working and answered the question about inadequate bathrooms (see online supplemental methods for additional details).

In the AWCS questionnaire, inadequate bathrooms were measured by: 'Are you bothered by any of the following in the place you spend most of your working time? … Inadequate toilet facilities.' Respondents could answer yes or no, but no information was elicited about why bathrooms were inadequate. For the purpose of this analysis, we interpret the question broadly to include inadequate physical properties (eg, uncleanliness, too few bathrooms) and inadequate access (eg, bathroom is present but logistically inaccessible). We then selected AWCS questions about work characteristics that might influence adequacy of bathrooms: workplace uncleanliness, working outdoors daily, working in a vehicle daily, work pace set by machine, work pace set by customers, ability to take breaks when needed and ability to control pace of work. These or related characteristics have been reported in association with inadequate workplace bathrooms.[3 5 6 9 26]

We used Poisson regression with robust SEs to estimate prevalence ratios (PRs) and 95% CIs for associations between work characteristics and inadequate bathrooms, with PR ≥1.5 defined as an association between the characteristic and inadequate workplace bathrooms. This cutpoint was arbitrary, but we had no objective method to determine associations with inadequate bathrooms. We stratified analyses by gender because of potential gender-based differences in occupations, working conditions and perceptions of adequate bathrooms. In our conceptual model, gender is depicted as a predictor of occupation and not a potential modifier of the relationships depicted; conducting a
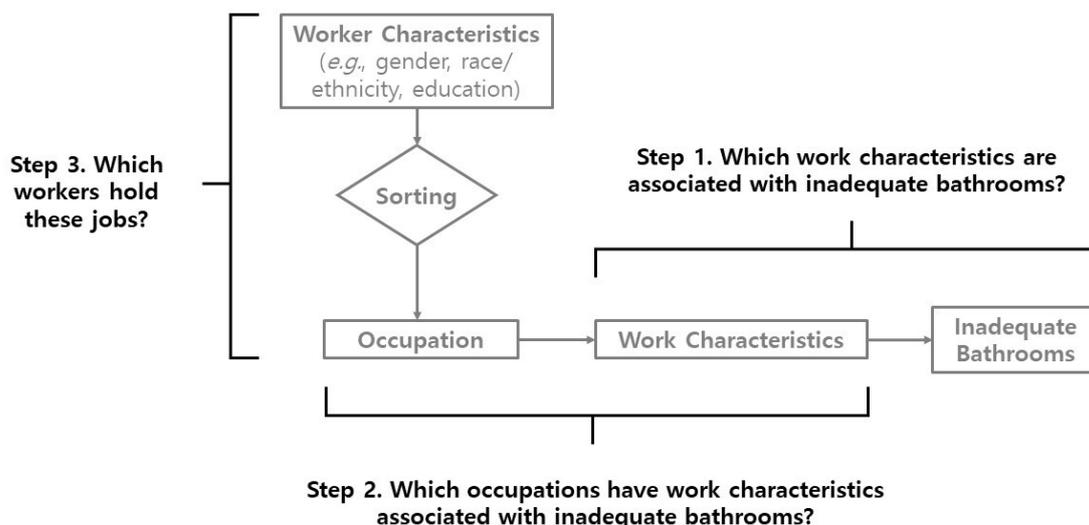

Figure 2 Three steps used to identify potential differences in inadequate bathrooms in the workplace by worker characteristics.

Table 1 Prevalence of inadequate bathrooms by work characteristic among the 1822 respondents—American Working Conditions Survey, 2015

	n	Weighted prevalence of inadequate bathrooms (row %)	Prevalence ratio	95% CI
Workplace cleanliness				
Not clean	277	48	5.9	3.8 to 9.2
Clean	1483	8	1.0	Reference
Missing	62			
Works outdoors				
Daily	103	36	2.9	1.8 to 4.6
Less than daily	1716	12	1.0	Reference
Missing	3			
Works in a vehicle				
Daily	130	29	2.2	1.4 to 3.7
Less than daily	1688	13	1.0	Reference
Missing	4			
Pace set by machine				
Yes	334	23	1.9	1.2 to 3.1
No	1488	12	1.0	Reference
Missing	0			
Pace set by customers				
Yes	1395	16	1.6	1.0 to 2.6
No	427	10	1.0	Reference
Missing	0			
Can take breaks				
Not usually	711	18	1.5	1.0 to 2.3
Usually	1109	12	1.0	Reference
Missing	2			
Can control pace of work				
No	370	16	1.1	0.7 to 1.7
Yes	1451	15	1.0	Reference
Missing	1			

stratified analysis allows us to assume separate models for the causation of work-related health inequities for men and women.

