

Examining Longitudinal Patterns of Psychotropic Medication Use by Individuals with  
Intellectual Disabilities Relocating from Institutions to Community Settings

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Submitted in partial fulfilment  
of the requirements for the degree of

Masters of Arts in Applied Disability Studies

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## Abstract

For 133 years, institutionalization was the primary model of care provided for individuals with intellectual disabilities in Ontario. By March 31, 2009, the last remaining institution in Ontario was closed. Given that individuals with intellectual disabilities are more likely to develop health and mental health comorbidities than the general population, investigating outcomes after relocation is critical for ensuring safe and successful transitions to community settings. This study examined changes in psychotropic medication usage following deinstitutionalization as well as changes over time in the community. Various proxy measures were collected on demographic variables (e.g., age, sex, etc.), adaptive functioning, challenging behaviour, psychotropic medication usage, health status, and mental health status. A multilevel model was used to investigate within and between-person changes in psychotropic medication usage longitudinally across three points in time. Variables, including adaptive functioning, challenging behaviour, and health and mental health status, were investigated as potential predictors of psychotropic medication usage. Health variables and mental health status positively predicted psychotropic medication. Cognitive performance and health instability from the facility to the community had a negative influence on the total number of psychotropic medications. Challenging behaviour did not predict psychotropic medication usage in this study, possibly due to the measure used. Further examination of these results may be used to inform policy and practice for individuals with intellectual disabilities in Ontario.

*Keyword(s):* Deinstitutionalization, intellectual disabilities, psychotropic medication, polypharmacy, longitudinal

### Acknowledgements

First and foremost, I would like to thank the former residents who participated in the Facilities Initiative study. Secondly, I would like to express my gratitude to the dedicated volunteers, research assistants, and former students who assisted in the data collection of the Facilities Initiative Study. Thank you to Dr. Jan Frijters for your help in developing this thesis and for supporting my statistical understanding. Thank you to Dr. Rosemary Condillac for your mentorship and continually reinforcing the importance of work-life balance. To my friends, thank you for your encouragement throughout this process. Thank you to my family for your love and support and for believing in me. And to Mischa Kapp, thank you for your patience and encouragement, from the start to the end of this journey.

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## Introduction

On March 31, 2019, the last three remaining institutions in Ontario were closed. After the closing of the institutions, the Facilities Initiative (FI) studies were conducted to evaluate the well-being of individuals with intellectual disabilities (ID) after moving to community settings. These studies examined the impact of deinstitutionalization on former residents who transitioned to community settings.

There were four components in the FI studies including; the Quasi-Longitudinal (QL) study (Condillac, Frijters, & Martin, 2012); a survey of the perspectives of the community agencies (Griffiths, Owen, & Condillac, 2015), a survey of family member feedback following deinstitutionalization (Griffiths, Owen, & Condillac, 2015); and a focus group/interview study on the perceptions of the deinstitutionalization process for families, former residents, agencies, behavioural consultants, and planners (Owen, Griffiths, & Condillac, 2015). In the QL study, the authors found that overall, the majority of former residents were faring the same or better in the community since relocating from the facilities. In particular, former residents experienced improvements across cognitive capacity (CPS) and both perceived ability and current performance of daily living activities (IADLs). Although there were increases in anhedonia and depression symptoms, the individuals who were experiencing difficulties in the community at the first community visit, appeared to have been more well-adjusted by the second community visit (Condillac et al., 2012). These findings aligned with reports from other deinstitutionalization outcome studies and overall, support integrated community-living as having improved the quality of lives of individuals with ID (Hamelin, Frijters, & Griffiths, 2011; Lemay, 2009; Kim, Larson, & Larkin, 2001).

In 2012, Rahim conducted further analyses for the QL study that focused on psychotropic medication patterns before and after deinstitutionalization among the same group of individuals in the QL study (Condillac et al., 2012). A significant increase in the number of antidepressant and antipsychotic medications was reported after relocation to community settings. These findings contradicted other studies that found either a decrease in psychotropic medication (McGillivray & McCabe, 2005) or no change following deinstitutionalization (Nottestad & Linaker, 2003). The mixed results emphasized the need for additional research to be conducted that examines psychotropic medication among individuals who experienced deinstitutionalization.

The current study was conducted to further analyze medication usage from the QL study and evaluated psychotropic medication usage among the same group of individuals who relocated to community settings in Ontario (Condillac et al., 2012; Rahim, 2012). This study differed from Rahim (2012) in that it examined changes across three points in time (facility, community, and community follow up) and the investigation of potential predictors of psychotropic medication use. Understanding changes over time in the community is critical for evaluating the extent to which individuals with ID are living improved lives in the community, and many deinstitutionalization studies lacked this component of analysis (McGillivray & McCabe, 2005; Nottestad & Linaker, 2003). Secondly, examining predictors of psychotropic medication usage can lead to a better understanding of risk factors for polypharmacy and psychotropic medication use among individuals who relocated to community settings in Ontario and may provide insights to inform treatment planning and service delivery.

The purpose of this study is to contribute to and inform the field of research examining psychotropic medication usage among individuals with ID who experienced

deinstitutionalization. This study may increase the awareness of the overreliance on psychotropic medications used to treat individuals with ID despite the lack of consistent evidence to suggest their efficacy (Lunsky et al., 2017; O'Dwyer, McCallion, McCarron, & Henman, 2018).

Understanding specific relationships between individual characteristics and psychotropic medication usage may help medical and mental health professionals increase their sensitivity to risk factors for polypharmacy and could potentially influence prescribing practices away from overmedicating people with ID. These findings could be used to inform regulatory bodies and organizations that have created and are responsible for revising psychotropic medication guidelines for individuals with ID.

## **Literature Review**

### **History of Institutionalization**

For over a century, institutionalization was the primary method for caring for individuals with an intellectual disability in Ontario (Brown & Radford, 2015). For this study, ID refers to individuals who experienced limitations before the age of 18 that manifest as motor, social, cognitive, or language impairments (Maulik, Mascenrenhas, Mathers, Dua, & Saxena, 2011). Participants from studies that used the outdated terminology “mental retardation” or the preferred term in the UK, learning disability, will be referred to as having an intellectual disability. This section reviews the history of institutionalization in North America.

Within the early industrial and agricultural societies in the nineteenth and early twentieth century, individuals with impairments worked within the community or with their families (Cameron, 2014; Oliver & Barnes, 2012). During this time, the contribution of individuals with impairments was recognized. However, as industrialization developed, the notion of an ideal employee emerged, which resulted in individuals with impairments struggling to find

employment (Cameron, 2014). Institutions arose as school settings to train individuals with ID to become adult workers (Trent, 1994). Although the initial intent was to train individuals, the purpose of institutions ultimately became to segregate this group of individuals from others (Griffiths, Owen, & Condillac, 2017).

Walmsley (2006) emphasized that the growth of institutions from 1900 to 1950 occurred for two reasons: protecting society from the perceived negative influence of individuals with ID, and for concealing persons with ID from the harmful effects of society. In particular, eugenics emerged as a societal belief throughout the late nineteenth and early twentieth century (Davis, 2014). This devastating ideology led to the belief that individuals with ID were best supported through an institutional setting in which their lives, including reproduction, could be controlled (Griffiths et al., 2017; Senn & The G. Allan Roeher Institute, 1996; Trent, 1994). In addition to the influence of eugenics, the medical model of disability contributed to the number of individuals living in institutions.

Although institutions were intended to focus on care, training, safety and rehabilitation, limitations also arose due to the medical model of care being applied to disability. At that time, the perspective of professionals in the field was that disability should be treated as a medical issue (Griffiths et al., 2017). Since ID was viewed as a medical condition, families believed that individuals with ID required constant professional care (Brown & Radford, 2015; Cameron, 2014). This medical model of disability was further supported by the fact that individuals grew old in the institutions, thereby suggesting that a diagnosis of ID was permanent and untreatable (Brown & Radford, 2015). As such, a medical model approach that was viable for segregation and control of individuals with ID developed over time and resulted in widespread institutionalization (Griffiths et al., 2017). Through the 50s and early 60s, a shifting perspective

from the nonmedical view of ID developed not only due to shifts in ideology but also due to devoted advocacy groups (Brown & Percy, 2007).

### **Deinstitutionalization**

The deinstitutionalization movement included two objectives: emphasizing a community living ideology for individuals with ID and transitioning individuals to residential-based homes (Griffiths et al., 2017). The paradigm shift from the medical model of disability to deinstitutionalization was largely moved forward due to families of individuals with ID promoting the principles of normalization, which states that persons with ID should have access to a typical life (e.g., choices and desires that are respected and considered, financial privileges, and security measures; Nirje, 1969). The negative publicity described by Blatt et al. (1980) also provided the support that relocation to community settings would improve the quality of life of individuals with ID.

