

Article

Task-Based Configuration Model for Occupational Safety and Health in Heritage Work Environments

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Abstract

Despite being classified as low-risk workplaces, museums involve tasks that generate demands, chemical exposure, and management-related stress that accumulate over time. This study assesses the relationship between occupational safety and health conditions in museums and task organization within operations to develop a task-based coordination approach grounded in practice. A mixed-methods design was employed in three museums, encompassing conservation, public interaction, and administrative activities. Data included 30 task observations in each museum, collected through on-site observations, posture assessment, checklist evaluation of chemical handling and ventilation practices, task-focused exchanges, and observation of leadership engagement during activities. Task configurations, defined as the combination of technical and organizational conditions under which a task is performed during routine activities, were compared through task scenarios developed as analytical models using a composite task-level safety index. Results suggested that exposure patterns varied with the technical and organizational conditions of task execution. Task configurations combining adjustable equipment, functional ventilation, coordinated task allocation, and regular leadership presence had lower frequencies of ergonomic, chemical, and organizational non-compliance. The findings indicate that occupational safety and health practice in museums depends on how technical and organizational measures operate at the task level.

Keywords: coordination; museums; occupational safety and health integration; scenarios; task



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1. Introduction

Museums are often classified as low-risk workplaces in occupational safety and health (OSH). In daily practice, museum staff face ergonomic, chemical, and psychosocial risks that receive limited attention. Museum activities involve the preservation, conservation, and management of cultural collections, with routine tasks performed under diverse environmental and organizational conditions [1,2]. Routine museum tasks involve physical effort and chemical handling. Museum work also requires sustained cognitive demand [3]. Limited staffing and time pressure intensify workload and reduce recovery opportunities.

These conditions affect workers unevenly and place a higher burden on employees with reduced physical capacity or long-term vulnerabilities [4].

OSH risks vary across museum functions. Conservators handle solvents and adhesives, often in areas with limited ventilation. Security and visitor service staff perform prolonged standing or walking tasks with minimal ergonomic support. Administrative and curatorial staff work under tight deadlines with limited flexibility [5]. In smaller institutions, safety practices tend to remain reactive and informal, relying on short-term adjustments and ad-hoc decisions, with limited use of structured planning and systematic managerial oversight [2,6]. Museums have progressed more slowly in developing OSH practices. Existing studies tend to address isolated hazards or specific technical solutions, while organizational contexts characterized by limited resources and the absence of in-house OSH expertise remain insufficiently examined [7,8].

Practical risk reduction in museums relies on coordinated ergonomic, chemical, and psychosocial measures. Ergonomic actions align tasks with worker capacity through workstation adjustment and task organization [9]. Chemical exposure decreases through functional ventilation, task separation, and consistent use of personal protective equipment (PPE) [10]. Mental health measures support early recognition of stress and workload management during peak periods [11].

Evidence from other sectors reports that complex systems are not always required to improve OSH. Hazard identification, task-level risk assessment, and clear internal procedures reduce exposure when aligned with real work conditions [12]. Policy frameworks support prevention strategies that integrate physical and psychosocial risk control and protect workers with long-term vulnerabilities [13]. Conventional risk assessment approaches often fail to capture task-level variability and cumulative exposure in resource-constrained work environments [14].

This study responds to these approaches by shifting OSH analysis in museum environments from occupational roles and isolated hazards to routine task configurations. Routine tasks constituted the analytical unit of the study. For comparative analysis, routine tasks sharing similar combinations of technical, organizational, and leadership conditions observed during task execution were grouped into task configurations. A task configuration refers to the technical, organizational, and leadership conditions under which a task is performed. This definition distinguishes task configuration from the formal duties and responsibilities associated with an occupational role. The analysis examines how ergonomic provisions, chemical safety practices, organizational psychosocial arrangements, and leadership presence operate together during daily work and correspond to differences in task-level conditions. Leadership engagement is treated as an observable condition during task execution, distinct from cultural framing or self-reported attributes. The Integrated Scenario Safety Index (ISSI) was used to compare task configurations on the basis of the integration of technical and organizational safety measures. The ISSI is a composite indicator that combines ergonomic, chemical, and organizational dimensions at task level to evaluate the degree of OSH integration across different task configurations. Building on observed task conditions, which include configuration-level comparisons and daily adaptive strategies, the research presents a task-focused, human-centered framework derived from regular work practices.

2. Literature Review

Museums expose staff to several OSH risks, often without formalized safety protocols. Despite their classification as low-risk environments, routine work involves sustained physical demands, chemical exposure, and psychosocial demands. These risks do not affect staff uniformly and place a higher burden on older workers and those with pre-existing

health conditions [2]. Comparable exposure patterns occur in other task-driven workplaces characterized by limited role rotation and restricted organizational capacity [15,16].

Across the three museums, ergonomic demands occurred most frequently during artifact handling and exhibition setup. Repetitive actions, sustained non-neutral postures, and unsuitable furniture contribute to musculoskeletal disorders [11]. Studies have noted that adjustable workstations, lifting aids, and ergonomic training can reduce these risks, but their implementation across museum institutions remains uneven. Research from other sectors on task organization indicates that these differences stem from task planning and sequencing, with the availability of ergonomic solutions playing a limited role [9].

Staff engaged in public interaction or concurrent responsibilities experience higher psychosocial demands [17,18]. Cognitive and emotional demands, combined with limited organizational support, increased the risk of stress and burnout. Interventions such as counseling, peer support, and workload adjustment have produced positive effects in other sectors [5,17,18]. Studies in occupational health management report that such measures lose effectiveness when detached from daily task allocation and workload planning [19].

Chemical hazards were reported in conservation areas. Prolonged exposure to solvents, adhesives, and cleaning agents, especially in spaces with limited ventilation, was associated with respiratory and skin problems [2]. Staff with pre-existing respiratory conditions or chemical sensitivities are more affected under these conditions. The literature supports real-time air quality monitoring, improved ventilation, and consistent PPE use as effective control measures [7,20,21]. Task-based exposure studies from other work sectors report that concentration levels vary with task duration, ventilation use, and work sequencing during routine activities [22,23].

Despite well-documented risks reported across different work sectors, research on OSH in museums remains limited. Most studies assessed single hazards and rarely proposed combined approaches. In other sectors, coordinated OSH strategies supported by leadership and policy frameworks are applied [24]. These sectors provide transferable examples of low-cost and adaptable tools, including motion-based ergonomic assessment, Internet of Things-supported air monitoring, and management-led safety audits, which could be adapted to museum environments. The interaction of such tools at the task level and their influence on daily work decisions remain insufficiently examined in museum contexts [25].

3. Materials and Methods

3.1. Study Design

This study uses a mixed-methods design to examine OSH conditions in museums. The scope covers ergonomic, chemical, and psychosocial risks present during routine work. Daily work tasks define the unit of analysis. Departments and occupational roles were used to group tasks with comparable characteristics. Each task acts as a discrete analytical unit defined by physical demands, environmental conditions, and work organization. This design departs from role-based and department-level OSH assessment by treating task execution and task configuration as the primary analytical unit. In museum environments, a single occupational role frequently involves heterogeneous task sequences, such as artifact handling, exhibition preparation, conservation activities, and visitor interaction, each associated with different exposure conditions. Task-level analysis examines work demands during task execution. Role-based approaches group exposure conditions by occupational roles or department. The approach permits comparison across museums with different internal arrangements and maintains equivalence at the task level. Exposure assessment captures cumulative effects from repeated task execution during regular shifts.

