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REVIEW ARTICLE

Predictors for work participation of people with visual impairments: A systematic review and meta-analysis

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Abstract

Introduction: The aim of this systematic review and meta-analysis was to assess factors associated with work participation in people with visual impairments and to explore how these factors may have changed over time.

Method: A comprehensive search of PubMed, Embase.com, EBSCO/APA PsycInfo, EBSCO/CINAHL and EBSCO/ERIC from database inception to 1 April 2022 was performed. We included studies with cross-sectional design, case–control, case-series or cohort design, involving visually impaired working-age adults with at least moderate visual impairment, and evaluated the association between visual impairment and work participation. Studies involving participants with deaf-blindness or multiple disabilities were excluded. We assessed study quality (Newcastle–Ottawa Scale [NOS]), examined between-study heterogeneity and performed subgroup analyses. The study protocol was registered in PROSPERO, CRD42021241076.

Results: Of 13,585 records, 57 articles described 55 studies including 1,326,091 participants from mostly high-income countries. Sociodemographic factors associated with employment included higher education (odds ratio [OR] 3.34, 95% confidence interval [CI] 2.47 to 4.51, I^2 0%), being male (OR 1.59, 95% CI 1.37 to 1.84, I^2 95%), having a partner (OR 1.73, 95% CI 1.12 to 2.67, I^2 34%), white ethnicity (OR 1.36, 95% CI 1.07 to 1.74, I^2 0%) and having financial assistance (OR 0.38, 95% CI 0.26 to 0.55, I^2 85%). Disease-related factors included worse visual impairment (OR 0.61, 95% CI 0.46 to 0.80, I^2 98%) or having additional disabilities (OR 0.55, 95% CI 0.49 to 0.62, I^2 16%). Intervention-related factors included mobility aid utilisation (OR 0.35, 95% CI 0.10 to 1.18, I^2 94%). A potential moderating effect of time period and geographical region was observed for some factors. Study quality (NOS) was rated moderate to high.

Conclusion: Several sociodemographic and disease related factors were associated with employment status. However, the results should be interpreted with caution because of overall high heterogeneity. Future research should focus on the role of workplace factors, technological adjustments and vocational rehabilitation services on work participation.

KEYWORDS
employment, meta-analyses, predictors, systematic review, visual impairments, work participation

INTRODUCTION

Visual impairments often have a substantial impact on quality of life,[1] mental health[2,3] and activities of daily living, including work participation.[2,4,5] The leading causes for low vision at working age are mainly retinal disorders, such as high myopia causing retinal damage, hereditary retinal disorders such as retinitis pigmentosa or Stargardt disease and diabetic retinopathy.[6,7] Although the prevalence of blindness corrected for age has reduced over the past three decades, the absolute number of people with a visual impairment continues to grow.[8] This may be explained by demographic aging and population growth, increased comorbidity (obesity, diabetes mellitus and hypertension) as well as changes in lifestyle and environmental factors (increased near-visual activities).[9,10]

Over the past few decades, there have been notable improvements in support and work opportunities for visually impaired persons. The proclamation of the Convention on the Rights of Persons with Disabilities,[11] recognising and promoting the right to work for persons with disabilities, may have positively affected working status. Moreover, in the workplace there has been a shift from physical jobs to more desk-oriented work in which technologies are more often used.[12,13] Opportunities for people with visual impairment are growing due to advances in (vocational) rehabilitation[14,15] and assistive technological developments,[16,17] including object recognition, navigation and computer utilisation software.

However, despite these developments, employment rates of people with visual impairments remain low.[18] In high-income countries such as the Netherlands, the employment rate of visually impaired people is 36.8% compared with 67.1% among the general working-age population.[19–21]

People with a visual impairment not only experience difficulties in finding and keeping a job, they often reluctantly work fewer hours or have a job for which they are overqualified ('underemployed').[4,19,20,22–25] Unemployment or underemployment can cause dependent relationships and influence an individual's personality and self-esteem.[26–29] This loss in work participation and productivity also generates high economic costs.[30,31] In 2010, the worldwide societal costs of visual impairment was estimated at US$ 3 trillion.[32] This is explained by direct medical costs related to health care utilisation, but mainly by reduced work participation.[31] Furthermore, occupational physicians experience difficulty in advising and assessing people with visual impairment.[33]

Previous reviews provided some insight into factors associated with the employment of people with visual impairment[4,34–36] such as gender, severity of visual impairment, braille reading level and education level. However, results remained inconclusive and methodological challenges were observed in these reviews, including small sample sizes and heterogeneity. In conclusion, the work participation rate of visually impaired people is low and several developments in different fields may have affected work participation over time. However, research in this field is incomplete and suffers from methodological challenges. Available reviews could benefit from more comprehensive literature-searching, a worldwide focus including high-, middle- and low-income nations,[34–36] and meta-analysis, if possible, taking into account heterogeneity of studies and study populations with visual impairments.

This study aimed to provide an overview of possible factors associated with work participation in people with visual impairments and to explore how these factors may have changed over time. Evidence from this overview may improve the assessment of work disability and vocational rehabilitation (VR) for people with visual impairments.

Key points

- This systematic review and meta-analysis showed that several sociodemographic and disease-related factors are associated with employment for visually impaired working-age adults.
- The role of workplace factors, technology and vocational rehabilitation services has not been studied frequently but could potentially contribute to work participation for visually impaired working-age adults.
- The United Nations Convention of the Rights of Persons with Disabilities empowers people to participate in society including work; however, specific vulnerable subgroups of working-age adults with visual impairments deserve more attention.

METHOD

A review protocol was developed based on the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) statement,[37] which provides guidance in structuring methods and improving the reporting of results. The study protocol was registered at PROSPERO (registration number CRD42021241076).

Search method and selection procedure

An extensive and systematic literature search was performed to identify all relevant publications in the bibliographic databases PubMed, Embase.com, EBSCO/APA PsycInfo, EBSCO/CINAHL and EBSCO/ERIC from inception up to 1 April 2022, in collaboration with a medical information specialist. The following terms were used (including synonyms and closely related words) as index terms

or free-text words: 'Visually Impaired Persons', 'Blindness', 'Employment', 'Industrial psychology', 'Vocational rehabilitation', 'Work participation' and 'Work capacity'.

The references of the identified articles were searched for relevant additional publications. Duplicate articles were excluded. All languages were accepted. The full search strategies for all databases can be found in the Data S1.

First, the de-duplicated database was divided by five reviewers who performed the first selection, to exclude evidently nonrelevant articles on the basis of the title (e.g., nonvisual disorders).[38] Then the remaining items were screened independently by two reviewers based on systematic analysis of: (1) the title and abstract and (2) the full text of the articles. Rayyan software (rayyan.qcri.org)—a systematic review web application—was used for screening purposes.[39] Subsequently, potentially relevant articles that met the inclusion criteria were further assessed for eligibility. Discrepancies were resolved by discussion and/or consulting a third reviewer.

Eligibility criteria for including studies in the review

For study selection, the following inclusion criteria were used: (1) studies with a cross-sectional design, case–control design, case-series design or cohort design; (2) participants with at least moderate visual impairment according to the World Health Organization (WHO) criteria, defined as presenting visual acuity of 6/18 (20/60) to 3/60 for moderate to severe visual impairment (low vision) and worse than 3/60 for blindness,[40] or on the basis of similar information or other indications of low vision or blindness; (3) working-age population (>18 years) and (4) study should have evaluated the association between visual impairments and work participation.

The following papers were excluded: animal studies, abstracts, review articles, commentaries, editorials, book chapters, case reports and unpublished results. Studies with a main focus on participants who were deaf-blind or with multiple disabilities were also excluded.

Data extraction

Information was extracted independently from all included articles by one reviewer (RD) using a standardised form and entered in Microsoft Excel software (version 2016; Microsoft.com). Discrepancies were resolved by consensus and with the involvement of two authors (JH and RvN). From each eligible article, the following characteristics were retrieved: (1) first author, (2) country and year of publication, (3) study design, (4) sample information (mean age, age range, cause and severity of visual impairment, gender distribution, sample size, VR setting), (5) participant selection, (6) method for diagnosis visual impairment, (7) definition of employment outcome, (8) method of analysis and (9) unadjusted and adjusted effect sizes for employment outcome (odds ratio [OR]). If in individual studies the WHO classification for severity of visual impairment was not applied, we used the classification of the study author. For level of education that resulted in having obtained a diploma, we used three levels (low: elementary school; moderate: high school and associate's degree; high: bachelor's degree and higher). In case of multiple follow-up moments per study, the latest follow-up was used. Study authors were contacted in case of insufficient information on any of these items. When ORs were missing, in some instances, we were able to calculate these outcome data from raw study results. When parameters of interest were missing or not fully reported and could not be calculated from raw data, corresponding authors were contacted by email. A data extraction table is available upon request.

Quality assessment

Assessment of the methodological quality (risk of bias) of the studies selected for meta-analysis was performed independently by two reviewers according to the Newcastle–Ottawa Scale (NOS),[41] a critical appraisal tool for nonrandomised studies. An adapted version by Modesti et al.[42] was used for cross-sectional studies. Any disagreement was resolved by discussion.

The NOS consists of eight items within three sections: selection and definition of study groups (0–4 stars); comparability of study groups (0–2 stars); and outcome assessment and/or soundness of statistical analysis (0–3 stars). A total maximum score of these three subsets is 9. A study with a total NOS score of 7–9 was considered to be high quality, 4–6 indicated moderate quality and 1–3 indicated low quality.

Data analysis

To describe work participation for people with visual impairments, we plotted the employment rates of the included studies over time, per region, educational level, study quality and study design. Meta-analysis was performed with Cochrane Review Manager (RevMan; training.cochrane.org/online-learning/core-software/revman, version 5.3),[43] using the inverse variance method. ORs and 95% confidence intervals (95% CIs) or standard error were obtained or calculated for employment status (e.g., being [competitively] employed) as a binary outcome, to investigate the association between employment status in visually impaired people and the various sociodemographic, disease-, personal- and work-related factors of interest. For every study, we selected the odds ratio (OR) from the model with the maximum adjusted number of covariates.[44] By log-transforming the (adjusted) effect size estimates (OR) and reported 95% CIs, the pooled effect sizes were estimated. For practical

reasons, we calculated the pooled effect size for each factor when at least four distinct studies were available and displayed these in forest plots.

The random-effects model with the inverse variance method was used to provide a weighted average effect size estimate. The random-effects model allows to address for the anticipated high heterogeneity within and between studies resulting from differences in design and measures samples, which is inherent in observational studies compared with randomised trials.

Potential statistical heterogeneity was informed using the I^2 test, which is a statistic for quantifying inconsistency, with four different levels: 0%–40% (might not be important), 30%–60% (may represent moderate heterogeneity), 50%–90% (may represent substantial heterogeneity) and 75%–100% (considerable heterogeneity).[45]

We conducted exploratory subgroup analysis, when at least 10 distinct studies per factor were available, as recommended by the Cochrane handbook.[46] In general, subgroup analyses can be used for comparisons of predefined subgroups of interest such as particular patient or intervention types, as well to investigate sources and magnitude of heterogeneity.[47] The following two subgroups of interest were addressed: studied region (Asia, Australia, Europe, North America and South America) and the time period of the study (1960–1990, 1990–2000, 2000–2010 and 2010–2022). In additional subgroup analyses (sensitivity analyses),[48] we investigated whether the pooled effect sizes were affected by research design, complexity of quantitative analysis (univariate vs. multivariate), study quality and potential outliers.

RESULTS

Search results

The literature search generated a total of 13,585 references: 3745 in PubMed, 5185 in Embase.com, 1742 in APA PsycInfo, 1679 in CINAHL and 1234 in ERIC. After removing duplicates that were selected from more than one database, 9361 references remained. One additional article was identified from a reference list of previous systematic reviews.[4,34]

After screening titles and abstracts, 203 articles remained, for which the inclusion and exclusion criteria were reviewed. Different outcomes of the same study described by multiple articles were reviewed together as one study. This resulted in 57 articles describing 55 different studies for inclusion in this review.

The authors of the selected studies were contacted in case of missing data. We received responses from two out of ten contacted corresponding authors who provided data for three studies.[49–51]

The flowchart of the search and selection process is presented in Figure 1. Reporting is in accordance with the PRISMA guidelines.[52]

Characteristics of included studies

The key characteristics of the 55 included studies, including 40 cross-sectional studies and 15 cohort studies, are presented in Table 1. All cohort studies had a retrospective design, and in 86% of these cohorts, participants patients were identified through a disability service registry. The included studies were published between 1969 and 2022; more than half of the reviewed studies (38 out of 55) were carried out in the last two decades, with 21 studies undertaken in the past 10 years.

Most (66%) of the studies were conducted in North America (35 from the United States and 3 from Canada), followed by 10 studies from Europe, 3 studies from Australia and New Zealand, 3 studies from Asia and 1 study from South America. Almost all studies (98%) had population samples from high-income countries.

Analysis of the 55 studies included a total of 1,326,091 participants, with study samples ranging from 28 to 892,220 participants. The reported ages ranged from 20 to 72 years, with an overall mean of 42 years. All but one study (males only)[53] included both males and females (proportion of females ranged from 33% to 72%).

