



Current Status of Evidence-Based Practices to Enhance Employment Outcomes for Transition Age Youth and Adults on the Autism Spectrum

Mary J. Baker-Ericzén^{1,2,3,4} · Roxanne ElShamy⁴ · Rebecca R. Kammes⁵

Accepted: 1 December 2021 / Published online: 22 February 2022

© The Author(s), under exclusive licence to Springer Science+Business Media, LLC, part of Springer Nature 2022

Abstract

Purpose of Review This review provides a highlight of existing evidence-based practices and community support systems that exist to enhance employment outcomes for autistic transition-age youth (TAY) and adults. An update is provided on the current status of these programs and the impact they are having on employment outcomes for this population.

Recent Findings Many programs exist that prove to be efficacious in improving employment outcomes. These programs can be categorized as vocational rehabilitation service system level interventions, provider and consumer level interventions targeting skills related to employment, and consumer level interventions delivered within community vocational rehabilitation or education settings. A more recent increase in programs is consistent with multiple research and policy calls for amplified programming in this area.

Summary Despite these recent increases, there is still a need to further develop effective programming to support employment outcomes as the growing autistic population age into adulthood. Community-based research and practice should continue to be developed and tested.

Keywords Autism · Adults · Transition age youth · Vocational rehabilitation · Evidence-based practices · Employment

Introduction

The population of adults on the autism spectrum (AS) has increased significantly over recent decades, with attention seldom focused on AS beyond adolescence [1]. As

the prevalence of AS rises, so does the number of autistic adults looking to enter the workforce [2]. In fact, about 50,000–80,000 AS students exit high school annually [3], giving rise to a rapidly growing transition age youth (TAY) population [4]. The coming decade is expected to see about one million autistic youth enter adulthood, and history suggests that obstacles abound [5•].

This increased TAY population is experiencing a concerning pattern in employment outcomes, with only 4–11% of autistic young adults competitively employed [6–9]. One study found that only 58% of autistic young adults (ages 21–25) were employed for any amount of time and pay [4]. The outlook continues to be bleak, with over 66% of autistic TAY failing to transition into postsecondary educational institutions or employment shortly after leaving high school, with 50% lacking employment and 70% without higher education years after graduation [10].

For the population of middle-aged autistic adults, unemployment is also a staggering problem. Estimates remain grim, suggesting that up to 80% of autistic adults are unemployed [11] and these unemployment rates are higher than those seen in any other disability [12]. These rates go against

This article is part of the Topical Collection on *Autism Spectrum Disorders*

✉ Mary J. Baker-Ericzén
mbakerericzen@sdsu.edu

¹ Department of Administration, Rehabilitation and Post-Secondary Education, San Diego State University, San Diego, CA, USA

² Interwork Institute, 6367 Alvarado Court, Suite 350, San Diego, CA 92120, USA

³ Child and Adolescent Services Research Center, San Diego, CA, USA

⁴ Intricate Mind Institute, San Diego, CA, USA

⁵ Department of Counseling, Educational Psychology, and Special Education, Michigan State University, East Lansing, MI, USA

the desires and intellectual capacity of autistic people to perform many work-related duties. It has been shown that autistic adults without intellectual disability are three times more likely to be unemployed than those with intellectual disability [7]. Autistic adults with college degrees still confront employment problems [13]. Employment statistics can also be misleading and misrepresentative. One study found that of the 20% of autistic men in their sample that held jobs, half of these individuals worked in sheltered employment settings [6].

Employment plays a vital role in the quality of life and identity of an individual [14, 15] and thus should be available to all. Unemployment has been shown to negatively impact individual mental health and functioning [16]. There are also implications for society as unemployment costs represent a productivity loss of \$38 billion each year [17]. Society would benefit greatly from the talents of autistic individuals through increased employment and career pathways [18] along with increased tax contributions and reductions in long-term government-funded programs [19]. Current employment trends for autistic people point to increased detrimental personal and societal losses if more targeted, evidence-based vocational services aimed at improving employment outcomes are not made available [20].

In this article, we highlight existing evidence-based practices (EBPs) and present new community-derived practices designed to enhance employment outcomes for autistic TAY and adults. Interventions were chosen and organized based on both employment-related skills targeted and/or use within community vocational rehabilitation (VR) services. Descriptions of VR services and each of the selected interventions are provided along with brief mention of community-derived practices. The objective is not to conduct a systematic review (refer to Hedley et al. [21] and Scott et al. [22] for systematic reviews) but rather to provide information on the current status of EBPs and community programs to enhance employment. We conclude with a call to action for expanding services intervention research to both develop and test programs. This could establish community ready EBPs that can be swiftly scaled up and made accessible within community VR services.

Vocational Rehabilitation Service System and Employment Outcomes

In the State-Federal Vocational Rehabilitation (VR) system, as it is called in the USA, eligibility for employment services is determined based on disability and the desire for employment. All services are individualized and aimed at finding and maintaining employment [23]. Federal funding for VR agencies is provided through the Rehabilitation Services

Agency, while state governments match the federal funds at a 21% rate [24]. Services are aimed to enhance competitive integrated employment.

With the rise in the population of autistic adults, there has been a subsequent rise in the use of VR services. Autistic individuals in the VR system have doubled in cases every 5 years since 2000 [25]. However, employment rates have not changed with use [26]. One study [27] explored the effects of VR Services on autistic adults. These researchers found that overall, VR services are scarce. However, when received, the services did increase the chance of employment, and frequent use (more than one of the six core services) resulted in 80% employed. These findings are particularly relevant as 50% of autistic people received only one service [27]. Studies have shown that VR services that focus on job skills preparation as opposed to job placement have a much better success rate in terms of post-VR employment in autistic adults [28]. There has also been an increasing amount of evidence suggesting that general vocational counseling can have a positive effect on autistic individuals' employment and life planning, yet most VR services do not provide counseling [29].

