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Worldwide prevalence of inadequate work ability among hospital nursing personnel: A systematic review and meta-analysis

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Abstract

Purpose: To estimate the worldwide pooled prevalence of inadequate work ability among hospital nursing personnel using the Work Ability Index (WAI).

Design: Systematic review and meta-analysis.

Methods: A systematic search was conducted on Medline/PubMed, Scopus, Web of Science, Scielo, PsychInfo, CINAHL, Nursing and Allied Health, LILACS, and Google Scholar from inception to July 2021 to identify observational studies on work ability among hospital nursing personnel using the WAI. Two researchers independently completed the study selection, quality assessments, and data extraction on the prevalence of inadequate work ability that was pooled using the random effects model. Finally, subgroup analyses were performed to explore sources of heterogeneity.

Findings: A total of 42 studies were included, consisting of 24,728 subjects worldwide from 14 countries. Of these, 35 studies were included in the meta-analytical analyses. The worldwide pooled prevalence of inadequate work ability among hospital nursing personnel was 24.7% (95% CI = 20.2%–29.4%). High levels of heterogeneity were detected in all studies. Prevalence was higher in studies where samples were composed of nurses and nursing assistive personnel (26.8%; 95% CI = 22.4%–31.5%) than in those of nurses alone (22.2%; 95% CI = 13.1%–32.9%) and in studies where the sample was over 40 (28.1%; 95% CI = 19.5%–37.5%) than in those with a sample under that age (22.4%; 95% CI = 15.8%–29.7%).

Conclusions: Almost one in four members of hospital nursing staff in the world has inadequate work ability and therefore are at risk of several negative outcomes during their working life. These prevalence data correspond to the pre-pandemic period, so new studies should also be especially useful in quantifying the impact of the COVID-19 pandemic on work ability in the hospital nursing workforce.

Clinical relevance: The above findings justify the launch of initiatives that include annual assessment for the early identification of inadequate work ability, offering the

possibility of anticipated corrective measures. Nursing workforce older than 40 years and those belonging to the professional category of nursing assistive personnel should be priority target groups for screening and intervention to improve work ability.

KEYWORDS
hospital, meta-analysis, nurses, nursing assistants, nursing staff, hospital, work, work ability, work ability index

BACKGROUND

Work ability has been defined as the ability of a person, or rather a perception of their ability, to meet the demands of their job (Ilmarinen, 2009). Inherent in this definition is the notion that work ability is not only a function of one's personal capacities, including physical, mental, and social/interpersonal abilities, but also job requirements (Cadiz et al., 2019). That is why work ability varies within the same individual depending on their position or working conditions.

Extended evidence shows that work ability is a prognostic factor in absence from work (Reeuwijk et al., 2015), including long-term absence (Török et al., 2020), risk pension status (Roelen et al., 2014), early retirement intentions (Pit & Hansen, 2014), and outcomes beyond their working life, such as disability and death in later life (von Bonsdorff et al., 2011). For these reasons, the promotion of excellent work ability has been considered a key factor in prolonging a productive working life (Lindberg et al., 2006). Since the 1980s, researchers have focused on the evaluation of work ability, and its study has progressively gained prominence in the decades since, conditioned by demographic transitions, changes in work processes, and the incursion of new technologies and changes in labor relations (Ilmarinen, 2005). These changes have had a major impact on the nursing profession since nurses work in increasingly complex and challenging contexts, with a higher demand for care of people with multimorbidity and advanced age, leading to increased physical and mental demands made on these professionals (Catton, 2020). Additionally, hospital nurses have been reported to have especially high psychological and physical job demands (Jalilian et al., 2019).

To measure work ability, the Finnish Institute of Occupational Health developed the Work Ability Index (WAI) (Tuomi et al., 1988). The WAI is the most widely accepted and commonly used instrument to measure work ability and is available in 25 languages (van den Berg et al., 2009; World Health Organization, 2012). It is composed of 60 items distributed in seven dimensions that assess (a) current work ability compared with the lifetime best (1 item), (b) work ability in relation to the demands of the job (2 weighted items), (c) number of current diseases diagnosed by a physician (out of a list of 51 diseases), (d) estimated work impairment due to disease (1 item), (e) sick leave during the past 12 months (1 item), (f) own prognosis of work ability 2 years from now (1 item), and (g) mental resources (3 items) (Tuomi et al., 1997). Scores on each dimension are added together, with a range from 7 to 49, which allow workers to be classified into four categories: poor (7–27); moderate (28–36); good (37–43); and excellent work ability (44–49). These categories were derived from the 15th and 85th percentiles of the scores obtained for a population of Finish municipal employees in 1981, and the resulting cutoffs have remained unchanged since that time (Ebener & Hasselhorn, 2019). However, since then, numerous studies have dichotomized the variable by merging the categories poor and moderate into inadequate work ability (7–36) and good and excellent adequate work ability (37–49). This could be due to statistical reasons, but also because both poor and moderate categories are the ones in which the worker has already had an imbalance between individual resources and the demands of the job, and therefore interventions to restore or improve work ability are needed.

Until now, several studies around the world have used the WAI to determine work ability among nurses; however, the prevalence rates of inadequate work ability, including poor and moderate work ability, among hospital nurses vary considerably between studies. In this sense, knowing an approximation of the global prevalence of inadequate work ability among hospital nursing personnel around the world helps to estimate the magnitude of the problem and determine the need for corrective measures. Therefore, the objective of this study is to develop a systematic review and meta-analysis to estimate the worldwide pooled prevalence of inadequate work ability among hospital nursing personnel measured by means of the WAI.

METHODS

A meta-analytic study was conducted following the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) 2020 statement (Page et al., 2021). The systematic review protocol for this study was registered with the International Prospective Register of Systematic Reviews (PROSPERO) on 26 July 2021 (pending registration number).

Eligibility criteria

Studies were included in accordance with the following criteria:

- Study design: primary observational studies with a cross-sectional or prospective research design. Studies aimed at psychometric testing of the WAI were excluded.
- Prevalence data: studies that have data on the prevalence of inadequate work ability or data on which prevalence could be

calculated. In studies in which such data were not found, the authors were contacted and asked to provide them. Only data from those who responded within 5 days of contact were included.