The definition of employment as the outcome varied across studies and was frequently not described fully. Twelve studies (21%) used a definition that included competitive employment,[23,49,54–63] five used paid or gainful employment[19,64–67] and one study used open employment[68] or earnings set above minimum federal wage.[69] Although most studies focused on describing employment outcomes for working-age adults, a few (12%) also included participants who were not part of the working-age population (e.g., retired, students) or lacked a separate analysis for working-age participants.[54,70–75]

Most studies included samples with all participants being visually impaired, except for 10 studies (18%),[27,70,72–74,76–80] of which half was part of a national epidemiological study.[27,70,72,73,80]

The severity of visual impairment (e.g., total/legal blindness, low vision) or fulfilment of certain criteria for low vision (e.g., the criteria for visual impairment by the International Classification of Diseases [ICD] or the WHO) was reported in the majority of studies. But only a few studies[74,81–86] provided more information about the diagnoses of visually impaired participants. Some studies (42%) also reported additional disabilities (nonvisual), such as physical or mental disabilities.

The employment rates were reported in 47 of 55 studies and are displayed in Figure 2. Employment rates varied strongly between studies, ranging from 24% to 87% with an overall mean of 47% (SD 15%) and corresponding median of 45% (IQR 34, 57). Interpolation of data seemed to indicate a slight trend of increasing employment rates over time (41% in 1982 to 52% in 2022). Figure S1 shows the employment rates for different subgroups, revealing that the mean employment rates reported in cohorts (50%) were slightly higher than those reported in cross-sectional studies (46%).

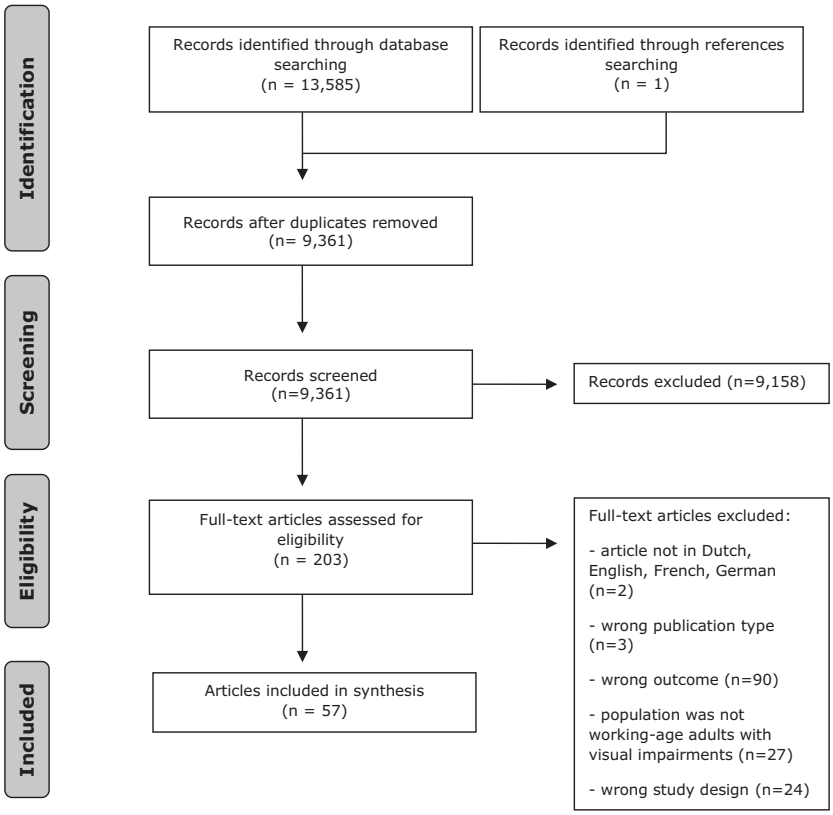


FIGURE 1 Flowchart of the search and selection procedure of studies.

Similarly, slight variations in employment rates were seen in studies from different geographical regions, with European participant samples (52%) showing somewhat higher employment rates, followed by Asian (49%), Australian and North American (45%) and South American samples (38%).

Twenty-one studies (38%) reported that (a part of) their sample was or had been part of a VR programme or other job-support programme. These studies were all performed in the United States or Asia, but not in Europe. Study samples with a majority of their participants, who were or had been in a VR setting,[49–51,54–60,62,63,65,67,69,71,78,82,87–91] reported a somewhat higher employment rate mean compared with samples not from a VR setting; 50% and 46% respectively. Moreover, six studies investigated the association between different types of VR services and employment.[55,58,62,67,69,90,92] Twenty-seven different types were assessed, which could be grouped into four categories, as suggested by Giesen et al.[58,67] based on service delivery patterns: Special and Remedial Services, Job-Related Services, Evaluation and Training and Supports.

Quality assessment

Tables 2 and 3 show the methodological quality of the individual studies, measured with the NOS. Overall, the quality score of the included studies ranged from 3 to 8 points, with a median score of 6 and 7 for cross-sectional studies and cohort studies, respectively.

High study quality (≥7 points) was rated in 33% of the cross-sectional studies and in 80% of the cohort studies. For both designs, studies often did not report adequately on (adjustment for) confounding factors. Cross-sectional studies frequently failed to show any comparison between responders and nonresponders and frequently lacked independent blind assessment of employment status as the outcome. Regarding the cohort studies, important items for lower quality were the selection of participants, where some participants were already employed at the start of the study. Lower quality also related to the lack of reporting of any loss to follow-up data.

Meta-analysis

Ten variables met our predetermined threshold for meta-analysis with data from at least four distinct studies. These variables were associated with work participation and could be grouped into six sociodemographic factors (gender, age, education, marital status, ethnicity and financial assistance), two disease-related factors (severity of visual impairment and co-morbidity) and two intervention-related factors (VR and mobility aid utilisation). Using the framework of the International Classification of Functioning (ICF),[93] we further identified work-related factors (e.g., previous work experience) and person-related factors (e.g., various psychological factors) (Figure 3), but these factors lacked

TABLE 1 Characteristics of reviewed studies in alphabetic order of the first author.

Study	Design	Sample size	Sampling frame	Sampling method (year(s) and source of data)	Age (age range (year(s)); mean (M) age (SD))	Female (%)	VR status	Sample VI characteristics	Additional disabilities	Employment measure	Methods of analyses
Beach[29] (1995, Canada)	Cross	36	Visually impaired clients from Canadian National Institute for the Blind's, residing in private residence; employed and unemployed	NR; questionnaire	18–55 *M* = NR	58%	NR	100% VI; 40% congenital, 60% adventitious visual impairment	NR	Current employment status (not specified)	Chi-square
Bell[54] (2010, USA)	Cross	188,978	Legally blind consumers who exited State–Federal VR system during FYs 1997–2007; employed and unemployed at time of exiting VR	1997–2007; RSA-911 data	14–104 *M* = 48.1 (19.9)	48% (1997)–55% (2007)	100%	100% VI; all legally blind	NR	Competitive employment status at time of closure VR; wages	NR (Univariate)
Bell & Mino[50] (2013, USA)	Cross	1056 577[a]	Legally blind and visually impaired adults; employed and unemployed	2011; survey, online or by phone	18–87[l] NR[a] *M* = 46.5 (13.8)[l]; 49.2 (12.5)[a]	44%[l] 51%[a]	39% active VR; 55% closed VR case[l] NR[a]	100% VI (self report); 66% legally blind, 34% visually impaired[l] NR[a]	NR	Employment status at time of closure VR: fulltime, part-time; annual earnings	NR (Univariate)
Bell & Silverman[51] (2018, USA)	Cross	1153 1122[b] 691[a]	Adults who self-identified as blind or visually impaired; employed and unemployed	2016; survey online or by phone	18–89[l] 18–70[a] *M* = 46.1 (15.2)[l]; 48.9 (13)[a]	58%[l] 58%[a]	95% having had VR case before of which 34% still open VR case[l] NR[a]	100% VI (self report); 75% blind, 25% low vision, 61% no usable vision, 37% usable vision[l] NR[a]	32%[l] NR[a]	Employment status: fulltime job or self-employed and closed VR; monthly income	NR (Univariate)
Bengisu[115] (2008, Turkey)	Cross	198	Visually impaired adults; employed and unemployed	NR; telephone surveys	18–62 *M* = 36 (9)[j]; 28 (8)[k]	34.0%	NR	100% VI; legally/totally blind, other VI	5%[j] 11%[k]	Employment status (not specified)	Logistic regression
Cabrales-Lopez[76] (2019, Colombia)	Cross	180 155[c]	Patients with some degree of permanent visual impairment, who attended two specialised institutions in Medellín; employed and unemployed	2015; survey	18–NR[c] *M* = low vison: 46 (22); blind: 43 (24)	56%[l] NR[c]	NR	Mix VI/non-VI; 41% nonvisually, 34% low vision, 25% blindness[l] NR[a]	NR	Active employment status (not specified)	NR (univariate)
Capella-McDonnall[55] (2005, USA)	Cohort	181	Blind or visually impaired consumers of VR services; all were not comp. employed at time of application	1995–2000; public-use data obtained from Cornell University's website for the Longitudinal Study of the Vocational Rehabilitation Services Program	<30–65 *M* = NR	57%	100%	100% VI; 28% blind or legally blind	57%	Competitive employment, self-employment, supported employment or with the BEP	Multiple logistic regression
Cavenaugh[56] (2002, USA)	Cohort	8676 4487[b]	VR-consumers with major visual disability or blindness, with initiated Individualised Plans for Employment, whose case had closed in 1998; no data on employment at application; at case closure employed/unemployed	1998; RSA data	55–70+ *M* = ♂ 67; ♀ 72	68%	100% closed VR case	100% VI; 67% legally blind, 33% visually impaired	17.7%	Competitive sector placement at time of closure VR: competitive employment, BEP, self-employment	Stepwise multiple regression analysis

TABLE 1 (Continued)

Study	Design	Sample size	Sampling frame	Sampling method (year(s) and source of data)	Age (age range (year(s)); mean (M) age (SD))	Female (%)	VR status	Sample VI characteristics	Additional disabilities	Employment measure	Methods of analyses
Chaumet-Riffaud[86] (2017, France)	Cross	148	Retinitis pigmentosa (RP) patients; employed and nonemployed	1998; survey by phone and face-to-face	NR *M* = 38.2 (7.1)	78%	NR	100% VI; All RP 22.3% limited VI, 29.7% low vision, 48.0% legally blind	NR	Employment status (not specified)	Pearson's chi-square
Chong[70] (2009, Singapore)	Cross	3280 1516[d]	Adults aged 40–80 years; employed and unemployed	2004–2006; survey Singapore Malay Eye Study (SiMES)	40–80 *M* = NR	52%	NR	Mix VI/non-VI; 44% unilateral visual impairment, 66% bilateral visual impairment[d]	NR	Employment status (not specified)	NR (univariate)
Cimarolli[87] (2006, USA)	Cross	97	VR-consumers with major visual disability or blindness, whose case had closed ≥ 1 year; Excl: cogn/hearing deficit; employed and unemployed	NR; telephone survey	25–64 *M* = 47 (9.9)	64%	100% closed VR case	100% VI	NR	Employment status; fulltime, part-time	Independent sample *t*-tests, chi-square analysis
Clapp[71] (2020, USA)	Cohort	1964 1808[e]	Visually impaired applicants from VR FY 2007; at time of application and closure employed/unemployed	2005–2012; RSA-911 data and data from the state Unemployment Insurance agency	NR *M* = 44.2	52%	73% closed VR-case	100% VI; 42% blind, 19% congenital blind	1% intellect, 6% hearing, 4% physical, 2.7% learning, 10% mental	Employment status (not specified); (quarterly) earnings if employed	NR (Univariate)
Clements[64] (2011, UK)	Cross	559	Working-age individuals from a subsample of a nationally representative survey of blind and visually impaired adults; employed and nonemployed	2005–2006; survey	18–64 *M* = NR	NR	NR	100% VI; blind or visually impaired	NR	Paid employment (incl. self-employed)	Bivariate, binary logistic regression (multivariate)
Cmar, McDonnall, Crudden[88] (2018, USA)	Cross	327	Nondrivers with visual impairment; employed/unemployed	2013–2014; survey	18–65 *M* = 46 (12)	NR	76% had VR services	100% VI; 40% totally blind, 18% profound vision loss, 28% moderate/severe vision loss, 14% mild vision loss	44% other physical limitation	Full-time employment: employed or self-employed ≥35 h per week	Multiple logistic regression analysis
Crudden[49] (2018, USA)	Cross	14,229	VR-consumers with signed Individualised Employment Plan, and received ≥1 VR service; employed/unemployed	2015; RSA-911 data	18–75 *M* = 25.5 (14.0)	48%	100% VR applicants	100% VI; 50.7% legal blindness	3.6% cognitive secondary disability, 37.4% non-cognitive secondary disability	Competitive employment at application VR; employment with or without support in an integrated setting, self-employment except for BEP, state agency-managed BEP	Logistic regression
Cumberland[72] (2016, UK)	Cross	112,314	Adults as part of epidemiologic study; employed/unemployed	2009–2010; UK Biobank data from 6 regional centres in England and Wales	40–73 *M* = 56.8 (8.1)	55%	NR	Mix VI/non-VI; 0.7% had visual impairment or blindness, 22.9% had reduced vision in 1 or both eyes	NR	Employment status (not specified)	Multinomial regression

(Continues)

TABLE 1 (Continued)