The main VR services used with autistic populations are supported employment and customized employment. Supported employment provides direct, individualized support to an individual with a significant disability within a competitive employment or an integrated employment setting, on a short-term basis, working towards full independent competitive employment [30]. "Customized employment, for an individual with a significant disability, is based on an individualized determination of the strengths, needs, and interests of the individual, designed to meet the specific abilities of the individual with a significant disability AND the business needs of the employer, and carried out through flexible strategies" [31]. Multiple past studies found that supported employment increases work outcomes, skills, and quality of life when used for AS individuals [32–34]. Yet, more recent research suggests that VR-supported employment services are less than optimal for AS individuals [20]. Comprehensive reviews on supported employment interventions for AS adults found studies to be of poor quality and focused on "on-the-job" supports, providing only general job coaching as the intervention [35]. Along these lines, many researchers argue that vocational resources are not far-reaching enough in services offered, citing that autistic individuals benefit from different types of support and require multiple, individualized types of assistance, from job placement or training to social and communication support [26]. One report outlines an ideal intervention model in which supported employment services extend into the long-term, involving guidance to sustain employment, monitoring of job progress, financial assistance and planning, awareness training for coworkers, and verifying job satisfaction [36]. As it stands, however,

most employment services are ill-equipped to understand the scope and variation of needs that are necessary for employment success for autistic adults [37]. Additionally, factors associated with employment outcomes for AS adults remain under-researched and poorly understood [21]. Although there has been an increased interest in expanding VR approaches and further developing vocational interventions in recent years, overall VR services lack research and evidence-based practices [38].

Vocational Rehabilitation System and Outcomes for Transition Age Youth (TAY)

State VR agencies play a critical role in helping TAY on the autism spectrum attain their vocational goals. With the passage of the Workforce Innovation and Opportunity Act (WIOA) of 2014, services to autistic TAY have taken on a higher priority. State VR agencies intervene while students are in high school and are mandated to devote a minimum of 15% of their funding to youth 16–22 years of age [31]. Inter-agency partnerships with education now occur and offerings of vocational education and school-to-work programs that attend heavily to work experiences through internships take place in schools. In fact, the promotion of early work experiences has become a core component of most prevailing transition frameworks under the WIOA [39, 40]. It has also been recommended for policymakers to develop specific standards and indicators for agencies regarding this population [41]. One such policy is The *School-to-Work Opportunities Act* which authorized state funding for the development of programs that improve work-related skills including the following: (1) provision of career awareness, exploration, and counseling services; (2) connecting school-based learning and work-based learning; and (3) providing instruction in work attitudes, employability skills, and participation skills. Yet, this transition period remains stressful for both youth and their families [42, 43].

Disappointingly, postsecondary outcomes have not yet changed substantively despite the strong focus of work experiences in federally mandated transition services [44, 45] and despite supported employment models for TAY [46, 47]. Similar to autistic adults, this is likely due to insufficient knowledge about best practices for VR services to use in serving autistic TAY. This is particularly concerning because of the continuous growth in VR for this population, with TAY now representing about 30–40% of the VR population. There continues to be a limited evidence base of interventions to optimize employment and other life outcomes for these individuals [20]. As both the 2020 Federal Youth Transition Plan: A Federal Interagency Strategy [48] and the National Institute on Disability, Independent Living, and Rehabilitation Research (NIDILRR) 2018–2023

Long-Range Plan [49] state, there is a need to develop and embed evidence-based practices in VR and a need to enhance programming for youth to pursue self-directed pathways towards education, employment, health, and independent living. To this end, there are recommendations to adapt efficacious interventions established for other populations to inform the advancement of approaches for autistic individuals [20, 50•].

Highlights of Evidence-Based Practices to Enhance Employment of the Autistic Population

Not only is there a greater need for the development and testing of evidence-based practices to improve employment, but interventions should also occur across multiple levels: system/program level, provider level, and consumer level. A small body of research on evidence-based practices for autistic TAY and adults offer some programs tested and available within VR services and others available in community programs. Brief summaries are provided highlighting the interventions and the autistic populations involved in system, provider, and consumer level interventions.

Service System Level Interventions

Project SEARCH One evidence-based practice available within the TAY service system that has shown promise for autistic TAY is Project SEARCH plus AS supports (PS + ASD) [51]. Project SEARCH is a 9-month transition-to-work internship program that utilizes an intensive community-based employment internships model for youth and young adults with a wide range of disabilities [52]. PS + ASD is an adapted version of Project SEARCH that includes added techniques designed to meet the needs of autistic youth and is designed to be implemented for autistic TAY currently in a high school setting [51, 53]. The intervention includes the addition of applied behavior analysis techniques regarding behavior supports—functional behavioral assessment, task analysis, repeated trials of discrete tasks, behavioral rehearsal, prompting, self-management and reinforcement procedures along with a social communication curriculum, and the use of visual supports and role playing practice [51, 53]. Across multi-site randomized controlled trial (RCT) studies, as well as one retrospective observational records review, PS + ASD has been shown to be effective in increasing attainment and long-term continuation of competitive employment for autistic students with 73–87% obtaining competitive employment, and an 80% employment retention rate [53–57]. Results indicate that an intensive and business-based internship model, delivered with individualized behavioral supports, for autistic TAY is

an avenue for increasing employment. However, identified barriers include intensive time in operations and implementation, cost intensive for training, resources, and technical assistance by Project SEARCH team, staffing requiring ABA instruction and practice, and need for interagency collaborations across VR, schools, and other agencies and large-scale businesses like a hospital system.

Division TEACCH Supported Employment Another intervention delivered within VR services is the Division TEACCH (Treatment and Education of Autistic and related Communication Handicapped Children and Adults) Supported Employment Program [58]. The TEACCH Supported Employment program utilizes a personalized approach to identify individual strengths, conduct appropriate job placements, and provide long-term support services to autistic adults receiving VR services across a multitude of settings. This is done using a job coach supporting individuals or small groups within the business setting. Participants receive several additional support services such as social groups, skill-based counseling sessions, and vocational training along with job coaching and employer autism training. Across a 10-year evaluation of the implementation of the TEACCH Supported Employment program within existing VR services with about 90 autistic adults with or without intellectual disability, approximately 96% of participants were placed in jobs with an 89% retention rate [58]. TEACCH Supported Employment is a valuable model using an individualized and community-based approach that provides continued long-term support. However, it (similar to Project SEARCH) is time and cost intensive and requires significant staff training. It is unclear if the program has gone through a research study, and although the evaluation outcomes reported high rates of employment, there was a narrow range of work settings with most working part-time (average 28 h a week) and earning below minimum wage. Its implementation has also been limited to date.