- Instrument: studies using the complete form of the WAI to measure work ability were included, excluding those using shortened or partial versions of the WAI (individual dimension/s or items).
- Population: the study population was nursing personnel who worked in hospitals around the world. Nursing personnel encompassed nurses and Nursing Assistive Personnel. Nursing assistive personnel included all categories of unlicensed personnel who are accountable to and work under the direct supervision of a nurse to implement specifically delegated patient care activities (Association of Women's Health, 2009). Studies conducted on midwives were excluded. Studies with aggregate data from hospital nurses with other categories of hospital professionals (physicians) and with nursing personnel working in other clinical

TABLE 1 Search strategy

Database	Search strategy	Results
Web of Science (WOS)	([“work ability index”] OR AB = [“work ability index”] OR AK = [“work ability index”]) AND ([nurs*] OR AB = [nurs*] OR AK = [nurs*]) AND ([hospital*] OR AB = [hospital*] OR AK = [hospital*])	54
MEDLINE/Pubmed	((“work ability index” [Tittle/Abstract]) OR (“work ability index” [Title]) OR (“work ability index” [Other Term])) AND ((nurs*[Tittle/Abstract]) OR (nurs*[Other Term])) AND ((hospital*[Tittle/Abstract]) OR (hospital*[Title])) OR (hospital*[Other Term]))	49
CINAHL	(“work ability index” OR AB “work ability index” OR SU “work ability index”) AND (nurs* OR AB nurs* OR SU nurs*) AND (hospital* OR AB hospital* OR SU hospital*)	22
Scopus	(TITLE-ABS-KEY [“work ability index”]) AND (TITLE-ABS-KEY[nurs*]) AND (TITLE-ABS-KEY [hospital*])	65
Lilacs	(“work ability index”) AND (nurs*) AND (hospital*)	22
PsycINFO	(ab[“work ability index”] OR ti[“work ability index”]) AND (ab[nurs*] OR ti[nurs*]) AND (ab[Hospital*] OR ti[Hospital*])	13
ProQuest nursing and allied health	(ab[“work ability index”] OR ti[“work ability index”]) AND (ab[nurs*] OR ti[nurs*]) AND (ab[Hospital*] OR ti[Hospital*])	10
Scielo	(“work ability index”) AND (nurs*) AND (hospital*)	14
Google scholar	“work ability index” AND nurses AND hospital	-

