Effectiveness of a Driving and Community Mobility Intervention for Teens and Young Adults With Autism Spectrum Disorder

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Importance: Driving and community mobility (DCM) is key to supporting independence in teens and young adults (TYA) with autism spectrum disorder (ASD).

Objective: To determine whether an intervention focused on DCM can effectively improve DCM knowledge and skills in TYA.

Design: A pretest–posttest design using the same intervention and outcome measures.

Setting: University research setting.

Participants: Thirty-eight participants with ASD completed the program (M age = 17.76 yr, SD = 3.58). Twenty-six (68%) were male, and 12 (32%) were female.

Intervention: A 5-day intensive intervention using group and individualized strategies, including driving simulation, focused on improving performance skills needed for DCM.

Outcome and Measures: Total and category scores of the Performance Analysis of Driving Ability (P-Drive) were analyzed using a repeated-measures analysis of variance measuring time (pretest vs. posttest), gender, and year of intervention. Paired *t* tests were used to determine the outcomes of the Canadian Occupational Performance Measure (COPM), anxiety measure and perception survey.

Results: Results indicated a significant main effect for time ($p < .001$) and year ($p < .036$), but not gender ($p < .26$), with no significant interaction effects, supporting the fidelity of the intervention. The COPM showed significant changes ($p \leq .001$) in both performance and satisfaction, as well as a reduction in anxiety ($p = .008$).

Conclusions and Relevance: Outcomes suggest that the intervention successfully improved DCM knowledge and skills for TYA. This adds new evidence that an occupational therapy intervention specific to TYA with ASD is effective in developing independence in DCM.

Plain-Language Summary: Driving is the primary mode of community mobility in North America and other Western countries. Adults with autism spectrum disorder (ASD) who have a means of community mobility have a chance of employment that is 5 times greater than that for those who do not. Driving and community mobility are key to supporting independence among teens and young adults with ASD. However, teens and young adults with ASD have significantly lower rates of getting a driver's license. The results of this study show that occupational therapy practitioners can play a critical role in addressing driving and community mobility. Occupational therapy interventions that are specifically designed for and unique to each teen and young adult with ASD can effectively improve driving and community mobility skills and increase independence.

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Obtaining a driver's license is a major step in attaining independence and participating in adult roles such as work, social participation, and leisure activities beyond the home environment (Cheak-Zamora et al., 2022). Although many people with autism spectrum disorder (ASD) obtain their driver's license, they do so significantly later than drivers without ASD. One in three adolescents with ASD obtain a license, compared with 83.5% of neurotypical adolescents (Curry et al., 2018). Parents have also reported that, for teens and young adults (TYA) with ASD, learning to drive is a challenge that is specifically related to the limitations associated with the multitasking demands and complex skills associated with driving (Cox et al., 2012). Therefore, to identify the challenges, Vindin et al. (2021) examined the experience of learning to drive from the viewpoint of people with ASD themselves, as well as their parents and driving instructors. The internal challenges included anxiety; difficulties with cognitive and executive function, motor coordination, and social communication; and lack of motivation and confidence. Along with the external challenges of obtaining parents' acceptance and the additional costs in time and money, the Vindin et al. (2021) study indicated that there is a clear need for a specialized model of training.

Indeed, during the past decade, there has been extensive research evaluating driving and ASD, including comparing the performance of teens with and without ASD (Brooks et al., 2016; Chee et al., 2019; Classen, Monahan, & Wang, 2013; Daly et al., 2014; Reimer et al., 2013; Sheppard et al., 2016, 2017, 2022), barriers to driving for teens with ASD (Almberg et al., 2017; Ross et al., 2018), crash and licensing rates (Curry et al., 2018, 2021), and driving simulation studies (Classen, Monahan, & Wang, 2013; Cox et al., 2016; McDonald et al., 2018; Patrick et al., 2020; Selander et al., 2021; Svancara et al., 2022; Ting Chee et al., 2019; Wade et al., 2017). However, none of these studies investigated intervention or training programs designed for TYA with ASD. For example, although driving simulation has been shown to be an effective evaluation tool (Brooks et al., 2016; Classen, Monahan, Brown, et al., 2013; Classen, Monahan, & Wang, 2013; Cox et al., 2016; Sheppard et al., 2010, 2017), there are very limited studies that evaluate it as an intervention tool.