Among the included AWCS respondents (1019 women and 803 men), 13% of women and 16% of men reported inadequate workplace bathrooms. Of the seven work characteristics, all but ability to control pace of work were associated with inadequate bathrooms (table 1). The strongest association was with workplace uncleanliness (PR 5.9, 95% CI 3.8 to 9.2), followed by working outdoors daily, working in a vehicle daily and work pace set by machines. When stratified by gender, pace set by customers was associated with inadequate bathrooms only among men and ability to take breaks only among women (online supplemental table 1).

Reflections on step 1

In step 1, we identified work characteristics associated with inadequate bathrooms using AWCS data. If we did not have this data source, we could have used secondary sources (eg, literature) to identify work characteristics potentially associated with inadequate bathrooms. However, because we had access to these data, we could quantify these associations.

Conducting step 1 using AWCS, which was not designed specifically to study workplace bathroom access, revealed further data needs. Important work characteristics associated with inadequate bathrooms were not collected in AWCS; these include

information on the physical space and attributes of workplace bathrooms, such as distance from the workspace, availability of toilet paper, presence of doors and locks and accessibility to workers with disabilities. This information would allow us to better inform strategies for improving workplace bathrooms. Some causes of inadequate bathrooms (eg, availability and accessibility) are covered by OSHA regulations and can be enforced through inspections and citations, whereas others (eg, cleanliness) would likely require other approaches, such as pressure from workers or labour unions.[26] We also found differences by gender, which might indicate gender or sex differences in perceptions of bathroom adequacy or bathroom needs, hypotheses we could not pursue without more detailed data on why workers thought their bathrooms were inadequate. An additional limitation in AWCS was that the sample size was small relative to the large number of jobs in the US workforce. Online supplemental table 2 shows the jobs in the study population in 23 broad Standard Occupational Classification groups; some groups had few or no respondents. As a result, the AWCS population is likely not representative of the full US workforce. Although we cannot assume that our results are representative of all workers, we can use these data to better understand workplace characteristics associated with bathroom access in a contemporary worker population.

Step 2: identify occupations with work characteristics indicating inadequate bathrooms
Occupational Information Network

We used the Occupational Information Network (O*NET, version 24.0) to link occupations with work characteristics.[27] O*NET is a Department of Labor database that describes most jobs in the US workforce. Each occupation is characterised using a standard set of data collected from workers or experts about work characteristics, pay and requirements. Validation studies find good agreement between O*NET and worker-reported work characteristics, and O*NET is commonly used as a job exposure matrix to obtain work data not otherwise available in research studies.[28]

Of the six work characteristics identified in step 1, three were included in O*NET: working outdoors, working in a vehicle and work pace set by machine. O*NET included information for each job on (1) how often it required workers to be outdoors exposed to weather and outdoors under cover (five categories ranging from never to every day), (2) how often the job required workers to be in an enclosed vehicle and in an open vehicle (five categories ranging from never to every day) and (3) the degree to which a work pace determined by speed of equipment was important to each job (five categories ranging from 'not important at all' to 'extremely important'). O*NET converted the five response categories to a score ranging from 0 to 100, with higher scores indicating more frequency or importance. For working outdoors and working in a vehicle, we used the highest of the two scores (outdoors exposed to weather/under cover, enclosed/open vehicle) as the measure. We sorted jobs by O*NET score and defined jobs with scores ≥75th percentile as having that work characteristic.