Institutions received negative publicity regarding allegations of abuse, loss of personal security, punishment, and conditions and lack of positive outcomes (Blatt, 1980). These concerns were publicized by Blatt and Kaplan in 1966, who exposed the extent to which institutions were not providing adequate care for individuals with ID. These findings eventually led to institutional reform. In particular, institutions became smaller and better supervised from the 1970s to 1990s with increased staffing (Griffiths et al., 2017). In Ontario, by the mid-1970s, 16 institutions were open, and over 10,000 people with ID were receiving residential care in these institutions (Martin & Ashworth, 2010). However, Canada began closing and downsizing institutions as support for community-based living settings for individuals with ID emerged. Despite these changes in sizes and crowding of institutions, when Blatt (1980) examined the changes in the institutions in the US 15 years later, concerns remained. Although progress was made in terms of increased

staffing, more funding, and less crowding, the authoritarian treatment of the residents remained (Blatt; 1980; Taylor & Bogdan, 1992). Blatt (1980) concluded that closing institutions and promoting community integration would help resolve these concerning attitudes towards individuals with ID.

The continued trends towards deinstitutionalization in the 1980s may be seen by the enactment of various plans and acts by the Ontario government. Following the initial downsizing and closing of institutions in the 1970s, Bill 82 was enacted in 1980, which required that children with disabilities remain in the public-school system (Brown & Radford, 2015). In 1983, the Five-Year Plan was implemented by the Ontario government, which set closure dates for various institutions across Ontario (Brown & Radford, 2015). Lastly, in 2004, the Ministry of Community and Social Services (MCSS) announced that the three remaining institutions (i.e., Huronia Regional Centre, Rideau Regional Centre, and Southwest Regional Centre) would be closed by 2009. By March 31, 2009, the final institution in Ontario was closed. The deinstitutionalization trends observed in Ontario, Canada also aligned with the policies of other nations, including the United States, England, and Australia (Lemay, 2009).

### **Deinstitutionalization Outcomes**

Institutions were considered to provide comprehensive care supporting all aspects of personal health and well-being. Researchers studying the outcomes of deinstitutionalization have sought to determine the degree to which individuals' outcomes and access to supports and services were the same, better, or worse than they had been in the facilities. There have been multiple studies that have examined a specific group of individuals who transitioned to community (e.g., Condillac et al., 2012; Nottestad & Linaker, 1999) as well as meta-analyses that have evaluated deinstitutionalization outcomes across several studies (e.g., Hamelin et al.,

2011; Lemay, 2009; Kim et al., 2001). Outcomes that have been examined include quality of life, family contact and involvement, adaptive behaviour and daily living activities, cognitive functioning, health, mental health, and psychotropic medication use.

**Quality of life.** Most studies reported improvements in quality of life (QoL) after participants transitioned to the community (e.g., Condillac et al., 2012; Lemay, 2009; Nottestad & Linaker, 1999; Nottestad & Linaker, 2003; Kim et al., 2001). In 2012, Condillac et al. examined QoL using the Other Person Interview developed by Raphael, Brown and Renwick (1996). The measure was designed to estimate the quality of life for people with ID who may not have the skills to respond to an interview. In the QL study, administration of the measure was by proxy with a staff person who knew the person well and was active in his or her day-to-day life. During the first community visit, mean QoL indicators fell within the adequate range (i.e., might need improvement) suggesting that some individuals had optimal QoL, while others experienced adequate or suboptimal QoL. However, during the second community visit, a significant increase in QoL was noted with many more individuals experiencing optimal QoL, and the distribution of scores approximating previous findings for individuals in community settings in Ontario. This significant increase suggested an improvement in life quality over time, with further adjustment to the community. Similarly, Lemay (2009) reported that deinstitutionalization resulted in increases in QoL. However, community settings could be improved. Nottestad and Linaker (1999; 2003) also reported improvements in living conditions, as well as increases in perceived QoL when participants moved the community. As such, most individuals with ID transitioning from institutions to community living experienced gains in perceived QoL in the community.

**Family contact and involvement.** The changes observed in the levels of family contact due to deinstitutionalization were mixed across North America deinstitutionalization studies

(Condillac et al., 2012; Spreat & Conroy, 2002). Spreat and Conroy (2002) determined that family contact often increased after the individuals were living in the community and that these changes were maintained for up to four years (Spreat & Conroy, 2002). In 2015, Owen, Griffiths, and Condillac reported the findings from two of the FI studies. Overall, the authors found that the reports from the families were positive. In the final report of the QL study, Condillac et al. (2012) examined family involvement before and after community placements and found that 44.3% of the participants were doing better in terms of family contact. The authors reported that 50% had the same amount of family contact since relocating. Only 5.7% of the participants were doing worse in that they had not seen their family within the last month. Therefore, most North American studies reported improvements in family contact and involvement following relocation to community settings.

**Adaptive behaviour and daily living activities.** In the QL study, Condillac et al. (2012) reported that individuals with ID improved in the performance of self-care and instrumental activities after deinstitutionalization. These improvements in adaptive skills were consistent with previous studies that evaluated adaptive function in individuals with ID who had transitioned to community placements (Hamelin et al., 2011; Kim et al., 2001; Lemay, 2009). Hamelin et al. (2011) conducted a meta-analysis of studies evaluating adaptive behaviour outcomes after deinstitutionalization. Overall, studies that qualified for the meta-analysis ( $N = 48$ ) demonstrated that there were gains across 75% of adaptive behaviour domains. The individuals who achieved the greatest gains in adaptive functioning had transitioned to group home settings, rather than cluster homes or intermediate care centres. Similarly, Kim et al. (2001) conducted a meta-analysis of studies that examined adaptive functioning as a deinstitutionalization outcome. Thirteen of 22 studies were found to have significant increases in adaptive behaviour skills

following relocation. These findings suggested that, overall, most individuals who moved to community settings were reported to have made significant gains in adaptive functioning after transitioning to the community.

**Cognitive functioning.** After individuals with ID in Ontario transitioned to community living, there were cognitive functioning improvements observed across most individuals (Condillac et al., 2012). Given that the Cognitive Performance Scale (CPS) included a decision-making item, changes in cognitive functioning were partially explained by the increased emphasis on choice-making in the community compared with the custodial care model in some of the facilities (Condillac et al., 2012). Lemay (2009) conducted a meta-analysis of deinstitutionalization studies in Canada. Lemay (2009) determined that individuals with severe cognitive deficits experienced adaptive functioning improvements as well. Young, Ashman, Sigafoos, and Grevell (2000; 2001) reported on deinstitutionalization outcomes in Australia. Similarly, the authors reported significant improvements in adaptive behaviours, such as choice-making, following deinstitutionalization. These findings aligned with the increases in choice-making and cognitive functioning found in the QL study (Condillac et al., 2012).

**Health.** In the QL study, medical symptoms increased across pain, bladder management, and health stability (Condillac et al., 2012). These specific changes may have been related to the significant portion of the sample who were aging and/or to changes in staff across settings. Other physical health conditions associated with aging may have contributed to the increases observed in pain management as well as community staff training for recognizing and managing pain in individuals with ID, particularly non-verbal individuals. Similarly, Lemay (2009) hypothesized that mortality rates increasing following deinstitutionalization might have occurred due to individuals becoming more susceptible to mortality after experiencing major life changes.

Lerman, Apgar, and Jordan (2003) examined deinstitutionalization and mortality among 150 “movers” and 150 “stayers” in New Jersey. The authors analyzed risk factors for all deaths using a logistic regression. Age, low self-care, medical conditions, and epilepsy/seizure disorders predicted deaths. However, adding whether the individual stayed or moved did not change the model. Therefore, deinstitutionalization did not impact mortality in this group of individuals. Overall, although some studies indicated minor changes related to health, these changes may have been anticipated, as these populations were aging and experiencing major life changes through the process of relocation.

