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Review

A Scoping Review on Implementation and Evaluation Methods of Total Worker Health® Approaches

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Abstract

The integration of occupational safety and health protection with workplace efforts to promote worker health and well-being is a well-established concept, progressively formalized through the CDC-NIOSH Total Worker Health® (TWH) program. This scoping review aimed to map and describe the implementation and evaluation methods used in TWH approaches across occupational settings. Scopus, Web of Science, and PubMed were searched using predefined search strings based on "Total Worker Health" and "Total Worker Health approach". The original search was conducted in January 2023 and was updated in July 2026 using the same databases and search strategies. Eligible studies were peer-reviewed articles written in English that addressed the application, implementation, assessment, or evaluation of TWH approaches in occupational settings. Sixty studies identified in the original search were fully charted and summarized using descriptive frequency tables. The updated search retained eight additional recent studies, which were reported separately and additionally charted across a focused set of core methodological domains. Across the original corpus and the updated studies, substantial heterogeneity was observed in occupational sectors, study aims, intervention components, assessment methods, analytical approaches, and reporting formats. The main tools used to evaluate TWH aspects and interventions were surveys, questionnaires, interviews, meetings, focus groups, training activities, and mixed-methods evaluations. No single standardized model for implementing or evaluating TWH approaches emerged from the mapped literature; however, more consistent reporting of implementation processes, assessment tools, study populations, and analytical approaches may improve comparability, reproducibility, and transferability across occupational settings.

Keywords: Total Worker Health; worker well-being; occupational health; workplace intervention; implementation; evaluation methods; scoping review; TWH strategies

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1. Introduction

1.1. Background and Problem Statement

The integration of worksite health protection and health promotion represents a concept that brings together activities designed to improve the health of workers while simultaneously addressing the safety and healthfulness of working conditions [1]. Workers' safety, health, and well-being are affected not only by workplace safety and health hazards,

but also workers' own health behaviours [2,3]. A workplace where healthy behaviours are promoted, enables a motivated and healthy workforce and leads in the long run to an increase in workers' well-being and, in turn, their productivity [2]. Regarding these themes, two complementary approaches may exist: the first is based solely or mainly on occupational safety and health (OSH) programs, designed to prevent work-related injuries and illnesses by reducing workers' exposure to occupational hazards; the second is based mainly on wellness programs, designed to help workers to improve their own health and well-being [3]. Although these two approaches differ in emphasis, both aim to maintain or improve workers' safety, health, and well-being; their integration may have synergistic effects on worker safety and health [4–8], including improvements in healthy behaviours and reductions in work-related injuries, absenteeism, and health care costs [5,9,10].

Previous reviews of integrated workplace interventions have reported variable effects across health-related and work-related outcomes [6–8]. Small businesses are relevant to TWH implementation because they often have fewer formal OSH and health-promotion resources and may face greater organizational and financial constraints than larger enterprises [6,11]. These characteristics may influence the adoption and implementation of integrated worker-health approaches and justify considering small-business settings within the TWH literature reviewed here.

Based on these themes, in the United States, a paradigm shift in occupational health and safety practice has occurred in response to rapidly changing working conditions (e.g., contingent workers, workers in an expanded services sector, an increasing number of older workers, low-wage workers, and workers with chronic conditions [12]). For this reason, to respond to these challenges, the National Institute for Occupational Safety and Health (NIOSH) has promoted a comprehensive, interdisciplinary approach known as Total Worker Health (TWH) [13]. The integration of occupational safety and health protection with workplace efforts to promote worker health and well-being is not a new theme promoted by the Centres for Disease Control and Prevention (CDC)–NIOSH (e.g., Healthier U.S. Workforce Initiative and WorkLife Initiative). However, a practical effort to well-define this concept and apply it in relation to the traditional risk assessment process was born only in 2011, with the definition of the CDC-NIOSH Total Worker Health® program. Indeed, TWH is defined as the complex of "policies, programs, and practices that integrate protection from work-related safety and health hazards with promotion of injury and illness prevention efforts to advance worker well-being" [4]. The TWH approach is a new paradigm that advocates for a "Foundation of safety and health through which work can contribute to a higher level of well-being [14]". The TWH approach does not contrast with or replace traditional occupational safety and health programs; rather, it builds on protection from work-related hazards as a foundation and broadens the scope to include strategies that advance overall worker well-being [4,15]. Consistently, the NIOSH TWH Hierarchy of Controls expands, without replacing, the traditional risk-management hierarchy to include controls and strategies that more broadly advance worker well-being [15]. Thus, the definition of "worker well-being", as an integrative concept that characterizes quality of life with respect to an individual's health and work-related environmental, organizational, and psychosocial factors, is reinforced [4]. In fact, TWH bases its approach on the recognition that work influences human health with both traditional occupational risk factors (i.e., chemical-physical and biological) and more recently recognised factors, such as those related to work organisation and environment. However, TWH approach requires development and implementation efforts among multiple actors, and their competences, from different work units and distinct levels of the organizational hierarchy to communicate effectively, coordinate planning efforts, make decisions and provide support for meaningful front-line worker involvement [13]. For this reason, businesses can encounter numerous obstacles in

the pursuit of TWH [16]. Planning, assessment, and evaluation tools have been developed by NIOSH and other organizations to support TWH application. However, how TWH approaches are operationalized, implemented, assessed, and evaluated across occupational settings remains methodologically diverse and has not been consistently mapped.

1.2. Aim of the Study

Previous reviews have examined TWH effectiveness, specific domains such as stress, ergonomics, mental health, and nutrition, or applications across occupational settings [17–21]; however, their primary objectives were not to map how implementation, assessment, and evaluation methods were operationalized and reported across studies. Therefore, the aim of this scoping review was to describe how TWH approaches have been implemented and evaluated across occupational settings. Specifically, the included studies were analysed to document: (i) study aims, intervention strategies, and methods; (ii) adopted assessment methods; (iii) planning, assessment, and evaluation tools; (iv) types of data collected and analytical approaches used; and (v) barriers, contextual factors, and methodological issues reported in TWH application and intervention studies.

