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Individual and Environmental Factors Associated with Polypsychotropic Medication Regimens among Adults with Intellectual Disability

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Abstract:	Polypharmacy, the concurrent use of multiple medications, is common among adults with intellectual disability. Psychotropic medications are often implicated in polypharmacy among this population. The current study aimed to determine individual and environmental factors associated with polypsychotropic medication regimens using a population-based sample of adults with intellectual disability who receive Home and Community-Based Services waivers in Oklahoma. The following questions guided the study: a) What is the prevalence of polypsychotropic medication regimens? b) What are the individual and environmental factors significantly associated with polypsychotropic medication regimens? Findings confirmed high prevalence rates of polypsychotropic medication regimens among adult participants and highlighted significantly associated individual and environmental factors.

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Abstract

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7 disability. Psychotropic medications are often implicated in polypharmacy among this population. The
8 current study aimed to determine individual and environmental factors associated with
9 polypsychotropic medication regimens using a population-based sample of adults with intellectual
10 disability who receive Home and Community-Based Services waivers in Oklahoma. The following
11 questions guided the study: a) What is the prevalence of polypsychotropic medication regimens? b)
12 What are the individual and environmental factors significantly associated with polypsychotropic
13 medication regimens? Findings confirmed high prevalence rates of polypsychotropic medication
14 regimens among adult participants and highlighted significantly associated individual and
15 environmental factors.

16 *Keywords:* adults, intellectual disability, polypsychopharmacy, psychotropic medication,
17 individual factors, environmental factors

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22 **Individual and Environmental Factors Associated with Polypsychotropic Medication Regimens among**
23 **Adults with Intellectual Disability**

24 Polypharmacy, the concurrent use of multiple medications, is common among adults with
25 intellectual disability (ID) (McMahon et al., 2020; Stortz et al., 2014). While polypharmacy is considered
26 appropriate when clinically indicated (Masnoon et al., 2017), high rates of polypharmacy among
27 individuals with ID is associated with an increased risk for developing adverse medication events,
28 medication–medication interactions, and medication-related problems (Erickson et al., 2022; McMahon
29 et al., 2020; O’Dwyer et al., 2016). The term polypharmacy broadly refers to the use of multiple
30 medications prescribed at any one time for a patient (Masnoon et al., 2017). A recent systematic review
31 of existing literature found the most commonly reported definition of polypharmacy is the numerical
32 definition of five or more medications daily, however, definitions ranged from two or more to 11 or
33 more medicines (Masnoon et al., 2017). Polypharmacy regimens can include medications taken on a
34 regular basis, such as treatment for a chronic illness as well as medications taken on an as-needed basis,
35 such as for anxiety. Some definitions include prescription as well as nonprescription medications and
36 supplements that are taken regularly.

37 One particular class of medications often implicated in polypharmacy among adults with ID are
38 psychotropic medications. The prescribing of psychotropic medications, including anti-psychotics, anti-
39 depressants, mood stabilizers and anti-epileptic medications is particularly common among individuals
40 with ID, with rates of psychotropic medication usage estimated between 28% and 89% (Bowring et al.,
41 2017; Costello et al., 2022; O’Dwyer et al., 2016; Song et al., 2023; Stortz et al., 2014; Tan et al., 2015).

42 Predictors of the use of psychotropic medication by persons with ID have been identified by a
43 number of studies. Mental health diagnoses and behavioral management needs, commonly referred to
44 in both literature and practice as *challenging behaviors* are frequently documented reasons for
45 prescribing psychotropic medications (Matson & Neal, 2009; Sheehan et al., 2015; Tan et al., 2015).

46 Challenging behaviors, including self-injurious, disruptive, and destructive behaviors are related to some
47 biological factors, but are often associated with psychosocial factors related to life situation and
48 inequalities (Hastings et al., 2013). Other individual factors include having more severe or profound ID,
49 autism, and communication access needs (i.e., people who cannot rely on speech alone to be heard and
50 understood; Matson & Neal, 2009; McClintock et al., 2003). A potential problem occurs when mental
51 health diagnoses and documented challenging behaviors co-occur, which may lead to sequential
52 addition of new medications without the discontinuation of current medications, leading to
53 polypsychotropic medication regimens (O'Dwyer et al., 2016). The term *prescribing cascade* defines the
54 prescribing behavior of adding additional, potentially avoidable medications (Rochon & Gurwitz, 2017).

55 Numerous studies have reported that a sizeable number of adults with ID are prescribed more
56 than one psychotropic medication (Bowring et al., 2017; Lunskey & Modi, 2018; Sheehan et al., 2015;
57 Tsiouris et al., 2013). Polypsychotropic medication regimens have been associated with increased
58 adverse events including memory loss, sleeping problems, and weight gain, as well as lower quality of
59 life (Koch et al., 2015; Scheifes et al., 2016). The prevalence rates of polypsychotropic medication
60 regimens varies from 22% to 40% (Lunskey & Modi, 2018; McMahon et al., 2020; O'Dwyer et al., 2017).
61 However, there is also significant variability in methods used to study polypsychotropic medication
62 regimens among individuals with ID. The specific number of concurrent psychotropic medications used
63 to define polypsychotropic medication regimens varies, with thresholds fluctuating from 2 or more
64 medications to 3 or more (Lunskey & Modi, 2018; McMahon et al., 2020; O'Dwyer et al., 2016, 2017).