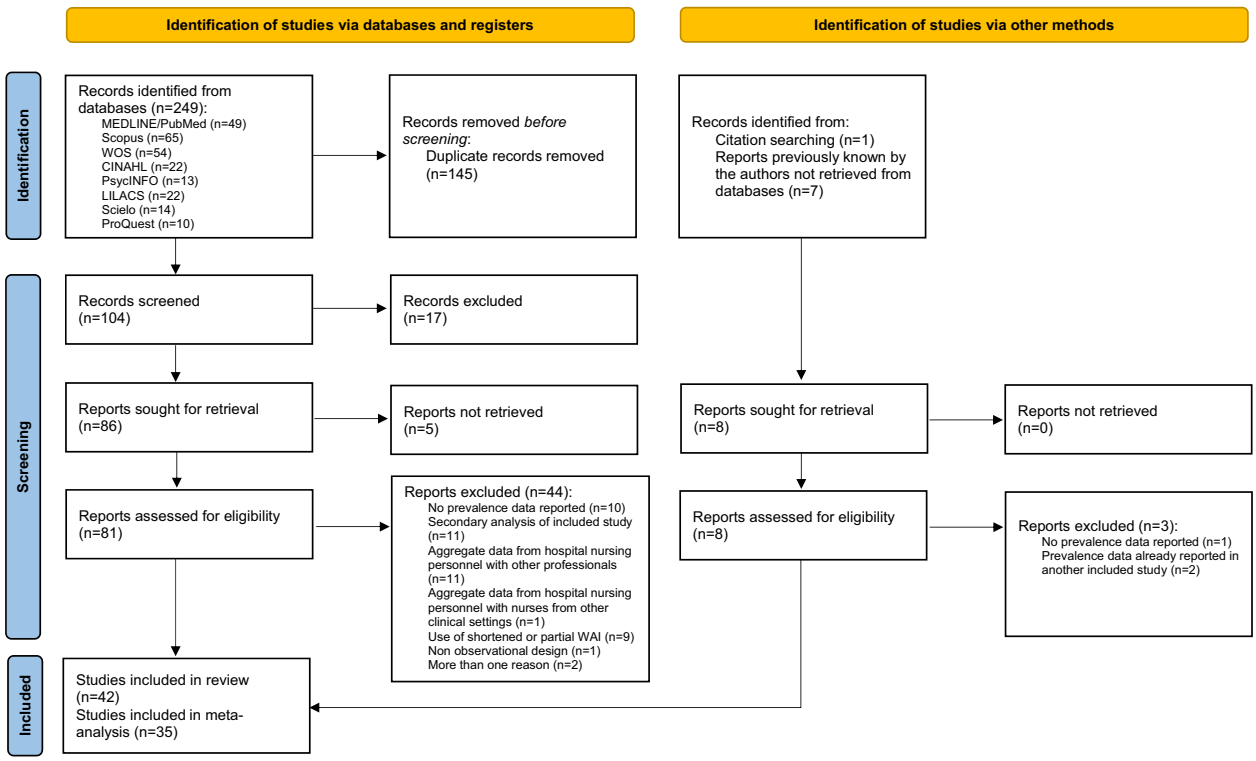

DIAGRAM 1 Flow diagram

TABLE 2 Characteristics of the studies

Author(s), year	Country of the origin of sample	Type of publication	Study design type	Sampling method	Sample size (N)	Sampling fraction (%)	Professional categories
Akodu and Ashalejo (2019)	Nigeria	Journal article	Cross-sectional	Convenience	135	94.4%	Nurses
Capelo et al. (2012)	Portugal	Conference proceedings	Cross-sectional	Convenience	78	70.9%	Nurses-NAP
Carel et al. (2013)	Israel	Journal article	Cross-sectional	Convenience	515	NR	Nurses
Da Silva et al. (2016)	Brazil	Journal article	Cross-sectional	Convenience	100	85.5%	Nurses-NAP
Das et al. (2019)	Bangladesh	Journal article	Cross-sectional	Random	197	NR	Nurses
Duran and Cocco (2004)	Brazil	Journal article	Cross-sectional	Convenience	54	NR	Nurses-NAP
Ehegartner et al. (2020)	Germany	Journal article	Cross-sectional	Random	382	NR	Nurses
Fischer and Martinez (2013)	Brazil	Journal article	Cross-sectional	Convenience	514	83.8%	Nurses-NAP
Fischer et al. (2006)	Brazil	Journal article	Cross-sectional	Convenience	696	69.9%	Nurses-NAP
Fonseca (2012)	Portugal	Dissertation	Cross-sectional	Convenience	159	NR	Nurses-NAP
Garosi et al. (2018)	Iran	Journal article	Cross-sectional	Convenience	101	NR	Nurses
Golubic et al. (2009)	Croatia	Journal article	Cross-sectional	Convenience	1086	78.0%	Nurses
Habibi et al. (2012)	Iran	Journal article	Cross-sectional	Random	228	NR	Nurses-NAP
Hilleshein et al. (2011)	Brazil	Journal article	Cross-sectional	Convenience	93	NR	Nurses
Hoe et al. (2011)	Australia	Conference proceedings	Longitudinal	Convenience	768	69.1%	Nurses
Izu et al. (2016)	Brazil	Journal article	Cross-sectional	Convenience	144	87.3%	Nurses-NAP
Knežević et al. (2010)	Croatia	Journal article	Cross-sectional	Convenience	1210	NR	Nurses-NAP
Magnago et al. (2015)	Brazil	Journal article	Cross-sectional	Convenience	498	84.1%	Nurses-NAP
Maia et al. (2014)	Portugal	Conference proceedings	Cross-sectional	Convenience	455	NR	Nurses
Martinez et al. (2017)	Brazil	Journal article	Cross-sectional	Convenience	514	83.8%	Nurses-NAP
Martins (2002)	Brazil	Dissertation	Cross-sectional	Convenience	168	62.7%	Nurses-NAP
Melikidou and Sourtzi (2014)	Greece	Journal article	Cross-sectional	Convenience	188	70%	Nurses-NAP
Murassaki et al. (2013)	Brazil	Journal article	Cross-sectional	Convenience	260	88.1%	Nurses-NAP
Nery et al. (2013)	Brazil	Journal article	Cross-sectional	Convenience	24	100%	Nurses-NAP
Nowrouzi et al. (2015)	Canada	Journal article	Cross-sectional	Random	111	80.4%	Nurses
Nunes et al. (2013)	Portugal	Conference proceedings	Cross-sectional	Convenience	109	NR	Nurses-NAP
Oliveira (2016)	Brazil	Dissertation	Cross-sectional	Convenience	135	55.5%	Nurses
Pereira et al. (2021)	Brazil	Journal article	Cross-sectional	Convenience	54	90%	Nurses-NAP
Quispe Carbajal (2021)	Peru	Dissertation	Cross-sectional	Convenience	30	75%	Nurses
Raffone and Hennington (2005)	Brazil	Journal article	Cross-sectional	Convenience	465	52.5%	Nurses
Rodrigues et al. (2019)	Brazil	Journal article	Cross-sectional	Convenience	164	NR	Nurses-NAP
Rongen et al. (2014)	Belgium, Finland, France, Germany, United Kingdom, Italy, Netherlands, Norway, Poland and Slovakia	Journal article	Cross-sectional	Convenience	9927	66%	Nurses-NAP

Hospital unit	Age in years (mean ± SD)	Proportion of women *n* (%)	Poor work ability (WAI score 7–27) *n* (%)	Moderate work ability (WAI score 28–36) *n* (%)	Inadequate work ability (WAI score <37) *n* (%)	Inadequate work ability (other criteria)	Quality score
NR	40.2 ± 10.5	126 (93.3%)	8 (5.9%)	31 (23.0%)	39 (28.9%)	–	10/13
NR	33.1 ± 9.6	62 (79.5%)	1 (1.3%)	16 (21.0%)	17 (23.2%)	–	9/13
Multispecialty	41.1 ± 9.8	460 (89.0%)	5 (1%)	0 (0.0%)	5 (1%)	–	10/13
Multispecialty	39.4 ± 9.5	88 (88.0%)	–	–	–	35 (35%)	12/13
Multispecialty	35.9 ± 8.0	187 (94.9%)	NR	NR	10 (7.1%)	–	13/13
ED	37.3 ± NR	40 (74.1%)	0 (0.0%)	7 (13.2%)	7 (13.2%)	–	10/13
NR	40.1 ± 12.0	309 (81.0%)	67 (17.5%)	148 (38.7%)	215 (56.2%)	–	11/13
Multispecialty	35.5 ± 8.1	397 (77.2%)	NR	NR	58 (11.3%)	–	12/13
NR	34.9 ± 10.5	611 (87.8%)	NR	NR	159 (22.8%)	–	12/13
Multispecialty	36.5 ± 9.9	132 (83.0%)	9 (5.7%)	33 (20.8%)	42 (26.4%)	–	12/13
ICU	24.5 ± 3.6	71 (70.0%)	6 (5.9%)	27 (26.7%)	33 (32.7%)	–	11/13
Multispecialty	38.7 ± 10.3	1010 (93.0%)	NR	NR	380 (35.0%)	–	12/13
Multispecialty	38.4 ± 8.5	0 (0.0%)	NR	NR	63 (27.6%)	–	10/13
NR	41.7 ± 9.0	92 (98.9%)	0 (0.0%)	14 (15.1%)	14 (15.1%)	–	9/13
NR	NR	NR	9 (1.2%)	56 (7.3%)	65 (8.5%)	–	12/13
NR	46.4 ± 8.5	127 (88.2%)	5 (3.5%)	30 (20.8%)	35 (24.3%)	–	11/13
NR	NR	NR	67 (5.5%)	357 (29.5%)	424 (35.0%)	–	13/13
NR	41.3 ± 8.9	437 (87.8%)	29 (5.7%)	187 (37.6%)	216 (43.3%)	–	12/13
NR	33.0 ± 9.6	368 (81%)	3 (0.7%).	55 (12.1%)	58 (12.8%)	–	10/13
Multispecialty	35.9 ± 9.0	410 (79.9%)	–	–	–	49 (16.1%)	12/13
NR	NR	156 (92.9%)	3 (1.8%)	24 (14.3%)	27 (16.1%)	–	12/13
NR	35.6 ± 6.2	153 (83.0%)	7 (3.7%)	54 (28.7%)	61 (32.4%)	–	10/13
NR	NR	205 (78.9%)	–	–	–	101 (38.85%)	12/13
ICU	40.0 ± 8.0	10 (41.6%)	0 (0%)	4 (17.0%)	4 (17.0%)	–	10/13
Obstetric care	41.9 ± 10.2	105 (94.6%)	NR	NR	21 (29.2%)	–	12/13
NR	34.9 ± 10.0	92 (84.4%)	NR	NR	4 (3.7%)	–	8/13
Multispecialty	NR	110 (81.5%)	3 (2.2%)	22 (16.3%)	25 (18.5%)	–	13/13
Multispecialty	NR	44 (81.5%)	3 (5.6%)	17 (31.5%)	20 (37.1%)	–	12/13
ICU	NR	23 (76.7%)	0 (0.0%)	4 (13%)	4 (13.0%)	–	12/13
Multispecialty	43 ± 6.3	406 (87.3%)	NR	NR	78 (16.8%)	–	12/13
NR	NR	133 (81%)	5 (3.0%)	61 (37.0%)	66 (40.0%)	–	13/13
NR	42.1 ± 0.32	8805 (88.7%)	NR	NR	2430 (24%)	–	12/13

