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Anti-Hypertensive Medication Use and Factors Related to Adherence Among Adults With Intellectual and Developmental Disabilities

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Abstract

Adults with intellectual and developmental disabilities (IDD) are known to experience significant health disparities; however, few studies have described anti-hypertensive medication adherence in this population. Using administrative data from South Carolina from 2000–2014, we evaluated the odds of adherence to anti-hypertensive medication among a cohort of adults with IDD and hypertension. Approximately half (49.5%) of the study cohort were adherent to anti-hypertensive medication. Those who lived in a supervised residence, had a Medicaid waiver, and had more frequent contact with a primary care provider were more likely to be adherent. Organizations that serve people with IDD have an opportunity to increase adherence by educating these individuals, their family members, and caregivers about the importance of adherence to anti-hypertensive medication.

Keywords

intellectual disability; developmental disabilities; hypertension; anti-hypertensive agents; Medicaid; prevalence

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Approximately 30%, or about 75 million, U.S. adults have hypertension (Merai et al., 2016), a key treatable risk factor for cardiovascular disease (Chobanian et al., 2003). Lifestyle interventions, such as weight loss, reducing dietary salt intake, and exercise, have been shown to reduce blood pressure, but treatment with one or more anti-hypertensive medications is often necessary to achieve optimal blood pressure control (Weber et al., 2014). Despite these well-known treatment strategies, nearly half of U.S. adults with hypertension do not have it under control (Yoon, Fryar, & Carroll, 2015), which has been associated with adverse cardiovascular outcomes and increased healthcare costs, and is largely attributed to non-adherence to anti-hypertensive medication (Ho, Bryson, & Rumsfeld, 2009; Mazzaglia et al., 2009; Ritchey et al., 2016).

Estimates of non-adherence in the U.S. range widely; one national study of administrative claims data estimated non-adherence at 18.4% (Elliott, Plauschinat, Skrepnek, & Gause, 2007), while estimates among certain Medicare and Medicaid populations are higher, 26.3% and 45% to 75%, respectively (Bailey et al., 2014; Ritchey et al., 2016; Shaya et al., 2009; Vacek, Hunt, & Shireman, 2013). A recent study among Medicare beneficiaries found a substantial decrease in cardiovascular events for those reaching a specified adherence threshold (≥80% of days were covered by prescription fills) (Yang, Chang, Ritchey, & Loustalot, 2017). Therefore, it is important to understand anti-hypertensive treatment patterns and identify contributors or barriers to adherence in order to address blood pressure control. Several factors have been found to contribute to non-adherence, including patient-related factors such as age, race, socioeconomic status, and the presence of comorbidities, as well as factors related to health care providers and systems, and complexity of treatment regimens (Bailey et al., 2014; Sabaté, 2003; Shaya et al., 2009; Siegel, Lopez, & Meier, 2007). However, certain sub-populations may experience unique health needs, which, in turn, may affect treatment and adherence in ways that differ from the general population. One such population is adults with intellectual and developmental disabilities (IDD); intellectual disability begins before the age of 18 and is defined by problems with both intellectual functioning and adaptive behavior, while developmental disability is a broader term that encompasses both intellectual disability as well as other disabilities beginning in childhood (National Institutes of Health, 2016). Adults with IDD are a population known to experience significant health differences and disparities as compared with adults without IDD or other disabilities and on whom there are sparse data available from population-based health surveys (Cooper et al., 2015; Havercamp & Scott, 2015; Havercamp, Scandlin, & Roth, 2004; U.S. Department of Health and Human Services, 2005). There are previous studies describing hypertension among adults with functional limitations (Pharr & Bungum, 2012; Stevens, Courtney-Long, Gillespie, & Armour, 2014). Studies that have considered hypertension in adults with IDD are few, and report comparable prevalence of hypertension as the general population (de Winter, Bastiannse, Hilgenkamp, Evenhuis, & Echteld, 2012), poor screening/recognition and poor receipt of chronic care management (Cooper et al., 2015; Cooper et al., 2018; de Winter et al., 2012), and higher risk of death from cardiovascular causes (O'Leary, Cooper, & Hughes-McCormack, 2017); a single study noted limited adherence (Vacek et al., 2013). Given the dearth of health data on this population, we sought to assess factors potentially related to adherence to anti-hypertensive medication among adults with IDD, using administrative data from South Carolina.

