

**Improving Neurodivergent Experiences in the Workplace:  
Identifying Barriers and Facilitators to Employment for Autistic Adults**

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### **Abstract**

Autistic adults have higher rates of unemployment and underemployment than both non-autistic disabled and non-disabled adults. Given the positive relationship between employment and quality of life, it is essential to gain a better understanding of the obstacles to and facilitators of employment for autistic adults. A mixed methods approach is used to study the landscape of accommodations for autistic adults (N = 85) who are currently or were previously employed. Additionally, the positive and negative factors related to employment are considered within an ecological systems framework. Approximately half of the participants reported that they did not receive any workplace accommodations, while 73.2% of these individuals believed they would benefit from accommodations. Of the factors impacting employment, task training received the most positive, and mental health challenges received the most negative average rating. Qualitative analyses of free responses revealed positive and negative contributors to employment experiences impacting five levels of interaction across four themes (acceptance of neurodivergence, communication, autonomy, and formal/informal accommodations). The themes act differentially across the levels. Recommendations for novel accommodations are described relating to each theme and level. Importantly, increased top-down support for employees and cultural changes are essential for the long-term employment success of autistic adults.

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### **Lay Abstract**

Autistic adults have much higher rates of unemployment than non-autistic adults. The reasons for positive and negative experiences in the workplace for autistic adults are not well understood. While some positive and negative factors related to employment experiences of autistic adults have been studied on their own, there is limited research on how these factors interact. Further, previous work in this area focuses largely on the transition to employment. This paper explores the workplace experiences of 85 autistic adults, half of whom have a co-diagnosis of ADHD. It describes the most commonly received accommodations, the perceived usefulness of these supports, the most and least helpful contributing factors, and how these factors interact to impact employment. Combined quantitative and qualitative analyses (survey data and thematic analysis from open-ended/free responses) reveal novel insights into the factors that support employment across multiple levels of interaction. On average, specific task training had the most positive impact on employment experiences, while mental health challenges had the most negative impact on employment experiences. An analysis of free responses from participants suggest five levels (individual, workplace, colleagues, supervisor, society) and four themes (acceptance of neurodivergence, high-quality communication, autonomy, availability of formal/informal accommodations) that are important for improving experiences in the workplace. This paper outlines concrete actions that all individuals in the workplace can take to improve the employment experiences of autistic adults, while also calling for larger cultural shifts and policy changes to make these steps effective and sustainable in the long term.

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Autistic adults have strikingly high disparities in employment outcomes compared to their non-autistic peers with and without other disabilities. These discrepancies include higher rates of unemployment (ranging from 50% to 71%) and lower rates of being employed least once (63%; U.S. Bureau of Labor Statistics, 2023; Office for National Statistics, 2022; Newman et al., 2011; Roux et al., 2013; Shattuck et al., 2012). The notable gap in employment rates suggests the need for greater insight into the barriers and facilitators to employment for autistic individuals.

Autism is diagnosed based on (1) social communication challenges and (2) restricted and repetitive behaviors (American Psychological Association, 2013). Previous research has examined how features of the workplace can create specific challenges for individuals with these diagnostic characteristics (e.g., Waisman-Nitzan, Gal, & Schreuer, 2021). The poor employment outcomes of autistic adults have largely been attributed to stigma, communication challenges with non-autistic colleagues, and limited availability and accessibility of accommodations in the workplace (Black et al., 2020; Harmouth et al., 2018; Roux et al., 2013). However, many autistic adults also possess strengths that make them assets in the workplace, including strong focus, efficiency of task completion, and dedication (e.g., Cope & Remington, 2022). The barriers described above may prevent autistic employees from optimally utilizing their strengths and reaching their potential.

Furthermore, lack and/or loss of employment has been closely linked to decreased quality of life and worse mental health among autistic individuals (Moss et al., 2017; Taylor et al., 2022). Autistic individuals are also more likely to have co-occurring diagnoses, including diagnoses of attention-deficit/hyperactivity disorder

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(ADHD; 28%), anxiety disorders (20-65%), and depressive disorders (11-53%), than the general public, which may lead to additional challenges in the workplace (Fombonne et al., 2022; Hollocks et al., 2019; Hudson et al., 2019; Jadav & Bal, 2022; Lai et al., 2019). Despite the heterogeneous profiles of autistic individuals, existent research on employment of autistic people primarily includes autistic males with limited characterization of co-occurring diagnoses, limiting the generalizability of findings.

This work addresses several gaps in the literature. First, participants with a range of co-diagnoses and diverse gender identities are included, increasing the representation of autistic experiences and the generalizability of the results. Second, a mixed-methods approach including both quantitative and qualitative analyses is utilized to capture the rich and varied experiences of participants. Finally, the authors consulted with autistic collaborators to refine the data interpretation and to increase the relevance of the findings within the autism community.

The study addresses three primary research questions: (1) What is the landscape of workplace accommodations for autistic adults?; (2) Which factors (positive and negative) do autistic adults identify as being the most relevant to their employment experiences?; (3) How can workplace experiences and accommodation processes be improved across multiple levels of interaction?

### **Methods**

#### **Participants**

This online, survey-based, study was conducted with autistic participants recruited in collaboration with Simons Powering Autism Research (“SPARK”; SPARK Consortium, 2018). The SPARK database of autistic individuals has been confirmed to

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have a high degree of autism diagnosis validity (Fombonne et al., 2022). All SPARK participants reside in the United States (US).

### ***Recruitment and Enrollment Procedures***

Potential participants were first screened by SPARK team members between August and December of 2022. Eligible participants met the following criteria: legally independent adults (specified in SPARK's questionnaire); aged 18 to 65 years; currently employed for pay or employed for pay in the past five years. Interested and eligible participants were contacted by the study coordinator and completed the consent form and surveys online via Qualtrics (Qualtrics.org) on the Prolific online experiment website (Prolific.co). Participants were compensated with a gift card.

### ***Enrolled Participants***

A total of 86 participants were enrolled; one participant was excluded for incomplete survey data (survey completion < 80%). The final sample consisted of 85 autistic adults, including adults with ( $n = 43$  [28 female]) and without ( $n = 42$  [27 female]) a co-occurring ADHD diagnosis (**SI-1**). Participants' gender identities and race are included in **SI-1**.

### ***Measures***

Participants completed four online surveys. Additional information about each, including a copy of the *Novel Custom Employment Experiences Survey*, is included in SI-Methods.

The novel employment survey included questions about employment history, accommodations, and positive and negative factors related to employment experiences. The survey was designed based on the author's review of existing literature about the

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employment experiences of autistic individuals and non-autistic individuals with disabilities (Harmuth et al., 2018; Hammel et al., 2015; Hayward et al., 2019; Hendricks et al., 2010). The authors extracted accommodations and relevant factors for the employment experiences of autistic adults and organized them into an ecological systems-theory framework spanning the individual-, work environment- (sub-levels: accommodations and general work environment), and societal-level (**Figure 1**). The survey included Five-point Likert scale ratings and multiple-choice options. Free response questions were used to capture additional information about participants' employment experiences. The survey also included questions about other employment-related topics, including the impact of the COVID-19 pandemic on employment, attitudes toward employment, and perceived employment experiences compared to their peers. These data are beyond the scope of the current paper and are not included here.

### ***Additional Characterization Measures***

Participants completed the Patient-Reported Outcomes Measurement Information System (PROMIS) Short-Form Instrument, Emotional Distress-Anxiety Short Form (PROMIS Health Organization), the Quality of Life Survey (QoLS; Burckhardt & Anderson, 2003), and the Autism Quotient (AQ; Baron-Cohen et al., 2001). Scores on the PROMIS can range from 7 to 35; higher scores indicate greater severity of anxiety. Scores on the QoLS can range from 16 to 112; higher scores indicate a higher quality of life. Scores on the AQ can range from 0 to 50; higher scores indicate more autism-related symptoms.