In a systematic review of factors affecting driving and transportation skills among people with ASD, Lindsay (2017) found only three studies addressing strategies to improve these skills. Wilson et al. (2018) also sought to synthesize the literature about driving characteristics and driver training for people with ASD. They identified useful strategies with only a few types of training programs, highlighting a clear need for effective and specialized training programs. One specific intervention is a cognitive–behavioral program focused on executive functioning and emotional regulation skills with individualized simulator practice (Baker-Ericzén et al., 2021). This pilot study demonstrated some positive results; however, it did not involve occupational therapy practitioners. Another strategy is an app developed by an occupational therapist that shows promise as a tool to improve hazard awareness and detection related to driving (Monahan et al., 2020). It is important to note that, although many occupational therapists are driving rehabilitation specialists who work individually with clients with ASD, these services are typically for private pay and not widely available.

Driving and community mobility (DCM) is defined in the *Occupational Therapy Practice Framework: Domain and Process* (4th ed.; American Occupational Therapy Association, 2020) as "planning and moving around in the community using public or private transportation, such as driving, walking, bicycling, or accessing and riding in buses, taxi cabs, ride shares, or other transportation systems (p. 31)." As an instrumental activity of daily living (IADL), DCM is solidly within the scope of occupational therapy practice and, therefore, should be evaluated with evidence-based performance measures to implement effective and efficient intervention strategies. To our knowledge, there are no evidence-based evaluation tools for community mobility and no standardized on-road assessments for novice drivers. Moreover, there are no evidence-based comprehensive occupational therapy interventions to improve either community mobility or driving for TYA with ASD. Thus, a DCM "boot camp" was developed for TYA with ASD to improve the participants' community mobility and support growth toward independence in driving. Outcome measures were specifically chosen to collect data and answer the research question of whether the DCM boot camp was effective in improving simulated driving performance and/or community mobility skills in TYA with ASD.

Method

Design

A pretest–posttest design was used to evaluate the effectiveness of our intervention, a 5-day DCM boot camp. All pretesting was completed before the start of the intervention, typically within 1 to 3 weeks of the start. The intervention consisted of 5 days (approximately 32 hr), and the post evaluations occurred on the last afternoon of the program.

Participants

Participants were recruited through contacts in the community and organizations (e.g., Autism Speaks), former participants and parents, and providers of services for clients with ASD. For inclusion in the study, participants had to be 14 to 30 yr old, with a motivation to participate and a diagnosis of ASD. In North Carolina, teens who are 14.5 yr old are eligible to take a school-supported driver's education course and get their permit at age 15. This study was approved by the University and Medical Center Institutional Review Board, and all participants signed a consent form. If the participant was age 17 yr or younger, a parent or guardian provided signed consent for participation and the teen signed assent.

Instrumentation

Although various assessments were used for pretesting, only select assessments were used to evaluate change (pre- and posttest). The following assessments were chosen because they showed evidence of the ability to demonstrate change (fidelity) as well as relevancy to skills related to DCM.

The Performance Analysis of Driving (P-Drive; Patomella, 2014) is a structured, observational tool of driving performance that is based on 25 skill items. The P-Drive consists of four categories of skills: Maneuver (operational skills such as steering, using pedals, controlling speed), Orient (e.g., following directions, position on road, planning), Follow Regulations (e.g., obeying stop signs, following speed limits), and Heeding (also called Attending and Acting; e.g., attending and responding to other road users, using mirrors, reacting, problem solving). Designed for on-road performance, it was originally validated on a simulator (Patomella et al., 2006) and applied in other simulator studies (Leonardo et al., 2023; Patomella et al., 2006; Romer et al., 2022). The P-Drive has high reliability and validity across the literature (Patomella et al., 2010; Patomella & Bundy, 2015; Vaucher et al., 2015). Because there is evidence that the P-Drive can separate drivers into categories of driving ability with a specificity of .92 and a sensitivity of .93 (Patomella & Bundy, 2015), the P-Drive has been used to determine an individual's fitness to drive. There is also a strong correlation between raw scores and internal measure, with a recommended raw score cutoff at 81 for adequate driving performance. For each year of the intervention, the same researcher trained one or two raters to score the P-Drive on the STISIM Drive® (Systems Technology, Inc., Hawthorne, CA) driving simulator on a specific individual scenario. With the manual, each scored item was identified and discussed between the raters as to how to properly score. Videos of on-road driving and replays of driving simulator sessions were scored and discussed until all raters achieved 80% agreement.