Methods

The South Carolina Revenue and Fiscal Affairs Office, Health and Demographic Section (H & D), is a central state repository for health and human service data. Data housed at H & D and utilized for this project originated from Medicaid, the Department of Disabilities and Special Needs (DDSN), and the Department of Social Services. Through a series of statutes and agreements, agencies and organizations entrust data to H & D while retaining access control at all times. We obtained data use agreements from participating organizations, and the data linkages and analyses were performed at the H & D. Non-H & D investigators received aggregated data for review. Procedures for the protection of human subjects were reviewed and approved by the University of South Carolina Institutional Review Board.

IDD Cohort

We searched the South Carolina Medicaid fee-for-service (FFS) and health management organization (HMO) claims for *International Classification of Diseases, Ninth Revision, Clinical Modification* (ICD-9-CM) codes related to IDD for the study period 2000–2014. The ICD-9-CM codes used were based on the disability-related condition algorithms available from the chronic conditions data warehouse of the Centers for Medicaid and Medicare Services (Table 1). Medicaid members were included in the IDD cohort if three criteria were met: (1) they were 22 to 64 years of age during the study period; (2) they had either an inpatient encounter or two other service encounters (excluding pharmacy and laboratory claims) with an IDD diagnosis code at least 30 days apart; and (3) they had at least one calendar year of eligibility during the study period.

Adherence Study Cohort

Once the IDD cohort ($N = 22,463$) was established, we searched all member FFS and HMO medical and pharmacy claims during the study period for hypertension diagnosis codes and anti-hypertensive medications. Cohort members were only identified as having hypertension if a code was present on at least one inpatient encounter or two outpatient service encounters at least 30 days apart (Table 1). We selected anti-hypertensive medications from the following therapeutic classes: diuretics, beta-blockers, angiotensin converting enzyme (ACE) inhibitors, angiotensin II receptor blockers, calcium-channel blockers, alpha blockers, alpha-2 receptor agonists, central agonists, peripheral adrenergic inhibitors, vasodilators, and renin inhibitors. Combination medications were also selected. A minimum of two prescription claims or at least a 60-day supply was required for cohort members to be identified as having a prescription for anti-hypertensive medication. A total of 6,429 members were identified as having both a hypertension diagnosis and an anti-hypertensive medication prescription.

All members with their first anti-hypertensive medication prescription during the study period and who were continuously eligible in the year following their first prescription (here-inafter referred to as ‘‘measurement year’’) were selected to further study anti-hypertensive medication adherence ($N = 3,909$). In order to establish the measurement year as the baseline year, a two-year ‘‘clean’’ period during which no anti-hypertensive medications were identified prior to the measurement year was required. For ‘‘first’’

prescriptions identified in 2000 and 2001 of the study period, claims from 1998 and 1999 were searched for anti-hypertensive medications and all members with claims were excluded. Members with IDD and a hypertension diagnosis code who were dually covered (Medicaid plus commercial insurance or Medicare), pregnant, had end-stage renal disease or were organ-transplant recipients were excluded from further analysis. Additionally, all members must have had an essential hypertension code (401.x) (i.e., their hypertension was primary and not caused by another medical condition) during the first six months of the measurement year. This requirement and exclusion criteria are consistent with Healthcare Effectiveness Data Information Set (HEDIS) recommendations (National Committee for Quality Assurance, 2003). A total of 1,573 members remained in the adherence study cohort.

Anti-hypertensive medication claims identified during a member's measurement year were selected to calculate adherence. The proportion of days covered (PDC) measures the number of days a prescription is on-hand during the measurement period and divides by the total number of days in the measurement period (365 days for this study). PDC is the National Committee for Quality Assurance/National Quality Forum endorsed measure for studying medication adherence in administrative pharmacy claims data, aligns with current standards from the Pharmacy Quality Alliance, and is preferred over the simple summation of ''days of supply'' (Nau, n.d.). Macro coding which allows for a PDC calculation at both the therapeutic class and patient disease level, was utilized for this study (Wang, Huang, & Traubenberg, 2013). Consistent with recent studies, we considered PDC greater or equal to 80% to be adherent, a level shown to be associated with decreased risk of adverse cardiovascular events (Ritchey et al., 2016; Yang et al., 2017).

Covariates

We included age, sex, race, county type, presence of a specific IDD code, receipt of supplemental nutrition assistance program (SNAP; previously referred to as Food Stamps) for at least three months during the study period, residential service setting, primary care visits, receipt of support services, and comorbid conditions. County type was determined using the zip code approximation rural-urban commuting area codes and was aggregated into one of four categories: (1) urban focused, (2) large rural city, (3) small rural town and (4) isolated small rural town (Rural Health Research Center, n.d.). Members with a diagnosis code for autism, cerebral palsy, Down syndrome, other genetic condition or fetal alcohol syndrome were considered to have a specific condition diagnosis code. Members with mild-to-profound or unspecified intellectual disability and no specific condition codes comprised a second group (Table 1). SNAP eligibility, included as a proxy for poverty, requires proof of household or individual income below the federal poverty level.