(Continues)

TABLE 2 (Continued)

Author(s), year	Country of the origin of sample	Type of publication	Study design type	Sampling method	Sample size (*N*)	Sampling fraction (%)	Professional categories
Rostamabadi et al. (2017)	Iran	Journal article	Cross-sectional	Random	214	85.60%	Nurses
Rotenberg et al. (2008)	Brazil	Journal article	Cross-sectional	Convenience	1248	74%	Nurses-NAP
Rotenberg et al. (2009)	Brazil	Journal article	Cross-sectional	Convenience	1194	70.8%	Nurses-NAP
Rypicz et al. (2021)	Poland	Journal article	Cross-sectional	Convenience	349	96.9%	Nurses
Silva et al. (2018)	Brazil	Journal article	Cross-sectional	Convenience	110	NR	Nurses-NAP
Silva et al. (2019)	Brazil	Journal article	Cross-sectional	Convenience	375	72.7%	Nurses-NAP
Sopajareeya (2020)	Thailand	Conference proceedings	Cross-sectional	Convenience	260	83.3%	Nurses-NAP
Sorić et al. (2013)	Croatia	Journal article	Cross-sectional	Convenience	1101	65%	Nurses
Vasconcelos et al. (2011)	Brazil	Journal article	Cross-sectional	Convenience	272	86.8%	Nurses-NAP
Vilela et al. (2013)	Portugal	Conference proceedings	Cross-sectional	Convenience	43	66.1%	Nurses-NAP

Abbreviations: ED, Emergency Department; ICU, Intensive Care Unit; NAP, Nursing Assistive Personnel; NR, Non-reported.
[a]Data provided by the authors.

settings (primary care) were also excluded unless data from hospital nursing personnel could be extracted independently.

Reports published in English, Spanish, Portuguese, German, Italian, Croatian, and Greek were included. Only four studies were excluded due to publication languages, three in Chinese and one in Persian. No restrictions on the publication date were applied. Both original peer-reviewed articles and gray literature (conference proceedings, conference abstract, and dissertations) were included.

Information sources and search strategy

A systematic search was performed to identify relevant reports in the following databases: Web of Science (WOS), Medline/PubMed (WOS interface), CINAHL, Scopus, Lilacs, PsycINFO, ProQuest Nursing and Allied Health, and Scielo (WOS interface). A partial gray literature search was also performed on Google Scholar, limited to the first 50 most relevant reports retrieved. The search strategy was developed by the research team and then peer reviewed by a researcher with experience in bibliographic searches outside the project. ("work ability index") AND (nurse*) AND (hospital*) was the general search strategy used, adapted to the syntax and subject headings of the databases. The searches were performed separately by two experienced researchers in the literature search in all databases where no limits were imposed. More detailed information on search strategies is provided in Table 1.

To address the saturation of the literature, reference lists of the selected literature were also manually searched to obtain additional relevant studies. Additionally, some articles that were not recovered from the database search but were previously known to the research team to be relevant to this review were included.

Selection process

To ensure the reliability of the study selection process, it was carried out by two members of the review team independently. The selection process started with screening titles and abstracts, followed by full reading for the initially selected studies. The full texts of eligible studies were then retrieved as far as possible to corroborate this. To resolve any disagreement, a third member of the review team was consulted. Discarded studies were classified according to the reason for exclusion. Finally, the same members of the research team conducted an inverse search, searching potentially eligible items in the reference lists of included studies, repeating the previous process. See the PRISMA flow diagram (Page et al., 2021), Diagram 1.

Data collection process

The following data were extracted: Authors, year of publication, origin country of the sample, type of publication (journal article, conference proceedings or dissertation), study design (cross-sectional vs. longitudinal), sampling method (convenience vs. random), sample size (*N*), sampling fraction (%), professional category (nurses vs. nurses/Nursing Assistive Personnel), hospital unit, age in years (mean SD), proportion of women (n—%), prevalence of poor work ability (n—%), prevalence of moderate work ability (n—%), and prevalence of inadequate work

Hospital unit	Age in years (mean ± SD)	Proportion of women *n* (%)	Poor work ability (WAI score 7–27) *n* (%)	Moderate work ability (WAI score 28–36) *n* (%)	Inadequate work ability (WAI score <37) *n* (%)	Inadequate work ability (other criteria)	Quality score
ICU	28.9 ± 4.1	172 (80.4%)	–	–	–	37 (17.8%) poor 55 (25.7%) moderate	12/13
NR	NR	1092 (87.5%)	–	–	–	Females: 1092 (40.5%) Males: 156 (25.6%)	12/13
NR	40.3 ± 13.1	1039 (87%)	–	–	–	464 (38.9%)	12/13
Multispecialty	46.9 ± 9.7	347 (99.4)	60[a] (17.2%)	162[a] (46.4%)	222[a] (66.6%)	–	12/13
Multispecialty	39.5 ± 9.2	990 (90.0%)	5 (4.5%)	37 (33.6%)	42 (38.1%)	–	9/13
NR	41.5 ± 9.2	327 (87.2%)	39 (10.4%)	103 (27.5%)	142 (37.9%)	–	12/13
NR	39.5 ± NR	250 (96.3%)	1 (0.4%)	137 (52.8%)	138 (53.2%)	–	12/13
NR	42 ± NR	987 (88%)	NR	NR	395 (35.8%)	–	12/13
ED	41.7 ± 9.3	223 (82%)	NR	NR	NR	110 (40.8%)	12/13
NR	34.9 ± 9.2	38 (88.4%)	NR	NR	7 (16.3%)	NR	8/13

ability (n—%). Data were extracted in duplicate by two researchers, and discrepancies were resolved by consensus between the research team.

The sample size and the crude prevalence rate of poor and moderate work ability among nursing personnel were collected from the results of the studies. These categories were determined by the WAI cutoff points according to its instructions (Tuomi et al., 1988), since poor work ability is represented by a WAI score in the range of 7–27 and moderate by a WAI score in the range of 28–36. Inadequate work ability is a merged category that combines the two previous categories (low and moderate) and therefore is represented by a WAI score <37. Data from studies using a different criterion for inadequate work ability than the one described were coded separately. If the crude prevalence rate was not reported directly, two investigators independently performed the appropriate calculations based on the data provided by the study results. The corresponding authors of the studies in which prevalence data were not reported were contacted to request data. In the case of longitudinal studies, baseline prevalence data were extracted for analysis.

