



State-Level Variation in Vocational Rehabilitation Service Use and Related Outcomes Among Transition-Age Youth on the Autism Spectrum

Anne M. Roux¹ · Jessica E. Rast¹ · Paul T. Shattuck¹

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Abstract

Employment outcomes for transition-age youth with autism spectrum disorder (TAY-ASD) following Vocational Rehabilitation (VR) services declined between 2002 and 2011; although a few states showed significant progress. We examined inter-state variation in VR service use and outcomes among TAY-ASD in 2014–2016, finding significant differences in the percentage of TAY-ASD who received VR services, entered VR services during secondary school, had timely development of an employment plan, and were employed at VR exit. Inter-state differences remained significant after adjusting for the influence of individual-level demographics and state-level unemployment and fiscal capacity, suggesting other factors influence variation. Future research should monitor whether changes in the VR program, via the 2014 Workforce Innovation and Opportunity Act, move the needle on VR outcomes for TAY-ASD.

Keywords Vocational rehabilitation · Transition-age youth · Autism spectrum disorder · Employment · State systems

Introduction

Transition-age youth with autism spectrum disorder (TAY-ASD) in the U.S. fare worse than many of their peers with other types of disabilities in terms of employment outcomes. According to nationally representative data, slightly over half (53%) of TAY-ASD hold at least one job between high school and their early twenties, compared to 88–89% of those with emotional disturbance, learning disabilities, and speech-language impairments; and 63% of those with intellectual disability (Roux et al. 2013). Those who work typically do so part-time and earn low wages (Roux et al. 2013; Kaya et al. 2016; Burgess and Cimera 2014; Migliore et al. 2012, 2014), and experience unstable patterns of employment (Wei et al. 2014). For all people, unemployment has

negative effects on health, mental health, and social participation (Pharr et al. 2011; Wilson and Walker 1993; Schur 2002), and can fuel a downward spiral of poor outcomes (Ben-Shlomo and Kuh 2002; Wight et al. 2010). Preventing unemployment is a critical priority for the roughly 50,000 transition-age youth on the autism spectrum (TAY-ASD) who enter adulthood each year.

State Vocational Rehabilitation (VR) agencies play an important role in providing services for people with disabilities who need assistance to prepare for, find, and maintain employment, including those with ASD. Under the direction of the U.S. Department of Education's Rehabilitation Service Administration (RSA), state VR agencies administer services through an extensive network of local VR offices and community rehabilitation providers using a combination of federal formula grants and state funds. For a comprehensive overview of VR services as they relate to youth and adults on the autism spectrum, we refer readers to the National Autism Indicators Report: Vocational Rehabilitation (Roux et al. 2016). Unfortunately, the mean national percentage of TAY-ASD who achieved employment following VR services decreased by 6% in cases closed between federal fiscal years (FFY) 2002 and 2011; although, significant progress occurred in a handful of states (Burgess and Cimera 2014).

* Anne M. Roux
amr376@drexel.edu

Jessica E. Rast
jer336@drexel.edu

Paul T. Shattuck
pts33@drexel.edu

¹ A.J. Drexel Autism Institute, Drexel University, 3020 Market St., Suite 560, Philadelphia, PA 19130, USA

Recent revisions to federal legislation governing VR program administration in the 2014 Workforce Innovation and Opportunity Act (WIOA) place focus on the importance of early delivery of vocational preparation and employment supports via new Pre-Employment Transition Services (Pre-ETS) for students with disabilities in addition to traditional VR services (U.S. Department of Education 2016a). The WIOA legislation clearly specifies “competitive, integrated employment” as the intended outcome of VR services, restricts the use of sub-minimum wage work, and strengthens the use of Pre-ETS and extended work trials to avoid premature determination of VR ineligibility or case closure. The law also requires states to identify groups that have been unserved or underserved by VR, and to include goals and strategies for addressing the needs of these groups, potentially including those with ASD (34 CFR §361.29).

The number of youth and adults with ASD in the annual count of closed VR cases doubled between 2009 and 2014 from 7428 to 17,753 (Roux et al. 2016), and TAY-ASD are a growing segment of VR service users (Chen et al. 2015b). Of TAY-ASD (ages 16–25 years at application) who received VR services and whose case closed in FFY 2011, approximately 50% achieved competitive employment, defined as a job in an integrated setting in which some employees do not have disabilities, paying at or above the minimum wage, or self-employment (Kaya et al. 2016). Further analysis of FFY 2011 data for ASD cases by age group indicated that only 47% of youth who entered VR at age 18 or younger gained competitive employment, compared to 55% of young adults (19–25 years) and 61% of adults ages 26 years and older (Chen et al. 2015b). We do not know whether these rates have improved for TAY-ASD in more recent data.

Factors of VR Outcomes

A handful of studies have examined factors of successful employment specific to TAY-ASD who received VR services. In these studies TAY-ASD were more likely to be employed at the time of case closure if they were male, older at application, White race and non-Hispanic ethnicity; had higher educational levels at case closure; were not receiving Social Security or Medicaid/Medicare benefits; and if they received a greater number of VR services, at a higher total cost and over a shorter period of time (Chen et al. 2015b; Kaya et al. 2016, 2018; Migliore et al. 2012). TAY-ASD who received job placement services and/or on-the-job supports and were about three to four times more likely to become employed (Chen et al. 2015b; Kaya et al. 2018). However, these individual-level factors only explained a small amount of variance in TAY-ASD outcomes.