65 Factors contributing to the concurrent use of multiple psychotropic medications among people
66 with ID have been explored in a few previous studies. Among a Canadian sample of individuals with ID
67 and psychiatric disorders who were seeking outpatient psychiatric services, Lunskey and Modi (2018)
68 found polypsychotropic medication regimens to be a significant concern and identified multiple
69 significant contributors to polypsychotropic medication regimens. Among the significant factors within

70 their specialty-clinic sample, Lunsky and Modi (2018) found that women, individuals living in supervised
71 residential settings, and those with a psychiatric diagnosis in two or more diagnostic categories were
72 more likely to receive polypsychotropic medication regimens defined as 3 or more psychotropic
73 medications. Using a large, nonclinical sample of aging people with ID in Ireland, O'Dwyer and
74 colleagues (2017) found that living in a residential institution and having a history of reporting a mental
75 health condition or sleep problems were associated with polypsychotropic medication regimens of just 2
76 or more psychotropics. However, unlike Lunsky and Modi, O'Dwyer et al. found gender had no
77 significant effect on polypsychotropic medication regimens within their non-clinical sample.

78 While research has established that polypsychotropic medication regimens are common
79 (Bowring et al., 2017; McMahon et al., 2020) and lead to an increase in adverse medication events and
80 negatively affect quality of life among adults with ID (Scheifes et al., 2016), there is limited research
81 exploring the prevalence and predictors of polypsychotropic medication regimens among population-
82 based samples in the United States. As highlighted by Stortz et al. (2014) and Song et al. (2023), more
83 research is needed that further examines both the prevalence and predictors of polypsychotropic
84 medication regimens among larger, population-based samples of adults with intellectual and
85 developmental disabilities in the United States. In addition to using more generalizable samples, more
86 research is needed regarding the individual and environmental characteristics associated with
87 psychotropic medication regimens to inform clinical practice and state services and supports (Dove et
88 al., 2012).

89 **Social-Ecological Model**

90 The social-ecological model provides a framework that may help to better understand
91 determinants of polypsychotropic medication regimens among adults with ID and serve to guide the
92 development of effective interventions that target potentially problematic polypsychotropic medication
93 regimens. The social-ecological model of disability brings attention to the impact of social and

94 environmental factors on human functioning, interaction between persons, and their environment
95 (Shogren, 2013). The multilevel model considers the complex interplay between individual and
96 environmental factors and allows us to understand the range of factors that may place people at higher
97 risk polypsychotropic medication regimens. At the microsystem is the person. Next is the
98 mesosystem/environmental, made of the neighborhood, community, and organizational level. The
99 macrosystem is the overarching pattern or culture and society. The social-ecological model highlights
100 the importance of considering both individual and environmental factors when studying potential
101 predictors of polypsychotropic medication regimens and potentially provides a helpful framework for
102 categorizing factors that, when known, can improve effective approaches for monitoring and/or
103 reducing polypsychotropic medication regimens.

104 **The Current Study**

105 The current study aimed to identify the prevalence and predictors of polypsychotropic
106 medication regimens among a large population-based sample of adults with ID who received Medicaid
107 Home and Community-Based Services (HCBS) waivers in Oklahoma. One goal of HCBS is to maximize a
108 person's potential living in the community. Identifying the individual and systems/environmental level
109 variables that are or could be supported by HCBS may have important policy implications. The following
110 questions guided the study: a) What is the prevalence of polypsychotropic medication regimens among
111 adults with ID who receive HCBS waivers in Oklahoma? b) What are the individual and environmental
112 factors significantly associated with polypsychotropic medication regimens among adults with ID who
113 receive HCBS waivers in Oklahoma?

114 **Method**

115 **Data**

116 The current study is a retrospective cross-sectional analysis of polypsychotropic medication
117 regimens among adults with ID. Data used for this study were obtained from the Oklahoma 2017–2018

118 National Core Indicators Adult In-Person Survey (NCI IPS) dataset provided by the Oklahoma State
119 University Center for Developmental Disabilities (OSUCDD) in the United States. The NCI IPS is a
120 nationally validated instrument administered to adults with intellectual and developmental disabilities
121 who receive Medicaid HCBS waived services. As a component of a national quality enhancement
122 program, the NCI IPS is designed to improve long-term supports and services for adults with intellectual
123 and developmental disabilities in the United States. Data collection procedures were approved by the
124 human subjects review board (IRB) at Oklahoma State University and a data use agreement was used
125 between universities for secondary data analysis in the current study.