Risk of bias in individual studies

The instrument proposed in the critical appraisal guide of observational studies in epidemiology (Ciapponi, 2010) was used to assess the methodological quality of the included studies. All were independently reviewed by two researchers to ensure the internal validity of the studies in three dimensions of the instrument, which consisted of 13 items: participants (items 2–6), definition and measurement of key variables (items 11–14), and statistical analysis and confounder variables (items 15–18). The degree of compliance statement represented by each item was first evaluated in five categories ("very good, good, fair, poor, or not informative"). The quality of the study can be considered high if most statements are answered as "very good" or "good" (Ciapponi, 2010). Therefore, for ease of reporting, a score was assigned to each individual study. For this purpose, a point was assigned for each item whose compliance with the statement it represents was rated as "very good" or "good," and no points were assigned in all other cases. These ratings were not used as a criterion for study eligibility.

Data analysis

The Freeman–Tukey double arcsine method (Miller, 1978) was used to calculate the prevalence rate with 95% confidence intervals (CI) for each individual study. Then, an inverse-variance-weighted random-effects meta-analysis was performed by conventional methods (DerSimonian & Laird, 1986). A random effects model is recommended for the meta-analysis of prevalence when heterogeneity is observed in prevalence estimates between studies, as in the case of this study, as a fixed effects model is likely to produce misleading results in the presence of significant heterogeneity (Wang & Liu, 2016). Three independent meta-analyses were performed to calculate the pooled prevalence of poor, moderate, and inadequate work ability among hospital nursing personnel. Additionally, subgroup analyses were performed defined by the mean age range (under 40 vs. over 40), professional categories (nurses vs. nurses/Nursing Assistive Personnel), and origin country of the sample (Brazil vs. the rest of the world) to control for a possible confounding factor, due to the fact that half of the studies included and, consequently, a large

part of the sample (20%) came from a single country, Brazil. No other subgroup analyses could be performed due to the small number of studies in some categories (e.g., type of publication, study design, and sampling method) and the homogeneity of studies with regard to other characteristics (e.g., proportion of women, since only one study did not exceed 70% of women in the total sample).

Heterogeneity between individual studies was evaluated using Cochran Q test statistics, considering that heterogeneity was present if the *p*-value is less than 0.10 (10%) (Hoaglin, 2016). The degree of inconsistency between studies was measured using Higgins' I2 test statistic in a meta-analysis, with values of 25%, 50%, and 75% considered low, moderate, and high inconsistency, respectively

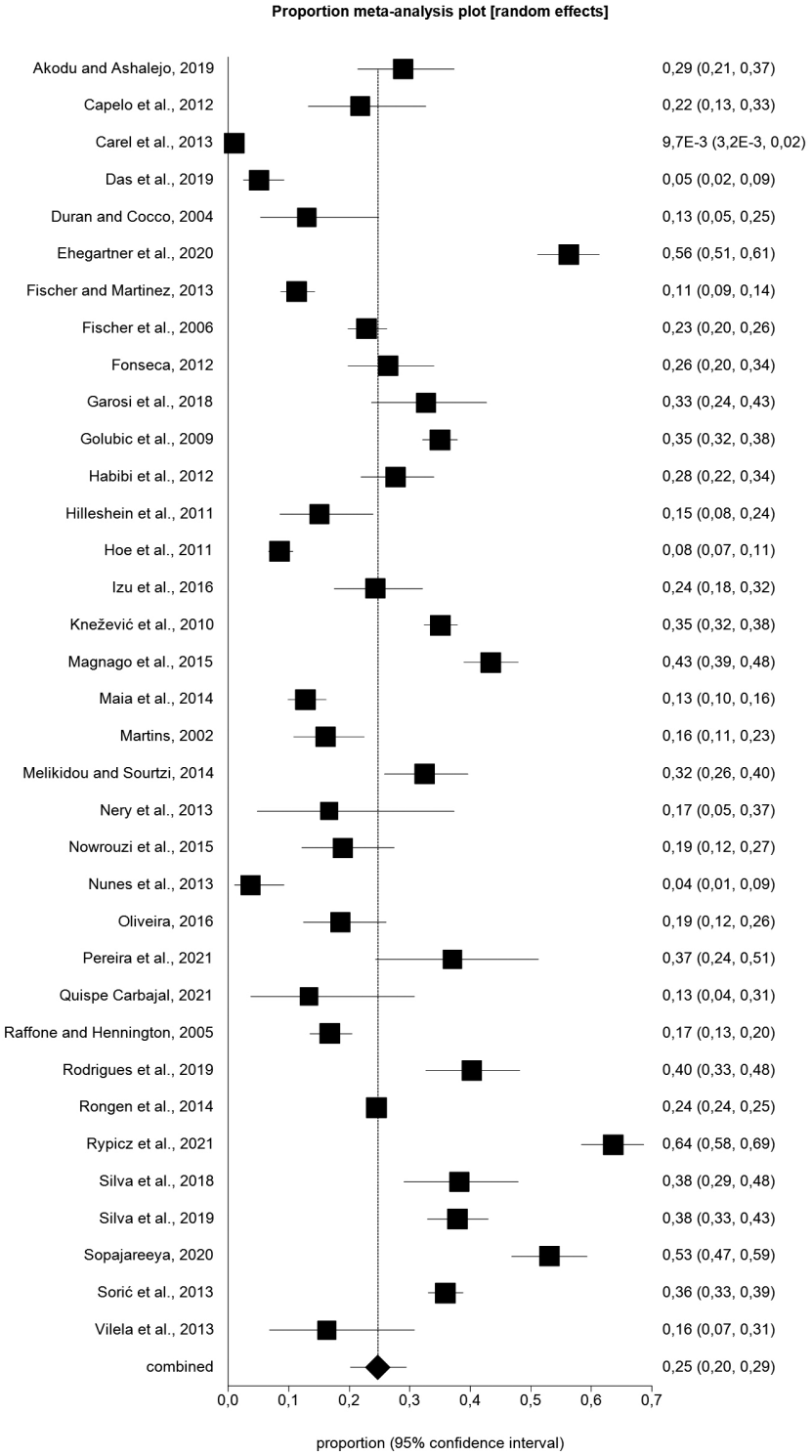

FIGURE 1 Forest plot for individual studies (square) and overall summary (diamond) of the prevalence of inadequate work ability. The lines indicate the 95% confidence interval. Studies are listed alphabetically

(Higgins et al., 2003). The consistency of the results was assessed by performing sensitivity analyses by excluding any study one by one and seeing that the results did not change substantially. Publication bias was assessed using Egger's linear regression, with a *p*-value less than 0.05 implicating publication bias (Egger et al., 1997). StatsDirect software was used for all statistical analyses described previously.

