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A Systematic Review of Factors Related to Employment Outcomes for Adults with Visual Impairments

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Abstract

Introduction:

The purpose of this study was to conduct a systematic review of survey-based research on predictors or correlates of employment outcomes for individuals with visual impairments.

Methods:

We used a three-pronged systematic search process to identify quantitative, English, peer-reviewed articles published from 1990 to August 2018 that included analyses of factors related to employment in American adults with visual impairments. We coded all included articles for sample parameters, participant characteristics, quality indicators, and study outcomes.

Results:

Thirteen articles were included in the review. The majority of studies met few, if any, quality indicators. Education level, braille reading medium, and attending integrated or public schools were significantly associated with employment outcomes in most analyses in which those variables were included. Other demographic and disability-related variables were generally not associated with employment or yielded inconsistent results across studies. Psychosocial, service, and miscellaneous variables were included less frequently and were generally not associated with employment or yielded mixed results, with a few exceptions.

Discussion:

Based on our quality indicator ratings, there were consistent methodological weaknesses in this body of literature. Small samples (N=200 or fewer) were prevalent across studies, which limits both generalizability and statistical power. Use of non-representative and non-national samples

further limit generalizability of the results and a lack of longitudinal studies hinders our ability to draw causal inferences. More high-quality employment research is needed, particularly in the areas of braille, transportation self-efficacy, and other psychosocial factors.

Implications for practitioners:

Despite the methodological issues identified in the included studies, results support findings from other systematic reviews regarding the importance of educational advancement for individuals with visual impairments. Practitioners should encourage individuals with visual impairments who do not have a college degree to explore options for postsecondary education.

A Systematic Review of Factors Related to Employment Outcomes for Adults with Visual Impairments

Less than half (43.5%) of working-age adults with visual impairments were employed in 2016 (Kraus, Lauer, Coleman, & Houtenville, 2018), and only 29.5% were employed full-time/full-year (Erickson, Lee, & von Schrader, 2018); in contrast, 76.5% of working-age adults without disabilities were employed (Kraus et al., 2018). Furthermore, among employed individuals, underemployment is still a concern, as workers with visual impairments have lower earnings and higher poverty rates than the general population (Erickson et al., 2018). Given these alarming discrepancies, researchers, policy makers, and practitioners have sought to understand the factors that may heighten or mitigate the risk of un- and underemployment in adults with visual impairments in order to identify particularly high-risk subpopulations as well as potential areas for intervention.

Previous Research Reviews

We located three previous reviews on factors predicting employment and labor force participation outcomes in individuals with visual impairments; two of those focused solely on transition-age youth (Cavenaugh & Giesen, 2012; Nagle, 2001) while one (Goertz, van Lierop, Houkes, & Nijhuis, 2010) focused on the broader working-age population. In that review, Goertz and colleagues reported on 13 quantitative survey studies published between January 1990 and May 2008, six of which involved participants from the United States. These six studies—as well as the seven from other countries—were small cross-sectional studies; of the six U.S. studies, only one involved more than 100 participants.

Goertz and colleagues (2010) noted that many of the studies evidenced sub-optimal methodological quality, particularly regarding their reliance on small sample sizes and

univariate, cross-sectional data analysis. They noted that these limitations may help to account for the varied and inconsistent results seen across many studies and that inadequate statistical power may have suppressed the recognition of meaningful predictors of employment. Additionally, the studies used heterogeneous operational definitions of predictors, another possible reason for the varied and inconsistent findings. Finally, the aggregation of studies from different countries may also account for some of the inconsistency in results, as a variety of socioeconomic, cultural, and political factors, such as education and labor laws, attitudes towards disability, and vocational and disability benefits systems may influence the impact of different factors on employment outcomes.

Despite the high level of noise in their results, Goertz and colleagues (2010) did identify a few factors that were somewhat consistently linked to employment outcomes across studies. Male gender often predicted higher employment while greater severity of visual impairment tended to predict lower rates of employment, with some mixed findings. Higher levels of education also tended to predict better employment outcomes.

Purpose and Aims

Our purpose in this study is to conduct an updated systematic review of survey-based research of factors that predict employment outcomes in people with visual impairments in the United States. This review builds on Goertz and colleagues' (2010) review in several ways. First, this review captures over 10 additional years of research, providing an important update to the literature. Second, by focusing on studies from only one country, we provide more consistent parameters for the results. Third, in addition to examining statistical significance, we also examine effect sizes where reported, providing information on the potential magnitude of a given factor on employment outcomes. Finally, we disaggregate employment outcomes by type (e.g.,

employment status, earnings) to better delineate results between different outcome variables. With that in mind, our aims in the present review are as follows:

1. Systematically summarize the survey-based research on factors related to employment outcomes in American adults with visual impairments from 1990 to August 2018.
2. Assess the methodological quality of this body of literature.
3. Identify consistent, statistically significant and meaningful predictors of employment outcomes in American adults with visual impairments in this body of literature.

Method

Search Strategy

In August 2018, we conducted a three-pronged systematic literature search to identify articles. First, we searched the Academic Search Premier, Academic Search Complete, ERIC, MEDLINE, PSYCINFO, and Psychology and Behavioral Sciences Collection databases using the search string: "(blindness OR "legally blind" OR "vis* impair*" OR "low vision" OR "vision loss") AND ("employ*" OR "work*" or "job*" or "earnings") AND ("predict*" or "correlat*" or "factor*")" at the abstract level. The search yielded 2,627 abstracts (1,603 with duplicates removed).

Next, we conducted targeted searches of specific journals in visual impairment and rehabilitation. We searched *Journal of Applied Rehabilitation Counseling, Journal of Rehabilitation Research and Development, Journal of Rehabilitation, International Journal of Rehabilitation Research, Rehabilitation Counseling Bulletin,* and *Journal of Rehabilitation Administration* using (blindness OR "legally blind" OR "vis* impair*" OR "low vision" OR "vision loss") and *Journal of Visual Impairment & Blindness* using ("employ*" OR "work*" or "job*" or "earnings"). These searches yielded 877 abstracts, most of which were duplicates from

the original database search. We also conducted a hand search of the *Journal of Blindness and Innovation Research*, which yielded 65 abstracts. As the third and final step in the search process, we searched the references of all included articles and Goertz and colleagues' (2010) review.

