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Industrial Hygiene
Performance Metrics

2nd edition

Clear and concise measures for tracking operations and organizational performance.

Edited by R. Scott Lawson, MS, CSP and Celia A. Booth, CIH, CSP

Written by the AIHA® Leadership & Management Committee

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Chapter 1

Performance Measures

Performance measures are defined as the actionable metrics that an organization can use to assess its actions or programs in relation to its goals. These metrics generally serve to either assist in providing strategic direction or to assess a particular process or procedure. Although metrics are often used to determine progress toward established goals, they can also be used in decision making, problem solving, and process optimization. Performance measurement can be used as a continual improvement tool for your program. Performance measures are indicators that:

- Qualitatively assess the status of your industrial hygiene (IH) program (e.g., self-evaluation of progress to implement management practices; employee and public perception surveys).
- Quantitatively track the presence and effectiveness of controls [e.g., ventilation rates, personal protective equipment (PPE) use, etc.].
- Quantitatively show whether your program is effective and efficient (e.g., occupational injury/illness incident rate; lost workday cases due to occupational injuries/illnesses; results of exposure monitoring).

Developing and using a health and safety performance measure requires knowledge of an organization's risk profile. Performance measures are chosen based on that profile to monitor areas requiring improvement or those with the potential to pose the greatest risk of harm if significant deviations occur. When selecting metrics, some basic issues need to be acknowledged:

- Data collection and analysis are often resource intensive. Identifying the smallest number of metrics that will focus attention on key issues is generally best.
- Metrics drive action and often identify unexpected issues. Organizations must be prepared to act on any identified issues.
- Organizations place themselves at great risk when they choose not to address identified issues. Addressing an issue does not always require corrective actions. On occasion, just a note to file explaining why no action was taken is sufficient.

While acknowledging that there are many methodologies for developing and presenting performance measures, this chapter identifies the key elements used to develop performance measures.

Other types of metrics also exist for purposes unrelated to process or performance improvement. These include the following:

- Informational metrics that provide potentially interesting but not actionable analysis. An example might be identification of all brown-eyed employees.
- Vanity or promotional metrics that are often used to suggest excellence without conveying real performance information. A common example is reporting in sustainability reports of results without context (i.e., percentage of reduction of chemical incidents without including a definition of incident). In an environmental context, this is called *greenwashing*.

Process of Metrics

The selection of metrics or performance measures typically occurs as part of an organization's management system. Management systems generally include the following steps that enable the selection and use of metrics:

1. Conduct risk analysis to determine what processes or potential exposures (internal or external) could result in harm to individuals, facilities, or the environment.
2. Select the risks that are most likely to occur or those with the greatest potential impact for long- or short-term monitoring using a metric. Care must be taken to select metrics that measure effects that are potentially (directly or indirectly) causative of the issue of concern and not just correlated.

3. Create a schedule for the collection of data, calculation of metrics, and review of changes over time. This process must be part of implementing any new metric.
4. Verify that data sources are consistent and reliable. Metrics are only as valid as the source data.
5. Establish acceptable control boundaries when metrics are selected to determine the points at which measured deviations require corrective actions.

The selected portfolio of metrics should change over time as operations are modified or new risks are identified. It is also important to stop collecting metrics that no longer provide needed actionable information. Periodic reassessments of metrics should be part of any team or management review included in the organization's management system. These reassessments are typically conducted annually, but the frequency should be determined based on your organization's needs. Sometimes metrics outlive their usefulness between reassessments. At that point, they should be removed to reduce burden and establish focus on the metrics that are making significant contributions. In Figure 1-1 from ANSI Z10.0-2019, this review would occur during the management systems "check" stage (Evaluation and Corrective Action).[1]