RESULTS

Study selection

The selection process is reported in detail in the PRIMA flow diagram (Page et al., 2021) (Diagram 1). A total of 267 reports were initially found: 259 in electronic databases and 8 through other methods. After removing duplicates from the database search result, the titles and abstracts of 104 studies were selected, and 86 were considered potentially relevant studies for full-text reading. The eight additional records identified by other methods were also considered. Five articles could not be retrieved in full text despite the efforts made to retrieve them by various means. A total of 47 articles were excluded for the nominated reasons specified in Diagram 1: 44 from databases and 3 retrieved using alternative methods. Finally, 42 studies (Akodu & Ashalejo, 2019; Capelo et al., 2012; Carel et al., 2013; Das et al., 2019; Duran & Cocco, 2004; Ehegartner et al., 2020; Fischer & Martinez, 2013; Fonseca, 2012; Garosi et al., 2018; Golubic et al., 2009; Habibi et al., 2012; Hilleshein et al., 2011; Hoe et al., 2011; Izu et al., 2016; Knežević et al., 2010; Magnago et al., 2015; Maia et al., 2014; Fischer et al., 2006; Martinez et al., 2017; Martins, 2002; Melikidou & Sourtzi, 2014; Murassaki et al., 2013; Nery et al., 2013; Nowrouzi et al., 2015; Nunes et al., 2013; Oliveira, 2016; Pereira et al., 2021; Quispe Carbajal, 2021; Raffone & Hennington, 2005; Rodrigues et al., 2019; Rongen et al., 2014; Rostamabadi et al., 2017; Rotenberg et al., 2008, 2009; Rypicz et al., 2021; Silva et al., 2016,

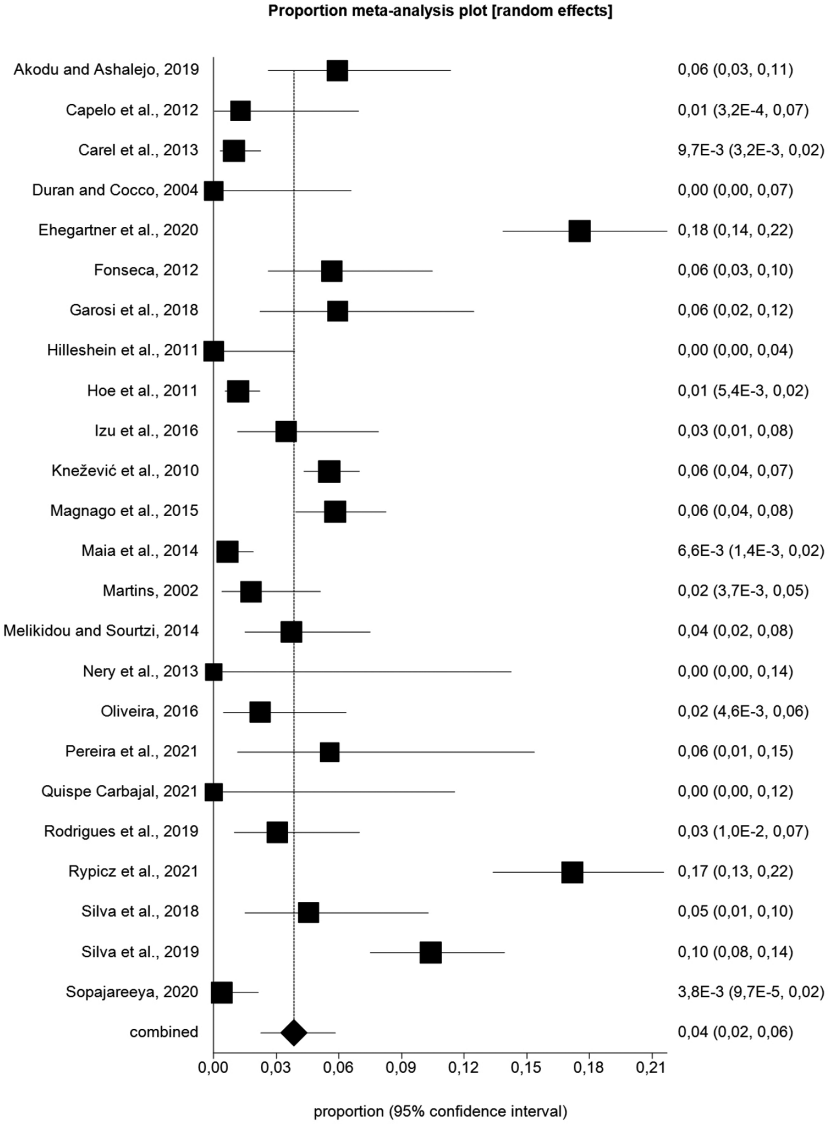

FIGURE 2 Forest plot for individual studies (square) and overall summary (diamond) of the prevalence of poor work ability. The lines indicate the 95% confidence interval. Studies are listed alphabetically

2018, 2019; Sopajareeya, 2020; Sorić et al., 2013; Vasconcelos et al., 2011; Vilela et al., 2013) were included in the systematic review and 35 of them in the meta-analyses performed.

Study characteristics

The characteristics of the 42 studies included are reported in Table 2. These comprised 24,728 subjects with a mean age of 38.4 years and an average of 84.6% of women among the studies that reported these sociodemographic data. In all, 13 studies were carried out on nursing staff from various hospital units (31.0%), four in the ICU (9.5%), two in the emergency department (4.8%), and one in obstetric care (2.4%) with no specific origin reported in the remaining studies. The studies were developed in 14 different countries, of which 20 (47.6%) were developed in Brazil and 5 (11.9%) in Portugal. One study was multinational (Rongen et al., 2014), conducted in several European countries, and is the one with the largest sample, 9927 participants, while the study with the smallest sample size had 24 participants (Nery et al., 2013). 97.6% of the studies were cross-sectional, and 88.1% used convenience sampling. Regarding the type of publication, 32 studies corresponded to journal articles (76.2%) and the rest to gray literature, with 6 conference proceedings (14.3%) and 4 dissertations (9.5%).

Risk of bias

In the first round, the average degree of agreement between the two researchers was 94.3%, reaching total agreement in a second round of consensus with the research team. The scores assigned to each individual ranged between 8 and 13, with a score of 12 being the most assigned. These scores are shown in detail in Table 2.