126 **Participants**

127 All adults (age 18 years and older) included in the 2017–2018 dataset received at least one
128 Medicaid Home and Community Based waived service (e.g., vocational, direct support staff) in
129 addition to case management from Oklahoma Human Services Developmental Disabilities Services
130 (Oklahoma DDS). According to Oklahoma Administrative Code 317:40-1-1 (2021), to be eligible for
131 Oklahoma DDS services, a diagnosis of ID is generally required. All participants in the current sample had
132 a primary diagnosis of ID. .

133 **Procedures**

134 Since 2013, the Oklahoma DDS has contracted with researchers at OSUCDD to collect the NCI
135 IPS. The NCI IPS is administered in face-to-face interviews with adults with disabilities and people
136 actively involved in their lives. The survey has three components. The first component is the
137 “Background Section,” which contains information related to the individual’s demographic
138 characteristics, health, diagnoses, use of services, behavioral support needs, and daily activities and
139 employment. Background data is gathered from a combination of case management records, service
140 provider records, and state Developmental Disability agency database, but may also come from other
141 sources such as the individuals themselves. State database records are also used, if necessary, to obtain

142 exam and health history and employment status. The second component, “Section I,” is collected by a
143 trained research team member via a face-to-face conversation with the individual receiving services.
144 Section I focuses on personal experiences regarding home and employment/daily activities
145 environments, relationships with friends and family members, satisfaction with supports and services,
146 and self-directed supports and may only be answered by the individual receiving services. The third
147 component, “Section II” concentrates on the individual’s rights, access to services, community
148 involvement, and choice. These questions are objective, based on observable behavior and can be
149 answered by the individual receiving services or a “proxy” respondent who knows the individual well,
150 such as a family member or friend. Questions across all three sections of the NCI IPS are made as
151 accessible as possible to increase participation by all individuals. The language used in the NCI IPS is as
152 easy to understand as possible and includes suggested rephrasing for questions that may be nuanced or
153 more difficult to understand. All data is collected by surveyors who are trained in accessible data
154 collection procedures to allow individuals with diverse abilities to respond to as many questions as
155 possible.

156 As part of the 2017–2018 NCI IPS data collection procedures, a question was added to the
157 Background Section of the Oklahoma specific version of the NCI IPS that recorded the names of all
158 medications taken by the individual. To assure accuracy of medication data collected, surveyors
159 recorded information included on the participants’ current medication list and a team of trained
160 graduate students reviewed and entered all medications into the data set. Psychotropic medications
161 included those that could be prescribed for regular administration as well as those that may be used on
162 an “as needed” basis. The Oklahoma NCI survey obtained medication information based on the
163 medication name, but did not include directions for use or dosing instructions. This led to the inclusion
164 of psychotropic medications that are commonly used chronically as well as those used on an as needed
165 basis. Alternative medications such as herbal substances were not included.

166 **Measures**

167 ***Polypsychotropic Medication Regimen.***

168 Psychotropic medication was identified using the Anatomic Therapeutic Chemical (ATC)
169 classification system (WHO Collaborating Centre for Drug Statistics Methodology, 2024). For this study,
170 medications in the level 1 category of Nervous System including level 1 categories of psycholeptics (e.g.,
171 antipsychotics, anxiolytics, and hypnotics/sedatives) and psychoanaleptics (e.g., antidepressants,
172 psychostimulants, nootropics, anti-dementia drugs, and combinations with psycholeptics), as well as
173 antiepileptics were identified. Additional medications included clonidine and guanfacine if taken by the
174 participant in the absence of hypertension diagnosis, as both clonidine and guanfacine are often
175 prescribed “off-label” for persons with challenging behavior. Seizure medication (ATC classification
176 antiepileptics) was also coded as a mood stabilizer if the participant did not have a diagnosis of seizure
177 disorder.

178 The categorical dependent variable, polypsychotropic medication regimen, was then created by
179 summing the total number of all psychotropic medications documented as taken by the participant. The
180 value of the total number of psychotropic medications taken by each individual was then coded into
181 four categories: no psychotropics, 1 to 2, 3 to 4, and 5 or more psychotropics. The quartile function was
182 used in the frequency analysis function in SPSS to determine the cut points for the four polypsychotropic
183 medication regimen categories.

184 ***Micro/Individual Characteristics.***

185 Individual level factors included a total of eight categorical variables: age, gender, race,
186 preferred means of communication, mobility, vision and/or hearing impairment, and personal health
187 status. A categorical variable was also created to explore the role of participants’ mental health (i.e.,
188 mood disorder, anxiety disorder, psychotic disorder, or other mental illness/psychiatric diagnosis)
189 and/or documented challenging behavior (e.g., self-injurious behavior, aggression, pica). Participants

190 were categorized as having no documentation of mental health diagnosis or challenging behavior;
191 mental health diagnosis only; challenging behavior only; or both mental health diagnosis and challenging
192 behavior documented. These eight micro/individual variables included in the analysis were chosen to
193 characterize the sample based on their availability in the dataset and their hypothesized or
194 demonstrated association with psychotropic medication use in previous studies. Data for all eight
195 micro/individual factors was collected from participants' state records and verified by the individual
196 and/or the individual's proxy (e.g., family member or staff). Table 1 provides detailed information about
197 the categorization of each micro/individual characteristic variable.