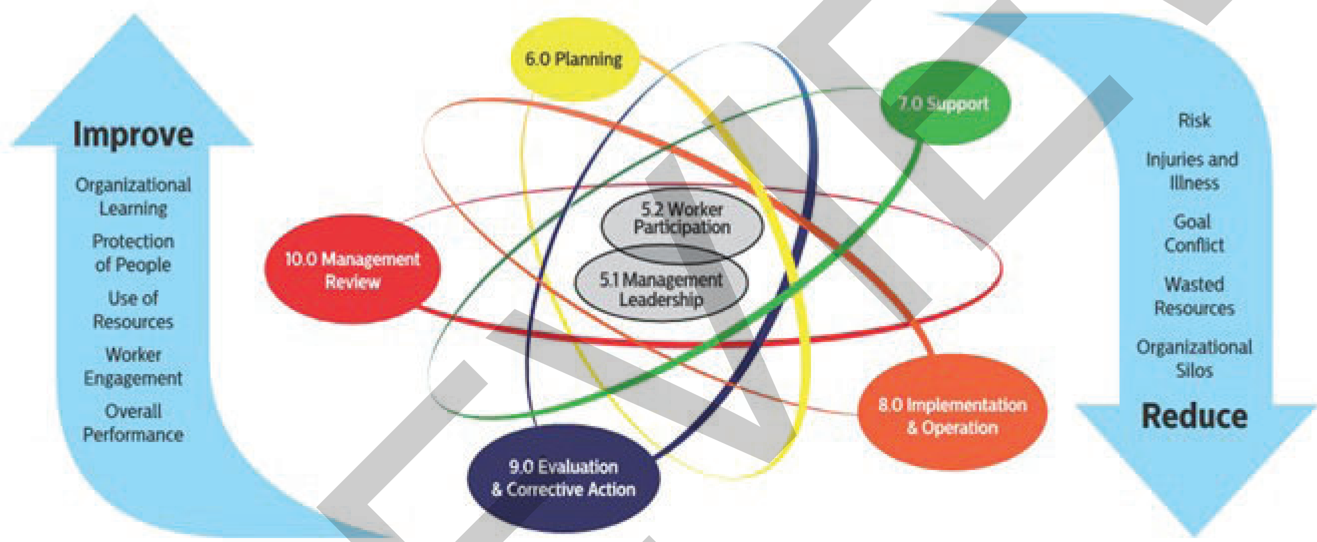

Figure 1-1. Occupational health and safety management systems. Source: Figure 2 in *Guidance and Implementation Manual for ANSI/ASSP Z10.0-2019: Occupational Health and Safety Management Systems.*[1] Reprinted with permission.

Type of Metric

Performance measures have different levels of usefulness depending on how closely they correlate with the goals of improving workplace health or preventing occupational injuries/illness.

Metrics can be categorized as prospective (leading) or retrospective (lagging). Prospective indicators potentially measure the precursors to serious worker accidents, injuries, and illnesses. Examples of prospective metrics include the number of skin and clothing radiation contamination events, the number of workers with degraded PPE, and the number of exposures above the predetermined company control limits. Prospective metrics can also be used for evaluating the controls that prevent events, such as the percentage of controls in place, the percentage of conformance to these controls, and the number of new and better controls. Retrospective indicators quantify events that have already occurred. Examples of retrospective indicators include the number of workers with a 10-dB (decibel) threshold shift of hearing loss, the total recordable illness case rate, and radiological and chemical uptakes. These outcome measures require less effort to acquire and may offer little benefit to the organization in its efforts to identify root causes of events and prevent additional impacts.

Metrics can further be separated into quantitative and qualitative indices (Refer to Table 1-1). Quantitative indices are recordable rates or numerically discernable events such as total recordable illness rates or the number of unsafe or unhealthy acts or conditions. Every quantitative performance indicator is composed of both a number and a unit of measure. The number gives a magnitude (how much), and the unit gives the number significance (what). Quantitative indices have the advantage of being easier to verify and calculate but can be misused. A downside of using quantitative indices, which are often called results or outcome measures, is that it can take a long time to trend any meaningful information from the data collected.

Table 1-1. Qualitative and Quantitative Metrics

Qualitative	• Objective: Non-numerical values define risk factors. • Likelihood/impact with definite value based on individual expertise.
Quantitative	• Subjective: Risk factors estimated numerically. • Probability/impact assigned a definite number based on history.
Semi-Quantitative	• Context oriented: Bin values unique to scenario. • Probability/impact derived numerical values with unique context. • Control banding categories assigned for similar data.

Quantitative indices provide information on the individual parts of a metric program; however, to evaluate the program, qualitative metrics should be used to determine how the parts of this worker-industry-community trio harmonize together.

Qualitative indices are program evaluation tools that show whether an organization or program is effective, especially regarding such goals as employee participation and health hazard awareness and prevention. Ascertaining the opinions of the interested parties (communities, workers, management) about the status of company activities is an important qualitative measure needed to assess the well-being of the worker and public as well as the impact the industry has had on their lives.

The ultimate benefit of using performance metrics is to drive continual improvement of a company's program. Qualitative metrics can provide useful information about areas within the program that need restructuring or risk prioritization within a qualitative exposure assessment. Metrics aid in determining and ranking potential health risks faced by workers and differentiating between acceptable and unacceptable exposures.

Leading/Prospective/Process

Selecting appropriate leading metrics is often difficult because confirming their link to causation of harm is challenging. However, when carefully selected, these metrics have the advantage of identifying actions that may prevent incidents before they occur. For example, a leading metric:

- Prospectively identifies mission, financial, or quality of life impact.
- Can be used to motivate management and workers.
- Is usually an indirect measure of program effectiveness because factors outside the IH program can significantly influence the measure (e.g., nonoccupational exposures to solvents used in painting contributing to respiratory disease from occupational exposures).