Achieving Competitive, Customized Employment Through Specialized Services (ACCESS) The Achieving Competitive, Customized Employment through Specialized Services intervention, developed and tested within VR services, protocolizes the customized employment process within a user-friendly system that incorporates an interconnected package of tools, templates, and logs that promote consistent application of the intervention [59]. It uses 6 key elements: discovery process, vocational profile, customized employment planning meeting, portfolio/visual resume, customized job development and negotiation, and accommodations and post-employment supports over the course of 8–9 months. The intervention utilizes a fidelity instrument called Benchmarks of Quality Checklist (BQC), to assist with training, to monitor adherence to the intervention model, and

to document omissions, additions, and adaptations that are made during implementation for each consumer. This is the first intervention to protocolize the customized employment approach. Although the research data is limited with a small sample size and minimal outcome data available to date, additional studies are underway and initial results show promise. Success of the intervention was found to be greatly impacted by provider agencies and practitioners' engagement. Authors note that highly qualified, well-trained practitioners and involvement of all stakeholders are necessary for successful implementation. High turnover in provider agencies paired with large caseloads/capacity issues are of concern, particularly when serving autistic individuals who require more time and attention.

Provider and Consumer Level Interventions

Other employment interventions for autistic TAY and adults focus more specifically on skill building due to the cognitive, social, communication, and behavioral impacts often associated with AS [60] and the direct impacts these areas of deficits have on employment [61]. To this end, a few skill-based interventions, many originally designed for schizophrenic/serious mental illness populations, have now been adapted or developed and tested for autistic TAY or adults with promising results towards gaining skills and employment.

Cognitive Enhancement Therapy (CET) Cognitive enhancement therapy was adapted from an intervention for schizophrenic/SMI populations [62] for autistic adults and tested in both an open trial feasibility study and a RCT. Cognitive enhancement therapy was found effective for young adults with good verbal skills. Cognitive enhancement therapy integrates computer-based executive functioning training exercises with a small group-based social-cognitive curriculum over 18 months (60 h of computer training and 45 group sessions). Results demonstrated high satisfaction, attention, retention, and improved cognitions, social behaviors, and employment [63, 64]. An advantage of this intervention is the focus on socialization and engagement within groups that provides multiple opportunities for real-world practice. A disadvantage is that it has not been tested within vocational services, only a university clinical research setting, and it does not directly address employment within the program and only utilizes neurocognitive training to enhance cognitive and social skills related to employment.

Social Cognition and Interaction Training for Adults on Autism Spectrum (SCIT-A) The original Social Cognition and Interaction Training intervention was a group intervention designed to improve social cognition, social skills, and community functioning with the goal of employment for schizophrenic populations [65]. This intervention was

modified specifically for employment ready autistic adults and included adaptation of curricula content as well as increases in visual examples with videos of adult social encounters (e.g., within a workplace). A feasibility study was conducted on eleven adults who were participating in job skills training, medication management, and individual therapy in which 6 received the 18-week group intervention and five did not. The intervention was delivered in a research setting and study results demonstrated an increase in social communication skills for participants in comparison to a group that received treatment as usual [66]. Authors note using employment relevant examples in videos while teaching social skills. However, this study was not conducted within VR services and did not report specifically on employment outcomes for participants. Thus, it is unknown if these gains in employment-relevant social cognitions actually improved employment outcomes.

Acquiring Career, Coping, Executive Control, and Social Skills (ACCESS) This intervention targets social and adaptive skills, self-determination skills, and coping self-efficacy (self-perceptions of the ability to cope with stress) through novel integrative therapy involving social skills training, group therapy, cognitive-behavioral therapy, and educational work with the young adults and caregivers for autistic TAY. Using stakeholder feedback and research literature, the program was developed from an earlier intervention called the Adult Social Knowledge (ASK) Workshop. Acquiring Career, Executive Control, and Social Skills intervention was tested using a randomized clinical trial design and participants were recruited through a variety of methods including social media informationals, a subject tracking system, and professional referrals. Clinical outcomes included significant improvements in adaptive and self-determination skills as reported by caregivers and self-reported heightened belief in ability to utilize social support to cope with stress. Implementation outcomes included high acceptability and efficacy. An important positive feature of this program is its use of a community-based participatory research approach to develop the curriculum and deliver the intervention while students were actively involved in a vocational experience (internship or job). While short-term post data (about 5 months) showed promising results on global adaptive functioning and self-determination, no long-term follow-up data or employment outcomes were collected [67].

Interventions for Adults and TAY Within VR or Education Settings

Other skill-based provider and consumer level interventions were developed and tested *within* community VR and TAY vocational programs, within educational settings. One of the interventions presented was first designed and tested for

autistic adults and then later adapted and tested with autistic TAY resulting in two evidence-based versions of the vocational soft skills intervention.

Adolescent Curriculum for Communication and Effective Social Skills (ACCESS) This program targets 31 social communication skills across three categories: peer-focused, adult-focused, and self-focused skills, including initiating and maintaining conversation, building social networks, handling disagreements, and prioritizing personal hygiene [68]. In 2017, the Walker social skills curriculum was adapted by incorporating video modeling and was tested for effectiveness in improving social communication skills of autistic TAY in the workplace. The students learned social skills in a small class delivered two times per week over 20 weeks. Each session was divided into 5-min intervals in which reinforcement through a token economy was used at each interval to teach skills. The study utilized a multiple probe design. An increase in social communication skills and a decrease in problem behaviors was observed in all participants following intervention with gains maintained 3 months post-intervention. Teachers reported the intervention was easy to deliver, enjoyable to participants, and both acceptable and effective in improving social communication skills necessary in a workplace. Four of the participants engaged in work activities post-intervention. It is unknown if the skills learned in the vocational training center generalized into work settings. The program indicated teacher's requiring a graduate degree and multiple years of experiences working with disabilities indicating it may not be suited for many staff working within VR settings [69].