2. Materials and Methods

2.1. Review Design and Reporting Framework

This scoping review was conducted and reported in accordance with the PRISMA 2020 statement and the PRISMA Extension for Scoping Reviews (PRISMA-ScR) [22,23]. No protocol was prospectively registered or formally prepared before conducting the review; this aspect is acknowledged as a limitation.

2.2. Information Sources and Search Strategy

Scientific articles were searched in Scopus, Web of Science, and PubMed. For each database, the search strategy was based on the terms "Total Worker Health" OR "Total Worker Health approach", adapted to the specific database fields, as reported in Table S1. The original search was conducted in January 2023. To address the time elapsed since the original search, an updated search was performed in July 2026 using the same databases and search strategies, covering records published or indexed from January 2023 to July 2026.

2.3. Eligibility Criteria

The eligibility criteria were structured according to a Population–Concept–Context (PCC) framework, which was considered more appropriate than PICO because the review aimed to map implementation and evaluation methods rather than to compare interventions or estimate intervention effects. The Population included workers, employers, occupational health and safety professionals, and organizations; the Concept was the implementation, assessment, or evaluation of Total Worker Health® approaches; and the Context comprised occupational settings.

2.4. Study Selection

Eligible records were peer-reviewed scientific articles written in English that addressed the application, implementation, assessment, or evaluation of TWH approaches in occupational settings. Commentaries, editorials, conference papers, letters to the editor, review articles, non-English papers, unavailable full texts, and studies not relevant to the aims of this review were excluded. The original search was screened using the general eligibility criteria described above. For the updated search, a conservative eligibility approach was applied to avoid broadening the scope of the review: records were retained only when

Total Worker Health® was a central component and the article described the application, implementation, feasibility, evaluation, or transfer of a TWH intervention, program, training activity, or applied approach in an occupational setting. Studies were excluded when TWH was used only as a broad conceptual framework, or when they focused exclusively on general worker well-being, safety climate, psychometric validation, framework development, or needs assessment without an applied TWH intervention, program, or training activity. The screening and selection process was performed by two reviewers (C.Z., A.S.). Disagreements were resolved by discussion and consensus. No automation tools were used in the screening or selection process.

2.5. Data Charting Process

Data extraction and charting were performed by C.Z. and A.S. using a predefined extraction framework. For the 60 studies identified in the original search, extracted variables included: publication year; study location; occupational sector; type and size of organization; number and type of workers involved; TWH themes and aims; type of TWH intervention or strategy; assessment methods; use of surveys, questionnaires, interviews, focus groups, meetings, training activities, or other assessment tools; type of data collected; analytical approaches; incentives; and critical issues reported by the authors. Missing or unclear information was recorded as "not available". No numerical imputation was performed. Primary authors were not contacted to retrieve missing information because the review aimed to map information available in published reports. No formal critical appraisal, study-level risk-of-bias assessment, or assessment of the quality of the collected data was conducted. The review mapped the types of data and analytical approaches reported by the included studies rather than grading methodological quality or certainty of evidence.

The eight studies retained from the updated search were additionally charted using a focused set of core methodological domains: country/setting and population, study design, type of TWH application or intervention, assessment and evaluation methods, analytical approach, and reported implementation barriers or facilitators when available. These studies are presented separately in Table S13 to permit a structured comparison with the methodological patterns identified in the original corpus while preserving the original detailed descriptive tables based on the 60 fully charted studies. For descriptive synthesis, information reported by the included studies was grouped into pragmatic categories reflecting recurring TWH themes, assessment methods, data types, analytical approaches, and reported barriers or issues. These categories were based on the content reported in the articles and the relevant study context and were not mutually exclusive when a study addressed more than one domain.

2.6. Data Synthesis

Consistent with the scoping nature of the review, the objective was to map how TWH approaches have been implemented and evaluated across occupational settings rather than to estimate intervention effectiveness. A narrative synthesis was therefore performed, supported by descriptive frequency tables. Studies could contribute to more than one category when categories were not mutually exclusive; percentages were calculated over the 60 fully charted studies unless otherwise specified.

3. Results

3.1. General Description of the Studies Considered

The original search identified 539 records: 184 from Scopus, 187 from Web of Science, and 168 from PubMed. After duplicate removal (n = 335), 204 records were screened.

Records were screened first by title and then by abstract. Overall, 26 records were excluded after title screening and 40 after abstract screening. Reports not available in full text (n = 9) were recorded as not retrieved. The remaining full-text reports were assessed against the inclusion and exclusion criteria. The original search resulted in 60 studies that were fully charted. The updated search identified 213 additional records: 129 from Scopus, 2 from Web of Science, and 82 from PubMed. After deduplication, 129 unique records were screened; five records corresponded to studies already included in the original dataset. The remaining 124 new records were screened using the conservative eligibility criteria described above. Eight additional recent studies were retained and summarized separately. The study selection process is reported in Figure 1. Overall, 68 studies were considered after the updated search: 60 studies from the original search were fully charted (Table S2, Supplementary Materials) and eight additional studies from the updated search were reported separately and additionally charted across core methodological domains (Table S13, Supplementary Materials). The fully charted evidence comprised a range of designs, including observational and cross-sectional studies, qualitative and mixed-methods studies, feasibility and pilot studies, intervention evaluations, and randomized or cluster-randomized trials. The eight updated studies similarly included mixed-methods development/evaluation, feasibility studies, randomized or cluster-randomized intervention evaluations, longitudinal participatory program evaluation, and pre-post/follow-up training evaluations.

