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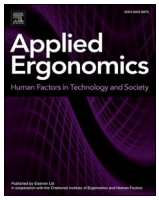

Comparing perceptions of operational inefficiencies among clinical healthcare workers by professional role

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ABSTRACT

Operational inefficiencies remain a critical occupational burden to clinical healthcare workers, contributing to adverse organizational and employee outcomes. Perceptions of these inefficiencies likely vary across occupational roles, yet these differences have not been thoroughly explored in the healthcare setting. To address this gap, inefficiencies at work were self-reported by 1083 interdisciplinary clinical healthcare workers within a large academic medical center in the southeastern United States. A qualitative inductive thematic analysis was used to describe employee perceptions of work tasks, processes, or systems that seem duplicative, poorly designed, or unnecessary. Matrix coding was used to explore differences based on professional roles. Specific inefficiencies were differentially experienced across professional roles, including but not limited to role definition, education, and staffing. The reported differences highlight the need to engage with all healthcare workers to enhance the experience of all roles across the organization.

1. Introduction

Advancements in medicine and technology and the growing prevalence of chronic health conditions necessitate a more specialized, collaborative workforce that can address complex medical needs (Knickman and Kovner, 2015). As a result, the United States (US) healthcare system has shifted from a mostly physician-delivered uni--disciplinary model to a multi-disciplinary team approach (Dinh et al., 2020; Doherty and Crowley, 2013; Knickman and Kovner, 2015). Healthcare organizations now employ a variety of healthcare professionals with a range of training, responsibilities, and functions (Anderson and McDaniel Jr, 2000; Landry and Erwin, 2015), including radiologists, medical assistants, respiratory therapists, and social workers (Knickman and Kovner, 2015). When implemented effectively, the multidisciplinary model can enhance the organization's efficiency through professionals operating at the top of their licensure through streamlined systems (Dinh et al., 2020; Doherty and Crowley, 2013; Epstein, 2014; Srinivas et al., 2024). This is a key reason for its widespread adoption. However, the increasing variety of healthcare professions can also present unique challenges to efficiency (Nigam et al., 2014; Studdert et al., 2002; Tsiachristas et al., 2015; West and Lyubovnikova, 2013), which must be addressed if the healthcare system is to deliver cost-effective, high-quality care.

One of the challenges presented by a multidisciplinary team is the difficulty identifying inefficient processes within the organization. Studies show that the perception of inefficiencies is subjective and that different professional groups have varying opinions of what constitutes and contributes to inefficient processes or practices (Contandriopoulos et al., 2018; Cresswell and Sheikh, 2013; Nigam et al., 2014). When healthcare was mainly delivered by physicians and nurses, employees were more likely to identify similar inefficiencies due to the congruence between their perspectives and duties. This is contrasted with teams composed of multiple types of professionals, in which identification of different inefficiencies is more likely due to distinctive training, functions, and responsibilities of each occupation (Nigam et al., 2014).

Within healthcare settings, operational inefficiencies occur when the ratio of the quality and quantity of healthcare services delivered to the resources used to produce them is out of balance, and thus, processes are deemed unproductive or wasteful (Nigam et al., 2014). To add further difficulty to identifying operational inefficiencies within healthcare settings, this ratio can encompass many inputs and outputs. The outputs generally considered when defining efficiency in the healthcare setting

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can be health, quality, timely delivery, expense, and patient satisfaction, while inputs are regarded as resources like healthcare processes and procedures, staffing, and medical supplies (Cogin et al., 2016; Guerrini et al., 2018; Papalexi et al., 2020; Yaduvanshi and Sharma, 2017). With a myriad of inputs and outputs, the array of operational inefficiencies that healthcare professionals may identify is wide-reaching. Inefficiencies cited in the literature include poor communication and workflow resulting from the design of the physical work environment (Ahmadpour et al., 2021), resource access issues or shortages (Phuong et al., 2019; Strech et al., 2008), poorly designed and coordinated electronic health systems and services (Blijleven et al., 2017), and the expectation to complete work tasks that are perceived as illegitimate or inconsistent with a provider's level of competence (Anskär et al., 2022). Staffing decisions (Marufu et al., 2021; Tamata and Mohammadnezhad, 2023), inefficient organizational interactions (e.g., rounding burdens) (Chan et al., 2022), supply waste (Janik-Karpinska et al., 2023), and duplication of tests and tasks (Ayabakan et al., 2017) have also been identified, with still more sources of healthcare inefficiencies (Storfjell et al., 2009). With variations in responsibilities and scope across healthcare roles, certain inefficiencies may affect some roles more than others.

Healthcare managers use a variety of tactics to identify operational inefficiencies, including data analysis, economic evaluation, lean engineering principles and processes, and solicitation of employee feedback (Cannavacciuolo et al., 2015; Cylus et al., 2017; D'Andreamatteo et al., 2015; Jamal et al., 2015; Kazadi, 2023; Moraros et al., 2016; Sartini et al., 2022). The goal of these methods is to ascertain the most important operational inefficiencies to address and maximize the quality and quantity of health services delivered from resources used to produce those services. However, each of these methods has its drawbacks.

When using employee feedback, managers are more likely to elicit and include the perceptions of high-power, high-authority professionals. In healthcare systems, this is often administrators and physicians (Goldstein and Ward, 2004; Mason et al., 2013; Veronesi et al., 2013). Since role-specific training and orientation can shape the way individuals perceive operational inefficiencies, as well as their willingness to engage in organizational solutions (Franco et al., 2002; Nigam et al., 2014), this approach risks overlooking key inefficiencies that fall outside of the perspective of higher-level professionals and may reduce the willingness of other professions to contribute to the solution. In contrast, a more comprehensive understanding of role-related experiences facilitates the development of tailored interventions that address unique challenges and perspectives on common problems (Ahlness et al., 2023; Anderson et al., 2024; Galura and Parchment, 2024; Morley et al., 2022; Van Bogaert et al., 2014), and facilitate the entire team's involvement in a solution (Franco et al., 2002; Nigam et al., 2014).

Identifying and addressing inefficiencies is not only important for the profitability of the organization. There are also negative individual-level downstream effects of unaddressed operational inefficiencies, including increased risk for burnout (Boitet et al., 2023b; Dyrbye et al., 2017; West et al., 2018), distress (Colón-López et al., 2022), and staff experiencing violence from patients (Meese et al., 2024; Milcent and Milcent, 2018). With healthcare workforce burnout now recognized as a public health crisis within the US, coupled with current and predicted healthcare worker shortages that threaten the viability of the healthcare system, addressing these inefficiencies is more critical than ever in the present climate (Athey and E, 2020; Murthy, 2022; Zhang et al., 2020).