Among VR service users with ASD of all ages there is also evidence that service receipt and outcomes vary substantially by one’s state of residence. While 68% of

eligible VR applicants with ASD received VR services prior to case closure in FFY 2014, rate of service receipt ranged from 39% of eligible VR applicants with ASD in North Dakota to 88% in Pennsylvania (Roux et al. 2016). Despite the importance of early work experiences, the percentage who began receiving these services during secondary school varied by 70 points across states. Rates of successful employment following VR services ranged from 29% in New Mexico to 79% in Alabama for VR service users with ASD. Using a sample of 19 states, Migliore et al. (2014) also found large interstate variation for TAY-ASD in receipt of services, rate of employment following VR services, and hours worked per week.

Observed differences in VR service receipt and outcomes may also be related to differences in state economic conditions. Higher rates of state unemployment are associated with lower rates of competitive employment among youth and adults with disabilities (Alsaman and Lee 2016; Chan et al. 2014; Giesen and Cavanaugh 2013; Migliore et al. 2014; Poppen et al. 2017), given that there are more available workers to fill job openings. Additionally, a state’s fiscal capacity (defined as revenue a state collects and uses to pay for the functioning of the state) may affect expenditures for public services like VR, as has long been noted for spending on social welfare (Toikka et al. 2004) and Medicaid waivers (Miller et al. 2001). Allocation of federal VR funding to states is based on state population and per capita income, with states sharing 21% of VR program administration costs (U.S. Department of Education 2017a).

Experiences with VR services across states vary along several dimensions of VR agency policies and practices—some of which may especially impact youth. First, not everyone on the autism spectrum qualifies for VR services. In a recent survey of adults with ASD who had jobs or were seeking work, only 53% had ever used VR services (Coleman and Adams 2018). People with ASD who seek VR services are more likely to be denied qualification than their peers with other disabilities because their disability may be deemed too severe to benefit from services (Lawer et al. 2009). Even among those who qualify, not everyone receives services. In some states access to vocational services is difficult for people with ASD who do not have a co-occurring intellectual disability (Nicholas et al. 2017; Taylor and Seltzer 2011). Others are found eligible but then do not proceed to finalize an Individualized Plan for Employment (IPE), which is a prerequisite for receiving VR services. In a sample of TAY-ASD in their final year of high school, vocational services were among the most frequent unmet service needs; and TAY-ASD who were racial/ethnic minorities, had behavioral issues, and whose parents had mental health issues like anxiety, had higher overall levels of unmet service needs (Taylor and Henninger 2015).

Second, the length of the process to access VR services varies: from application, to eligibility determination, to signing the IPE, to receiving services, to potentially becoming employed. Federal guidelines state that the IPE should be completed within 90 days of eligibility determination, but this does not always happen. Experts hypothesize that excessively lengthy VR processes may deter TAY-ASD from accessing VR services (Roux et al. 2018), similar to youth with other types of disabilities (Honeycutt et al. 2017). Decreasing wait time for accessing VR services is an important aspect of success of early vocational intervention (Partnerships in Employment 2014).

Third, timing of initiation of services varies. Some youth receive VR services early in their pre-vocational years, entering during high school, while others may not begin these services until years after leaving school. In FFY 2014 states began reporting secondary student status in VR data (U.S. Department of Education, October 25, 2013), which is considered a measure of early outreach to youth (Honeycutt et al. 2015a). There is preliminary indication that students from states that implement transition beginning at age 14 are more likely to be employed 4 years after leaving high school (Cimera et al. 2013).

To our knowledge, only two peer-reviewed studies have examined the VR service experiences and outcomes of TAY-ASD at the state level, using data from FFY 2006–2010 and FFY 2011 (Burgess and Cimera 2014; Migliore et al. 2014). We have not identified any studies which explored the degree to which individual-level factors versus state-level economic conditions accounted for inter-state variation among TAY-ASD who use VR services.

Study Purpose

Our overall aims for this study were to characterize the types and degrees of state-level variation in VR service use and outcomes among TAY-ASD whose case closed in FFY 2014–2016; and to determine the degree to which predicted state-level mean values of employment-related outcomes vary after controlling for individual-level and state-level covariates we hypothesize are associated with these outcomes. Specifically, we examined the following research questions by state: (1) of all TAY-ASD who applied to VR and were found eligible for services, what percentage received VR services? (2) what percentage of TAY-ASD who received VR services were secondary students at the time of application? (3) what percentage of TAY-ASD who received VR services had an IPE completed and signed in a timely manner? (4) what percentage of TAY-ASD who received VR services exited with a job? (5) to what degree did identified differences persist after controlling for individual-level demographics and state economic environment?

The datasets selected for this study represent baseline data immediately preceding approval of state plans for WIOA implementation in 2016–2017 (U.S. Department of Education 2017b). This study sets the stage for future research examining whether changes made under WIOA will move the needle on key indicators of VR service use and outcomes for TAY-ASD.