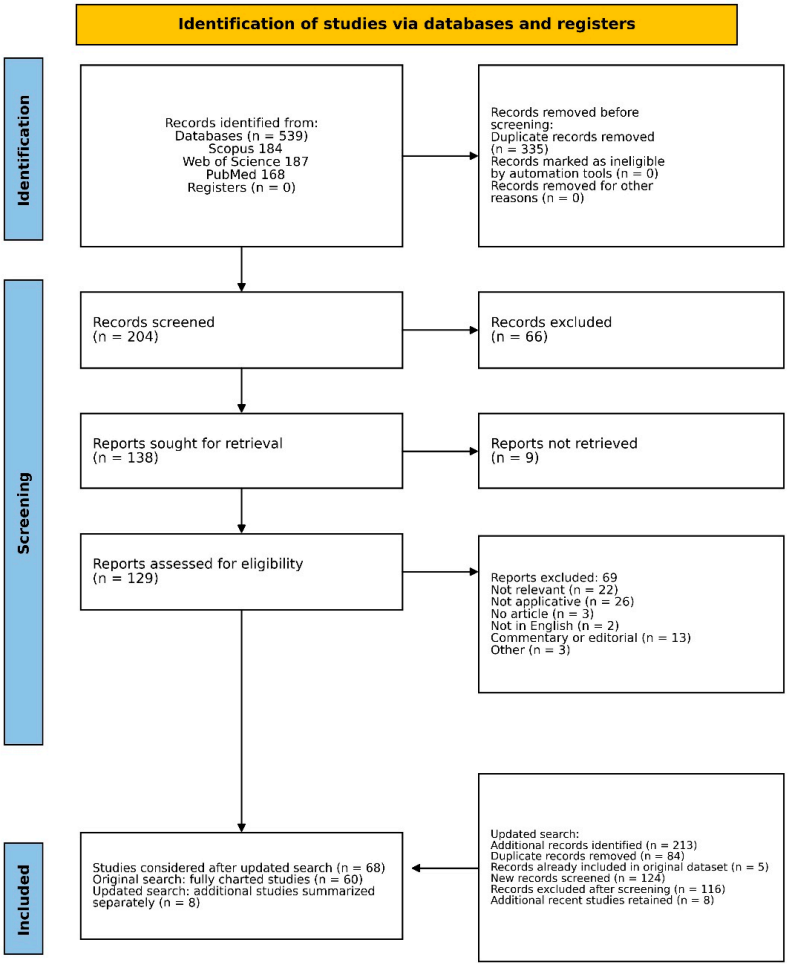


Figure 1. Flow diagram of the literature search and study-selection process, including the original search conducted in January 2023 and the updated search conducted in July 2026. The original search identified 60 studies that were fully charted; the updated search identified eight additional studies that were retained and reported separately. Adapted from Page et al. [22].

3.1.1. Publication Year and Period of the Study

Most articles were published between 2018 and 2022, accounting for 82% (49/60) of the fully charted studies; 2021 was the most represented publication year, with 32% (19/60) (Table 1). Five articles, corresponding to 8% (5/60), were published in 2023. The starting year of the study was not reported in 37% (22/60) of articles, whereas 30% (18/60) of studies started in 2016–2017. Study duration was not reported in 25% (15/60); overall, 60% (36/60) of studies had a duration of 12 months or less, including 37% (22/60) with a duration of 6 months or less (Tables S3 and S4). No study was reported as starting in 2011 or 2012.

Table 1. Publication year of the 60 studies identified in the original search and fully charted in this review. Percentages were calculated using 60 studies as denominator and rounded to the nearest whole number.

Publication Year	*n*	%	References
2023	5	8%	[2,24–27]
2022	5	8%	[28–32]
2021	19	32%	[1,13,33–49]
2020	10	17%	[50–59]
2019	7	12%	[3,60–65]
2018	8	13%	[11,66–72]
2017	2	3%	[73,74]
2016	2	3%	[75,76]
2015	1	2%	[77]
2014	0	0%	-
2013	1	2%	[78]
Total	60	100%	

3.1.2. Geographical Distribution

Among the 60 fully charted studies, 83% (50/60) were conducted exclusively in the United States. One additional study involved the United States and Canada (2% (1/60)), and one involved the United States and Mexico (2% (1/60)). Individual studies were conducted in Canada, Chile, Guatemala/Nicaragua/Mexico, Ireland, and Italy (2% (1/60) each), while geographical information was unavailable for 5% (3/60) of studies (Table 2). A more detailed geographical distribution of the 60 fully charted studies, including country-level information and State-level or broader geographical detail for U.S.-based studies, is reported in Table S5 (Supplementary Materials).

Table 2. Country-level geographical distribution of the 60 studies identified in the original search and fully charted in this review. Studies involving more than one country were counted in each applicable country; therefore, categories are not mutually exclusive and percentages are not expected to sum to 100%. Percentages were calculated using the 60 fully charted studies as the denominator. Note: n.a. = not available.

Study Location	*n*	%	References
United States	52	87%	[1,3,11,13,24–31,33,34,36–39,41,42,44,45,47–51,53–72,74–78]
Canada	2	3%	[36,52]
Mexico	2	3%	[27,32]
Guatemala	1	2%	[32]
Nicaragua	1	2%	[32]
Chile	1	2%	[46]
Ireland	1	2%	[35]
Italy	1	2%	[2]
n.a.	3	5%	[40,43,73]

3.1.3. Investigated Occupational Field and Workers Involved in the Exposure Assessment

Since the TWH approach is related to worker well-being, it can be applied across occupational settings, regardless of occupational sector and worker level. Regarding the occupational fields in which the selected articles described the application of the TWH approach (Table 3), most articles involved more than one occupational sector (33% (20/60)). Among the remaining studies, healthcare was the most represented sector (15% (9/60)), followed by agriculture and food services (13% (8/60)) and construction (12% (7/60)). A smaller number of studies involved specific occupational settings, such as an aluminium rolling plant and road maintenance. Employees/workers only were involved in 55% (33/60) of studies, employers/managers/technical or high-level staff only in 35% (21/60), both groups in 8% (5/60), and participant type was unavailable in 2% (1/60) (Table S6, Supplementary Materials). Overall, the reviewed studies covered a wide range of occupational settings, while relatively few involved both workers and organizational or managerial representatives.