**Mental health.** In the QL study, Condillac et al. (2012) noted that most individuals with ID experienced the same or improved levels of psychiatric symptoms. Nonetheless, some individuals experienced increased levels of anhedonia (i.e., loss of pleasure) and or depression symptoms. However, these symptoms improved over time in the community. The individuals who experienced the greatest increases in depression and anhedonia were older individuals who had lived in the institutions for longer amounts of time. Condillac et al. (2012) emphasized that changes in anhedonia and depression symptoms may have emerged due to the large number of changes associated with transitioning (e.g., loss of contact with friends, family, and staff, and changes in living arrangements, etc.). Nottestad and Linaker (1999) also examined the psychiatric health care needs of individuals who transitioned from institutions to the facilities in Norway. The authors found no significant changes in psychiatric health problems when participants transitioned to the community. Nottestad and Linaker (2003) also determined that there were no changes in the proportion of individuals diagnosed with anxiety or schizophrenia across settings, demonstrating that these diagnoses persisted after individuals relocated to community settings. The results of these studies indicated that transitioning to the community

may be related to initial increases in some mental health symptoms, such as depression and anhedonia symptoms, but did not impact psychiatric diagnoses overall. However, these symptoms appeared to decrease over time in the community.

**Challenging behaviour.** Reports on challenging behaviour (CB) following deinstitutionalization were mixed across studies. In the QL study, most individuals demonstrated the same or lower levels of CB after transitioning to the community (Condillac et al., 2012). However, the authors reported increases in self-injurious and sexually inappropriate behaviours in some individuals after transitioning to the community. The authors hypothesized that these increases in CB might have been responses to individuals having difficulty with transitioning and communicating this distress. They also suggested that the increases in sexually inappropriate behaviour could have been related to community expectations rather than individual behaviour. For instance, some behaviours (e.g., undressing before arriving in the bathroom) may have been acceptable in facility settings but problematic in the community settings. Nottestad and Linaker (1999) also determined that former residents experienced higher levels of CB after relocation to community settings. Kim et al. (2001) conducted a meta-analysis of deinstitutionalization studies in the US and found that ten studies reported a reduction in CB, while eight studies indicated increases in CB. These results emphasized the fact that the reports regarding CB after deinstitutionalization varied across studies.

**Psychotropic medication.** There have been mixed reports regarding changes in psychotropic medication following deinstitutionalization (e.g., Condillac et al., 2012; McGillivray & McCabe, 2005; Nottestad & Linaker, 2003; Rahim, 2012). Rahim (2012) examined psychotropic medication patterns among the group of individuals who experienced deinstitutionalization in Ontario. The results demonstrated a significant increase in psychotropic

medications, specifically antidepressants and antipsychotic medications when participants transitioned to the community. In 2005, McGillivray and McCabe examined the influence of residence (e.g., institutions, community, respite care, and other) on psychotropic medication among individuals with ID in 1993 and 2000. The authors reported that in 1993, medication usage was greater among persons living in institutions. Further, in 2000, facility residents experienced more polypharmacy than individuals living in community settings. However, in 2000, the proportion of psychotropic medication prescriptions relative to the population was the same across facility and community settings. Similarly, Nottestad and Linaker (2003) reported no differences in terms of psychotropic medication use by individuals who had transitioned to the community. These studies reported inconsistent findings relating to psychotropic medication use following deinstitutionalization, which lend support to the need for further research into medication patterns and polypharmacy in the context of deinstitutionalization.

### **Polypharmacy and Individuals with Intellectual Disabilities**

The definition of polypharmacy varied across studies (e.g., Burd et al., 1997; Esbensen et al., 2009; Hurley et al., 2003; McGillivray & McCabe, 2005; Robertson et al., 2000; Stolker et al., 2001; Stolker et al., 2002; Stortz et al., 2014;). Some studies included the combination of general medications (non-psychotropic) and psychotropic medications within their definition of polypharmacy (Ebensen et al., 2009). Other studies limited their definition of polypharmacy to multiple psychotropic medications (Burd et al., 1997; Hurley et al., 2003; McGillivray & McCabe, 2005). In this study, the definition of polypharmacy is “the combination of two or more psychotropic drugs from the same or different medication classes” (Stortz et al., 2014, p. 62). This definition was selected because the focus of this study was to examine the predictors of polypharmacy as measured by the number of psychotropic medications being used.

Many studies examining medication trends among individuals with ID have reported considerable reliance on psychotropic medication, high dosages of psychotropic medications, and frequent polypharmacy (e.g., Deb, Unwin, & Deb, 2015; Bowring, Totsika, Hastings, Toogood, & McMahon, 2017a; Rahim, 2012; Nottestad & Linaker, 2003). Prevalence rates of psychotropic medication usage have ranged from 39.2% to as high as 90% across individuals with ID (Deb et al., 2015; Lunsky et al., 2017; Tsiouris, Kim, Brown, Pettinger and Cohen, 2013). The prevalence of polypharmacy among persons with ID was also high, ranging from 7% to as high as 59% (Bowring et al., 2017a; Kiernan, Reeves, & Alborz, 1995). Unfortunately, individuals with ID may be prescribed these medications to manage CB, rather than to treat psychiatric symptoms (Deb et al., 2015; Lunsky et al., 2017, & Nottestad & Linaker, 2003). As a result, this vulnerable population is often prescribed psychotropic medications inappropriately (Lunsky et al., 2017). These elevated numbers of psychotropic medications (Deb et al., 2015; Lunsky et al., 2017) and or elevated dosages of psychotropic medications (Deb et al., 2015; Nottestad & Linaker, 2003) highlight the importance of improving documentation to ensure that there is a greater understanding of the psychotropic medication usage in this population (Lunsky et al., 2017). Secondly, investigating how variables are related to psychotropic medications is essential when examining polypharmacy and medication utilization trends. Studies examining these relationships included both bivariate and multivariate analyses. In order to determine the relevant “predictors” for the models proposed in this thesis, the results of bivariate and multivariate studies were considered separately in the following sections.

**Age and psychotropic medication.** Most research suggested that age, to a certain extent, was associated with psychotropic medication usage (e.g., Bowring et al., 2017a; Deb et al., 2015; Sheehan et al., 2015; Tsiouris et al., 2013). Researchers have found that increasing age was

associated with psychotropic medication usage in bivariate analyses (Bowring et al., 2017a; Deb et al., 2015; O'Dwyer, Peklar, McCallion, McCarron, & Henman, 2016). Other studies examined age as a predictor of psychotropic medication usage in multivariate models and found significant associations (Bowring et al., 2017a; Sheehan et al., 2015; Tsiouris et al., 2013). Sheehan et al. (2015) examined psychotropic medication patterns among individuals with ID ( $N = 33,016$ ). Multivariate Poisson regression analyses were conducted to examine associations between medication usage and specific predictor variables. Age was found to be one of the significant predictors associated with psychotropic medication use in their model. Similarly, Bowring et al. (2017a;  $N = 267$ ) conducted a generalized linear model and determined that increasing age was associated with psychotropic medication usage. Further, Tsiouris et al. (2013) found that as a predictor, age was significantly related to psychotropic medication in both a logistic regression model for the use versus non-use of psychotropic medication and a Poisson regression for the total number of medications. Deb et al. (2015) examined trajectory patterns of antipsychotic medication use among individuals with ID who exhibit CB using bivariate comparisons ( $N = 100$ ). Antipsychotic medication dosage was positively correlated with age. Lastly, O'Dwyer et al. (2016) conducted bivariate analyses and determined that older age was significantly associated with excessive polypharmacy defined as 10 or more regular medications and/or psychotropic medications.

In contrast, some studies did not find age to be a significant predictor associated with psychotropic medication in multivariate models (O'Dwyer et al., 2017; Spreat, Conroy, & Fullerton, 2004). In 2004, Spreat et al. surveyed psychotropic medication patterns among individuals with ID in Oklahoma in a stepwise logistic regression model. The authors found that age was not a significant predictor associated with psychotropic medication. Further, in a

multinomial logistic regression conducted by O'Dwyer et al. (2017), age was not a significant predictor associated with psychotropic medications. Given these varying reports, researchers should consider age when examining potential predictors of psychotropic medication usage.

**Sex and psychotropic medication.** Multiple studies have examined the influence of sex on psychotropic medication usage (Bowring et al., 2017a; O'Dwyer, 2017; Spreat et al., 2004; Tsiouris et al., 2013). While Bowring et al. (2017a) indicated that maleness was associated with polypharmacy (Bowring et al., 2017a), other researchers found that sex did not influence psychotropic medication usage (O'Dwyer, 2017; Spreat et al., 2004; Tsiouris et al., 2013). Bowring et al. (2017a) determined that maleness was independently associated with an increase in psychotropic medication in a generalized linear model. In contrast, using various multivariate analyses, O'Dwyer (2017;  $p = .61$ ) and Tsiouris et al., (2013;  $p = .07$ ), determined that sex was not a significant predictor associated with either psychotropic medication usage or the number of psychotropic medications, respectively. Lastly, Spreat et al. (2004) stated that sex was not a significant predictor associated with psychotropic medication usage in their stepwise logistic regression model. As such, most studies suggested that sex was not associated with an increase in psychotropic medication usage. Nonetheless, considering sex is relevant in this thesis as it has been included as a potential predictor in many studies, with some variation in results (Bowring et al., 2017a; O'Dwyer, 2017; Spreat et al., 2004; Tsiouris et al., 2013).