Study	Design	Sample size	Sampling frame	Sampling method (year(s) and source of data)	Age (age range (year(s)); mean (M) age (SD))	Female (%)	VR status	Sample VI characteristics	Additional disabilities	Employment measure	Methods of analyses
Darensbourg[57] (2013, USA)	Cohort	3610	Nonemployed VR-consumers with closed cases in FY 2006, aged <66 years, with primary disability of blindness or visual impairment; at time of application all nonemployed competitively; at case closure employed/unemployed	2006; RSA-911 data	<66 years *M* = NR	52%	100% closed VR case	100% VI	NR	Competitive employment at time of closure VR:part-time or full-time employment in integrated environments, self-employment, or a state-managed BEP	Logistic regression
DeLaGarza & Erin[116] (1993, USA)	Cross	70	70 graduates of the Texas School for the Blind and Visually Impaired, who graduated between 1985 and 1990. Excl: deaf-blindness, verbal intelligence quotient <70; employed/unemployed	NR; survey by structured interview	NR *M* = 20	52%	NR	100% VI; 43% total blind, 57% low vision	NR	Employment status (not specified): job titles, wages, number of hours worked per week, manner of finding employment, length of time to find employment, methods they used to seek employment, assistance for finding a job	NR (Univariate)
Freeman[68] (1991, Canada)	Cross	69	69 out of 92 legally blind persons who were children in the original 1973–1974 study; employed/unemployed	1987–1988; co-conducted individual interviews	16–34 *M* = 24.8	44%	NR	100% VI; 37% blind, 63% partially sighted	42%	Open employment: full- or part time job, similar for a well-sighted person, and obtained in ordinary way	NR (Univariate)
Giesen[59] (2013, USA)	Cohort	4478	VR-consumers, who were legally blind or with other visual impairment, received SSDI, and closed after receiving VR services; employed/unemployed	2010; RSA-911 data	NR (inclusion 18–75 years) *M* = 46.2 (11.5)	47%	100% closed VR case	100% VI; 73.2% legally blind	2.5% cognitive secondary disability 40.7% noncogn. secondary disabilities	Competitive employment at time of closure VR: employment in an integrated setting; self-employment; BEP employment; and supported employment in an integrated setting that was full- or part-time and that was compensated at the maximum of the state or federal minimum wage	Two-level hierarchical generalised linear model

TABLE 1 (Continued)

Study	Design	Sample size	Sampling frame	Sampling method (year(s) and source of data)	Age (age range (year(s)); mean (M) age (SD))	Female (%)	VR status	Sample VI characteristics	Additional disabilities	Employment measure	Methods of analyses
Giesen[58,67] (2016 & 2018, USA)	Cohort	3610	VR-consumers, who were legally blind or with other visual impairment, and who received SSDI, closed after receiving VR services; employed/unemployed	2011; RSA-911 data	NR (inclusion 18–75 years) *M* = 47.3	45%	100% closed VR case	100% VI; 73% legally blind	2.5% cognitive; 39.6% noncognitive	*Study 2016*: Competitive employment at time of closure VR: employment in an integrated setting, self-employment, BEP employment, and supported employment in an integrated setting; and was full or part-time and compensated at the maximum of the State or Federal minimum wage *Study 2018*: Achievement of employment with earnings at levels that exceed Substantial Gainful Activity	Multilevel logistic regression
Gillies[77] (1998, Australia)	Cross	167[l] 82[d]	Group 1: random sample of member from National Federation of the Blind Citizen of Australia, with blindness or visual impairment. Group 2: random sample of nonvisually impaired persons; employed/unemployed	NR; questionnaire	NR (inclusion: 16–65 years) *M* = NR	53%[l] 32%[d]	NR	Mix VI (49%)/non-VI; legal blindness or other visual impairment	NR	Employment status; part-time, full-time	NR (Univariate)
Goertz[19] (2017, The Netherlands)	Cross	299	Participants, recruited from two companies which provide equipment for persons with various levels of VI; employed/unemployed	2010; telephone survey	NR (inclusion 15–64 years) *M* = 45.6 (12.0)	52%	NR	100% VI (self report); 53.2% low vision, 39.8% very low vision, 7% blind; 25.4% from birth VI, 74.6% VI later in life	61.5%	Paid work (not further specified)	Stepwise logistic regression analysis
Gupta[117] (2021, Canada)	Cross	1,519,840 892,220[f]	People who reported having a seeing disability; employed/unemployed	2017; nationally representative data from the 2017 Canadian Survey on Disability collected by Statistics Canada	25–64[f] *M* = NR	NR	NR	100% VI (self report)	NR	Employment status: full-time or part-time employed, unemployed, out of labour force	Multivariate binary logistic regression model
Hagemoser[28] (1996, USA)	Cross	109	Blind VR-consumers adults; employed (group 1), unemployed (group 2)	NR; questionnaire	NR (inclusion 20–62 years) *M* = 42.9 (8.2)[j]; 46.5 (11.8)[k]	43%–44%	NR	100% VI; all blind	NR	Sustained (un) employment (at least 1 year)	Backward-elimination multiple regression

(Continues)

TABLE 1 (Continued)

Study	Design	Sample size	Sampling frame	Sampling method (year(s) and source of data)	Age (age range (year(s)); mean (M) age (SD))	Female (%)	VR status	Sample VI characteristics	Additional disabilities	Employment measure	Methods of analyses
Hill[60] (1989, USA)	Cohort	17,228	Blind and visually impaired VR-consumers with successfully closed cases in FY 1982; employed/unemployed	1982; RSA-911 data	NR *M* = 46.7	56%	100% closed VR case	100% VI; 5.2% blind with no light perception, 41% legally blind, 11.4% blind one eye with other eye defective, 18% blind one eye with good other eye, 24% other VI	15.2% major secondary disabilty, 80% minor secondary disability	Employment status: placed in the competitive labour market, self-employed, placed in sheltered work, or established as a homemaker	Multinomial logit model
Houtenville[27] (2003, USA)	Cross	NR	Sample of the civilian noninstitutionalised population of the United States with info on the economic status and various chronic conditions; employed/unemployed	1983–1996; The National Health Interview Survey, conducted by the National Center for Health Statistics	25–61 *M* = NR	NR	NR	Mix VI/non-VI	NR	Employment rates; mean household size adjusted income	NR (Univariate)
Jang[69] (2013, Taiwan)	Cohort	313	Visually impaired VR-consumers, whose case had completed and closed between 2008 and 2010; employed/unemployed	2008–2010; Records from Taiwanese National Vocational Rehabilitation Services	NR *M* = 37.9 (11.5)	38%	100% closed VR case	100% VI; 71% severe VI, 29% mild VI	NR	Successful employment outcome: after completing disability services being ≥90 days employed in integrated setting, full-time or part-time, with compensation above minimum wage set by the government	Backward logistic regression analysis
Jo, Chen, Kosciulek[89] (2010, USA)	Cross	128	Former Michigan Commission for the Blind clients whose cases had been either successfully or unsuccessfully closed FY 2003–2004; employed/unemployed	2003–2004; survey	18–63 *M* = 41.8 (5.9)	53%	100% closed VR case	100% VI	NR	Competitive employment at time of closure VR: competitively employed ≥90 days, self-employed, or BEP operators	Binary logistic regression
Joffe[53] (1978, USA)	Cross	101 89[e]	Substantially employed group and a chronically unemployed visually impaired group	NR; structured interview	21–61 *M* = 40.4	0%	NR	100% VI; 28% totally/partially blind, congenital; 28% partially sighted, congenital; 32% totally/partially blind, acquired; 12% partially sighted, acquired	0%	Employment status: full-time employed continuously the past 2 years with earnings ≥$ 200/month	*t*-tests

TABLE 1 (Continued)

Study	Design	Sample size	Sampling frame	Sampling method (year(s) and source of data)	Age (age range (year(s)); mean (M) age (SD))	Female (%)	VR status	Sample VI characteristics	Additional disabilities	Employment measure	Methods of analyses
Klein & Cruickshanks[73] (1994, USA)	Cross	4926	Inhabitants, living in the city or township of Beaver Dam and being 43–84 years of age at the time of the census; employed/unemployed	1988–1990; questionnaire	NR (inclusion 43–84 years) *M* = NR	56%	NR	Mix VI (18%)/non VI; 21% impaired vision, 0.5% legally blind[d]	NR	Employment status: part-time, full-time	NR (Univariate)
Klein & Moss[74] (1994, USA)	Cohort	1240	Persons with younger-onset diabetes (1) or older-onset diabetes (2); employed/unemployed	1980–1982; clinical exam and structured interview	NR (inclusion ≥25 years) *M* = NR	1: 53% 2: 55%	NR	Mix VI/non VI; diabetic retinopathy	NR	Employment status: part-time, full-time	NR (Univariate)
La Grow[23] (2004, N-Zealand)	Cross	150	Working-age visually impaired members of Royal New Zealand Foundation of the Blind; employed/unemployed	NR; survey	18–63 *M* = 43.0	83%	NR	100% VI (self report); 18.2% no usable vision, 59.5% little usable vision, 22.3% a lot of usable vision	42%	Paid/competitive employment; underemployment	Pearson chi-square
Lawson[61] (2010, USA)	Cross	28	Visually impaired high school graduates, who received services from the Foundation for Blind Children; employed/unemployed	NR; survey	23–30 *M* = 28.9 (2.4)	14%	NR	100% VI; 54% totally blind or light perception only; 39% perception through 20/200; 11% better than legally blind	32%	Competitive employment: full or part-time work in an integrated setting in the competitive labour market, including self-employment, and, compensated ≥ minimum wage, and level of benefits paid as similar employees who are not disabled	Fisher's Exact and Mann Whitney-*U* test
Lee & Park[92] (2008, S-Korea)	Cross	874	Working-age visually impaired adults; employed/unemployed	2004; telephone survey	18–65 *M* = 48.2 (11.5)	35%	14.6% received a form of adjustment training	100% VI; 35.4% severe VI	10%	Employment status: full-time job (regular, contract), piecework or self-employment	Multivariate logistic regression
Leonard[90] (1999, USA)	Cohort	167 130[e]	Visually impaired persons with referral to VR services; employed/unemployed	1989–1994; telephone survey	18–79 *M* = 41	44%	100% VR-applicants	100% VI (self report); 83.6% partially sighted, 16.4% blind	28.3%	Employment status (not specified); job level; perceived underemployment	Multiple logistic regression
Marques[81] (2019, Portugal)	Cross	546 254[g]	Visually impaired individuals, recruited from four public hospitals, with visual acuity 0.30 logMAR or worse; employed/unemployed	NR; face-to-face interviews	17–64[g] *M* = NR	49%[g]	NR	100% VI; diabetic retinopathy, high myopia and diseases of the cornea	65%	Employment status (not specified)	Chi-square, logistic regression
Martz[78] (2008, USA)	Cohort	13,751 709[d]	VR consumers with different disabilities who have exited from VR programmes during 1998–2004; employed/unemployed	1998–2004; telephone survey	NR	NR	100% closed VR case	Mix VI (5%)/non-VI	NR	Employment status (not specified)	Logistic regression

(Continues)

TABLE 1 (Continued)

Study	Design	Sample size	Sampling frame	Sampling method (year(s) and source of data)	Age (age range (year(s)); mean (M) age (SD))	Female (%)	VR status	Sample VI characteristics	Additional disabilities	Employment measure	Methods of analyses
McCarty[118] (1999, Australia)	Cross	250	Adults with visual impairment; employed/unemployed	1997; telephone survey	19–59 *M* = 40.7	52%	NR	100% VI (self report); 16% totally blind	NR	Employment status: full-time, part-time; under-employment	Multivariate analysis
McDonnall[62] (2020, USA)	Cohort	880	VR consumers with blindness or other visual impairment caused by traumatic brain injury (TBI), whose case had closed during FY 2013–2015 (deaf-blindness was excluded); employed/unemployed	2013–2015; RSA-911 data	18–65 *M* = 39.8 (13.4)	33%	100% closed VR case	100% VI caused by TBI; 46.3% legally blind	All TBI	Competitive employment at time of closure VR: working at an employer job, in self-employment, or in a BEP position and earning ≥ federal minimum wage	Hierarchical generalised linear modeling
Moore[82] (1984, USA)	Cross	108	Blind and visually impaired VR consumers, who had closed cases in FY 1982; employed/unemployed	NR; questionnaire	17–76 *M* = 43	58%	100% closed VR case	100% VI; 6% totally blind with no light perception, 41% legally blind, 53% various VI (infections, cataract, glaucoma)	NR	Employment status: competitive, sheltered, nonrehabilitated	Univariate, Pearson correlation/ANOVA
Pavey[66] (2008, UK)	Cross	1007 220[h]	Visually impaired people, who had been in compulsory education within the last 25 years; employed/unemployed	2005–2006; survey with interviews	18–42[h] *M* = NR	55%	NR	100% VI; 100% onset at childhood	NR	Paid employment status	NR (Univariate)
Pfouts[91] (1982, USA)	Cross	98	Totally blind adults; employed/unemployed	1979–1980; survey by questionnaire, North Carolina Register of the Blind	20–56 *M* = NR	50%	55% closed VR case	100% VI; all totally blind	NR	Employment status (not specified)	Multiple regression
Rahi[79] (2009, UK)	Cohort	9330	Members of the 1958 British birth cohort at age 44 or 45 years; employed/unemployed	2002–2003; series of clinical examinations or face-to-face interviews, or both	44–45 *M* = NR	NR	NR	Mix VI/non VI; 90.9% normal vision both eyes, 6.8% normal vision one eye, 1.3% socially significant VI (VA 6/12–6/18), 0.9% VI (VA 6/19–6/60) or blindness (VA >3/60)	NR	Employment status (not specified)	Logistic, multinomial, proportional odds ordinal logistic regression
Roy[119] (1998, UK)	Cross	51	Visually impaired college graduates, identified from Royal National Institute for the Blind; employed/unemployed	NR: semi-structured telephone interviews (>1 year after graduation)	NR *M* = 30 (7)[j]; 30 (8)[k]	NR	NR	100% VI; 78% blind, 22% partially sighted	NR	Employment status (not specified)	Chi-square
Ryles[120] (1996, USA)	Cross	74	Congenitally legally blind adults who learned to read braille or print as their original reading medium, identified by The Washington State Library for the Blind and Physically Handicapped; employed/unemployed	NR; survey by structured interview	18–55 *M* = NR	57%	NR	100% VI; all congenitally legally blind	NR	Employment status (not specified); income levels	Chi-square