Table 3. Occupational fields represented in the 60 studies identified in the original search and fully charted in this review. Percentages were calculated using 60 studies as the denominator.

Occupational Field	*n*	%	References
Agriculture and food services	8	13%	[27,32,35,36,42,48,62,66]
Aluminum rolling plant	1	2%	[70]
Construction	7	12%	[28,47,57,58,67,72,74]
Correctional facilities	4	7%	[30,54,61,64]
Education	3	5%	[29,50,53]
Health	9	15%	[13,25,26,44,52,65,73,76,77]
Human resources	1	2%	[24]
Road maintenance	2	3%	[38,51]
Military	3	5%	[33,40,68]
More sectors	20	33%	[1–3,11,31,34,37,39,41,43,45,49,55,56, 60,63,69,71,75,78]
Transport	2	3%	[46,59]
Total	60	100%	

3.1.4. Number and Size of Organizations and Number of Workers Involved in TWH Studies

The number and size (in terms of workers) of the organizations involved in the studies are reported in Table 4. It is worth noting that more than one-third of the studies (37% (22/60)) did not report the number of organizations involved. Overall, 38% (23/60) of the selected studies involved no more than 10 organizations, while 15% (9/60) involved a single organization.

The size of the organizations involved was classified as small, medium, or large, primarily according to the definition provided by the authors of the selected studies. Information on organization size was not available in 72% (43/60) of studies. Small organizations were involved in 20% (12/60) of studies, either alone (13% (8/60)) or together with medium and/or large organizations (7% (4/60)). The inclusion of small organizations is particularly relevant because they may have fewer occupational safety and health resources, greater financial constraints, and higher rates of occupational injury and illness than larger organizations [11]. Table S7 (Supplementary Materials) provides further details on the number and size of the organizations involved in TWH projects in the selected studies.

Regarding the number of workers involved in TWH projects, only two studies (3% (2/60)) involved fewer than 10 workers, while 22% (13/60) involved between 10 and 50 workers and 27% (16/60) involved between 100 and 500 workers. Five studies (8% (5/60))

involved more than 1000 workers. Information on the number of workers involved was unavailable in 22% (13/60) of studies. The number of workers may play a key role in the assessment of TWH issues. Sample size may influence the range of analyses that can be performed, but the amount of data alone does not determine the quality of the evidence; relevance, completeness, and methodological appropriateness are also important.

Table 4. Number and percentage of the 60 studies identified in the original search and fully charted in this review, according to the number and size of organizations involved and the number of workers enrolled. Note: *n* = number; n.a. = not available.

Number (*n*) of Organizations Involved	***n***	**%**	**References**
1	9	15%	[32,46,47,52,58,68–70,75]
$1 < n \leq 10$	14	23%	[1,13,27,29,42,48,50,51,54,61,64,67,71,72]
$10 < n \leq 50$	7	12%	[25,30,31,37,38,43,49]
$50 < n \leq 100$	4	7%	[34,53,55,56]
$n > 100$	4	7%	[41,45,60,78]
n.a.	22	37%	[2,3,11,24,26,28,33,35,36,39,40,44,57,59,62,63,65,66,73,74,76,77]
Total	60	100%	
Size	***n***	**%**	**References**
Small	8	13%	[11,31,34,37,43,55,56,69]
Medium	1	2%	[46]
Large	4	7%	[32,42,70,75]
Small + Medium	2	3%	[1,3]
Small + Medium + Large	2	3%	[28,60]
n.a.	43	72%	[2,13,24–27,29,30,33,35,36,38–41,44,45,47–54,57–59,61–68,71–74,76–78].
Total	60	100%	
Number (*n*) of workers involved in the study	***n***	**%**	**References**
$n < 10$	2	3%	[58,74]
$10 < N \leq 50$	13	22%	[25,28,29,42,43,51,52,65,69,71–73,77]
$50 < N \leq 100$	7	12%	[2,13,26,46,50,68,75]
$100 < N \leq 500$	16	27%	[3,27,30,31,35,36,39,40,49,54,59,61,63,64,66,76]
$500 < N \leq 1000$	4	7%	[33,38,44,67]
$N > 1000$	5	8%	[24,32,55,56,78]
n.a.	13	22%	[1,11,34,37,41,45,47,48,53,57,60,62,70]
Total	60	100%	

3.2. TWH Themes and Aims

Since the TWH approach is linked to a wide range of issues relating to the safety, health and well-being of workers, the studies selected for this review focused on the presence of different elements and their relationships. Although groups of themes relevant to improving worker well-being have been defined [4], this concept is not so straightforward to adapt to a case study. In this review, some general groups of

themes were defined based on the authors' interpretation and following the study setting (Table 5). Precisely because the themes of TWH are so varied, the studies reviewed usually consider more than one group of themes. This can be explained by the fact that the topics of safety, health and wellbeing are by nature interrelated. However, the studies that analysed only one topic were included in the category "Policies, programmes and practices" [1,11,26,37,39,43,44,58,69–71].

Table 5. TWH themes identified in the 60 studies identified in the original search and fully charted in this review. Categories are not mutually exclusive, and individual studies could contribute to more than one theme; percentages were calculated using the 60 fully charted studies as the denominator and are therefore not expected to sum to 100%.