Article Inclusion

Our inclusion criteria were as follows: (a) published in English; (b) published in a peer-reviewed journal; (c) published in 1990 or later; (d) involved quantitative analysis of survey data (i.e., not Rehabilitation Services Administration Case Service Report [RSA-911] data); (e) included adults with visual impairments as a specific population of analysis; (f) involved only participants from the United States; and (g) included at least one analysis of predictors or correlates of employment or related outcomes (earnings, underemployment, etc.). We chose 1990 as the lower cut-off year for inclusion to reflect passage of the Americans with Disabilities Act of 1990, which greatly enhanced employment protections for people with visual impairments and other disabilities. Because RSA-911 datasets contain unique, population-level data on consumers in the State/Federal vocational rehabilitation system, those studies were analyzed separately (Authors, submitted a). Studies examining only transition-age youth with visual impairments were also analyzed separately (Authors, submitted b), given the unique factors and needs (e.g., school-based services) studied in that population.

Data Extraction and Coding

Both authors independently extracted and coded data from all included articles. If articles included multiple relevant analyses (e.g., one analysis of employment status and one analysis of income), we coded and reported each analysis separately. In cases where the study authors reported both univariate and multivariable analyses or both preliminary and final models for the

same data, we reported only the results of multivariable analyses and final models. After coding, we compared results and resolved all discrepancies through discussion and additional review of the articles. Additionally, we double-checked all data against article text to ensure accuracy. Because all data coded were objective and were checked against the articles in question, we did not calculate inter-rater reliability for the coding.

All articles were coded for (a) sample size; (b) participant demographics (age, gender, race/ethnicity); (c) disability characteristics (severity of visual impairment, age at onset, additional disabilities); (d) employment rate; and (e) sampling frame and method. All analyses were coded for (a) outcome variable, (b) statistical analysis used, and (c) statistical significance and effect size (if reported) for all predictor variables. In addition, we assessed the methodological quality of all studies using a set of eight quality indicators (QIs). The QIs were based on Thompson, Diamond, McWilliam, Snyder, and Snyder's (2005) proposed QIs for correlational research and modified in consultation with experts in the areas of visual impairment and employment. They are as follows:

- Effect sizes: Reported effect sizes for all predictors (final model)
- Confidence intervals: Provided confidence intervals for all effect sizes (final model)
- Multivariable analyses: Used at least one multivariable (i.e., multiple predictor) analysis of outcomes
- Assumptions met: Reported if one or more assumptions of main statistical tests met (final model)
- Longitudinal design: Included variables measured at one time point and outcomes measured at a different time point

- National sample: Involved participants from at least 45 U.S. states
- Representative sample: Used a non-convenience sample
- Power calculation: Provided a power calculation or other accepted sample size metric if using a sample of less than 1,200

Outcome Analysis

In addition to reporting statistical significance, we analyzed effect sizes where reported, allowing us to examine practical significance. Benchmarks for odds ratios (OR) were modified from Rosenthal's (1996) guidelines to include a "negligible" category for ORs of 1.01-1.05 (or 0.95-0.99) and a "very small" category for ORs of 1.06-1.49 (or 0.68-0.94); such modification is recommended in cases where a body of effect sizes can be established (Thompson, 2006). Our other benchmarks for ORs reflected Rosenthal's guidelines, with "small" effects falling between 1.50 and 2.49 (or 0.41-0.67), "medium" effects falling between 2.50 and 3.99 (or 0.25-0.40), and "large" effects being 4.00 or greater (or less than 0.25). We used small, medium, and large benchmarks of 0.2, 0.5, and 0.8 for *d* effect sizes and .01, .06, and .14 for r^2 effect sizes (Cohen, 1988).

Results

Included Studies

Thirteen articles (Bell & Mino, 2013; Bell & Silverman, 2018; Capella-McDonnall, 2005; Cimarolli & Wang, 2006; Cmar, McDonnall, & Crudden, 2018; Crudden & Hanye, 1999; Fireison & Moore, 1998; Hagemoser, 1996; Jo, Chen, & Kosciulek, 2010; Leonard, D'Allura, & Horowitz, 1999; Ryles, 1996; Silverman & Bell, 2018; Wolffe, Roessler, & Schriner, 1992) met inclusion criteria. The articles included 23 main outcome analyses, many consisting of several univariate analyses, resulting in a total of 82 separate analyses of correlates or predictors of

employment outcomes. Articles were predominantly published in three journals: *Journal of Visual Impairment & Blindness* (*n*=6), *Journal of Blindness Innovation and Research* (*n*=3), and *Journal of Vocational Rehabilitation* (*n*=3); one article was published in the *Journal of Applied Rehabilitation Counseling.*

Sample Parameters

The samples used in analyses ranged from 40-691 participants (*M*=224, *SD*=206), although researchers reported demographic information for (larger) samples than the analysis samples in five studies; for example, Bell and Mino (2013) reported demographic information for a sample of 1,056 participants but used a subsample of 577 participants for analyses of predictors of employment. These instances are noted in Table 1. The sample sizes for which demographics were reported ranged from 40-1,153 (*M*=348, *SD*=359). For analysis samples, five studies had less than 100 participants, four had 100-400 participants, and four had more than 400 participants. Five studies included participants from one or two U.S. states. Only three studies included participants from 46 or more states (i.e., national or "near national" samples).

Nine studies included information about the years in which data were collected, which ranged from 1989 to 2016. For studies published between 1992 and 2010, sampling methods included mail (*n*=4); mail plus phone (*n*=2); in-person, from lists of employees (*n*=2); and a multistage, complex sampling design (*n*=1). In the four studies published in 2013 or later, sampling methods included Internet (*n*=2) and Internet combined with other methods (*n*=2). In two studies (Crudden & Hanye, 1999; Fireison & Moore, 1998), researchers recruited only National Industries for the Blind (NIB) employees. For 10 of the remaining 11 studies, researchers reported employment rates for their samples. The overall employment rate ranged from 32-70%, and the full-time employment rate as reported by the study authors ranged from

25-46%. Sample parameters for each study are provided in Table 1, including additional information about sampling frames and sample restrictions.