TABLE 1 (Continued)

Study	Design	Sample size	Sampling frame	Sampling method (year(s) and source of data)	Age (age range (year(s)); mean (M) age (SD))	Female (%)	VR status	Sample VI characteristics	Additional disabilities	Employment measure	Methods of analyses
Scholl & Bauman[65] (1969, USA)	Cross	644	Former visually impaired pupils from residential/ day schools; employed/ unemployed	1968; interviews	23–42 *M* = NR	36.3%	100% closed VR case	100% VI; all lost their sight prior to a period of gainful employment; 93.5% legally blind both eyes	45%	Gainful employment; percentage of time worked	NR (Univariate)
Sherrod[80] (2014, USA)	Cross	19,849[l]	Working-age American participants from the 1999 to 2008 National Health and Nutrition Examination Survey; employed/ unemployed	1999–2008; survey with vision examination and questionnaires	16–74[l] *M* = NR	51%[l] 53%[d]	NR	Mix VI (0.08%)/non-VI	NR	Employment status: part-time, full-time	NR (Univariate)
Silverman[121,122] (2015 & 2018, USA)	Cross	433[l] 419[i]	Legally blind people, identified by American Council of the Blind (ACB) and National Federation of the Blind; employed/ unemployed	2012; online survey	18–90[l] 18–65[i] *M* = NR	59%–61%	NR	100% VI; all legally blind; 66% blind at birth or <2 years, 12% during childhood, 22% in adulthood	NR	Employment status (not specified)	Multiple regression
Steinman[63] (2013, USA)	Cohort	13,741	Blind (1) and visually impaired (2) VR-consumers, who had completed Individualised Plan for Employment forms on record; employed/unemployed	2010–2011: RSA-911 data FY, data National Survey of State Vocational Rehabilitation	22–66 *M* = 1: 44.6 (11.4) 2: 47.4 (11.3)	1: 47% 2: 49% (total: 48%)	100% closed VR case	100% VI; 49.1% legal blindness	1: 38.9% 2: 35%	Competitive employment at time of closure VR: employment in an integrated setting, self employment, or full-time or part-time participation in a state-managed BEP, ≥minimum wage	Multilevel logistic regressions
Szlyk[83] (1998, USA)	Cross	52	Legally blind patients; employed/unemployed	NR; questionnaire	18–62 *M* = 41 (11)	67%	12%[j] 4.8%[k]	100% VI; legal blindness due to Stargardt (42%), cone dystrophy (6%), Best vitelliform macular dystrophy (4%) or achromatopsia (12%)	NR	Employment status (not specified)	Logistic regression
Walther[123] (1996, Germany)	Cross	56	Adult graduates of the School for People with Low Vision in Thuringia, who finished school in 1970–1986; employed/ unemployed	NR; questionnaire	NR	46%	NR	100% VI; 23.2% VA 0.04-0.1, 28.6% VA 0.1, 14.3% VA 0.2, 23.2% VA >0.3	NR	Employment status (not specified)	NR (univariate)

(Continues)

TABLE 1 (Continued)

Study	Design	Sample size	Sampling frame	Sampling method (year(s) and source of data)	Age (age range (year(s)); mean (M) age (SD))	Female (%)	VR status	Sample VI characteristics	Additional disabilities	Employment measure	Methods of analyses
Wolffe[75] (1992, USA)	Cross	76	Blind or visually impaired consumer members of the ACB; employed/unemployed	NR; questionnaire	17–71 *M* = 44.0	41%	NR	100% VI; 65% low vision, 32% totally blind, 3% deafblind; 47% congenital, 53% adventitious	3% deaf-blind	Employment status: full-time, part-time	Chi-square
Zapata[84] (2020, USA)	Cross	183	Working-age adults with RP, recruited from Facebook; employed/unemployed	2015; online questionnaire	22–64 *M* = 43 (11)	72%	NR	100% VI; all RP	NR	Employment status: full-time, part-time	Multiple logistic regression
Zapata[85] (2022, USA)	Cross	180	Working-age adults with self-reported VI, recruited through online forums and mailing lists for people with VI; employed/unemployed	2019; online questionnaire	21–66 *M* = 46 (12)	67%	NR	100% VI; totally blind or light perception 19%; Stargardt disease 5%, RP 36%, macular degeneration <1%, glaucoma 9%, cataracts 1%, diabetic retinopathy 2%, RP and cataracts 10%, glaucoma and cataracts 4%, multiple causes (nonspecified) 8%, other cause(s) 24%	24%	Employment status: full-time, part-time	Stepwise logistic regression

Abbreviations: ACB, American Council for the Blind; BEP, Business Enterprise Programme; FY, fiscal year; NR, not reported; RSA, rehabilitation services administration; SSDI, social security disability insurance; VA, visual acuity; VI, visually impairment; VR, vocational rehabilitation.

[a]Subsample with closed VR.

[b]Working-age group, max 70 years.

[c]18+ year.

[d]VI only group.

[e]Employment analysis.

[f]Age 25–64 years.

[g]Working-age group.

[h]18–42 years.

[i]18–64 years.

[j]Employed group.

[k] Unemployed group.

[l] Total study sample.

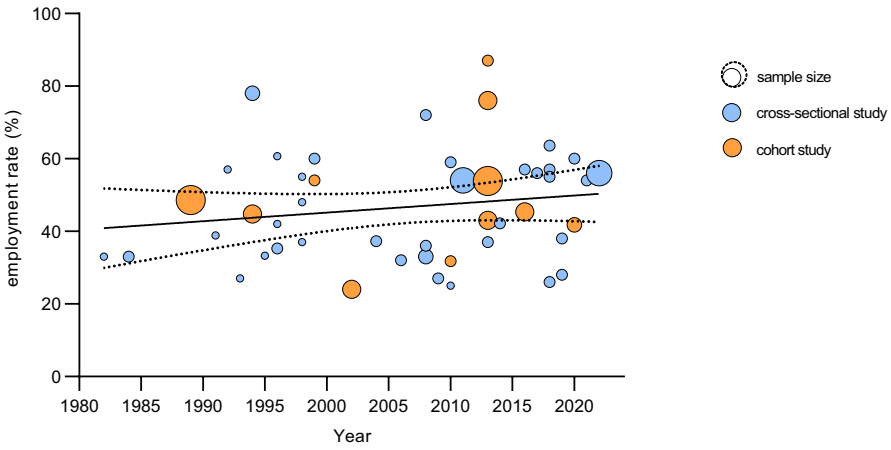


FIGURE 2 Scatterplot for employment rates of included studies over time. The plot reports the employment rates (%) of unique study samples, distributed over time. Forty-seven of the 55 included samples from our study are displayed, which reported the employment rates of (sub)samples with all visually impaired participants. The majority of these (sub)samples included working-age adults only. The size of the dot represents the size of the individual sample. The black trend line displays the interpolation with 95% confidence interval (not weighted for sample size) of all 47 samples.

our predetermined threshold for meta-analysis of four studies.

In our meta-analyses, we observed high heterogeneity for most variables, indicating variability among studies and associations (see Forest plots, Figure 4). For each of the 10 variables in the meta-analysis we described the main findings.

Gender

In 29 studies, data were reported on the association between gender and employment in working-age adults with visual impairment showing that males had a somewhat higher odds of being employed than females, with ORs varying between 0.68 and 3.1 and an overall effect size of 1.59 OR (95% CI 1.37 to 1.84). However, heterogeneity of the pooled studies was high (I^2 95%). Subgroup analyses (Figure 5a) revealed that the OR for males remained stable across different regions. Subgroup analyses for time period showed significant relevant and higher ORs with generally low heterogeneity (OR 1.83 to 2.19) and slightly lower ORs in the more recent time periods for male gender (period 2010–2022: 1.25 OR, 95% CI 1.11 to 1.41, I^2 78%). Sensitivity analysis showed that high between-study heterogeneity could not be explained by separating studies with univariate from multivariate analyses nor by study quality or study design. Moreover, sensitivity analyses had no major effect on the magnitude of the effect sizes.

Age

In 10 studies, data were reported on the association between age and employment. In general, there was no meaningful association between age and employment, with ORs varying between 0.93 and 1.02 and an overall pooled OR of 0.99 (95% CI 0.97 to 1.00). Additionally, the heterogeneity of the pooled studies was high (I^2 91%).

Subgroup analysis (Figure 5b) revealed a difference in ORs between time periods. The earlier time period (2000–2010: OR 0.97, 95% CI 0.96 to 0.98, I^2 0%, $n = 3$) showed a slightly positive association for younger age and employment, while no association appeared in the later time period (2010–2022: OR 1.00, 95% CI 0.99 to 1.01, I^2 80%, $n = 7$). Further subgroup analyses showed that the high heterogeneity could not be explained by the type of analysis (univariate vs. multivariate), study quality or study design. Moreover, sensitivity analyses had no major effect on the magnitude of the ORs.

Marital status

In five studies, data were reported on the association between marital status/with partner and employment, showing being married/with partner having higher odds of being employed compared with being nonmarried/without partner, with ORs varying between 1.05 and 3.42 and a pooled OR of 1.73 (95% CI 1.12 to 2.67) with no important heterogeneity (I^2 34%).

Education

Figure S2 shows the association between employment and the three educational levels (low, moderate and high). Subsequently, we regrouped the three education-levels into two levels and pooled data in two different analyses (1, low vs. moderate/high level; 2, low/moderate level vs. high level).

The first analysis compared high school diploma or higher versus a lower degree, revealing ORs of nine individual studies, ranging from 0.48 to 4.98, and showed a pooled OR of 1.83 (95% CI 1.23 to 2.73). The second analysis

TABLE 2 Quality assessment based on the (modified) Newcastle–Ottawa Scale cross-sectional studies.

	Selection					Exposure		
Study	Representativeness of the sample	Sample size	Nonrespondents	Exposure ascertainment	Comparability	Outcome assessment	Statistical test	Total score
Beach[29]	★	☆	☆	★	☆☆	★☆	☆	3
Bell[50]	★	★	☆	☆	☆☆	★☆	☆	3
Bell[51]	★	★	☆	☆	☆☆	★☆	☆	3
Bengisu[115]	★	★	☆	★	★☆	★☆	★	6
Cabrales-Lopez[76]	★	★	☆	☆	☆☆	★☆	★	4
Chaumet-Riffaud[86]	★	★	☆	★	☆☆	★☆	★	5
Chong[70]	★	★	★	★	★★	★☆	★	8
Cimarolli[87]	★	☆	☆	★	☆☆	★☆	★	4
Clements[64]	★	★	☆	★	★★	★☆	★	7
Cmar[88]	★	★	☆	★	★★	★☆	★	7
Crudden[49]	★	★	☆	★	★★	★☆	★	7
Cumberland[72]	★	★	☆	★	★★	★☆	★	7
DeLaGarza[116]	★	☆	★	★	★☆	★☆	★	6
Freeman[68]	★	☆	☆	★	☆☆	★☆	☆	3
Gillies[77]	★	☆	☆	★	★☆	★☆	★	5
Goertz[19]	★	★	☆	★	★★	★☆	★	7
Gupta[117]	★	★	★	☆	★★	★☆	★	7
Hagemoser[28]	★	★	☆	★	★☆	★☆	★	6
Houtenville[27]	★	★	☆	★	★☆	★☆	☆	5
Jo[89]	★	★	☆	★	★☆	★☆	★	6
Joffe[53]	★	★	☆	★	☆☆	★☆	☆	4
Klein & Cruickshanks[73]	★	★	☆	★	★★	★☆	★	7
LaGrow[23]	★	★	☆	★	☆☆	★☆	☆	4
Lawson[61]	★	☆	☆	★	☆☆	★☆	★	4
Lee[92]	★	★	☆	★	★★	★☆	★	7
Marques[81]	★	★	☆	★	★★	★☆	★	7
McCarty[118]	★	★	☆	☆	★★	★☆	★	6
Moore[82]	★	★	☆	★	☆☆	★☆	★	5
Pavey[66]	★	★	☆	★	☆☆	★☆	☆	4
Pfouts[91]	★	☆	☆	★	★☆	★☆	★	5
Roy[119]	★	☆	☆	★	☆☆	★☆	★	4
Ryles[120]	★	☆	☆	★	☆☆	★☆	★	4
Scholl & Crissey[65]	★	★	★	★	★★	★☆	★	8
Sherrod[80]	★	★	☆	★	★☆	★☆	★	6
Silverman[121,122]	★	★	☆	★	★★	★☆	★	7
Szlyk[83]	★	☆	☆	★	★★	★☆	★	6
Walther[123]	★	☆	☆	★	☆☆	★☆	☆	3
Wolffe[75]	★	☆	☆	★	☆☆	★☆	☆	3
Zapata[84]	★	★	☆	★	★★	★☆	★	7
Zapata[85]	★	★	☆	☆	★★	★☆	★	6

compared a bachelor diploma or higher versus a lower degree, revealing ORs of 12 individual studies, ranging from 1.2 to 8.02, and showed a pooled OR of 2.65 (95% CI 2.08 to 3.39). In conclusion, a higher level of education resulted in higher odds of being employed. However, the heterogeneity of the studies was high (I^2 64% to 76%).

TABLE 3 Quality assessment based on the (modified) Newcastle–Ottawa Scale cohort studies.