**Adaptive functioning and psychotropic medication.** There have been mixed reports exploring the influence of adaptive functioning on polypharmacy (Bamburg, Matson, & Gouvier, n.d.; Bowring et al., 2017a; O'Dwyer et al., 2017; Tsiouris et al., 2013). Bamburg et al. (n.d.) examined adaptive skills for individuals with ID receiving psychotropic medications. These authors determined that individuals who received antipsychotic or mood stabilizer medications

had reduced adaptive social scores compared to individuals receiving only anti-seizure medication. This suggests that psychotropic medications could be linked to lower adaptive functioning scores. Similarly, O'Dwyer et al. (2016) conducted bivariate analyses and determined that level of ID was significantly associated with polypharmacy status. Further, O'Dwyer et al. (2017) found that level of ID was a significant predictor associated with receiving one psychotropic medication in a multinomial logistic regression. However, these results were not consistently found in other studies.

Researchers have found that the level of functioning was not associated with psychotropic medication usage (Bowring et al., 2017a; Tsiouris et al., 2013). Bowring et al. (2017a) determined that severe-profound ID diagnoses were not significantly associated with psychotropic medication usage when all relevant and significant variables were entered in the generalized linear model. Similarly, Tsiouris and colleagues (2013) conducted a hurdle analysis and determined that the degree of ID did not influence the usage or number of psychotropic medications. Lastly, in a multinomial model conducted by O'Dwyer et al. (2017), level of ID was not a significant predictor associated with psychotropic polypharmacy. Nonetheless, the emphasis that most studies placed on including adaptive functioning or degree of ID variables as potential predictors highlighted the importance of considering adaptive functioning when examining psychotropic medication usage.

**Health status and psychotropic medication.** Health status should be considered when examining psychotropic medications. Individuals with ID may exhibit health concerns, including physical disabilities, hearing and vision impairment, communication disorders and psychiatric diagnoses (Oullette-Kuntz et al., 2005). Increased health concerns, combined with ID, increase the risk of this population facing health disparities when compared to the typical population

(Oullette-Kuntz et al. 2005; Phillips, Morrison, & Davis, 2004; Sullivan et al., 2018). Persons with ID have a lower age at mortality than typical individuals, which highlights the health disparity experienced amongst individuals with ID (Heslop, Lauer, & Hoghton, 2015; Lauer & McCallion, 2015). Stortz et al. (2014) identified polypharmacy to be an important component to examine for evaluating health services for persons with ID, as consuming multiple psychotropic medications may be dangerous and often requires additional clinical resources (Sullivan et al., 2011). These concerns have emerged because persons with intellectual disabilities exposed to polypharmacy are more likely to experience side effects than patients in the general population and may lack the ability to report or understand these side effects (Lunsky & Modi, 2017). Additionally, O'Dwyer et al. (2016) conducted bivariate analyses, which demonstrated that various chronic diseases (e.g., neurological, gastrointestinal, joint disease, endocrine disease, hypertension, reported pain, etc.) were significantly associated with polypharmacy status. Neurological conditions, gastrointestinal disease, endocrine disease, and hypertension were also significant predictors associated with polypharmacy in a multinomial logistic regression. As such, researchers should consider health status when examining potential predictors of polypharmacy.

**Psychiatric diagnoses and psychotropic medication.** Psychiatric diagnosis is a critical variable to consider when investigating predictors of psychotropic medication usage. Research has found that individuals with ID are likely to be prescribed psychotropic medication to treat CB in the absence of a corresponding psychiatric diagnosis (Perry et al., 2018). Psychiatric conditions are common in this population, with the prevalence of psychiatric illness ranging from 10 to 39% (Deb, Thomas, & Bright, 2001; Costello & Bouras, 2006). These additional mental health challenges, combined with impairments in adaptive skills and intellectual functioning,

result in this population facing a higher risk of developing health problems when compared to the general population (Oulette-Kuntz et al., 2005; Deb et al., 2001; Sullivan et al., 2018).

There were mixed reports regarding whether mental health symptoms or diagnoses predict or were associated with polypharmacy. Some studies reported a significant association between polypharmacy and mental health (Bowring et al., 2017a; Tsiouris et al., 2013), while others do not (Deb et al., 2015; Perry et al., 2018). In 2013, Tsiouris and colleagues examined the stated reasons for psychotropic prescriptions and determined that 49%, 13%, and 38% of the medications were prescribed for psychiatric symptoms, managing CB, and both psychiatric symptoms and CB respectively. Further, polypharmacy was highest among individuals with ID who had bipolar disorder, psychoses (a core feature of the schizophrenia disorder spectrum; Arciniegas, 2015), depression, autism spectrum disorder (ASD), personality disorder and/or obsessive-compulsive disorder. Many of these disorders, including bipolar, psychosis, depression, and obsessive-compulsive disorder were also significant predictors of the total number of psychotropic medications in a Poisson regression. The authors concluded that practitioners had treated psychiatric diagnoses among individuals with ID in a manner that mirrors treatment for the general public. This article provided support in improvements towards evidence-based treatments in psychiatry among individuals with ID. This finding aligned with Bowring et al. (2017a)'s study in the UK, which found a statistically significant association between the presence of a psychiatric illness and psychotropic medication in a generalized linear model. Similarly, Sheehan and colleagues (2015) identified a significant relationship between severe mental illness and new antipsychotic prescriptions in a multivariable mixed Poisson regression. Conversely, other studies indicated a non-significant relation between polypharmacy and mental health diagnoses (Lunsky et al., 2017; Perry et al., 2018).

Individuals with ID may be prescribed psychotropic medication despite not having any psychiatric diagnoses (Lunsky et al., 2017; Perry et al., 2018). Perry et al. (2018) examined CB and psychotropic medication in individuals with ID in the UK. Statistically significant Chi-square associations between recorded psychiatric diagnoses or psychotropic medication were not found, which suggested that individuals with ID were prescribed off-label psychotropic medications to manage CB. Psychotropic medication trends in Ontario also indicated an over usage of psychotropic medication for individuals with ID (Lunsky et al., 2017). Lunsky and colleagues (2017) examined antipsychotic medication patterns in individuals with ID across Ontario. Overall, 39% of adults with ID were prescribed antipsychotics, and approximately one-third of these individuals did not have a documented psychiatric diagnosis. The lack of associations between psychotropic medications and psychiatric illness may have occurred due to these medications being used to treat CB rather than mental health.

**Challenging behaviour and psychotropic medication.** Individuals with ID are more likely to develop CB, such as aggression, property destruction, self-injurious behaviour, and pica when compared to the general population (Emerson et al., 2000; Matson & Neal, 2009). Approximately 18% of individuals with ID exhibit significantly dangerous behaviour (Bowring et al., 2017b). Bowring et al. (2017b) determined that 18.1% of individuals with ID engaged in overall CB, while 7.5%, 8.3% and 10.9% engaged in self-injurious, aggressive-destructive, and stereotyped behaviour, respectively. The high rate of occurrence of CB also poses a problem for mental health service staff and hospital staff (Matson & Neal, 2009). As a result, mental health clinics and institutions often target CB for treatment.

Multiple studies reported that CB was associated with psychotropic medication use (e.g., Deb et al., 2015; Lunsky et al., 2017; Nottestad & Linaker 2003). In 2003, Nottestad and Linaker

(2003) investigated psychotropic medication use before and after relocation using a stepwise linear regression. The authors determined CB to be the main predictor for psychotropic dosage before and after deinstitutionalization, which may emphasize how individuals with ID were prescribed medications to manage behaviour rather than for treating psychiatric symptoms. Similarly, Deb et al. (2015) examined trajectory patterns of antipsychotic medication use among individuals with ID who exhibit CB. Participants were studied across two points in time in clinic-based community settings across a 6-month period ( $N = 100$ ). The authors determined that a high percentage of participants were prescribed psychotropic medications at baseline and follow-up, with 89% and 90% respectively. Doses of antipsychotic medication were positively correlated with property destruction, SIB, and severe aggression. Overall, these studies demonstrated the relationship between psychotropic medication and CB that continues to persist among individuals with ID.