Supported Employment, Comprehensive Cognitive Enhancement, and Social Skills (SUCCESS and TAY SUCCESS) SUCCESS is a manualized curriculum to enhance executive functioning and memory skills (13 sessions) and social cognitive and communication skills (12 sessions) including self-determination and self-advocacy in autistic individuals within community services: VR (adults) or educational (TAY) settings [70–72]. It specifically targets cognitions most expected in vocational soft skills, threading content from each construct into the next. As the authors state, "SUCCESS is implemented within supported employment by (1) delivering it through small groups within the vocational agency; (2) training employment staff to support the use of strategies within vocational training and/or employment settings; and (3) linking executive functioning and social skills content to the individual's job search and/or work activities" conducted over 25 sessions across a 6-month period [70]. Adapted from SUCCESS, TAY SUCCESS was designed specifically for TAY students involved in vocational services on their High School campus in pre-transition employment services. The curriculum was expanded with additional

chapters addressing the unique needs of transitioning into adulthood and developing life goals and post-secondary outcomes of employment and college education delivered over one academic school year [72, 73]. Both programs were developed using a community-based participatory research (CBPR) approach involving multiple stakeholders including consumers (autistic TAY and adults and caregivers), providers, teachers, and administrators. SUCCESS and TAY SUCCESS were both tested in community-based RCTs and found improvements in executive functioning and social abilities along with functioning, self-efficacy, and employment. Employment outcomes include increased job attainment and job advancements compared to control group with all working in competitive integrated employment settings. Implementation outcomes include high feasibility, acceptability, and satisfaction with positive qualitative statements from students, parents, teachers, and administrators about the interventions [70–72]. Disadvantages of these programs are a lack of information on staff training and the resources required to scale up for large-scale use across VR service systems and TAY educational transition services.

Interventions for Adults and TAY Utilizing Online and Virtual Technologies

Online and virtual reality interventions have also been adapted or developed for autistic adults to enhance vocational outcomes. One of the interventions presented was first tested for autistic adults and then later adapted and tested with autistic TAY resulting in two evidence-based versions of each of the virtual reality job interview training intervention.

Virtual Reality Job Interview Training (VR-JIT and VIT-TAY) VR-JIT uses a highly interactive computerized virtual reality training model to improve job interview skills among autistic people. With speech recognition technology, participants interact with a simulated interviewer who asks common interview questions and prompts participants to speak on previous work experience, qualifications, and job-related skills. VR-JIT features a progression of skill development and offers real-time feedback and post-interview commentary based on the content of the interviewee's responses and their performance. A RCT study was conducted to assess the feasibility and efficacy of VR-JIT. Clinical outcomes suggest that the intervention group experienced improved job interview skills and enhanced self-confidence and a follow up study reported increased employment. The intervention was initially intended for use by adults with chronic mental illness (schizophrenia and bipolar disorder), and thus lacks e-learning material and interview scripts specific to autism. However, the results suggest that the intervention is still generalizable to autistic adults [74, 75]. Participants

indicated the virtual reality job interview training program as easy to use and enjoyable. Adapted from VT-JIT, Virtual Interview Training for Transition Age Youth (VIT-TAY) was developed for autistic TAY to be used within educational pre-employment transition service settings supporting work force development. In mock job interviews for a fictional company, trainees respond to questions posed by virtual interviewers played by actors. The training targets 10 different job interview skills including the following: confidence, professionalism, dependability, the ability to work well with others, and the ability to speak on personal strengths, weaknesses, and past experiences. VIT-TAY was tested using a RCT design in multiple types of community school settings in two states. Clinical outcomes included improved job interview skills, lower job interview anxiety, and greater access to jobs. Implementation outcomes include high acceptability, feasibility in schools, and high enjoyment from participants [76]. A disadvantage to this program is the lack of community member involved in program design or research which could negatively impact the dissemination and implementation of the program.

JobTIPS Training Program Another intervention that utilizes video modeling and virtual reality technology to address the difficulty that autistic youth face in regard to the job interview is the JobTIPS training program [77]. The JobTIPS curriculum features step-by-step instructions on the job search, interview, and orientation processes, as well as containing embedded video models, quizzes, printable scripts, worksheets, and organizational tools. In an RCT study, outcomes showed that participants who received JobTIPS training experienced a significant improvement in their interviewing skills. The program, however, was more effective in improving content (verbal responses) rather than delivery skills (physical presence). Future improvements may require incorporating subtle nonverbal cues by the avatars into the program's interface [77]. Real world employment outcomes were not reported and therefore intervention effectiveness towards employment is unknown.

Community-Derived Specialized Vocational Programs as Promising Practices

In hopes of seeing employment rates for autistic people rise, many researchers and autism advocates have begun to recognize the potential for success of these individuals in jobs within the technology industry such as programming, information technology, software testing, and cyber-ware. While data revealing autistic people's abilities to be cognitively aligned with the nature of technical roles is scarce, longitudinal studies often point to a certain affinity for the systematic and rule-based formats within this population [78]. One national longitudinal study concluded that autistic people

are more likely to enter STEM fields during postsecondary education than non-STEM fields, and that computer-science is the most popular major among autistic individuals [79]. Programs focused on helping autistic people gain employment cite this population's unique qualities and abilities in error detection, attention to detail, comfort with repetitive tasks, and high levels of focus, as making these individuals especially suited for jobs in software testing or security [80]. Following in the footsteps of one Danish IT company, Specialisterne, tech giants like SAP Software Solutions and Microsoft have implemented hiring and onboarding initiatives for autistic adults looking for information technology roles, revealing that social responsibility and business benefits were two of the main incentives for the effort [81]. While a number of new programs available in the community are known for specialization in technology fields, it is important to note the diversity of autism so that a "one size fits all" approach is not the solution to improving employment outcomes. Rather, the utilization of person-centered, individualized approaches, that are flexible and fit the direct abilities and interests of the individual, should be used to improve employment outcomes [82].

Conclusion

Although a number of EBPs exist and have been highlighted here, there continues to be a need for new program development for AS adults so that curriculums and programming are in place when the growing AS population age into adulthood and are prepared to offer longer-term or more comprehensive services. This is consistent with multiple policy and research calls for (1) increased evidence-based interventions; (2) the development of treatment manuals to encourage replication of promising vocational support programs; (3) models for professional development to work with autistic adults in VR; and (4) recommendations to apply efficacious interventions with other populations to inform the advancement of employment approaches for autistic individuals [83, 84, 85]. Additionally, recent government reports identified supporting professional development for vocational service providers as a policy priority to improve competitive employment [48–87]. According to the 2020 Federal Youth Transition Plan, two main priorities for adult services research are (1) promoting work-based learning and (2) supporting professional development of service providers [88].