Lagging/Retrospective/Outcome

Lagging metrics have the disadvantage of only measuring events (including harm) that have already occurred. However, these metrics generally have the advantage of being most clearly correlated with the outcome of concern. Lung function decline measured using longitudinal spirometric testing on a worker is an example of a lagging metric. This measure can be indicative of past exposures and overall respiratory health but does not indicate current exposure conditions. A lagging metric:

- Is directly related to the goal of preventing occupational illness.
- Measures the result of identifying workplace hazards and successfully reducing the health impact.
- Tells how effective the prevention or reduction of worker illness and injury is after the fact. It may take some time to see improvements in injury and illness rates.

Chapter 4

Hearing Conservation

Earplug Fitting Distributions

Type of Metric

Leading/Process

Description

The numbers and percentages for each earplug size fitted with gender distributions, mean age, and different size in each ear. This can be calculated as follows:

$$\frac{\text{Number of Earplug Type X Fitted for Group Y}}{\text{Total Number of Earplugs Fitted for Group Y}} \times 100$$

Objective

- Identify the distribution of sizes and different size in each ear of the fitted preformed earplugs.
- Include gender distributions under each size as well as average age.

Target Audience

Occupational and environmental health and safety (OEHS) professionals

Current Requirements

- OSHA 29 CFR Part 1910.95 (General Industry)[1] and 1926.52 (Construction)[2]
- MSHA noise standard: 30 CFR Part 62 (Occupational Noise Exposure)[3]

Benefits/Value

- The efficacy of earplug-fitting procedures can be evaluated and monitored.
- Sizing distributions can assist restocking purchases.
- The process of fitting preformed earplugs enhances the probability that an individual will be properly instructed in insertion techniques and proper maintenance procedures. Army data indicate less hearing shift among those fitted with preformed, sized earplugs than among those issued hand-formed foam plugs.

Weaknesses/Limitations

Data validity is highly dependent on the accuracy of data entry. Although such practices can be flagged, Army data have been corrupted by individuals entering the same size of earplug for all recipients.

Data Sources

- Audiograms, if sizing information is captured as a required entry
- Corporate database

Interpreting Data

With sufficient numbers of fittings, the efficiency of earplug-fitting procedures can be evaluated. For example, there should be skewing of women toward the smaller sizes. Conversely, men will be skewed toward larger sizes than women. Mean age should increase with earplug size because ear canals usually enlarge with age.

A different size earplug in each ear should indicate 1–2% for the triple-flange and at least 8–10% for the single-flange if medical personnel are properly sizing each ear.

No entries under specific sizes for numbers of 30 or more may indicate improper stocking procedures where the correct size is not available for fitting and issue. Refer to Figure 4-1 (A and B) for examples.

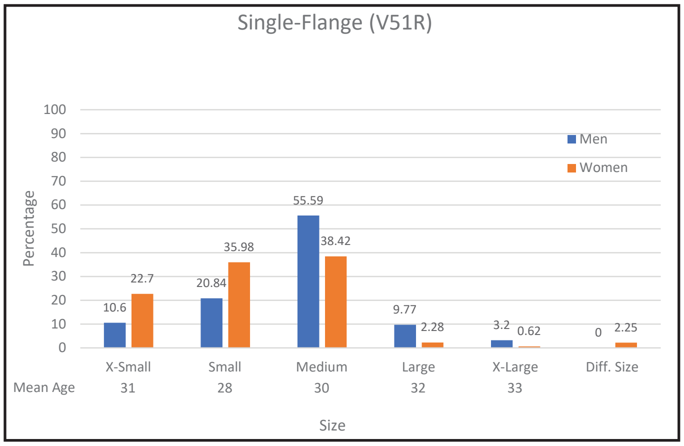

Figure 4-1A. Percentages for single-flange earplug fitted with gender distributions, mean age, and different size in each ear.

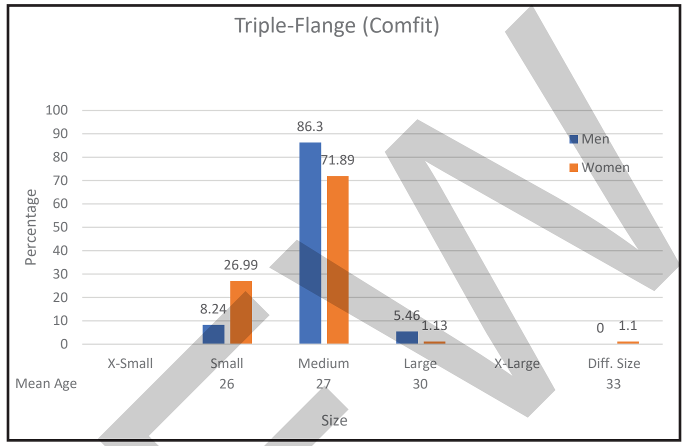

Figure 4-1B. Percentages for triple-flange earplug fitted with gender distributions, mean age, and different size in each ear.