### **Analyses**



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### ***Employment Sector Classification***

To understand the job sectors in which participants were employed, two research team members independently reviewed and classified participants' answers to a free response question about their current or most recent previous job title and role. Each role was classified according to the major U.S. employment group sectors (www.bls.gov). The initial inter-rater agreement was 73%. All disagreements were resolved through discussion. For participant responses with insufficient information, the raters followed the procedure outlined in **SI-Methods**.

### ***Quality of Life and Anxiety Comparisons***

Comparisons of anxiety scores (PROMIS), quality of life scores (QoLS), and autism characteristics (AQ) were made between (1) participants with versus without ADHD; and (2) Participants who were currently versus previously employed. Given the equal variances between groups, independent t-tests were used.

### ***Characterizing Accommodations***

Participants were provided a list of accommodations and prompted to select all the accommodations that they had received in their workplace. If they selected the option "I do not/did not receive any of these accommodations", the same list was provided again. Participants were then asked to select the accommodations that they thought could potentially be beneficial. The percent of people who received/would benefit from receiving at least one of the accommodations and the percent that each accommodation was received/would be beneficial to receive were calculated.

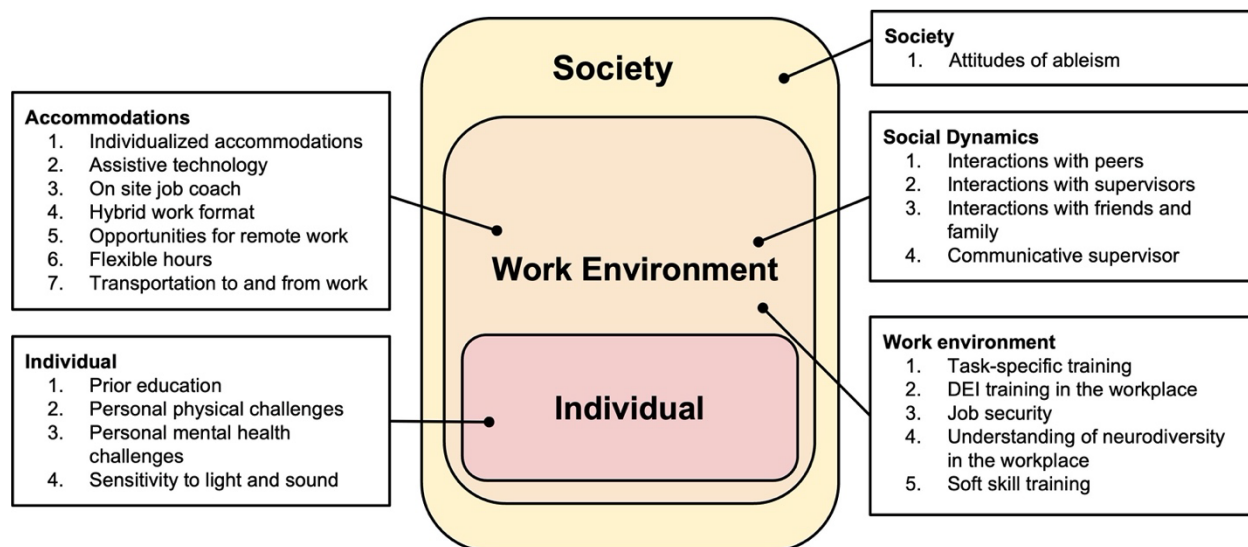
### ***Likert Scale Analyses***

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Participants used a 5-point Likert scale (1 = *Very Negative*; 2 = *Negative*; 3 = *Neutral*; 4 = *Positive*; 5 = *Very Positive*) to indicate how various factors affected their employment. The ratings of all factors, as well as factors within each level and sub-level, were ranked based on their average values (i.e., most positive to most negative) and statistically compared using the Friedman test with the Conover test post hoc. The Friedman test was chosen given the non-normally distributed, ordinal data. Notably, some factors and accommodations had missing Likert scale ratings due to participants reporting “I have not experienced this.” To address this missing data, all ratings of “I have not experienced this” were converted to neutral ratings of 3, to avoid skewing the results positively or negatively.

### Figure 1

*Factors hypothesized to impact employment experiences of autistic adults, across the individual, work environment, and societal level, based on literature review*



### Qualitative Thematic Analyses

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Free responses were analyzed; The positive and negative factors that impacted participants' employment were extracted. Two raters on the research team completed the following: Firstly, the raters read all responses and independently identified the system level and sub-level that each factor acted upon (e.g., individual, workplace, society). Secondly, the raters independently classified how the barriers and facilitators highlighted in the responses clustered together within broad themes. Thirdly, the raters re-read quotes within each broad theme and sorted them into sub-themes. Finally, the raters discussed and compared their sub-themes until a consensus was reached. Inter-rater reliability was not calculated, as the goal was to capture as many details and perspectives as possible (see Busetto et al., 2020). Themes and sub-themes were then discussed and refined with the other authors.

### ***Community Involvement***

To ensure that the interpretations of the findings are accurate and relevant to the daily lives of autistic adults, the authors received feedback from two autistic community members with employment experience and two neuroinclusion consultants who specialize in improving neurodivergent employment experiences. The collaborators provided feedback primarily related to Table 3, which the authors utilized to modify the results and interpretations.

All procedures were approved by the relevant Institutional Review Board in accordance with the Declaration of Helsinki.