Analysis was conducted using information from three task-level data streams: structured observations performed on-site, professional discourse on specific tasks, and an assessment of task configurations based on scenarios. These inputs identify exposure patterns and OSH measures applicable to routine work. Observations and task evaluations cover routine activities under normal working conditions. Episodic events, exceptional workloads, and non-recurrent activities are excluded. The design concentrates on tasks with sustained physical demands, repeated exposure, or limited recovery time, such as consecutive exhibition setup activities, repeated manual handling during object relocation, prolonged standing during security duties, or task sequences performed with minimal breaks between activities. Breaks between tasks were recorded as part of the observed task sequence and were not analyzed as separate quantitative variables.

3.2. Case Selection

Three museums were selected as case studies based on technical criteria relevant to OSH exposure. Selection targeted institutions that combine conservation laboratories with regular public interaction. These settings involve concurrent physical strain, chemical handling, and psychosocial demand. Case selection followed a purposive approach aimed at identifying museums with comparable task structures while allowing variation in institutional context. Variation in geographical context and staff size supports comparison of task allocation, exposure frequency, and OSH management capacity. All selected institutions operate under European occupational safety and health regulatory frameworks, including workplace safety legislation and chemical management requirements derived from the Registration, Evaluation, Authorization and Restriction of Chemicals (REACH) regulation. Each museum includes conservation activities, front-of-house duties, and administrative work. This structure permits comparison across comparable task categories.

Observations covered multiple consecutive workdays to capture recurrent exposure during routine operations. Data collection excluded special events and atypical activities. Table 1 presents the institutional characteristics of the selected museums.

Table 1. Museum case study summary.

Museum Codification	Geographical Context	Employee Numbers	Domain
Museum A	Urban	51–200	Decorative Art
Museum B	Rural	70–90	History
Museum C	International urban	150–250	Art

Across the three museums, the main hazard categories were comparable and included manual handling during exhibition preparation, solvent use in conservation activities, and prolonged standing or visitor interaction tasks. The analysis assessed the differences in the application of safety practices and control measures during task execution as observable indicators of how these hazards were managed across sites.

3.3. On-Site Task Evaluations

On-site task evaluations consisted of observational assessments that covered ergonomic strain, chemical exposure, psychosocial stressors and leadership engagement during routine work activities. The observations were conducted at the task level, using an identical protocol across all locations. The field observations were performed by members of the research team with training in occupational safety and health and experience in workplace risk assessment. Observations took place during routine work activities in the examined departments. At each museum site, observations were conducted during routine work periods in the departments included in the study. Task observations included active

work phases and covered complete task sequences when these occurred during normal work operations. Each observation covered the duration of the observed task sequence. Observation data were recorded using checklists included in the study protocol.

The task-level observations covered recurrent operational activities performed in conservation, exhibition preparation, visitor interaction, security duties, and administrative work. These tasks included artifact handling during exhibition setup, preparation and application of conservation materials, cleaning or stabilization treatments, manual handling and transport of objects, technical support activities during exhibition preparation, including installation and adjustment of exhibition elements, lighting adjustments, and mounting or dismantling of display structures, visitor monitoring and checkpoint duties involving prolonged standing, information provision to visitors, and computer-based administrative work. These activities represent routine operational tasks involving direct interaction with materials, tools, or the work environment.

Ergonomic risk assessment used the Rapid Entire Body Assessment method (REBA), which scores posture, applied force, and task repetition during active work [26]. REBA scoring occurred during artifact handling, exhibition setup, and routine technical tasks. The assessment covered active work phases. REBA scoring captured seated and standing postures observed during active work. The analysis did not treat these tasks as separate categories. Preparation and idle time were excluded. A 24-item ergonomic checklist recorded workstation adjustability, lifting aids, task lighting, and floor conditions (Table 2). The checklist captured environmental factors influencing physical demands in routine museum tasks.

Table 2. Excerpt from the ergonomic observation checklist.

Item Observed	Criterion
Adjustable workstations	Height-adjustable by the user
Use of lifting aids	Devices present and used during manual handling
Anti-fatigue mats	Present in prolonged standing zones
Task lighting	Focused lighting available at <500 lux

Chemical exposure assessment relied on structured visual inspection of conservation and restoration areas during routine activities. Observations recorded PPE use, chemical labeling, storage practices, and availability and proper functioning of ventilation systems. A 17-item checklist derived from the REACH regulation guided the assessment (Table 3) [27]. Items covered labeling accuracy, segregation of substances, PPE use, and exposure conditions during solvent and adhesive handling.

Table 3. Excerpt from the REACH-based chemical safety checklist used during on-site evaluations.

Criterion Evaluated	Purpose
Labeling of hazardous substances	Identification of chemicals
Availability and use of personal protective equipment	Protective measures for exposure
Ventilation or fume extraction in workplaces	Reduce airborne contamination in confined conservation areas
Proper chemical storage and segregation	Prevent chemical incompatibilities and accidental exposure
Spill kits and containment measures are available on-site	Support prompt response to accidental releases

An observational guide, developed from specific sections of the Copenhagen Psychosocial Questionnaire (COPSOQ), was utilized for psychosocial risk assessment [28]. The study observed psychosocial conditions during task execution rather than individual

perceptions of work. For this reason, indicators derived from selected COPSOQ dimensions were applied as an observational guide during on-site task assessment. Selected COPSOQ dimensions were used as an observational guide for task-level psychosocial conditions and not as a self-reported psychosocial questionnaire. Observation covered workload distribution, role clarity, team interaction, time pressure, and task allocation during routine work. Each indicator was coded separately using predefined observational criteria, and no composite psychosocial score was calculated. Assessment relied on observation of task allocation, coordination during work, interruptions, deadline pressure, and task switching. Task coordination was evaluated by observing how tasks were distributed and sequenced during routine work. The protocol recorded whether tasks were performed sequentially or simultaneously across roles. Observers noted interruptions, connections between activities, and task switching without preparation time. These observations described organizational conditions shaping task execution. Coordination indicators were examined together with ergonomic and chemical indicators. No self-reported psychosocial instruments were applied. Because observational assessment may introduce interpretation bias, predefined indicators and standardized recording procedures were applied. Inter-rater agreement was assessed on 10% of observation records, resulting in a Cohen's Kappa value of 0.84.

Each observation session included six task executions for each occupational role involved in routine museum activities, including conservators, curators, technicians, administrative staff, and security personnel. Individual task observation lasted between 10 and 25 min, depending on task sequence and workflow continuity. Tasks were selected based on recurrence in daily operations and involvement in material handling, tool use, or sustained interaction with the work environment. Observations included routine task executions in conservation, exhibition preparation, visitor services, security duties, and administrative work across the three museums. Based on this protocol, the dataset included 90 task observations. Thirty observations were conducted in each museum. Observations covered identical routine task categories defined in the study protocol, allowing direct comparison of task-level conditions across the three sites.

Most observed task sequences corresponded to activities performed regularly during museum operations. Non-routine tasks occurred occasionally and involved temporary adjustments in exhibition preparation, object handling, or workspace organization. These activities sometimes required additional manual handling or temporary changes in the work area and may therefore involve higher exposure conditions than routine tasks. Because routine tasks represented the dominant work activities across the three museums, the comparative analysis focused on these task sequences. Ergonomic, chemical, and psychosocial indicators were recorded concurrently to maintain temporal alignment across exposure categories. Inter-rater agreement was assessed on 10% of observation records. Cohen's Kappa reached 0.84. Observations took place during regular shifts and covered core operational areas at each museum.

3.4. Task-Based Professional Input

Task-based professional input was collected through work-related exchanges conducted in the three museums. A total of 30 staff members participated, with ten participants from each museum. Participants represented different occupational roles, including curators, conservators, technicians, administrative staff, and security personnel. At each site, ten staff members per group were selected based on task-related OSH exposure identified during on-site observations. Selection followed observed task profiles and excluded personal health status and demographic attributes. Participation was voluntary and involved staff members present during the observation periods. No staff members declined participation, and no financial compensation was provided. Each exchange followed a

fixed guideline (Table 4) and covered task execution, ergonomic measures in use, PPE application, work organization, and routine safety communication. All prompts referred only to work tasks and operating conditions. No information on individual feelings, coping strategies, or personal stress states was collected, and audio or video recording was not used. Each exchange lasted 40 to 60 min and took place during normal working hours. Notes recorded task limitations, procedural inconsistencies, and adaptive practices identified during observed activities. The input was used to contextualize on-site task observations and organizational conditions.