Despite the need for a multi-disciplinary-focused solution to operational inefficiencies within healthcare settings, there is a lack of comprehensive qualitative studies comparing self-reported inefficiencies of clinical healthcare workers across roles. Most studies only compare perspectives of operational inefficiencies between nurses and physicians while excluding large groups of other healthcare professionals (House and Havens, 2017; Tang et al., 2013). Other studies only include one professional group without understanding its relation to other professions within the multidisciplinary team (Jamal et al., 2015). Studies that include more professional groups in analysis are limited in scope and focus on singular clinics, cases, programs, or inefficiencies (Panda et al., 2016).

To our knowledge, this is the first study to examine the operational inefficiencies experienced within the totality of healthcare delivery by the multidisciplinary team in a large healthcare setting. Without this understanding, role-specific inefficiencies cannot be identified, nor can the ways in which these inefficiencies are experienced across roles be fully understood. As a result, this critical information cannot be effectively integrated into organizational strategies aimed at improving efficiency. This study addresses this significant gap in understanding with two key aims: (i) To understand how systemic inefficiencies are perceived across multidisciplinary clinical roles within healthcare teams and (ii) To use qualitative methods to identify nuanced experiences of inefficiency that are unable to be identified by purely quantitative methods. We aim to provide additional insight needed to ensure that organizational interventions and approaches are tailored to the specific needs of each role, enhancing the overall effectiveness of those interventions and improving communication and collaboration, leading to more efficient workflows.

2. Materials and methods

2.1. Study design and participants

An anonymous, cross-sectional, semi-structured survey was distributed to 23,697 eligible employees across various professional roles, including clinical (e.g., physician, ancillary staff, medical trainee, and nurses) and non-clinical (e.g., administration and management, Scientist/Non-clinician Faculty, and Graduate/Postdoc Trainees) workers at a large academic medical center in the southeastern United States. This was part of a larger annual employee engagement survey effort aimed to capture the experience of those working within a large, multi-site medical enterprise, including a university hospital, a large eye hospital, a children's hospital, and other affiliated regional campuses and clinics, as described in other studies (Boitet et al., 2023a, 2023b; Meese et al., 2021, 2024). The survey measured individual resilience and wellbeing, as well as individual- and organizational-level factors and major general work, clinical and nonwork stressors. The overall purpose of the survey was to capture the holistic experience of healthcare workers to identify areas for organizational improvement, including addressing inefficiencies related to work. The data were collected from June to July 2022 through an internet-based survey using Qualtrics (Seattle, Washington). Participants were informed of the minimal risks associated with the anonymous survey and were required to provide consent to participate before beginning. Participants were automatically exited from the study if they declined. The surveying organization's Institutional Review Board reviewed and approved the study protocol.

The purpose of this study was to understand clinical healthcare workers' experience with operational inefficiencies within their workplace. As such, only clinical staff were considered in the current analysis and included physician and clinician faculty, physician scientists, advanced practice providers (APPs), nurses, medical trainees (e.g., medical students, residents, and fellows), and ancillary staff (certified medical assistants, clinical lab personnel, nutritionists, pharmacists, and pharmacy technicians, radiology professionals, rehabilitation and therapy service staff, respiratory therapists, and social workers).

2.2. Variables and descriptive analysis

The definition of operational inefficiency adopted for this study was the imbalance in the ratio between the value of health services delivered (i.e., the quantity and quality of care) to the resources used in producing health services, resulting in wasteful or unproductive work (Nigam et al., 2014). To capture the clinical healthcare worker experience based

on this definition, the variable considered for qualitative analysis was an open-ended survey item that asked about the employee's perceptions of work inefficiency: *"Are there tasks, processes or systems that seem duplicative, poorly designed or unnecessary? Are there ways to improve workflow?"* The question prompt was intentionally broad to capture inefficiencies related to individual work experience and to capture differences based on job role.

Demographics were collected as close-ended categorical variables and included age, gender, race, and professional role. Supervisor status and work location were also collected. Descriptive statistics of the categorical variables were conducted using StataSE 18.0 (Stata Corp., College Station, Texas) and summarized using frequency and percentages.

2.3. Qualitative analysis

Using the six phases recommended by Braun and Clarke (2006), we conducted an inductive thematic analysis using a semantic approach, where themes summarized explicit statements by respondents. Qualitative analysis was conducted using NVivo 14 (Lumivero, Denver, CO). To enhance the credibility of the findings, two researchers co-coded all data for inter-rater triangulation (Patton, 2023). Coders included a professor of industrial engineering specializing in occupational ergonomics and a doctoral student in health services administration with a history as a healthcare chaplain. After familiarizing themselves with the data, the researchers coded the first 100 responses together to generate a preliminary codebook and then simultaneously, but individually, coded batches of responses, meeting together to recursively adapt the codebook and discuss any discrepancies. All responses were coded, even though inductive thematic saturation, the point at which no new substantive codes and no new themes emerge (Saunders et al., 2018), was met by 1150 responses. Intercoder reliability was assessed using a percentage of intercoder agreement, which was 98.25% overall and higher than 94% for any individual code.

Following open coding, the two coders met to cluster similar codes and create a hierarchical node structure based on related ideas. A team of researchers specialized in organizational behavior refined the coding structure based on theoretical understandings of operational inefficiencies. Then, matrix coding (Patton, 2023) was used to assess and summarize the data according to professional role using Nvivo's coding comparison query. First, code-oriented variable-by-theme matrix coding was used to visualize the number of occurrences of each code by professional role, enabling researchers to compare the frequency with which codes emerged by professional role (Miles et al., 2014; Sivesind, 1999). Then, content-oriented variable-by-theme coding was conducted (Miles et al., 2014; Sivesind, 1999). In this step, the two coders read and analyzed all coded text within each cell of the professional role-by-code matrix to generate a nuanced understanding of similarities and differences in codes between professional groups. Using this technique prevents oversimplifying content to the presence and frequency of codes and allows for nuanced differences in the content of the codes by professional role to be generated. Finally, the team of researchers specialized in organizational behavior was consulted about inferences to further enhance the credibility of the findings.