	Selection					Outcome			
Study	Representativeness of the exposed cohort	Selection of the non-exposed cohort	Exposure ascertainment	Demonstration that outcome of interest was not present at start of study	Comparability	Assessment of outcome	Duration of follow-up	Adequacy of follow-up	Total score
Bell[54]	★	★	★	☆	☆☆	★	★	☆	5
Capella-McDonnall[55]	★	★	★	★	★★	★	★	☆	8
Cavenaugh[56]	★	★	★	☆	★★	★	★	☆	7
Clapp[71]	★	★	★	☆	☆☆	★	★	☆	5
Darensbourgh[57]	★	★	★	★	★★	★	★	☆	8
Giesen[59]	★	★	★	☆	★★	★	★	☆	7
Giesen[58,67]	★	★	★	☆	★★	★	★	☆	7
Hill[60]	★	★	★	☆	★★	★	★	☆	7
Jang[69]	★	★	★	☆	★★	★	★	☆	7
Klein & Moss[73]	★	★	★	★	★★	☆	★	☆	7
Leonard[90]	★	★	☆	☆	★★	★	★	☆	6
Martz[78]	★	★	★	☆	★★	★	★	☆	7
McDonnall[62]	★	★	★	☆	★★	★	★	☆	7
Rahi[79]	★	★	★	☆	★★	★	☆	★	7
Steinman[63]	★	★	★	☆	★★	★	★	☆	7

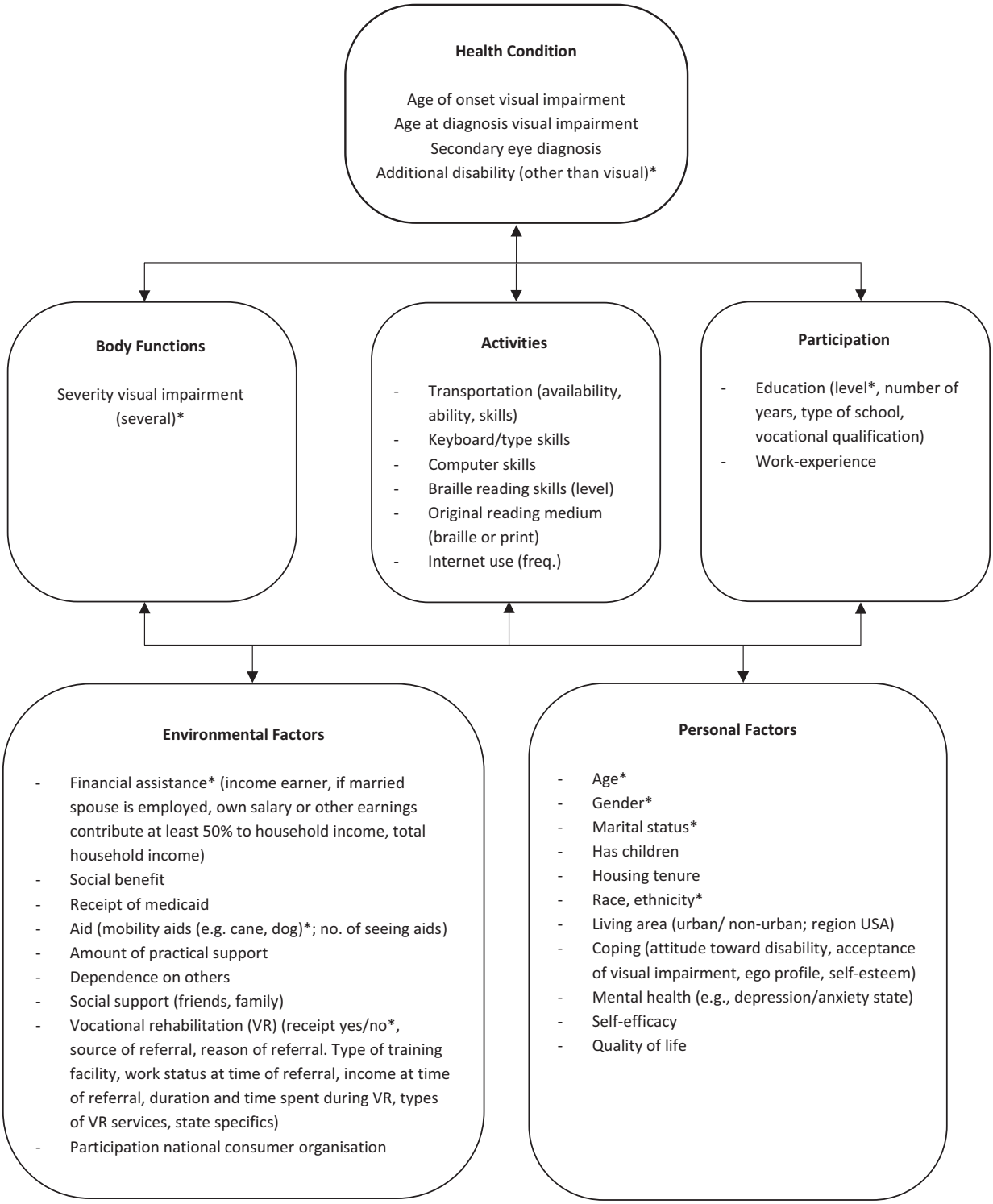


FIGURE 3 Summary of predictors mentioned in available studies for employment status in people with visual impairment, organised in the International Classification of Functioning conceptual framework. *Included in meta-analysis

Because in the second analysis at least 10 studies showed pooled data on the association between employment and a bachelor diploma or higher versus a lower degree, we were able to perform further subgroup analysis for this comparison. Subgroup analyses (Figure 5c) revealed that across the studied regions, the ORs for employment were similar with low to high levels of heterogeneity. Furthermore, the time period of the study may have had a moderating effect on the association, but could not explain the high heterogeneity. Pooled data from eight

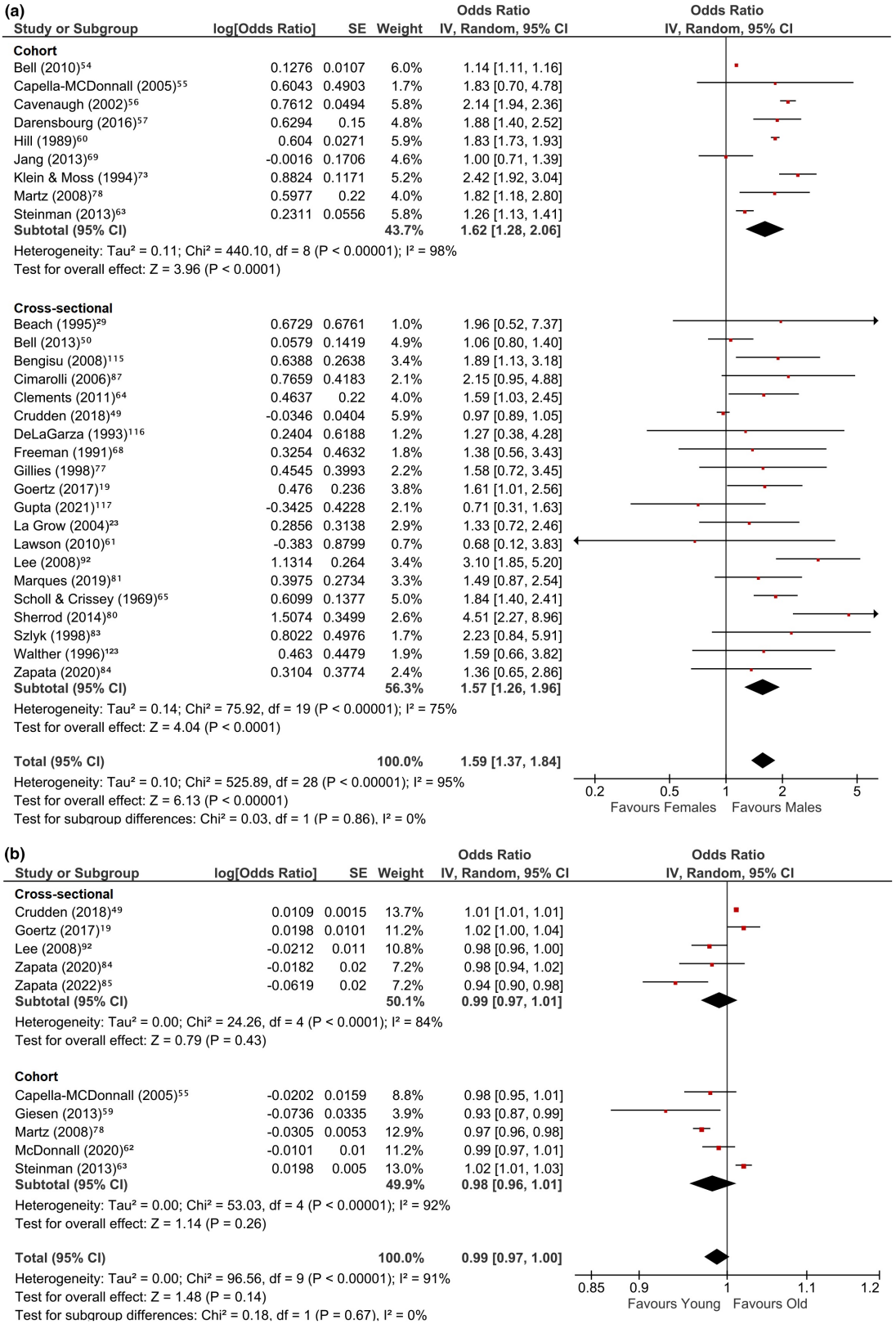
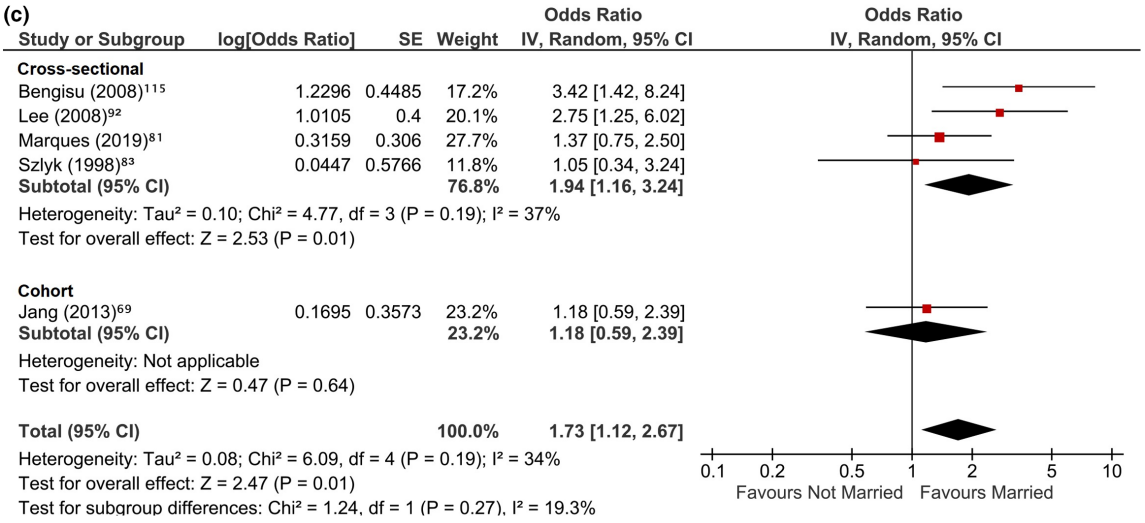
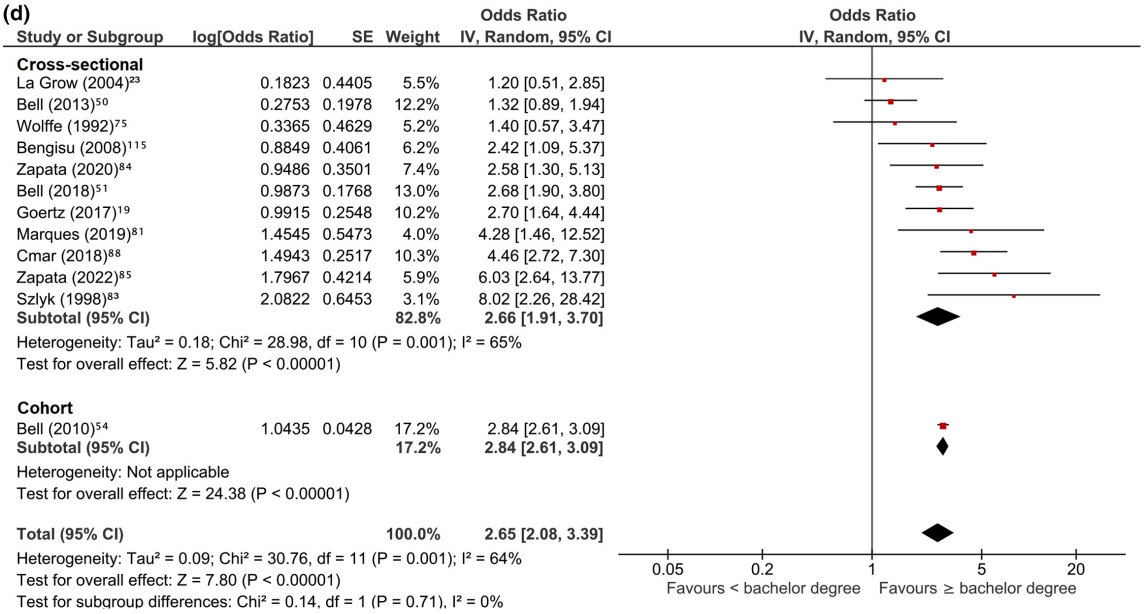


FIGURE 4 Meta-analyses of the association between employment status and different variables. The dots represent the effect sizes (odds ratio) and the lines represent the 95% confidence interval (CI) from each primary study. Size of the dots reflects the weight attributed to each study (with random effects model). The diamond represents the pooled summary effect size and CIs. (a) Gender: comparison male versus female; (b) Age: comparison young versus older age; (c) Marital status/with partner: comparison yes versus no; (d) Education: comparison bachelor diploma or higher versus a lower degree; (e) Ethnicity: comparison white versus non-white; (f) Financial assistance: comparison yes versus no; (g) Severity of visual impairment: comparison blind versus low vision; (h) Additional disability: comparison yes versus no; (i) Use of mobility aid: comparison yes versus no; (j) Vocational training: comparison yes versus no. SE, standard error.