Table 4. Task-based work-focused exchange guide (excerpts).

Topic	Sample Work-Focused Prompt
Ergonomic practices	How does the workstation layout influence task execution?
PPE use	What protective equipment is used during chemical handling tasks?
Workload organization	How are tasks scheduled during high-demand periods?
Leadership communication	How are safety instructions communicated during routine work?

Task-based professional input excluded personal health information and any form of individual self-assessment. The input was used only to define task configurations and organizational arrangements corresponding to task-level exposure observed during on-site evaluations.

3.5. Leadership Engagement Assessment

Leadership commitment was assessed by direct observation conducted during routine work operations and planned inspections. The assessment criteria comprised observable metrics directly pertinent to OSH implementation. These metrics included the efficacy of safety communication in daily tasks, the visible presence of leadership in operational zones, the provision of resources for hazard mitigation, and strict compliance with predefined safety protocols. The observations aimed to document how management actions affected the routine work. Binary values were used to code leadership engagement indicators, indicating their presence or absence during the observation period. No individual performance or behavioral assessments were conducted. The indicators used for this analysis are enumerated in Table 5.

Table 5. Leadership engagement indicators (binary coding).

Indicator	Criterion
Safety briefings conducted	Regular briefings documented during routine operations
OSH officer designated	Formal assignment of OSH responsibilities
Written protocols accessible	OSH procedures visible or available on-site
Leadership presence during inspections	Attendance at walkthroughs or site checks
Budget allocation for OSH actions	OSH items recorded in operational plans

3.6. Data Analysis

Qualitative data from task-based professional input were analyzed using thematic coding. Coding followed an inductive procedure grounded in task execution and observed work conditions. Notes were recorded during or immediately after each exchange. Each record was reviewed in full. Segments referring to task demands, exposure conditions, procedural limitations, and work organization were coded by topic. The analysis considered the recurrence of each theme and its distribution across occupational roles. A second reviewer examined a subset of coded records to verify coding stability. No personal data

was processed, and no verbatim quotations were reported. Identified themes structured the qualitative results.

Quantitative indicators were derived from on-site task evaluations and scenario-based task scores. Ergonomic assessment relied on REBA scores and checklist variables describing workstation configuration and task execution. Chemical safety indicators covered labeling, storage, ventilation status, and personal protective equipment use. Leadership engagement was recorded as a binary indicator based on observed presence during routine operations. Quantitative analysis used descriptive statistics based on aggregated percentages from task observations. Noncompliance percentages were reported for each OSH domain and museum. Mean percentages and ranges across the three museums summarized the distribution and variation of the results. Given the small number of museums, the analysis remained exploratory and did not permit inference beyond the cases included in the study. The relationship between leadership engagement and task-level OSH compliance was examined using the Pearson correlation coefficient. Statistical significance was set at $p < 0.05$.

Consistency between data sources was assessed through observer–participant convergence. Scenario-based task scores were compared with on-site observation results for the same task categories. Convergence reflected agreement between task configuration judgments and observed working conditions.

A summary of the data sources, indicators, and scoring procedures applied in the study is presented in Table 6.

Table 6. Summary of methods, indicators, and scoring procedures used in the study.

Data Source	Method/Instrument	Indicators	Scoring/Coding	Analytical Role
Ergonomic assessment (on-site observations)	REBA method	Posture, force, repetition	Standard REBA score	Identification of ergonomic strain
Chemical safety assessment (on-site observations)	REACH-based checklist	PPE use, labeling, storage, and ventilation	Compliance/non-compliance coding	Evaluation of chemical safety practices
Psychosocial observation (on-site observations)	COPSOQ-derived observational guide	Workload distribution, role clarity, team interaction, time pressure, and task allocation	Observational coding of task allocation, interruptions, task overlap, simultaneity, and task switching	Assessment of psychosocial and organizational task conditions
Leadership engagement (on-site observations)	Observational indicators	Briefings, inspections, protocol visibility	Binary coding (present/absent)	Assessment of leadership involvement
Task-based professional input	Task-focused work-related exchanges	Task limitations, procedural inconsistencies, adaptive practices, and coordination problems reported by conservators, curators, technicians, administrative staff, and security personnel	Thematic coding of recurring task-level constraints and work practices	Contextual interpretation of observed task conditions
Task configuration formulation	Cross-analysis of observations and professional input	Recurrent combinations of technical and organizational conditions during routine tasks	Pattern identification and configuration definition	Definition of fragmented, partial, coordinated, and alternating duty configurations
Scenario-based staff review of defined task configurations	Scenario-based evaluation	Median task-level safety score	0–100 scoring scale	Comparison of task configurations

Table 6. Cont.

Data Source	Method/Instrument	Indicators	Scoring/Coding	Analytical Role
OSH constraint analysis	Aggregated task indicators	Ergonomic, chemical, and organizational constraints	Constraint recorded when at least one checklist or observation criterion was not met; threshold classification based on affected tasks (<30%, 30–59%, ≥60%)	Cross-museum comparison
ISSI calculation from median configuration scores	Composite index	Configuration-level OSH integration	Calculated from median safety scores and number of OSH elements present	Comparison of configuration integration

3.7. Scenario-Based Evaluation

Four task-based configurations were defined to examine how different combinations of OSH measures operate under routine work conditions. Configuration development was grounded in observed practices and recurrent patterns identified through on-site task evaluations and task-based professional input. Configurations differed in the presence or absence of four OSH elements present during task execution: leadership engagement, ergonomic provisions, organizational-level psychosocial arrangements, and basic digital task support. Organizational psychosocial arrangements refer to observable aspects of work organization, including task allocation, workload distribution, time pressure, and coordination during routine activities.

All configurations reflected conditions documented in practice. Thirty staff members, ten from each museum, reviewed the configurations. Selection was based on observed task exposure profiles and encompassed multiple occupational roles. Participants received identical written descriptions of the four configurations. For each configuration, a task-level safety score was assigned based on expected working conditions during routine task execution. Scores ranged from 0 to 100 and referred exclusively to task conditions. Median values summarized configuration scores, limiting the influence of extreme values. Comparisons were conducted within and across museums using median-based ranking. Scores reflected the combined presence of OSH elements. Individual measures were not evaluated separately.

Configurations were classified by integration level according to the number of OSH elements present. This classification permitted the identification of threshold patterns associated with higher task-level safety scores at higher integration levels.

To support configuration-level quantitative comparison, an ISSI was calculated for each configuration. The index was constructed as a composite indicator derived from study data and defined as:

$$\text{ISSI} = M \times (C/4) \quad (1)$$

where M is the median task-level safety score assigned to the configuration, C represents the number of OSH elements present, and 4 represents the total number of elements considered. This formulation preserves the median score while scaling it according to the degree of OSH integration, without applying weighting factors. ISSI ranges from 0 to 100 and serves as an internal comparison indicator. The index does not constitute a validated scale and does not assess individual states or health outcomes.

The ISSI was constructed as an internal composite indicator to facilitate comparison between scenario configurations with different levels of OSH integration. The index is not intended as a validated measurement scale but as an exploratory analytical tool used to examine relative differences between configurations within the study dataset.

3.8. Ethical Considerations

The study involved no collection of personal, sensitive, or medical data. All activities concerned work tasks and OSH conditions. Participation was voluntary. Information was provided verbally before data collection. No identifying details were recorded. Work-related exchanges took place without managerial presence. Content referred to task execution, procedures, and OSH arrangements. Personal views, health status, or private experiences were excluded. Records served statistical aggregation and thematic coding at the task level. This approach preserved confidentiality throughout data collection and analysis.