3. Results

A total of 6466 employees completed the survey (27.3% response rate) with 3493 being clinical staff whose responses were considered for this study. A total of 1083 clinical staff (31% of all clinical staff survey respondents) responded to the open text-based item related to work inefficiency and served as the final analytical sample. Characteristics of

Table 1
Characteristics of Qualitative Question Survey Respondents presented in Counts and Percentage by Professional Role. (n = 1083).

	All Respondents (N = 1083)		Physicians and Clinical Faculty (N = 247)		Physician Scientists (N = 61)		Advanced Practice Providers (N = 106)		Nurses (N = 378)		Medical Trainees (N = 33)		Ancillary staff (N = 258)	
Age	N	%	N	%	N	%	N	%	N	%	N	%	N	%
18-34	319	29.5	20	8.1	1	1.6	26	24.5	148	39.2	25	75.8	99	38.4
35-54	419	38.7	133	53.8	27	44.3	47	44.3	117	31.0	5	15.2	90	34.9
55+	157	14.5	53	21.5	18	29.5	9	8.5	58	15.3	0	0.0	19	7.4
PNA/missing	188	17.4	41	16.6	15	24.6	24	22.6	55	14.6	3	9.1	50	19.4
Gender														
Male	234	21.6	112	45.3	27	44.3	11	10.4	37	9.8	18	54.5	29	11.2
Female or sexual minority	682	63.0	95	38.5	23	37.7	70	66.0	290	76.7	12	36.4	192	74.4
PNA/missing	167	15.4	40	16.2	11	18.0	25	23.6	51	13.5	3	9.1	37	14.3
Race														
Non-white	194	17.9	42	17.0	7	11.5	5	4.7	56	14.8	7	21.2	77	29.8
White	666	61.5	150	60.7	40	65.6	72	67.9	251	66.4	19	57.6	134	51.9
PNA/missing	223	20.6	55	22.3	14	23.0	29	27.4	71	18.8	7	21.2	47	18.2
Supervisor														
Yes	416	38.4	185	74.9	56	91.8	20	18.9	112	29.6	12	36.4	31	12.0
Work Location														
Admin Office (in-person)	45	4.2	12	4.9	5	8.2	0	0.0	22	5.8	1	3.0	5	1.9
Admin Office (hybrid/remote)	26	2.4	3	1.2	8	13.1	1	0.9	11	2.9	1	3.0	2	0.8
Ambulatory	317	29.3	112	45.3	11	18.0	49	46.2	59	15.6	4	12.1	82	31.8
Emergency Room	52	4.8	13	5.3	1	1.6	0	0.0	25	6.6	1	3.0	12	4.7
Hospital ICU	152	14.0	11	4.5	2	3.3	11	10.4	98	25.9	0	0.0	30	11.6
Hospital (non-ICU)	256	23.6	34	13.8	3	4.9	23	21.7	120	31.7	14	42.4	62	24.0
Operating/Procedure Room	96	8.9	42	17.0	6	9.8	19	17.9	17	4.5	8	24.2	4	1.6
Hospital Laboratories	29	2.7	6	2.4	1	1.6	1	0.9	0	0.0	1	3.0	20	7.8
Research Lab	17	1.6	0	0.0	14	23.0	0	0.0	0	0.0	0	0.0	3	1.2
Other	93	8.6	14	5.7	10	16.4	2	1.9	26	6.9	3	9.1	38	14.7

PNA = Preferred Not to Answer.

the survey respondents are reported in Table 1.

Clinical staff reported 36 distinct inefficiency themes. Notably, these inefficiencies encompass both typical problematic processes (e.g., "*We have to push like fifty buttons just to start an echo*." (Ancillary staff) as well as inefficiencies that stem from underlying issues but are not wasteful processes in and of themselves (e.g., "*Pay front desk staffing enough money to make it a more stable job so there's less turn-over. We are constantly having to train new staff and they leave before they are very knowledgeable about what they are doing*." (Physician and clinician faculty).

Inefficiencies were classified into seven categories, which describe overarching organizational processes, functions, or purposes. The categories were:

(1) ***Resource access and function*****:** difficulty obtaining tangible and intangible assets that help employees accomplish their work or poor operation of these resources.
(2) ***Protocols and standardization:*** issues with processes being standardized in a way that is not helpful or the need for standardization to support a more efficient work environment.
(3) ***Work burden:*** contributors to the perceived heavy workload employees need to accomplish, either because specific tasks must be completed multiple times or because of high productivity expectations.
(4) ***Accountability and equity:*** interrelated concepts within the dataset, describing the need for workers at various levels to be held responsible to similar standards and responsibilities or to be treated equally.
(5) ***Staffing decisions and practices:*** organizational practices regarding appropriate staffing levels and the allotment and scheduling of staff.
(6) ***Patient scheduling and flow:*** how patients are organized to receive healthcare services and moved through the healthcare system.
(7) ***Organizational interactions:*** communication between and within groups in both formal and informal meetings.

See Table 2 for a complete list of inefficiencies with subthemes, descriptions, and exemplary quotations.

Code-oriented and content-oriented variable-by-theme matrix coding revealed similarities and differences in the experience of inefficiencies by professional role.

3.1. Similarities

There is considerable similarity in the way that professional roles describe many operational inefficiencies. No substantive qualitative differences were identified between how professional roles described the following inefficiencies: compensation, communication resources, digital applications and programs, paperwork or charting burden, overwork, multiple or numerous inefficiencies, accountability and equity of leaders, accountability and equity of organization, lack of standardization or frequent changes, needed standardized administrative process, patient scheduling, patient transfers, throughput, referrals and discharge planning, and meeting and rounding burden.

Similarly, the primary difference between several inefficiencies was that different professional groups identified specific tasks relevant to their job, people with whom they work most closely, or issues related to their job scope but otherwise described the experience of the inefficiency in the same way to other professions. For example, nurses identify specific chart note functions relevant to nursing tasks, like patient intake and discharge, while physicians identify chart note functions relevant to charting the clinical visit. Themes in which this was the case include the electronic healthcare record (EHR), clinical resources, accountability of other units, departments and organizations, duplicative work, and needed standardized clinical processes.

Table 2
Inefficiency Descriptions and Exemplary Quotations, arranged by Frequency of Identification.