198 ***Meso/Environmental Characteristics.***

199 Environmental factors are those associated with a participant's living and social opportunities,
200 including access to health resources. For this study, meso/environmental characteristics were measured
201 across three categorical variables including type of residence, weekly physical exercise , and
202 metropolitan classification of residential zip code. Previous research has demonstrated the association
203 between psychotropic medication use and persons living in group homes Exercise can be considered a
204 social facilitator in that it may increase socialization outside the home, as well as have a beneficial effect
205 on mental health (Giummarra et al., 2022). Weekly exercise was chosen as it may represent the ability of
206 the participant to engage in community-based activities as well as having demonstrated benefit in
207 alleviating depression and anxiety (St. John et al., 2020; Temple & Walkley, 2007). Metropolitan
208 classification was chosen as a representative measure of many social determinants of health. Table 1
209 provides detailed information about the categorization of each meso/environmental characteristic
210 variable.

211 **Analysis**

212 Descriptive statistics were calculated for each variable using mean and standard deviation for
213 continuous variables and frequency with percentage for categorical variables. Bivariate comparison of

214 the micro/individual and meso/environment characteristics with the categorical dependent variable of
215 number of psychotropic medications was conducted using Chi-square test. Multinomial logistic
216 regression was conducted to determine the association of the set of individual and environment
217 characteristics with the categorical dependent variable number of psychotropic medications. The initial
218 model is presented, along with the models comparing the category of no psychotropic medication
219 (reference category) to each of the other three categories (1 to 2, 3 to 4, and 5 or more). For each
220 model, the odds ratios are presented for each of the independent variables. Because they were
221 categorical, a reference category is compared to all other categorical data for each variable. SPSS
222 Version 28.0.1.0 was used for all data analyses.

223 **Results**

224 The current sample included a total of 606 adults who were prescribed a total of 1214
225 psychotropic medications. Using the ATC classification system (WHO Collaborating Centre for Drug
226 Statistics Methodology, 2024), the most common psychotropic medication class prescribed was
227 psycholeptics (560 medications prescribed across 606 participants, which includes antipsychotics,
228 anxiolytics, and hypnotics/sedatives), followed by psychoanaleptics (530 medications, which included
229 antidepressants, psychostimulants, nootropics, anti-dementia drugs), antiepileptics prescribed when
230 diagnosis of seizure disorder was not documented (72 medications), and Other (52 Medications, which
231 included clonidine and guanfacine). Table 1 presents the breakdown of the sample by polypsychotropic
232 medication regimen and comparison of individual and environmental characteristics across participants
233 in the four polypsychotropic medication regimen categories. The mean age and the distribution of
234 persons by age categories were not significantly different across polypsychotropic medication regimen
235 groups. Participants' race, mobility, preferred means of communication, hearing and/or vision
236 impairment, and personal health status were also not significantly different between polypsychotropic
237 medication regimen groups. Statistically significant differences were found between polypsychotropic

238 medication regimens and both the individual factor, mental health/challenging behaviors as well as the
 239 environmental factor, type of residence. However, there were no significant differences found between
 240 psychotropic regimen groups and metropolitan classification of residence or weekly exercise.