4. Results

4.1. On-Site Task Evaluation Results

Ergonomic risk indicators varied across museums at the task level. In Museum A, REBA scores recorded during repetitive manual tasks indicated sustained non-neutral postures and limited use of posture aids. Adjustable workstations and lifting devices were absent or unavailable during observed task execution. In Museum B, adjustable workstations and lifting aids were present, but checklist records indicated inconsistent use across observed tasks. REBA scores varied accordingly between task executions. In Museum C, ergonomic aids were present and applied during observed tasks. REBA scores recorded during routine activities were lower and presented reduced posture-related strain indicators. Across sites, ergonomic risk aligned with task-level availability and application of ergonomic measures.

Chemical safety indicators differed across museums when assessed through checklist-based observations of PPE use, labeling practices, storage conditions, and ventilation status. In Museum A, checklist items recorded partial compliance, with intermittent PPE use and limited ventilation in conservation areas. Labeling and storage practices met requirements for some substances but were incomplete for others. In Museum B, PPE use varied across tasks, labeling inconsistencies were noted, and several conservation spaces lacked active ventilation during observed activities. In Museum C, checklist records indicated consistent PPE use, standardized labeling, appropriate chemical segregation, and functioning ventilation systems during routine conservation tasks. Task-level observations suggest that chemical safety conditions depended on the concurrent presence of equipment, procedures, and ventilation.

Psychosocial indicators recorded through structured observation varied across sites. In Museum A, task allocation records indicated high task density and frequent task switching within observed work periods. In Museum B, workload distribution differed between teams, with uneven task sequencing recorded during some observation sessions. In Museum C, observations documented more stable task allocation patterns and coordinated workflows across roles. Observable indicators of time pressure and task coordination differed between sites.

Leadership engagement indicators also varied. In Museum C, leadership presence was recorded during routine activities and inspections. Safety procedures were reinforced during observed walkthroughs, and written OSH protocols were accessible in work areas. In Museum A, leadership presence during routine task execution was not recorded, and checklist items related to protocol accessibility reflected variation across departments. In Museum B, leadership presence was documented during scheduled inspections but not during daily task execution. Binary leadership indicators aligned with observed differences in ergonomic, chemical, and psychosocial task-level conditions.

Figure 1 summarizes indicator level compliance for ergonomic measures, chemical safety indicators, and psychosocial organizational arrangements across the three museums.

Compliance values represent the proportion of applicable observational and checklist indicators met during routine work activities.

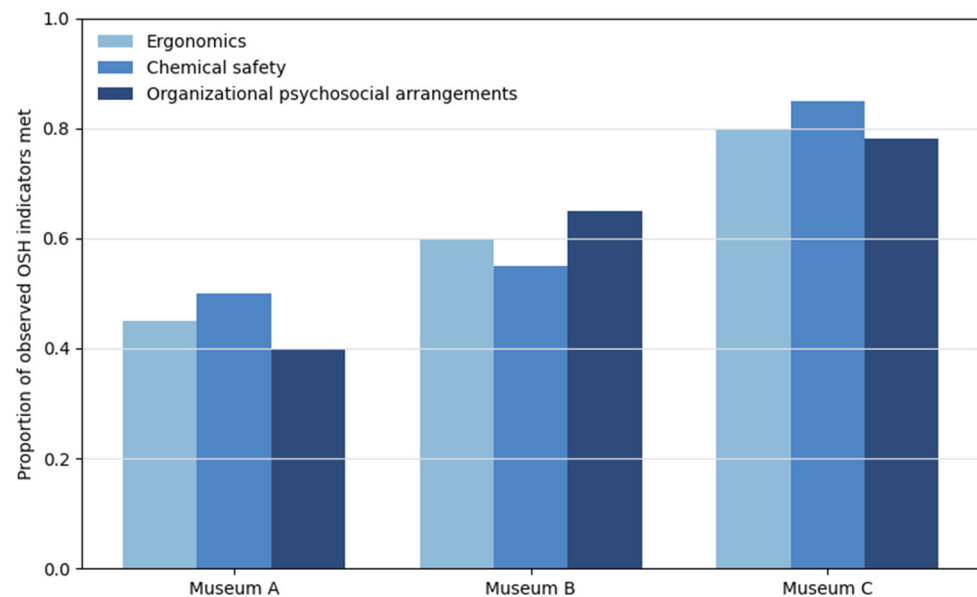


Figure 1. Task-level OSH compliance across the three museums based on on-site observations.

4.2. Task-Based Professional Input Results

Task-based professional input identified recurring task configurations associated with distinct OSH measures across the three museums. The material related to routine task execution and organizational conditions was examined in parallel with on-site task evaluations. One configuration, marked by enclosed workspaces, reliance on general room ventilation, and limited task-level adaptation, recurred across conservation and technical activities. This configuration predominated in Museum A and appeared in parts of Museum B. Task execution under these conditions involved fixed work heights, limited access to lifting aids, and the absence of localized extraction during chemical handling. Professional input further described rigid task sequencing during exhibition preparation and limited redistribution of activities across staff.

The main task configuration patterns identified across the museums are summarized in Table 7.

Table 7. Task configuration patterns observed across museums.

Configuration Pattern	Main Characteristics	Typical Activities	Museum Context
Fragmented configuration	Limited ergonomic aids, general room ventilation, and weak task coordination	Artifact handling, exhibition preparation, and conservation tasks	Predominantly Museum A; partially Museum B
Partial configuration	Technical controls are present but inconsistently applied	Exhibition setup, technical support activities	Museum B
Coordinated configuration	Adjustable equipment, localized ventilation, coordinated task allocation, and leadership presence	Conservation treatments, exhibition preparation	Museum C
Alternating duty configuration	Task rotation and alternating work positions	Security monitoring, visitor checkpoint duties	Museum C; partially Museum B

In Museum B, several task sequences followed partial configurations in which technical controls were present but applied inconsistently at the task level. Access to ventilation and lifting aids varied with workspace availability and task timing. During the same operational period, tasks alternated between controlled and uncontrolled conditions, particularly during exhibition setup and technical support activities.

Museum C implied a contrasting pattern characterized by configurations in which technical controls were embedded within coordinated task organization. Professional input described routine use of localized ventilation during conservation tasks, consistent availability of lifting aids and adjustable work surfaces during technical activities, and predefined task sequences during exhibition preparation. Under these conditions, task allocation supported coordination across roles and reduced task interruption.

Security-related activities followed two distinct configurations. In Museum A and Museum B, routine operations involved stationary duties with prolonged standing. In Museum C, task alternation and access to seated checkpoints formed part of standard duty arrangements.

Across all sites, leadership engagement emerged as a configuration-level attribute. Regular supervisory presence during routine task execution and direct communication of safety procedures coincided with coordinated configurations. Limited or inspection-focused presence coincided with fragmented task arrangements.

4.3. Data Analysis Results

Data analysis combined task-level observational records, checklist-based indicators, and coded task-based professional input to characterize OSH conditions across museums. The descriptive analysis included frequencies, percentages, arithmetic means, ranges, and predefined operational categories. Results were reported by OSH domain, task category, and museum. The predefined thresholds classified constraint frequency as low, moderate, or high.

4.3.1. Distribution of Task-Level OSH Non-Compliance

Task-level non-compliance was classified into three operational domains: ergonomic, chemical safety, and organizational. For each domain, a constraint was recorded when at least one predefined checklist or observation criterion was not met during task execution.

Constraint frequency was categorized using the following thresholds:

- Low: <30% of observed tasks affected;
- Moderate: 30–59% of observed tasks affected;
- High: $\geq 60\%$ of observed tasks affected.