Theme	Description	Exemplary Quotation
Resource Access and Function		
Electronic Healthcare Record (EHR)	Issues with the operability of the EHR or other patient documentation, including click burden, downtime issues, system navigation, and specific non-functioning forms.	The EMR is labor intensive and user-unfriendly (Physician and Clinician Faculty)
Staff Compensation & Benefits	Availability and adequacy of compensation and other benefits, including paid time off, breaks, wellness events and resources, on-site transportation, and travel.	CME reimbursement is too cumbersome and makes employees feel like they have to do a lot of work for a benefit. (APP)
Training & Education	Issues accessing quality continuing education opportunities, such as difficulty leaving a clinic to attend training, inappropriate training, and specific types of training that are needed but not offered.	Focusing on training and evaluation of knowledge learned early on could help eliminate issues with workarounds or shortcuts. (Nurse)
Clinical resources	Access to and function of supplies needed for clinical tasks, such as medications, machines, or test results. Issues with restocking and availability of resources.	Making sure each operating room has the necessary equipment it needs before each case (Medical Trainee)
Space and Parking	Space does not meet staff needs, including space that is poorly designed, insufficient for clinic demands, poorly turned over, and inadequate parking.	As we have grown, we've had to repurpose space which is tight in several areas. (Ancillary Staff)
Communication resources	Challenges related to communication devices (e.g., pager) include interruptions by technology during breaks and difficulty integrating the devices into the workflow. Includes devices that inhibit the flow of information between workers or patients.	[Communication tool] is annoying and disrupts workflow with difficult to silence notifications (I have to uncover my face to make it stop beeping while I'm working in a sterile environment?). (Physician and Clinician Faculty)
Digital applications and programs	The need for electronic forms, applications, or services to improve clinical and administrative tasks, including paperwork, charting, dietary ordering, and procedures.	No one [is] open to new technologies that can improve patient care and make the radiology workflow easier (Physician scientist)
Research systems	Issues with systems designed to support research at the institution include slow Institutional Review Board processes, issues with hiring research personnel, and trouble accessing research funds.	[Grant departments] are both disasters causing so much unnecessary frustration, loss of time, loss of money, and exhaustion. It makes it hard to want to get funding when the leadership does not help us execute it, makes it so difficult to use funds, document funds, or fulfill grants appropriately. (Physician Scientist)
Other resources mentioned by less than 2% of respondents: food services, resources for patients with psychiatric diagnoses or complex social needs, supply waste, covid-related resources, HR hiring and staffing resources, generic supplies and ordering, patient insurance coverage, and operational improvement teams		
Protocols and Standardization		

(*continued on next page*)

Table 2 (*continued*)

Theme	Description	Exemplary Quotation
Needed standardized clinical process	Clinical processes and procedures that could be improved through standardization, including medicine distribution, check-in workflow, and medical procedures.	Respiratory Therapist driven protocols would help. Not everyone needs IPV and FVCs Q6. (Ancillary Staff)
Needed role definition	Need for clear expectations around task execution to avoid work that is out of scope for certain roles or role overlap.	Clearly define scope of work and operational procedures (Physician Scientist)
Needed autonomy & decisional involvement	A desire for more power or authority in their roles to address or prevent inefficiencies, including involvement in decisions and the ability to lead processes and procedures directly related to their or their clinics' work.	Let those who utilize the hospital lab the most to have control. (Physician and Clinician Faculty)
Lack of standardization or frequent changes	Changes that happen too often for employees to keep up with, or a perceived unmet need for process standardization, in general.	Stop implementing new processes and allow leadership to hardwire current processes. Filter all changes through one source so too much doesn't come at once, which is all the time. (Nurse)
Standardized regulation or credentialing issues	Inefficiencies caused by credentialing or auditing processes.	The nonsense auditing and [accreditation body] stuff. These people have NO idea what I do and they come in and tell me what I can or cannot do. (Physician and Clinician Faculty)
Needed standardized administrative process	Suggestions for standardized administrative processes or procedures to help with inefficiencies. Examples include hiring, billing, and tracking continuing education hours.	Tracking CME's is spread among different desks at different departments and hospitals. A central and knowable accounting could spare this stressor at the time of license renewal. (Physician and Clinician Faculty)
Work Burden		
Duplicative work	The same person, or two or more people/departments doing the same task more than once. Redundant charting, clinical processes, and administrative processes are frequently described.	Nurses, residents, then attendings taking the same history seems redundant and leads to frustrated families who usually take that out on resident learners who spend the most time with them. (Medical Trainee)
Paperwork and charting burden	The time burden or stress from excessive paperwork and charting.	Too much "stuff" that has to be done in charting that takes us away from patient care. Policy and procedure instead of doing what is easiest and best for patients and family of patients. (Nurse)
Overwork	Issues with workload, either from unrealistic expectations, insufficient staffing relative to job demands, or other factors.	There is no possible way for nurses to chart and do everything that is required of them … Requirements are unrealistic. (Nurse)
Multiple/numerous	The sheer number of inefficiencies is highlighted without reference to what they are.	The inefficiencies are literally too many to name. (Medical Trainee)
Accountability and Equity		
Of coworkers	Problems that result from coworkers not completing their work effectively or efficiently, such as sluffing off responsibilities or performing clinical tasks poorly.	Coworkers are lazy and that puts extra work on the employees that actually do work. (Ancillary staff)
Of other units, departments or organizations	Problems that arise due to other areas not completing their tasks effectively or efficiently, such as processing lab results, writing effective chart notes, or transferring patients.	I not only complete my duties as a PCT but also those of EVS [Environmental Services], nutrition services, transport, etc. Most of those areas are understaffed and the staff within those fields often lack efficiency, leaving the work to those on the floor. (Ancillary Staff)
Of leaders	Issues that arise from leaders' ineffective job completion, such as perceived inefficacy of decisions made and organizational contribution, and redundancy in leadership roles.	The higher ups area always making decisions for our workplaces and make things so much more difficult, when they have no idea how someone's clinic actually run. (Ancillary Staff)
Of organization	Inefficiencies due to organizational level failures, such as perceived misspending of funds and a misaligned mission, negatively impacting efficient, quality care.	Institutional responsiveness is slowing (Physician Scientist)
Staffing Decisions and Practices		
Appropriate Staffing	Issues related to staffing numbers and suggestions to hire, retain, or, to a lesser degree, fire staff. Hiring and retaining staff identifies various roles, while firing staff refers almost exclusively to leadership.	Hiring more staff would improve workload, predictability, and morale. (Physician and Clinician Faculty)
When and where people work	Inefficiencies related to staff allocation and staff scheduling that do not function optimally, including staff allocation on specific units, shift assignment, virtual work, and issues related to weekend, night, and holiday work.	Our unit has its own challenges and special considerations that are very hard to explain to non-clinical staff who are trying to make decisions on where to send nurses. (Nurse)
Patient Scheduling and Patient Flow		
Patient scheduling	Strains on staff and patients regarding scheduling patients appropriately, the scheduling service being centralized rather than clinically based, overbooking, access issues, and prioritizing appropriate cases. Most citations pertain to a disconnect between the scheduling services and the clinic and/or patient needs.	90% of appts scheduled have to be rescheduled by the [nurse navigators]s because they are scheduled incorrectly in some way. Either [central schedulers] need more training or we need to be rid of access for scheduling oncology patients and have dedicated oncology schedulers. (Nurse)
Patient transfers, referrals, throughput, discharge planning	Issues related to the flow of patients through the inpatient system or between inpatient and outpatient systems. Frequently mentioned issues include boarding in the emergency	Patient throughput is challenged by boarding, poor patient progression through health care system leading to an overburdened emergency department unable to meet the needs of the community and special