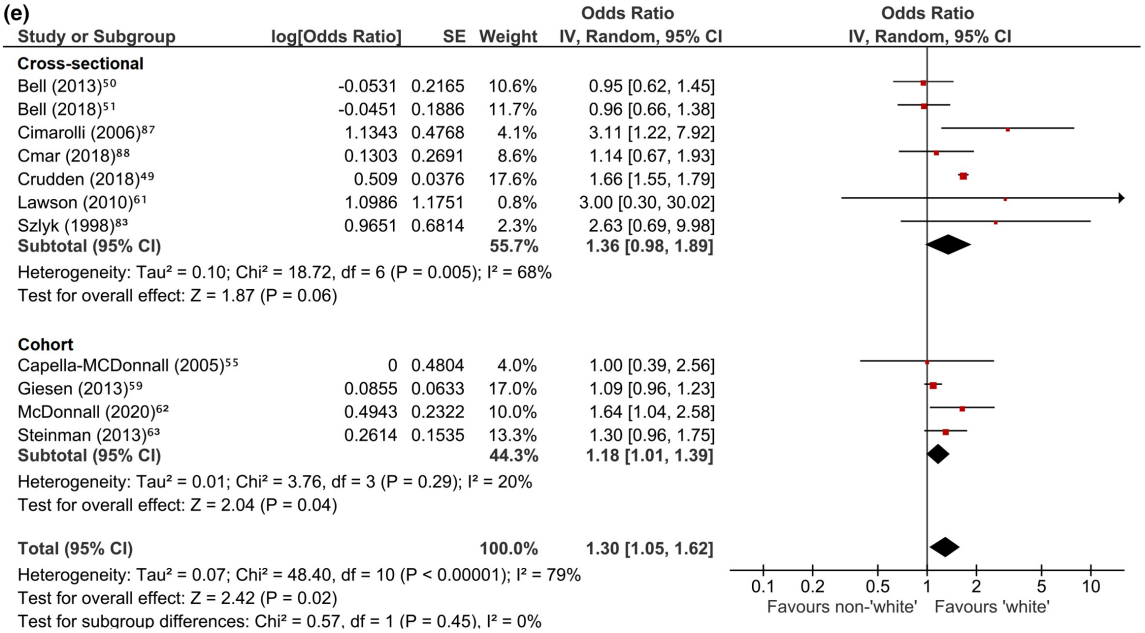
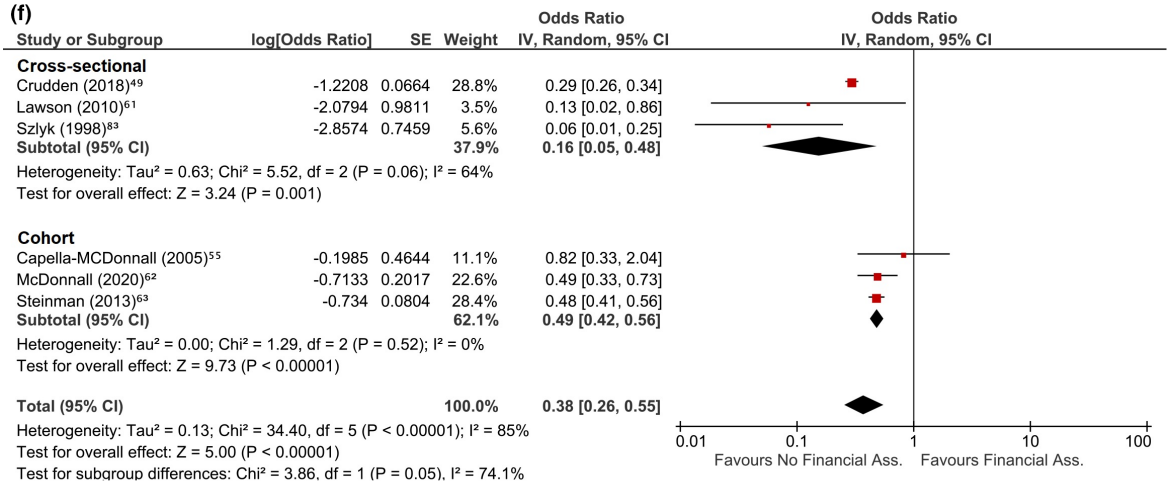


FIGURE 4 (Continued)



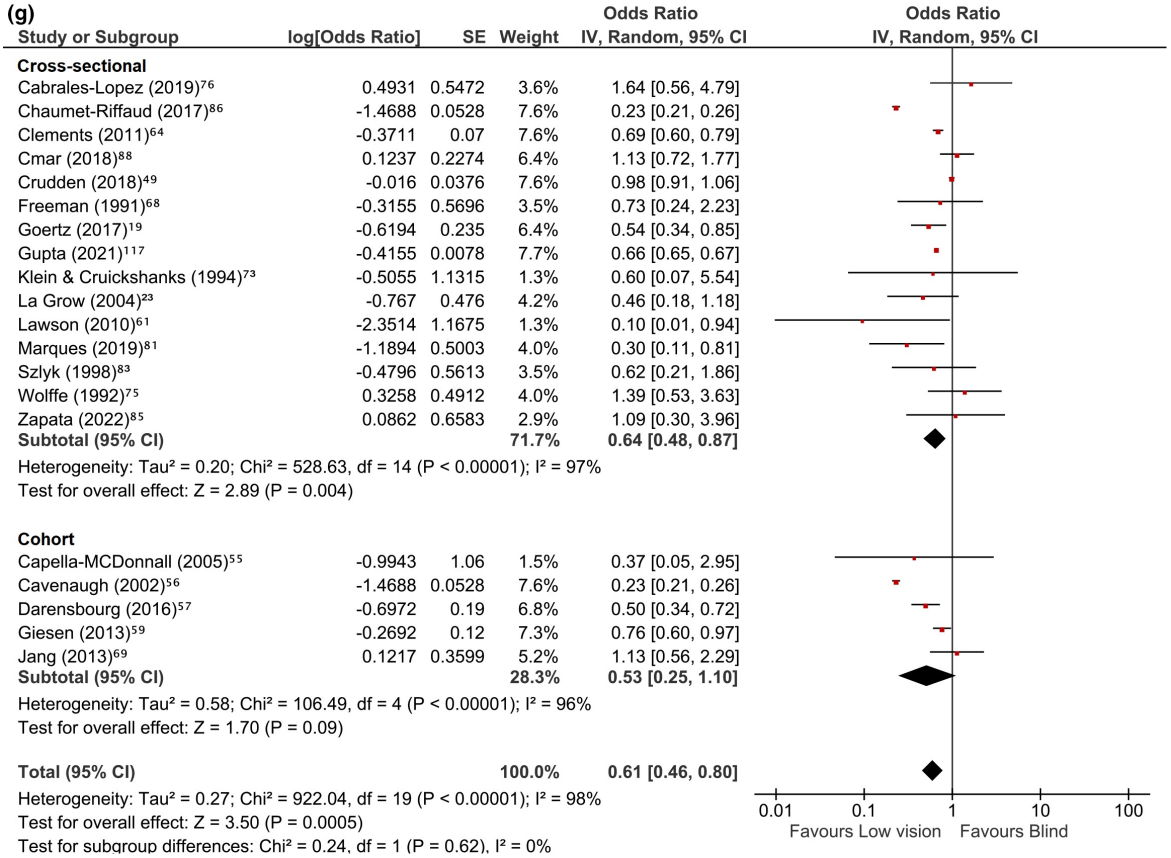
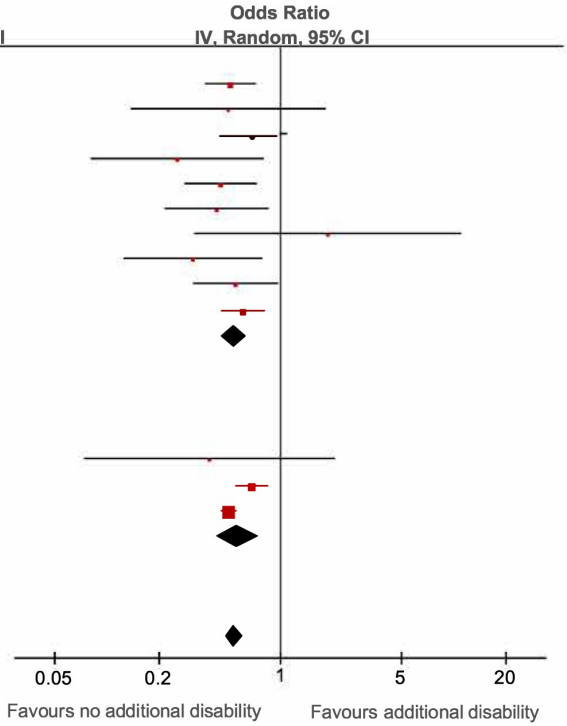


FIGURE 4 (Continued)

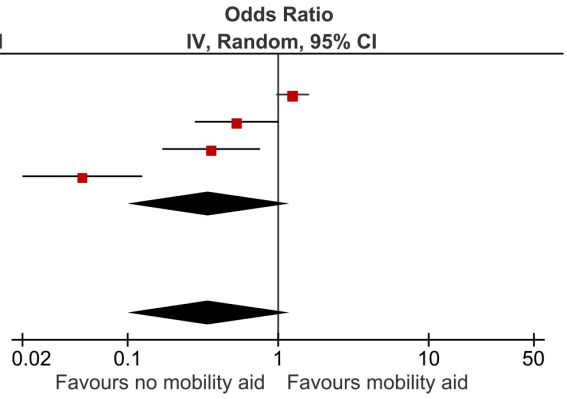
(h)

Study or Subgroup	log[Odds Ratio]	SE	Weight	Odds Ratio IV, Random, 95% CI
Cross-sectional				
Bell (2018)[51]	-0.6643	0.1731	9.6%	0.51 [0.37, 0.72]
Clements (2011)[64]	-0.6931	0.66	0.8%	0.50 [0.14, 1.82]
Cmar (2018)[88]	-0.3548	0.2249	6.2%	0.70 [0.45, 1.09]
Freeman (1991)[68]	-1.3679	0.5854	1.0%	0.25 [0.08, 0.80]
Goertz (2017)[19]	-0.7943	0.245	5.3%	0.45 [0.28, 0.73]
La Grow (2004)[23]	-0.8452	0.352	2.7%	0.43 [0.22, 0.86]
Lawson (2010)[61]	0.6286	0.9037	0.4%	1.87 [0.32, 11.02]
Lee (2008)[92]	-1.1616	0.469	1.6%	0.31 [0.12, 0.78]
Marques (2019)[81]	-0.5954	0.287	4.0%	0.55 [0.31, 0.97]
Sherrod (2014)[80]	-0.4829	0.15	12.1%	0.62 [0.46, 0.83]
Subtotal (95% CI)			**43.7%**	**0.55 [0.46, 0.64]**
Heterogeneity: Tau² = 0.00; Chi² = 8.07, df = 9 (P = 0.53); I² = 0%				
Test for overall effect: Z = 7.30 (P < 0.00001)				
Cohort				
Capella-MCDonnall (2005)[55]	-0.9416	0.85	0.5%	0.39 [0.07, 2.06]
Giesen (2013)[59]	-0.3667	0.113	18.2%	0.69 [0.56, 0.86]
Steinman (2013)[63]	-0.6733	0.0526	37.6%	0.51 [0.46, 0.57]
Subtotal (95% CI)			**56.3%**	**0.58 [0.44, 0.76]**
Heterogeneity: Tau² = 0.03; Chi² = 6.19, df = 2 (P = 0.05); I² = 68%				
Test for overall effect: Z = 3.98 (P < 0.0001)				
Total (95% CI)			**100.0%**	**0.55 [0.49, 0.62]**
Heterogeneity: Tau² = 0.01; Chi² = 14.29, df = 12 (P = 0.28); I² = 16%				
Test for overall effect: Z = 9.98 (P < 0.00001)				
Test for subgroup differences: Chi² = 0.12, df = 1 (P = 0.73), I² = 0%				



(i)

Study or Subgroup	log[Odds Ratio]	SE	Weight	Odds Ratio IV, Random, 95% CI
Cross-sectional				
Bell (2013)[50]	0.2202	0.1277	26.7%	1.25 [0.97, 1.60]
Bell (2018)[51]	-0.6352	0.3265	25.2%	0.53 [0.28, 1.00]
Zapata (2020)[84]	-1.0244	0.3814	24.6%	0.36 [0.17, 0.76]
Zapata (2022)[85]	-2.9957	0.4675	23.5%	0.05 [0.02, 0.13]
Subtotal (95% CI)			**100.0%**	**0.35 [0.10, 1.18]**
Heterogeneity: Tau² = 1.45; Chi² = 52.91, df = 3 (P < 0.00001); I² = 94%				
Test for overall effect: Z = 1.69 (P = 0.09)				
Total (95% CI)			**100.0%**	**0.35 [0.10, 1.18]**
Heterogeneity: Tau² = 1.45; Chi² = 52.91, df = 3 (P < 0.00001); I² = 94%				
Test for overall effect: Z = 1.69 (P = 0.09)				
Test for subgroup differences: Not applicable				