241 **Table 1**

242 Comparison of Individual and Environmental Characteristics between Adults with Intellectual Disability

243 Based on the Number of Psychotropic Medications Reported Taking ($n = 606$)

Variable	No Psychotropics ($n = 126$)	1 to 2 Psychotropics ($n = 195$)	3 to 4 Psychotropics ($n = 166$)	5 or More Psychotropics ($n = 119$)	P value
Total number of Psychotropics	0	1.5 (0.5)	3.4 (0.49)	6.1 (1.32)	<0.001
<i>Micro/Individual Characteristics</i>					
Age (continuous)	46.3 (12.1)	48.7 (12.6)	49.1 (12.1)	46.9 (12.6)	0.15
Age (categorical)					0.22
18 to 29	13 (23.2)	17 (30.4)	11 (19.6)	15 (26.8)	
30 to 39	24 (23.3)	32 (31.1)	29 (28.2)	18 (17.5)	
40 to 49	37 (26.2)	43 (30.5)	36 (25.5)	25 (17.7)	
50 to 59	37 (19.3)	57 (29.7)	54 (28.1)	44 (22.9)	
60 and older	15 (12.2)	46 (40.4)	36 (31.6)	17 (14.9)	
Gender					0.3
Male	76 (21.8)	107 (30.7)	90 (25.8)	76 (21.8)	
Female	50 (19.5)	88 (34.2)	76 (29.6)	43 (16.7)	
Race					0.12
White	91 (19.7)	143 (30.9)	137 (29.6)	92 (19.9)	
Minority	35 (24.5)	52 (36.4)	29 (20.3)	27 (18.9)	
Preferred Communication					0.40
Spoken	89 (21.5)	124 (30.0)	121 (29.3)	79 (19.1)	
Gestures/ Vocalization/Aids	35 (19.9)	63 (35.8)	40 (22.7)	38 (21.6)	
Sign language	2 (11.8)	8 (47.1)	5 (29.4)	2 (11.8)	
Mobility					0.08
Mobile w/out aid	98 (23.1)	133 (31.4)	111 (26.2)	82 (19.3)	
Mobile with aid	22 (21.2)	30 (28.8)	33 (31.7)	19 (18.3)	
Non-ambulatory/	6 (7.7)	32 (41.0)	22 (28.2)	18 (23.1)	

Not mobile					
Hearing and/or Vision Impairment					0.07
No	77 (24.0)	98 (30.5)	78 (24.3)	68 (21.2)	
Yes	49 (17.2)	97 (34.0)	88 (30.9)	51 (17.9)	
Personal Health Status					0.24
Excellent	28 (27.5)	32 (31.4)	30 (29.4)	12 (11.8)	
Good	72 (22.2)	103 (31.7)	87 (26.8)	63 (19.4)	
Fair	24 (14.3)	57 (33.9)	46 (27.4)	41 (24.4)	
Poor	2 (20.0)	3 (30.0)	3 (30.3)	2 (20.0)	
Mental Health/ Challenging Behavior					<0.001
No MH or CB	95 (44.0)	73 (33.8)	38 (17.6)	10 (4.6)	
MH Only	20 (9.3)	82 (38.0)	69 (31.9)	45 (20.8)	
CB Only	9 (22.5)	10 (25.0)	9 (22.5)	12 (30.0)	
Both MH and CB	2 (1.5)	30 (22.4)	50 (37.3)	52 (38.8)	
<i>Meso/Environmental Characteristics</i>					
Type of Residence					<0.001
Family Home	48 (34.5)	48 (34.5)	33 (23.7)	10 (7.2)	
Small Group home (2-3)	18 (10.5)	49 (28.7)	53 (31.0)	51 (29.8)	
Large Group home (4-15)	11 (19.6)	16 (28.6)	16 (28.6)	13 (23.2)	
Own home/ apartment	40 (19.3)	70 (33.8)	57 (27.5)	40 (19.3)	
Metropolitan Classification of Residential ZIP Code					0.37
Large Urban	69 (21.2)	105 (32.2)	84 (25.8)	68 (20.9)	
Micropolitan	39 (22.5)	53 (30.6)	45 (26.0)	36 (20.8)	
Small town	14 (14.7)	32 (33.7)	34 (35.8)	15 (15.8)	
Rural	4 (33.3)	5 (41.7)	3 (25.0)	0 (2.0)	
Exercise					0.17
Some	92 (22.7)	132 (32.5)	111 (27.3)	71 (17.5)	
None	34 (17.0)	63 (31.5)	55 (27.5)	48 (24.0)	

Note. Means and standard deviations are reported for continuous variables; Frequencies and percentages are reported for categorical variables.

244

245 The multinomial logistic regression model is shown in Table 2. The overall model is presented,

246 along with the models comparing the category of no psychotropic medication (reference category) to

247 each of the other three categories (1 to 2, 3 to 4, and 5 or more). For each model, the odds ratios are

248 presented for each of the independent variables. Because variables were categorical, a reference
 249 category (no psychotropic medication) is compared to all other categorical data (1 to 2, 3 to 4, and 5 or
 250 more psychotropic medications) for each variable. The overall model exhibited good model fit
 251 characteristics, with the Likelihood Ratio test for significance <0.001 and the pseudo-R squared
 252 Nagelkerke value = 0.412. For the overall model, the independent variables with significant Likelihood
 253 Ratio Tests were the individual factors of Mobility and Mental Health Diagnosis/Challenging Behavior.
 254 Type of residence was the only significant environmental factor.