Methods

We analyzed administrative data from the RSA's Case Service Report (RSA-911) for FFY 2014–2016. The RSA-911 contains information for all individuals whose VR case closed in a given FFY including, but not limited to, demographics, disability characteristics, VR services received, and employment status at case closure. We used 3-year estimates to control for any mild fluctuations in data across years within states and to increase the statistical precision of our findings for states with fewer cases, a technique used in prior publications using RSA-911 data (Honeycutt et al. 2013, 2015b). Analysis of this secondary dataset was deemed exempt by the Drexel University Institutional Review Board.

We analyzed data for 35,823 TAY-ASD who met the following criteria: (a) were ages 14 through 24 years at the time of application to VR, (b) had autism as the primary or secondary cause of their work impairment, (c) received VR services after being found eligible, and (d) whose case closed in FFY 2014–2016. On average across states, TAY-ASD comprised 38% (range 11–62%) of the overall TAY-IDD cases who exited from VR in FFY 2014–2016. Our study focused on the subgroup of TAY-ASD who received VR services prior to case closure, while other studies of state variation have used the total caseload count (all who applied for services including those who never used services) as the denominator (Burgess and Cimera 2014). Focusing on the population that received services more directly informs policy and practice seeking to improve those services.

We note that VR counselors designate ASD in an individual's VR case record based on a review of records, such as special education documents and physician reports, but this diagnosis is not clinically verified unless additional evaluation is provided by VR to determine eligibility for services. Based on procedural requirements for proof of disability, we believe that people with a recorded designation of autism are unlikely to not have autism, given the high specificity of this designation. However, classification of autism within primary versus secondary work impairment categories is likely more subjective.

Our analytic design improved upon prior research in several ways. First, we included all states and the District of Columbia (D.C.) to obtain a comprehensive, descriptive baseline of key VR indicators for TAY-ASD. Prior

studies have limited analyses to states with at least 100 TAY-ASD case closures in a given year (Migliore et al. 2014), or have excluded states with the lowest number of cases (Kaya et al. 2016; Burgess and Cimeria 2014). Our study also included youth who had a job at the time of application to VR, while others have excluded these youth (Kaya et al. 2016; Migliore et al. 2014). We rationalized that youth who applied to VR despite having a job may have been working in non-integrated employment settings, or needed additional support to maintain a current job, or experienced poor match between their current job and their skills or environmental preferences.

Measures

Dependent Variables

Our selection of dependent variables was anchored in a conceptual framework borrowed from the field of evaluating the performance of human service programs (Kettner et al. 2017; Martin and Kettner 2009), measuring three aspects of program performance—outputs, quality and outcomes. Outputs refer to the quantity of services provided in terms of either units of service provided (volume) or the number of individuals who received services. Quality indicators measure the proportion of outputs that meet predefined standards in domains such as reliability and responsiveness. Outcomes measure effectiveness of programming in terms of results and accomplishments of program participants.

We sought to establish baseline state rates for four dependent variables.

Among youth eligible for VR services:

- Service Receipt (output). The percentage of youth who received any VR services between eligibility determination and case closure.

Among youth who received any VR services before case closure:

- Early reach (quality—reliability). The percentage of youth who were secondary students when they entered VR.
- Timeliness (quality—responsiveness). The percentage of youth who had an IPE developed within 90 days of eligibility determination.
- Employment (outcome). The percentage of youth who were employed at the time of case closure. RSA defines employment as maintaining a job in competitive or supported employment for 90 days in an integrated setting.

Individual-Level Variables

We examined individual-level demographic and characteristic information for all TAY-ASD ($n=35,823$). These variables included gender, age, race, ethnicity, and primary sources of financial support and health insurance at the time of application. To provide context, we also calculated the proportion of TAY-ASD cases within the broader category of TAY with intellectual and developmental disabilities (TAY-IDD) which included TAY with work impairments due to intellectual disability (coded as Mental Retardation in the RSA Case Service Report), cerebral palsy, traumatic brain injury, and autism ($n=98,792$).

State-Level Variables

We included two state-level measures of economic conditions. State unemployment levels for 2016 came from the U.S. Department of Labor (Bureau of Labor Statistics 2018). We also selected a measure of state fiscal capacity—the gross domestic product (GDP) by state. State GDP is the state counterpart to the national Gross Domestic Product (GDP) and is “the most comprehensive measure of economic activity in states” (Cao and Yoon 2017). We calculated real GDP per capita for each state for 2016 using data from the U.S. Department of Commerce (Bureau of Economic Analysis 2018) and the U.S. Census Bureau (U.S. Census Bureau Population Division 2017). Both unemployment and state GDP were included as continuous variables in modeling centered around the mean of state values, after assessment of distribution. The average state unemployment rate was 4.67 (range 2.9–6.9). The average state GDP per capita was \$50,600 (range \$31,900–\$159,700).

Analysis

For all four dependent variables, we calculated counts and frequencies by state, as well as summary statistics, including the average value of all 51 states, the range, and the inter-quartile range. These statistics summarized the state values, such that the mean of the state values represented the mean of the 51 state means, not the mean of the individual VR cases in the 51 states. We then calculated the average and population standard deviation among states for each dependent variable and calculated z-scores for each to standardize the state scores with a mean of zero and a standard deviation of one. We noted states that fell above or below one or two standard deviations of the mean of the standardized z-scores. This method allowed for statistical comparison of states to denote outliers.