The Beck Anxiety Inventory (BAI; Beck et al., 1988) is a self-report questionnaire of 21 items on which participants rate their physiological, cognitive, or a combination of anxiety-related symptoms over the past week. The BAI has been used extensively in research with high internal consistency, construct validity, and sensitivity to the symptoms (Wang & Gorenstein, 2013). We began using the BAI in 2019.

The Canadian Occupational Performance Measure (COPM; Law et al., 1990) is a measure of an individual's self-perception of occupational performance. Using an interview format, the client identifies three to five problems and rates their performance and satisfaction regarding these problems. The COPM is considered valid, reliable, and useful, and it is used with a wide variety of clients (Carswell et al., 2004). Research has indicated that a change of two points or more is considered clinically important (Law et al., 2014). In our study, when interviewed, participants were asked to identify problems and goals that were directly related to DCM. The COPM was added in 2019.

Parents' and Participants' Pre- and Postassessments

Using Qualtrics™, we developed pre- and postquestionnaires to collect both the parents' and participants' perceptions of change resulting from the intervention. Because the questionnaires were quite lengthy, asking about specific skills and knowledge (e.g., knowledge of the components of a vehicle, executive functioning, motor planning), only five questions related to overall DCM performance were included for this study. On a 5-point Likert scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*), participants and parents responded to the same statements before and after the intervention, with a section for additional comments. A final question on a 7-point Likert scale ranging from 1 (*very unlikely*) to 7 (*very likely*) asked how likely they would be to recommend the boot camp to other parents and participants.

Setting and Equipment

Each iteration of the intervention was held in the occupational therapy department using several classrooms, a driving lab, and outdoor areas (e.g., parking lot, grassy areas). The driving research lab has a kitchen, two distinctly different driving simulators, a Vision Coach™ board, and tables and chairs.

DriveSafety™ DS200 (DriveSafety Inc., Draper, UT) is a high-fidelity, compact driving simulator using Simclinic software. It has three fully adjustable screens with a steering wheel and pedals yielding a full view of an 110° field of view. This system demonstrates consistency in interrater reliability (Jeghers et al., 2022) and is appropriate for teaching driving skills to young adults with disabilities (Brooks et al., 2014).

STISIM Drive is a high-fidelity driving simulator software with three computer screens offering a 135° field of view. It shows good validity with significant correlation between the on-road and simulator errors (Lee et al., 2003) as well as the ability to discriminate between different driving skill levels (Lee et al., 2003; Mayhew et al., 2011). A different version of the scenario (Road Test) was used for pre- and posttesting of the intervention. The 4-mi, 10- to 15-min scenario includes driving in urban, rural, and farmland areas; school zones; and residential communities and includes several critical events (unexpected pedestrian, object in roadway, etc.), with each version having a different presentation order of critical events. One of the versions was further modified to have similar, but also completely different critical events to eliminate any "learning" of scenarios. Thus, pre- and postintervention assessments of driving on the simulator, using the two scenarios, were different, used only once, and separated by at least 18 days.

Intervention and Procedure

The intervention was established in 2015, piloting evaluation and intervention tools with additional program development changes over the next year. On the basis of the pilot development, only assessment tools and interventions that contributed to information about the participants or suggested change were continued. For example, because the same simulator was used for pre- and posttesting and intervention, it became clear that participants were anticipating critical incidents that were on the posttest, even though the specific scenario was not used. On the basis of this observation, the posttest scenario was modified to have similar but completely different critical events to eliminate "learning" from the pretesting. In addition, a second simulator was purchased so that the STISIM simulator was used for evaluation only, and the DriveSafety simulator was used for intervention only, eliminating any learning of the specific scenarios used for pre- and posttesting of the scenario drive as an outcome.