255 **Table 2**

256 Multinomial Logistic Regression

Variable	Overall Model Likelihood Ratio Tests		Reference is No Psychotropics Category		
			1 to 2 Psychotropics Exp(B) (p value)	3 to 4 Psychotropics Exp(B) (p value)	5 or More Psychotropics Exp(B) (p value)
	Chi-Square	P value			
<i>Micro/Individual Characteristics</i>					
Age (categorical)	10.87	0.54			
18 to 29			Reference	Reference	Reference
30 to 39			1.23 (0.7)	2.3 (0.17)	1.35 (0.65)
40 to 49			0.99 (0.98)	1.64 (0.41)	0.79 (0.72)
50 to 59			0.88 (0.81)	1.78 (0.36)	0.84 (0.79)
60 and older			1.62 (0.43)	2.20 (0.24)	0.67 (0.59)
Gender	1.39	0.71			
Female			Reference	Reference	Reference
Male			0.91 (0.72)	0.90 (0.71)	1.20 (0.60)
Race	4.36	0.23			
White			Reference	Reference	Reference
Minority			1.19 (0.58)	0.70 (0.30)	0.74 (0.44)
Preferred Communication	4.81	0.57			
Spoken			Reference	Reference	Reference
Gestures/Vocalization/Aids			1.21 (0.55)	0.82 (0.56)	1.32 (0.49)
Sign language			3.14 (0.19)	2.03 (0.45)	1.64 (0.67)

Mobility	28.53	<0.001			
Mobile w/out aid			Reference	Reference	Reference
Mobile with aid			1.42 (0.33)	2.4 (0.02)	2.32 (0.06)
Non-ambulatory/Not mobile			6.86 (<0.001)	10.7 (<0.001)	15.27 (<0.001)
Hearing and/or Vision Impairment	2.50	0.48			
No			Reference	Reference	Reference
Yes			1.14 (0.63)	1.23 (0.48)	0.83 (0.59)
Personal Health Status	14.83	0.10			
Excellent			Reference	Reference	Reference
Good			1.17 (0.67)	0.99 (0.97)	2.18 (0.10)
Fair			2.18 (0.06)	1.76 (0.21)	5.62 (0.001)
Poor			0.49 (0.50)	0.41 (0.43)	0.78 (0.84)
Mental Health/ Challenging Behavior	172.5	<0.001			
No MH or CB			Reference	Reference	Reference
MH Only			7.43 (<0.001)	12.48 (<0.001)	44.21 (<0.001)
CB Only			1.70 (0.31)	3.34 (0.03)	16.27 (<0.001)
Both MH and CB			32.41 (<0.001)	124.54 (<0.001)	494.22 (<0.001)
<i>Environmental Characteristics</i>					
Type of Residence	20.41	0.02			
Family Home			Reference	Reference	Reference
Own home			1.26 (0.55)	0.85 (0.71)	2.41 (0.11)
Group home 2 to 3 Residents			1.79 (0.17)	2.14 (0.09)	6.83 (<0.001)
Group home 4 to 15 Residents			0.92 (0.87)	0.74 (0.61)	2.79 (0.14)
Metropolitan Classification of Residential ZIP Code	11.26	0.26			
Large Urban			Reference	Reference	Reference
Micropolitan			0.65 (0.16)	0.67 (0.23)	0.51 (0.07)
Small town			1.22 (0.64)	1.73 (0.20)	0.95 (0.91)
Rural			0.87 (0.86)	0.48 (0.43)	--
Exercise	1.05	0.79			
Some			Reference	Reference	Reference
None			0.96 (0.90)	0.98 (0.94)	1.25 (0.53)

257 The next level of analysis of the multivariable nominal regression model is the comparison of the

258 different models representing the levels or categories of numbers of psychotropic medications,

259 comparing the model for the group with no psychotropic medication to the models for the groups of 1

260 to 2, 3 to 4, and 5 or more. The following is a description of the comparisons of independent variables
261 that were significant in the overall model. Persons who were nonambulatory had significantly higher
262 odds of taking 1 to 2, 3 to 4, or 5 or more psychotropic medications compared to persons who were
263 mobile without aids.

264 For the mental health and challenging behavior variable, persons taking 1 to 2, 3 to 4, or 5 or
265 more psychotropics were most likely to have either challenging behavior only, or both challenging
266 behavior and mental health diagnosis. Persons taking 3 to 4 and 5 or more psychotropics were
267 significantly more likely to have a mental health diagnosis, all compared to those not taking a
268 psychotropic medication. Regarding type of residence, persons living in group home of 2 to 3 persons
269 had the highest likelihood of taking 5 or more psychotropics compared with those taking no
270 psychotropics. One health status category was significant, with people reporting fair health more likely
271 to take 5 or more meds compared to those reporting excellent health.

272 Discussion

273 The present study provided another view of the issue of prescribing multiple psychotropic
274 medications within a general population of persons with ID receiving HCBS waived services in a single
275 US state and explored in detail the association of individual and environmental factors with a broad
276 range of polypsychotropic medication regimens.

277 Psychotropic Usage and Polypsychotropic Medication Regimens Among a Population-Based Sample of 278 Adults with Intellectual Disability in Oklahoma.