We then used multilevel logistic regression modeling to quantify state variation in the four dependent variables and the extent to which state unemployment and state fiscal

capacity were associated with the dependent variables. Multilevel modeling (MLM) is appropriate for analysis of VR cases which are not assumed to be independent of each other given that the cases are clustered within states. We assumed that cases within a state are subject to the economic, policy, and practice conditions within that state. In this study, we used MLM to determine the role of state-level economic conditions in the variation between states for individual outcomes of interest. We controlled for individual-level demographics and used MLM to model the four dichotomous dependent variables (e.g., 1 = employed at VR exit, 0 = not employed; and 1 = secondary student at entry into VR, 0 = not a secondary student at entry).

For purposes of MLM, our use of 51 states is considered a sufficient number of state-level (Level 2) units to achieve an acceptable estimate of variance in practice (Maas and Hox 2005; Stegmueller 2013). The bias in parameter estimates and the variance of the fixed effects (at the individual level) is considered negligible in groups of this size. Generally, the sample size is of most concern at the level of inference. Because the level of inference in this study is at the second level (state variance in outcomes), the number of states is important.

Four sequential models were fitted for each dependent variable. Model 1 was an empty, intercept-only, model which accounted for nesting within states but contained no individual- or state-level variables. Model 2 added the individual-level demographic variables seen in Table 1. Model 3 controlled for the same individual-level variables as model 2 and added the centered state unemployment rate. Model 4 controlled for individual-level variables and state unemployment rate and added the centered state GDP.

To assess state variability, we calculated the median odds ratio (MOR) for all models. The MOR is a way to quantify the variability at the state-level (Level 2) in this multilevel logistic regression model, in which partitioning of variance is not as straightforward as linear or other models. The MOR compares the odds of the outcome for all possible pairs of two randomly chosen individuals with the same values on all covariates from different states, and then takes the median of these odds ratios to understand the variation between states in the median case. The calculation for the MOR includes the state-level random intercept variance and is bound by 1 on the lower end, as the higher odds are always placed in the numerator of the ratio. Therefore, an MOR of 1 indicates no state variability, and an MOR much above 1 indicates large state variation (Merlo et al. 2006).

We also calculated the proportional change in variance (PCV) as a percentage for each model as compared to model 1. The PCV measures the extent to which the variables included in a model explain the variation in the outcome across states [(variance of model n – variance of model 1)/variance of model 1 where $n = 2–4$] by comparing the

Table 1 Characteristics of TAY-ASD who received VR services prior to case closure in FFY 2014–2016

	($n = 35,823$)	(%)
Male	29,906	83.2
Age at application		
14–15	556	1.6
16	2490	6.4
17	6777	18.3
18	8258	23.5
19	4947	14.1
20	3972	11.3
21	3274	9.6
22	2261	6.3
23	1814	4.9
24	1474	4.1
Race		
White	30,252	83.3
Black	3605	10.8
Other/multiple	1966	5.9
Ethnicity—Hispanic or Latino	2541	7.5
Primary source of support at application		
Personal income (earnings, interest, dividends, rent)	1048	2.8
Family and Friends	26,789	73.7
Public support (SSI, SSDI, TANF, etc.)	7535	22.0
All other sources (e.g., private disability insurance and private charities)	451	1.4
Type of health insurance at time of application		
Private	15,257	40.6
Public	11,266	33.8
Both private and public	2121	6.0
No insurance	7179	19.6

SSI supplemental security income, SSDI social security disability insurance, TANF temporary assistance for needy families

random intercept of the first model to subsequent models with additional variables.

The coefficients of the individual-level variables from models 2 through 4 are not included in the tables, as they were not the main interest in our multilevel modeling (available upon request). The coefficients as odds ratios from state-level variables are included in models 3 and 4. All analyses were performed using Stata 15.

Results

Descriptive characteristics of TAY-ASD who received services are summarized in Table 1. The majority of TAY-ASD who received VR services were male (83%), white (83%), and non-Hispanic (92%). Over one-quarter (26%) applied for VR services at ages 14–17 years. At the time of application,

TAY-ASD were primarily financially supported by family and friends (74%) and less than one-quarter (22%) were receiving public supports such as Social Security Income. Approximately 40% of TAY-ASD had public insurance, or a mixture of public and private.

Inter-State Variation

The distributions of the dependent variables are presented in Table 2. Of all TAY-ASD who applied to VR and were found eligible for services, the number of TAY-ASD who received services in each state ranged from 35 in D.C. to 2408 in New York. Across the three years of data, three other states had fewer than 100 cases—New Mexico, North Dakota, and Wyoming; while California and Ohio had more than 2000 cases. Averaging all 51 state values, approximately 70% of TAY-ASD received VR services after being found eligible. New Jersey and Tennessee had the lowest percentages (51%) of TAY-ASD who received services after being found eligible, while 89% of eligible TAY-ASD in Pennsylvania received services—greater than two standard deviations above the mean of state means.

Averaging all 51 state values, nearly 50% of TAY-ASD who received VR services were secondary students at the time of application (early reach). This ranged from 10% in New Jersey and 12% in Montana—both greater than two standard deviations below the mean of state means, to 77% in Oklahoma. Using the mean of all state values, 54% of TAY-ASD who received VR services had an IPE developed within 90 days (timeliness). This ranged from 23% in Iowa—greater than two standard deviations below the mean of state means—to 84% in California.