Information on residential service setting was compiled from Medicaid and DDSN files and categorized as the following: (1) supervised community-based settings, including supervised apartment living, assisted living facilities, boarding homes, group homes, and community residential care facilities; (2) nursing home facilities and intermediate care facilities for those with IDD (ICF/ID) or (3) home. Nursing homes and ICF/ID are group living facilities which provide 24 hours a day active treatment and health services for individuals with IDD

(Centers for Medicare & Medicaid Services, n.d.). A variable indicating receipt of support services was compiled from Medicaid data if a member was on an IDD-related waiver for at least 90 days during the measurement year (South Carolina Department of Disabilities and Special Needs, 2017).

Primary care visits were estimated from the administrative claims data. In the U.S., multiple specialties provide primary care. Therefore, a visit was considered primary care if: (1) an office, other outpatient service, or nursing home evaluation and management Current Procedural Terminology (CPT) code was noted on the encounter claim; and (2) the rendering physician specialty was recorded as primary care (e.g., family practice, general practice, internal medicine, pediatrician); or the service was provided by a nurse practitioner. In addition, all-inclusive visits occurring in a federally qualified health department or rural health center were counted as primary care visits. Comorbid conditions were identified using the Charlson Comorbidity Index, a set of conditions associated with elevated mortality risk and defined by ICD-9-CM codes from claims data (D'Hoore, Bouckaert, & Tilquin, 1996).

Statistical Analyses

We calculated the prevalence of hypertension and sample characteristics for all members with IDD and the adherence study cohort as well as types and numbers of anti-hypertensive medications used by adherence study cohort members. We also calculated frequencies of selected characteristics of members of the adherence study cohort during the measurement year, stratified by 80% PDC. We evaluated the odds of having a PDC of 80% or higher during the measurement year using a multivariate logistic regression model. The model included community and other support-related variables (residential setting, primary care visits, waiver support services) as well as demographic characteristics (age, sex, race, county type, specific IDD code, SNAP), number of medication types, and comorbid conditions. Data in Tables 1–3 represent 100% of Medicaid beneficiaries meeting the inclusion criteria; therefore, confidence intervals are not shown. All analyses were conducted using SAS 9.4 (SAS Institute, Cary, North Carolina).

Results

We identified 22,463 members with IDD in the study period 2000–2014, of whom 42.2% were identified as having a hypertension diagnosis (Table 1). A total of 1,573 members met criteria for inclusion in our adherence study cohort (Table 1). Most (81%) adherence study cohort members were born between 1947 and 1980, making them slightly older than all members with IDD, of whom 73.8% were born between 1958 and 1992. Overall, 62.9% of the adherence study cohort were Black/African American, and 64.5% received SNAP for at least three months during the study period compared with half (45.9% and 50.4%, respectively) of all members with IDD. Slightly over half (52.7%) of the adherence study cohort was male, most (61.3%) lived in an urban focused area, and approximately one-third (32.7%) had a specific IDD code recorded. Certain comorbid conditions, including ADHD/anxiety, urinary retention, or ‘‘other severe mental health condition’’ were recorded for 15.5%, 2.4%, and 42.0% of the adherence study cohort, respectively (Table 1).

For both the entire study period and the adherence study measurement year, the most common type of medication prescribed to the adherence study cohort were diuretics (67.1% and 52.5%, respectively). Over the study period, 28.2% of the adherence study cohort had one medication type and 71.8% had two or more types recorded. During the measurement year, slightly over half (50.6%) had one medication type recorded (Table 2).

Approximately half (49.5%) of the adherence study cohort reached ≥80% PDC (i.e., were considered adherent to anti-hypertensive medication). Compared with those with <80% PDC, those who were adherent were older (45–54 years, 26.4% vs. 23.0%; 55–64 years: 13.2% vs. 8.6%), male (54.2% vs. 51.3%), White (34.3% vs. 28.2%), had a specific IDD code recorded (34.3% vs. 26.3%), did not receive SNAP (42.1% vs. 29.0%), and lived in community-based settings (19.4% vs. 5.9%) or nursing home or ICF/ID facility (7.6% vs. 1.9%). Most (85.0%) of those who were adherent to anti-hypertensive medication had one or more primary care visits recorded, compared with 80.5% of those who were not adherent. Over one-third (36.4%) of those who were adherent were on a waiver for at least 90 days compared with 18.9% of those who were not adherent. Those who were adherent had a higher number of medication types recorded than those who were not adherent (two types: 30.9% vs. 25.8%; three or more types: 18.4% vs. 6.3%). Rural-urban residence areas and comorbid conditions, with the exception of mental health or substance use comorbidity, which was more prevalent in those who were not adherent, were similar between the two groups (Table 3).