A consistent format was used to collect data for each year of the intervention. Data were collected between 2018 and 2022, with the exception of 2020, because of the pandemic. The principal investigator (PI) was an occupational therapy faculty member who planned and managed the intervention with assistance from one other faculty member and six to eight occupational therapy students who were completing a master's degree thesis or research project.

Interested participants or parents completed an application form, and an individualized evaluation was completed to determine appropriateness for the program. In addition to the assessments for both pre- and posttesting, we used other assessments during the evaluation to gain insight into individual goals, levels of independence, and motivation. Although the intervention focused primarily on driving-related skills, there were also interventions that were specifically designed to address community mobility skills, because some participants had no driver's education or experience, some were not ready to begin driving, or some of the participants' behaviors and intellectual abilities may preclude them from becoming independent drivers. Although licensure would be the ideal outcome measure for some of the participants, it was not necessarily an appropriate outcome measure for all participants. Specifically, younger participants, although gaining significant knowledge and experience, were often not yet ready to become independent drivers.

On the first day of the intervention, each participant received an individualized schedule that included both small- and large-group activities. Each participant also completed daily one-on-one sessions on the driving simulator and Vision Coach. The first 2 days of the intervention included general, knowledge-based sessions related to predriving skills and community mobility skills using active learning strategies (e.g., scavenger hunts, mapping games, etc.). On the last three mornings, whole-group activities were used that included the use of stationary vehicles for orientation and the demonstration of vehicle parts, an interactive visit with local law enforcement officers, and a bus ride around town for community mobility skills application. The final afternoon consisted of additional individualized activities, posttesting, and a "graduation" ceremony for parents and friends of participants. Table 1 describes the primary intervention activities used in the intervention.

Fidelity of Intervention

Using a model for implementation fidelity (Carroll et al., 2007), the fidelity of the intervention was found to be high. First, the intervention met the criterion of adherence; specifically, the content (topics), strategies (e.g., games, activities, only one simulator), frequency (e.g., number of times using simulator or Vision Coach), and duration (number of hours, days) were the same each year. In terms of moderators, we addressed five issues: intervention complexity, facilitation strategies, quality of delivery, participant responsiveness, and measurement. In terms of intervention complexity, using the two pilot years of data, we created an informal but detailed handbook that included activities, visual aids, and tools (e.g., simulator, magnetic board) that were used each year, with minor changes to improve quality (i.e., add improved photos of hazards). For facilitation strategies, the timing of the intervention was the same each year, with equally trained students in both academic work and specific training for the intervention over the summer semester in preparation for the interventions. The quality of delivery was consistent; the principal investigator provided constant monitoring and feedback in training and during the intervention to maintain consistency and accuracy. Participant responsiveness was substantial, with few exceptions; participants were engaged and responsive to strategies in the intervention. In addition, without exception, those who delivered (the students) the interventions were highly engaged and responsive. Finally, for measurement, consistent tools and methods of measurement were used, with precise measurement with some assessment tools (e.g., P-Drive, BAI).

Data Analysis

The pre- and posttest P-Drive scores were summarized as means (*SD*) by gender (male or female) and study year (2018, 2019, 2021, or 2022), and for all participants. We used repeated-measures analysis of variance (ANOVA) models to analyze the P-Drive scores. The models included time (pre–post), gender, study year, and the Time × Gender and Time × Study Year interactions as factors. We compared COPM scores for performance and satisfaction and the BAI anxiety scores at baseline and the end of intervention using paired *t* tests. Because data were recorded on a Likert scale for pre-post questionnaires, the perceptions of