Most of the example data are from a younger population. Although there is appropriate skewing of women toward the smaller sizes, both earplugs are too skewed toward the medium size. Mean ages increase for both earplugs except for the extra-small, single-flange type. The different size for the single-flange should be at least 8–10% if fitted properly. The different size for the triple-flange is appropriate.

Hearing Protection Used

Type of Metric

Leading/Process

Description

The number and percentage of each type of hearing protective device (HPD) used within an organizational unit. Refer to Figure 4-2 for an example of how to collect and share data.

The type of hearing protection used should be identified by specific model or brand name and date issued. Specificity could also be limited to generic categories (e.g., foam earplugs, noise muffs, ear canal caps, custom-molded earplugs, etc.).

The type of hearing protection used could be entered on the individual's audiogram to facilitate data gathering and reporting.

Objective

Identify the number and types of hearing protectors used.

Target Audience

- Purchasing staff
- OEHS professionals

Current Requirements

- OSHA 29 CFR Part 1910.95 (General Industry)[1] and 1926.52 (Construction)[2]
- MSHA noise standard: 30 CFR Part 62 (Occupational Noise Exposure)[3]

Benefits/Value

- Data can be used to evaluate company/agency doctrine on hearing protection. For example, company/agency doctrine dictates that everyone should have freedom of choice from a variety of hearing protection offered unless medically or environmentally contraindicated. Data indicate, however, that only one type of hand-formed (foam) earplug is being "used."
- A high percentage of hand-formed earplugs can be a management red flag that someone is resisting the extra cost of noise muffs, is not taking the extra effort required to fit sized, preformed earplugs, or is not instructing workers in the use of hearing protection.
- A high percentage of ear canal caps for high-level exposures (over 95 dBA) is a red flag because they provide poor noise reduction capabilities.

Weaknesses/Limitations

The type of hearing protection issued may not always be reflective of the type of hearing protection used. Self-report data on the type of hearing protection used also have limitations. Ideally, verification in the workplace should yield the most valid data.

Data Sources

- Audiograms, if hearing protection information is captured as a required entry
- Workplace noise surveys/inspections
- Purchasing database

Interpreting Data

A variety of hearing protection is usually appropriate for a variety of noise exposures (levels and duration), other environmental conditions (heat and humidity), compatible headgear, individual preferences, and communication requirements. Data trends should reflect company/agency doctrine, assuming that best practices are followed. Refer to Figure 4-2 for an example.

For the example presented in Figure 4-2, it would have to be determined on an individual basis whether the appropriate hearing protector was being used. However, the pie chart provides a "big picture" look at company/agency doctrine to reveal whether a variety of hearing protection was available to accommodate individual preferences, types, and levels of noise exposure, communication requirements, etc.

Monitoring Audiometry Compliance

Type of Metric

Leading/Process

Description

The percentage of workers within an organizational unit who have received a hearing test within a calendar/fiscal year compared to the number of workers reported as exposed to hazardous noise can be calculated as follows:

$$\frac{\text{Workers with Hearing Test}}{\text{Exposed Workers}} \times 100$$

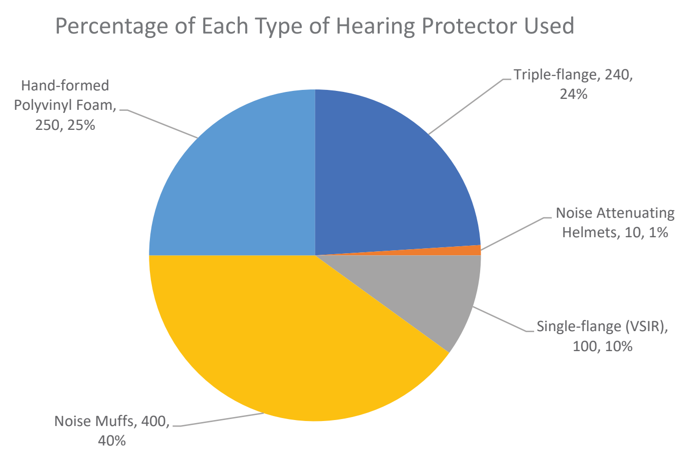

Figure 4-2. Percentage of each type of hearing protector used.

Chapter 10

Indoor Air Quality

As noted early in this publication, performance measures can be used by organizations to provide strategic direction. Additionally, they can be used as a continual improvement tool to assess actions or programs in relation to established goals or assess a particular process or procedure for problem solving and process optimization. Such broad uses certainly include metrics for indoor air quality (IAQ).