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Table 2 (*continued*)

Theme	Description	Exemplary Quotation
	department, operating room flow, discharge planning, and referrals.	needs of our patients. (Physician and Clinician Faculty)
Organizational Interactions		
Communication	Breakdowns in information flow between people in a unit, between departments, or between organizations, including communication of mission and priorities, interdisciplinary work, email burden, and siloed work.	In my particular small group, the passing of information does not always happen and we get left out of some things. (Ancillary Staff)
Meetings and Rounding	Ineffective, inefficient, or too many meetings, rounding, or committee assignments.	So. Many. Meetings. Meetings that talk about what the last meeting said, yet we will meet about it again and again. (Nurse)

3.2. Notable qualitative differences professional groups' inefficiency descriptions

Meaningful differences were identified in how professional groups experienced several inefficiencies:

3.2.1. Training and education

Survey participants described training and education from different perspectives. Physicians and physician scientists have the most pessimistic view of training required by the organization, often describing it as unnecessary, burdensome, or irrelevant to their role. One physician scientist reported, "*Compliance education is burdensome … The recent module on financial responsibility … was awful; it was only appropriate for admin persons working in financial and with no experience at [organization]*". Physicians and physician scientists wanted improved education processes that are tailored and streamlined as possible, with many of the requirements being removed. In comparison, medical trainees (e.g., medical students, residents, and fellows) most often commented on training through the lens of their role as learners. While they viewed some specific educational experiences as unfavorable, the majority reported education as having value and requested additional or modified learning experiences: "[*organization] clinics are not good learning experiences; there could be a greater emphasis on teaching.*" Medical trainees also identified training and education as a method to address the incompetencies of other workers at the institution. They were similar to other professions in this way; nurses, APPs, physicians, and ancillary staff also endorse training having value to improve other's incompetence: "*Lack of training the correct way has all of the new techs thinking they don't have to answer the phone, fill the medicines in the queue, etc.*" (Ancillary staff).

3.2.2. Needed role definition

While there are similarities in the way that professionals experience the need for role definition, there are also crucial differences. Physicians, APPs, and Pharmacists (one of the ancillary staff roles) describe the need to operate at the top of their licensure and view the solution to be offloading lesser tasks onto people with less training (e.g., administrative burdens): "*Physicians are asked to perform tasks that are well below pay grade and best use of time"* (Physician). In contrast, nurses, ancillary staff, and medical trainees primarily describe the burdens of overwork associated with others offloading responsibilities on them, especially when these are not within their defined job responsibilities: "*I feel like nurses are the catch all for most processes. We consistently have to pick up where other services are short staffed (EVS [Environmental Services], Dietary, etc.)"* (nurse). Ancillary staff also describe a lack of understanding of their role and duplicative tasks between themselves and other providers: "*Responsibilities of social workers vs RN [registered nurse] case managers feels duplicative and not a good use of skills*."

3.2.3. Autonomy and decisional involvement

Several types of inefficiencies related to autonomy span across roles, such as the inability to control one's work schedule and the inability to make clinical decisions or perform clinical procedures within the scope of practice. For ancillary staff, however, issues related to autonomously scheduling one's work were more salient than for other roles. Specifically, ancillary staff cited a disconnect with management understanding their role and motivating the need for more autonomy in clinic scheduling: "*Middle management (Leads) create daily schedules for all departments. With interdisciplinary leads (PT[physical therapy], OT [occupational therapy], ST[speech therapy]), the schedule is often incorrect and does not accurately represent the needs of patients. This could be easily fixed by allowing each therapy department to create their own schedule*."

Another difference was that only nurses and ancillary staff referenced being excluded from decision-making within the clinic: *"Better way to improve work flow is by actually listening to those who actually work in the work place. The higher ups are always making decisions for our workplaces and make things so much more difficult, when they have no idea how someone's clinic actually runs." (*Ancillary staff). Additionally, nurses reported a perceived lack of autonomy as undermining their expertise and experience: "*The cosigning of discharges demeans the professionalism of the nurse*." While frustrated by the lack of accountability and equity, other professional roles did not experience it as personally damaging to one's conception of self.

3.2.4. Appropriate staffing

Issues related to appropriate staffing levels include hiring staff (197 cases), retaining staff (82 cases), and, to a lesser degree, firing staff (12 cases). Various specific roles were mentioned in hiring and retaining staff while firing staff almost exclusively referred to leadership. Both nurses and ancillary staff most frequently identified needing more professionals within their roles. Physicians, APPs, and physician scientists most frequently referred to needing additional administrative personnel.

3.2.5. When and where people work

This subtheme included a range of staffing decisions related to when and where people work, with considerable differences between professional groups in which specific decisions were noted. Nurses, APPs, ancillary staff, and physicians identify clinical shifts that would create a better workflow for the unit or be better suited for their schedule. Both shift predictability for the employee and the unit is desired: "*I do not understand how [organization] thinks it is safer to keep travelers on a unit and reallocate staff nurses. Even if a staff nurse picks up on open shift, a traveler should be reallocated first.*" (Nurse). Nurses also mention matching needs to staffing resources, with the perception that using a digital application to staff units is not sufficiently addressing this issue. For them, acuity and patient-to-provider ratio are key factors for improving the efficiency of staffing allocation. Appropriate accommodations for staffing the weekends, nights, and holidays were also an issue for all roles except physician scientists:

> "*An unnecessary system/process to me is having a social worker in care coordination roles (and the corresponding RN's [registered nurses] too) be considered a required employee on holidays that has to come in. We are so very limited on holidays as the agencies/resources we usually work with are closed on most holidays, …While I understand the reason for having an on-call worker on the major holidays, I do not find it beneficial for us to be here on every holiday with no way to really provide services.*" (Ancillary staff).