Table 1. Brief Description of the Occupational Therapy Strategies Used

Topic	Description	Skills Targeted
Law enforcement experience	Simulated traffic stop with university law enforcement officers	Communication, self-advocacy, safety awareness
Hazard detection	Instruction on common and unpredictable driving hazards	Visual scanning, executive functioning
Rules of the road	Review of basic driving rules with hands-on traffic scenarios using a magnetic traffic board; generally at least two sessions.	Knowledge application and generalization
Ride hailing	Instruction on taxi and ridesharing options, simulated ride-hailing experience	Communication, safety awareness
Vision Coach	Individual sessions on interactive light board	Processing speed, scanning
Community mobility	Instruction on various aspects of community mobility, typically two to three sessions	Knowledge application and generalization, safety awareness
Time management	Simulated activities for organizing a day and travel	Problem solving, planning, sequencing
"What to do if . . . " scenarios	Discussion of what to do during unexpected events	Problem solving, knowledge application and generalization, safety awareness
Self-navigation	Using maps and GPS, smartphone vs. paper map	Problem solving, planning
Vehicle orientation	Identification of vehicle components, how to adjust and use.	Knowledge application
Driving simulator	Application of skills for driving, generally implemented once or twice per day	Processing speed, multitasking, divided attention, knowledge application and generalization

future abilities for DCM were compared using Wilcoxon signed rank tests. All analysis was completed using IBM SPSS Statistics (Version 28), with the significance level set at .05.

Results

Participants

Each of the four intervention groups (years) had a range of 7 to 13 participants for a total of 38—26 male (68%) and 12 female (32%)—who completed the program and assessments. Ages ranged from 14 to 30 yr ($M = 17.76$, $SD = 3.58$, median = 17, mode = 15). Approximately equal numbers of participants had completed driver's education (yes = 18 [47%]; no = 20 [53%]), but the majority ($n = 28$; 74%) did not have their permit, and only 2 had a driver's license before the intervention.

Outcomes

Overall, results from this study are promising. There was a significant main effect of time (pretest vs. posttest) on the total score of the P-Drive, as well as each of its four categories, demonstrating the effectiveness of the intervention on driving performance on the simulator. There was a significant main effect of study year on the total score and on the scores for the Maneuver, Orient, and Heeding categories (but not for Following Regulations), indicating that participants' performance was different between the years. There was a significant main effect of gender on the total score and the Heeding score, suggesting some differences between male (difference score/pre-post, $M = 5.2$, $SD = 6.8$) and female (difference score/pre–post, $M = 3.1$, $SD = 4.6$) participants, although because of the low number of female participants, this must be interpreted cautiously. Finally, there was no significant interaction effect between time and study year or between time and gender for any outcomes, which indicated the consistency (fidelity) of the intervention effect. Table 2 displays the results of the repeated-measures ANOVA of the P-Drive scores. Table 3 shows the P-Drive total and category scores on the driving simulator for all participants. Figure A.1 in the Supplemental Material, available online with this article at https://research.aota.org/ajot, presents the means of the categories for pre– and post–P-Drive scores. Figure A.2 presents the differences between the means of the total scores on the P-Drive total and categories across the years.

In terms of anxiety, the BAI showed that participants ($n = 31$) demonstrated a significant reduction in anxiety ($t = 2.83$, $p = .008$) from pretest ($M = 16.16$, $SD = 12.08$) to posttest ($M = 11.58$, $SD = 10.17$).

There was a statistically significant difference in both performance and satisfaction scores. The median change scores for both performance and satisfaction show a change of 2.00, indicating clinical significance for at least half of the participants. Nine participants

Table 2. Pretest, Posttest, and Difference Scores on the P-Drive for All Participants

Time Frame	Category, *M* (*SD*)				
	Total Score	Maneuver	Orient	Following Regulations	Heeding
Pretest	55.58 (13.51)	13.70 (3.85)	10.28 (2.99)	8.24 (1.96)	23.37 (6.79)
Posttest	66.38 (13.72)	16.42 (3.81)	11.78 (3.12)	10.30 (1.98)	27.88 (6.84)
Difference	10.80 (10.20)	2.72 (2.72)	1.50 (2.42)	2.07 (2.17)	4.51 (6.23)

Note. $n = 38$.

scored between 2.0 and 2.80, and 8 participants scored over 3.00, resulting in 55% of the participants demonstrating significant change. In terms of satisfaction, a greater change was evident: Five participants scored between 2.0 and 2.34, and 13 scored over 3.00, with 58% demonstrating significant change. Table 4 shows the pre- and posttest scores on the COPM, as well as the change score for the 31 participants who completed the interviews.