Among the 967 jobs with O*NET estimates, 70 (7%) had all three characteristics associated with inadequate bathrooms (working outdoors, working in a vehicle, pace set by machine), 158 (16%) had two, 202 (21%) had one and 537 (56%) had none. The jobs with the highest 20 scores are shown in table 2 as examples of jobs identified.

Table 2 Examples of job titles associated with outdoor work, working in a vehicle and pace set by machine—O*NET version 24.0

	Outdoor work		Working in a vehicle		Pace set by machine	
	Job title	O*NET score	Job title	O*NET score	Job title	O*NET score
1	Sailors and marine oilers	100	Police patrol officers	100	Extruding and drawing machine setters, operators, and tenders, metal and plastic	95.2
2	Railroad brake, signal and switch operators	100	Refuse and recyclable material collectors	99.6	Tire builders	92.6
3	Roustabouts, oil and gas	100	Fish and game wardens	99.6	Roof bolters, mining	92.0
4	Service unit operators, oil, gas and mining	100	Wellhead pumpers	99.4	Packaging and filling machine operators and tenders	92.0
5	Pipelayers	100	Pest control workers	99.0	Conveyor operators and tenders	91.6
6	Metre readers, utilities	100	Transit and railroad police	98.6	Computer-controlled machine tool operators, metal and plastic	89.2
7	Derrick operators, oil and gas	99.8	Fire inspectors	97.6	Logging equipment operators	89.0
8	Crossing guards	99.8	Logging equipment operators	97.4	Mine cutting and channelling machine operators	88.6
9	Refuse and recyclable material collectors	99.6	Airfield operations specialists	96.8	Chemical plant and system operators	88.2
10	Roofers	99.6	Telecommunications line installers and repairers	96.0	Metal-refining furnace operators and tenders	88.2
11	Landscaping and groundskeeping workers	99.6	Front-line supervisors of police and detectives	96.0	Chemical plant and system operators	87.8
12	Pile driver operators	99.6	Locomotive firers	96.0	Cement masons and concrete finishers	87.6
13	Parking enforcement workers	99.6	Bus drivers, school or special client	96.0	Printing press operators	86.8
14	Rotary drill operators, oil and gas	99.4	Automotive master mechanics	95.8	Extruding, forming, pressing and compacting machine setters, operators and tenders	86.4
15	Wellhead pumpers	99.4	Postal service mail carriers	95.4	Hoist and winch operators	86.0
16	Brickmasons and blockmasons	99.4	Baggage porters and bellhops	95.0	Biofuels processing technicians	85.8
17	Log graders and scalers	99.2	Animal control workers	94.8	Textile knitting and weaving machine setters, operators and tenders	85.0
18	Rail-track laying and maintenance equipment operators	99.0	Locomotive engineers	94.8	Food batchmakers	84.8
19	Septic tank servicers and sewer pipe cleaners	99.0	Criminal investigators and special agents	94.8	Farm workers and labourers, crop	84.4
20	Pump operators, except wellhead pumpers	98.8	First-line supervisors of logging workers	94.6	Meat, poultry and fish cutters and trimmers	84.2

O*NET, Occupational Information Network.

Revisiting AWCS data

The remaining three work characteristics—uncleanliness, ability to take breaks and pace set by customers—were unavailable in O*NET, and we found no other data set aside from AWCS linking jobs to these characteristics. There were too few AWCS respondents in each job to use these data to identify specific jobs associated with each work characteristic. If we were to conduct this analysis more formally, we could explore collaborating with industrial hygienists to identify jobs with the missing characteristics; in particular, pace set by customers might be a work characteristic that could be assigned based on industry and occupation.

Reflections on step 2

We had mixed success. Half of our analysis was a dead end, and half proceeded to step 3. We were also unable to continue our gender-stratified analyses because O*NET reports a single score for each job. Population-based occupational health research can be challenging because of the large sample sizes required to obtain a representative sample of the hundreds of jobs in the US workforce. Data sets like O*NET that include information on nearly all jobs are important supplements to population-based studies. We had concerns about moving on to step 3 with only half of our work characteristics of interest found in O*NET. Given occupational health's historical focus on the hazards found in male-dominated manufacturing or manual labour jobs, it would not be surprising if the work characteristics included in O*NET were those predominantly found in those jobs.[29] In the AWCS population, men, workers with less than a college education and workers of colour were more likely to work in jobs with those three working conditions (online supplemental table 3). We proceeded with the analysis aware that our study might identify jobs commonly held by men, those without a college degree and workers of colour as being associated with inadequate bathrooms solely because of the types of working conditions included in O*NET.