TWH Theme Group	Brief Description of Group	*n*	%	References
Policies, programs, and practices	Set of themes concerning TWH policies, programmes and practices (e.g., knowledge, preparedness, perception and implementation of TWH)	30	50%	[1,3,6–24,31,34,36,37,39,41–45,48,50,51,53,55,58,60,62,66,68–72]
Work environment and working conditions	Set of themes concerning work environment and working conditions (e.g., work organisation, health climate)	27	45%	[2,3,25,27–29,32,36,40–42,46–49,51,53,55–57,60,62,67,68,73,76,78]
Health behaviours	Set of themes concerning health behaviours (e.g., diet, physical activity, sleep)	21	35%	[25,30,31,33–35,40,47,52,53,56,57,59,64,66,67,72,74–77]
Worker health outcomes	Set of themes concerning worker health outcomes (e.g., psychological and physical results, injuries, diseases)	23	38%	[25,28,31,32,40,46–48,53–55,57,61,62,64–67,72,74–77]
Perception of health and safety at site	Set of themes concerning perception of health and safety at site (e.g., use of protective equipment, perception to be exposed to risk factors, safety climate)	24	40%	[2,13,24,28–30,32,34,36–38,49–51,53,55,56,62,63,66,67,74,77,78]
Demographic information	Set of themes concerning demographic information (e.g., age, education, sex, job activity)	24	40%	[2,24,25,28,30,32,36,38,41,45,47,49,53,54,59,61,63,66,67,72–74,76,77]
Work outcomes	Set of themes concerning work outcomes (e.g., perception to be able to work, job enrichment, health promotion, personal development, work productivity)	12	20%	[2,30,32,33,42,46,47,50,57,64,72,77]
Perception of intervention activities	Some studies ask if the intervention was useful or not, if there is interest in continuing	5	8%	[48,62,67,74,75]

Overall, TWH theme groups were frequently addressed across the fully charted studies (Table 5). Policies, programs, and practices were addressed in 50% (30/60) of studies, work environment and working conditions in 45% (27/60), perceptions of health and safety at the worksite and demographic information in 40% (24/60) each, worker health outcomes in 38% (23/60), and health behaviours in 35% (21/60). Work outcomes and perceptions of intervention activities were less frequently addressed, in 20% (12/60) and 8% (5/60) of

studies, respectively. These differences may reflect both the objectives of the studies and the specific characteristics of the TWH interventions or approaches considered.

As reported in Table 6, study aims were heterogeneous and not mutually exclusive. Investigation of TWH aspects in practice was reported in 67% (40/60) of studies, implementation of a TWH approach in 55% (33/60), proposal of methods, tools, programs, or action plans in 45% (27/60), and assessment of TWH knowledge or application in 35% (21/60). Examples of specific planning, assessment, and evaluation tools and programs are reported in Table S8 (Supplementary Materials). In addition to the tools identified in the reviewed studies, NIOSH provides a Total Worker Health® Toolkit that compiles practical resources to support organizations in implementing TWH approaches [79]. An example was the SSWell study by the Colorado School of Public Health at the University of Colorado, a multi-year research project with a focus on small organizations and support for the health, safety, and well-being of their workforce, and how employees perceive their workplace culture [31,34,37,49,55,56]. This project was, however, built based on the Health Links Healthy Workplace Assessment program proposed by CDC-NIOSH [2,19,26,41,56,63,72,74,77].

Table 6. Classification of study aims in the 60 studies identified in the original search and fully charted in this review. Categories are not mutually exclusive and individual studies could contribute to more than one aim; percentages were calculated using the 60 fully charted studies as denominator and are therefore not expected to sum to 100%.

Aim	*n*	%	References
Checking TWH knowledge (and TWH application)	21	35%	[1,2,11,13,24,26,29,31,34,39,41,43,45,49,50,60,68,69,71,76,78]
Investigating TWH aspects in practice	40	67%	[3,24,25,27,28,30,32–35,37,38,40–42,44,46–50,52–57,59,61,65–67,70–77]
Implementing TWH approach	33	55%	[1,13,24,27,29,30,33,36–38,41–44,47–51,54,56,59,62,63,67,70–77]
Proposing methods-tools-plans/programmes, action plans	27	45%	[1,3,13,24,29,31,36,41,43,47,48,50,51,54,58,60,62–64,66,67,70,74–78]

3.3. Assessment and Evaluation Methods

Assessment and evaluation methods varied considerably across the reviewed studies, reflecting the diversity of occupational settings, study objectives, and TWH applications. Surveys were the most frequently reported method, used in 58% (35/60) of studies, followed by interviews in 38% (23/60), questionnaires in 27% (16/60), focus groups and meetings in 25% (15/60) each, and training activities in 18% (11/60) (Table 7). These categories were not mutually exclusive, as individual studies frequently used more than one assessment or evaluation method. Quantitative and qualitative approaches were therefore often combined, particularly for participatory assessment, prioritization of needs, intervention planning, and evaluation.

The level of methodological detail reported for these approaches was variable. Among studies using surveys, only a limited number provided complete information on instrument structure, administration mode, and timing [13,24,30,59]. Surveys were administered electronically or in person, and their length and completion time varied substantially across studies [1,13,24,29,30,39,44,45,47,49,50,56,57,59,61,72,76,77]. Interviews were reported in 38% (23/60) of studies and included semi-structured, joint, key-informant, and in-depth formats, administered by telephone, online, or face-to-face [11,13,25,26,46,53,54,58,65,69–71]. Questionnaires were used in 27% (16/60) of studies, although information on their structure, administration, and timing was also

frequently incomplete. Detailed examples of survey, interview, and questionnaire tools are reported in Tables S9–S11.

Table 7. Assessment and evaluation methods reported in the 60 studies identified in the original search and fully charted in this review. Categories are not mutually exclusive; individual studies could contribute to more than one method. Percentages were calculated using the 60 fully charted studies as denominator and are therefore not expected to sum to 100%.