Participant Characteristics

Of studies that provided an age range (*n*=12), seven analysis samples included only working-age participants (i.e., 65 years or younger). Across studies, the age range of participants was approximately 17-87 years. Women represented 36-64% of samples for which gender was reported (*n*=12). Most samples (*n*=9) were relatively balanced in terms of gender (i.e., 41-60% female). The samples for which race and ethnicity were reported (*n*=11) were predominantly White (43-86%, with only three samples under 60%). Complete race and ethnicity data can be seen in Table 2.

In the majority of studies, researchers reported information about participants' severity of visual impairment (*n*=10) and age at onset of visual impairment (*n*=9). Severity of visual impairment categories varied across studies (see Table 2); for example, some used dichotomous indicators (e.g., blind vs. visually impaired) and others used functional descriptors (e.g., no usable vision, very little usable vision, quite a bit of usable vision). In two studies, all participants had congenital or childhood-onset visual impairment (i.e., birth-2 or birth-6 years). In another study, all participants had adventitious visual impairment (i.e., 18 years or older). In the other six studies that included age at onset estimates, 41-65% of participants had congenital visual impairments.

Percentages of participants with additional disabilities also varied across studies that reported this information (*n*=8). In three studies, 32-57% of participants had one or more additional disabilities. In another three studies, researchers reported estimates for only one type

of additional disability (i.e., physical limitation, health condition, deaf-blindness). In two studies, researchers specifically excluded participants with additional disabilities.

Quality Indicators

The QI ratings for each study are provided in Table 3. Overall, the included studies met an average of 1.85 (*SD*=1.72) out of eight QIs, with a range of zero to six. Ten studies met zero to two QIs; the remaining studies (*n*=3) met three (Hagemoser, 1996), four (Jo et al., 2010), and six (Capella-McDonnall, 2005) QIs. The most commonly met QI was multivariable analyses (*n*=6), followed by assumptions met (*n*=4), and power calculation (*n*=4). The least commonly met QIs were effect sizes (*n*=2), confidence intervals (*n*=1), and longitudinal design (*n*=1).

Statistical Analyses and Outcome Variables

In nine analyses representing six studies, researchers conducted at least one multivariable analysis, most commonly multiple logistic regression (*n*=6). Univariate statistical procedures included chi-square, independent sample t-tests, and ANOVA. In the two studies involving NIB workers, researchers employed MANOVAs for analyses with multiple outcome variables. Bell and Mino (2013) and Bell and Silverman (2018) did not specify the type of statistical analyses used, but their results indicate that they likely used independent sample t-tests, univariate F-tests, and univariate tests of proportions.

The outcome variable of "employment" was conceptualized in various ways: any employment (*n*=6), full-time/full-time or self- employment (*n*=4), competitive employment (*n*=2), and employment level (*n*=1). "Full-time" employment was operationalized in slightly different ways in different studies, with some researchers using a 35- or 40-hour per week cut-off and others not providing an operational definition of "full-time." Other outcome variables examined less frequently were annual earnings/income level (*n*=2), perceived underemployment

(*n*=2), job satisfaction (*n*=1), and unemployment (*n*=1). Outcome variables for the MANOVAs of NIB employees were (a) hours worked per week, hourly wage, job satisfaction, and job tenure; and (b) gross salary, job satisfaction, and work preference.

Factors Related to Employment Outcomes

The following section provides an overview of study variables, their relationships with employment outcomes, and effect sizes (if reported by study authors). See Table 4 for specific information for each study.

Demographic variables. Researchers investigated relationships between age and employment in six studies; age was a significant predictor in two of these studies. Bell and Silverman (2018) found that younger age significantly predicted full-time or self-employment in a univariate analysis with a small effect (*d*=0.37). In contrast, Cmar and colleagues (2018) found that older age significantly predicted full-time employment, although they also found a significant age by transportation self-efficacy interaction effect (see psychosocial variables section for details). Age did not predict earnings in one univariate analysis (Bell & Mino, 2013).

Race/ethnicity variables were included in five analyses across four studies. Cimarolli and Wang (2006) found a significant negative relationship between African American race and employment and a significant positive relationship between White race and employment. The other studies yielded no significant relationships between race/ethnicity and employment or earnings.

Gender was included in four analyses across three studies. Male gender was significantly associated with employment in one univariate analysis (Cimarolli & Wang, 2006) and had a small positive effect on earnings in another (Bell & Mino, 2013). Gender was not significantly

associated with employment in one univariate (Bell & Mino, 2013) and one multivariable (OR=1.83; Capella-McDonnall, 2005) analysis.

Researchers included education level in 10 analyses across eight studies. In seven analyses, education level was positively associated with employment. Effect sizes for education level (where reported) were generally very small or small, but the OR of 1.36 per year of education in Cmar et al. (2018) would equate to a larger effect for more years of education completed (e.g., OR=3.43 for an additional four years of education). Education level did not significantly predict employment in two multivariable analyses (OR=0.76 and 1.12). Additionally, education level had a significant positive effect on earnings in one univariate analysis.

In two studies, researchers examined relationships between school setting and employment outcomes. Leonard and colleagues (1999) found a significant, small, positive relationship between integrated school setting and employment (OR=1.74). Fireison and Moore (1998) found that participants who attended public schools had significantly higher gross salaries than those who attended specialized schools but found no differences in job satisfaction or work preference.

Disability variables. Severity of visual impairment was included in 10 analyses across eight studies, and it was statistically significant in two multivariable analyses. First, persons who are visually impaired were employed in lower-level positions than those who are blind (Leonard et al., 1999). Second, persons with mild vision loss (but not moderate, severe, or profound vision loss) were more likely to work full-time than persons who are totally blind (OR=2.82; Cmar et al., 2018). In the other eight analyses, severity of visual impairment (including functional vision loss) was not significantly associated with employment, unemployment, or earnings.

Researchers included age at onset of visual impairment in six analyses within five studies. Bell and Silverman (2018) found that congenital blindness was associated with full-time or self-employment with a very small effect (OR=1.41). Similarly, Cmar and colleagues (2018) found that age at onset was negatively associated with full-time employment, but it interacted with transportation self-efficacy (details provided in psychosocial variables section). In other studies, age at onset was not significantly associated with any employment-related outcomes.