Averaging 51 state values, 58% were employed at the time of case closure following receipt of VR services. The District of Columbia had the lowest percentage of TAY-ASD with a job at exit (29%), greater than two standard deviations below the mean of state means, while Washington and Nebraska had the highest at 75% and 76%.

Multilevel Analysis Results

Results for each model are shown in Table 3. As state unemployment levels increased, rates of employment of TAY-ASD significantly decreased. However, state GDP per capita was not associated with employment or any of the additional dependent variables. The addition of individual- and state-level variables did not significantly reduce the variation between states in most cases. Three of the four dependent variables (service receipt, timeliness, and employment receipt of services) had small to no changes in the MORs across models. For these three outcomes, the addition of the individual- and state-level variables did not explain much of the observed variance between states, as can also be seen by

the stable PVC between models. However, this was not the case for secondary student status at the time of VR application. For this outcome, the MOR and random intercept variance increased with the addition of individual-level variables between models 1 and 2, and the PVC between models 1 and 2 was very large in the negative direction. The variance did not change to the same degree between models 3 and 4, suggesting that the addition of state-level variables did not greatly impact variability between states.

For all four dependent variables, we observed significant variation between states after controlling for individual-level demographic factors, state unemployment, and state fiscal capacity (Model 4). The largest state variation, even after controlling for other factors, was seen in secondary student status at the time of application (MOR = 2.24). The MOR for completion of a signed IPE within 90 days of eligibility was 1.89 after controlling for individual- and state-level factors. The MOR was smaller for receipt of services (MOR = 1.5) and exiting VR with employment (MOR = 1.42) but remained > 1 and the differences remained significant. Therefore, variation remained that was unexplained by individual-level demographics, state unemployment, or state fiscal capacity for all four dependent variables.

Discussion

This study revealed a high degree of state-level variation across key aspects of VR service use and outcomes of TAY-ASD using recent data from FFY 2014–2016. This finding adds to prior work documenting wide state variation in VR service use and outcomes for adults with ASD (Roux et al. 2016; Roux et al. 2018), for youth with ASD in older datasets (Burgess and Cimera 2014; Migliore et al. 2014), and for youth with disabilities other than autism (Honeycutt et al. 2015b). This finding was not surprising, as it has long been known that where you live matters in terms of outcomes for a wide range of disability-related topics including access to autism services (Thomas et al. 2012), financial burden in families raising children with special health care needs (Parish et al. 2012; Shattuck and Parish 2008), and employment outcomes of young adults who received Social Security Income benefits during childhood (Hemmeter et al. 2017).

Interstate differences were strongest for the percentage of TAY-ASD who were secondary students when they applied for VR services—a 25 percentage point difference between the lower and upper quartiles. The percentage of TAY-ASD who received VR services varied the least across states, with an 11-point difference between the lower and upper quartiles. However, a 38-point gap remained between the highest and lowest state mean, indicating that some states are faring significantly worse in delivering VR services to TAY-ASD who are determined eligible.

Table 2 Variation in VR service experiences and outcomes across states for TAY-ASD whose case closed in FFY 2014–2016. *Source* Rehabilitation Services Administration RSA-911 data, FFY 2014–2016

State	Total number served	Service receipt (%)	Early reach (%)	Timeliness (%)	Employment (%)
TAY-ASD who received some services before case closure (n = 35,823)					
Alabama	469	75.9	53.5	72.6*	73.6*
Alaska	149	81.4*	51.7	55.3	61.1
Arizona	446	60.7	55.2*	44.7	49.3
Arkansas	221**	57.4*	31.2	78.3*	53.8
California	2210	73.1	52.8	83.6*	55.1
Colorado	457	64.7	55.1	37.7*	68.7*
Connecticut	457	73.0	54.3	49.8	48.8
Delaware	182	76.2	56.6	64.3	66.5
District of Columbia	35*	53.0*	68.6*	71.9*	28.6**
Florida	1645*	70.1	65.3	52.2	40.2*
Georgia	626	57.0*	36.4	43.7	68.4
Hawaii	116	67.1	25.0*	58.8	44.0*
Idaho	379	67.7	49.6	57.6	52.2
Illinois	1665*	80.8*	64.4	55.3	45.7*
Indiana	1,136	70.3	53.6	56.1	56.7
Iowa	431	80.6*	22.3*	22.5**	60.3
Kansas	336	68.4	33.0*	59.8	59.2
Kentucky	521	59.1*	35.1	26.8*	52.6
Louisiana	277	58.8*	41.9	56.0	57.4
Maine	310	54.9*	61.9	28.1*	47.4*
Maryland	669	63.0	66.8*	44.9	67.7
Massachusetts	800	73.5	63.9	32.8*	59.8
Michigan	1459*	80.9*	68.5*	70.0*	49.8
Minnesota	1,227	73.0	68.8*	47.7	66.3
Mississippi	149	61.1	71.1*	64.9	36.9**
Missouri	1124	62.6	47.7	49.6	68.1
Montana	144	68.6	11.8**	71.5*	51.4
Nebraska	267	65.4	39.3	54.3	75.7*
Nevada	204	64.4	26.0*	52.5	62.7
New Hampshire	334	65.1	45.5	44.7	54.2
New Jersey	757	50.6*	10.3**	65.0	64.5
New Mexico	98	61.3	49.0	54.1	38.8*
New York	2408**	73.2	72.2*	62.3	59.2
North Carolina	1,315	64.5	25.8*	68.4	66.9
North Dakota	87	56.1*	59.8	32.2*	69.0*
Ohio	2111**	72.2	65.1	51.2	51.4
Oklahoma	364	74.1	76.6*	72.9*	50.8
Oregon	632	63.8	35.9	41.9	69.0*
Pennsylvania	1966*	88.5**	41.7	79.5*	54.5
Rhode Island	144	69.6	51.4	50.0	61.1
South Carolina	424	82.3*	63.4	73.7*	47.6
South Dakota	181	75.7	59.1	68.9	73.5*
Tennessee	492	50.7*	42.1	36.5*	60.0
Texas	1975*	66.7	42.9	59.4	63.3
Utah	526	71.1	69.0*	54.4	67.1
Vermont	294	85.0*	39.1	75.8*	60.9
Virginia	1292	79.0*	64.0	32.5*	61.8