Finally, virtual work was perceived both positively and negatively across roles. Ancillary staff, however, more frequently reference virtual work positively and conducive to their role: "*majority of the tasks that I'm doing at work during working hours are task that can really be done in the*

comfort of my own home."

3.2.6. Communication

This theme included various types of communication, with specific communication barriers and frustrations differing by roles. Physicians more frequently mentioned email burden. Siloed work served as a more salient impediment for ancillary staff, nurses, and physicians than other roles: "*There needs to be coordination between nursing and physicians so that all members of the care team know up to date patient status, plan of care, discharge plan and can openly address any concerns or milestones.*" (Nurse).

3.3. Differences in frequency with which inefficiencies are identified

In addition to being qualitatively different, the frequency with which professional roles identified specific inefficiencies varied. See Table 3 for the number of staff who reported each inefficiency by role. The top five inefficiencies identified by all respondents were: duplicative work (19.6% of cases), appropriate staffing (19.3% of cases), EHR (16.2% of cases), needed standardized clinical practices (15.1% of cases), and communication (11.0% of cases). However, there was variance in the top five inefficiencies identified by each role, with some high-ranked inefficiencies among professional groups not being highly ranked among the total sample (Table 4).

In addition to the most frequently identified inefficiencies differing

Table 3
Number of staff reporting inefficiency type by professional role.

	All Respondents (N = 1083)		Physician and Clinician Faculty (N = 247)		Physician Scientists (N = 61)		APPs (N = 106)		Nurses (N = 378)		Medical Trainees (N = 33)		Ancillary staff (N = 258)	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Resource Access and/or Function	**596**													
Electronic Healthcare Record	175	16.2	57	23.1	9	14.8	17	16.0	70	18.5	6	18.2	16	6.2
Staff Compensation, Perks & Benefits	73	6.7	17	6.9	9	14.8	7	6.6	17	4.5	0	–	23	8.9
Training & Education	69	6.4	10	4.0	4	6.6	8	7.5	27	7.1	5	15.2	15	5.8
Clinical resources	65	6.0	12	4.9	6	9.8	2	1.9	20	5.3	3	9.1	22	8.5
Space and Parking	40	3.7	9	3.6	2	3.3	1	0.9	16	4.2	2	6.1	10	3.9
Communication resources	39	3.6	12	4.9	3	4.9	6	5.7	13	3.4	0	–	5	1.9
Digital apps and programs	26	2.4	3	1.2	5	8.2	1	0.9	10	2.6	0	–	7	2.7
Research systems	26	2.4	3	1.2	20	32.8	1	0.9	2	0.5	0	–	0	–
Food service	20	1.8	0	–	0	–	1	0.9	12	3.2	0	–	7	2.7
Resources for pts with psychiatric diagnoses or complex social needs	16	1.5	5	2.0	1	1.6	0	–	7	1.9	0	–	3	1.2
Supply Waste	15	1.4	2	0.8	1	1.6	2	1.9	2	0.5	0	–	8	3.1
Covid-related resources	12	1.1	5	2.0	1	1.6	2	1.9	1	0.3	0	–	3	1.2
HR hiring and staffing resources	7	0.6	2	0.8	1	1.6	0	–	4	1.1	0	–	0	–
Generic supplies and ordering	6	0.6	0	–	3	4.9	0	–	0	–	0	–	3	1.2
Patient insurance coverage	4	0.4	1	0.4	1	1.6	0	–	0	–	0	–	2	0.8
Operational improvement team	3	0.3	2	0.8	0	–	1	0.9	0	–	0	–	0	–
Protocols and Standardization	**419**													
Needed standardized clinical process	164	15.1	33	13.4	5	8.2	12	11.3	61	16.1	5	15.2	48	18.6
Needed role definition	101	9.3	25	10.1	4	6.6	19	17.9	26	6.9	4	12.1	23	8.9
Autonomy & Decisional Involvement	60	5.5	16	6.5	2	3.3	5	4.7	17	4.5	1	3.0	19	7.4
Lack of standardization or changes too frequent	36	3.3	10	4.0	3	4.9	4	3.8	11	2.9	0	–	8	3.1
Issues with regulation/credentialing standardization	34	3.1	8	3.2	4	6.6	2	1.9	13	3.4	1	3.0	6	2.3
Needed standardized administrative process	24	2.2	15	6.1	3	4.9	2	1.9	3	0.8	0	–	1	0.4
Perceived Work Burden	**405**													
Duplicative work	212	19.6	37	15.0	12	19.7	16	15.1	106	28.0	2	6.1	39	15.1
Paperwork and charting burden	75	6.9	12	4.9	2	3.3	7	6.6	45	11.9	5	15.2	4	1.6
Overwork	72	6.6	16	6.5	3	4.9	10	9.4	26	6.9	3	9.1	14	5.4
Multiple or numerous inefficiencies	46	4.2	13	5.3	2	3.3	5	4.7	14	3.7	2	6.1	10	3.9
Accountability and Equity	**327**													
Of coworkers	108	10.0	18	7.3	4	6.6	16	15.1	33	8.7	3	9.1	34	13.2
Of other units, departments or organizations	99	9.1	17	6.9	9	14.8	8	7.5	45	11.9	1	3.0	19	7.4
Of leaders	92	8.5	24	9.7	3	4.9	7	6.6	27	7.1	1	3.0	30	11.6
Of organization	28	2.6	9	3.6	2	3.3	1	0.9	11	2.9	0	–	5	1.9
Staffing Decisions and Practices	**296**													
Appropriate Staffing	209	19.3	55	22.3	11	18.0	25	23.6	57	15.1	8	24.2	53	20.5
When and where people work	87	8.0	12	4.9	1	1.6	5	4.7	41	10.8	1	3.0	27	10.5
Patient Scheduling and Patient Flow	**171**													
Patient scheduling	110	10.2	31	12.6	5	8.2	21	19.8	28	7.4	2	6.1	23	8.9
Patient transfers, referrals, throughput, discharge planning	61	5.6	18	7.3	2	3.3	6	5.7	24	6.3	1	3.0	10	3.9
Organizational Interactions	**146**													
Communication	119	11.0	28	11.3	8	13.1	15	14.2	37	9.8	2	6.1	29	11.2
Meetings and Rounding	27	2.5	8	3.2	3	4.9	3	2.8	6	1.6	2	6.1	5	1.9

Table 4
Top 5 most frequently mentioned inefficiencies by professional role.