For the five select questions about the perception of change of abilities from the questionnaires completed by the matched parents and participants (same individual pre- and postsurveys), the results demonstrated no significant differences for the parents. However, three of the five questions showed statistically significant differences between the pre- and posttests for the participants. Table 5 highlights the pre- and posttest frequencies, means, and Wilcoxon signed rank tests. Finally, both parents and participants were asked whether they would recommend the boot camp for TYA with ASD. Of 46 parents, 44 (95.6%) indicated that they would be likely or very likely to recommend it to others, and of 37 participants, 33 (89.2%) indicated that they would be likely or very likely.

Discussion

This study describes the first comprehensive intervention program, to our knowledge, with outcomes designed to address DCM for TYA with ASD. The results highlight how a multifaceted approach can demonstrate significant changes in skill level. As identified in multiple studies (Cox et al., 2012; Lindsay, 2017; Vindin et al., 2021; Wilson et al., 2018), there are various challenges to achieving independent community mobility, particularly with autistic TYA. In this study, outcomes on an interactive driving simulator, a commonly used anxiety measure, the COPM specifically related to DCM, and surveys of participants and parents each showed significant results.

In terms of simulated driving performance, overall results demonstrated significant improvement in the participants' ability to handle the operational and tactical components of driving as a result of the intervention. Although not expected, there were significant differences between years of the interventions. However, on reflection, it was recognized that, because each participant had unique skills and performance levels, groups varied between years. For example, the group in 2021 consisted of 9 participants with abilities that were relatively similar. In contrast, the group in 2022 consisted of 14 participants whose range of skills were significantly more diverse. Although most of the P-Drive scores demonstrated change, as expected, the exception was in the Following Regulations category (i.e., obeying stop signs and speed limits), because it is well established that TYA with ASD tend to be rule followers (Almberg et al., 2017; Huang et al., 2012). However, it is not clear why there was a difference in gender for the total and the Heeding category. Future studies with more female participants will be needed to explore this result.

There are several reasons for confidence in these results. First is the lack of any interaction effects, which statistically supports that assumption that the intervention was consistent across years and strengthens the

Table 3. Repeated-Measures ANOVA for Time, Study Year, and Gender Effects ($N = 38$)

Source	*df*	Total Score		Maneuver		Orient		Following Regulations		Heeding	
		F	*p*	*F*	*p*	*F*	*p*	*F*	*p*	*F*	*p*
Time	1, 33	28.80	**<.001*****	26.00	**<.001*****	11.40	**.002****	23.10	**<.001*****	13.70	**.001****
Year	1, 33	3.76	**.020***	7.89	**<.001*****	6.93	**.001****	1.35	.275	3.19	**.036***
Gender	1, 33	5.44	**.026***	1.68	.204	3.70	.063	2.29	.140	8.64	**.006****
Time × Year	1, 33	0.08	.968	0.47	.704	0.93	.435	0.66	.581	0.25	.860
Time × Gender	1, 53	0.99	.326	1.21	.279	0.004	.952	1.63	.211	0.57	.456

Note. Boldface indicates statistical significance. ANOVA = analysis of variance; *df* = degrees of freedom.
*$p < .05$. **$p < .01$. ***$p < .001$.

Table 4. Mean Scores and Paired *t* Tests of the COPM at Baseline and the End of Intervention

COPM	Score, *M*			*SD*	Median	Minimum Difference	Maximum Difference	*p*
	Baseline	Posttest	Difference					
Performance	5.75	7.90	2.16	1.36	2.00	0.00[a]	5.00	**.001***
Satisfaction	5.64	8.22	2.57	1.80	2.30	0.00[b]	6.40	**.001***

Note. $n = 31$. The COPM was added to the outcome measures in 2019. Boldface indicates statistical significance.
[a]Only 1 participant had a difference score of 0 in performance, and 4 others had a difference score of <1.00.
[b]Only 3 participants had a difference score of 0 in satisfaction and 2 others had a difference score of <1.00.
*$p < .001$.

robust main effect of time. Second, all the participants were assessed with a driving simulator system that was different from the one used for the intervention. Third, there are limitations to using simulator summary data as an outcome measure. It has been shown that the computer output may not be sensitive to detect driving deficits (Classen, Monahan, & Wang, 2013). Therefore, a standardized observational assessment such as P-Drive is a more sensitive measure of performance. It is also important to note that, although the change in performance was observed on the driving simulator, the resulting changes are more likely a result of the multifaceted experiences and engaging activities of the total intervention (e.g., hazard detecting, roadway strategies, scanning abilities) that contributed to the learning and improved performance of the participants.