However, for an EBP to be disseminated successfully, the program must be feasible, cost-effective, and acceptable to the end-users, such as VR services, high schools, and vocational training centers [89]. Many of the EBPs described in this review had small sample sizes and often were not delivered within vocational service or pre-employment transition service educational settings. Additionally, many of the

skills-based interventions limited their populations to AS individuals without a co-occurring intellectual disability and minimal racial/ethnic diversity, impacting the effectiveness of broad use. To this end, it is critical that future interventions be developed and tested in a way that attends to the needs of the population and service system from the onset, such as using CBPR methods, diverse populations, and testing directly in community settings. Few of the highlighted interventions used such methods. It is also important to be mindful of resources. The interventions that demonstrated positive outcomes with large samples all required significant resources such as intensive staff training, large amounts of service hours, and services extending beyond typical service system length which many VR systems are not in a position to offer with budget and policy constraints. Future studies need to engage a more holistic and systemic approach to services research that includes utilizing dissemination and implementation frameworks, hybrid research designs, and an equity focus to ensure feasibility, accessibility, and scaling up for broad community use. In sum, there is a strong call for further research and funding of community-based, community-involved, EBP development and testing particularly to address autistic individual's employment and life outcomes.

Compliance with Ethics Standards

Conflict of Interest The authors declare no competing interests.

Human and Animal Rights and Informed Consent This article does not contain any studies with human or animal subjects performed by any of the authors.

References

Papers of particular interest, published recently, have been highlighted as: ● Of importance

1. Bailey AJ. Autism in adults. *Autism Res.* 2012;5:1–2. <https://doi.org/10.1002/aur.233>.
2. Gerhardt PF, Lainer I. Addressing the needs of adolescents and adults with autism: a crisis on the horizon. *J Contemp Psychother.* 2011;41(1):37–45. <https://doi.org/10.1007/s10879-010-9160-2>.
3. VanBergeijk E, Klin A, Volkmar F. Supporting more able students on the autism spectrum: college and beyond. *J Autism Dev Disord.* 2008;38:1359. <https://doi.org/10.1007/s10803-007-0524-8>.
4. Roux AM, Shattuck PT, Rast JE, Rava JA, Anderson KA. Transition into young adulthood. In: National autism indicators report. Life Course Outcomes Research Program, AJ Drexel Autism Institute, Drexel University, Philadelphia, PA. 2015.
5. ● Shattuck PT, Garfeld T, Roux AM, Rast JE, Anderson K, Hassrick EM, et al. Services for adults with autism spectrum disorder: a systems perspective. *Curr Psychiatry Reports.* 2020;22(3):13.