Table 8 presents the descriptive statistics for task-level OSH noncompliance by domain and museum.

Table 8. Descriptive statistics for task-level OSH noncompliance by domain and museum.

OSH Domain	Museum A (%)	Museum B (%)	Museum C (%)	Mean (%) ¹	Range (Percentage Points)
Ergonomic	65	45	20	43.3	45
Chemical safety	45	65	15	41.7	50
Organizational	70	40	25	45.0	45
Mean across domains	60	50	20	43.3	40

¹ Mean values represent arithmetic means calculated from the percentages reported for the three museums within each OSH domain. The final row presents the mean percentage across the three domains for each museum. Range represents the difference between the highest and lowest percentages and is reported in percentage points.

Across the three museums, organizational noncompliance had the highest mean percentage, at 45%. The mean percentage was 43.3% for ergonomic noncompliance and 41.7% for chemical safety noncompliance. Chemical safety revealed the greatest variation across museums, with a range of 50 percentage points. Ergonomic and organizational noncompliance each had a range of 45 percentage points. The mean percentage across the three domains was 60% in Museum A, 50% in Museum B, and 20% in Museum C.

Ergonomic non-compliance reached the high-frequency category in Museum A, driven by limited access to lifting aids and non-adjustable workstations. Chemical safety non-compliance reached the high-frequency category in Museum B, primarily due to ventilation deficiencies and inconsistent PPE use. Museum C remained below the 30% threshold across all domains.

4.3.2. Task Category-Specific Constraint Profiles

Task-level analysis identified distinct OSH non-compliance profiles across task categories and museums. Conservation tasks exceeded the high-frequency threshold ($\geq 60\%$ of observed tasks affected) for chemical safety in Museum B and fell within the moderate range (30–59%) in Museum A. This pattern was associated with solvent handling tasks performed under limited ventilation or inconsistent protective conditions. Technical and exhibition-related tasks exceeded the high-frequency threshold for ergonomic conditions in Museum A and remained within the moderate range in Museum B. These patterns were associated with manual handling, repetitive setup activities, and limited availability of adjustable equipment during routine task execution. Front-of-house tasks did not exceed the high-frequency threshold for ergonomic or chemical conditions in any museum. Organizational aspects related to task scheduling, prolonged standing, and limited task rotation reached the moderate range across all sites. Figure 2 summarizes the proportion of tasks affected by ergonomic, chemical, and organizational constraints across the three task categories, aggregated across the three museums.

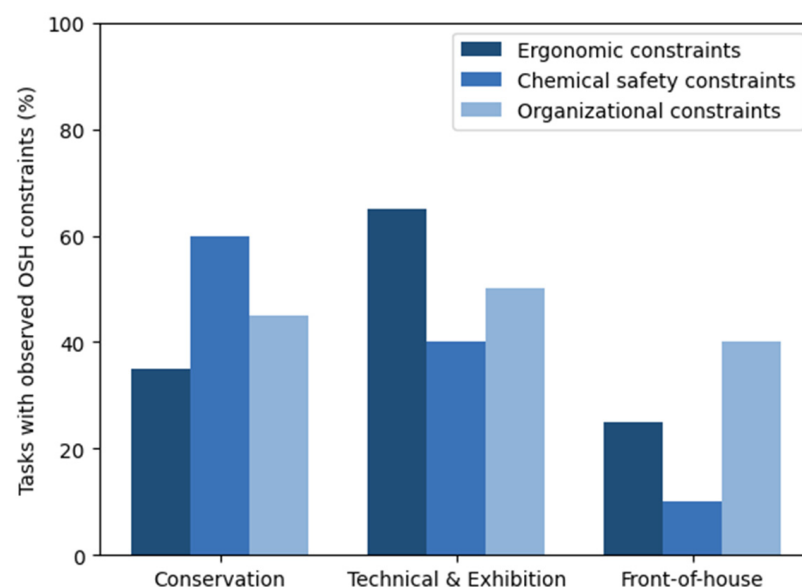


Figure 2. Distribution of task-level OSH constraint domains by task category across museums.

4.3.3. Leadership Engagement and Task-Level OSH Compliance

Leadership engagement indicators were coded as present when at least one observable leadership action occurred during task execution, including participation in walk-throughs, task coordination activities, or direct safety-related communication. Indicators were recorded at the task level and treated as binary variables. Task-level OSH compliance was defined as the simultaneous fulfillment of all applicable checklist criteria within the relevant domain. Compliance was assessed separately for ergonomic conditions, chemical safety practices, and ventilation status during routine task execution.

Tasks performed under conditions of documented leadership engagement showed higher compliance across all assessed domains. Ergonomic criteria were met in at least 70% of observed tasks when leadership engagement was present, compared with less than 45% of tasks when leadership engagement was absent. During chemical handling activities, appropriate use of personal protective equipment occurred in at least 75% of tasks with leadership engagement and in fewer than 50% of tasks without such engagement. Operational ventilation systems were observed in at least 80% of chemical-related tasks conducted under leadership engagement, compared with fewer than 55% of tasks conducted without leadership presence. Table 9 summarizes task-level OSH compliance rates stratified by leadership engagement status.

Table 9. Task-level OSH compliance by leadership engagement status.

OSH Indicator	Leadership Present	Leadership Absent
Ergonomic criteria met	≥70% of tasks	<45% of tasks
PPE use during chemical tasks	≥75% of tasks	<50% of tasks
Ventilation operational during chemical tasks	≥80% of tasks	<55% of tasks

Correlation analysis indicated a moderate positive association between leadership engagement indicators and task-level OSH compliance (Pearson $r = 0.48$, $p < 0.05$).

4.3.4. Convergence Between Data Sources

Convergence analysis compared task-level constraint patterns identified through on-site observations with those derived from task-based professional input. The agreement was evaluated at the task-category level. For interpretation purposes, high convergence corresponded to agreement in at least 70% of task categories, while moderate convergence corresponded to agreement between 40% and 69%. It was recorded for ergonomic and chemical safety patterns across all three museums. Data sources consistently identified the same task categories as recurrently affected by non-adjustable workstations, manual handling demands, inconsistent PPE use, and ventilation limitations in conservation areas. Organizational patterns suggest moderate convergence. Several coordination and task sequencing issues identified through professional input were not observable during short observation windows in activities involving workload distribution and task overlap. Figure 3 summarizes convergence levels between on-site observations and task-based professional input by the OSH domain and the museum.

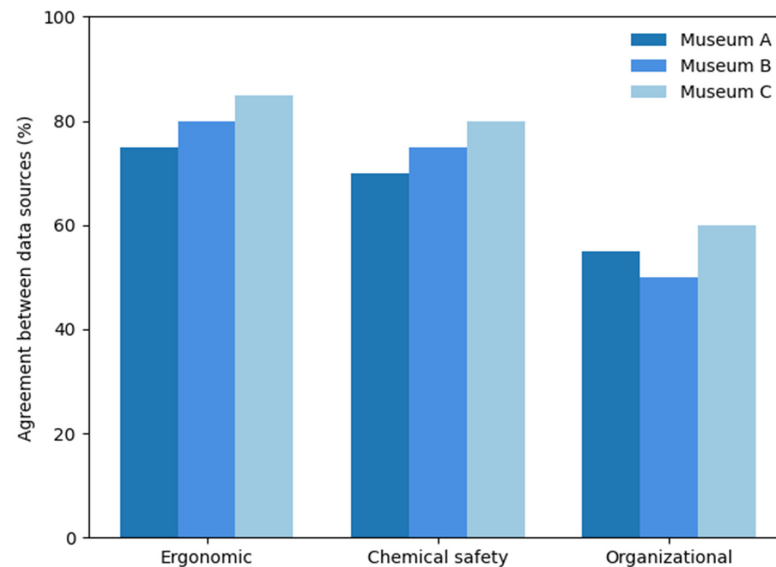


Figure 3. Convergence between on-site observations and task-based professional input by the OSH domain across museums.