## **Results**

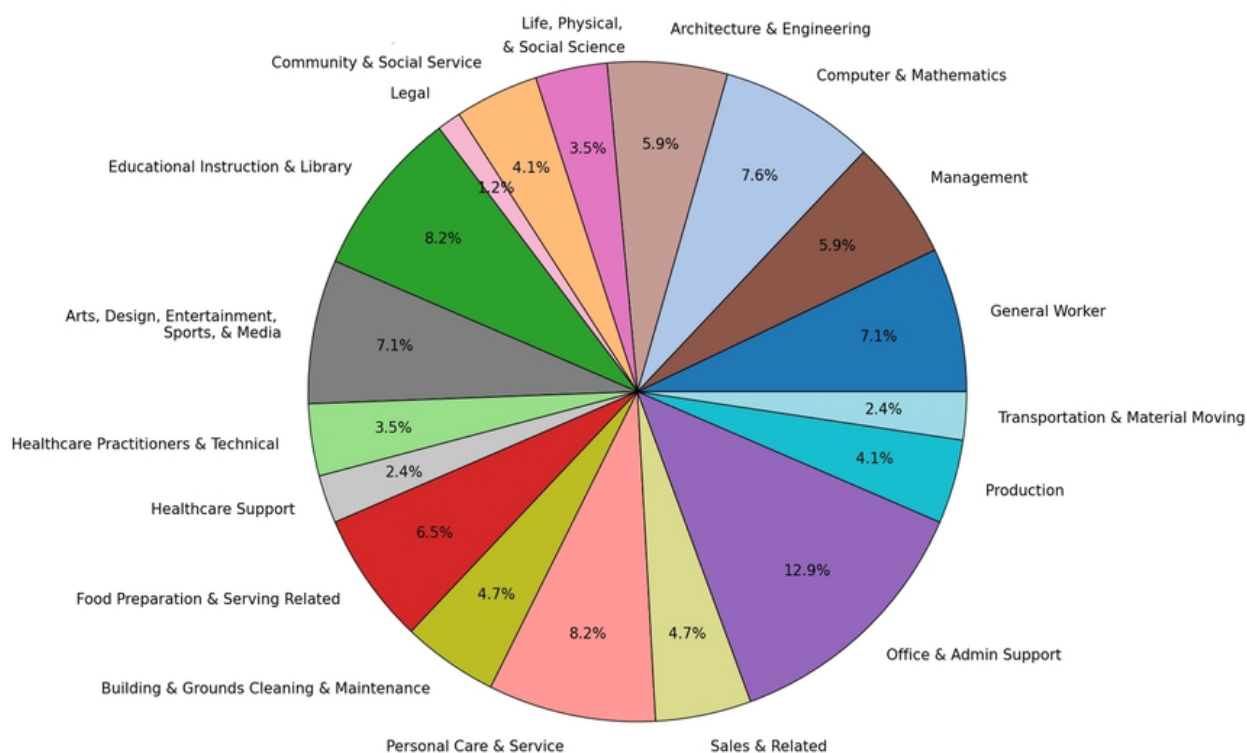
### **Employment Profiles**

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Across all autistic participants, 67.1% reported being currently employed and 32.9% reported being previously employed (years worked:  $M = 3.9$  years). The breakdown of the number of years and hours worked, and salary ranges are included in **SI-2**. The participants included employees across a wide range of employment sectors, including Computer/Mathematics, Arts/Design, Management, Entertainment, Sports/Media, Office and Administrative Support (**Figure 2**).

### Figure 2

*Employment sectors in which autistic participants are currently, or were previously, employed*



*Note.* Participants who reported more than one job are included in each category that they reported. Individuals in the “General Worker” category did not provide sufficient information for characterizing their employment sector in either the survey or SPARK database.

### Quality of Life and Anxiety Scores by Employment Status

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Autistic adults with and without ADHD did not differ in their scores of self-reported stress (PROMIS-T-score) ( $p = .17$ ,  $t = -1.40$ ), quality of life (QoL) ( $p = .48$ ,  $t = 0.71$ ), or Autism Quotient ( $p = .62$ ,  $t = 0.50$ ) (**S1-2**). As such, all subsequent findings reported are collapsed across these two groups, unless stated otherwise.

The currently employed autistic participants had significantly higher QoLS ratings ( $M = 73.4$ ,  $SD = 16.3$ ) than the previously employed ( $M = 65.8$ ,  $SD = 12.3$ ) participants ( $t(75) = 2.04$ ,  $p = .045$ ). The currently employed group also had significantly lower PROMIS scores ( $M = 60.1$ ,  $SD = 8.1$ ) than the previously employed ( $M = 64.4$ ,  $SD = 10.1$ ) participants ( $t(84) = -2.12$ ,  $p = .037$ ), indicating lower levels of anxiety in the currently employed group. The currently and previously employed groups did not differ in their AQ scores ( $t(84) = 0.38$ ,  $p = .71$ ).

### **Accommodations Received by Autistic Adults**

Across all autistic adults (currently and previously employed), 51.8% (17.6% M, 30.6% F) reported receiving at least one accommodation in the workplace. The most common accommodations received were a flexible work schedule (27.6%), modified job tasks (15.3%), and a job coach (12.2%). Of all the people who reported that they did *not* receive any accommodations, 73.2% reported they *believe they would benefit* from accommodations. The most commonly reported accommodations by these people were extended time for tasks (23.8%), flexible work schedule (17.5%), and modified job tasks (15.9%).

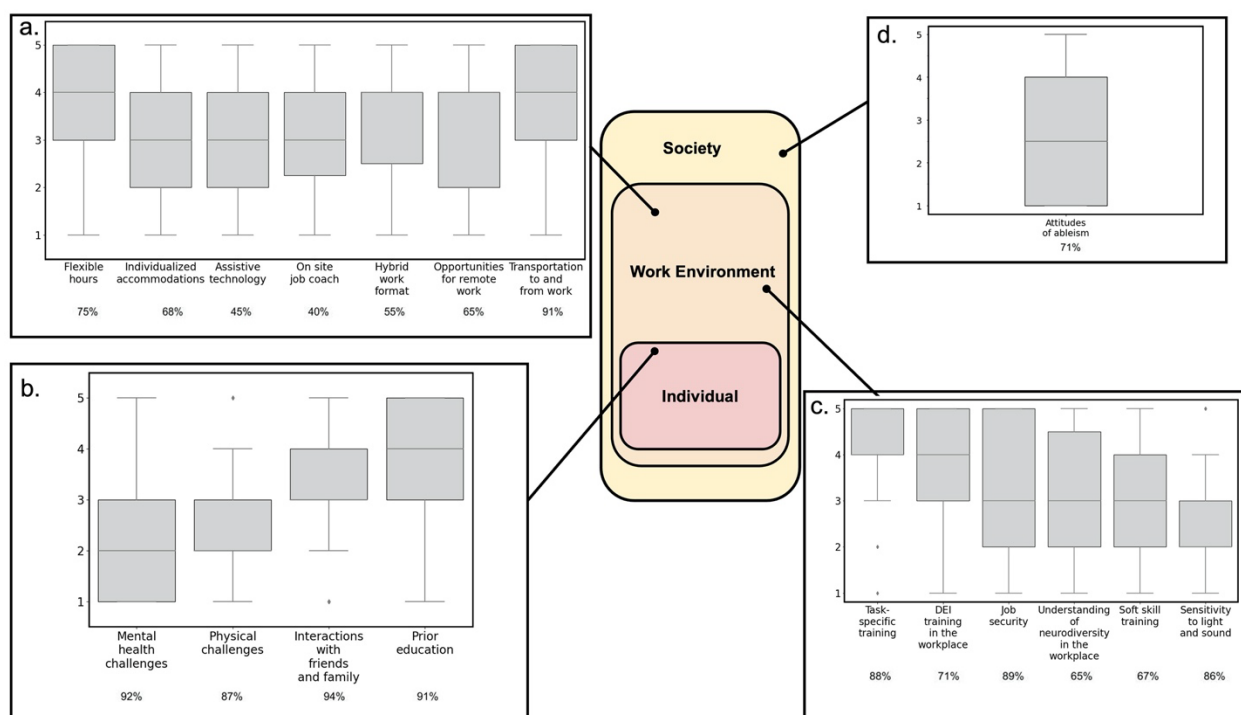
Participants also rated how positively or negatively different accommodations impacted their employment experiences. *Flexible hours* ( $M = 3.7$ ,  $SD = 1.2$ ) and *Transportation to and from work* ( $M = 3.5$ ,  $SD = 1.2$ ) were rated significantly more

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positively ( $p$ 's < 0.01) than an *On site job coach* ( $M = 3.0$ ,  $SD = 1.2$ ) and *Assistive technology* ( $M = 3.0$ ,  $SD = 1.3$ ). The other accommodations included in the survey (*Individualized accommodations*, *Hybrid work format*, and *Opportunities for remote work*) had relatively neutral ratings (**Figure 3**).

**Figure 3**

*Likert Scale Ratings (1-5) of the usefulness of specific accommodations at the level of a) the individual, the work environment consisting of b) accommodations in the workplace and c) the general work environment, and d) society*



*Note.* The percent value under each accommodation/factor represents the percent of participants who reported that they currently or previously received each. Participants who did not have experience with a given accommodation contributed a neutral rating of 3 (neither positive nor negative). Only participants who reported experiencing each accommodation rated the usefulness of each (indicated by the percentages below each factor in the figure).

### Ratings of Positive and Negative Factors

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To better understand the relative impact of various barriers and facilitators in the workplace, the factors that most positively and negatively impacted participants' employment experiences across levels and sublevels were compared. Across all factors, a visual analysis revealed that participants reported being most positively impacted by (ordered from most positive): specific task training ( $M = 4.1$ ,  $SD = 0.9$ ); prior education ( $M = 3.8$ ,  $SD = 1.1$ ); flexible hours ( $M = 3.7$ ,  $SD = 1.2$ ); and diversity, equity, and inclusion training ( $M = 3.6$ ,  $SD = 1.3$ ). They indicated that they were most negatively impacted by (from most negative): mental health challenges ( $M = 2.3$ ,  $SD = 1.2$ ), sensitivity to light and sound ( $M = 2.4$ ,  $SD = 1.1$ ), physical health ( $M = 2.5$ ,  $SD = 1.1$ ), and attitudes of ableism ( $M = 2.6$ ,  $SD = 1.2$ ) in the workplace (**SI-3**).