Step 3: describe workers in jobs with inadequate bathrooms

We obtained the distribution of gender, race/ethnicity and education by occupation from the 2015–2019 Current Population Survey (CPS) accessed through the IPUMS website.[30] CPS is the nation's primary source of employment data, in which approximately 60 000 households are interviewed about their labour market participation.[31] We successfully linked 417 CPS jobs to O*NET (see online supplemental methods for further details)

Table 3 Demographic composition of jobs with 0, 1, 2 or 3 characteristics associated with inadequate bathrooms—Current Population Survey, 2015–2019

		Jobs with 0 characteristic* (n=265)	Jobs with 1 characteristic* (n=86)	Jobs with 2 characteristics* (n=47)	Jobs with 3 characteristics* (n=15)
Gender					
% Women	Range	1.6–97.7	0.5–81.8	0.0–44.8	0.0–28.0
	Median	53.9	20.4	5.8	3.1
Educational attainment					
% College degree	Range	2.7–100	1.3–87.2	0.0–77.6	1.5–76.0
	Median	45.2	8.7	14.6	7.5
Race/ethnicity					
% NH white	Range	23.8–94.9	29.1–86.8	22.0–92.0	36.1–86.8
	Median	68.8	60.4	70.7	70.6
% NH black	Range	0.6–35.4	0.0–36.5	0.0–27.1	0.0–21.2
	Median	8.9	9.3	9.2	6.4
% Hispanic or Latino	Range	0.0–65.8	6.5–54.5	2.1–76.4	5.9–59.2
	Median	10.7	20.0	13.3	19.2
% NH Asian or Pacific Islander	Range	0.0–58.4	0.0–14.0	0.0–14.7	0.0–4.9
	Median	5.4	3.3	2.2	0.8
% NH American Indian or Alaska Native	Range	0.0–6.6	0.0–3.8	0.0–2.9	0.1–3.3
	Median	0.5	0.6	0.5	1.0
% NH multiracial	Range	0.0–5.5	0.0–3.8	0.0–3.7	0.1–2.3
	Median	1.4	1.2	1.1	0.7

*Jobs with 0, 1, 2 or 3 of the following characteristics: working outdoors, working in a vehicle or pace set by machine.
NH, non-Hispanic.

and reported the demographic composition of jobs with 0, 1, 2 or 3 of working outdoors, working in a vehicle and pace set by machine (table 3). These results reveal apparent inequities. As the number of characteristics associated with inadequate bathrooms increases, jobs have fewer women and college-educated workers, and the racial/ethnic composition of jobs changes.

Reflections on step 3
O*NET-CPS data had a large enough sample size to generate the demographic distributions of workers within each job; we were no longer restricted by the small sample size of AWCS. However, we entered step 3 suspecting that we would identify jobs with a high proportion of men, workers of colour and those with less than college education, and we did. It makes sense that these jobs could have inadequate workplace bathrooms because they often involve working outdoors without bathrooms nearby or working in situations where a work task cannot be left to use the bathroom. What remains to be seen is who works in the jobs with the other three work characteristics: uncleanliness, inability to take breaks and work pace set by customers. These could represent jobs held by women; these characteristics have been reported in studies of working women.[5 6 9]

We also note a limitation of O*NET: it provides a single score for each job. Previous research demonstrates that men and women who hold the same job title perform different tasks[32] and that O*NET scores correlate with self-reported work characteristics more strongly for non-Hispanic white workers than for racial/ethnic minority workers,[33] raising the possibility that the data might not accurately reflect the working conditions of some worker groups at high risk for inadequate bathrooms.