Table 2 (continued)

State	Total number served	Service receipt (%)	Early reach (%)	Timeliness (%)	Employment (%)
Washington	849	59.2*	32.3*	36.0*	75.4*
West Virginia	224	66.3	71.9*	28.4*	51.3
Wisconsin	1155	69.5	42.4	42.1	68.6
Wyoming	84	72.4	47.6	75.0*	67.9
Summary statistics for state values					
Mean of state means	702	68.2	49.8	54.3	58.1
Minimum	35	50.6	10.3	22.5	28.6
Maximum	2408	88.5	76.6	83.6	75.7
Interquartile range					
25%	223	61.9	39.2	44.2	51.4
75%	1130	73.4	63.9	66.7	67.0

“Service receipt” is the percent who received services of all TAY-ASD found eligible. “Early reach” is the percent who were secondary students at the time of application. “Timeliness” is the percent who signed an IPE within 90 days of eligibility. “Employment” is the percent who exited with a job

*State is more than 1 standard deviation away from the mean value

**State is more than 2 standard deviations away from the mean value

Table 3 Multilevel regression models of vocational rehabilitation outcomes for transition-age youth on the autism spectrum. *Sources* State unemployment rates for 2016 come from the Bureau of Labor

Statistics. State GDP for 2016 comes from the Bureau of Economic Analysis and 2016 state population comes from the U.S. Census Bureau Population Division

	Service receipt	Early reach	Timeliness	Employment
Fixed effects				
State unemployment (CI) Model 3	1.00 (.89, 1.14)	1.16 (.91, 1.48)	1.11 (.92, 1.34)	.87* (.78, .97)
State unemployment (CI) Model 4	1.01 (.89, 1.14)	1.14 (.89, 1.45)	1.11 (.92, 1.34)	.87* (.78, .98)
State GDP per capita (CI) Model 4	1.00 (1.00, 1.00)	1.00 (1.00, 1.00)	1.00 (1.00, 1.00)	1.00 (1.00, 1.00)
Random effects				
Model 1 variance of the random intercepts	.1811 (.1201, .2732)	.5083 (.3393, .7614)	.4332 (.2895, .6481)	.1569 (.1013, .2430)
Model 2 variance of the random intercept	.1802 (.1195, .2718)	.7701 (.5148, 1.1520)	.4570 (.3055, .6837)	.1569 (.1013, .2430)
Model 3 variance of the random intercept	.1802 (.1195, .2718)	.7509 (.5024, 1.1224)	.4464 (.2983, .6680)	.1333 (.0860, .2066)
Model 4 variance of the random intercept	.1803 (.1196, .2719)	.7201 (.4819, 1.0760)	.4463 (.2984, .6676)	.1339 (.0863, .2076)
Proportional change in variance from model 1 to model 2 (%)	0.50%	−51.51%	−5.51%	5.26%
Proportional change in variance from model 1 to model 3 (%)	0.51%	−47.74%	−3.06%	15.03%
Proportional change in variance from model 1 to model 4 (%)	0.46%	−41.68%	−3.03%	14.67%
Model 1 MOR	1.50*** (1.37, 1.62)	1.97*** (1.70, 2.24)	1.87*** (1.63, 2.10)	1.46*** (1.34, 1.58)
Model 2 MOR	1.50*** (1.37, 1.62)	2.30*** (1.92, 2.69)	1.90*** (1.65, 2.15)	1.44*** (1.33, 1.56)
Model 3 MOR	1.50*** (1.37, 1.62)	2.28*** (1.90, 2.65)	1.89*** (1.65, 2.13)	1.41*** (1.31, 1.52)
Model 4 MOR	1.50*** (1.37, 1.62)	2.24*** (1.88, 2.60)	1.89*** (1.65, 2.13)	1.42*** (1.31, 1.52)

Model 1 is an intercept only model. Model 2 includes the individual-level variables seen in Table 1. Model 3 includes all of the variables found in model 2 and the centered state unemployment rate. Model 4 adds centered state GDP to model 3

The MOR is calculated as: $e^{[0.95 \times \sqrt{\text{TAO}(00)}]}$

The proportional change in variance (PCV) is the (variance of model n – variance of model 1)/variance of model 1 where n = 2–4

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

The variation observed across states for each dependent variable was not adequately explained by individual level demographics, state unemployment levels or state fiscal capacity. This finding suggests that other factors within states are contributing to differences in VR outcomes, strengthening the hypothesis that differences in state-level VR policies and practices may play a role in employment outcomes for TAY-ASD. Clearly, some states experienced much higher rates of success in achieving employment for TAY-ASD, with four states (Alabama, Nebraska, South Dakota, and Washington) reporting that more than 70% of TAY-ASD attained employment following VR services. Discovering differences in the organization, delivery, and coordination of policies and practices that support employment for TAY-ASD in these and other higher-performing states is a critical next step in identifying and replicating successes.