(j)

Study or Subgroup	log[Odds Ratio]	SE	Weight	Odds Ratio IV, Random, 95% CI
Cross-sectional				
Cmar (2018)[88]	0.1924	0.3017	25.7%	1.21 [0.67, 2.19]
Szlyk (1998)[83]	-0.2432	0.8199	8.3%	0.78 [0.16, 3.91]
Subtotal (95% CI)			**34.0%**	**1.15 [0.66, 2.00]**
Heterogeneity: Tau² = 0.00; Chi² = 0.25, df = 1 (P = 0.62); I² = 0%				
Test for overall effect: Z = 0.50 (P = 0.62)				
Cohort				
Clapp (2020)[71]	0.4268	0.1332	35.0%	1.53 [1.18, 1.99]
Leonard (1999)[90]	-0.4308	0.21	31.0%	0.65 [0.43, 0.98]
Subtotal (95% CI)			**66.0%**	**1.01 [0.44, 2.35]**
Heterogeneity: Tau² = 0.34; Chi² = 11.89, df = 1 (P = 0.0006); I² = 92%				
Test for overall effect: Z = 0.03 (P = 0.98)				
Total (95% CI)			**100.0%**	**1.05 [0.62, 1.76]**
Heterogeneity: Tau² = 0.18; Chi² = 12.16, df = 3 (P = 0.007); I² = 75%				
Test for overall effect: Z = 0.17 (P = 0.86)				
Test for subgroup differences: Chi² = 0.06, df = 1 (P = 0.80), I² = 0%				

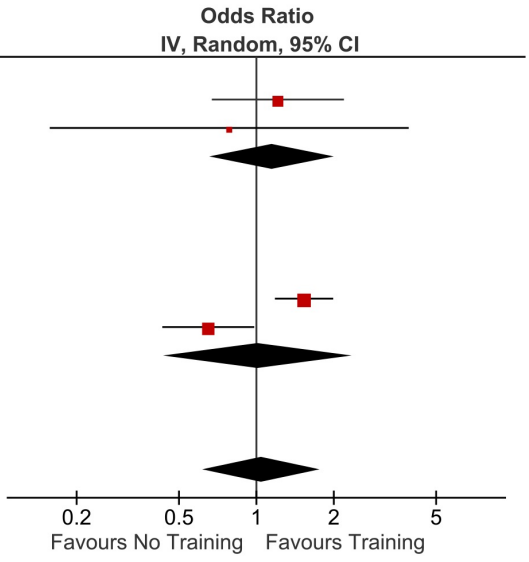


FIGURE 4 (Continued)

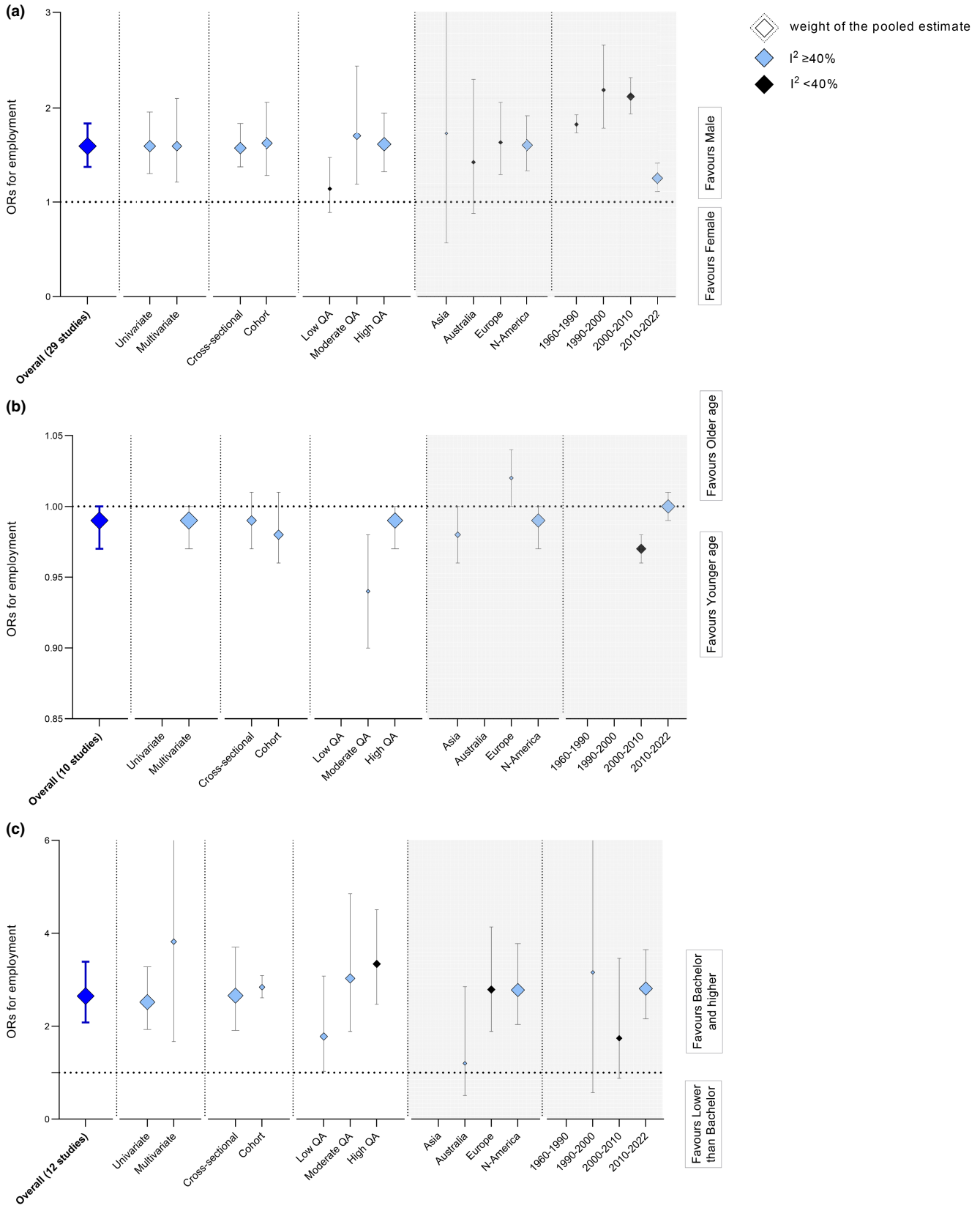


FIGURE 5 Meta-analyses with subgroup analysis on the association between employment status and (a) gender, (b) age, (c) level of education, (d) ethnicity, (e) severity of visual impairment and (f) having additional disability. The diamonds represent the pooled effect sizes (odds ratio [OR]), and the lines represent the 95% confidence interval (CI) around each effect in the subgroup. The size of the diamond reflects the weight attributed to each subgroup from the random-effects analysis. The color of the diamond represents magnitude of heterogeneity (blue: $I^2 \geq 40\%$ heterogeneity levels or no measurement of heterogeneity because 1 study; black: $I^2 < 40\%$). Effect size is statistically significant, if CI not includes or crosses '1'. Predefined subgroups: level of quantitative analysis, study design, level of study quality (QA: quality assessment), studied region, time period of study.

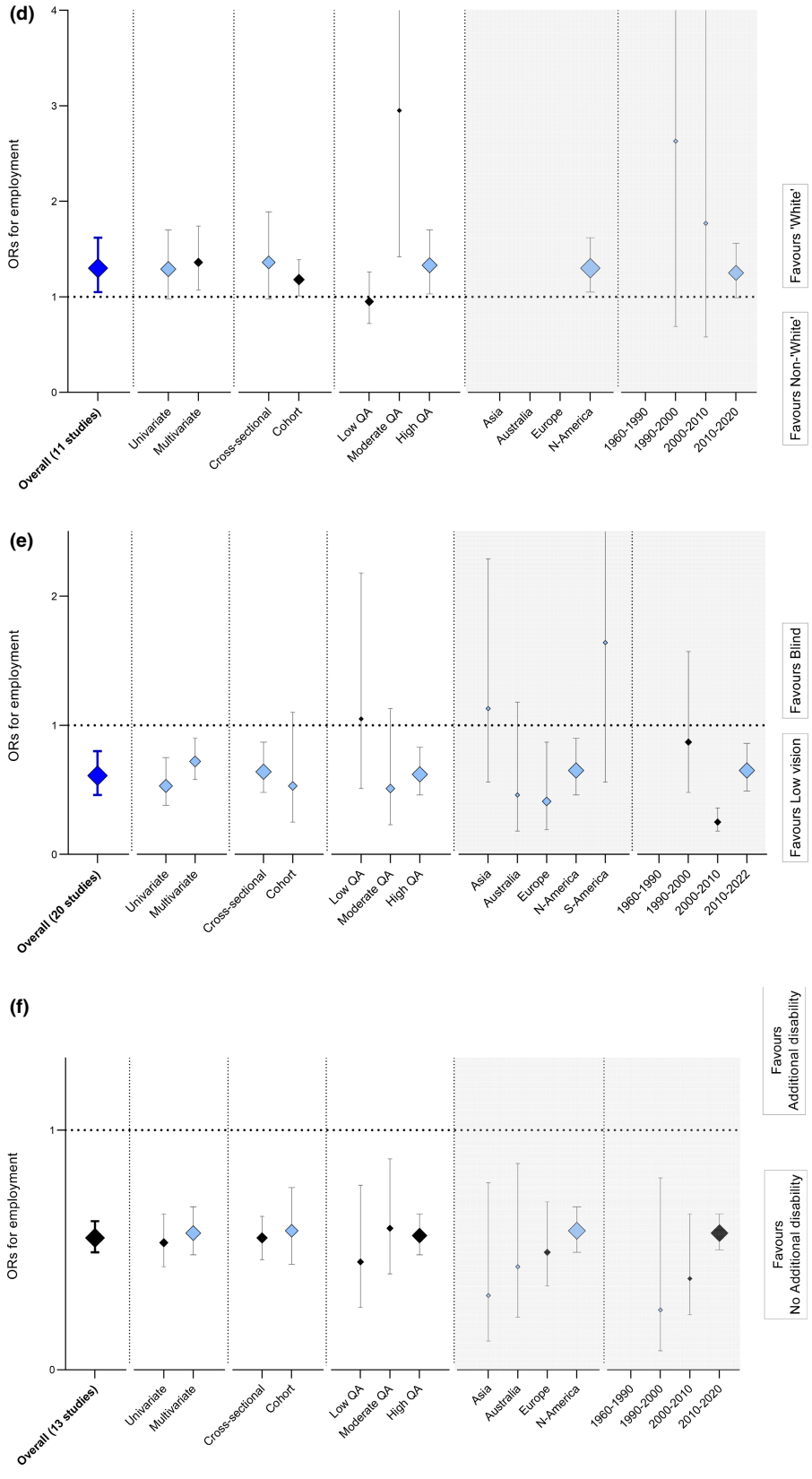


FIGURE 5 (Continued)

studies performed in the most recent time period (2010–2022) showed a higher and statistically significant OR (OR 2.81, 95% CI 2.16 to 3.65, I^2 68%) compared with pooled data from two studies performed in an earlier time period (2000–2010: OR 1.71, 95% CI 0.88 to 3.46, I^2 27%).

Further subgroup analyses showed that high heterogeneity could not be explained by the type of analysis (univariate vs. multivariate) or study design. However, separating high-quality studies from lower quality studies, the heterogeneity disappeared and the magnitude of the OR increased (OR 3.34, 95% CI 2.47 to 4.51, I^2 0%).

Ethnicity

In 11 studies, data were reported on the association between ethnicity and employment, all reported by studies from the United States. Participants described as having 'white' ethnic background had in general equal to higher odds of being employed compared with participants without a 'white' ethnic background. Odds ratios varied between 0.95 and 3.11, with an overall OR of 1.3 (95% CI 1.05 to 1.62). However, heterogeneity of the pooled studies was high (I^2 79%).

Subgroup analyses (Figure 5d) for region or time period as potential moderators were not possible, since the vast majority of studies were from one region (USA) or one time period (2010–2020).

Sensitivity analysis revealed a major reduction in heterogeneity (from 79% to 25%) after removing the study of Crudden et al.[49] and slightly changed the magnitude but not the trend for ethnicity and employment (OR 1.18, 95% CI 1.01 to 1.38, I^2 25%). Subsequently, after removing low-quality studies, the strength or significance of the association did not alter substantially (OR 1.29, 95% CI 1.06 to 1.58, I^2 31%). Furthermore, dividing studies based on univariate or multivariate analysis resulted in a slightly higher OR for multivariate studies, and reduced heterogeneity to zero (OR 1.36, 95% CI 1.07 to 1.74, I^2 0%).

Receipt of financial assistance

In six studies, data were reported on the association between financial assistance and employment showing that having financial assistance resulted in lower odds of being employed compared with no financial assistance, with ORs varying between 0.06 and 0.82 and a pooled OR of 0.38 (95% CI 0.26 to 0.55). However, the heterogeneity of the studies was high (I^2 85%).

Severity of visual impairment

In 20 studies, data were reported on the association between severity of visual impairment and employment, showing that being blind resulted in lower odds of being employed compared with low vision, with ORs varying between 0.10 and 1.64 and a pooled OR of 0.61 (95% CI 0.46 to 0.80). The heterogeneity of the studies was high (I^2 98%).