Anxiety has been identified as a significant barrier to driving (Baker-Ericzén et al., 2021; Chee et al., 2015; Kersten et al., 2020; Lindsay, 2017; Vindin et al., 2021). Therefore, in 2019, a measure of anxiety was added that clearly demonstrated decreases in anxiety as a group. It is interesting that, in a few cases, anxiety did increase. This appeared to be in people who were overconfident of their driving abilities, especially on the driving simulator, reflecting a potential impairment of metacognition (Grainger et al., 2014). Similarly, although the majority of participants indicated significant changes on the COPM for satisfaction, individual participants may not have changed or recognized a change. This may be due to impairment of metacognition; because they were not driving in an actual motor vehicle on road; or because drivers with ASD are more likely to underrate their driving (Daly et al., 2014; Sheppard et al., 2022) and, thus, see their goal of driving as not yet attained. Future research using qualitative interviews may be needed to explore this further.

When participants were asked if they believed that they would be independent drivers in the future before and after the intervention, there was no significant difference. This is likely due to the statement reflecting their motivation to achieve driving status rather than performance. In contrast, the participants likely did not expect to improve in areas of community mobility (e.g., learning to use public transportation, navigating the community), which was emphasized in the intervention, resulting in significant differences in those questions. Notably, how to use a GPS did not change, but using a map did, illustrating TYA use of technology over traditional methods of navigation. Curiously, there were no changes in parents' perception of change in their child's future abilities. This may be due to various reasons, one potentially being the fact that the postsurvey was conducted on the last day, and parents may not have had the opportunity to observe change. Anecdotally, parents have made comments about significant changes observed that are not captured in our assessment tools. Future research should include longitudinal data collection, measuring both participants' and parents' perception of change after a period of 3 to 6 months. Additionally, using qualitative methods in future studies may be of more use for capturing this information. For example, about a month after completion of the intervention, one mother reported a story demonstrating a specific improvement in her son's community mobility. During orientation at high school, she suggested that they walk around to see where his classes were located. His reply was "I don't need to do that, I learned how to read a map [in boot camp] and can do it myself." Another participant, a college student at our university who had a limited desire to drive, learned to use the university bus system and immediately started using it instead of always calling his father for a ride.

Finally, almost all parents and participants indicated their strong recommendation of the intervention to others. Although a perception, it does suggest that both participants and parents felt that the intervention was effective.

Limitations

One significant limitation of the study is there was no specific measurement of community mobility. We were only able to find one tool (Dickerson & Schold Davis, 2020), but it has no validity or reliability and, therefore, was not used. In an attempt to measure change in the larger concept of community mobility, the COPM was used, and questions pertaining to community mobility were included in the questionnaires. As a tool of self-perception, the COPM was a challenge with this population and may not be the best measure, because research has suggested that people with ASD have an underdeveloped concept of self

Table 5. **Parents' and Participants' Perception of Change for Future Abilities Related to Driving and Community Mobility**