Secondary disability and health variables were included in four studies. Secondary disability had a small, significant negative relationship with full-time or self-employment in one univariate analysis (OR=0.52; Bell & Silverman, 2018), and it was a medium, non-significant negative predictor of employment in a multivariable analysis (OR=0.39; Capella-McDonnall, 2005). Having a physical limitation did not predict full-time employment in one study (Cmar et al., 2018). In another study, better self-reported health had a significant positive relationship with employment, and activity restrictions had a significant negative relationship with employment (Cimarolli & Wang, 2006).

Relationships between reading medium and employment outcomes were examined in 10 analyses across five studies. In four univariate analyses, researchers found significant associations between braille use and employment with very small to small effect sizes when reported (Bell & Mino, 2013; Bell & Silverman, 2018; Ryles, 1996), but findings regarding reading medium varied in three multivariable analyses. In one analysis, primary reading medium of print significantly predicted employment (OR=1.78; Leonard et al., 1999). In another analysis, braille as a secondary reading medium (i.e., learning braille after childhood) significantly predicted employment with a very small effect (OR=1.44), but braille as a primary reading medium did not (Silverman & Bell, 2018). A third analysis yielded a very small, significant

effect on unemployment for primary braille readers (i.e., a lower unemployment rate; OR=0.76) but not secondary braille readers (Silverman & Bell, 2018). Braille use had a small, significant effect on earnings in one analysis (Bell & Mino, 2013), but it was not significantly associated with income level in another (Ryles, 1996). Finally, both primary braille readers (d=0.38) and secondary braille readers (d=0.24) reported significantly higher job satisfaction (Silverman & Bell, 2018).

Variables related to mobility devices were included in five univariate analyses across two studies. Cane use had a significant relationship with both competitive employment and earnings, with small effect sizes (Bell & Mino, 2013). Mobility aid type was not significantly associated with full-time or self-employment (Bell & Silverman, 2018), but cane type had a small, significant effect on competitive employment and earnings (Bell & Mino, 2013). Descriptive statistics indicated that participants who used long, rigid canes had higher competitive employment rates than those who used other types of canes or no canes, and earnings were highest among participants who used either long canes or no canes.

Psychosocial variables. Psychosocial variables were included in five studies. Employment was significantly positively associated with life satisfaction and friend support, but negatively associated with cynicism, low self-esteem, overprotection, and conflict with social network members. Furthermore, three variables were significantly associated with perceived underemployment: cynicism, Type A behavior, and not receiving encouragement from family and friends. Anxiety was significantly negatively associated with employment in a univariate analysis (Cimarolli & Wang, 2006) but not in a multivariable analysis (Hagemoser, 1996). General self-efficacy was not a significant predictor of employment (OR=1.03; Leonard et al., 1999), but greater transportation self-efficacy predicted full-time employment (Cmar at al.,

2018). Significant interaction effects for transportation self-efficacy indicated that the effect of transportation self-efficacy on employment decreased with age and increased with age at onset; effect sizes for transportation self-efficacy for these interaction effects were very small to small (OR=0.96-2.38), with statistically significant ORs ranging from 1.29-2.38. In one study (Jo et al., 2010), researchers examined different dimensions of acceptance of vision loss in relation to employment; only the "transformation of comparative-status values" scale had a significant effect (OR=1.15 per 1-unit increase). Psychosocial variables that were not significant predictors of employment included depression, obsessiveness, Type A behavior, work motivation, family support, family problems, encouragement from family and friends (OR=1.70), satisfaction with social contact (OR=1.59), and three of the social network variables investigated by Cimarolli & Wang.

Service variables. Researchers examined relationships between VR service variables and employment in two studies (Capella-McDonnall, 2005; Jo et al., 2010). Capella-McDonnall found significant, small to large effects on competitive employment for quality of VR counselor-consumer relationship (OR=2.39), applying for VR services for employment help (OR=3.41), and obtaining a degree through education as a VR service (OR=9.37). Jo and colleagues found that VR client satisfaction had a significant effect on employment (OR=1.06 per 1-unit increase in satisfaction).

Rehabilitation training or service variables were included in three studies (Bell & Mino, 2013; Cimarolli & Wang, 2006; Leonard et al., 1999). Bell and Mino found small, significant effects for receipt of rehabilitation training and type of rehabilitation training on both competitive employment and earnings, but Cimarolli and Wang found that receipt of rehabilitation services was not significantly associated with employment. Receiving more

rehabilitation teaching hours was significantly associated with employment in lower-level positions (Leonard et al., 1999). Of the specific rehabilitation service variables examined by Leonard and colleagues, only technology training significantly predicted employment (OR=2.20); it also predicted employment in higher-level positions.

Miscellaneous variables. In two studies (Bell & Mino, 2013; Bell & Silverman, 2018), consumer organization membership had a small, significant relationship with employment (two univariate analyses) and earnings (one univariate analysis); specific relationships by organization were not reported, but descriptive statistics appear to favor National Federation of the Blind membership. Several other miscellaneous variables were included in only one study apiece. For example, working since onset of disability had a significant, medium effect on competitive employment (OR=3.66; Capella-McDonnall, 2005). Additionally, living in the Midwest region of the United States was a significant predictor of full-time employment compared to living in the Northeast (OR=2.29) and the West (OR=4.24) but not the South (OR not reported; Cmar et al., 2018). Availability of public transportation and public transportation skills were not significant predictors of employment; the extremely large but non-significant effect size (OR=74.70) for public transportation skills reported by Leonard and colleagues (1999) can presumably be attributed to a reporting or typographical error. Other variables that did not significantly predict employment included receipt of financial assistance (OR=0.82), computer skills (OR=1.09), and keyboard skills (OR=1.39).

Discussion

We conducted a systematic review of survey-based U.S. research on factors associated with employment outcomes among individuals with visual impairments. Thirteen articles, published from 1992 to 2018, were included in the review. All analysis sample sizes were less

than 700, which contrasts drastically with the samples of 1,968-16,765 reported in articles that involved analysis of RSA-911 data (Authors, submitted a).

We assessed all studies on eight QIs. Most studies (*n*=10) met 0-25% of the QIs, and only one study (Capella-McDonnall, 2005) met 75% of the QIs. This body of research is generally characterized by inconsistent reporting, extensive use of univariate analyses, and small non-representative, non-national samples. Still, we can draw multiple conclusions from these studies, especially when considering their results alongside results from other studies and systematic reviews.