- This is an important reference because it reviews recent research on services for autistic adults and found that the evidence base for these services remains small and highly variable. This reference indicates the importance of expanding research on these services and outcomes for adults in order to improve systems of care for this growing population.**
6. Cederlund M, Hagberg B, Billstedt E, Gillberg IC, Gillberg C. Asperger syndrome and autism: a comparative longitudinal follow-up study more than 5 years after original diagnosis. *J Autism Dev Disord.* 2008;38(1):72–85. <https://doi.org/10.1007/s10803-007-0364-6>.
 7. Taylor JL, Seltzer MM. Employment and post-secondary educational activities for young adults with autism spectrum disorders during the transition to adulthood. *J Autism Dev Disord.* 2011;41:566–74.
 8. Wehman PH, Schall CM, McDonough J, et al. Competitive employment for youth with autism spectrum disorders: early results from a randomized clinical trial. *J Autism Dev Disord.* 2014;44:487–500.
 9. Wilczynski SM, Tramell B, Clarke LS. Improving employment outcomes among adolescents and adults on the autism spectrum. *Psychol Sch.* 2013;50:876–87.
 10. Shattuck PT, Narendorf SC, Cooper B, Sterzing PR, Wagner M, Taylor JL. Postsecondary education and employment among youth with an autism spectrum disorder. *Pediatrics.* 2012;129(6):1042–9. <https://doi.org/10.1542/peds.2011-2864>.
 11. Austin RD, Pisano GP. Neurodiversity as a competitive advantage. *Harvard Bus Rev.* 2017;95:96–103.
 12. Barnhill GP. Supporting students with Asperger syndrome on college campuses: current practices. *Focus Autism Other Dev Disabl.* 2016;31(1):3–15. <https://doi.org/10.1177/1088357614523121>.
 13. Howlin P. Outcome in adult life for more able individuals with autism or Asperger syndrome. *Autism.* 2000;4(1):63–83. <https://doi.org/10.1177/1362361300004001005>.
 14. Scott J, Fowler D, McGorry P, Birchwood M, Killackey E, Christensen H, et al. Adolescents and young adults who are not in employment, education, or training. *BMJ.* 2013;347:5270. <https://doi.org/10.1136/bmj.f5270>.
 15. Walsh FP, Tickle AC. Working towards recovery: the role of employment in recovery from serious mental health problems. A qualitative meta-synthesis. *Int J Psychosoc Rehabil.* 2013;17(2):35.
 16. • Solomon C. Autism and employment: Implications for employers and adults with ASD. *J Autism Dev Disord.* 2020;50:4209–17. <https://doi.org/10.1007/s10803-020-04537-w>. **This is an important reference because it summarizes literature on employment services and outcomes for autistic adults, as well as focusing on potential outcomes for employers who hire these individuals. It provides employer, employee, policy, and service recommendations to help better address the gap that still exists in employment rates of autistic adults.**
 17. Buescher AV, Cidav Z, Knapp M, Mandell DS. Costs of autism spectrum disorders in the United Kingdom and the United States. *JAMA Pediatr.* 2014;168(8):721–8.
 18. Nichols DB, Hedley D, Randolph JK, Raymaker DM, Robertson SM, Vincent J. An expert discussion on employment in autism. *Autism in Adulthood.* 2019;1(3):162–9.
 19. Smith TJ, Ching D, Weston A, Dillahunt-Aspillaga CJ. Achieving competitive, customized employment through specialized services (ACCESS). *J Vocat Rehabil.* 2019;50(3):249–58.
 20. Taylor JL, McPheeters ML, Sathe NA, Dove D, Veenstra-VanderWeele J, Warren Z. A systematic review of vocational interventions for young adults with autism spectrum disorders. *Pediatrics.* 2012;130(3):531–8.
 21. Hedley D, Uljarevic M, Cameron L, Halder S, Richdale A, Dissanayake C. Employment programmes and interventions targeting adults with autism spectrum disorder: a systematic review of the literature. *Autism.* 2016. <https://doi.org/10.1177/1362361316661855>.
 22. Scott M, Milbourn B, Falkmer M, Black M, Bølte S, Halladay A, et al. Factors impacting employment for people with autism spectrum disorder: a scoping review. *Autism.* 2019;23(4):869–901. <https://doi.org/10.1177/1362361318787789>.
 23. U.S. Government Accountability Office. (2012, July). Students with Disabilities: Better Federal Coordination Could Lessen Challenges for Students with Disabilities in the Transition From High School. (Publication No. GOA-12-59). Retrieved from: <https://www.gao.gov/assets/600/592329.pdf>
 24. U.S. Department of Education. Office of Special Education and Rehabilitative Services, Rehabilitation Services Administration, Annual report, Fiscal year 2012, report on Federal activities under the Rehabilitation Act. Washington, D.C. 2012. Retrieved from: <https://www2.ed.gov/about/reports/annual/rsa/2012/rsa-2012-annual-report.pdf>
 25. • Roux AM, Garfield T, Shattuck PT. Employment policy and autism: analysis of state Workforce Innovation and Opportunity Act (WIOA) implementation plans. *J Vocat Rehabil.* 2019;51:285–98. <https://doi.org/10.3233/JVR-191046>. **This is an important reference because it directly examined important policy and programing that was developed to help individuals with disabilities find and maintain employment. They found that autistic individuals are still widely excluded from these policies and programs, and discuss key points on why some states do better than others in employment rates for autistic adults.**
 26. Burgess S, Cimera RE. Employment outcomes of transition-aged adults with autism spectrum disorders: a state of the states report. *American J Intellect Dev Disabilities.* 2014;119:64–83.
 27. Ditchman NM, Miller JL, Easton AB. Vocational rehabilitation service patterns: an application of social network analysis to examine employment outcomes of transition-age individuals with autism. *Rehabil Couns Bull.* 2018;61(3):143–53. <https://doi.org/10.1177/0034355217709455>.
 28. Roux AM, Rast JE, Anderson KA, Garfield T, Shattuck PT. Vocational rehabilitation service utilization and employment outcomes among secondary students on the autism spectrum. *J Autism Dev Disord.* 2021;51:212–26.
 29. Sung C, Sánchez J, Kuo HJ, Wong CC, Leahy MJ. Gender differences in vocational rehabilitation service predictors of successful competitive employment for transition-aged individuals with autism. *J Autism Dev Disord.* 2015;45:3204–18. <https://doi.org/10.1007/s10803-015-2480-z>.
 30. U.S. Department of Education. Office of Special Education and Rehabilitative Services, Rehabilitation Services Administration (2014) Annual Report, Fiscal Year 2012, Report on Federal Activities Under the Rehabilitation Act. Washington, D.C. Retrieved from: <https://www2.ed.gov/about/reports/annual/rsa/2012/rsa-2012-annual-report.pdf>
 31. U.S. Department of Labor: Workforce Innovation and Opportunity Act. 2014.
 32. García-Villamisar D, Hughes C. Supported employment improves cognitive performance in adults with autism. *J Intellect Disabil Res.* 2007;51(2):142–50.
 33. Howlin P, Alcock J, Burkin C. An 8 year follow-up of a specialist supported employment service for high-ability adults with autism or Asperger syndrome. *Autism.* 2005;9(5):533–49.
 34. Lawer L, Brusilovskiy E, Salzer MS, Mandell DS. Use of vocational rehabilitative services among adults with autism. *J Autism Dev Disord.* 2009;39(3):487–94.
 35. Nicholas DB, Zwaigenbaum L, Zwicker J, Clarke ME, Lamsal R, Stoddard KP, et al. Evaluation of employment-support services for adults with autism spectrum disorder. *Autism.* 2017. <https://doi.org/10.1177/1362361317702507>.