Perception of Change	*N*	*n* (%) Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Paired *n*	*p*
Parents: "When I think about my child, I believe they will . . ."								
Be an independent driver							36	.132
Pretest	36	0 (0)	3 (8.3)	5 (13.9)	20 (55.6)	8 (22.2)		
Posttest	36	0 (0)	0 (0)	8 (22.2)	18 (50.0)	10 (27.8)		
Have increased ability navigating in the community							36	.814
Pretest	36	0 (0)	0 (0)	0 (0)	25 (69.4)	11 (30.6)		
Posttest	36	0 (0)	0 (0)	3 (8.3)	24 (66.7)	9 (25.0)		
Use public transportation safely							35	.976
Pretest	35	0 (0)	3 (8.3)	10 (27.8)	16 (44.4)	6 (16.7)		
Posttest	36	0 (0)	1 (2.8)	12 (33.3)	18 (50.0)	5 (13.9)		
Get to an unknown destination using GPS or a smartphone							36	.475
Pretest	36	0 (0)	1 (2.8)	3 (8.3)	19 (52.8)	13 (36.1)		
Posttest	36	0 (0)	1 (2.8)	3 (8.3)	19 (52.8)	13 (36.1)		
Get to an unknown destination using maps							36	.475
Pretest	36	0 (0)	9 (25.0)	3 (8.3)	15 (41.7)	9 (25.0)		
Posttest	36	1 (2.8)	8 (22.2)	5 (13.9)	16 (44.4)	6 (16.7)		
Participants: "When I think about my future, I believe I will be . . ."								
Be an independent driver							38	.083
Pretest	38	0 (0)	0 (0)	1 (2.6)	17 (44.7)	20 (52.6)		
Posttest	38	0 (0)	0 (0)	2 (5.3)	9 (23.7)	27 (71.1)		
Have increased ability navigating in the community							37	**.019***
Pretest	37	1 (2.6)	1 (2.6)	1 (2.6)	16 (42.1)	18 (47.4)		
Posttest	38	0 (0)	0 (0)	0 (0)	12 (31.6)	26 (68.4)		
Use public transportation safely							38	**.046***
Pretest	38	0 (0)	42 (5.3)	5 (13.2)	16 (42.1)	15 (39.5)		
Posttest	38	1 (2.6)	0 (0)	0 (0)	15 (39.5)	22 (57.9)		
Get to an unknown destination using GPS or a smartphone							38	.796
Pretest	38	0 (0)	0 (0)	1 (2.6)	19 (50.5)	18 (47.4)		
Posttest	38	1 (2.6)	0 (0)	1 (2.6)	15 (39.5)	21 (55.3)		
Get to an unknown destination using maps							38	**.046***
Pretest	38	1 (2.6)	5 (13.2)	2 (5.3)	17 (44.7)	13 (34.2)		
Posttest	38	0 (0)	2 (5.3)	6 (15.8)	13 (34.2)	17 (44.7)		

Note. For each statement, the parent or participant indicated their level of agreement. Boldface indicates statistical significance.
* $p < .05$, Wilcoxon signed rank test.

(Mitchell & O'Keefe, 2008) that is often are not consistent with others' observations (Sandercock et al., 2020). Another limitation may be the level of prior knowledge and experience of participants. Some participants had taken driver's education, and some had no prior knowledge or experience; therefore, future research is needed to explore this issue as well as to determine when the optimal time is for education or intervention.

Finally, one could argue that the "gold standard" of the on-road driving evaluation was not used. However, about half of the participants did not have driver's education and, therefore, would not be ready or legally eligible to perform in an on-road assessment, making the scoring of an on-road assessment irrelevant and unsafe. However in future research, it would be important to add an on-road component for those who have a permit or license.

Implications for Occupational Therapy Practice

This work offers an innovative intervention to improve DCM for TYA with ASD. The study has the following implications for occupational therapy practice:

- Interactive driving simulators have significant potential as an occupational therapy intervention to decrease anxiety related to driving and to improve cognitive and executive function deficits, motor coordination, social communication skills, motivation, and confidence.
- The P-Drive has excellent potential as an occupational therapy observational tool for evaluating driving performance on simulators and/or on-road assessments.
- A group-centered, interactive intervention is effective in building the foundation for the IADL of DCM and can be a model for implementation for the increasing numbers of TYA with ASD.
- Targeted strength-based strategies and the social support of a group may be particularly valuable for practitioners to assist TYA in mastering the skills of driving and achieving independent community mobility.

Conclusion

TYA with ASD who are not independent in DCM are at risk for being underemployed and underinsured (Cheak-Zamora et al., 2022; Roux et al., 2015). For this critical IADL, occupational therapy practitioners need to address this earlier in childhood to facilitate the motor and process skills that underlie the skills, abilities, and knowledge for independent community mobility. In terms of driving, driving instructors and parents are typically not adequately equipped to address the many barriers to learning to drive that are faced by TYA with ASD (Vindin et al., 2021). This study offers evidence on how occupational therapy intervention can successfully meet clients' needs. Future research is also needed to identify the best intervention strategies specific to people with ASD, because their strengths and challenges differ depending on their maturity, experience, and level of functioning.

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