	All Respondents		Physician and Clinician Faculty		Physician Scientists		APPs		Nurses		Medical Trainees		Ancillary staff	
1	Duplicative work	19.6%	1 EHR	23.1%	1 Research systems	32.8%	1 Appropriate Staffing	23.6%	1 Duplicative work	28.0%	1 Appropriate Staffing	24.2%	1 Appropriate Staffing	20.5%
2	Appropriate Staffing	19.3%	2 Appropriate Staffing	22.3%	2 Duplicative work	19.7%	2 Patient scheduling	19.8%	2 EHR	18.5%	2 EHR	18.2%	2 Standardized clinical process	18.6%
3	EHR	16.2%	3 Duplicative work	15.0%	3 Appropriate Staffing	18.0%	3 Role Definition	17.9%	3 Standardized clinical process	16.1%	3 Paperwork and charting burden	15.2%	3 Duplicative work	15.1%
4	Standardized clinical process	15.1%	4 Standardized clinical process	13.4%	4 Accountability and Equity of other units, departments or organizations	14.8%	4 Accountability and equity of coworkers	16.0%	4 Appropriate Staffing	15.1%	3 Standardized clinical process	15.2%	4 Accountability and equity of coworkers	13.2%
5	Communication	11.0%	5 Patient scheduling	12.6%	4 EHR	14.8%	5 Duplicative work	15.1%	5 Accountability & equity of other units, departments or organizations	11.9%	3 Training & Education	15.2%	5 Accountability and equity of leaders	11.6%
					4 Staff compensation, perks and benefits	14.8%	5 EHR	15.1%	5 Paperwork and charting burden	11.9%				

Note: When inefficiencies were mentioned with the same frequency, they are indicated as occupying the same rank and listed in alphabetical order.

by professional role, some roles did not identify inefficiencies that were commonly identified by other professional roles (Table 4). Notably, medical trainees did not identify many of the operational inefficiencies identified by other professional groups, including many specific resource access and function inefficiencies, accountability and equity of the organization, needed standardized administrative processes, and lack of standardization or frequent changes. Only nurses and ancillary staff mentioned issues with patient food services, with APPs referencing issues with obtaining food for themselves. Ancillary staff did not identify research systems as inefficient and minimally mentioned paperwork and charting burdens. APPs notably did not reference when two roles were doing the same task twice when describing duplicative work, while all other professional groups did.

4. Discussion

The objectives of this study were to determine whether operational inefficiencies are experienced differently across professional roles and to gain a deeper understanding of how different professional groups perceive and encounter inefficiencies within multidisciplinary teams. Qualitative techniques were employed to capture the nuance necessary to better inform targeted organizational work design solutions. While our results indicated that healthcare workers identified inefficiencies that have been previously documented in the literature [e.g., staffing decisions (Marufu et al., 2021; Tamata and Mohammadnezhad, 2023), organizational interactions (Chan et al., 2022), and duplication of tasks (Ayabakan et al., 2017)], we also identified notable emergent differences in how various professional groups experienced and perceived these inefficiencies. Our findings underscore the importance of considering professional group identity when addressing inefficiencies in the healthcare system. When viewed in aggregate, the identified organizational inefficiencies and differences across roles highlight three ways that organizations can address organizational inefficiencies to enhance the functioning of the multidisciplinary team.

4.1. *Engage all professional groups' organizational experiences*

Several themes highlight the need to engage all professional groups' experience of organizational inefficiencies. First, our data indicated a need for increased role definition, which was identified by all professional groups yet experienced differently across roles. Roles requiring higher level degrees (physicians, APPs, and pharmacists) reported inefficiency due to perceived barriers to operating at the top of their licensure. Concurrently, ancillary staff and nurses perceived inefficiency as a result of their roles being viewed as a "catch-all" for tasks. Hence, if the organization were to elicit operational inefficiencies only from professionals with higher degree levels, an organizational intervention could involve offloading lower-level responsibilities that are not at the top of one's licensure to ancillary staff and nurses, which may have an unintended consequence of increasing the perceptions of organizational inefficiency among the ancillary staff and nurses.

This finding is relevant to the call in the literature for organizations to align with a person-centered framework, a value-based approach to healthcare that prioritizes people as a central pillar to positive outcomes, such as wellbeing, job satisfaction, and quality patient care (Phelan et al., 2020). In the case of role definition and distribution of tasks, a potential solution from this study's data is to elicit feedback from all professional groups, especially when considering decisions that will impact their specific role and expectations. When using employee engagement surveys to assess inefficiencies, responses should be analyzed by role, and more nuanced, qualitative responses elicited when possible. This is supported by the finding that the top five aggregate inefficiencies in our study are different than the top inefficiencies identified by any singular clinical role. It is further supported by the intricacies that emerged from qualitative data, such as the cosigning of discharges threatening the professional identity of nurses. Using

qualitative data can provide greater efficacy in identifying and addressing specific inefficiencies.

Furthermore, clinical healthcare workers would benefit from decisional involvement regarding standardized tasks workers personally carry out, or that affect their ability to perform aspects of their work. Decisional involvement not only fosters a sense of ownership but also aligns with the participatory ergonomics approach (Burgess-Limerick, 2018; Carayon et al., 2021; Haines et al., 2002; Xie et al., 2015), which facilitates communication between workers of every level of an organization to better develop and implement solutions addressing the intricacies and needs of the workers' specific duties.

4.2. Address work burden to allow access to meaningful work specific to professional groups

The issue of work burden was identified as another overarching theme in this study, including references to duplicative work and heavy workload. Notably, many quotes related to work burdens referenced inefficiencies that prevented workers from fully engaging in the most meaningful aspects of their jobs. Examples in this study's data include physicians being drawn away from patient care by charting, social workers from counseling by research tasks, and physician scientists from research by administrative responsibilities. Meaning in work has been identified as a core component of workforce engagement, allowing healthcare workers to foster a sense of accomplishment and importance in their work (Liu et al., 2021; Sikka et al., 2015). When systems or processes hinder workers' ability to access this meaning, they pose a threat not only to job satisfaction, wellbeing, and employee retention but also to the quality and safety of patient care (Lai and Fleuren, 2022). Research has identified that predictors of the ability to access meaning in work include work-role fit, significance of work tasks, and socio-moral climate (Schnell et al., 2016), indicating a strong argument for organizations to examine role-specific hindrances to work engagement.