### **Psychotropic Medication Across Settings**

There have been multiple studies that have examined psychotropic medication patterns among individuals who experienced deinstitutionalization (e.g., Kelly & Su, 2015; McGillivray & McCabe, 2005; Nottestad & Linaker, 2003; Rahim, 2012; Spreat et al., 2004). In addition to understanding variables associated with psychotropic medication usage over time, investigating the changes across settings (i.e., facility to community living) is critical for evaluating the extent to which the presence of certain variables may increase or decrease the likelihood of polypharmacy as individuals transition from institutions to community living.

**Facilities.** The number of psychotropic medications prescribed among individuals with ID living in institutions has varied across studies (Kelly & Su, 2015; Nottestad & Linaker, 2003; Rahim, 2012). In 2015, Kelly and Sue evaluated medication patterns among individuals who

transitioned from Georgia, USA institutions. The authors determined the mean psychotropic and anticonvulsant usage among individuals to be 68% when persons were living in the facilities. This value aligned with other deinstitutionalization studies, such as Nottestad and Linaker's (2003) study, in which 50% of the residents used psychotropic and anticonvulsant medications. In contrast, when Rahim (2012) examined psychotropic medication patterns among individuals deinstitutionalized in Ontario (same sample as the current study), she indicated that 74.2% of participants were prescribed psychotropic medication in the institutions. These higher percentages of psychotropic medication usage may have emerged as this study evaluated the final group of individuals to experience deinstitutionalization in Ontario. It is possible that these individuals represented a subset of individuals who were harder to serve, in that they experienced more psychiatric symptoms and/or engaged in more severe CB. This could account for the higher psychiatric medication usage among individuals in this sample.

**Transitioning to the community.** Many studies suggested an increase in the prevalence of psychotropic medication usage among individuals who transitioned to the community from institutional settings (Kelly & Su, 2015; Nottestad & Linaker, 2003; Rahim, 2012). In 2015, Kelly and Su evaluated psychotropic and anticonvulsant medication patterns among individuals with ID who transitioned from Georgia, USA institutions to community living ( $N = 325$ ). Psychotropic medications usage among individuals with ID who had never lived in an institution was also collected to serve as a comparison group ( $N = 12,722$ ). The authors determined that the increases observed among individuals who had recently transitioned were significantly higher when compared to when these individuals were living in institutions ( $M = 0.68$  and  $M = 1.84$ , respectively). The recently transitioned group also demonstrated significantly higher psychotropic medication values when compared to the comparison group ( $M = 1.01$  and  $M =$

1.98, respectively). These findings emphasized the importance of evaluating persons who experienced deinstitutionalization specifically, as their psychotropic medication patterns may differ from individuals who have always lived in community settings. Similarly, Rahim (2012) indicated that psychotropic medication usage increased significantly when individuals transitioned to the community ( $M = 74.2\%$  and  $M = 83.3\%$ , respectively). Lastly, Spreat et al. (2004) examined individuals with ID who either stayed or left the institutions. There was an increase in the use of antidepressant and anxiolytics medications (6.6% and 3.0% respectively;  $p < .05$ ) but no significant difference in antipsychotic medications among individuals who relocated to community settings.

Some studies found that psychotropic medications were higher for those living in institutions. McGillivray and McCabe (2005) examined the patterns of psychotropic medication for managing CB and places of residence among individuals with ID between 1993 and 2000 ( $N = 873$ ). Bivariate analyses were conducted to compare medication usage across two settings. In 1993, individuals living in the institutions received a larger number of medications compared to those in the community. Similarly, in 2000, polypharmacy was greater among participants living in institutions, however, the proportion of psychotropic medications prescribed relative to the population was not different across facility and community settings

Other studies have found a lack of consistency in psychotropic medication usage across institutions and community settings (McGillivray & McCabe, 2005; Nottestad & Linaker, 2003). In 2003, Nottestad and Linaker examined psychotropic medication patterns among individuals who were deinstitutionalized in Norway ( $N = 109$ ). Nottestad and Linaker (2003) found no significant changes related to psychotropic medication patterns when individuals transitioned to the community ( $M = 50\%$  in institutions,  $M = 54\%$  in the community). Further, the authors

conducted a stepwise linear regression to examine variables that predicted medication usage. Nottestad and Linaker (2003) determined that there were no significant changes in neuroleptic usage across the settings. Similarly, McGillivray and McCabe (2005) determined that the proportion of participants prescribed medication was not significantly different when comparing persons living in institutions or facilities. These results emphasized that transitioning to the community does not necessarily result in a change in psychotropic medication prescriptions among individuals with ID. Overall, these findings emphasized that additional examination of polypharmacy across settings may reveal areas for health care practitioners to target in order to improve health care service provided to individuals with ID.

### **Longitudinal Research**

Given the lack of consistent findings across studies that examine polypharmacy over time among individuals with ID who experienced deinstitutionalization (Kelly & Su, 2015; Nottestad & Linaker, 2003; Rahim, 2012), additional longitudinal studies are necessary to determine the predictors of changes and patterns of psychotropic medication use over time.

**Multilevel models.** Within the past decade, a common method for analyzing longitudinal data has been the multilevel analysis (Curran, Obeidat, & Losardo, 2010). Although researchers previously examined psychotropic medication patterns among individuals with ID who relocated to community settings, most studies only examined changes across two points in time (Nottestad & Linaker, 2003; McGillivray & McCabe, 2005; Willet & Sayer, 1994). By capturing “snapshots” over more points in time, additional information can be provided to inform the extent to which individual characteristics influence an individual’s change over time (Willet & Sayer, 1994).

In a multilevel model, an individual growth model is used to demonstrate the change single individuals experience over time (Willet & Sayer, 1994). This level of the model is referred to as within-person variation or the “level 1 model”, or fixed effects (Willet & Sayer, 1994, p. 363). The second level of a multilevel analysis refers to the relationship between the individual growth trajectories and the predictors of change, thereby representing the between-person variation (Willet & Sayer, 1994). By including an analysis of both fixed (within-person) and random (between persons) effects, multilevel models examine “between-person differences in within-person change” (Curran et al., 2010, p. 121). Therefore, a multilevel model would account for the extent to which individual characteristics influence the overall model, whereas a generalized estimating equation would not. Further, this type of strategy may be more effective than other generalized estimating equation strategies, such as multivariate analysis of variance (MANOVA), as individuals missing data at certain points in time could still be counted in the overall model (Fitzmaurice, Laird, & Ware, 2004).

### **Research Gaps**

There are various limitations demonstrated in previous research that examined polypharmacy trends among individuals with ID. Storz et al. (2014) emphasized that improvements could be made when analyzing polypharmacy trends among individuals with ID by incorporating multivariate analyses. Further, Sheehan et al. (2015) indicated that few studies had examined psychotropic medication patterns among adults with intellectual and or developmental disabilities (IDD) with a longitudinal design (Deb et al., 2015; Nottestad & Linaker, 2003; Rahim, 2012). Most deinstitutionalization studies only evaluated psychotropic patterns across two points in time (Nottestad & Linaker, 2003; Rahim, 2012). Lastly, no studies to date were found that evaluated psychotropic medications among individuals who experienced

deinstitutionalization using a multilevel model analysis, which would account for individual differences when examining polypharmacy trends across settings and over time. By examining this population using a multilevel longitudinal model across three points in time, more information may be obtained that could potentially inform the regulation of polypharmacy and long-term psychotropic medication usage among individuals with ID.

**Significance: Informing Regulation**

Sullivan et al. (2018) created the *Primary Care of Adults with Intellectual and Developmental Disabilities: 2018 Canadian Consensus Guidelines*. This study updated the 2011 Canadian guidelines for primary care of individuals with ID and provided recommendations for improving the care that individuals with ID received from family physicians and health professionals. The guidelines emphasized that a person-centered approach should be implemented, which considers the importance of effective communication and the individual's capacity for making decisions. Emphasis was also placed on team building and ensuring that health care teams are developed in a manner that provides interdisciplinary support. Health care status was discussed thoroughly in these updated guidelines, with a focus on consistent health assessments and assessing adaptive functioning. Sullivan et al. (2018) also indicated that assessment of mental health care should be implemented consistently. This guideline included assessing mental health symptoms and CB. Screening should be conducted by assessing changes from baseline in behaviour and mental state. A final set of guidelines thoroughly addressed polypharmacy.