Nevertheless, the finding of wide state variation in the percentage of TAY-ASD who applied to VR as a secondary student (early reach) is important and timely. Whether students with disabilities interact with VR during high school is a key indicator of whether youth are being provided ample time to prepare for the transition to adulthood. Federal WIOA legislation now requires states to allot at least 15% of VR funding to Pre-Employment Transition Services (Pre-ETS) aimed at successfully transitioning students into post-secondary employment or education (34 CFR §361.65). This indicator of student status at VR application signals whether states are facilitating early awareness of the assistance VR can provide TAY-ASD during the transition to adulthood and may be a measure of how well special education and VR services are coordinated in a state.

Across states, TAY-ASD comprised an average of nearly 40% of the overall TAY-IDD cases who exited from VR in FFY 2014–2016. We are not aware of prior statistics indicating the size of the TAY-ASD population within the IDD population who received VR services. Given the size of this group, and the fact that youth are the largest age group of VR users with ASD (Chen et al. 2015b), the topic of improvements to VR services for TAY-ASD warrants substantial focus. States like Michigan have identified youth with autism as “the primary emerging population reported as either currently, or to be, an underserved population” (pg. 313) in their most recent VR state plan (U.S. Department of Education 2016b), and highlighted a need for technical assistance and training to better serve TAY-ASD. It is possible that engaging TAY-ASD in VR services and achieving success may require modifications to standard VR practices in states. As some states implement innovations to better address the needs of this underserved group, monitoring VR outcomes of TAY-ASD will be essential for evaluating effectiveness.

This study has several implications for future research. First, future research should identify which aspects of policy and practice are associated with better VR outcomes

across states, while allowing for the possibility that policies and practices may operate differently based on state context and the characteristics of the subpopulation that is receiving services. For example, Alabama and South Dakota had high employment rates at VR exit and also had rates of service receipt, early reach, and timely signing of IPEs which were above the mean of states means. In these states, provision of early and timely services may have influenced employment outcomes. Yet, Nebraska and Washington had rates well below the mean for each of these indicators, even though their employment rates at VR exit were also high. The performance profiles of these example states suggest that differing pathways may each lead to higher employment outcomes in states dependent upon contextual factors and other aspects of policy and practice. Case studies of higher performing states could elucidate innovative policies and practices which may be contributing to the successes of some states in serving TAY-ASD.

Second, further investigation of service delivery and organizational processes must be conducted with a broad lens. VR services do not exist in isolation; they work best when coordinated within the complex array of shorter-term transition services and longer-term services and supports available within a state to support the school-to-work transition for youth with disabilities (Nye-Lengerman 2017; Fabian et al. 2016; Luecking et al. 2017). It is important to determine whether seamless transition practices, including initiating VR services at least 2 years prior to high school exit (Luecking et al. 2017), are contributing to improved employment outcomes for TAY-ASD. In Maryland, students who received a seamless transition model experienced far fewer days between eligibility determination and IPE development, which the authors attributed to improved collaboration and information sharing between the school, VR and families (Luecking et al. 2017). It is possible that specific aspects of transition-related policies and practices bear more influence on vocational outcomes for the TAY-ASD group.

Further, we caution that employment success cannot be measured with simple yes/no indicators regarding job status. While some studies have found comparable employment rates for TAY-ASD and TAY-IDD, wages and hours worked by TAY-ASD were notably lower than those of TAY-IDD (Migliore et al. 2014). Documentation of hours worked, wages earned and benefits, job satisfaction, match of the job to employee skill sets and environmental preferences, and sustainability of employment over time are necessary information for providing a holistic assessment of employment status. We note here that wage information is no longer publicly available in RSA-911 annual datasets—a change which will significantly limit our ability to measure baseline and future changes in gainful employment.

Finally, while this study focused on the subpopulation of TAY-ASD who successfully accessed VR services, it

is imperative that future research also examine those who might need these services but do not access them, so that state-level barriers to service receipt can also be better understood. Using RSA-911 data, we are only able to analyze information about people after they are determined to be eligible for services. There are no reliable estimates of the proportion of the population of TAY-ASD who require VR services from which to evaluate the adequacy of the numbers who are being served in a state.