Measures of indoor environmental quality (IEQ) can vary widely. Indeed, IEQ is much broader than IAQ and includes additional parameters such as lighting, ergonomics, noise, and other non-IAQ considerations. Therefore, the discussion of this chapter is restricted only to IAQ. In decades past, measurement of carbon dioxide in the indoor air was long used[1] as a general indicator of sufficient "ventilation for acceptable indoor air quality."[2] Standards for the use of carbon dioxide as a primary indicator have been equivocal[3] (Endnote i). However, the amount of carbon dioxide in the indoor air (in parts per million) is still frequently and increasingly used today as a surrogate for human-emitted bio-effluents (i.e., odors) to predict human comfort with general air quality in indoor spaces.[4]

Several organizations serve as sources for a wide variety of other metrics pertaining to IAQ[5–19] (Endnotes ii, iii, iv, and v). As a perhaps oversimplified but important concept, standards for outdoor air are available; however, components of indoor air are related to components of outdoor air plus all potential indoor air source components. Additionally, the components of indoor air have both initial construction and ongoing maintenance elements[20] (Endnote vi). This is supported by the book entitled *Healthy Buildings*[21] (as reviewed in AIHA's guidance document *Best Practice Guide for Leading Health Metrics in Occupational Safety and Health Programs*[22]). The book provides the following metric to support this concept: "% buildings continuously commissioned to ensure optimal indoor air quality is maintained."[21,22] (Endnote vii).

The broad approach of the U.S. General Services Administration (GSA) is indicative of the complexity of measuring and managing the quality of indoor air.[23] As noted by the U.S. GSA, a plethora of

> ...standards and programs have emerged that focus on elements affecting the quality and productivity of the built environment, including Leadership in Energy and Environmental Design (LEED), I-Beam, green purchasing standards, Green Building Initiative, and other sustainability requirements. The extent to which these and related initiatives affect IAQ is often unclear.

Some of these measurement criteria are focused on the following:

- IAQ maintenance measures, such as filter changes and other routine maintenance procedures.
- IAQ threshold values, which are used to differentiate potential problem areas from nonproblem areas.
- Purchasing requirements for environmentally friendly, or "green," products seeking to minimize conditions such as volatile organic compound off-gassing.[24]
- Well-established standards such as those published by the American Society for Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) to maintain ventilation and thermal comfort standards for mechanical building systems in new construction and renovation.
- Newer criteria for the commission of building equipment and systems that can affect IAQ, such as GSA PBS P-100: Facilities Standards for the Public Buildings Service and the U.S. Green Building Council's LEED for New Construction and Major Renovation.
- Metrics focused on ubiquitous, naturally occurring materials such as mold, asbestos, lead, nuisance dust, and other particulate matter of various size criteria.
- The U.S. GSA specifically notes criteria for IAQ components such as humidity[25] (Endnote viii) and important substances such as carbon dioxide,[25] (Endnote ix) carbon monoxide,[25] (Endnote x) formaldehyde,[25,26] (Endnote xi), and asbestos.[25] (Endnote xii)

- Whereas mold sampling may or may not be useful in general occupancies, there is an important exception for surgical, immune-suppressed, and certain other healthcare facilities. This exception applies in situations where nosocomial infection rate metrics and construction-related and other prevention measures in hospital environments may be paramount.[11] Other bioaerosols, such as SARS-CoV-2, can be readily measured and might also be candidates for measurement criteria.

Exceptions to "general" metrics of IAQ abound. For example, the U.S. Environmental Protection Agency (EPA) published *Voluntary Guidelines for States: Development and Implementation of a School Environmental Health Program*. This guideline notes that as of March 2012, 33 states had some type of state regulation regarding IAQ in schools.[27] Therefore, state regulations should be referenced regarding criteria or metrics for measuring IAQ in schools. Another ecample is the joint publication between the U.S. EPA and U.S. Consumer Product Safety Commission, which discusses metrics of residential environments, with a focus on radon.[28]

Metric Example No. 1: Management System Audits, Including Maintenance of HVAC Systems

A management system audit approach to IAQ currently appears to be widespread. An example is the GSA conducting periodic building audits, inspections, and surveys to measure and maintain IAQ. The implementation of such audits is one IAQ "management system"-related approach. Again, the book entitled *Healthy Buildings*[21] (Endnote vii) supports the following metric: "% buildings continuously commissioned to ensure optimal indoor air quality is maintained." Such a metric appropriately emphasizes the critical aspect of "maintenance" of building systems for assuring optimal IAQ.

Below is an example of a more passive approach of a management system-focused IAQ metric, "Percentage of Indoor Air Quality Complaints Resolved."