4.3.5. Cross-Museum Task-Level OSH Profiles

Task-level indicators were aggregated to define distinct OSH profiles for each museum using threshold-based classification. Profiles were derived from the relative frequency of recorded task-level OSH non-compliance patterns across ergonomic, chemical safety, and organizational domains. Museum A displayed a combined high-frequency profile for ergonomic and organizational non-compliance, with domains exceeding the $\geq 60\%$ threshold of affected tasks. Chemical safety non-compliance remained within the moderate range (30–59%) at this site. Museum B presented a mixed profile characterized by high-frequency chemical safety non-compliance ($\geq 60\%$) and moderate ergonomic non-compliance (30–59%), while organizational non-compliance did not exceed the high-frequency threshold. Museum C exhibited a low non-compliance profile, with no OSH domain exceeding the 30% threshold. Ergonomic, chemical safety, and organizational domains all remained within the low-frequency category ($<30\%$) across observed task categories. Figure 4 presents the proportion of tasks with OSH non-compliance across ergonomic, chemical safety, and organizational domains in the three museums on the basis of threshold classification.

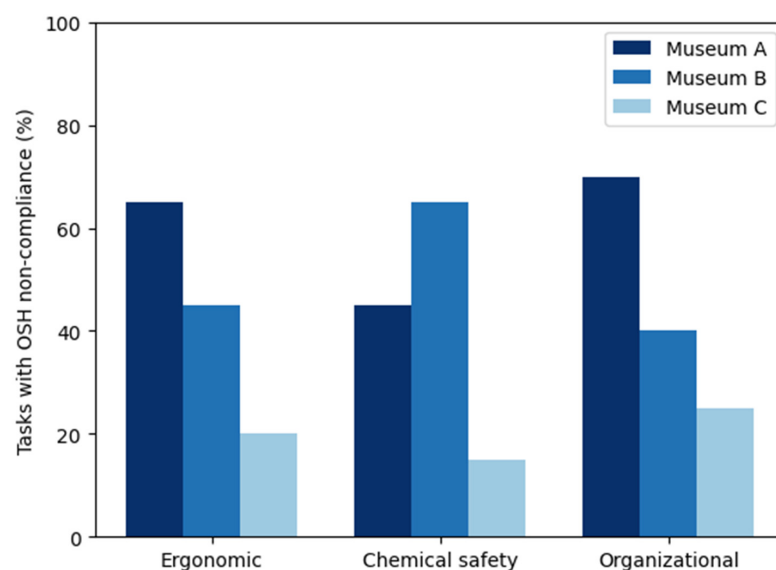


Figure 4. Cross-museum task-level OSH non-compliance profiles based on threshold classification.

4.4. Scenario-Based Configuration Results

Scenario-based evaluation distinguished task configurations according to the level of OSH integration. Results are reported at the configuration level and refer exclusively to task-level working conditions under routine arrangements.

Task configurations with low OSH integration produced the lowest median safety scores across all museums. These configurations were characterized by the absence of leadership presence during routine activities, limited ergonomic provisions, weak task coordination, and no digital task support. Median scores remained concentrated in the lower range, with minimal variation between institutions, indicating consistently unfavorable task conditions.

Configurations with intermediate OSH integration produced moderate median safety scores. These configurations included selected technical or organizational elements, such as ergonomic equipment or partial task coordination practices, but lacked leadership presence or coordinated application across tasks. Median scores displayed greater dispersion across museums, reflecting variability in how isolated elements operated during task execution.

Configurations with full OSH coordination produced the highest median safety scores at all sites. These settings combined visible leadership presence during routine work, consistent ergonomic provisions, organizational arrangements implanted in task planning, and basic digital tools for task monitoring. Median scores were consistently higher and reflected reduced variability between museums, indicating stable task-level conditions.

ISSI values followed the same configuration-level pattern. Configurations including a higher proportion of OSH elements yielded higher ISSI values across all museums. Lower ISSI values were associated with fragmented configurations and limited coordination of OSH components. Configuration ranking by ISSI remained stable across institutional contexts, independent of museum size or location.

Comparison between scenario-based results and on-site task evaluations indicated convergence at the configuration level. Configurations associated with higher ISSI values corresponded to task arrangements meeting a higher proportion of ergonomic, chemical safety, and organizational criteria. Lower ISSI configurations aligned with observed task arrangements characterized by limited controls and fragmented organization.

Scenario-based results did not include individual assessment, health outcomes, or personal perception measures. Findings describe configuration-level differentiation of task conditions and their alignment with observed OSH arrangements.

5. Discussion

5.1. Ergonomic Risks

Ergonomic demands were associated with physical strain across observed museum tasks. Manual handling, exhibition assembly, and conservation activities involved repeated movements, static postures, and work at fixed heights. These conditions were consistently documented through task-level observation and checklist data, with higher constraint frequency in museums lacking adjustable work surfaces, lifting aids, or task-specific carts.

Comparable task demands in other sectors are managed through established ergonomic controls. Mechanical lifting devices and height-adjustable workstations reduce spinal strain during manual handling tasks [29,30]. Manufacturing settings apply adjustable conveyors and anti-fatigue flooring to limit cumulative strain during repetitive tasks. These measures correspond directly to the physical demands observed in museum work, particularly during object handling and exhibition setup.

Despite this alignment, ergonomic controls remain inconsistently applied in museums. Prior studies attribute delayed implementation to constrained budgets and limited ergonomic planning, with intrinsic task limitations playing a minor role [31,32]. Cross-

museum comparison suggested that ergonomic risk varied with task configuration, with task type showing limited influence. Museums providing adjustable tables, carts, or mobile platforms displayed lower frequencies of posture-related strain indicators. Where such measures were absent, task execution required increased physical effort and prolonged static positions.

Scenario-based configuration results further indicate that ergonomic measures alone do not stabilize task-level safety conditions. Higher scenario scores emerged only when ergonomic provisions coincided with coordinated task allocation and visible leadership engagement. This pattern aligns with evidence that ergonomic interventions achieve sustained effects when embedded within organizational arrangements, with isolated technical fixes showing limited durability [33].

5.2. Chemical Exposure

Chemical risks were concentrated in conservation tasks involving routine use of solvents, adhesives, and cleaning agents. Task-level observations documented inconsistent application of protective measures, including intermittent glove and mask use and absence or inactivity of local ventilation in several workspaces. These conditions have been previously associated with respiratory and dermal reactions in museum environments, particularly among staff with existing sensitivities [34].

Comparison across museums indicated that chemical exposure patterns followed procedural reliability, with limited influence from the specific substances handled. Workspaces with clear labeling, regular use of personal protective equipment, and operational ventilation displayed lower frequencies of chemical safety non-compliance. Where these elements were missing or unevenly applied, task execution relied on individual judgment, with limited use of standardized procedures.

Control strategies applied in industrial and laboratory settings provide direct reference points. Mandatory protective equipment, standardized chemical labeling, and local exhaust ventilation form the basis of exposure control in environments with routine solvent use [35]. These measures rely on task-level application and can be applied to conservation activities using portable extraction units, dedicated exhaust systems, and scheduled equipment checks [22].

Scenario-based configuration results indicate that chemical safety measures produce stable task-level improvements only when embedded within coordinated arrangements. Protective equipment or monitoring applied in isolation did not correspond to higher scenario scores. Higher configuration-level scores emerged when chemical control measures coincided with defined procedures and visible leadership involvement during routine work. This pattern suggests coordinated task execution as the basis of chemical exposure management in museums.