At the level of the individual, challenges with mental and physical health were significantly rated to be the most negative ( $p < .01$ ). Prior education was significantly the most positive factor ( $p < .01$ ), for all factors except for interactions with friends and family ( $p > .05$ ). In the work environment, task training was significantly rated to be the most positive factor ( $p$ 's  $< .01$  for all comparisons except for DEI training which was  $p < .05$ ), and sensitivity to light and sound was the most negatively rated factor (all  $p$ 's  $< .01$ ).

### **Qualitative Theme Extraction**

#### ***Thematic Analysis***

An inductive qualitative analysis of participants' free responses was performed to gain greater insight into the barriers and facilitators for individual experiences. While the factors that participants provided ratings on within the level of the work environment included general aspects of the organization (training, culture, policies), the free

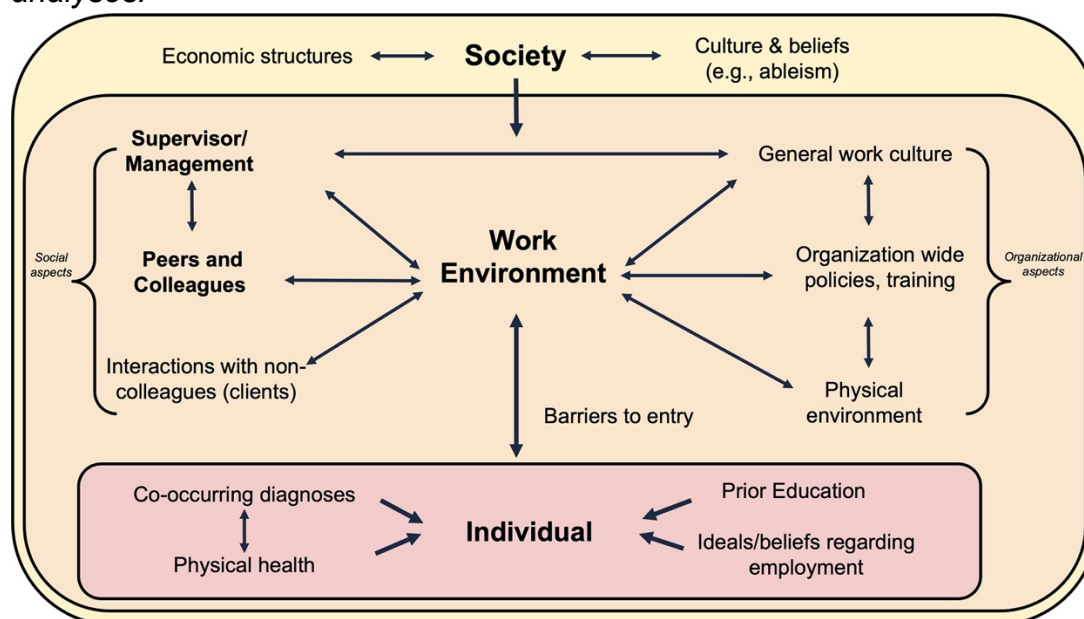
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responses revealed the significance of social dynamics, interactions, and communication. Subsequently, the three levels identified *a priori* (Individual, Work Environment, Society) were expanded to include the following five levels that overlap and interact: personal/individual, peers/colleagues, supervisors/management, workplace environment, and society (**Figure 4**).

The individual level is embedded within the work environment level, as various barriers and facilitators act solely for the individual but also arise through the individual's interactions with social, organizational, and physical aspects of the workplace. Additionally, supervisors and peers/colleagues are embedded within the work environment but are considered unique levels due to the considerations and challenges specific to each. These interactions are all embedded in society and are affected by broader societal attitudes and structures (**Figure 4**).

**Figure 4**

*Uni- and bi-directional interactions at each level (bolded, larger font) and sub-level identified by participants as being most relevant for employment according to qualitative analyses.*





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*Note.* The individual contributes to the culture and social dynamics of the work environment, but these interactions also affect the individual's personal well-being, expectations about employment, and sense of belonging in society. Similarly, supervisors play a pivotal role in influencing the work culture by setting the tone for social interactions at work. However, the work culture and values of the organization also inform how supervisors treat their employees. All of these interactions are influenced by societal awareness and attitudes towards neurodivergency.

Positive and negative factors were identified from the free responses that acted at and across all levels. These factors thematically clustered together to form the following four broad themes that can be addressed to improve employment experiences for autistic adults: *acceptance* of neurodiversity in the workplace, the quality of *communication*, the *autonomy* afforded to autistic employees, and the *accommodations* and supports provided formally through the company and informally on an individual basis (**Figure 5**).

**Acceptance.** Related to improving acceptance of neurodivergent individuals in the workplace, participants reported that having colleagues who had a *positive attitude towards their neurodivergence* and who treated them with *honor and respect* helped to facilitate their employment experience. Participants also expressed that *improved awareness and understanding of neurodivergence* in the workplace, *offering inclusion/DEI training*, and having supervisors who provided a *safe space for them to disclose* their diagnosis and accordingly allowed for *flexibility* to support them, increased their feelings of acceptance in the workplace.

**Autonomy.** Within the theme of autonomy, participants described the usefulness of *flexibility in their schedule, pace, and work format*, as well as the ability to *control and adjust their physical environment*. This included being able to work with *minimal interruptions* and having time for *non-social breaks*. *Reducing micromanagement*,

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particularly as related to supervisors' underestimating the abilities of neurodivergent employees, was also indicated as a way to improve an individual's sense of workplace autonomy and independence.

**Communication.** Participants described differences in social communication from non-autistic individuals as a key experience in the workplace. Strategies highlighted by the participants to improve workplace communication and interactions included: increasing *written/documented instructions* for employees, providing very *clear instructions about what exactly a specific job/task entails and what constitutes completion of that task*, and consideration of each *individual employee's capacity when assigning tasks*.