Limitations

While this study contributes substantially to our knowledge base regarding state VR service experiences of TAY-ASD, there are several limitations related to conducting state-level analysis within the RSA-911 dataset. First, there is considerable potential for bias when selecting to study the subpopulation of TAY-ASD who received VR services. The RSA-911 contains little information about people who were found eligible for VR services but did not receive them prior to case closure. Some youth may have found a job on their own, but others may have abandoned pursuit of services due to lengthy administrative processes or lack of match of services to their needs (Anderson and Butt 2018). Lawer et al. (2009) suggested that VR employment rates may be inflated by “creaming,” since those who are more difficult to serve may be actively or passively discouraged from applying to VR or found ineligible. Migliore et al. (2014) similarly recommended that state-level employment rates following VR services must take into consideration the percentage of youth who receive VR services, as rehabilitation rates could be higher in states where fewer youth receive VR services in the first place.

Lack of appropriate referral to VR services may also affect indicators of early entry into VR services. TAY-ASD who do not receive special education services and/or quality transition planning are less likely to learn about VR services and apply for them. The myriad complexities of accessing employment supports within a fragmented service delivery system are a known issue (Anderson et al. 2018a, b; Honeycutt et al. 2015a; Pillay and Brownlow 2016). If these access issues were better understood and addressed, and the true breadth of the population of TAY-ASD who would benefit from VR services were represented in the RSA data, it is possible that even greater state variation might be evident.

Second, although autism was listed as the primary or secondary cause of a person’s disability, procedures for verifying a clinical diagnosis are not necessarily consistent across VR agencies or counselors. It is unlikely that those with ASD noted in their medical and educational records are not on the autism spectrum. However, it is quite possible that there are some people in the dataset who do not have autism

listed as the cause of their job impairment, even though they may meet clinical criteria if applied.

Third, RSA-911 data are administrative, meaning they are entered by VR counselors—not by individuals with ASD themselves; therefore, true accuracy and reliability are unknown. Additionally, the RSA-911 dataset does not contain complete information on some demographic and impairment characteristics. For example, there is no data on household income, whether the person had a source of transportation, or severity of impairments. Therefore, we were unable to characterize participants along these dimensions. However, because RSA-911 data is routinely entered by VR staff, a positive feature of the dataset is the low rates of missing data. Further, because the data elements and data entry are guided by regulations that apply to all U.S. states and territories, the consistency of data reporting aids comparison.

Last, the scope of this paper did not include exploration of the state-level variation in receipt of particular VR services, although prior research indicates that receipt of specific VR services does vary by state (Roux et al. 2016; Nye-Lengerman 2017). We need to learn more about which services TAY-ASD tend to receive and how profiles of service receipt may change over time in response to new WIOA legislation.

Conclusions

VR services represent a potential stepping stone to employment, so understanding the factors that promote or inhibit the performance of this system is key to improving employment outcomes for TAY-ASD. VR services come with a high price tag, so understanding the social return on investment is also important. In the U.S., at the federal level we spend approximately \$1 on VR services for every \$4 we spend on school-age special education services; the 2017 federal budget for VR services was approximately \$3.2 billion dollars, compared to the \$12 billion dollars allotted to school-age special education services (U.S. Department of Education 2018). The cost of VR services for TAY-ASD over a 10-year period was \$7.5 million dollars (Burgess and Cimera 2014). The average amount that states spent on VR services for those with autism in FFY 2014 (\$5892) was higher than the average spending on those without autism (\$5481), with several states spending an average of \$4000–5000 more to serve those with autism (Roux et al. 2016). Despite this investment of public funding, the employment rate for TAY-ASD has not improved significantly over time, and those with ASD continue to work fewer hours at lower wages than those with other disabilities (Burgess and Cimera 2014). Honeycutt et al. (2015b) suggests that higher costs of VR services per person may limit the number of youth that a state can serve. Therefore, particularly as states begin to implement

the WIOA requirement to spend 15% of their VR budget on Pre-ETS, their ability to deliver traditional VR services for TAY-ASD should also be monitored.

The unexplained variance highlighted in this study points to a need for additional, ongoing research to better understand how VR agencies are serving TAY-ASD across states, the effects of these services, and whether changes in the VR program via the 2014 Workforce Innovation and Opportunity Act move the needle on VR outcomes for TAY-ASD. Although, there is an emerging knowledge base about factors of state-level variation for youth and adults with other disabilities (Honeycutt et al. 2015a, b; Sevak et al. 2018), little study has been conducted to examine factors of employment for people with ASD across ecological levels (Anderson et al. 2018b; Chen et al. 2015a). Nearly every state has some type of policy, legislation, or activities focused on implementing inclusive employment initiatives whether through VR agencies or through state departments of Developmental Disabilities (<http://www.apse.org>); but we do not know which policies and activities contribute to better outcomes.

Defining and measuring societal-level problems are the first steps toward building evidence-based policy solutions (Clancy et al. 2012). Ongoing tracking of indicators like the ones in this paper is critical because the impact of policies like WIOA on specific subpopulations are rarely monitored or evaluated by state agency administrators (Jansen et al. 2010). Researchers play an important role in filling this information gap and in fostering opportunities to learn from states that are achieving higher performance. Accumulating evidence about state-level variation for TAY-ASD over time will be useful for policy makers and program planners who seek evidence-informed improvements to the performance of state VR systems.

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Compliance with Ethical Standards

Conflict of interest Ms. Roux, Ms. Rast, and Dr. Shattuck each declare that they have no conflicts of interest.

Ethical Approval This study was deemed exempt by the Drexel University Institutional Review Board.

Informed Consent Not applicable. No data was collected, as this study was a secondary analysis.

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