5.3. Psychosocial and Organizational Demands

Psychosocial and organizational demands emerged primarily from task organization and workload structure, with individual characteristics showing limited influence. Public-facing roles and positions with coordination responsibilities involved concurrent task requirements, frequent interruptions, and limited flexibility in task sequencing. These conditions were most evident during periods combining routine operations with exhibition preparation or increased visitor flow.

Across the examined museums, organizational measures regarding task allocation and recovery time remained limited. Task planning rarely included explicit provisions for task rotation, buffer periods, or redistribution during peak demand. Where present, support-related initiatives were implemented episodically and remained detached from routine task

organization. In work environments characterized by sustained cognitive and interaction demands, these conditions are typically managed through structured task planning and integration of organizational support mechanisms into daily work arrangements [36]. Comparable approaches were largely absent in the museum settings examined.

Scenario-based configuration results indicate that psychosocial and organizational demands were lowest under configurations combining coordinated task allocation, clear role delineation, and leadership presence during routine activities. Configurations relying on isolated actions, such as occasional training sessions or informal peer interaction, did not correspond to higher configuration-level safety scores. This pattern indicates formal integration into task planning and OSH arrangements as the basis for managing psychosocial demands in museums.

Within the task-based OSH configuration framework developed in this study, psychosocial measures operate as structural elements of work organization. Their contribution to stable task-level safety conditions arises only when applied in conjunction with ergonomic provisions and leadership engagement. This finding reinforces the need to treat psychosocial demands as an organizational attribute embedded in task execution.

5.4. Leadership Engagement and OSH Coordination

Leadership engagement influenced the consistency of OSH implementation across routine museum tasks. Cross-museum comparison revealed that sites with regular leadership presence during daily activities displayed more uniform application of safety procedures, particularly in task areas with higher ergonomic or chemical exposure. Leadership actions observed included participation in task walkthroughs, reinforcement of procedures during routine interactions, and follow-up on the application of control measures.

Where leadership engagement was limited, OSH responsibilities were distributed without a unified coordination structure. This resulted in task-level variability in the application of ergonomic provisions, PPE use, and ventilation practices. In these settings, safety measures followed local practices, while shared operational standards remained limited.

Evidence from other sectors supports the role of leadership in stabilizing OSH practices. Routine leadership involvement in task preparation and equipment checks contributes to consistent application of safety measures during daily work [19,37]. Although museum hazards differ in nature, the underlying coordination mechanisms remain transferable. Leadership presence during task execution functions as an operational interface between procedures and practice.

Within the task-based OSH configuration framework developed in this study, leadership engagement acted as a stabilizing component that aligned ergonomic, chemical, and organizational measures. Its effect emerged at the configuration level, reinforcing coordinated task execution at the expense of isolated control measures.

5.5. Staff Input as an Operational OSH Indicator

Task-based professional input provided operational insight into how OSH measures were applied during routine work. Input focused on task execution conditions, availability controls, and procedural consistency. Across the examined museums, input patterns corresponded with on-site observations, particularly for ventilation conditions, ergonomic support, and PPE.

In settings with OSH arrangements, task-based input identified fewer procedural gaps and less variability in task execution. Where OSH coordination was uneven, input highlighted discrepancies between prescribed procedures and routine practice, including inconsistent application of protective measures and limited task adjustment during high-

demand periods. These observations aligned with constraint patterns identified through a checklist-based assessment.

Within the task-based OSH configuration framework, staff input served as a supplementary operational indicator and did not represent individual perception. Its value lay in identifying mismatches between task requirements and applied controls, allowing adjustment of task configurations before constraint patterns became recurrent. This supports integration of structured professional input into routine OSH management, beyond use as a stand-alone evaluative instrument.

5.6. Human-Centered Task-Based OSH Framework

The task-based OSH framework derives from configuration patterns observed during the analysis of routine tasks across the three museums. Fragmented, partial, and coordinated task configurations documented during routine museum activities suggested how ergonomic provisions, chemical safety practices, and task organization operated together during task execution.

Occupational safety and health conditions in museums depend on how routine tasks are configured and coordinated during daily work. Observations across the three museums showed that ergonomic strain, chemical exposure, and organizational pressure occurred in all institutions. Their intensity varied with task organization, equipment availability, and supervisory presence during routine activities. These findings indicate that task configuration shapes exposure conditions. Based on task patterns identified during on-site observations and task-based professional input, a task-based OSH framework was developed. The framework derives from routine activities such as artifact handling, conservation treatments, exhibition preparation, and visitor-related work. It reflects the conditions observed during daily museum operations and integrates three elements that repeatedly appeared in the results: ergonomic provisions during task execution, chemical safety practices in conservation work, and coordination of task allocation. These elements operate within the same task arrangements. When adaptable equipment, ventilation measures, and coordinated task allocation occurred together, task-level exposure indicators remained lower across observed activities. When these measures appeared separately or inconsistently, constraint patterns occurred more frequently during observations. Figure 5 summarizes these relationships at the task level. Task configuration represents the level where preventive measures interact during routine museum work. The framework illustrates how ergonomic provisions, chemical safety practices, and task organization operate together within routine activities.

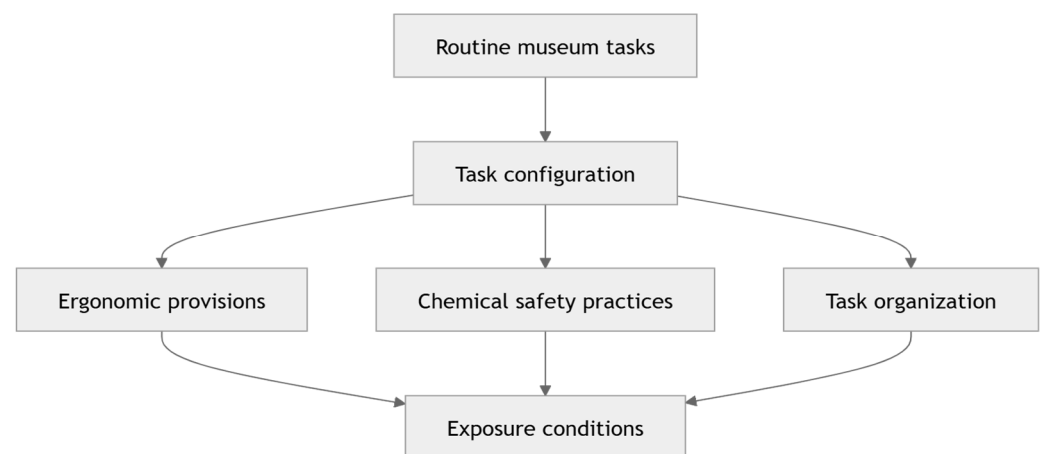


Figure 5. Conceptual model for human-centered OSH strategies for museum environments.

The task-based OSH configuration tool forms the operational core of the framework. The tool associates observed OSH conditions with routine task execution by examining how preventive measures operate within specific task arrangements. It evaluates ergonomic provisions, chemical safety practices, and task organization during daily work activities. Through this configuration logic, preventive measures are examined together. Observations across the three museums suggested that fragmented application of individual measures corresponded with frequent ergonomic strain, ventilation deficiencies, and organizational constraints. Tasks performed under coordinated conditions showed higher compliance with observed OSH criteria.

Figure 6 presents the analytical model for developing the task-level OSH scenarios based on field observations in museum work. Field data and task characteristics are used to define configurations that combine ergonomic provisions, chemical safety practices, and task organization. These configurations are then translated into task-level OSH scenarios and compared to identify patterns associated with lower frequencies of observed OSH constraints and more stable task execution conditions.

Figure 7 presents the operational tool that applies task-based OSH configurations during routine museum work. The tool translates scenario patterns into task-level actions during daily activities. These actions address gaps observed in configurations with partial OSH coordination and target tasks with physical strain or limited recovery time.