279 Among the population-based sample in the current study, roughly 80% of participants were
280 taking at least one psychotropic medication and nearly 20% of participants received polypsychotropic
281 medication regimens of 5 or more concurrent psychotropic medications. These findings indicate
282 somewhat higher rates of psychotropic usage and polypsychotropic medication regimens than
283 previously reported in other studies. According to national data reported from the 2017-2019 NCI IPS,

284 51% of all participants nationwide took at least one medication for mood, anxiety, psychotic disorder
285 and/or behavioral challenges and just 7% of participants in Oklahoma and nationwide took five or more
286 concurrent medications for mood, anxiety, or psychotic disorders. Similarly, a recent systematic review
287 and meta-analysis found that just 41% of adults with ID were prescribed psychotropic medications (Song
288 et al., 2023). In Lunsky and Modi's 2018 study of polypsychotropic medication regimens among patients
289 referred to a psychiatric outpatient clinic, roughly 20% of adults referred to the psychiatric outpatient
290 clinic for individuals with ID experienced polypsychotropic medication regimens of three or more
291 concurrent psychotropics, whereas roughly 47% of the current study's sample were reportedly taking
292 three or more current psychotropics. Interestingly, O'Dwyer et al. (2017) found similar prevalence rates
293 of polypsychotropic medication regimens among aging sample in the UK, with 47% of persons with ID
294 over 65 reportedly taking three or more medications. One notable difference between the present study
295 and the previous studies is the sample used for analysis. The present study used a population-based
296 study of adults with ID living in the community, while the others used samples referred to a psychiatric
297 service or focused on aging persons with ID.

298 The higher rates of psychotropic usage and polypsychotropic medication regimens found within
299 the current population-based sample may be related to the specificity and detail of the medication data
300 collected as part of the Oklahoma specific NCI IPS data collection protocol in 2017-2018. The combined
301 approach of recording names of all medications each participant was currently taking by trained data
302 collectors, as well as the coding of data conducted by the third author who has extensive expertise in
303 pharmacology may have provided a more accurate assessment of psychotropic usage and
304 polypsychotropic medication regimens than recorded by NCI IPS surveyors without training or expertise
305 in psychotropics. Current findings suggest that the prevalence of polypsychotropic medication regimens
306 may potentially be higher than estimated among the general population of adults with ID in United
307 States.

308 ***Individual Factors Associated with Polypsychotropic Medication Regimens***

309 The current analyses suggested that two of the targeted environmental factor variables were
310 associated with polypsychotropic medication regimens. Among the eight individual factor variables
311 explored, the current study found persons with limited mobility as well as those with mental health
312 diagnosis/documenting challenging behaviors were more likely to take more psychotropics medications.
313 Similar to the present study, Lunksy and Modi (2018) found that persons referred to a psychiatric service
314 who were diagnosed with anxiety, mood, or psychotic disorder were also more likely to have a
315 polypsychotropic medication regimen of 2 or more psychotropics. However, the current study
316 confirmed that persons who had both mental health diagnosis and challenging behaviors were
317 significantly more likely to take psychotropic medications than those with neither mental health
318 diagnoses or challenging behaviors, and the odds were much higher than persons with both mental
319 health diagnosis and challenging behaviors would be taking 5 or more psychotropics. Other research
320 confirms that persons with ID and a co-occurring mental health diagnosis are more likely to experience
321 polypsychotropic medication regimens (Tan et al., 2015; Vigod et al., 2016). Interestingly, in the current
322 study, persons having documented challenging behaviors had higher odds of polypsychotropic
323 medication regimens compared with persons with mental health diagnosis only. Two previous studies
324 similarly demonstrated that many persons with ID who take psychotropic medication do not have a
325 mental health related diagnosis (Folch et al., 2019; Sheehan et al., 2015). This consistent finding is
326 particularly concerning considering the dearth of evidence to justify the prescribing of psychotropics for
327 challenging behaviors in the absence of mental health diagnoses (Deb et al., 2023; Trollor et al., 2016;
328 Tyrer et al., 2014).

329 The current findings highlight the potentially problematic practice of prescribing psychotropic
330 medications that work in the central nervous system for use among persons with ID in light of the
331 absence of consistent evidence to support such practice and the risk of adverse side effects (Deb &

332 Unwin, 2007; Thomas et al., 2010; Tsiouris et al., 2013). Additional concerns arise when considering that
333 persons with challenging behaviors and no mental health diagnosis were more at risk for
334 polypsychotropic medication regimens than persons with mental health diagnosis only. It is important
335 for clinicians and caregivers to investigate further when challenging behaviors are present, which may
336 be due to physical or social factors and more likely to respond to non-medication approaches such as
337 cognitive behavior therapy and positive behavior support (Song et al., 2023).