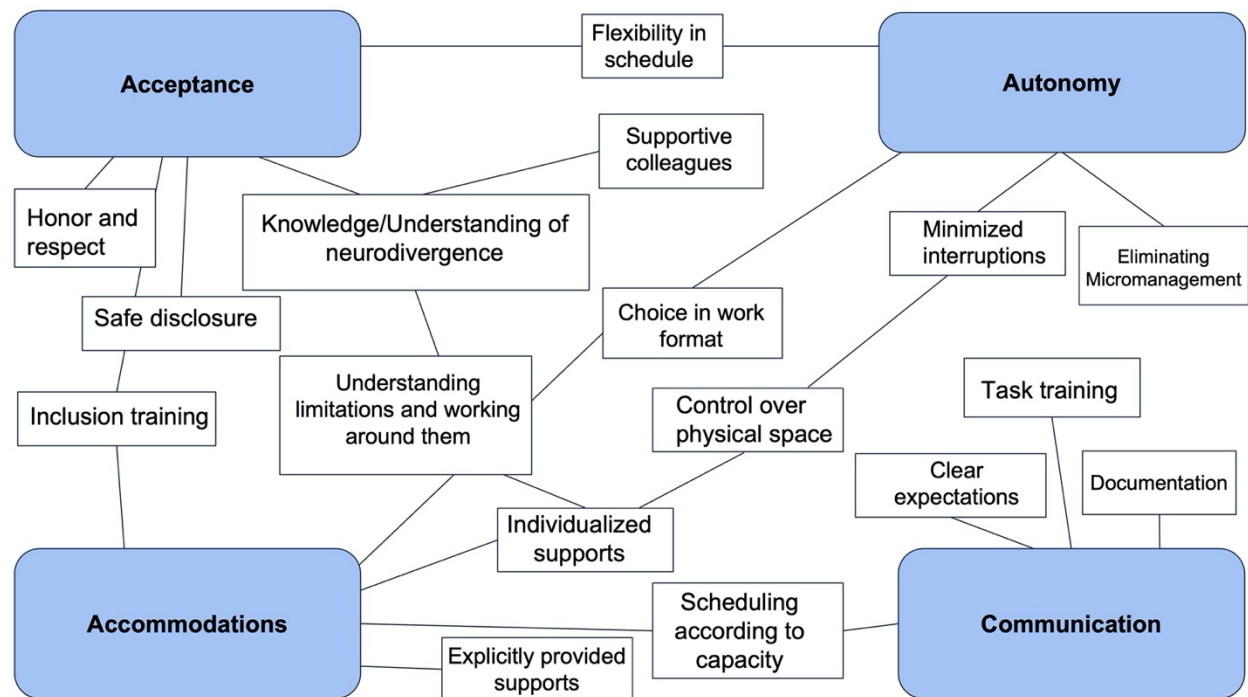
**Accommodations.** Participants indicated that *explicitly provided* accommodations and company-wide policies to promote inclusivity were crucial aspects of their employment success. Beyond the explicit provision of accommodations, participants indicated that the *provision of informal and individualized supports* or allowing process adjustments on a case-by-case basis (e.g., allowing employees to use headphones) could improve performance. Participants also described how making these informal negotiations was most feasible when their employers were aware of the needs and challenges associated with autism. Thus, taking diversity, equity, and inclusion initiatives to increase awareness about the challenges and strengths associated with neurodivergent profiles could offer additional visibility and opportunities to build inclusive workplaces.

Given the interconnected nature of the themes and sub-themes, some of the recommended steps can ameliorate multiple issues in the workplace (illustrated via the

connecting lines in **Figure 5**). For example, utilizing one strategy (e.g., providing choice in work format) is a process adjustment that also improves autonomy.

**Figure 5**

*Solution-oriented themes and sub-themes*



*Note.* The four primary themes (blue boxes) emerged from the qualitative analysis of participant’s free responses, interactions between these themes (connecting lines), and the solution-oriented sub-themes identified within each larger theme (white boxes). Given the intersecting nature of the themes, introducing one strategy (e.g., providing inclusion training) can provide benefits in more than one area (i.e., acceptance, accommodations).

***Deriving Novel Recommendations from Themes.***

The four themes act within and between the five levels identified in the systems-theory model. See **Table 3** for specific illustrations of these problems and proposed solutions through participant responses.

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Table 3

*Recommendations Extracted from Free Responses to Illustrate the Interactions Between Themes, Sub-Themes, and Levels*

| Theme      | Sub-theme         | Level                | Free Response   | Recommendation  |
|------------|-------------------|----------------------|---|---|
| Acceptance | Honor and respect | Individual           | <p>“Appreciation, understanding of my condition, believing I have done [sic] ASD tendencies and what they are and that I am smart, I'm just different.” (+)</p> | <p>Foster a work environment that respects and celebrates neurodiversity through employee resource groups, regular workshops, seminars (e.g. related to intersectionality, and shared experiences), newsletters, and social events.</p> <p>Provide Diversity, Equity, Inclusion, and Justice training for all employees to increase awareness about the needs and experiences of neurodivergent individuals.</p> <p>Train supervisors on neuroinclusivity and how to respond appropriately to and support employees who disclose their diagnosis.</p> |
|            |                   | Peers and Colleagues | <p>“Genuinely understanding and trustworthy coworkers who don't take my quirks and differences as personal affronts.” (+)</p>                                   |   |
|            |                   | Supervisor           | <p>“Most employers have been unforgiving of my neurodiversity, one even going so far as to yell at me for</p>   |   |

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|          |   |   |  |  |
|----------|---|---|--|--|
|          |   |   | <p>taking time to think through tasks before doing them and making lists.” (-)</p>   |  |
| Autonomy | <p>Flexibility and Individualized supports</p> <p>Micromanaging</p> | <p>Work environment (culture and policies)</p> <p>Supervisors</p> | <p>“Working alone with a flexible schedule in order to achieve tasks on time” (+)</p> <p>“I have always had very supportive and understanding supervisors who are happy to give leeway as long as I get my work done” (+)</p> <p>“My managers continue to believe that because of my disabilities that I’m not able to perform my job and even ask others to go check my work even though it has been completed satisfactory.” (-)</p> | <p>Provide employees with seating areas with minimal distractions available upon request.</p> <p>Make allowances for creative solutions that increase task and schedule flexibility. For example, provide opportunities for independent work, options to set one’s schedule and breaks, and options for reduced day-to-day oversight for individuals who typically complete their tasks.</p> |

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|               |               |   |  |   |
|---------------|---------------|---|--|---|
| Communication | Documentation | Work environment (training)             | “Instruction booklets, equipment manuals” (+)  | Provide clear task training and instructions through multiple modalities (face-to-face, summary emails and written feedback, booklets with audio/pictorial instructions, etc.)  |
|               |               | Work environment (culture and policies) | “Cannot express my neurodiverse issues, they don’t get it” (-)   | Having mechanisms in place between supervisors and employees to clarify instructions and provide feedback without fear of censure. For example, anonymous surveys, weekly group check-ins in-person or via email, reserved time in supervisors’ schedules for one-on-one meetings, etc. |
|               |               | Peers and Colleagues                    | “The co-workers would constantly bicker and gossip about each other, starting drama and fights about each other, which would also limit their ability to do their portion of the hotel duties which in turn would leave a huge amount of tasks to be done in addition to my own duties in order to | Build a friendly work culture and increase accessibility to HR specialists who can support employees in escalated issues involving social dynamics, mental health, and/or life events.  |

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|  |                           |                    |  |  |
|--|---------------------------|--------------------|--|--|
|  | <p>Clear expectations</p> | <p>Supervisors</p> | <p>process the night audit and 'change' the day for the hotel. This increased stress of having to go far outside the scope of dictated work duties, led to an eventual mild mental breakdown." (-)</p> <p>"Knowing exactly what is expected and what constitutes completion." (+)</p> <p>"Effective communication from superiors was the only positive factor. It was the only way I could understand what was actually expected and so I was able to build from that. It became the main motivation and guide" (+)</p> <p>"I have had supervisors whose expectations are unrealistic and if</p> | <p>Optionally anonymous survey to inform supervisors about how social dynamics are affecting individual workloads.</p> <p>Provide management training to supervisors on adapting job roles around neurodiverse needs and work with employees to create schedules/workloads that are compatible with individual capacities.</p> |
|--|---------------------------|--------------------|--|--|

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|                |                            |   |  |  |
|----------------|----------------------------|---|--|--|
|                |                            |   | <p>followed would lead directly to burnout." (-)</p> <p>"I do not get feedback. I have been asking for an employee review for literally years." "Lack of meaningful feedback." (-)</p>                                     |  |
| Accommodations | Provision/lack of supports | Work environment (physical environment) | <p>"I work in the food industry so everything is pretty much always incredibly loud which gets hard to work around." (-)</p> <p>"Ability to stim through fidgeting or listening to music makes it easier to work." (+)</p> | <p>Provide access to options for modifying/adapting to the physical work environment (e.g., using headphones/ear plugs, installing light dimmers and/or changing fluorescent light bulbs, modifying volume of background music, using scentless soaps in the bathroom, using personal tools to fidget and stim).</p> |



## IMPROVING NEURODIVERGENT EXPERIENCES IN THE WORKPLACE

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|  |  |  | <p>“To have my own office that I can close my door” (+)</p> <p>“I’m not social, so putting me in a low interaction area” (+)</p> | <p>Solicit feedback from employees about reasonable adjustments to create sensory supportive physical work environments.</p> <p>Provide access to third-party individuals (e.g. - mediators, employee resource groups) who can negotiate for accommodations and/or anonymously request support on behalf of employees with needs.</p> <p>Ensure the presence of quiet break rooms and allow flexibility in the use of these spaces.</p> |
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*Note:* Researchers reviewed participants’ free responses and categorized them according to major theme, sub-theme, and level. Researchers then developed recommendations based on the free responses related to each theme. Quotes highlighted in green followed by (+) indicate positive experiences. Quotes highlighted in red followed by (-) indicate negative experiences.