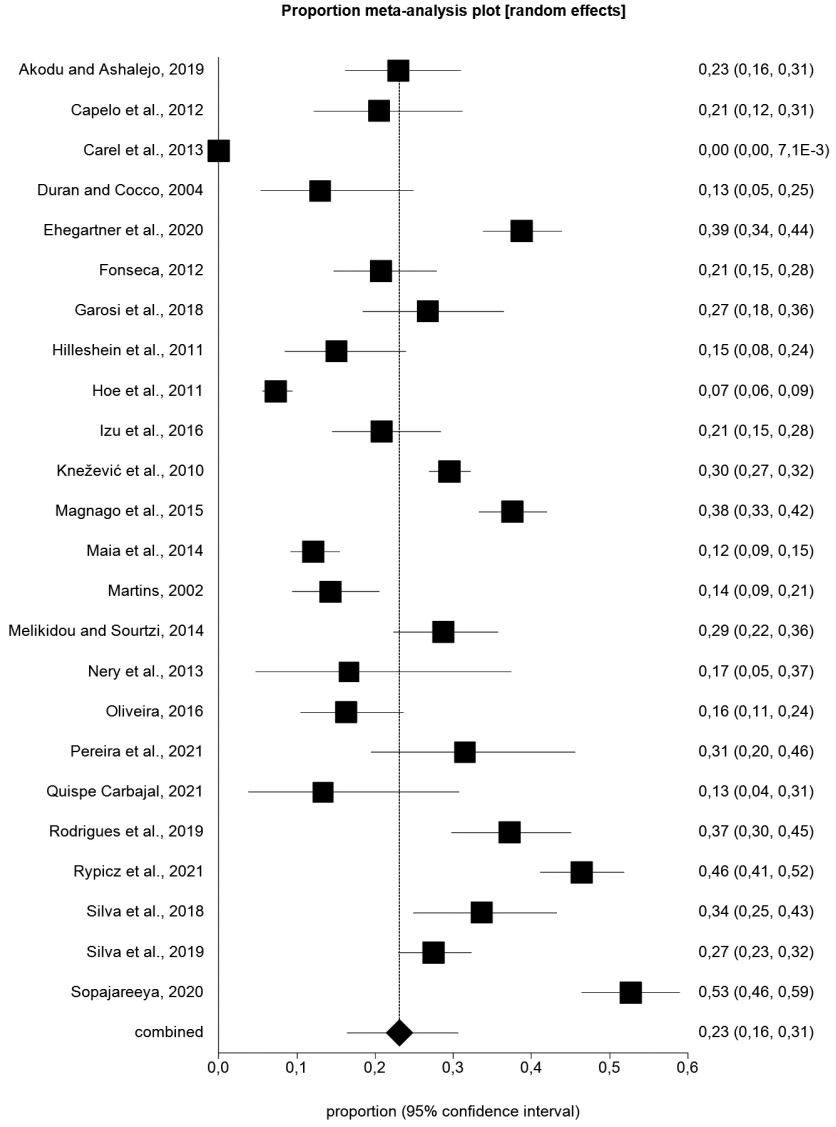

FIGURE 3 Forest plot for individual studies (square) and overall summary (diamond) of the prevalence of moderate work ability. The lines indicate the 95% confidence interval. Studies are listed alphabetically

Worldwide pooled prevalence of inadequate, poor, and moderate work ability

Seven studies reported prevalence based on different WAI cutoff points established in its instructions (Tuomi et al., 1988). They usually used different cutoff points depending on the age range of the participants, mostly in accordance with the proposal of Kujala et al. (2005), and were excluded from the meta-analysis due to the impossibility of comparison.

The pooled prevalence of inadequate work ability from 35 studies was 24.7% (95% CI = 20.2%–29.4%). The forest plot with the prevalence estimation for individual studies and the overall summary of the prevalence of inadequate work ability are shown in Figure 1. Heterogeneity analysis yielded a Cochran Q of 1586.89 ($df = 34$) with p-value <0.0001 and inconsistency analysis yielded an I^2 index of 97.9% (95% CI = 97.6%–98.1%), indicating extremely high heterogeneity and inconsistency. There was no significant change in the pooled mean scores obtained when each study was excluded from the analysis.

Of the 35 earlier studies included in the above meta-analysis, 24 also reported disaggregated prevalence between poor and moderate. The pooled prevalence of these studies was 3.8% (95% CI = 2.2%–5.8%) and 23.1% (95% CI = 16.4%–30.5%) for poor and moderate work ability, respectively. Figure 2 shows the forest plot of the meta-analysis on poor work ability and Figure 3 shows the moderate work ability. High heterogeneity and inconsistency were detected for both poor (Cochran Q = 297.47; $df = 23$; $p < 0.0001$; and $I^2 = 92.3\%$; 95% CI = 90.2%–93.7%) and moderate work ability analysis (Cochran Q = 1028.86; $df = 23$; $p < 0.0001$; and $I^2 = 97.8\%$; 95% CI = 97.5%–98%). No significant changes in the pooled mean scores were observed when each study was excluded from the analysis.

Subgroup analysis

The subgroup analyses are presented in Table 3. The prevalence of inadequate work ability is higher in studies developed with nurses and nursing assistive personnel (26.8%) than in studies developed with nurses alone (22.2%). Similarly, the prevalence was higher in studies in which the average age of the samples was over 40 years (28.1%) than in those with a sample under 40 (22.4%). The prevalence was similar in studies developed in Brazil to those developed in other countries (24.7 vs. 24.6%).

TABLE 3 Subgroup analyses of inadequate work ability

Subgroups	Categories	Number of studies	Prevalence (%)	95% CI (%)	Events (*n*)	Sample size (N)	I^2 (%)	Cochran Q
Professional categories	Nurses	15	22.2	13.1–32.9	1564	5923	98.8	1.166,020689 ($df = 14$) $p < 0.0001$
	Nurses-NAP	20	26.8	22.4–31.5	3962	15,003	95.4	410.11 ($df = 19$) $p < 0.0001$
Main age range	Under 40 years	15	22.4	15.8–29.7	1079	4278	96.4	389.92 ($df = 14$) $p < 0.0001$
	Over 40 years	13	28.1	19.5–37.5	3816	14,119	98.7	933.68 ($df = 12$) $p < 0.0001$
Origin country of the sample	Brazil	14	24.7	18.5–31.5	893	3494	94.7	245.03 ($df = 13$) $p < 0.0001$
	Rest of the world	21	24.6	18.5–31.3	4633	17,432	98.5	1.340.80 ($df = 20$) $p < 0.0001$

Abbreviations: IC, Confidence interval; NAP, Nursing Assistive Personnel.

DISCUSSION

To our knowledge, this is the first comprehensive meta-analysis to examine the worldwide prevalence of work ability among nursing personnel.

Currently, the world does not have a global nursing workforce based on universal health coverage (World Health Organization,

2020). Therefore, the nursing workforce must remain healthy and prevent the attrition of the workforce. Inadequate work ability is a predictor of several negative outcomes among nurses, such as poor quality of life (Milosevic et al., 2011) and turnover intention or the intention to leave the profession in the near future (Camerino et al., 2006, 2008; Rongen et al., 2014). The results of this meta-analysis estimate that nearly 25% of the world's nursing workforce has inadequate work ability and would therefore be at risk of such negative effects.