Metric Example No. 2: Percentage of Indoor Air Quality Complaints Resolved[29]

Type of Metric

Leading/Process

Description

Formula Calculation:

$$\frac{\text{Number of IAQ complaints resolved}}{\text{Number of IAQ complaints received}} \times 100 = \text{\% of IAQ complaints resolved}$$

Objective

The objective of the IAQ Program is to eliminate complaints and lost workdays due to IAQ issues. Because it is nearly impossible to predict and prevent IAQ problems completely, three pieces of data are required to evaluate effectiveness of IAQ programs:

- The rate at which complaints are resolved.
- The reduction in the incidence of new complaints.
- The reduction in days away from work (DAFW) due to IAQ issues.

Target Audience

- Industrial hygiene (IH) staff
- Medical staff
- Management
- Workers

Benefits/Value

- Patterns of IAQ complaints and their contribution to total DAFW will be better understood, helping IH staff determine the level of resources needed to address problems.
- Medical staff will have a better understanding of the extent of chronic problems and whether they are contributing to DAFW.

Data Sources

- Reports to medical staff
- First-aid log
- Workers' compensation claims
- IH department records
- Statutory injury and illness records such as an OSHA Log

Interpreting Data

A high percentage (closer to 100%) indicates success in resolving IAQ issues.

Summary of Metrics for Indoor Air Quality

The selection of an appropriate metric for IAQ can be complex and may be highly dependent on building occupancy. A variety of organizations serve as sources for such metrics pertaining to IAQ. Such resources should be referenced as part of any selection of an IAQ metric or process.

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Chapter 16

Total Worker Health® Metrics

Note: *The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the National Institute for Occupational Safety and Health (NIOSH), Centers for Disease Control and Prevention (CDC).*

Introduction

The value assessment of *Total Worker Health* (TWH) programs and practices is an emerging body of knowledge. Therefore, specific, discrete performance measures like the ones presented for other topics in previous chapters have not yet been developed, tested, and field-calibrated. However, there are several novel tools and approaches currently available to occupational and environmental health and safety (OEHS) professionals. These tool and approaches will allow practitioners to begin to assess the quality of TWH programs, practices, and impact.

The survey metrics described in this chapter are varied—some are qualitative, some are semi-quantitative, and others are quantitative. However, each metric focuses on a broad array of features, including structural, process, and outcome-based areas (further subdivided into organizational and worker well-being areas). Using one aggregated set of metrics to gauge all these features is not the norm at this time.

TWH is defined as policies, programs, and practices that integrate protection from work-related safety and health hazards with the promotion of injury- and illness-prevention efforts to advance worker well-being.[1] Furthermore, TWH approaches focus on systemic, organizational-level interventions that are integrated and comprehensive in that they include health protection and disease prevention for work and nonwork issues.[2]

TWH approaches typically address changes to improve the organizational context for work, the physical environment, and psychosocial factors that impact workers. Worker behavior modifications often supplement efforts to address priority focal areas (organization, physical environment, and psychosocial factors).[3,4]

The approach for assessing TWH programs follows the traditional hierarchy of controls concept, as applied to TWH programs specifically, which first seeks to eliminate working conditions that threaten worker safety, health, and well-being. If elimination is not possible, the secondary approach is to substitute or replace unsafe, unhealthy working conditions with safer, health-enhancing policies, programs, and practices that improve workplace safety and health culture. Another organizational-level control is redesign of the workplace for worker safety, health, and well-being. If the upstream approaches fall short of accomplishing the goal, implement behavior modifications such as education and encouragement of personal lifestyle changes.[5]

Many of the currently available metrics in this field, which are often formatted as tools or surveys, vary in terms of objectives, target audience, level of detail, and general focus. A total of 10 tools are included in the current metrics assessment of this chapter for reader consideration:

1. Workplace Integrated Safety and Health (WISH) Assessment[6]
2. Healthy Work Participatory Program (HWPP)[7]
3. CDC National Healthy Worksite Program (NHWP) Health and Safety (H&S) Climate Survey[8]
4. NIOSH Worker Well-Being Questionnaire (WellBQ)[9]
5. NIOSH Quality of Worklife (QWL) Survey[10]
6. Healthy Work Survey (HWS)[11]
7. Dimensions of Corporate Integration[12]
8. CDC Worksite Health Scorecard[13]
9. HealthLinks™ [14]
10. HERO Health and Well-being Best Practices Scorecard in Collaboration with Mercer© (HERO Scorecard©)[15]

Types of Metrics and Elements of Emphasis

The tools or survey metrics evaluated include qualitative, semi-quantitative, and quantitative metrics. Both leading/process and lagging/outcome metrics are included. For example, some tools gauge organization of work (a leading metric) and others focus on employee outcomes (a lagging metric).