338 Persons who were nonambulatory or mobile with aids were also more likely to have
339 polypsychotropic medication regimens. This may be related to the overall level of impairment, which
340 was demonstrated in the elderly population (Khezrian et al., 2019). However, interestingly, an
341 individual's personal health status did not have a significant influence on polypsychotropic medication
342 regimen. Questions remain whether comorbidity with other medical or psychological diagnoses was
343 associated with polypsychotropic medication regimens, as previous research demonstrated poor self-
344 rated health status was associated with greater numbers of psychotropic medications used by persons
345 with ID (McMahon et al., 2020). Additionally, in the present study, neither hearing and/or vision
346 impairment nor preferred means of communication were significantly associated with polypsychotropic
347 medication regimens. While not found in the current study, hearing and/or vision impairment and
348 preferred means of communication have been associated with general polypharmacy in older adults
349 without ID (Gutiérrez-Valencia et al., 2019; Smith et al., 2019). This previously determined relationship
350 may be associated with concurrent increases in chronic illness that perpetuate medication prescribing.

351 ***Environmental Factors Associated with Polypsychotropic Medication Regimens***

352 The model analysis also suggests that just one of the three environmental factor variables
353 explored in the model was significantly associated with psychotropic medication regimens. The current
354 analysis found persons living in a small group home of 2 to 3 residents were more likely to report
355 polypsychotropic medication regimens of 5 or more medications. Similar to the present study, Lunksy

356 and Modi (2018) found that adults with ID living with family members were less likely to experience
357 polypharmacy than those living in supported living environments. O’Dwyer et al. (2016) also found that
358 living in a supported living setting was associated with polypsychotropic medication regimen of 5 or
359 more medications. The current findings raise questions regarding the influence of the small community
360 group home settings on the provision of care and social inclusion of adults with ID. Sheehan et al. (2015)
361 examined the prevalence of prescribing psychotropic medications for person with ID, mental health,
362 and/or challenging behavior in a large population-based study. Sheehan et al. included a measure of
363 social deprivation (Townsend score), which serves as an environmental or social construct that may be
364 associated with incidence of challenging behavior or prescribing of psychotropic medications.
365 Interestingly, they found that the social deprivation score was not associated with prescribing of
366 antipsychotic medication for challenging behavior.

367 **Study Limitations**

368 Despite the strengths of this population-based study that included unique and detailed
369 psychotropic data as well as individual and environmental factors, there are significant limitations to
370 consider when interpreting the findings. First, the current analyses included some variables that
371 incorporated proxy responses and coding of state records. There is a possibility that proxies may
372 misinterpret individuals’ experiences, undermining the validity of the current data. While obtaining
373 information about weekly physical exercise and personal health status from the individuals themselves
374 would be ideal, previous studies have found strong, significant correlations between participant and
375 proxy answers to a choice questionnaire (Perry & Felce, 2005; Stancliffe & Parmenter, 1999).
376 Additionally, the cross-sectional design restricted the current analysis to variables included in the NCI IPS
377 survey. Key predictive factors for polypsychopharmacy may not have been represented in the current
378 analysis. The single state population-based sample and focus on specific population of individuals with
379 ID known to services may limit generalizability of the current findings to the population as a whole,

380 and/or other states, due to differences in policy and practice. Finally, the method used to collect and
381 verify medication data was felt to increase the accuracy of the medications that the subjects were
382 taking. However, the lack of information regarding whether the medication was taken regularly versus
383 on an as-needed basis (PRN) as well as the lack of information regarding the prescribing purpose of the
384 medication taken may have led to higher psychotropic medication counts compared with other studies.

385 **Conclusion**

386 Overall, the current study suggests both need and value for further exploration of the
387 prevalence rates of polypsychotropic medication regimens among adults with ID in United States. The
388 study uniquely highlights the significant role both individual and environmental factors may play in
389 increasing risk of polypsychotropic medication regimens. While it is clinically recommended that a goal
390 of reducing multiple medications be set and attempted as possible when persons with ID are started on
391 psychotropic medications (Adams et al., 2023; Deb et al., 2023; National Collaborating Centre for Mental
392 Health (UK), 2015; Sullivan et al., 2018), there are currently no clear national standards or rules guiding
393 medication management for persons with ID in the United States leaving this population at higher risk
394 for overuse and/or misuse of multiple psychotropics. Deprescribing initiatives like the Stopping Over-
395 Medication of People with Intellectual Disability, Autism, or Both (STOMP) program supported by the
396 National Health Service England designed to increase awareness of overprescribing of psychotropic
397 medications for persons with ID, as well as provides guidelines for clinicians to consider to reduce or
398 eliminate these medications from patients medication regimens (Branford et al., 2019). This guideline is
399 supported by both the government as well as health care organizations. Better understanding of the
400 significant associations noted in the current population-based study of polypsychotropic medication
401 regimens can serve to highlight the key individual and environmental factors that may put persons with
402 ID at increased risk of polypsychotropic medication regimens and assist professionals and caregivers in
403 more effectively targeting persons at the highest risk for potentially dangerous polypsychotropic

404 medication regimens. In time, by identifying potential factors associated with polypsychopharmacy,
405 effective changes in Medicaid HCBS provision, medical treatment, and policies can be implemented to
406 minimize the risks of polypsychotropic medication regimens among adults with ID.

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