These guidelines emphasized the importance of understanding polypharmacy and the use of psychotropic medications to manage mental health symptoms, diagnoses and CB. In particular, Sullivan et al. (2018) indicated that polypharmacy and long-term use of psychotropic

medications are highly prevalent among individuals with ID. Further, the authors highlighted that adverse reactions to psychotropic medications might impact QoL. Their recommendations included reviewing current medications every three months, establishing a baseline for medications, and informing the individual with ID and his or her caregivers of all the relevant components of psychotropic medication (i.e., appropriate use, interactions with other medications, etc.).

Other Canadian researchers highlighted the importance of improving the current inappropriate percentages of antipsychotic prescriptions (Lunsky et al., 2017). The authors suggested that the use of chart audits and feedback mechanisms might improve the field's understanding of psychotropic medication usage and the extent to which relevant guidelines are followed. In the current study, by examining both the changes in psychotropic medication usage as well as potential predictors of polypharmacy, a greater awareness of the patterns may emerge. In turn, the findings could be used as suggestive evidence to inform new policies or to revise guidelines for prescribing psychotropic medication for individuals with ID in Ontario.

### **Summary**

Individuals with ID who experienced deinstitutionalization are more likely to be exposed to polypharmacy than the general population (McGillivray & McCabe, 2005; Stortz et al., 2014). To begin to address the current practice of overprescribing of psychotropic medications, thorough examinations of the variables associated with polypharmacy should be conducted (Stortz et al., 2014). The purpose of this study is to contribute to the body of research examining psychotropic medication usage among individuals with ID who experienced deinstitutionalization across three points in time: before leaving the facility, after moving to the community, and at a subsequent community follow-up visit. By examining data that spans across

more than two points in time, a more thorough understanding of within-person changes may be considered (Willet & Sayer, 1994). Further, the use of a multilevel model ensures that between-person differences are understood with reference to the within-person changes over time (Curran et al., 2010; Willet & Sayer, 1994). By understanding how an individual's characteristics contribute to the model, scientists and practitioners may more thoroughly understand predictors that influence psychotropic medications across the entire sample while still accounting for individual change.

### **Research Questions**

1. What is the mean number of psychotropic medication usage across each point in time in this sample?
2. What are the relationships between psychotropic medication, age, sex, cognitive performance, adaptive behaviour, medical diagnoses, serious health conditions, pain, psychiatric diagnoses, depression, and CB?
  - a. Age was hypothesized to be positively correlated with an increase in psychotropic medication usage (Bowring et al., 2017a; Deb et al., 2015; Sheehan et al., 2015; O'Dwyer et al., 2017).
  - b. Sex was not hypothesized to be correlated with psychotropic medication usage (O'Dwyer, 2017; Spreat et al., 2004; Tsiouris et al., 2013).
  - c. Health status was hypothesized to be positively correlated with psychotropic medication usage (Ouellette-Kuntz et al., 2005; Sullivan et al., 2018).
  - d. Adaptive functioning was not hypothesized to be correlated with psychotropic medications (Bowring et al., 2017a; Tsiouris et al., 2013).

- e. Increased mental health symptoms and or psychiatric diagnoses were hypothesized to be positively correlated with psychotropic medications (Bowring et al., 2017a; Sheehan et al., 2015; Tsiouris et al., 2013).
  - f. CB was hypothesized to be positively correlated with psychotropic medications (Deb et al., 2015; Lunsky et al., 2017; Nottestad & Linaker, 2003).
3. Do age, sex, cognitive performance, adaptive behaviour, medical diagnoses, serious health conditions, psychiatric diagnoses, depression, pain, and CB predict the total number of psychotropic medications? What are the relative influences of each variable? Do these influences change over time and across settings?
- a. Age was hypothesized to predict an increase in psychotropic medication usage (Bowring et al., 2017a; Deb et al., 2015; O'Dwyer et al., 2017; Sheehan et al., 2015).
  - b. Sex was not hypothesized to predict psychotropic medication usage (O'Dwyer, 2017; Spreat et al., 2004; Tsiouris et al., 2013).
  - c. Individuals with additional health challenges were hypothesized to be taking a greater number of psychotropic medications than those with fewer health-related challenges (Ouellette-Kuntz et al., 2005; Sullivan et al., 2018).
  - d. Adaptive functioning was not hypothesized to predict psychotropic medications (Bowring et al., 2017a; Tsiouris et al., 2013).
  - e. Individuals with increased levels of mental health symptoms or numbers of diagnoses were hypothesized to receive a higher number of psychotropic medications than those with fewer mental health symptoms or diagnoses (Bowring et al., 2017a; Sheehan et al., 2015; Tsiouris et al., 2013).

- f. Individuals displaying increased levels of CB were hypothesized to be taking a greater number of psychotropic medications than individuals with no CB (Deb et al., 2015; Lunsky et al., 2017; Nottestad & Linaker 2003).

## **Methods**

### **Participants**

The data for this study were gathered as part of the QL component of the FI study, which included data collected from 2005-2008 within the facilities, and follow up data collected between 2009 and 2012. The sample included 120 participants (67 males, 52 females, one missing) who had relocated from the remaining three Ontario institutions (i.e., Rideau Regional Centre, Southwestern Regional Centre, and Huronia Regional Centre). Participants were an average age of 55.05 when the assessment was completed for C1 ( $SD = 0.73$ ), ranging from 33.43 to 77.10 years of age. Participants demonstrated various degrees of cognitive and adaptive abilities.

### **Recruitment**

The FI study consisted of relocating 941 former residents with ID into community settings. Data collection for the original study started in March 2010, almost a year after the closure date of March 31, 2009. Initial recruitment started in August 2009. This initial recruitment consisted of the MCSS sending consent to contact forms to the agencies currently support former residents. Methods for contacting included email and telephone contact via Executive Directors of community services, circulation of flyers through community organizations, and a one-page flyer listed in the Networks of Specialized Care. This recruitment process resulted in a total of 120 individuals participating in the study, thereby representing

12.75% of the individuals who experienced relocation during the Facilities Initiative study. Data collection ended in December of 2011.

**Consent for participation.** After consent to contact forms were completed and received by the researchers, a consent form was sent to the individual with ID or his/her family member. Consent to collect new information from individuals and their direct care staff, to access information from their facility files and for subsequent analyses related to the original research questions was obtained from participants (or their substitute decision-makers) prior to the first and second community visits. In the case of proxy consent, assent was sought from individuals at the time of community visits. Only one participant declined to participate in part of the data collection requiring his/her direct involvement but gave consent for staff to provide information to research assistants directly. Research ethics board (REB) clearance was previously obtained, which included consent for the usage of data for future studies.

**Sampling.** A critical component of research interpretation is evaluating if individuals who participated in the study are similar or different than those who did not participate. An analysis was completed to examine the similarities and differences between the 894 individuals who did not participate in this study and the 120 participants who lived in the facilities with them in 2005. Chi-square analyses were conducted using Statistical Package for the Social Sciences (SPSS v. 26) to compare the location (facility), age (in 2005), sex, primary method of communication, severity of communication impairments (expressive and receptive), CPS, adaptive functioning (ADL Hierarchy Scale), pain, health instability (Chess), aggression (ABS), and depression (DRS). Independent *t*-tests were used to compare the average age, adaptive functioning score (IADL-Perf), and the average number of health conditions. Results from the comparison are listed in Table 1.

Table 1

*Baseline (2005) Sample Characteristics*

	Individuals with one community assessment N=120 %	Individuals without any community assessments N=894 %	Test statistic
Institution			
Huron Regional Centre (L3V)	33.6	33.1	$X^2 = .792$ ( $df = 2$ )
Rideau Regional Centre (K7A)	27.7	42.4	$p = .675$
Southwest Regional Centre (N0P)	38.7	24.5	
Average Age (SD)*	49.82 (7.90)	51.79 (9.59)	$t = 2.47$ ( $df = 167.63$ ) $p = .014$ $X^2 = 6.109$ ( $df = 1$ )
Age Categories*			
Under 50 years	60.00	47.99	$p = .013$
50+ years	40.00	52.01	
Male	55.5	63	$X^2 = 2.558$ ( $df = 1$ ) $p = .110$
Primary Method of Communication			
Verbal	25.8	30.5	$X^2 = 1.080$ ( $df = 1$ )
Non-Verbal	74.2	69.5	$p = .299$
Severely Impaired Communication			
Expressive			
Understood, usually understood, often understood (0-2)	24.2	24.4	$X^2 = .0034$ ( $df = 1$ )
Sometimes/rarely/never understood (3-4)	75.8	75.6	$p = .958$
Receptive			
Understands, usually understands, often understands (0-2)	37.5	34.3	$X^2 = .466$ ( $df = 1$ )