Description

The types of survey metrics included in this chapter vary, including those which gauge the following:

- How workers are faring.
- Perception of the organization's health and safety program by workers and/or organizational representatives.
- Worker attitudes.
- An organization's strengths, challenges, and suboptimized TWH opportunities, which can be calibrated by an individual with TWH expertise. This individual does not need to be a consultant; organizations can grow their own experts with proper training.
- Relationship between work organizational variables and health and safety impact.
- Identification of work stressors that make workers ill or less productive or cause deficits to the organizational bottom line.
- Relative impact of proven health program strategies.
- Comprehensive approach to assessing, documenting, and discussing worksite health assets.
- Actions to drive change and benchmark TWH processes across company sectors.

Metric Objectives

These tools are generally designed to promote better understanding of worker safety, health, and well-being, target interventions for improvement, and assess impact. For example, the HWS specifically looks at sources of stress at work (work stressors) and health and productivity outcomes.[7] The CDC NHWP H&S Climate Survey focuses on health-related information and programs to ensure that they address employees' health concerns.[8] The CDC Worksite Health Scorecard can help assess whether these strategies have been implemented and are effective.[13]

Metrics and Their Specific Target Audiences (Users)

- NIOSH WellBQ: Researchers, employers, workers, practitioners, and policymakers; understand the well-being of workers and target interventions to improve worker well-being, among other applications.[9]
- WISH: Employers (e.g., health and safety representatives, either in human resources or in safety, at the middle management level), researchers.[6]
- HWPP: Employers (e.g., program facilitators, team members).[7]
- HealthLinksTM: Employers (e.g., OEHS professionals) in small- to medium-sized private and public organizations, including government agencies.[14]
- NIOSH QWL Survey: Employers, practitioners, policymakers, researchers.[10]
- HWS: Individuals, employers, unions and worker advocates.[11]
- CDC NHWP H&S Climate Survey: Employers.[8]
- HERO Health and Well-Being Best Practices Scorecard©: Employers in companies of all sizes and industries.[15]
- Dimensions of Corporate Integration: Employers, employee-employer partnerships.[12]
- CDC Worksite Health Scorecard: Employers, human resource managers, health benefit managers, health education staff, occupational nurses, medical directors and wellness directors.[13]

Benefits/Value of Specific Tools

- The WISH, NIOSH WellBQ, QWL Survey, HWS, CDC Worksite Health Scorecard, and HealthLinks™ tools all capture important metrics outside of workplace policies and safety culture, including metrics of individual health and quality of life outside of work.[6,9–11,13,14]
- The HealthLinks™, HWS, and HERO Scorecard© tools allow for a follow-up consultation with experienced TWH professionals after completion.[11,14,15]
- The WISH and CDC NHWP H&S Climate Survey tools provide a relatively short survey approach that can be completed quickly,[6,8] whereas the HWS, QWL Survey, CDC Worksite Health Scorecard, NIOSH WellBQ, Dimensions of Corporate Integration, and HERO Scorecard© [9–13,15] tools provide a very detailed, lengthy approach to the assessment process.
- The WISH, HWPP, NIOSH WellBQ, QWL Survey, Dimensions of Corporate Integration, and HERO Scorecard© tools provide a broader, more integrated approach to TWH assessments.[6,7,9,10,12,15]
- Some tools, including the WISH, HWPP, HealthLinks™, QWL Survey, Dimensions of Corporate Integration, and CDC Worksite Health Scorecard, have a more specific focus on health and safety processes and related metrics in the workplace.[6,7,10,12–14]
- The NIOSH QWL Survey provides a holistic array of work organization variables as well as a broad range of health, safety, and performance outcomes.[10]
- The HWPP provides significant detail with substantial underlying support and documentation. These include training videos of intervention sessions to help train facilitators and guidance documents on topics such as gauging organizational readiness, fostering management support, and identifying safety and health priorities.[7]
- The Dimensions of Corporate Integration tool helps users to identify organizational priority areas of interest and potential effectiveness.[12]
- The NIOSH WellBQ provides an assessment of overall worker well-being, covering five domains.[9]

Weaknesses/Limitations

- A number of the tools lack differentiation in the scoring system or use a highly qualitative scoring system (including WISH, CDC NHWP H&S Climate Survey, HERO Scorecard©, and NIOSH WellBQ).[6,8,9,15] The initial use of the NIOSH WellBQ provides a baseline for comparison with future uses of this tool.[9]
- Some tools have a specific or narrow focus and may not be sufficiently broad to assess overall program performance, including WISH, Dimensions of Corporate Integration, and the CDC Worksite Health Scorecard.[6,12,13]
- The programs in the HWPP, Dimensions of Corporate Integration, and HealthLinks™ tools are very involved and will require a substantial time commitment for practitioners to learn and be able to implement them fully.[7]
- Some of the tools lack organization and structure with respect to TWH program implementation (e.g., the CDC NHWP H&S Climate Survey and HERO Scorecard©) but do address other areas of TWH interest.[8,15]