In multivariate analyses, Black/African American cohort members were less likely than their White counterparts to reach ≥80% PDC (*aOR*: 0.68, 95% CI: 0.53, 0.87), as were those who received SNAP during the measurement year (*aOR*: 0.74, 95% CI: 0.58, 0.94). Those with a mental health/substance use comorbid condition were also less likely to be adherent (*aOR*: 0.72, 95% CI: 0.55, 0.95). Adherence study cohort members who lived in community-based settings, and those who lived in nursing home or ICF/ID facilities were more likely to be adherent than those who lived in unsupervised settings (*aOR*: 4.20, 95% CI: 2.86, 6.19 and *aOR*: 5.49, 95% CI: 2.94, 10.22, respectively). Additionally, those with at least one primary care visit (*aOR*: 1.40, 95% CI: 1.04, 1.89), those who were on a waiver for at least 90 days (*aOR*: 2.68, 95% CI: 2.07, 3.47), and those taking two and three or more medication types (*aOR*: 1.76, 95% CI: 1.37, 2.25 and *aOR*: 5.02, 95% CI: 3.44, 7.33, respectively) were more likely to be adherent (Table 4).

Discussion

Overall, we found that just over 40% of adults with IDD had a diagnosis of hypertension, and approximately half of the adults in our adherence study cohort were considered to be adherent to anti-hypertension medication. We identified several factors supportive of adherence to anti-hypertensive medication refills among adults with IDD, including living in a supervised residence, being on a Medicaid waiver, and having more frequent contact with primary care providers.

We found that 42% of adults with IDD had hypertension, which is higher than prevalence estimates among similarly aged cohorts in the US general population (Yoon et al., 2015).

While still higher, it is similar to estimates for adults with functional cognitive limitation in the U.S. (Stevens et al., 2014). The high proportion of Black/African Americans in our analysis cohort may have contributed to this higher percentage given that hypertension is more common among Black/African Americans than other racial/ethnic groups (Chobanian et al., 2003; National Center for Health Statistics, 2016). Only half of our adherence study cohort was considered adherent to prescribed anti-hypertensive medication, which is lower than the nearly 7 in 10 U.S. adults with hypertension who report taking medication (Centers for Disease Control and Prevention, 2011), but similar to the 55% adherence noted in a study of Kansas Medicaid recipients with developmental disabilities (Vacek et al., 2013). However, the adherence rate in our study differs in a substantial way from studies that included a cohort with broadly defined disability. A recent study of Medicare Part D beneficiaries over the age of 65 years reported a 68.0% adherence rate in those whose initial entitlement reason was any type of disability (Ritchey et al., 2016). A 2009 study by Shaya et al., reported 24.8% adherence in an analysis of continuously enrolled, nonelderly Maryland Medicaid recipients; the Shaya et al., study did not look specifically at disability, but the Medicaid population is more likely to have a disability than the non-Medicaid population (Anderson, Armour, Finkelstein, & Wiener, 2010).

In our study, Black/African American cohort members were less likely to be adherent, as were those who received SNAP during the measurement year, and those with a noted mental health or substance use comorbidity. SNAP participation was not included in our study as a proxy for nutritional status. Rather, we used it as a surrogate for poverty, since only people at or below the federal poverty level are eligible for the benefit. Prior studies have identified race, substance use, and depression as risk factors for non-adherence among Medicaid (Bailey et al., 2014) and veteran (Siegel et al., 2007) populations, and higher non-adherence rates have been noted among Medicaid Part D enrollees living in poverty (Ritchey et al., 2016).