In general, demographic and disability variables were not significant predictors of employment outcomes, with a few inconsistent exceptions. Education level had a positive effect on employment in seven out of nine analyses and a positive effect on earnings in one additional analysis. This finding provides some additional support for education level as an important predictor of employment outcomes for persons with visual impairments, as found in other systematic reviews (Authors, submitted a,b; Goertz et al., 2010) and a study of VR consumers who are deaf-blind (McDonnall & Cmar, 2018). In most analyses that included reading medium, braille readers had better employment outcomes than print readers, although researchers found higher employment among print readers in one study.

Vocational rehabilitation service-related variables were investigated in only two studies (Capella-McDonnall, 2005; Jo et al., 2010), but they were the two highest quality studies included in this review, one of which was longitudinal. VR service-related variables were generally significant positive predictors of employment, with very small to large effect sizes. Obtaining a degree through education as a VR service had the largest overall effect on employment; VR consumers who received education as a VR service and obtained a degree had

approximately nine times higher odds of obtaining competitive employment at case closure than those who did not receive this service. This finding provides further support for the importance of higher education for individuals with visual impairments.

Technology training, consumer organization membership, working since onset of disability, U.S. census region, and some psychosocial variables (e.g., transportation self-efficacy, self-esteem, cynicism, and life satisfaction) were significantly associated with employment outcomes, but these variables were studied infrequently; thus, no definitive conclusions can be drawn about them. In general, other psychosocial, general rehabilitation, and miscellaneous variables were not associated with employment or yielded mixed results.

Limitations of the Literature

The studies in this review typically relied on small, non-representative, and non-national samples. Many samples were from particular agencies or states, and were often drawn from a single location or recruitment source. These limited sampling frames inherently limit the generalizability of the results, as such geographically-restricted convenience samples are unlikely to represent the broader population of individuals with visual impairments. For example, participants who are totally blind were over-represented in several of the samples in the present study (Bourne et al., 2017). The availability of the Internet as a means of recruitment may help alleviate this issue; the four most recently published studies in this review all used the Internet, in whole or in part, for recruitment and had larger sample sizes than many of the earlier studies, in which participants were recruited by other means. These later, Internet-based studies also represented the only three studies in the review to have participants from 45 states or more (i.e., “national” samples). However, online samples may also exclude individuals who do not have

Internet access or do not know how to use assistive technology to access online surveys; thus, when feasible, researchers may wish to include both online and telephone response options.

Small sample sizes also limit the statistical power of analyses, increasing the likelihood that meaningful relationships between predictor variables and employment may have been overlooked due to being statistically non-significant. Additionally, most authors did not report effect sizes for all predictors; reporting effect sizes would allow researchers to note non-significant but potentially practically meaningful results (Thompson, 2006). For example, if a researcher found that orientation and mobility (O&M) skills were related to employment at p=.07, d=0.75 in a sample of 50 participants, the medium effect size would indicate a potentially meaningful relationship despite the non-significant result. Similarly, effect sizes allow researchers to assess the relative *magnitude* of each predictor on employment; if two predictors are statistically significant at p<.05, but one has an effect size of d=0.25 and the other has an effect size of d=0.60, the variable with the effect size of d=0.60 has a much more substantial effect on employment despite them both being statistically significant. Universal reporting of effect sizes in this body of literature would allow for better, more detailed understanding of what variables have a truly substantial effect on employment outcomes in people with visual impairments. Such information could help guide more effective changes in research, policy, and practice.

Contributions of the Literature

Despite the potential drawbacks of survey research, it does provide some opportunities for expanded research questions that using archival datasets, such as RSA-911, does not. Namely, it allows researchers to examine variables of interest, such as reading medium, age at onset of visual impairment, and O&M skills, that are not present in the RSA-911 dataset.

Additionally, the use of survey methodology allows researchers to include participants who may not be involved the public VR system and thus would not be included in the RSA-911 data. Such individuals may provide important and novel data on independent employment outcomes that would not be captured in archival data. Thus, the use of survey research, particularly with efforts to increase methodological quality (e.g., larger, representative samples, multivariable analyses) has potential to considerably expand our knowledge of the factors that can impact employment in people with visual impairments, including and beyond those variables included in the RSA-911 data.

Limitations of This Review

The primary limitation of this review is our inclusion of only peer-reviewed studies, which may have excluded studies published in other formats, such as technical reports, dissertations, and association briefs. Although the inclusion of only peer-reviewed articles allowed for the systematizing of the search and ensured that all articles met a minimum standard of refereed review, it may somewhat narrow the scope of our findings (Hartling et al., 2017). Another limitation of our review is the exclusion of studies published prior to 1990. Although this limitation kept the corpus of studies relatively current and within the Americans with Disabilities Act timeline, it may have resulted in exclusion of interesting findings from older studies. A final limitation of this review was its restriction to U.S. samples. Despite the potential confound of different socioeconomic, cultural, and legal environments, studies of employment in people with visual impairments from other countries may provide potentially useful information.

Relationship to Other Reviews

Compared to Goertz and colleagues (2010), we found a considerably expanded body of studies conducted in the United States, which suggests that scholarly attention to factors that

impact employment in people with visual impairments is growing. Similar to Goertz et al.'s findings, many of the studies in our review were hampered by small sample size and variation in study quality, although, as noted previously, sample sizes tend to be larger in more recently published studies. These limitations may help to explain the somewhat inconsistent results across studies found in both the present review and Goertz and colleagues' review. For example, in the present review, severity of visual impairment was not typically a significant predictor of employment outcomes whereas legal blindness was frequently significantly related to lower employment in analyses of the RSA-911 data (Authors, submitted a). This difference is likely due to the fact that researchers using RSA-911 data have very large, representative national samples and thus are better able to detect small but meaningful differences in outcomes. Additionally, their common use of multivariable analyses allows researchers using larger datasets to better detect statistically significant effects that may be obscured by shared variance in univariate analyses. The use of consistent operational definitions across RSA-911 studies (e.g., the consistent categorization of legal blindness v. other visual impairment) may have also contributed to the more consistent findings in that review.