Data Sources (Respondents)

Some tools rely on workers or employees to assess their own health, safety, and well-being. These tools include:

- The NIOSH WellBQ: Worker self-assessment.[9]
- The NIOSH QWL: Worker self-assessment.[10]
- The HWS: Worker self-assessment.[11]

Others use information provided by employers, including OEHS professionals. These tools include:

- WISH: Validated survey tool.[6]
- HealthLinks™: Assessment of organizational support, including leadership, organizational champions, dedicated resources, benefits; health and safety team, etc.[14]

Appendix B

Sample Industrial Hygiene Management System Elements

The current publication of OHS management systems, including ISO 45001, ANSI Z-10, and OSHA VPP, only hint at the various criteria that make up an IH program and system. The following is a sample template for IH program categories (i.e., recognition), elements (i.e., hazard inventory), and sub-elements (i.e., hazardous materials) that may represent an industrial hygiene management system (IHMS_. It is expected that each organization will evaluate and modify these assessment criteria as they fit into the existing OHS management system.

RECOGNITION	EVALUATION	CONTROL	MANAGEMENT	COMPLIANCE
1.1 Hazard Inventory 1.1.1 Hazardous Materials 1.1.2 Haz. Exposures 1.1.3 Ergonomic Stressors **1.2 Mgmt** 1.2.1 Accountability 1.2.2 Contractor	**2.1 Assessments** 2.1.1 Exposure Assess. 2.1.2 Risk Mgmt. **2.2 Monitoring** 2.2.1 Sampling 2.2.2 Instrument Calibration 2.2.3 QA/QC **2.3 Haz. Review** 2.3.1 New/Modified Material 2.3.2 New/Modified Process 2.3.3 Existing Material/ Processes	**3.1 Engineering** 3.1.1 General 3.1.2 Ventilation 3.1.3 Maintenance **3.2 Administrative** 3.2.1 General 3.2.2 Work Practice 3.2.3 Emergency Planning 3.2.4 Training **3.3 PPE** 3.3.1 Selection 3.3.2 Use 3.3.3 Maintenance **3.4 Medical** 3.4.1 PPE Users 3.4.2 Medical Monitoring	**4.1 Documentation** 4.1.1 Injury & Illnesses Rpts. 4.1.2Accident Investigations 4.1.3 Employee Notifications 4.1.4 SDSs 4.1.5 Sampling Records **4.2 Staffing** 4.2.1 Organization 4.2.2 Qualifications 4.2.3 Job Des. 4.2.4 Personnel Selection 4.2.5 IH Training **4.3 Program Eval** 4.3.1 Annual Review 4.3.2 Inspections 4.3.3 Corrective Action Plans 4.3.4 Reports 4.3.5 Performance Measures	**5.1 Programs** 5.1.1 Respiratory 5.1.2 Hearing 5.1.3 Haz. Comm. 5.1.4 Laboratory 5.1.5 PPE **5.2 Toxic & Haz. Sub.** 5.2.1 Toxic & Haz. Sub. **5.3 State & Local** 5.3.1 State & Local **5.4 Co. Policy** 5.4.1 Co. Policy

Appendix C

Industrial Hygiene Management Systems Assessment Scoring Table

To fully benefit from an industrial hygiene management systems (IHMS) assessment, an organization should measure the categories and their respective elements. These can help guide an organization to better understand strengths and weaknesses while assisting the assessment team in communicating its findings and results. An additional benefit is that a scored assessment will serve as a baseline against which future assessments can be performed to truly measure the continual improvement process. Regardless of the scoring process used, the following is a representation of an IHMS assessment score.

Evaluation Criteria Scoring Outline

ID	Description	Baseline			Re-Assessment		
		Sub-element Scores	Element Scores	Category Scores	Sub-element Scores	Element Scores	Category Scores
1.1	Hazard Inventory		65			78	
1.1.1	Hazardous Materials	53			61		
1.1.2	Hazardous Exposures	72			85		
1.1.3	Ergonomic Stressors	69			88		
1.2	Management		84			85	
1.2.1	Accountability	81			83		
1.2.2	Contractor	86			86		
1.0	**RECOGNITION**			**75**			**82**
2.1	Assessments		74			79	
2.1.1	Exposure Assessment	76			76		
2.1.2	Risk management	72			81		
2.2	Monitoring		72			70	
2.2.1	Sampling	83			89		
2.2.2	Instrument Calibration	88			94		
2.2.3	QA/QC	44			28		
2.3	Hazard Review		56			76	
2.3.1	New/Modified Material	67			70		
2.3.2	New/Modified Process	73			82		
2.2.3	Existing Material	28		75			
2.0	**EVALUATION**			**67**			**75**

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