Sometimes/rarely/never understands (3-4)	62.5	65.7	$p = .495$
Cognitive Performance Scale (CPS)			$X^2 = 11.935$ ( $df = 6$ )
Intact (0)	0	0.2	$p = .063$
Borderline intact (1)	3.3	2.9	
Mild cognitive impairment (2)	3.3	3.1	
Moderate cognitive impairment (3)	14.2	12	
Moderate to severe cognitive impairment (4)	17.5	8.5	
Severe cognitive impairment (5)	45.8	51.7	
Very severe cognitive impairment (6)	15.8	21.4	
ADL Hierarchy Scale (ADL-H)			$X^2 = 8.399$ ( $df = 6$ )
Independent (0)	2.5	4.1	$p = .210$
Supervision required (1)	12.5	8.5	
Limited assistance required (2)	8.3	5.3	
Extensive assistance required, level 1 (3)	41.7	41.8	
Extensive assistance required, level 2 (4)	7.5	4.8	
Dependent on others (5)	15.8	17.7	
Totally dependent on others (6)	11.7	17.8	
Average IADL Performance Scale (SD)	47.38 (1.70)	47.25 (2.50)	$t = -.274$ ( $df = 191$ ) $p = .785$
Pain Scale			$X^2 = 3.347$ ( $df = 3$ )
No pain (0)	80	76.6	$p = .341$
Less than daily pain (1)	16.7	15.8	
Daily pain but not severe (2)	2.5	6.8	
Severe daily pain (3)	0.8	0.8	
Health Instability (Chess)			$X^2 = 6.546$ ( $df = 4$ )
Not at all unstable (0)	87.4	82.5	$p = .162$
(1)	10.9	13	
Unstable (2)	0	3.4	
(3)	1.7	0.7	
Highly unstable (4)	0	0.5	

			$X^2 = 4.758$
Aggressive Behaviour Scale			( $df = 2$ )
None (0)	32.8	40.5	$p = .093$
Mild to moderate (1-5)	61.3	50.9	
Severe (6+)	5.9	8.6	
			$X^2 = 0.415$
Depression Rating Scale			( $df = 1$ )
None (0)	85.8	87.9	$p = .519$
Possible depression (3+)	14.2	12.1	
Average Number of Health Conditions (SD)	3.89 (4.690)	3.85 (4.729)	$t = -.093$ ( $df = 1012$ )
			$p = .926$

Note. Table was based on Condillac et al. (2012, p. 20-21); \* $p < .05$ .

The results indicated that with the exception of age ( $p < .05$ ; Table 1), there were no significant differences between the 120 individuals who participated in the study and the 894 who had not participated across several key characteristics ( $p > .05$ ; Table 1). The average age of others in the facility in 2005 was higher ( $M = 51.79$ ,  $M = 49.82$ ; respectively) than the average age of individuals in our sample at that time ( $p = .014$ ). When the populations were divided into above and below 50 years of age, there were significantly more individuals in this sample who were under the age of 50 (60% and 48% for  $N = 120$  and  $N = 894$  respectively,  $p = .013$ ). The current sample was considered representative of the population of the facilities in 2005.

**Measures**

**InterRAI-ID.** The interRAI-ID (Martin, Hirdes, Fries, & Smith, 2007) is a comprehensive measure evaluating key domains of an individual with ID’s life. The interRAI-ID includes 391 items that examine 20 domains of life, including: personal information, health service history, cognition, communication, hearing and vision, physical functioning and self-care, physical health, medications, skin conditions, oral and nutrition status, psychiatric disorders, mental state indicators, life events, behaviour, psychosocial well-being and social supports, education, vocation, recreation, prevention and intervention, and home environment

(Martin et al., 2007). The measures embedded in the interRAI-ID instruments are valid and internally consistent among individuals with ID (Martin et al., 2007). The interRAI-ID consists of ten subscales described below. However, there are limitations to this measure. In particular, the interRAI-ID only requires medications to be recorded if they have been administered within the last three days. The interRAI-ID consists of ten subscales described below.

**Activities of Daily Living Hierarchy Scale.** This scale evaluates an individual's ability to complete everyday activities (Condillac et al., 2012). Items on this scale include personal hygiene, mobility, toilet use, and eating. Scores can range from 0 (independent) to 6 (totally dependent). This scale is inverted as lower scores represent increased adaptive functioning.

**Independent Activities of Daily Performance Scale.** The Independent Activities of Daily Performance Scale (IADL-Perf) evaluates an individual's ability to complete IADLs, such as meal preparation, phone use, ordinary housework, shopping, managing finances, transportation, and managing medications and work (Condillac et al., 2012). Scores may range from 0 to 48, with lower levels representing reduced assistance required (Condillac et al., 2012).

**Cognitive Performance Scale.** The Cognitive Performance Scale (CPS) evaluates four items (short-term memory, decision-making, expression, and self-performance in eating) to determine a predictive algorithm for cognitive status (Martin et al., 2007). The CPS may also be used over time to evaluate if cognitive status declines as a function of age. This scale is a 7-point Likert scale. Scores vary from intact (0), borderline intact (1), mildly impaired (2), moderately impaired (3), moderately to severely impaired (4), severely impaired (5) to very severely impaired (6). This scale is inverted in that, lower scores indicate higher cognitive performance. The internal consistency of this scale was not previously calculated as the CPS is a predictive algorithm (Martin et al., 2007).

**Depression Rating Scale.** The Depression Rating Scale (DRS) consists of the summation of seven items that may indicate possible depression over the last three days (Martin et al., 2007). The items are possible indicators of depression, which include negative statements, persistent anger, expressions of unrealistic fears, repetitive health complaints, repetitive anxious complaints, worried facial expression, and crying or tearfulness (Martin et al., 2007). The scale ranges from 0 to 14, with a score of 3 indicating possible depression. The DRS demonstrates good internal consistency for adults with ID, with Cronbach's alpha scores of 0.79 and 0.78 across psychiatric and complex continuing care settings, respectively (Martin et al., 2007).

**Aggressive Behaviour Scale.** This scale consists of the sum of four items: verbal abuse, physical abuse, resistance to care, and socially inappropriate disruptive behaviour to determine the level of aggression exhibited by an individual across three days (Martin, Hirdes, Fries, & Smith, 2007). Scores may range from 0 to 12, in which a 12 reflects the highest possible score for aggression. This scale demonstrates a high internal consistency in complex continuing care (Cronbach's alpha= .93) but a weaker internal consistency among adults with ID living in inpatient psychiatry settings (Cronbach's alpha= .59; Martin et al., 2007).

**Pain Scale.** The pain scale evaluates a person's level of pain in his or her everyday life (Condillac et al., 2012). The items evaluated include the intensity and frequency of pain. Scores may range from 0 to 4, with 0 representing no pain and 4 indicating severe daily pain (Condillac et al., 2012).

**Negative Symptoms Scale.** The Negative Symptoms Scale (NSS) examines to the extent to which an individual exhibits the following negative symptoms: expressions demonstrating a lack of pleasure, withdrawal, lack of motivating and decreased social interaction (Condillac et

al., 2012). This scale consists of scores ranging from 0 to 12, with higher scores reflecting more severe negative symptoms (Condillac et al., 2012).

**Changes in Health, End-stage Disease, Signs, and Symptoms.** This score was created by adding items in a variety of health-related measures (i.e., cognitive decline in last 90 days, adaptive daily living in last 90 days, shortness of breath, dehydration, edema, vomiting, weight loss, decrease in the amount of food/fluid, and instability of conditions). Item scoring ranges from 0 to 4, in which 0 represents not unstable, and 4 represents highly unstable. Further, Hirdes, Dinnus, and Teare (2003) determined that CHESS is a strong predictor of mortality ( $p < .001$ ).

**Behaviour Problems Inventory (BPI; Rojahn, 1984).** The BPI includes 52-items with 3 subscales examining self-injurious behaviours (SIB), stereotypical behaviours, and aggressive/destructive behaviours. In 1989, Rojahn, Polster, Mulick, and Wisniewski examined the scale by testing for interrater and retest reliability. Overall, the authors found that most items had acceptability reliability scores, particularly the aggression subscale items.

**Total number of psychiatric diagnoses.** A total number of psychiatric diagnoses was calculated by summing the presence or absence of four types of psychiatric diagnoses: cognitive disorders, psychotic disorders, mood disorders, and anxiety disorders.

**Total number of medical diagnoses.** A total number of medical diagnoses was created by adding the absence or presence of the following medical disorder: asthma, cerebral palsy, diabetes mellitus, epilepsy or seizure disorder, hypothyroidism, and traumatic brain injury.