Findings from our study showed that those living in more supervised settings (nursing home, ICF/ID, or supervised community setting) had statistically significantly higher adherence to anti-hypertensive medications compared with those who lived at home or in an unsupervised setting without Medicaid services. Our study explored the association of adherence with additional support and found those with at least one primary care visit during the measurement year and those on a waiver for 90 days or more (indications of higher levels of support) were more likely to be adherent. Although few studies have looked at indicators of community support or residential type as factors related specifically to anti-hypertensive medication adherence in adults with IDD, other research has found associations between mutable characteristics and adherence, including community and clinical supports. One research group posited that the better anti-hypertensive medication adherence they found in younger ages was a result of better community-based support for these adults (Vacek et al., 2013). Another study of anti-epileptic medication use in adults with developmental disabilities found higher adherence rates among those living in group homes compared with those living in semi-independent settings and those in family homes (Hom et al., 2015). Additionally, in a study of psychotropic medication use among those with developmental disabilities and mental illness, there was a positive association between outpatient visits and adherence, which the authors felt was due to a better support system (Tan et al., 2015). In the

general population modifiable factors associated with improved adherence to hypertension management include education, communication, and reducing pill burden (Klootwyk & Sanoski, 2011).

Our findings of an association between adherence and supervised living situations and community supports are also notable in that there has been a twenty-year trend toward increasing community and other support programs for people with IDD. Nationally, between 1999 and 2009, there was 17.3% increase in use of community group homes, 90.2% increase of assistance in an individual's own home, and 28.5% increase in services in host or foster care homes for people with IDD (Smith, Lakin, Larson, & Salmi, 2011). On the national level, in fiscal year 2009, the majority of Medicaid spending on long-term supports and assistance for those with IDD was for the Home and Community-Based Services (HCBS) Waiver program (Rizzolo, Friedman, Lulinski-Norris, & Braddock, 2013). The primary service category to be funded in fiscal year 2010 was residential habilitation services, representing 53% of total proposed waiver spending (Rizzolo et al., 2013). In South Carolina in 2009, only 810 people with IDD resided in public/private institutions (a decrease of 34.0% from 1999), while 3,271 people resided in community group homes, 142 in host homes, and 662 in their own or family homes (increases of 30.5%, 21.4%, and 5.9% from 1999, respectively; Smith et al., 2011). A subset of the South Carolina adults with IDD who live in their own or family homes have a Medicaid waiver that covers services such as residential habilitation, companion/personal assistance/supported living, adult day health, community transition supports, care coordination, transportation, prevocational, supported employment, assistive and medical technologies, and health and professional services (Rizzolo et al., 2013).

Many strategies have been evaluated to improve anti-hypertensive medication adherence. Some effective strategies include encouraging patients, caregivers, and healthcare providers to work together to set therapeutic goals, design and implement a treatment plan, and adjust based on patient progress (Tan et al., 2015); consistently incorporating regular follow-up with the health care system (Ho et al., 2009); and simplifying the treatment regimen (e.g., use of fixed-dose combination medicines, use of long-acting drugs, increasing day's supply per fill, etc.; Weber et al., 2014; Ritchey et al., 2016). The effectiveness of any of these strategies in the population of adults with IDD is unknown. However, our study suggests that interventions that incorporate additional structure and a community support component may aid in increasing anti-hypertensive medication adherence in adults with IDD. While our study results seem promising in supporting this approach, some caution is warranted as clinical outcomes that may result from such interventions in this population are unknown. An updated Cochrane review about improving adherence to prescribed medication regimens in general noted that current methods used are mostly complex (i.e., include interventions with multiple components) and not as effective for determining both adherence and clinical outcomes (Nieuwlaat et al., 2014). Further investigation of supportive systems within the IDD population should include not only adherence measures, but also outcome measures.

This study is subject to at least five limitations. First, we used administrative claims data and therefore were unable to assess measured blood pressure levels or blood pressure control. Second, PDC only assesses availability of medication and not whether or not the medication

was taken as prescribed; however, PDC is a standard and accepted method of determining adherence with these types of data (Ritchey et al., 2016; Yang et al., 2017). On the other hand, we could assess that medication was purchased at a pharmacy, which is more accurate than medical records for determining if the prescription was filled. Third, we measured adherence in the year following an individual's first anti-hypertensive medication prescription; this may or may not represent adherence in subsequent years. Fourth, results of this study pertain to the Medicaid population with IDD in South Carolina and may not necessarily be generalizable to other geographic areas or other disability types, including non-Medicaid populations. However, since adults with IDD represent a high cost group for the Medicaid program (The Pew Charitable Trusts & The McArthur Foundation, 2014), the identification of potential intervention strategies to improve health and reduce cost is important. Finally, we did not assess adherence by specific IDD type, as that was considered beyond the scope of this study; further work in this area may be warranted.