Finally, only one study in this review used longitudinal data; the lack of longitudinal studies in this review, Goertz and colleagues' (2010) review, and our review of RSA-911 studies (Authors, submitted a) greatly hinders our ability to understand the temporal or causal relationships between study variables and employment outcomes, as causation cannot be definitively inferred from cross-sectional studies. The availability of longitudinal data on transition-age youth with visual impairments has allowed us to better understand the factors that precede employment in that population (Authors, submitted b), but such data are generally lacking in the adult population. More longitudinal research on employment outcomes in adults

with visual impairments is needed to better understand true predictors—not just correlates—of employment.

Implications for Research and Practice

In several studies, researchers found that the use of braille was positively related to employment outcomes. Furthermore, qualitative findings indicate that acceptance of braille may be associated with self-acceptance, feelings of competence, and self-identity as a person who is blind (Schroeder, 1996). Taken together, these findings support the need for future research and intervention regarding braille education and training as a potential psychosocial and employment intervention, particularly for individuals with late-onset visual impairments, who have been found to use braille less frequently (Goudiras, Papadopoulos, Koutsoklenis, Papageorgiou, & Stergiou, 2009) and have slower braille reading speed (Oshima, Arai, Ichihara, & Nakano, 2014) than individuals with early onset visual impairment. Use of a group approach may be a promising way to motivate adults to learn braille, while providing added benefits of social and emotional support (Farrow, 2015). Similarly, researchers also found some support for transportation self-efficacy as a potential positive correlate of employment, again providing potential future guidance for research and intervention. Finally, in some studies, researchers found potential links between some psychosocial factors, such as anxiety and social conflict, and lower employment; however, because few studies included these variables, we can draw only tentative conclusions about their importance. It is also possible that the stress of chronic un- and underemployment could lead to greater psychosocial difficulties, again highlighting the need for more longitudinal research on this topic.

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Table 1

Sample Parameters

Study	Sample size	Sampling frame	Data year(s)	Sampling method	Sample restrictions	Employment rate (overall)	Employment rate (full-time)
Bell & Mino (2013)	1,056[a] 577[b]	Broad internet and community sample of adults with visual impairments	2011	Internet, email, mail, word of mouth, flyers	Received VR services and case closed[b]	51%	37%
Bell & Silverman (2018)	1,153[a] 691[b] 1,122[c]	Broad internet and community sample of adults with visual impairments	2016	Internet, study announcements	Received VR services and case closed[b]	50%	33%
Capella-McDonnall (2005)	181	LSVRSP (VR agencies in 32 U.S. states)	1995-2000	Multistage, complex sampling design[d]	Not competitively employed at VR application	NR	NR
Cimarolli & Wang (2006)	97	Adult applicants at a vision rehabilitation agency in New York during a one-year period	NR	Phone, mail	No cognitive, speech, or hearing impairments; onset of vision loss at 18+ years old	32%	25%
Cmar, McDonnall, & Crudden (2018)	327	Broad internet sample of adults with visual impairments and research registry members	2013-2014	Internet		64%	46%
Crudden & Hanye (1999)	431	Employees of 24 NIB-associated industries	1994	In-person (list of direct labor workers)	Vision loss for 3+ years; onset of vision loss from birth-2 or 5+ years old	100%[e]	NR

Fireison & Moore (1998)	270	Employees of 24 NIB-associated industries	1994	In-person (list of direct labor workers)	Legally bind by age 6	100%[e]	NR
Hagemoser (1996)	118[a] 68[b] 40[f]	Nebraska Services for the Visually Impaired and Iowa Department for the Blind	NR	Mail	Employed full-time or unemployed for at least one year; no additional disabilities	36%	36%
Jo, Chen, & Kosciulek (2010)	128	Former Michigan Commission for the Blind VR consumers	2003-2004	Mail	Excluded homemaker closures	70%	NR
Leonard, D'Allura, & Horowitz (1999)	167[a] 91[b] 63[g] 57[f]	Persons referred to vocational placement program at New York Lighthouse	1989-1994	Phone, mail		42%	NR
Ryles (1996)	74	Washington State Library for the Blind and Physically Handicapped patrons	NR	Mail	No additional disabilities; legally blind by age 2	42%	34%
Silverman & Bell (2018)	443[a] 419[b]	Broad internet sample of adults who are legally blind and research registry members	2012	Internet		55%	36%
Wolffe, Roessler, & Schriner (1992)	76	ACB members	NR	Mail		57%	42%

Note. VR=vocational rehabilitation; LSVRSP=Longitudinal Study of the Vocational Rehabilitation Services Program; NR=not reported; NIB=National Industries for the Blind; ACB=American Council of the Blind.
[a]Demographics only. [b]Employment analyses only. [c]Employment rate sample. [d]Secondary data analysis. [e]All NIB employees. [f]Underemployment analysis sample. [g]Employment level analysis sample.

Table 2
Participant Characteristics

Study	Age (in years)	Female	Race/ethnicity	Severity of visual impairment	Age at onset (in years)	Additional disabilities
Bell & Mino (2013)	18-87 *M*=46.47 (*SD*=13.81)	56%	79% White 9% African American 5% Hispanic 3% Asian 3% other/mixed 1% AI/AN <1% H/PI	67% blind 34% visually impaired	NR	NR
Bell & Silverman (2018)	18-89 (restricted to 18-70 for employment analyses) *M*=46.06 (*SD*=15.22)	58%	73% White 9% African American 6% Hispanic 5% NR 4% Asian 3% other 1% AI/AN <1% H/PI	75% blind 25% visually impaired 61% no usable vision 37% has usable vision	59% congenital 42% adventitious	32%
Capella-McDonnall (2005)	65 or younger	47%	73% White 14% African American 10% Hispanic 3% Asian/Pacific Islander 1% AI/AN	28% blind/legally blind	NR	57%
Cimarolli & Wang (2006)	25-64 *M*=47 (*SD*=9.86)	64%	43% White 35% African American 16% Hispanic 5% Asian 1% AI/AN	NR	All 18+	NR