### Discussion

In the present study, 85 previously and currently employed autistic adults with and without ADHD across a range of employment sectors, gender identities, and salaries indicated which factors most positively and negatively affected their employment experiences. Consistent with previous literature, the currently employed autistic adults reported lower levels of anxiety and higher quality of life than the unemployed autistic adults (Moss et al., 2017; Taylor et al., 2022).

Overall, approximately half of participants reported that they did not receive any formal accommodations in the workplace, although a majority of these individuals (73.2%) believed they would benefit from them. The most commonly reported accommodations were flexible work schedules and modified job tasks. The most commonly reported accommodations that people believed would be beneficial were extended time for tasks and flexible work schedules, which have received limited attention in prior literature but have become increasingly possible due to technological and cultural shifts driven by the COVID-19 pandemic (Mischke et al., 2023). Free responses from participants provide insight into why this accommodation was consistently rated positively; participants revealed that they benefit from having control over and being able to adjust their physical space, setting their own pace, taking breaks when needed, and minimizing interruptions, all of which are afforded by a flexible/hybrid work schedule.

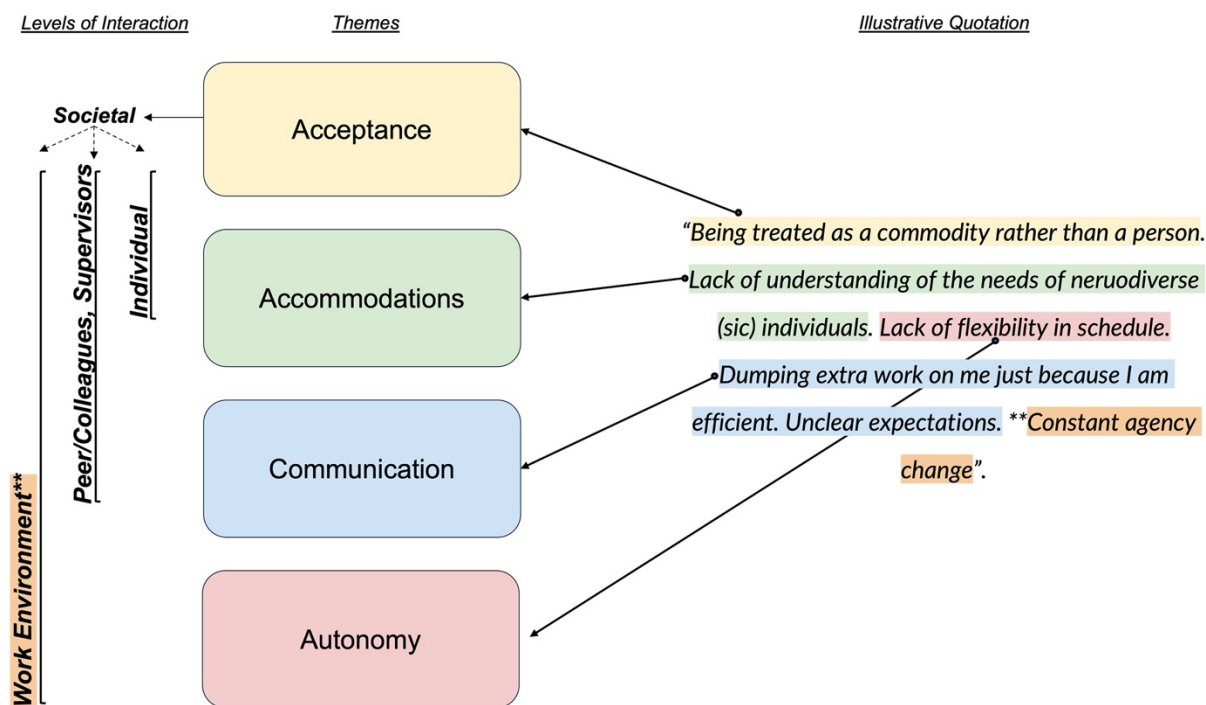
Together, the accommodation ratings and qualitative analyses elucidate various factors that positively and negatively impact autistic adults in the workplace across five levels of interaction (Individual, Work Environment, Supervisors, Peers/Colleagues,

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Society). Across these five levels, four themes were revealed to be most relevant to employment experiences (acceptance, accommodations, communication, autonomy). While the major themes extracted from the qualitative analyses act across every level of interaction, the authors' interpretation based on the thematic analysis suggests that certain themes are most relevant to particular levels (**Figure 6** and described below).

**Figure 6**

*Integration of Levels and Themes based on interpretation of quantitative and qualitative results*



*Note.* Each of the themes (in boxes/bubbles) derived from this study act differentially across the levels of interaction (in bold on the left). Notably, attitudes of acceptance and understanding at the societal level have a cascading effect that is relevant for improving employment experiences across all levels. An example quote from a participant in response to a question asking about negative experiences is provided to illustrate how each of these themes can intersect to affect the employment experiences of one individual. Color coding and arrows show the parts of the quote that correspond to the major themes and the asterisks show the part of the quote that is specific to the level of the work environment.

### Individual

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At the level of the individual, challenges with mental and physical health were consistently rated to be the most negative factors and prior education was rated to be the most positive factor across all participants. However, mental health considerations have been infrequently mentioned in previous literature related to employment experiences. These may have been highlighted in the present study due to the inclusive recruitment strategy used. The qualitative analysis suggested that the themes of acceptance and accommodations are the most relevant to improving workplace experiences at the individual level. Participants described how acceptance and knowledge of *their own* neurodivergence were important for them to identify, understand, and subsequently advocate for their needs in the workplace. Formally provided supports (e.g., mental health counseling/coaching) and/or informally provided supports (e.g., third-party individuals who negotiate for accommodations) can address barriers at the individual level, while also taking away the pressure of seeking out these supports from the individual. Participants also indicated that factors such as a later age of diagnosis and/or cultural stigma towards autism can pose additional barriers, highlighting the importance of a concurrent cultural shift towards increased knowledge and acceptance of neurodivergence.

### **Work Environment**

At the level of the *work environment*, sensitivity to light and sound was rated as the most negative factor and task-specific training was rated as the most positive factor. Qualitative analyses revealed that the intersection of communication, acceptance, and accommodations is crucial for facilitating effective interactions between autistic employees and their colleagues and supervisors in the workplace. These include

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enabling employees with different sensory needs to modify their workspaces and ensuring clear communication of job role requirements and expectations. Further, the theme of autonomy also plays a crucial role at the level of the work environment (**Figure 6**). Allowing flexibility in scheduling and deadlines, factoring in employee feedback on pace/workload, and allowing reasonable modifications to physical workspaces would create inclusive workplaces for autistic and non-autistic employees alike.