Conclusion

Our study identifies community and other supports as a strategic area which can be leveraged to improve medication adherence in people with IDD. Adults with IDD may live in a supervised residence, be on a Medicaid waiver (which confers eligibility for numerous services and supports), and have more frequent contact with a primary care provider. Unfortunately, an individual's ability to receive a Medicaid waiver is usually impacted by long waiting lists, averaging nearly 4 years for those with IDD in 2014 (The Kaiser Commission on Medicaid and the Uninsured, 2015). Nonetheless, it is likely feasible for organizations that serve people with IDD to provide more training about the issues related to medication adherence to family members, caregivers, primary care providers, and adults with IDD themselves, to support improved adherence in the least restrictive residential environments.

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Table 1

Sample Characteristics of All Members With Intellectual and Developmental Disabilities (IDD) Members and the Adherence Study Cohort—South Carolina, 2000–2014*

Demographic Characteristic	All IDD Members *N* (%)	Adherence Study Cohort *N* (%)
Total	22,463 (100)	1,573 (100)
Hypertension†	9,484 (42.2)	1,573 (100)
Anti-hypertensive prescription	8,012 (35.7)	1,573 (100)
Birth year		
1981–1992	5,383 (24.0)	209 (13.3)
1969–1980	5,762 (25.7)	439 (27.9)
1958–1968	5,411 (24.1)	471 (29.9)
1947–1957	4,236 (18.9)	365 (23.2)
1936–1946	1671 (7.4)	89 (5.7)
Sex		
Male	12,344 (55.0)	829 (52.7)
Female	10,119 (45.0)	744 (47.3)
Race		
White	10,858 (48.3)	491 (31.2)
Black/African American	10,316 (45.9)	990 (62.9)
Other/missing	1,289 (5.7)	92 (5.8)
Zip Code RUCA approximation‡		
Urban focused	14,313 (63.8)	964 (61.3)
Large rural city/town focused	5,021 (22.4)	331 (21.0)
Small rural town focused	2,055 (9.1)	177 (11.3)
Isolated small rural town focused	1,029 (4.6)	101 (6.4)
Missing/not represented	33 (0.1)	—
Dual coverage§		
Medicaid primary payer	9,,254 (41.2)	1,573 (100)
Other payer (Medicare, commercial)	13209 (58.8)	0 (0)
SNAP		

Demographic Characteristic	All IDD Members *N* (%)	Adherence Study Cohort *N* (%)
Yes – ≥3 months during study	11,322 (50.4)	1,015 (64.5)
No	11,141 (49.6)	558 (35.5)
IDD condition[//]		
Specific code recorded[¶]	8,921 (39.7)	476 (32.7)
Mild-profound/unspecified codes only[**]	13,542 (60.3)	1,097 (67.3)
Conditions for which hypertension drugs often used[#]		
ADHD/anxiety[††]	5,066 (22.6)	244 (15.5)
Urinary retention[‡‡]	1,074 (4.8)	37 (2.4)
Other severe mental health condition[§§]	9,915 (44.1)	660 (42.0)

[*] Data originated from South Carolina Medicaid, the Department of Disabilities and Special Needs (DDSN), and the Department of Social Services.

[†] Hypertension codes include: Any code beginning with 401–405. The adherence study cohort was limited to members with essential hypertension (401.x).

[‡] Zip code RUCA approximation for total IDD members used the zip code recorded for the greatest number of days during the study period, and for the adherence study cohort used the zip code recorded for greatest number of days during measurement year.

[§] Based on member's most recent year of eligibility during the study period for all IDD members and measurement year for the adherence cohort. Yearly percentages average 54.9%.

[//] Number of cases with a specific diagnosis recorded and a mild-to-profound or unspecified ID code: 8,387 (75.8%).

[¶] Case diagnosed with a specific code often related to intellectual disability. May or may not have mild to profound or unspecified intellectual disability code (i.e., 317, 318, 319). Specific condition codes include:

- Autism/PDD: 299.00, 299.01, 299.10, 299.11, 299.80, 299.81, 299.90, 299.91
- Cerebral Palsy: 343.0, 343.1, 343.2, 343.3, 343.4, 343.8, 343.9, 333.71
- Down Syndrome: 758.0
- Trisomy/Autosomal: 758.1, 758.2, 758.31, 758.32, 758.33, 758.39
- Fragile X Syndrome: 759.83
- Leukodystrophy: 330.0, 330.1, 330.2, 330.3, 330.8, 330.9
- Lesch Nyhan: 277.2
- Tubular Sclerosis: 759.5
- Prader-Willi Syndrome: 759.81

- Fetal Alcohol Syndrome: 760.71

[#]Mild-profound and unspecified ID codes include:

- ID Mild: 317
- ID Moderate: 318.0, 318.1, 318.2
- ID Unspecified: 319

[**]Conditions for which hypertension drugs are often used are not mutually exclusive. Conditions met the same diagnostic criteria as IDD and hypertension codes.