Method	*n*	%	References
Survey	35	58%	[1,3,13,24,26,29–34,37–40,44,45,47,49–51,53,55–57,59,61,62,64,67,72,74–77]
Interview	23	38%	[1,11,13,25–27,40,42,43,46,48,50,52–54,58,60,62,65,67,69–71]
Questionnaire	16	27%	[2,29,35,36,41,55,57,63,66,67,70,71,74–76,78]
Focus Group	15	25%	[27,28,30,38,43,46,50,54,58,60,62,65,67,68,73]
Meeting	15	25%	[1,13,27,29,38,42,43,48,50,51,54,62,72,76,77]
Training	11	18%	[1,27,31,33,36,38,48,63,70,72,75]

Focus groups and meetings were each reported in 25% (15/60) of studies. These methods were commonly used to support participatory discussion, identification of priorities, and intervention development. When reported, focus groups generally lasted approximately one hour or longer [54,65,68,73], while meetings could be repeated throughout the study or intervention process [1,38,42,43,48,51,54,62,72,76,77]. Training activities were reported in 18% (11/60) of studies and were delivered either in person [31,38,75] or online [33,36,48,63,72,75]. Training was generally incorporated as part of a broader TWH intervention rather than used as a stand-alone assessment method.

Overall, TWH assessment and evaluation relied on a wide range of context-adapted methods and frequently combined quantitative, qualitative, and participatory approaches. However, reporting was often incomplete with regard to instrument structure, administration procedures, timing, and analytical methods. This variability limits direct comparison across studies and highlights the importance of more transparent and consistent reporting of the methods used to implement and evaluate TWH approaches.

3.4. Other Assessment Data

Although the main assessment methods for TWH programs are described in the previous paragraph, ten of the reviewed articles also combine the above-mentioned techniques with other assessment methods (Table 8). In addition to traditional physical examinations, it is important to note that only in 2 articles [38,51] (both related to the same Hearwell programme, concerning an intervention created to preserve hearing among motorway maintenance workers) personal noise sampling and noise monitoring were combined with a survey-meeting-focus group and training activities. This may be of interest considering that the TWH approach is closely related to traditional occupational health and safety programmes and that workplace risk factors may contribute to health problems previously considered unrelated to work.

These findings illustrate that some TWH studies combined traditional occupational health measurements with broader assessments of worker health and well-being. Furthermore, one article [74] used wearable sensor devices (e.g., the Zephyr BioharnessTM 3 sensors and the ActiGraph GT9X unit) to collect physiological and inertial measurements. This article introduces the possibility of using wearable sensor devices in a TWH study, with potential associations between the physiological state of each worker and their performance. However, several problems have been identified in their application, in terms

of sensor usability and reliability. For example, several workers provided unfavourable responses regarding the comfort and the weight of Zephyr's sensor, worn on the chest, rather than the ActiGraph, worn on the wrist. Moreover, these devices are not validated, and statistical testing results showed that data collection within a single day would not be sufficient to describe a worker's health-related characteristics measured by heart rate, EE, MET, and physical activity. These examples illustrate the potential contribution of objective or instrument-based measurements alongside self-reported assessment methods.

Table 8. Additional assessment methods reported in the 60 studies identified in the original search and fully charted in this review. Categories are not mutually exclusive, as individual studies could report more than one additional assessment method; percentages were calculated using the 60 fully charted studies as denominator and are therefore not expected to sum to 100%.

Assessment	*n*	%	References
Physical exams	7	12%	[38,40,66,72,75–77]
Physiological measure	1	2%	[74]
Fitness assessment	1	2%	[66]
Sedentariness assessment with ankle-worn accelerometer (time spent sedentary/physically active)	2	3%	[66,75]
Inertial measurement	1	2%	[74]
Sleep tracking or actigraphy	2	3%	[33,66]
Audiometry	2	3%	[38,66]
Personal noise sampling or Noise monitoring	2	3%	[38,51]
Meteorological data from website	1	2%	[74]
Wearable sensor devices	1	2%	[74]

3.5. Additional Incentives

Participation incentives or other supports were reported in 38% (23/60) of the fully charted studies [24,25,31,33,34,36,44,45,47,49,54–57,61,65–67,72,73,75–77]. Most involved monetary contributions, gift cards, coupons, or discount vouchers; one study [45] offered training at no cost rather than a monetary incentive. These findings indicate that recruitment and participation were actively supported in a substantial proportion of studies, but the presence of incentives cannot be interpreted as direct evidence of insufficient worker involvement or dissemination.

3.6. Data Types and Analytical Approaches

TWH assessment and evaluation methods generated a wide range of quantitative and qualitative data, which were analysed using different approaches according to study aims and design (Table 9). Studies frequently reported more than one type of data and more than one analytical approach; therefore, the categories reported in Table 9 are not mutually exclusive, and their percentages are not expected to sum to 100%. Closed-ended data were reported in 70% (42/60) of studies, specific indices, scales, or coded variables in 30% (18/60), and open-ended data in 20% (12/60). Among non-statistical approaches, thematic analysis was reported in 13% (8/60) of studies, content analysis and method-evaluation models in 7% (4/60) each, and logic models in 2% (1/60). Among statistical approaches, group comparisons were the most frequently reported, in 48% (29/60) of studies, followed by descriptive statistics in 23% (14/60), multivariate analyses in 22% (13/60), and correlation analyses in 8% (5/60). Overall, the reviewed studies used diverse analytical strategies,

reflecting the heterogeneity of the data collected and the methodological objectives of TWH studies.

Table 9. Types of data and analytical approaches reported in the 60 studies identified in the original search and fully charted in this review. Categories are not mutually exclusive; individual studies could contribute to more than one data or analytical category. Percentages were calculated using the 60 fully charted studies as the denominator and are therefore not expected to sum to 100%.