Subgroup analyses (Figure 5e) revealed that studied region and time period were potential moderators in the association between the severity of visual impairment and employment status. Regarding region, odds for employment and severity of visual impairment remained stable across studies conducted in Australia (OR 0.46, 95% CI 0.18 to 1.18, $n = 1$), Europe (OR 0.41, 95% CI 0.19 to 0.87, I^2 98%) and North America (OR 0.65, 95% CI 0.46 to 0.90, I^2 98%). In contrast, studies conducted in Asia (OR 1.13, 95% CI 0.56 to 2.29, $n = 1$) and South America (OR 1.64, 95% CI 0.56 to 4.79, $n = 1$) showed opposite results, meaning that the odds of being employed were higher for people with blindness versus people with low vision. However, the number of Asian and South American studies was low, and the ORs were not statistically significant. Moreover, time period was also a moderator in the association between the severity of visual impairment and employment status, and generally showed lower heterogeneity levels. For instance, studies conducted in the 2000–2010 time period showed a higher pooled OR for people with low vision, was statistically significant and presented low heterogeneity (OR 0.25, 95% CI 0.18 to 0.36, I^2 15%). On the other hand, the pooled ORs for studies conducted in the 1990–2000 time period showed a smaller favourable pooled OR for people with low vision (OR 0.87, 95% CI 0.48 to 1.57, I^2 0%). Further subgroup analyses showed that the high heterogeneity could not be explained by the type of analysis (univariate vs. multivariate), study quality or study design. Moreover, sensitivity analyses had no major effect on the magnitude of the ORs.

Additional disability

In 13 studies, data were reported on the association between the presence of additional disability (nonvisual) and employment, showing that having an additional disability resulted in lower odds of being employed compared with no additional disability, with ORs varying between 0.25 and 1.87 and a pooled OR of 0.55 (95% CI 0.49 to 0.62). Between-study heterogeneity of the pooled studies was low (I^2 16%). Subgroup analyses (Figure 5f) revealed that the studied region and time period were potential moderators, meaning that the effect of having an additional disability (nonvisual) on being employed varied with region and time period.

Despite the pooled OR being different across regions, the ORs were similar with low to modest heterogeneity. Lowest pooled ORs were found for studies conducted in Asia (OR 0.31, 95% CI 0.12 to 0.78, $n = 1$), followed by Australia (OR 0.43, 95% CI 0.22 to 0.86, $n = 1$) and Europe (OR 0.49, 95% CI 0.35 to 0.7, I^2 0%). But the number of studies in these regions was low. The majority of studies were performed in North America, with a pooled OR of

0.58 (95% CI 0.49 to 0.68, I^2 41%), similar to the overall pooled OR.

Furthermore, subgroup analysis for time period showed somewhat lower pooled ORs for earlier compared with later time periods (1990–2000: OR 0.25, 95% CI 0.08 to 0.80, $n = 1$; 2000–2010: OR 0.38, 95% CI 0.23 to 0.65, I^2 0%; 2010–2020: OR 0.57, 95% CI 0.50 to 0.65, I^2 25%). Subsequently, additional subgroup analysis for the type of analysis (univariate vs. multivariate), study design or study quality revealed that the overall pooled ORs were quite robust.

Mobility aid utilisation

In four studies, data were reported on the association between mobility aid utilisation (e.g., cane, guide dog) and employment, showing that use of a mobility aid resulted in lower odds of being employed compared with no use of a mobility aid, with ORs varying between 0.05 and 1.15, and a pooled OR of 0.35 (95% CI 0.10 to 1.18). However, the pooled OR was not significant and the heterogeneity of the studies was high (I^2 94%).

Receipt of vocational rehabilitation service

In six studies, the association between one or more VR services and (competitive) employment was examined. However, pooling was not possible since these factors lacked our predetermined threshold for meta-analysis of four distinct studies. Nevertheless, we were able to pool for receipt of VR in general. Pooled ORs for the association on receipt of VR and employment were calculated for four studies with ORs ranging from OR 0.65 to 1.53 and a pooled effect OR of 1.05 (95% CI 0.62 to 1.76). The overall OR for being employed and receipt of VR showed variability in the association, was not significant and had high heterogeneity (I^2 75%).

DISCUSSION

This is the first meta-analysis to explore the association between different variables and the employment status of working-age adults with a visual impairment. Pooling results from 55 unique studies with a total of 1,326,091 participants. We found that several sociodemographic and disease-related factors may be associated with employment status in visually impaired people. Better odds for employment were identified for visually impaired people with higher education, male, married/with partner, no additional disability (nonvisual), no financial assistance, no use of a mobility aid, 'white' ethnic background or having less visual impairment. Age and receipt of VR showed no meaningful association.

In this study, we found wide variability in the prevalence of employment between studies, but in general a low employment rate (range 24% to 87%). Despite advances in (vocational) rehabilitation[14,15] and assistive technological developments,[16,17] we observed only a slight increase in the employment rate over time. Compared with populations having other sensory disabilities such as hearing impairment,[94,95] visually impaired people often have lower levels of work participation. This is also found, although less consistent, in comparison with populations with nonsensory disabilities, such as locomotor and mental disabilities.[96–98] For the observed wide variations in employment rates across the included studies, we assume that different factors may have contributed, for example, variations in data collection (e.g., registry databases, surveys), study setting or differences in legislations and employment support programmes across countries. For instance, Jang et al.[69] described a very high employment rate of 87% in their study sample of visually impaired people in Taiwan. Some countries, such as Taiwan, use specific incentive legislation strategies to stimulate work participation for visually impaired people; for example, there are job positions in the massage industry that are made available specifically to the visually impaired target group.

Associations between employment and variables such as education, comorbidity and severity of visual impairment found in the present study are in line with the narrative reviews of Goertz et al.[4] and Lund et al.[34,35] These authors reported that also other variables are associated with employment, such as braille reading level or having received communication training. However, these associations could not be confirmed in our meta-analysis, mainly due to insufficient comparable data to obtain a reliable effect estimate for these variables. In addition, differences in the methodological approach regarding our review resulted in the exclusion of some studies, such as qualitative studies or with variety in employment outcomes (e.g., earnings, functioning in work), which were included in Goertz et al.[4]

In addition, many of our findings on factors associated with employment in visually impaired working-age adults seem to overlap with factors for work participation with chronic diseases in general. Vooijs et al.[99] discovered that some predictors are often seen in different types of disabilities and have described these as disease-generic factors, such as age, gender, coping and more job/work-place-related factors (work autonomy, workplace adaptations and support from colleagues/employer). The level of education is also known to be highly associated with employment outcomes in the general population.[100] Indeed, in this study, a higher education level was a significant predictor that showed higher odds of being employed (OR 1.83 to 2.65), compared with lower levels of education.

When taking a closer look at the identified variables, we made two observations. First, the effect of work-related factors on employment chances in visually impaired people has barely been studied, despite their potential for

predicting work participation,[99] the developments over time regarding type of work (places) and advances in work support (assistive technology, VR). Second, many predictors from our meta-analysis are nonmodifiable, meaning that these factors cannot be changed, but they can be used to identify subgroups that need specific attention or support.

The severity of visual impairment was significantly associated with employment, showing higher odds (OR 1.64) of employment in people with low vision compared with people with blindness. This is in line with other studies that reported lower chances of employment in people with more severe impairments in general,[101] as well as other sensory impairments, such as a hearing impairment.[102] Furthermore, our meta-analysis revealed that use of a mobility aid (e.g., cane, guide dog) was negatively associated with employment (OR 0.35). This might be explained by having a mobility aid could be interpreted as a proxy for greater severity of the impairment.

Both having an additional disability, other than visual, and receipt of financial assistance were negatively associated with employment. Having financial assistance might indicate greater problems in functioning. However, one might argue that certain types of financial assistance are related to work history. Having a work history was associated with better employment chances in some investigations,[55,56,69,83] but due to the limited number of studies, we were not able to confirm that finding. Furthermore, Giesen and Lang[58] reported mixed results on employment, amount of earnings and social benefit, with better odds for employment but lower odds for a return to work when having higher earnings and social benefits.

Ethnicity showed an association with employment in this study. However, two points should be made. First, the association with ethnicity was only reported by studies conducted in the United States; thus, generalisation to other geographical regions is difficult. Second, without adjustment for indicators related to societal context such as education level or socioeconomic status, the conclusion and interpretation regarding the association of ethnicity and employment may be limited.[103] Nevertheless, assessing potential associations between employment and these indicators, and noticing disparities may be important to provide the required services.[104]

Finally, receipt of VR showed no significant association with employment. As the number of studies was low, showed variation in effect sizes and were all performed in the United States, our findings may not be internationally representative. In addition, characteristics of VR (e.g., type and duration of service, type of rehabilitation centre) varied across studies. In a narrative review, Lund et al. reported that some VR service-related variables were related to higher employment outcomes.[34,35] We also observed a higher mean employment rate for samples in a VR setting (Figure S1) compared with samples outside a VR-setting. On the other hand, referral towards VR may be targeting more individuals with greater severity of impairment, which is a group with lower employment chances. More research is warranted and should also focus on the various types of delivered VR services.

The second aim of this study was to explore whether the associations between employment and the identified variables from our meta-analysis changed over time for visually impaired people. For six of the ten variables (age, gender, education level, ethnicity, comorbidity and severity of visual impairment), we were able to explore possible trends over time. Overall, the present study showed that the odds for these six variables on employment slightly varied per time period, meaning that the association with employment may have changed over time. However, the magnitude of these trends was not clear because of low power, which was mainly caused by unequal distribution and low numbers of studies in the different time periods.

Nevertheless, several mechanisms are described in the literature, which may contribute to changes in employment opportunities for visually impaired people over time. First, several general trends occurred on the labour market, especially in high-income countries; for instance, the distribution of female workers has increased over time,[105] and people worked until a higher age due to an increased statutory retirement age[106] and prolonged good health. In addition, in more recent years, greater attention has been paid to preparing children with a visual impairment in their transition for work participation and the labour market by secondary schools or other parties.[36,107,108] Finally, types of work and workplaces have changed over the past decades, leading to different job and task requirements, for example, jobs are less physically demanding, often less manual work is available, work has higher complexity levels and there are more communication skill requirements.[109,110] Positive improvements for people with disabilities include improved technological possibilities at the workplace for visually impaired persons, which contribute to changes in employment in terms of productivity and fulfilling job-tasks.[12,13] But at the same time, several studies reported problems regarding implementation and societal misconceptions (stigmatisation) on assistive technology and accommodations in the workplace.[111,112] Awareness of these developments helps to understand the impact of some factors for visually impaired people being employed over time. Although, in the present review, it was not yet possible to quantify the effect.

Strength and limitations

A strength of this study was the elaborate search strategy and broad inclusion criteria for employment and visual impairment, enabling us to include a large number of studies to perform a meta-analysis. In addition, in contrast to earlier studies, we used standardised statistical methods to quantify employment outcomes. Finally,

methodological quality was addressed by using a standardised method.

Our study also suffered some limitations. First, definitions of visual impairment and employment outcome varied somewhat between studies, and it is difficult to assess in what way this impacted the results. Second, a few study (sub)samples were not only restricted to the working-age population but also included individuals who were not part of the working-age population, for example, retired people and students. However, since this was a minority of studies (12%), we do not believe it had a major impact on the results. Third, by including both cross-sectional and cohort studies, we were able to evaluate differences in study design, which were not apparent in the magnitude of the associations. As the meta-analysis was largely based on cross-sectional studies, causality in the observed associations could not be assessed. Fourth, although we acknowledge that in most countries rehabilitation is available, it is often provided to visually impaired persons before or during their working life. Therefore, some studies were conducted in a VR setting. We neither show an effect for VR in our review, nor do we deny its possible impact as discussed earlier. Finally, interpretation of our pooled results was limited by the generally unexplained substantial heterogeneity across investigated variables. Higher heterogeneity is very common among meta-analyses, which include observational studies. In our meta-analyses, addressing heterogeneity by subgroup analysis could have been affected by uneven covariate distributions among studies, as well as by the limited numbers of studies per subgroup and low statistical power. Furthermore, geographical region and time period proved to be potential moderators for age, gender, severity of visual impairment and comorbidity, but interpretation was hindered by limited information per variable. Most of the included studies were based on data registrations, which provided reliable data based on a large number of observations. However, these studies also limited our exploration possibilities to find out which factors contributed to heterogeneity, such as variations between countries regarding income level, social security legislation, employment support and access to VR.

Recommendations for practice and future research

The synthesis of available evidence could benefit from more well-designed high-quality studies, i.e., cohort studies with long-term follow-up moments, standardisation of definitions for employment outcomes[113] and study population characteristics such as severity of visual impairment definitions.[114] There is a need for identifying other factors that are associated with employment to inform the development of novel interventions. A distinction must be made in modifiable and nonmodifiable factors as these can provide both input for the type of intervention components and the identification of specific (vulnerable) subgroups that can be targeted with interventions. Recognising diversity among persons with disabilities is emphasised in the protocol United Nations Convention of the Rights of Persons with Disabilities in 2006.[11] However, within this target group, there are specific vulnerable subgroups that deserve more attention in order to participate in society, specifically regarding work participation.

Level of education across studies was the most consistent modifiable predictor for employment in visually impaired persons, as confirmed in this study. Therefore, interventions should provide more attention towards education for visually impaired people. Further research is needed on which types of education will actually improve employment chances for visually impaired people. In addition, there should be more focus in future research on the effects of other (modifiable) factors on employment, for example, types of work (place) and conditions with the use of possible (assistive technological) adjustments, ability to perform visual tasks and types of VR services.

REGISTRY

PROSPERO registration number: CRD42021241076.

AUTHOR CONTRIBUTIONS

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CONFLICT OF INTEREST STATEMENT

None.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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