[††]ADHD codes include: any code beginning with 314. Anxiety codes include: any code beginning with 300.0 or 300.4.

[‡‡]Urinary retention codes include: any code beginning with 788.2, 600.01, 600.21, 600.91 or 306.53.

[§§]Other severe mental/behavioral health condition codes include any code beginning with:

- 290 – 294: Organic psychotic conditions including dementia and alcohol and drug induced mental disorders
- 295: Schizophrenic disorders
- 296: Episodic mood disorders
- 298: Other nonorganic psychoses
- 300.4: Depression w/ anxiety
- 303: Alcohol dependence syndrome
- 304: Drug dependence syndrome
- 305: Nondependent abuse of drugs
- 311: Depressive disorder

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Table 2

Prescription of Specific Types and Numbers of Medications Among Adults With Intellectual and Developmental Disabilities (IDD)—South Carolina, 2000–2014[*]

	Study Period 2000–2014[†] ***N*** **(%)**	**Measurement Year**[‡] ***N*** **(%)**
Types of medication[§]		
Diuretics	3,312 (67.1)	826 (52.5)
Beta blockers	1,938 (39.3)	413 (26.3)
Angiotensin converting enzyme inhibitors	2,600 (52.7)	620 (39.4)
Angiotensin II receptor blockers	1,312 (26.6)	262 (16.7)
Calcium channel blockers	2,012 (40.8)	419 (26.6)
Alpha blockers	514 (10.4)	63 (4.0)
Alpha-2 receptor agonists	37 (0.8)	10 (0.6)
Central agonists	502 (10.2)	66 (4.2)
Peripheral adrenergic inhibitors	≤10 (≤0.2)	0 (0)
Vasodilators	119 (2.4)	≤10 (≤0.6)
Renin inhibitors	26 (0.5)	≤10 (≤0.6)
Number of medication types		
1	1,391 (28.2)	796 (50.6)
2	1,484 (30.1)	524 (33.3)
3	1,005 (20.4)	192 (12.2)
≥4	1,053 (21.3)	61 (3.9)

[*] Data originated from South Carolina Medicaid, the Department of Disabilities and Special Needs (DDSN), and the Department of Social Services.

[†] Hypertension (HTN) diagnosis and non-dual coverage years where prescription fill date ≥ first HTN diagnosis date (n = 4933).

[‡] Measurement year refers to the year following a member's first anti-hypertensive prescription fill date. Essential HTN diagnosis date is required during the first six months of the measurement year (n = 1573).

[§] Types of medication are not mutually exclusive.

Table 3

Characteristics of the Adherence Study Cohort During the Measurement Year by 80% PDC—South Carolina, 2000–2014 *

	≥80% PDC *N* (%)	<80% PDC *N* (%)
Total	779 (49.5)	794 (50.5)
Age (in years)		
22–34	245 (31.5)	310 (39.0)
35–44	225 (28.9)	233 (29.3)
45–54	206 (26.4)	183 (23.0)
55–64	103 (13.2)	68 (8.6)
Sex †		
Male	422 (54.2)	407 (51.3)
Female	357 (45.8)	387 (48.7)
Race †		
White	267 (34.3)	224 (28.2)
Black/African American	460 (59.1)	530 (66.8)
Other/missing	52 (6.7)	40 (5.0)
Zip Code RUCA approximation		
Urban focused	477 (61.2)	487 (61.3)
Large rural city/town focused	165 (21.2)	166 (20.9)
Small rural town focused	89 (11.4)	88 (11.1)
Isolated small rural town focused	48 (6.2)	53 (6.7)
IDD condition ‡		
Specific code recorded	267 (34.3)	209 (26.3)
Mild-profound/unspecified codes only	512 (65.7)	585 (73.7)
SNAP		
Yes – ≥3 months during year	451 (57.9)	564 (71.0)
No	328 (42.1)	230 (29.0)
Residence		
Unsupervised community living or home	569 (73.0)	732 (92.2)
Supervised community-based settings	151 (19.4)	47 (5.9)