Type of Data	***n***	**%**	**Reference**
Closed-ended answers	42	70%	[1–3,11,13,24,26,27,29–41,44,45,47,49,50,53–57,59,61,63,64,67,70,72,74–77]
Use of specific variables (e.g., index, scale, or inductive coding)	18	30%	[27,31–33,35,45,47,49,50,54,55,57,59,67,74,76,77]
Open-ended answers	12	20%	[1,25,28,42,43,46,52,62,68,70,71,73]
Non-statistical analysis	***n***	**%**	**Reference**
Content analysis	4	7%	[28,68,71,73]
Thematic analysis	8	13%	[1,25,42,43,46,52,70,71]
Logic model	1	2%	[62]
Model of evaluation of method	4	7%	[33,53,56,75]
Statistical analysis	***n***	**%**	**Reference**
Descriptive statistics	14	23%	[2,24–26,44,45,51,53,54,59,66,70,71,77]
Correlation analysis	5	8%	[44,53,59,60,76]
Comparison of groups	29	48%	[2,13,24,30,33–41,45,47,49–51,55,57,59–61,63,67,72,74–76]
Multivariate analysis	13	22%	[2,33–36,44,47,50,55,57,64,67,74]

3.7. Reported Barriers, Contextual Factors, and Methodological Issues

Several studies reported favourable outcomes or positive implementation experiences; however, intervention effectiveness was not assessed in this scoping review. The reviewed studies also reported a range of organizational, implementation-related, contextual, worker-related, and methodological issues that could influence the application or evaluation of TWH approaches (Table 10).

Table 10. Reported barriers, contextual factors, and methodological issues in the 60 studies identified in the original search and fully charted in this review. Categories are not mutually exclusive; studies could contribute to more than one category. Percentages were calculated using the 60 fully charted studies as the denominator and therefore are not expected to sum to 100%.

Domain	**Critical Issue**	***n***	**%**	**Reference**
Worker health and social factors	General issues in safety, health, and well-being	8	13%	[1,31,32,51,60,68,73,75]
	Physical health issues	10	17%	[28,30,38,40,47,57,64–66,74]
	Health behaviour issues	6	10%	[30,35,52,53,59,66]
	Psychological health issues	10	17%	[30,40,47,54,59,61,64,65,68,74]
	Family and social relationship issues	2	3%	[64,65]

Table 10. *Cont.*

Domain	Critical Issue	*n*	%	Reference
Organizational and implementation factors	Resources, structure, organisation and management measures at work	21	35%	[11,13,26,29,38,39,41–43,46,47,50,55,57,65–71]
	Difficulties in defining, assessing, or adapting an intervention	10	17%	[27,38,39,50,53,62,67,71,72,78]
	Loss of knowledge over time	1	2%	[63]
Broader contextual factors	Social, political, and economic realities or demographic and personal factors	2	3%	[28,52]
	Evidence dependent on organization size, occupational field, or work activity	5	8%	[3,34,45,47,60]
Methodological, analytical, and reporting factors	Issues that might be present but not recognized or adequately managed	6	10%	[1,3,24,25,50,78]
	Correlations among issues	16	27%	[28,32–34,40,50,52,53,55–57,59,61,64,66,75]
	Results focused only on intervention definition	2	3%	[30,58]
Other/no specific issue	Other reported issues	9	15%	[31,37,44,49,51,65,66,74,78]
	No specific critical issues reported	4	7%	[36,48,76,77]

Resource, structural, organizational, and management constraints were the most frequently reported issues, identified in 35% (21/60) of the fully charted studies. Challenges related to defining, assessing, or adapting an intervention were reported in 17% (10/60), while physical and psychological health issues were each reported in 17% (10/60). Other reported factors included general safety, health, and well-being issues (13% (8/60)), health behaviour issues (10% (6/60)), methodological or reporting limitations, and broader social, economic, demographic, or personal factors. Categories were not mutually exclusive, as individual studies could report more than one issue.

3.8. Findings from the Updated Literature Search

To address the time elapsed since the original search, the literature search was updated using the same databases and search strategies. Eight additional studies met these stricter criteria [80–87]. For the revised analysis, these eight studies were additionally charted using a focused set of core methodological domains, including country/setting and population, study design, type of TWH application or intervention, assessment and evaluation methods, analytical approach, and reported implementation barriers or facilitators when available (Table S13).

These recent studies mainly concerned web-based or workplace-based TWH interventions, participatory programs, and TWH training or leadership-training initiatives. Their assessment methods remained consistent with those observed in the original body of evidence, including surveys, interviews, focus groups, feasibility assessments, pre-post evaluations, mixed-methods evaluation, and follow-up assessment of training transfer. Overall, the methodological characteristics of the eight updated studies were broadly consistent with patterns observed in the original corpus, particularly the diversity of occupational settings and the frequent use of context-adapted and multimethod evaluation strategies.

However, because these studies were not incorporated into all of the detailed frequency tables developed for the original 60 studies, direct quantitative comparison between the original and updated evidence remains limited.

4. Discussion

This scoping review provides a structured overview of how Total Worker Health® approaches have been implemented, assessed, and evaluated across occupational settings. The fully charted studies covered heterogeneous sectors, worker populations, organizational contexts, intervention formats, assessment methods, data types, and analytical approaches. This methodological heterogeneity was also evident in study design, with the fully charted corpus including randomized and cluster-randomized trials, non-randomized and pre-post intervention evaluations, cross-sectional and longitudinal observational studies, qualitative and mixed-methods studies, case studies, and intervention-development or implementation evaluations (Table S14, Supplementary Materials). Surveys, interviews, questionnaires, focus groups, meetings, training activities, and additional assessment tools were frequently used, often in combination. At the same time, the level of methodological detail reported across studies was inconsistent, particularly with regard to instrument structure, administration procedures, timing, characteristics of the study population and organization, and analytical methods. Such reporting variability limits direct comparison across studies and makes it difficult to determine how specific methodological choices may be transferred across occupational contexts.

The observed heterogeneity likely reflects three related factors: the broad and multidimensional nature of TWH, the need to adapt interventions and assessment strategies to sector-specific and organizational contexts, and the absence of a shared methodological and reporting standard for TWH implementation and evaluation studies. TWH approaches may combine traditional occupational safety and health protection with organizational, behavioural, participatory, and health-promoting components, and their practical application therefore necessarily varies according to workplace hazards, workforce characteristics, organizational structure, and available resources. This heterogeneity should not be interpreted as evidence that standardization is impossible; rather, it suggests that greater consistency in core reporting elements may improve comparability while preserving context-specific adaptation.