Given the high prevalence estimated by this study, it is justifiable for governments, institutions, and employers to launch initiatives to address the work ability of nurses. An appropriate guideline would be the annual assessment of each worker's work ability using the WAI, which enables the early detection of inadequate work ability, or changes over time, offering the possibility of early intervention regarding work ability through the application of corrective measures (Costa et al., 2011). To guide the type of intervention needed, it is useful to break inadequate work ability down into poor and moderate subcategories. Based on the studies included in this meta-analysis that report such disaggregated information, it is estimated that 3.8% of nursing personnel have poor work ability and should therefore receive interventions aimed at restoring that ability, and 23.1% have moderate work ability and should, therefore, receive interventions aimed at improving it (Tuomi et al., 1988). Despite this need, there are still few experimental studies in the literature, especially directed at nurses that aim to restore or improve work ability. One of the only experiences identified is conducted by das Gecim and Esin (2021) who found that a self-management program for nurses aged 45 years or older showed significant improvements in work ability in a short period of time.

It should be especially noted that the data from all studies included in this meta-analysis were collected before 2020, and therefore the estimated prevalence corresponds to the pre-pandemic period. The COVID-19 pandemic has affected the mental health of healthcare workers through increased stress, anxiety, depressive symptoms, and insomnia (Spoorthy et al., 2020). Furthermore, the high incidence of COVID-19 infections in those who have been serving on the frontlines of the COVID-19 response has led to a high prevalence of incapacitating post-infection symptoms among healthcare workers, with fatigue and respiratory symptoms being the most common symptoms (Gaber et al., 2021). Given that all of these conditions have a negative impact on work ability, it is logical to think that the prevalence of inadequate work ability will have increased during the pandemic and will remain so for some time after the pandemic. The WAI has been proposed, in addition to a clinical evaluation, as a suitable scale to carry out long-term follow-up and provide information on work ability in workers at high risk of severe COVID-19, who return to work after suffering from COVID-19 and who suffered functional limitations before COVID-19 as their physical and mental condition may have changed due to the epidemic and lockdown (Godeau et al., 2021). The widespread use of the WAI in these situations would allow for the quantification of the impact of the pandemic on the work ability of the nursing workforce.

Subgroup analysis showed that age is one of the factors that reduce work ability, both among nurses (Camerino et al., 2006) and in other professions (van den Berg et al., 2009), as shown in this meta-analysis with prevalence of inadequate work ability in studies with samples that have a mean age of over 40. Similarly, studies whose sample consisted of nursing assistive personnel together with nurses were found to have a higher prevalence of inadequate work ability. In the few studies that report prevalence data disaggregated by categories, a lower work ability was detected among nursing assistive personnel with respect to nurses (Prochnow et al., 2013; da Silva et al., 2015). Therefore, it is logical to think that a large part of this high prevalence of inadequate work ability is attributable to individuals in this professional category. Taking into account the above, the nursing workforce older than 40 years and those belonging to the professional category of nursing assistive personnel should be priority target groups for screening and intervention to improve work ability. Unfortunately, the vast majority of studies did not report prevalence data separately for both professional categories, so further studies with disaggregated data would be necessary to estimate the differences between nurses and Nursing Assistive Personnel. The subgroup analysis aimed to control for the effect of 20% of the sample coming from Brazil; studies from this country obtained prevalence similar to those developed in the rest of the world, ruling out a possible confounding effect.

There are several limitations to this meta-analysis that should be discussed and taken into account when interpreting the results. First, although the literature search was extensive and exhaustive, also including gray literature as recommended (Conn et al., 2003), it cannot be guaranteed that all studies useful for determining the prevalence of work ability among nursing personnel are represented. Second, a considerable number of studies could not be included in prevalence rates because the author preferred to report WAI data as a continuous variable because the use of categories reduces statistical power (Cadiz et al., 2019) or reported aggregate data from hospital nursing personnel combined with other professionals. Third, although all continents were represented in the countries from which the sample was drawn, only three low- and lower-middle-income countries contributed to this study. Fourth, although the number of included studies is appreciably larger than those generally included in prevalence meta-analyses (Borges Migliavaca et al., 2020), many of the studies included worked with small sample sizes, with 19 studies below 200 subjects and, of these, 6 with samples below 100. Furthermore, given that convenience sampling was used in all but two studies, generalizability is unclear, as estimates derived from studies using convenience samples are often biased (Jager et al., 2017). Additionally, only one study was longitudinal and, although cross-sectional studies are suitable for prevalence assessment, they provide less information. Fifth, although the results of the subgroup analyses could potentially adjust for the heterogeneity moderated by certain variables, the heterogeneity of other variables could not be determined due to insufficient data variation or reporting. Furthermore, heterogeneity could not be eliminated in epidemiological surveys even

if subgroup analyses are performed (Long et al., 2014). Meta-regressions should be performed in future studies to assess heterogeneity more fully, where prevalence estimation is contrasted with one or more covariates (Thompson & Sharp, 1999). Lastly, publication bias was present in this meta-analysis, as expected, since observational and small studies show more heterogeneity than other designs, and heterogeneity interferes with the detection of publication bias (Delgado-Rodríguez, 2006; Egger et al., 1998). Future worldwide studies with longitudinal designs, representative samples, and disaggregated data reported according to uniform WAI criteria for different categories of work ability are needed to facilitate a comparison of prevalence rates within and between studies.

CONCLUSIONS

This meta-analysis has determined that almost one in four nursing personnel working in hospital settings around the world have inadequate work ability; in other words, they present an imbalance between individual resources and the demands of the job (Ilmarinen, 2009). Evidence supports that these circumstances can lead to negative repercussions on their quality of life (Milosevic et al., 2011) and even cause them to leave their job or profession. (Camerino et al., 2006; Rongen et al., 2014). Given the prevalence estimated by this study, the launch of initiatives including the annual assessment of these professionals using the WAI or other reliable measures is justifiable, allowing for the early identification of inadequate work ability or changes over time, offering the possibility of developing early corrective measures. Hospital nursing personnel over the age of 40 and those belonging to the professional category of nursing assistive personnel should be a priority target for screening and intervention to improve work ability, as this study has detected higher prevalence of inadequate work ability among these groups.

This meta-analysis also highlights the lack of uniformity in research on work ability among hospital nursing personnel. Future worldwide studies with longitudinal designs, representative samples, and disaggregated data reported according to uniform WAI criteria for different categories of work ability are needed to facilitate a comparison of prevalence rates within and between studies. New studies would also be especially useful with regard to quantifying the impact of the COVID-19 pandemic on work ability among the hospital nursing workforce.

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CONFLICT OF INTEREST

None.

CLINICAL RESOURCES

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