	≥80% PDC *N* (%)	<80% PDC *N* (%)
Nursing home, ICF/IDD facilities	59 (7.6)	15 (1.9)
# Primary care visits[§]		
No visits	117 (15.0)	155 (19.5)
≥1 visits	662 (85.0)	639 (80.5)
Waiver[//]		
On waiver ≥90 days	284 (36.4)	150 (18.9)
Not on waiver	495 (63.6)	644 (81.1)
Number of different medication types		
1 type	395 (50.7)	539 (67.9)
2 types	241 (30.9)	205 (25.8)
≥3 types	143 (18.4)	50 (6.3)
Obesity	88 (11.3)	92 (11.5)
Comorbidities Charlson Index		
≥1 comorbid condition	558 (71.6)	585 (73.7)
Mental health/substance use	317 (40.7)	361 (45.5)
Peripheral vascular disease	32 (4.1)	21 (2.6)
Cerebrovascular disease	68 (8.7)	60 (7.6)
Diabetes without complications	197 (25.3)	200 (25.2)
Diabetes with complications	28 (3.6)	29 (3.7)

[*] Data originated from South Carolina Medicaid, the Department of Disabilities and Special Needs (DDSN), and the Department of Social Services.

[†] In multiple eligibility files. The most recent file was used for sex and race unless race was unknown. If race was unknown, the most frequent known value from all files was used.

[‡] Not everyone had a claim with an IDD code during the measurement year; therefore, all claims during the study period were used to determine IDD condition.

[§] A visit was considered primary care if (1) rendering physician specialty was recorded as family practice, general practice, internal medicine or service was provided by nurse practitioner, (2) service was provided in office, nursing home, clinic or other medical center and (3) evaluation and management (E&M) office or other outpatient services CPT code was noted on encounter claim. Additionally, all-inclusive visits occurring in a federally qualified or rural health centers were considered primary care. E&M CPT codes utilized were consistent with the healthcare and effectiveness data and information set (HEDIS) measures. If no rendering specialty was noted, billing specialty was utilized.

[//] Waiver: Member was flagged if on intellectual disability, community long term care, or community support waiver (new or established) for ≥90 days during measurement year.

Table 4

Association of Demographic Characteristics With Adherence to Anti-hypertensive Medication (≥80% PDC) Among Adults With Intellectual and Developmental Disabilities (IDD), From Multivariate Logistic Regression[*]—South Carolina, 2000–2014[†]

	Adjusted Odds Ratio	95% Wald Confidence Limits	
Age (continuous)	1.02	1.01	1.03
Sex			
Male	Ref	Ref	Ref
Female	1.11	0.89	1.39
Race			
White	Ref	Ref	Ref
Black/African American	0.68	0.53	0.87
Other/missing	1.11	0.68	1.80
Zip Code RUCA Approximation			
Urban focused	Ref	Ref	Ref
Large rural city/town focused	1.15	0.88	1.52
Small rural town focused	1.08	0.75	1.54
Isolated small rural town focused	1.37	0.87	2.14
IDD Condition			
Mild-profound/unspecified codes only	Ref	Ref	Ref
Specific code recorded	1.22	0.94	1.57
SNAP			
No	Ref	Ref	Ref
Yes – ≥3 months during year	0.74	0.58	0.94
Residence			
Unsupervised community living or home	Ref	Ref	Ref
Supervised community-based settings	4.20	2.86	6.19
Nursing home, ICF/ID facilities	5.49	2.94	10.22
# Primary Care Visits			
No visits	Ref	Ref	Ref
≥1 visits	1.40	1.04	1.89
Waiver[≠]			

	Adjusted Odds Ratio	95% Wald Confidence Limits	
Not on waiver	Ref	Ref	Ref
On waiver	2.68	2.07	3.47
Number of Different Medication Types			
1	Ref	Ref	Ref
2	1.76	1.37	2.25
≥3	5.02	3.44	7.33
Obesity			
No	Ref	Ref	Ref
Yes	1.08	0.76	1.54
Comorbidities Charlson Index			
≥1 comorbid condition	0.82	0.59	1.13
Mental health/substance use (Yes vs No)	0.72	0.55	0.95
Peripheral vascular disease (Yes vs. No)	1.28	0.68	2.44
Cerebrovascular disease (Yes vs. No)	0.91	0.60	1.39
Diabetes without complications (Yes vs. No)	1.06	0.79	1.41
Diabetes with complications (Yes vs. No)	0.84	0.45	1.59

*Multivariate logistic regression model included only those covariates listed.

†Data originated from South Carolina Medicaid, the Department of Disabilities and Special Needs (DDSN), and the Department of Social Services.

‡Waiver: Member was flagged if on intellectual disability, community long-term care, or community support waiver (new or established) for ≥90 days during measurement year.