Although the review addressed both implementation and evaluation methods, the available literature provided substantially more detail on assessment and evaluation than on the implementation process itself. Information on implementation strategy, fidelity, adaptation, costs, facilitators, barriers, and sustainability was often limited or inconsistently reported. This imbalance is relevant because the ability to interpret or transfer a TWH approach depends not only on knowing which outcomes were measured and which analytical methods were used, but also on understanding how the intervention was introduced and integrated within the workplace. Future studies should therefore describe not only what was assessed and how, but also how TWH approaches were introduced, adapted, delivered, maintained, and integrated with existing occupational safety and health activities.

The organizational and implementation-related issues identified in this review are broadly consistent with those reported by Leso et al. [21], who highlighted limited awareness of the TWH approach, leadership commitment, participatory engagement, resource constraints, and difficulties in identifying health and safety priorities. In the present review, resource, structural, organizational, and management constraints were likewise the most frequently reported category of issues. Taken together, these findings indicate that the implementation of TWH approaches depends not only on the selection of appropriate

assessment tools, but also on organizational capacity, leadership support, worker participation, and the ability to adapt interventions to specific workplace contexts.

Several studies further illustrated how occupational and organizational context may influence both worker perceptions and the interpretation of TWH-related findings. For example, among home health aides, close and continuous contact with individuals with chronic conditions may have influenced workers' perceptions of their own health status [25]. In a pilot project involving preschool workers, health promotion was perceived as particularly relevant in a setting where health protection was already considered an established occupational priority [50]. Studies involving correctional workers highlighted interrelationships between work organization, psychological health, work ability, physical activity, work engagement, and work–family balance [64], while burnout was reported as a significant predictor of post-traumatic stress symptoms among jail officers [61]. These examples reinforce the importance of considering organizational and contextual factors when interpreting TWH implementation and evaluation findings, rather than viewing individual assessment methods or outcomes in isolation.

The focused charting of the eight studies identified through the updated search showed methodological patterns broadly comparable with those observed in the original corpus, while also indicating that implementation details remained unevenly reported across recent studies. The updated evidence included intervention, feasibility, participatory, training, and longitudinal evaluation approaches and continued to show considerable methodological diversity. Because these studies were charted across a focused set of core methodological domains rather than incorporated into all of the detailed descriptive tables developed for the original corpus, the comparison between the original and updated evidence should be interpreted primarily as a qualitative assessment of methodological patterns rather than as a direct quantitative comparison.

The review has some limitations. First, no formal critical appraisal or study-level risk-of-bias assessment was conducted; therefore, the review maps methodological and reporting characteristics but does not grade the robustness or certainty of the evidence. Second, the review was restricted to English-language peer-reviewed articles. Third, primary authors were not contacted to retrieve missing information because the objective was to map information available in published reports; consequently, items coded as "not available" reflect reporting incompleteness rather than necessarily the absence of the corresponding characteristic. Fourth, no protocol was prospectively registered or formally prepared before conducting the review. Finally, the eight studies identified through the updated search were charted across core methodological domains but were not incorporated into all detailed frequency tables developed for the original 60 studies.

Despite these limitations, the review identifies several methodological priorities for future TWH research. In particular, there is a need for more consistent and transparent reporting of occupational setting and population characteristics, intervention components, implementation processes, assessment tools, data collection procedures, analytical approaches, contextual factors, and study limitations. Greater consistency in these core reporting elements would improve comparability, reproducibility, and transferability across occupational settings without requiring TWH interventions themselves to follow a single standardized model. Future studies should also explicitly describe how TWH activities relate to and are integrated with existing occupational safety and health practices, so that both the intervention and the organizational context in which it is implemented can be adequately interpreted.

5. Conclusions

This scoping review mapped the implementation and evaluation methods used in Total Worker Health® approaches across a wide range of occupational settings. The reviewed literature showed substantial diversity in study populations, organizational contexts, intervention formats, assessment methods, data types, and analytical approaches. The additional studies identified through the updated search showed similarly diverse implementation and evaluation methods.

No single standardized model for implementing or evaluating TWH approaches emerged from the mapped literature. Rather, TWH approaches were adapted to specific occupational, organizational, and workforce contexts and frequently combined quantitative, qualitative, and participatory methods. At the same time, reporting of implementation processes, assessment tools, administration procedures, analytical approaches, and contextual factors was often incomplete or inconsistent.

More consistent and transparent reporting of these methodological elements is therefore needed to improve comparability, reproducibility, and transferability across occupational settings. Future TWH studies should explicitly describe how TWH activities are related to existing occupational safety and health programs and should provide practical, transparent, and transferable information for employers, workers, occupational health professionals, and researchers. Greater consistency in the description of implementation and evaluation methods may support the interpretation, replication, adaptation, and reporting of future TWH approaches.

Supplementary Materials: The following supporting information can be downloaded at https://www.mdpi.com/article/10.3390/hygiene6030058/s1: Table S1: Search query and databases used in the review; Table S2: Complete list of the 60 studies identified in the original search and fully charted in this review; Table S3: Starting year of the study among the 60 fully charted studies; Table S4: Duration of the study among the 60 fully charted studies; Table S5: Geographical distribution of the fully charted studies, with additional State-level or broader geographical detail for studies conducted exclusively in the United States; Table S6: Type of workers involved; Table S7: Number and size of organizations; Table S8: Planning, assessment, and evaluation tools, projects/programs and study initiatives; Table S9: Survey tools reported in reviewed studies; Table S10: Type of structured interview and administration method; Table S11: Questionnaire tools reported in reviewed studies; Table S12: Summary of the updated literature search and conservative eligibility screening. Table S13: Core methodological characteristics of the eight additional studies retained from the updated literature search. Table S14: Study design or methodological approach of the 60 studies identified in the original search and fully charted in this review.

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