Lessons learnt
Although our attempt to identify inequities was only semisuccessful, we identified men, workers with less than a college education and workers in racial/ethnic minority groups as more likely to work in jobs with characteristics indicating inadequate bathrooms. Given that much of the literature on workplace bathrooms focuses on women in healthcare, the experiences of men in occupations that do not require a college degree could be an important addition to the literature.

Our findings suggest at least three future directions. First, jobs with characteristics indicating inadequate bathrooms (table 2) could be starting points for identifying jobs that could benefit from intervention. Employers following OSHA regulations might already ensure bathroom access, and needs assessments among workers in these jobs could identify unmet needs or lax compliance. Second, data on workplace cleanliness, ability to take breaks and work pace set by customers could be useful if included in population-based or occupation-based data sources. A new national survey from the Bureau of Labor Statistics, the Occupational Requirements Survey, will include ability to pause work in its data collection.[34] Finally, given rising temperatures due to climate change, ensuring that outdoor workers have adequate bathrooms is crucial for preventing heat-related illness; workers with inadequate bathrooms avoid drinking at work, putting them at risk for dehydration.[12 35 36] In the AWCS population, outdoor workers were three times as likely as indoor workers to report inadequate bathrooms.

DISCUSSION
We developed a conceptual model to explore how to address a research question for which appropriate data do not exist. We combined multiple data sets to generate preliminary information about inequities in adequate workplace bathrooms. Difficulties at each step prevented us from coming to firm conclusions, but our attempt highlighted ways to leverage existing information to identify opportunities for future research and gaps in available data.

By presenting our effort to investigate inequities in adequate workplace bathrooms, we hope to inspire researchers to overcome the common situation of data availability dictating what research questions we ask. Instead, researchers can leverage existing data, although imperfectly, to expand the horizon of research topics we pursue, including issues of occupational health equity. Our conceptual model echoes calls for theory-driven, data-informed research.[37 38] By explicitly hypothesising the causal mechanisms for inequities, we identified three separate but crucial questions along the causal pathway and were able to use different data sets to address our research question. Starting a research study with a conceptual model, rather than generating a model based on available variables in a single data set, helps us to see what we could do with limited data and future directions for the field.

By breaking our larger research question into smaller ones, we could use multiple data sets to answer our question. Combining multiple data sources is often referred to as a fusion design.[39] Our process differed from most fusion designs because we did not integrate the data sets to create a single result; we conducted three separate analyses. In some ways, this process was similar to triangulation, in which multiple studies with different limitation are used to answer the same research question; however, our analyses answered separate smaller questions.[40] Although we hesitate to describe our strategy as either a fusion design or triangulation, we encourage researchers to think of creative ways to use multiple data sources to answer research questions.

Another strength of the conceptual model was steering us away from comparing the prevalence of inadequate bathrooms by gender, race/ethnicity and education, a typical approach if a large, diverse, individual-level data set on bathroom access existed. Such analyses focus on worker characteristics but do not inform solutions because they ignore structural causes of inequities. For work-related inequities, the workplace—not the individual—is the most effective intervention point, whether achieved by regulation or by following the hierarchy of controls.

As we reflected on each step of the analysis, we identified future directions to improve occupational health inequity research more broadly. First, incorporating information on work into population-based epidemiological studies would facilitate understanding health inequities. Although work is both a social and structural determinant of health, it is rarely included in epidemiological studies outside of occupational epidemiology.[2 41] Studies that include industry, occupation and work characteristics would allow researchers to understand how work contributes to health inequities. Second, the opposite is true—occupational health studies would benefit from including information on non-occupational social determinants of health for the same reasons. Third, a viable way to approach understudied occupational exposures, such as inadequate bathroom access, uncleanliness and inability to take breaks, could be to launch small-scale studies. By applying the methods we used in this analysis, even limited data from these small-scale studies could be useful in addressing complex emerging issues.

We encourage researchers to start a research project not by looking at available data, but by considering which research questions are worth asking. What data are collected and what are not—what is recognised as important and what is not—is decided in specific social contexts, which can be changed. If suitable data do not exist, researchers can advance knowledge by articulating assumptions, maximising use of fragmented data and drawing conclusions with appropriate caution. Data availability does not have to limit our pursuit of important research questions.

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