Cmar, McDonnall, & Crudden (2018)	18-65 *M*=45.89 (*SD*=12.27)	NR	78% White 10% African American 6% Hispanic 3% Asian 3% mixed/multiracial 1% AI/AN	40% totally blind 18% profound vision loss 28% moderate/severe vision loss 14% mild vision loss	41% birth	44% physical limitation
Crudden & Hanye (1999)	20-77 *M*=44.96	36%	59% White 5% Hispanic	30% no usable vision 40% very little usable vision 30% quite a bit of usable vision	53% birth-2 46% 5+	45%
Fireison & Moore (1998)	NR	39%	66% White 30% African American 4% Hispanic 4% other	26% no usable vision 35% very little usable vision 39% quite a bit of usable vision	100% birth-6	NR
Hagemoser (1996)	20-62 Employed: *M*=42.90 (*SD*=8.18) Unemployed: *M*=46.47 (*SD*=11.79)	Employed: 43% Unemployed: 44%	NR	NR	NR	0%
Jo, Chen, & Kosciulek (2010)	18-63 *M*=41.8 (*SD*=5.9)	53%	76% White 24% African American	NR	NR	NR
Leonard, D'Allura, & Horowitz (1999)	18-79 *M*=41.1 (*SD*=13.6)	44%	47% White 27% African American 17% Hispanic 5% Asian 5% other	84% visually impaired[a] 16% blind	43% birth 39% gradual 18% sudden	28% health condition

Ryles (1996)	18-55	57%	NR	100% legally blind 57% no light perception to light perception	100% birth-2	0%
Silverman & Bell (2018)	18-83 (restricted to 18-64 for employment analyses) *M*=44.66 (*SD*=14.46)	60%	79% White 6% other/mixed 5% Hispanic 4% NR 3% African American 3% Asian 1% AI/AN	63% totally blind 37% visually impaired[b]	65% birth-2 12% 2-18 22% 18+	NR
Wolffe, Roessler, & Schriner (1992)	17-71 *M*=44	41%	86% White 4% African American 4% Asian 4% Hispanic 3% AI/AN	65% visually impaired 32% totally blind 3% deaf-blind	47% congenital 53% adventitious	3% deaf-blind

Note. Percentages may not equal 100% due to rounding. AI/AN=American Indian/Alaska Native; H/PI=Hawaiian/Pacific Islander; NR=not reported.

[a]Original terminology: *partially sighted.* [b] Original terminology: *partially blind*.

Table 3
Quality Indicators (QIs)

Study	ES	CI	MA	AM	LD	NS	RS	PC	QIs met
Bell & Mino (2013)	N	N	N	N	N	Y	N	N	1
Bell & Silverman (2018)	N	N	N	N	N	Y	N	N	1
Capella-McDonnall (2005)	Y	Y	Y	N	Y	N	Y	Y	6
Cimarolli & Wang (2006)	N	N	N	N	N	N	N	N	0
Cmar, McDonnall, & Crudden (2018)	N	N	Y	N	N	Y	N	N	2
Crudden & Hanye (1999)	N	N	N	N	N	N	Y	Y	2
Fireison & Moore (1998)	N	N	N	N	N	N	Y	N	1
Hagemoser (1996)	N	N	Y	Y	N	N	N	Y	3
Jo, Chen, & Kosciulek (2010)	Y	N	Y	Y	N	N	N	Y	4
Leonard, D'Allura, & Horowitz (1999)	N	N	Y	Y	N	N	N	N	2
Ryles (1996)	N	N	N	N	N	N	N	N	0
Silverman & Bell (2018)	N	N	Y	Y	N	N	N	N	2
Wolffe, Roessler, & Schriner (1992)	N	N	N	N	N	N	N	N	0
Total (studies meeting each QI)	2	1	6	4	1	3	3	4	

Note. ES=Effect sizes; CI=Confidence intervals; MA=Multivariable analyses; AM=Assumptions met; LD=Longitudinal design; NS=National sample; RS=Representative sample; PC=Power calculation; Y=yes; N=no.

Table 4

Study Outcomes

Study	Outcome variable	Statistical analysis	Predictors and effect sizes (by category)				
			Demographic	Disability	Psychosocial	Service	Misc.
Bell & Mino (2013)	Annual earnings	NR (univariate)	Age: nr *Education level: 0.14 *Male gender: 0.03 Race/ ethnicity: nr	*Braille reader: 0.03 *Cane type: 0.05 *Cane use: 0.01 Severity of visual impairment: 0.01		*Rehab training (once)[a]: 0.04 *Rehab training (type): 0.02	*Consumer organization membership: 0.02
Bell & Mino (2013)	Competitive employment	NR (univariate)	Age: nr *Education level: 0.08 Male gender: nr Race /ethnicity: nr	*Braille reader: 0.02 *Cane type: 0.03 *Cane use: 0.01 Severity of visual impairment: 0.00		Rehab training (any): 0.00 *Rehab training (once)[a]: 0.02 *Rehab training (type): 0.01	*Consumer organization membership: 0.02
Bell & Silverman (2018)	Full-time or self-employment	NR (univariate)	*Age (younger): 0.37				
Bell & Silverman (2018)	Full-time or self-employment	NR (univariate)	*Education level: nr	*Additional disabilities: 0.52 *Age at onset (congenital): 1.41			*Consumer organization membership: 1.50

				*Braille reader (at least once a week vs. less/never): 1.24 Braille reader (< once a week vs. never): nr Mobility aid type: nr			
Capella-McDonnall (2005)	Competitive employment	Multiple logistic regression	African American[b]: 0.81 Age: 0.98 (per 1-year increment) Education level: 1.12 Male gender: 1.83 Other race[b]: 1.00	Legally blind[c]: 0.37 Secondary disability: 0.39		*Applied for VR services for employment help: 3.41 *Education as a VR service (got a degree vs. not received): 9.37 Education as a VR service (not received vs. received): 0.88 *Quality of counselor-consumer relationship: 2.39	Financial assistance: 0.82 *Worked since onset of disability: 3.66
Cimarolli & Wang (2006)	Employment	Chi-square	*African American: nr (neg) Hispanic: nr *Male gender: nr (pos) *White: nr (pos)		*Conflict with social network members: nr (neg) Social network did not understand independence: nr	Rehab services: nr	