### **Redefining accommodations**

Current systems for accessing workplace accommodations pose several challenges to neuroinclusion efforts; three of which are highlighted here. Firstly, medical documentation of a disability and/or the need for an accommodation is typically required to receive one. This requires substantial coordination between practitioners, employees, and employers and can introduce expensive testing and bureaucratic delays (Lindsay et al., 2021; Shattuck & Grosse, 2007). Secondly, once a diagnosis has been disclosed, employers are required to provide “reasonable accommodations” as long as they do not create “undue hardship” for the company (including high financial or administrative costs; Americans with Disabilities Act; U.S. Department of Labor, n.d.). The identification of “reasonable” accommodations often requires the employee to define what accommodations they need in a discussion with their employer. Employees may not be aware of the types of accommodations available to them, know which tools will be most helpful, or be comfortable advocating for themselves. For example, a familiar accommodation that an employee receives in a school environment (e.g., extra time on tests) may not be helpful within the workplace. Thirdly, while legally mandating accommodations has been useful in establishing a baseline for implementing supports,

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it does not incentivize supervisors to identify informal strategies to support their employees, which can often be easier and quicker to implement.

The authors propose broadening societal understanding of accommodations to consider accommodations as “any tool that can be used to help someone do their job better” (Neurodiversity in the Workplace, 2023) while continuing to acknowledge the legal definitions associated with the term. While the recommendations in Table 3 were specifically designed to support neurodivergent individuals, their positive impact can improve the employment experience and productivity of all employees. This positive impact can be further amplified by proactively making providing accessible to everyone in a top-down manner. One example of this outside the context of employment has been the use of closed captioning by media streaming services. While this feature was originally designed to increase the accessibility of media for individuals who are deaf or hard of hearing, captions have become integrated with and enhanced how many hearing individuals also prefer to consume content. Within the work environment, one such approach could be to allow all individuals to wear earplugs/headphones while performing their duties. This could be useful for many non-autistic employees who find it easier to focus when using these devices while being especially beneficial for autistic employees struggling with sensory overload. Importantly, these kinds of approaches would also mitigate the need for neurodivergent employees to undergo potentially stigmatizing processes like disclosing their diagnosis in order to receive accommodations, ensuring that the burden of seeking these resources does not fall entirely on the individual employee.

### **Implications at the Level of Society**

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Importantly, each level exists within, and is directly and indirectly impacted by, society (e.g., cultural beliefs, legal policies, and economic structures). In the present study, the analyses were designed primarily to probe relevant factors *within* the workplace, and recommendations were developed accordingly. However, participants also highlighted how broader societal attitudes and legal/economic infrastructures influence their daily experiences. Participant perspectives suggested that a cultural shift is necessary for improving the overall well-being of autistic individuals, which would in turn improve their job-related experiences and interactions. The following quote from one of the autistic community collaborators illustrates this idea:

As a high-masking Autistic person, lack of acceptance of Autistic traits leads me to mask in the work environment, which compromises my health and quality of life. If there were greater acceptance of natural Autistic ways of being, there would be less pressure to mask and would lead to increased quality of life.

While cultural shifts (e.g., increased knowledge and acceptance of neurodivergence) is an important overarching goal, recommendations for issues at the societal level may be too abstract for organizations to implement. For this reason, the scope of the recommendations in Table 3 was constrained to those that could be implemented within the work environment. This approach may be more practical and actionable and can serve as a catalyst for change and inclusivity more broadly. However, to truly improve the employment experiences of neurodiverse individuals, the authors advocate for a dual approach including proactive supports (formal and informal) in the workplace and concerted efforts over time toward the broader goal of fostering inclusivity by increasing

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all employees' awareness and understanding of neurodivergency, not tolerating stigmatizing behavior, and facilitating the autonomy of autistic individuals.

### **Limitations**

Several limitations should be considered. Firstly, while the recruitment methods were designed to be more inclusive than in previous studies (with respect to specific considerations of sex and co-occurring diagnoses), the sample is relatively homogeneous with regard to race. The barriers to obtaining diagnoses, employment, and accommodations are compounded by factors related to race, ethnicity, and socioeconomic status (Aylward et al., 2021; U.S. Bureau of Labor Statistics). Future work should consider how the framework presented here applies to the unique challenges faced by individuals with intersectional identities.

Secondly, factors such as self-awareness may have affected how participants responded to survey questions. Some research suggests that autistic individuals may have differences in self-awareness compared to non-autistic individuals (Huang et al, 2017; Mazefsky et al., 2011). Future research using interviews with autistic employees and their colleagues could yield additional insight.

Thirdly, a subset of autistic adults was excluded from the study (e.g., those who are not legally independent). Future research should investigate the barriers to entry for individuals from this excluded group who wish to become employed.

### **Conclusions**

The present study afforded the development of a data-driven framework for considering barriers and facilitators to employment for autistic adults, as well as actionable steps that can be taken by all individuals within a workplace to improve



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experiences for autistic adults. These recommendations are derived from participant responses and developed in collaboration with autistic community collaborators and neuroinclusion consultants. Future research must systematically and empirically evaluate the impact of implementing these recommendations within the workplace. Finally, while these bottom-up changes are necessary, top-down cultural shifts are essential to ensure the feasibility and impact of these recommendations.

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## References

- Aylward, B. S., Gal-Szabo, D. E., & Taraman, S. (2021). Racial, Ethnic, and Sociodemographic Disparities in Diagnosis of Children with Autism Spectrum Disorder. *Journal of developmental and behavioral pediatrics: JDBP*, 42(8), 682–689.  
<https://doi.org/10.1097/DBP.0000000000000996>
- American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). <https://doi.org/10.1176/appi.books.9780890425596>
- Americans With Disabilities Act of 1990, 42 U.S.C. § 12111 et seq. (1990).
- Baron-Cohen, S., Wheelwright, S., Skinner, R., Martin, J., & Clubley, E. (2001). The autism-spectrum quotient (AQ): evidence from Asperger syndrome/high-functioning autism, males and females, scientists and mathematicians. *Journal of autism and developmental disorders*, 31(1), 5–17. <https://doi.org/10.1023/a:1005653411471>
- Black, M.H., Mahdi, S., Milbourn, B., Scott, M., Gerber, A., Esposito, C., Falkmer, M., Lerner, M.D., Halladay, A., Ström, E., D'Angelo, A., Falkmer, T., Bölte, S., & Girdler, S. (2020). Multi-informant International Perspectives on the Facilitators and Barriers to Employment for Autistic Adults. *Autism Research*, 13: 1195-1214. <https://doi.org/10.1002/aur.2288>
- Burckhardt, C.S., Anderson, K.L. (2003). The Quality of Life Scale (QOLS): Reliability, Validity, and Utilization. *Health and Quality of Life Outcomes*, 1, 60. <https://doi.org/10.1186/1477-7525-1-60>
- Busetto, L., Wick, W., & Gumbinger, C. (2020). How to use and assess qualitative research methods. *Neurological research and practice*, 2, 14. <https://doi.org/10.1186/s42466-020-00059-z>
- Cope, R., & Remington, A. (2022). The strengths and abilities of autistic people in the workplace. *Autism in Adulthood*, 4(1), 22-31. <https://doi.org/10.1089/aut.2021.0037>