36. Maybee M, Swain JH. The need for employment supports for persons with intellectual and developmental disabilities in North Carolina. *North Carolina Med J*. 2009;70(6):548–51.
37. Westbrook JD, Nye C, Fong CJ, Wan JT, Cortopassi T, Martin FH. Adult employment assistance services for persons with autism spectrum disorders: effects on employment outcomes. *Campbell Syst Rev*. 2012;8:1–68. <https://doi.org/10.4073/csr.2012.5>.
38. Nicholas DB, Attridge M, Zwaigenbaum L, Clarke M. Vocational support approaches in autism spectrum disorder: a synthesis review of the literature. *Autism*. 2015;19(2):235–45. <https://doi.org/10.1177/1362361313516548>.
39. Certo NJ, Luecking RG, Murphy S, Brown L, Courey S, Belanger D. Seamless transition and long-term support for individuals with severe intellectual disabilities. *Res Pract Persons Severe Disabl*. 2008;33(3):85–95. <https://doi.org/10.2511/rpsd.33.3.85>.
40. Oertle KM, Seader KJ. Research and practical considerations for rehabilitation transition collaboration. *J Rehabilitation*. 2015;81:3–18.
41. Honeycutt TC, Thompkins A, Bardos M, Stern S. State differences in the vocational rehabilitation experiences of transition-age youth with disabilities. *Math Policy Res Reports* 2013;42(1):17–30.
42. First J, Cheak-Zamora N, Teti M, Maurer-Batjer A, First N. Youth perceptions of stress and coping when transitioning to adulthood with autism: a photovoice study. *Qual Soc Work*. 2019;18(4):601–20. <https://doi.org/10.1177/1473325018757078>.
43. Wong V, McGrew J, Ruble L. Predicting the outcomes of parents of transition-age youth or young adults with ASD. *J Autism Dev Disord*. 2020;50(8):2723–39. <https://doi.org/10.1007/s10803-020-04362-1>.
44. Butterworth J, Smith FA, Hall AC, Migliore A, Winsor J, Domin D. StateData: the national report on employment services and outcomes, 2013. In: All institute for community inclusion publications, 72. 2013. https://scholarworks.umb.edu/ici_pubs/72. Accessed 4 Apr 2021.
45. Newman L, Wagner M, Cameto R, Knokey AM, Shaver D. Comparisons across time of the outcomes of youth with disabilities up to 4 years after high school. A report of findings from the National Longitudinal Transition Study (NLTS) and the National Longitudinal Transition Study-2 (NLTS2). National Center for Special Education Research (ED). 2010.
46. Kessler Foundation/National Organization on Disability. (2010, October) The 2010 survey of Americans with disabilities. New York: Harris Interactive. <http://www.2010disabilitysurveys.org/pdfs/surveyresults.pdf>.
47. Wagner M, Newman L, Cameto R, Garza N, Levine P. After high school: a first look at the postschool experiences of youth with disabilities. In: National Longitudinal Transition Study-2 (NLTS2). SRI International, Menlo Park, CA. 2005.
48. The 2020 Federal Youth Transition Plan: A Federal interagency strategy for collaboration. <http://www.dol.gov/odep/pdf/20150302-FPT.pdf>
49. NIDILRR's Long-Range Plan for 2018–2023 was published by ACL in January 2019. To download a copy, go to <https://acl.gov/sites/default/files/about-acl/2019-01/NIDILRR%20LRP-2018-2023-Final.pdf>.
50. ● Burke M, Waltz-Kudla S, Rabideau C, Lounds Taylor J, Hodapp R. Pulling back the curtain: issues in conducting an intervention study with transition-aged youth with autism spectrum disorder and their families. *Autism: The International J Research and Practice*. 2018;23(2):514–523. <https://doi.org/10.1177/1362361317753016>. **This is an important reference because it addresses the issue of interventions for autistic transition age youth. It provides important key features for successful interventions and discusses the importance of being flexible and listening to the needs of the individuals being serviced and their families.**
51. Wehman P, Schall C, McDonough J, Molinelli A, Riehle E, Ham W, et al. Project SEARCH for youth with autism spectrum disorders: increasing competitive employment on transition from high school. *J Posit Behav Interventions*. 2012;15(3):144–55. <https://doi.org/10.1177/1098300712459760>.
52. Rutkowski S, Daston M, VanKuiken D, Riehle E. Project SEARCH: a demand-side model of high school transition. *J Vocat Rehabil*. 2006;25:85–96.
53. Wehman P, Schall C, McDonough J, Sima A, Brooke A, Ham W, et al. Competitive employment for transition-aged youth with significant impact from autism: a multi-site randomized clinical trial. *J Autism Dev Disord*. 2020;50:1882–2897. <https://doi.org/10.1007/s10803-019-03940-2>.
54. Schall CM, Wehman P, Brooke V, Graham C, McDonough J, Brooke A, Ham W, et al. Employment interventions for individuals with ASD: the relative efficacy of supported employment with or without prior project SEARCH training. *J Autism Dev Disord*. 2015;45(12):3990–4001. <https://doi.org/10.1007/s10803-015-2426-5>.
55. Schall C, Sima AP, Avellone L, Wehman P, McDonough J, Brown A. The effect of business internships model and employment on enhancing the independence of young adults with significant impact from autism. *Intellect Dev Disabil*. 2020;58(4):301–13. <https://doi.org/10.1352/1934-9556-58.4.301>.
56. Wehman P, Schall CM, McDonough J, Graham C, Brooke V, Riehle JE, et al. Effects of an employer-based intervention on employment outcomes for youth with significant support needs due to autism. *Autism*. 2017;21(3):276–90. <https://doi.org/10.1177/1362361316635826>.
57. Whittenburg HN, Schall CM, Wehman P, McDonough J, DuBois T. Helping high school-aged military dependents with autism gain employment through project SEARCH + ASD supports. *Mil Med*. 2020;185:663–8. <https://doi.org/10.1093/milmed/usz224>.
58. Keel JH, Mesibov GB, Woods AV. TEACCH-supported employment program. *J Autism Dev Disord*. 1997;27(1):3–9. <https://doi.org/10.1023/A:10258130220229>.
59. Jorgensen Smith T, Ching D, Weston A, Dillahunt-Aspillaga CJ. Achieving competitive, customized employment through specialized services (ACCESS). *J Vocat Rehabil*. 2019;50(3):249–58. <https://doi.org/10.3233/JVR-191004>.
60. Hendricks D. Employment and adults with autism spectrum disorders: challenges and strategies for success. *J Voc Rehabil*. 2010;32(2):125–34. <https://doi.org/10.3233/JVR-2010-0502>.
61. Hillier A, Campbell H, Mastriani K, Izzo MV, Kool-Tucker AK, Cherry L, et al. Two-year evaluation of a vocational support program for adults on the autism spectrum. *Career Dev for Exceptional Individ*. 2007;30:35–47.
62. Hogarty GE, Greenwald DP. Cognitive enhancement therapy: the training manual. 2006. <http://www.cognitivenhancementtherapy.com>. Accessed 4 Apr 2021.
63. Eack SM, Greenwald DP, Hogarty SS, Bahorik AL, Litschge MY, Mazefsky CA, et al. Cognitive enhancement therapy for adults with autism spectrum disorder: results of an 18-month feasibility study. *J Autism Dev Disord*. 2013;43(12):2866–77.
64. Eack SM, Hogarty SS, Greenwald DP, Litschge MY, Porton SA, Mazefsky CA, et al. Cognitive enhancement therapy for adult autism spectrum disorder: results of an 18-month randomized clinical trial. *Autism Res*. 2018;11(3):519–30. <https://doi.org/10.1002/aur.1913>.
65. Roberts DL, Penn D, Combs DR. Social cognition and interaction training: unpublished treatment manual. 2004.