Organizations should consider several points when considering work burden-related inefficiencies. Patient care and the advancement of clinical research are fundamental components of healthcare, with organizations commonly establishing strategic goals centered on patient satisfaction and research funding (Arnetz et al., 2020). To achieve these objectives, healthcare executives must recognize the work burdens and inefficiencies that impede the attainment of these goals. Importantly, what is meaningful for each profession varies, and role-specific or even individual-specific meaning must be considered when addressing how professionals spend their time. For example, physicians and nurses identified the EHR as a top inefficiency and frequently discussed it as impeding their ability to spend time on patient care. Similarly, physician scientists most frequently identified research system inefficiencies and discussed how those systems prohibited them from attaining and using funding that would equip meaningful research to advance knowledge. Opportunities for advancement, career development, and job crafting practices are shown to also increase work-role fit, wherein proactive career approaches allow individuals to align their skills with the demands of their jobs (Sylva et al., 2019; Tims et al., 2016).

4.3. Staffing, retention, and training for multi-disciplinary team efficacy

Thirdly, several identified inefficiencies prevented the team from working together efficiently, and if addressed, could enhance organizational efficiency. First, issues related to staffing emerged as a frequently cited inefficiency, encompassing the need for appropriate staffing in addition to allocation and scheduling. While healthcare worker shortages are well-documented (Halstead and Sautter, 2023; Konstantinidis, 2024; Mayes et al., 2024; Tamata and Mohammadnezhad, 2023), our data indicated nuance within its impact on healthcare efficiency. Healthcare workers reported the need to focus on the retention of employees who stay within the organization, in addition to efforts made to fill position vacancies. A request for appropriate staffing also emerged, with citations referring to the need for more specialized clinical support staff (e.g., social workers) to assist with patient needs that are out of the scope of the clinical providers' roles. Interestingly, ancillary staff, nurse, and administrative personnel roles were the most requested additional staff. In comparison to higher-level administrators, physicians, and APPs, these would be lower costs to add to the organization.

Related to this theme, issues related to accountability and equity of individuals and entities within the healthcare system were identified. For example, study participants described frustrations with the inability to focus on their job duties due to issues with coworkers not doing their part and fulfilling the responsibilities of vacant and understaffed roles. Similar to staffing concerns, our findings suggest that two components are important to consider in underperforming processes: (i) the actual process and (ii) the competence of the people engaging in those processes.

Respondents further highlighted a lack of training or competence among other team members, which resulted in their own experiences of inefficiency. Interestingly, trainees (e.g., medical students, residents, and fellows) found considerable value in training and education opportunities, likely due to their role within the organization as learners. Conversely, some roles identified required training as irrelevant in addition to training opportunities that are needed but not offered, with references to the limited amount of time healthcare workers have available to engage in potentially meaningful training opportunities. Therefore, there is value in considering educational burnout to create role-specific, relevant education. Organizations can work to provide training that is developed due to the identified needs of various job roles or departments. However, our data cautions against blanket training, which is required but not necessarily relevant to all roles and takes time away from more important work tasks.

4.4. Practical implications beyond this setting

The results of this study can further enhance how healthcare organizations approach eliciting and integrating employee feedback from the multidisciplinary team. The engagement strategies discussed in this work, such as providing access to job resources that promote meaning and purpose in work, alignment of employee and organizational values and expectations, job control and autonomy, and social support (Carayon et al., 2020; Shanafelt and Noseworthy, 2017) may also be applicable to related domains that have reported similar inefficiencies, such as the pharmaceutical supply chain (Papalexi et al., 2020). Integrating clinical decision support technologies that have been designed with human factors principles in mind may also improve operational efficiency (Carayon et al., 2020; Salwei et al., 2024). Additional research is needed, however, to better understand the nuanced experiences of employees in other fields to optimally address operational inefficiency.

4.5. Strengths and limitations

The results of this study must be considered within the constraints of its limitations. First, the study was conducted during the summer of 2022 using a text-entry question on a larger employee engagement survey. Healthcare workers during this time were challenged by a surge of COVID-19 (Archibald, 2022). As such, participants may not have had the opportunity to express themselves fully. Also, some participants may not have felt comfortable submitting written information, with concerns about their anonymity despite the anonymous nature of the survey. Further, this study only captured the experiences of work inefficiency in clinical populations, not the entire healthcare team. While the majority of the sample is white, female, and between the ages of 25 and 54 years old, the sample proportionally matched the demographics and characteristics of the larger sample from which the qualitative responses were drawn. Data was also collected from a single institution; however, the

survey was distributed to the entire institutional enterprise, which encompasses a separate eye hospital and several satellite or free-standing locations. Although the data may not be generalizable to all other hospital systems, the inefficient tasks, processes, and systems described largely mirror what is reported in the literature. Of note, the qualitative emergent themes do not necessarily attest to the frequency by which the entire population experienced these inefficiencies. Follow-up studies to corroborate these findings using quantitative measures that assessed the frequency of these emergent themes using a survey disseminated to healthcare professionals are needed. Finally, saturation may not have been met among all subgroups. An example is medical trainees, where only 33 respondents replied to the open-ended response. Caution should be paid to generalizing differences associated with this group. Future studies might examine a broader sample of medical trainees and their perspectives on workplace inefficiencies.

5. Conclusion

This study of clinical healthcare workers illustrated the work tasks, processes, and systems that were perceived as duplicative, poorly designed, or unnecessary. Some participants also described how workflows could be improved from their perspective in their specific role. While organizations may survey employee experiences, such as work inefficiencies, they may only collect data as categorical variables. Our results emphasize that organizations must consider qualitative data collection and its careful analysis, as this method provides the nuance and understanding needed to address root issues. Moreover, these responses must be analyzed based on job role. The evolution of healthcare requires additional focus on people and processes, creating job-specific solutions for problems faced by employee groups. In adopting organizational collective decision-making and engagement approaches, such as participatory ergonomics, solutions can be developed and implemented that address the nuanced work burdens affecting all workers.

CRediT authorship contribution statement

P.J. Sprik: Writing – review & editing, Writing – original draft, Validation, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **M.C. Schall:** Writing – review & editing, Writing – original draft, Validation, Supervision, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **L.M. Boitet:** Writing – review & editing, Writing – original draft, Validation, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **K.A. Meese:** Writing – review & editing, Writing – original draft, Validation, Resources, Project administration, Investigation, Data curation. **D.A. Rogers:** Writing – review & editing, Validation, Supervision, Resources, Project administration, Funding acquisition.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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