## IMPROVING NEURODIVERGENT EXPERIENCES IN THE WORKPLACE

- Fombonne, E., Coppola, L., Mastel, S., & O’Roak, B. J. (2022). Validation of Autism Diagnosis and Clinical Data in the SPARK Cohort. *Journal of Autism and Developmental Disorders*, 52, 3383–3398. <https://doi.org/10.1007/s10803-021-05218-y>
- Hammel, J., Magasi, S., Heinemann, A., Gray, D. B., Stark, S., Kisala, P., Carlozzi, N. E., Tulsy, D., Garcia, S. F., & Hahn, E. A. (2015). Environmental Barriers and Supports to Everyday Participation: A Qualitative Insider Perspective From People With Disabilities. *Archives of Physical Medicine and Rehabilitation*, Volume 96, Issue 4, 578-588. ISSN 0003-9993, <https://doi.org/10.1016/j.apmr.2014.12.008>
- Harmuth, E., Silletta, E., Bailey, A., Adams, T., Beck, C., & Barbic, S. P. (2018). Barriers and Facilitators to Employment for Adults With Autism: A Scoping Review. *Annals of International Occupational Therapy*, 1(1), 31–40. <https://doi.org/10.3928/24761222-20180212-01>
- Hayward, S. M., McVilly, K. R., & Stokes, M. A. (2019). Autism and employment: What works. *Research in Autism Spectrum Disorders*, 60, 48–58. <https://doi.org/10.1016/j.rasd.2019.01.006>
- Hendricks, D. (2010). Employment and adults with autism spectrum disorders: Challenges and strategies for success. *Journal of Vocational Rehabilitation*, 32(2), 125–134. <https://doi.org/10.3233/JVR-2010-0502>
- Hollocks, M. J., Lerh, J. W., Magiati, I., Meiser-Stedman, R., & Brugha, T. S. (2019). Anxiety and depression in adults with autism spectrum disorder: a systematic review and meta-analysis. *Psychological medicine*, 49(4), 559–572. <https://doi.org/10.1017/S0033291718002283>
- Huang, A. X., Hughes, T. L., Sutton, L. R., Lawrence, M., Chen, X., Ji, Z., & Zeleke, W. (2017). Understanding the self in individuals with autism spectrum disorders (ASD): A review of literature. *Frontiers in psychology*, 8, 1422. <https://doi.org/10.3389/fpsyg.2017.01422>

## IMPROVING NEURODIVERGENT EXPERIENCES IN THE WORKPLACE

- Hudson, C. C., Hall, L., & Harkness, K. L. (2019). Prevalence of Depressive Disorders in Individuals with Autism Spectrum Disorder: a Meta-Analysis. *Journal of abnormal child psychology*, 47(1), 165–175. <https://doi.org/10.1007/s10802-018-0402-1>
- Jadav, N., & Bal, V. H. (2022). Associations between co-occurring conditions and age of autism diagnosis: Implications for mental health training and adult autism research. *Autism research : official journal of the International Society for Autism Research*, 15(11), 2112–2125. <https://doi.org/10.1002/aur.2808>
- Lai, M. C., Kassee, C., Besney, R., Bonato, S., Hull, L., Mandy, W., Szatmari, P., & Ameis, S. H. (2019). Prevalence of co-occurring mental health diagnoses in the autism population: a systematic review and meta-analysis. *The lancet. Psychiatry*, 6(10), 819–829. [https://doi.org/10.1016/S2215-0366\(19\)30289-5](https://doi.org/10.1016/S2215-0366(19)30289-5)
- Lindsay, S., Osten, V., Rezai, M., & Bui, S. (2021). Disclosure and workplace accommodations for people with autism: A systematic review. *Disability and rehabilitation*, 43(5), 597-610.
- Mazefsky, C. A., Kao, J., & Oswald, D. (2011). Preliminary evidence suggesting caution in the use of psychiatric self-report measures with adolescents with high-functioning autism spectrum disorders. *Research in autism spectrum disorders*, 5(1), 164-174. <https://doi.org/10.1016/j.rasd.2010.03.006>
- Mischke, J., Luby, R., Vickery, B., Woetzel, J., White, O., Sanghvi, A., ... Smit, S. (2023). Empty spaces and hybrid places: The pandemic's lasting impact on Real Estate. Retrieved from <https://www.mckinsey.com/mgi/our-research/empty-spaces-and-hybrid-places>
- Moss, P., Mandy, W., & Howlin, P. (2017). Child and Adult Factors Related to Quality of Life in Adults with Autism. *Journal of autism and developmental disorders*, 47(6), 1830–1837. <https://doi.org/10.1007/s10803-017-3105-5>
- Neurodiversity in the Workplace. (2023). *Rethinking accommodation*. Unpublished manuscript.
- Newman, L., Wagner, M., Knokey, A.-M., Marder, C., Nagle, K., Shaver, D., Wei, X., Cameto, R., Contreras, E., Ferguson, K., Greene, S., & Swarting, M. (2011). *The Post-High*

## IMPROVING NEURODIVERGENT EXPERIENCES IN THE WORKPLACE

- School Outcomes of Young Adults With Disabilities up to 8 Years After High School. A Report From the National Longitudinal Transition Study-2 (NLTS2) (NCSER 2011-3005).* Menlo Park, CA: SRI International. 10.13140/RG.2.2.20600.57600.
- Office for National Statistics. (2022, February 10). *Outcomes for disabled people in the UK: 2021.* Outcomes for disabled people in the UK - Office for National Statistics. <https://www.ons.gov.uk/peoplepopulationandcommunity/healthandsocialcare/disability/articles/outcomesfordisabledpeopleintheuk/2021>
- Roux, A. M., Shattuck, P. T., Cooper, B. P., Anderson, K. A., Wagner, M., & Narendorf, S. C. (2013). Postsecondary employment experiences among young adults with an autism spectrum disorder. *Journal of the American Academy of Child and Adolescent Psychiatry*, 52(9), 931–939. <https://doi.org/10.1016/j.jaac.2013.05.019>
- Shattuck, P. T., & Grosse, S. D. (2007). Issues related to the diagnosis and treatment of autism spectrum disorders. *Mental retardation and developmental disabilities research reviews*, 13(2), 129-135. <https://doi.org/10.1002/mrdd.20143>
- Shattuck, P. T., Narendorf, S. C., Cooper, B., Sterzing, P. R., Wagner, M., & Taylor, J. L. (2012). Postsecondary education and employment among youth with an autism spectrum disorder. *Pediatrics*, 129(6), 1042–1049. <https://doi.org/10.1542/peds.2011-2864>
- SPARK Consortium. Electronic address: pfeliciano@simonsfoundation.org, & SPARK Consortium (2018). SPARK: A US Cohort of 50,000 Families to Accelerate Autism Research. *Neuron*, 97(3), 488–493. <https://doi.org/10.1016/j.neuron.2018.01.015>
- Taylor, J. L., Adams, R. E., Pezzimenti, F., Zheng, S., & Bishop, S. L. (2022). Job loss predicts worsening depressive symptoms for young adults with autism: A COVID-19 natural experiment. *Autism Research*, 15(1), 93–102. <https://doi.org/10.1002/aur.2621>
- U.S. Bureau of Labor Statistics (n.d.). BLS Data Finder 1.1: Employment-population ratio. <https://beta.bls.gov/dataQuery/find?st=0&r=50&s=popularity%3AD&fq=survey:|ln|&>

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[more=0&fq=cg:\[Unemployment+and+Labor+Force+Status\]&quot;Employment-population%22&q=Employment-population+and%20ratio%20and%20disability](#)

U.S. Bureau of Labor Statistics. (2023). *Employment–population ratio for people with a disability increases to 21.3 percent in 2022*. U.S. Bureau of Labor Statistics.

<https://www.bls.gov/opub/ted/2023/employment-population-ratio-for-people-with-a-disability-increases-to-21-3-percent-in-2022.html>

U.S. Department of Labor (n.d.). *Accommodations*. Office of Disability Employment Policy.

<https://www.dol.gov/agencies/odep/program-areas/employers/accommodations>

Waisman-Nitzan, M., Gal, E., & Schreuer, N. (2021). “It’s like a ramp for a person in a wheelchair”: Workplace accessibility for employees with autism. *Research in Developmental Disabilities*, 114, 103959–103959.

<https://doi.org/10.1016/j.ridd.2021.103959>