66. Turner-Brown LM, Perry TD, Dichter GS, Bodfish JW, Penn DL. Brief report: feasibility of social cognition and interaction training for adults with high functioning autism. *J Autism Dev Disord.* 2008;38(9):1777–84. <https://doi.org/10.1007/s10803-008-0545-y>.
67. Oswald TM, Winder-Patel B, Ruder S, Xing G, Stahmer A, Solomon M. A pilot randomized controlled trial of the ACCESS program: a group intervention to improve social, adaptive functioning, stress coping, and self-determination outcomes in young adults with autism spectrum disorder. *J Autism Dev Disord.* 2018;48(5):1742–60. <https://doi.org/10.1007/s10803-017-3421-9>.
68. Walker J, Todis B, Holmes D, Horton G. The Walker social skills curriculum: the ACCESS program (adolescent curriculum for communication and effective social skills). Austin: Pro-Ed. 1988.
69. Walsh E, Holloway J, Lydon H. An evaluation of a social skills intervention for adults with autism spectrum disorder and intellectual disabilities preparing for employment in Ireland: a pilot study. *J Autism Dev Disord.* 2018;48(5):1727–41. <https://doi.org/10.1007/s10803-017-3441-5>.
70. Baker-Ericzén MJ, Fitch M, Kinnear M, Jenkins MM, Smith L, Montano G, Twamley E, Crooke P, Garcia Winner M, Feder J, Leon J. Development of the supported employment, comprehensive cognitive enhancement and social skills (SUCCESS) program for adults on the autism spectrum: results of initial study. *Autism.* 2018;22:6–19. <https://doi.org/10.1177/1362361317724294>.
71. Baker- Ericzén MJ, Fitch M, Tran A, Scarvie K. Pilot RCT of the SUCCESS intervention: increasing vocational soft skills in adults with ASD. At: the 18th annual conference of the International Society for Autism Research. Montreal, Canada. 2019.
72. Baker-Ericzén M, Tran A, Scarvie K, Brookman-Frazee L, Kraemer B, Sax C. Transition age youth (TAY) SUCCESS RCT feasibility study targeting executive functioning and social cognitive skills to improve outcomes. In: ACHIEVE Committee Report. 2020.
73. Brookman-Frazee L, Baker- Ericzén, MJ, Chan J, Dickson KS, Rieth SR, Haine Schlagel R, Stadnick NA, Stahmer AC, Suhrheinrich J. Applying dissemination and implementation science to facilitate community implementation of evidence-based interventions. In: Matson J.L and Sturmey, P, ed. Handbook of Autism and Pervasive Developmental Disorders. Second edition. Volume 2 New York: Springer; 2021.
74. Smith MJ, Ginger EJ, Wright K, Wright MA, Taylor JL, Humm LB, et al. Virtual reality job interview training in adults with autism spectrum disorder. *J Autism Dev Disord.* 2014;44(10):2450–63. <https://doi.org/10.1007/s10803-014-2113-y>.
75. Smith MJ, Fleming MF, Wright MA, Losh M, Boteler Humm L, Olsen D, Bell MD. Brief report: vocational outcomes for young adults with autism spectrum disorders at six months after virtual reality job interview training. *J Autism Dev Disord.* 2015;45(10):3364–9. <https://doi.org/10.1007/s10803-015-2470-1>.
76. Smith MJ, Sherwood K, Ross B, Smith JD, DaWalt L, Bishop L, et al. Virtual interview training for autistic transition age youth: a randomized controlled feasibility and effectiveness trial. *Autism.* 2021. <https://doi.org/10.1177/1362361321989928>.
77. Strickland DC, Coles CD, Southern LB. JobTIPS: a transition to employment program for individuals with autism spectrum disorders. *J Autism Dev Disord.* 2013;43(10):2472–83. <https://doi.org/10.1007/s10803-013-1800-4>.
78. Wei X, Yu JW, Shattuck P, McCracken M, Blackorby J. Science, technology, engineering, and mathematics (STEM) participation among college students with an autism spectrum disorder. *J Autism Dev Disord.* 2013;43:1539–46.
79. Wei X, Christiano ERA, Yu JW, Blackorby J, Shattuck P, Newman LA. Postsecondary pathways and persistence for STEM versus non-STEM majors: among college students with an autism spectrum disorder. *J Autism Dev Disord.* 2014;44:1159–67.
80. Austin RD, Sonne T. The dandelion principle: redesigning work for the innovation economy. *MIT Sloan Manag Rev.* 2014;55(4):67–72.
81. Annabi H, Locke J. A theoretical framework for investigating the context for creating employment success in information technology for individuals with autism. *J Manag Organ.* 2019;25(4):499–515. <https://doi.org/10.1017/jmo.2018.79>.
82. Getting people with autism to work. In: INSAR 2018 Policy Brief. An international society for autism research policy brief. 2018.
83. Baker-Ericzén MJ, Brookman-Frazee L, Brodtkin E. Accelerating research on treatment and services for transition age youth & adults on the autism spectrum. *Autism.* 2018;22:2–5. <https://doi.org/10.1177/1362361317738646>. **This is an important reference because it provides evidence for the need to focus more research on issues pertinent to the population of autistic adolescents and adults. It provides three important lessons for future researchers to use to guide their work.**
84. Youth with autism: roundtable views of services needed during the transition into adulthood. In: Government Accountability Office (GAO) report. GAO-17-109. 2017.
85. Advisory committee on increasing competitive integrated employment for individuals with disabilities final report. Final Report. 2016. Retrieved from: https://www.dol.gov/odep/topics/pdf/ACICIEID_Final_Report_9-8-16.pdf
86. Office of Autism Research Coordination, National Institute of Mental Health, on behalf of the Interagency Autism Coordinating Committee (IACC): 2011–2012 IACC Autism Spectrum Disorder Research Portfolio Analysis Report. 2016. https://iacc.hhs.gov/publications/portfolio-analysis/2012/portfolio_analysis_2012.pdf. Accessed 31 Oct 2016.
87. Duncan AW, Bishop SL. Understanding the gap between cognitive abilities and daily living skills in adolescents with autism spectrum disorders with average intelligence. *Autism.* 2013.
88. Pinder-Amaker S. Identifying the unmet needs of college students on the autism spectrum. *Harv Rev Psychiatry.* 2014;22(2):125–37.
89. Curran GM, Bauer M, Mittman B, Pyne JM, Stetler C. Effectiveness-implementation hybrid designs: combining elements of clinical effectiveness and implementation research to enhance public health impact. *Med Care.* 2012;50:217–26. <https://doi.org/10.1097/MLR.0b013e3182408812>.

Publisher's Note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.