					Social network underestimated capability: nr Social network underestimated limitations: nr		
Cimarolli & Wang (2006)	Employment	Independent sample t-test	Age: nr *Education: nr (pos)	*Activity restrictions: nr (neg) Functional vision loss: nr *Health: nr (pos)	*Anxiety: nr (neg) Depression: nr Family support: nr *Friend support: nr (pos) *Life Satisfaction: nr (pos) *Overprotection: nr (neg)		
Cmar, McDonnall, & Crudden (2018)	Full-time employment (35+ hours per week)	Multiple logistic regression	*Age: nr (pos) *Education level: 1.36 (per year completed) Minority status: nr	*Age at onset: nr (neg) *Mild vision loss[d]: 2.82 Moderate/severe vision loss[d]: nr Physical limitation: nr Profound vision loss[d]: nr	*Transportation self-efficacy: nr (pos) *Transportation self-efficacy*Age: neg *Transportation self-efficacy*Age at onset: pos	!VR services	*Midwest (vs. Northeast): 2.29 Midwest (vs. South): nr (neg) *Midwest (vs. West): 4.24 Public transportation available: nr
Crudden & Hanye (1999)	Hours worked per week, hourly wage, job satisfaction, job tenure	MANOVA		Age at onset: nr			

Fireison & Moore (1998)	Gross salary, job satisfaction, work preference	MANOVA	*Type of school: nr <u>Follow-up analyses:</u> *Gross salary* Public school (vs. both public and specialized): nr *Public school (vs. specialized): nr Specialized school (vs. both public and specialized): nr *Job satisfaction* Type of school: nr *Work preference* Type of school: nr	
Hagemoser (1996)	Full-time employment for at least one year	Stepwise forward-inclusion discriminant analysis	*Education level: nr (pos)	!Anger Anxiety: nr *Cynicism: nr (neg) !Depression Family problems: nr *Low self-esteem: nr (neg) Obsessiveness: nr !Social discomfort Type A behavior: nr

Hagemoser (1996)	Perceived under-employment	Independent sample t-tests			Anger: nr Anxiety: nr *Cynicism: nr Depression: nr Employability: nr Family problems: nr Low self-esteem: nr Obsessiveness: nr Social discomfort: nr *Type A behavior: nr		
Jo, Chen, & Kosciulek (2010)	Employment	Multiple logistic regression		<u>Acceptance of vision loss subscales:</u> !Containment of disability effects !Enlargement of scope of values !Subordination of physique *Transformation of comparative-status values: 1.15 (per 1-unit increase)		*VR client satisfaction: 1.06 (per 1-unit increase)	
Leonard, D'Allura, & Horowitz (1999)	Employment	Multiple logistic regression	Education level: 0.76 *Integrated school setting: 1.74	!Age at onset *Primary reading medium (print): 1.78 !Visual acuity	Encouragement from family and friends: 1.70	!Academic skills training !Clerical skills training	Computer skills: 1.09 Keyboard skills: 1.39

				!Visually impaired[e]	Satisfied with social contact: 1.59 Self-efficacy: 1.03 Work motivation: 1.00	!Low vision services Low vision services hours: 0.65 !O&M/rehab teaching !O&M hours !Rehab teaching hours !Services received (hours) !Services received (number) *Technology training: 2.20 !Technology training hours !Vocational placement services	!Number of people in household Public transportation skills: 74.70
Leonard, D'Allura, & Horowitz (1999)	Employment level	Hierarchical multiple regression	*Education level: nr (pos) !Integrated school setting	!Age at onset !Primary reading medium (print) !Visual acuity *Visually impaired[e]: nr (neg)	!Encouragement from family and friends !Satisfied with social contact !Self-efficacy !Work motivation	!Academic skills training !Clerical skills training !Low vision services !Low vision services hours O&M/rehab teaching: nr (pos) !O&M hours	Computer skills: nr (pos) Keyboard skills: nr (neg) !Number of people in household !Public transportation skills

						*Rehab teaching hours: nr (neg) !Services received (hours) !Services received (number) *Technology training: nr (pos) !Technology training hours Vocational placement services: nr (pos)	
Leonard, D'Allura, & Horowitz (1999)	Perceived under-employment	Hierarchical multiple regression	!Education level !Integrated school setting	Age at onset (birth): nr (pos) !Primary reading medium (print) !Visual acuity !Visually impaired[e]	*Encouragement from family and friends: nr (neg) !Satisfied with social contact !Self-efficacy !Work motivation	!Academic skills training !Clerical skills training !Low vision services !Low vision services hours !O&M/rehab teaching O&M hours: nr (pos) Rehab teaching hours: nr (pos) !Services received (hours) !Services received (number)	!Computer skills !Keyboard skills Number of people in household: nr (pos) !Public transportation skills

				!Technology training !Technology training hours !Vocational placement services
Ryles (1996)	Employment	Chi-square	*Primary reading medium (braille): nr (pos) Visual acuity: nr	
Ryles (1996)	Full-time (40+ hours per week) vs. part-time employment	Chi-square	*Primary reading medium (braille): nr (pos)	
Ryles (1996)	Income level	Chi-square	Primary reading medium (braille): nr	
Silverman & Bell (2018)	Employment	Multiple logistic regression	Age at onset: nr Primary braille reader[f]: nr *Secondary braille reader[g]: 1.44 Severity of visual impairment: nr	
Silverman & Bell (2018)	Job satisfaction	ANOVA	*Primary reading medium: sig, nr	

				Planned contrasts: *Primary braille reader[f]: *d*=0.38 *Secondary braille reader[g]: *d*=0.24
Silverman & Bell (2018)	Unemploy-ment	Multiple logistic regression		Age at onset: nr *Primary braille reader[f]: 0.76 Secondary braille reader[g]: nr Severity of visual impairment: nr
Wolffe, Roessler, & Schriner (1992)	Employment	Chi-square	Age: nr *College degree: nr (pos) High school degree or less: nr *Some college but no degree: nr (neg)	Severity of visual impairment: nr

Note. *=statistically significant; !=not included in final model/analysis; nr=not reported; rehab=rehabilitation; VR=vocational rehabilitation; neg=negative; pos=positive; O&M=orientation and mobility.
[a]Reference group=4+ times. [b]Reference group=White. [c]Reference group=visually impaired. [d]Reference group=totally blind. [e]Described as "partially sighted" in the article; reference group=totally blind. [f]Reference group=secondary or non-braille readers. [g]Reference group=non-braille reader.