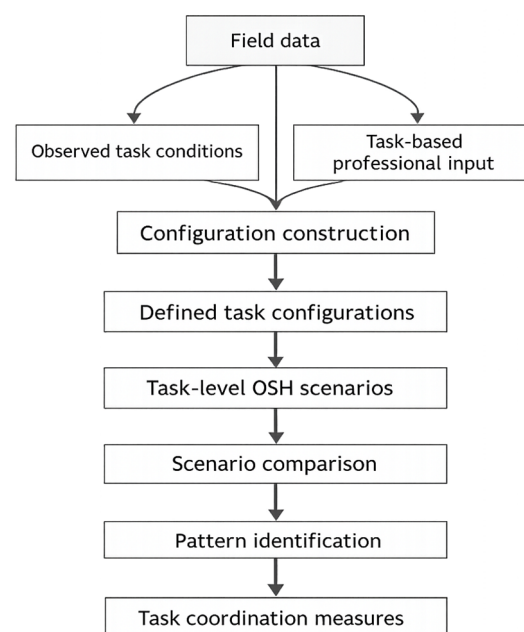


Figure 6. Analytical model for task-level OSH scenario construction.

The five daily adaptation measures summarized in Table 10 represent the operational output of the task-based OSH configuration tool. Each measure corresponds to a specific task-level constraint identified through on-site evaluations and task-based professional input. Together, the measures convert task configurations into routine actions applied during daily work. Real-time task adjustment mitigates repetitive or prolonged physical effort during activities such as manual handling and exhibition setup. Short daily OSH micro-messages reinforce task-specific controls where procedures existed but were applied inconsistently. Task planning based on declared limits adapts workload to current physical or cognitive capacity. Quiet recovery options reduce sustained psychosocial demand during prolonged standing or periods of high visitor flow. Structured staff feedback sessions support continuous refinement of tools, spaces, and routines based on direct

task experience. Applied as a set, these measures operationalize OSH configurations and provide a task-level mechanism for protecting staff exposed to sustained physical and cognitive demand or reduced recovery capacity.

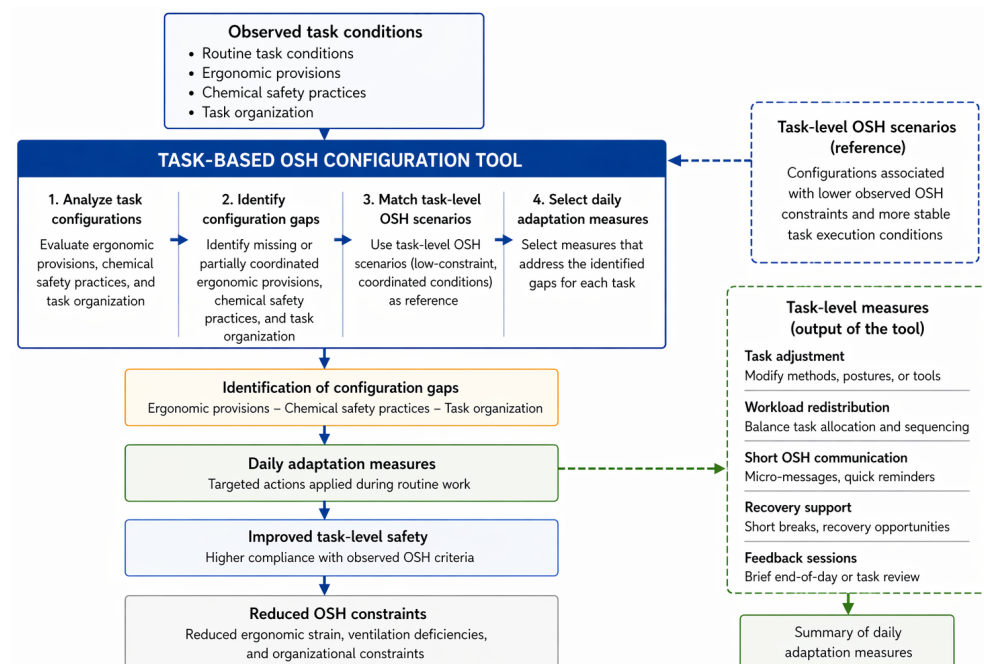


Figure 7. Operational tool for task-based OSH application.

Table 10. Summary of daily OSH interventions adapted for workers with reduced capacity.

Measure	What It Helps with	What It Needs	Why It Matters
Real-time task adjustment	Prevents physical strain during repetitive or prolonged tasks	Basic sensors and a method for short alerts	Reduces overload, especially for older staff or those with musculoskeletal limitations
Short daily OSH micro-messages	Reinforces safe task execution during routine work	Short messages delivered via phone, app, or e-mail	Supports procedural consistency with minimal effort
Task planning based on limits	Aligns tasks with current capacity or recovery needs	Simple declaration of limits used during planning	Prevents mismatch between task demands and functional capacity
Quiet areas and lighter shifts	Supports recovery from sustained stress or fatigue	Designated quiet space and low-demand task options	Reduces cumulative psychosocial strain
Staff workshops for small changes	Improves tools, spaces, and routines based on task feedback	Short, focused meetings using layouts or photographs	Enables incremental adjustment grounded in real work conditions

Earlier studies report that physical and psychosocial risks often co-occur and accumulate over time, particularly among workers with reduced physical capacity or chronic conditions [38–41]. However, most OSH approaches treat these risks as parallel domains, managed through separate ergonomic, chemical, or mental health interventions [42,43]. This framework defines task-level integration as the unit of OSH coordination, replacing approaches based on isolated measures or risk categories. The framework associates leadership engagement, ergonomic support, psychosocial provisions, and digital monitoring within a single task-based configuration tool, moving beyond risk evaluation by category or job role. This approach examines how combinations of measures operate

simultaneously during routine work and identifies threshold effects that are not visible in single-intervention models. A further contribution is the use of scenario-based comparison and the ISSI to define integration. Unlike prior models that remain descriptive or policy-oriented, the proposed framework translates configurations into daily task adjustments and decision rules. In museum environments, where resources are limited and work demands fluctuate, this task-centered mechanism provides a practical way to align OSH measures with real working conditions and to protect staff from sustained physical or cognitive demands.

This study has limitations related to sample size and study design. The analysis included three museums, which do not cover the full structural and organizational diversity of the sector and limit the transferability of the findings beyond comparable institutional settings. Although the selected institutions represented different operational contexts and comparable task structures, the limited number of cases does not permit statistical generalization at sector level. The results reflect comparative task-level analysis across these institutions and indicate the applicability of the proposed task-based OSH framework under similar working conditions. The cross-sectional approach captures OSH conditions at a single point in time and does not reflect temporal variation or longer-term effects of task-level interventions. Professional input was limited to work-related descriptions and may reflect local organizational context. Regulatory frameworks, labor arrangements, and internal management practices may influence transferability across institutions.

Further research should extend the task-based approach to a larger and more diverse set of museums. Longitudinal designs are needed to examine how OSH configurations influence exposure patterns, recovery, and perceived safety over time, particularly for staff exposed to sustained physical or cognitive demand.

6. Conclusions

This study introduces a task-based occupational safety and health configuration tool grounded in routine museum work. Analysis of three museum cases identified task configurations combining ergonomic provisions, ventilation measures, task allocation, and supervisory presence that corresponded with lower frequencies of ergonomic, chemical, and organizational constraints, while fragmented and partial configurations showed higher frequencies of these conditions. Security duties followed the same pattern, with alternating duty arrangements reducing prolonged standing. These findings from three museum case studies show that the interaction between technical measures and task organization shapes occupational safety and health conditions during routine work. The configuration approach organizes existing safety measures around task coordination and routine activity sequences without structural or staffing changes. Integration of technical measures with task organization at the task level corresponded with fewer ergonomic, chemical, and organizational constraints than situations where measures were applied separately.

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