**Total behaviour composite.** A CB variable was created by summing relevant measures on the Behavioural Symptoms section of the interRAI-ID. Relevant measures were determined based on the BPI (Rojahn et al., 1989).

## Procedure

**Data collection.** After completing the consent and recruitment processes, research assistants (RAs) booked a visit with the individual and his/her support worker. Experimenters sent a pre-visit package to the support staff, which included various measures for the staff informant to complete prior to the visit (interRAI ID; SIB-R, Bruininks et al., 1996; the Reiss Screen, Reiss, 1988; and the BPI, Rojahn, et al., 1989). In the current study, only measures on the interRAI-ID were analyzed. When the research assistant arrived, assent was obtained from the individual. In addition, if staff informants had not fully completed the pre-visit package, researcher assistants supported informants on the remaining sections. Notably, measures were primarily completed by the staff informants. However, if the individual wanted to participate, he/she could assist with completing the measures, though this happened infrequently, given the limited communication skills of individuals in this sample. Research assistants conducted behavioural observations with the participant and support staff. After completing the visit, research assistants returned the measures to the lab, entered the results into a database, and then double-checked entries for accuracy. Analyses were completed using SPSS (v.19 - v.26). Statistical analyses for the current study are described below.

### **Data analyses.**

**Missing variables.** The Little's Missing Completely at Random (MCAR) test was conducted to determine if values from all the relevant variables were missing completely at random. MCAR was conducted for any data points that overlapped with 0. The following time variables were created for the current study:

- A time variable with three points in time (time = F1 = 0; C1 = 1; C2 = 2)
- Facility to community change time variable (time variable 1= F1 = 0, C1 = 1, C2 = 1)

- Within community change (time variable 2 = F1 = 0, C1 = 0, C2 = 1).

As such, the MCAR test was conducted across F1 and C1 for the relevant variables (e.g., psychotropic medications, CPS, ABS, DRS, IADL-Perf, age, pain, CHESS, NSS, etc.). The results of the Little's MCAR for F1 were  $X^2 = 10.359$  ( $df = 8$ ,  $N = 120$ ;  $p = .241$ ). As a result, the null hypothesis that the data was missing completely at random was not rejected. The Little's MCAR for C1 also demonstrated that the missing data in C1 was missing completely at random ( $X^2 = 4.1701$   $df = 7$ ,  $N = 120$ ;  $p = .760$ ).

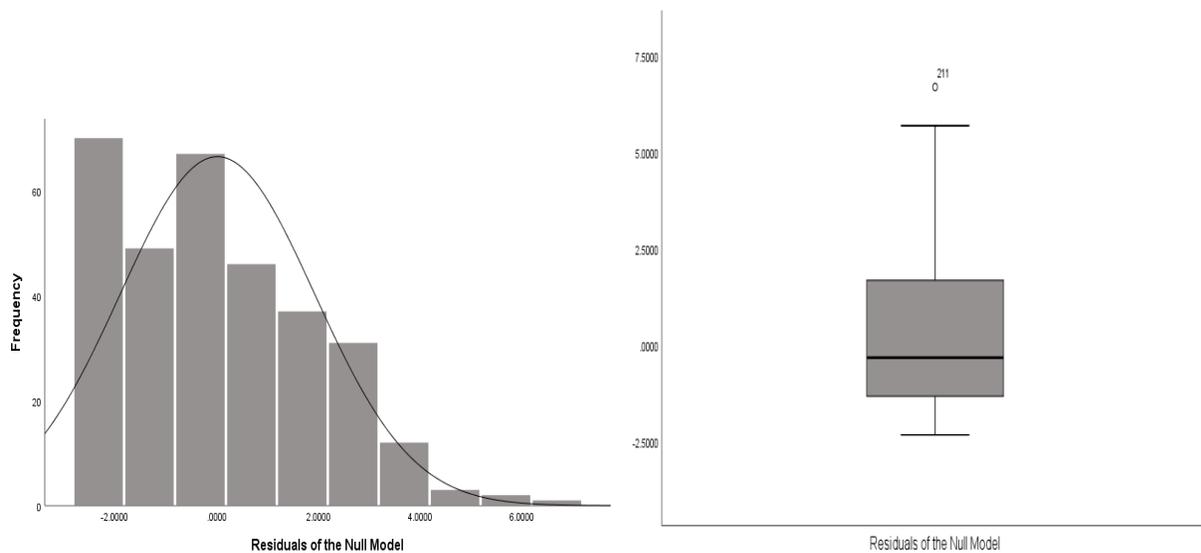
**Evaluating variables.** The preliminary analysis of the interRAI-ID scales was conducted by examining the descriptive statistics for each variable. The distribution of the variables and outliers were evaluated using histograms and boxplots, respectively. Skewness and kurtosis values were examined. When variables were not normally distributed (e.g., skewness and kurtosis values exceeding values of three; Field, 2013), they were transformed as necessary (e.g., square root transformations) using the SPSS compute variable function.

**Outliers.** Potential outliers were initially examined using boxplots. Certain cases were found outside of the whiskers of the boxplot for the following variables: the total number of psychotropic medications, the total number of psychiatric diagnoses, the total number of medical diagnoses, ABS, Pain, NSS, and CHESS. CPS, adaptive functioning, and the square root transformation of DRS did not have any outliers. No cases were excluded from the dataset as the cases that were outliers were frequently only one value past the whiskers of the boxplot. Outliers were also examined by plotting the residuals of the multilevel model

**Assumptions.** Given that multilevel linear models are considered an extension of linear modeling, the typical assumptions of linearity, normality, homogeneity of variance, and independence apply (Field, 2013). The linearity assumption was tested by comparing a

randomized dummy variable to the number of psychotropic medications. A linear relationship between the dummy variable and the IVs was not found (Adjusted  $R^2 = .001$ ,  $p = .420$ ).

Normality of the model was examined for each model by plotting the residuals. Therefore, these graphs were completed for the null, null growth, base model, and the final model. All the models, excluding the null and null growth model, appeared to have normally distributed residuals (Figures 1, 2, 3, and 4). Both the null and null growth models appeared to be positively skewed. However, an additional factor to consider is the central limit theorem, which indicates that as sample size increases, distributions become increasingly normally distributed (Field, 2013). Given that this study has 120 participants with two data points and that 86 of these participants have three data points, it can be concluded that the normality assumption was met.



*Figure 1.* Histogram and boxplot of the residuals of the null multilevel model.

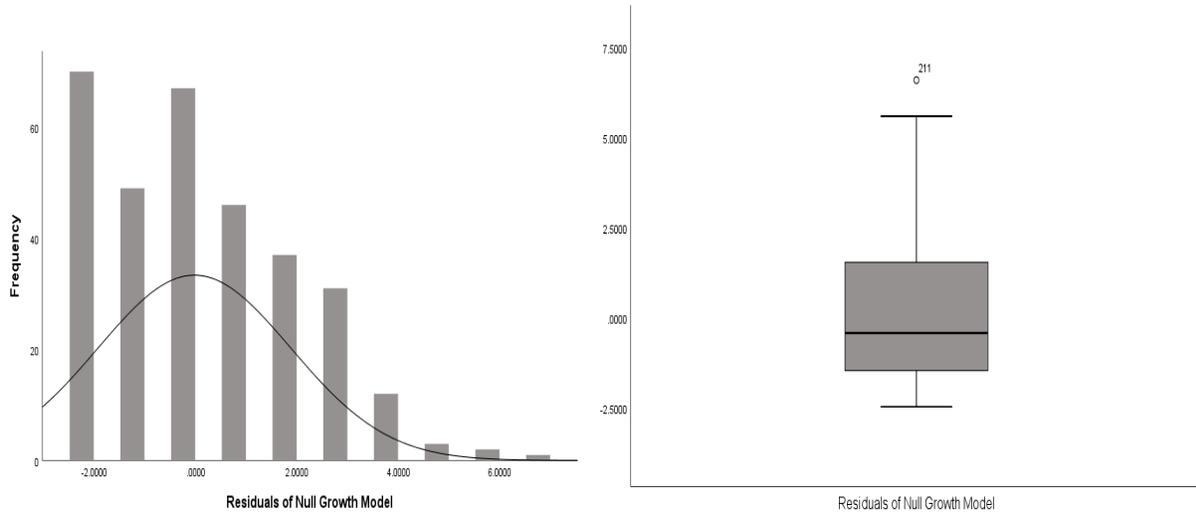


Figure 2. Histogram and boxplot of the residuals of the null growth multilevel model.

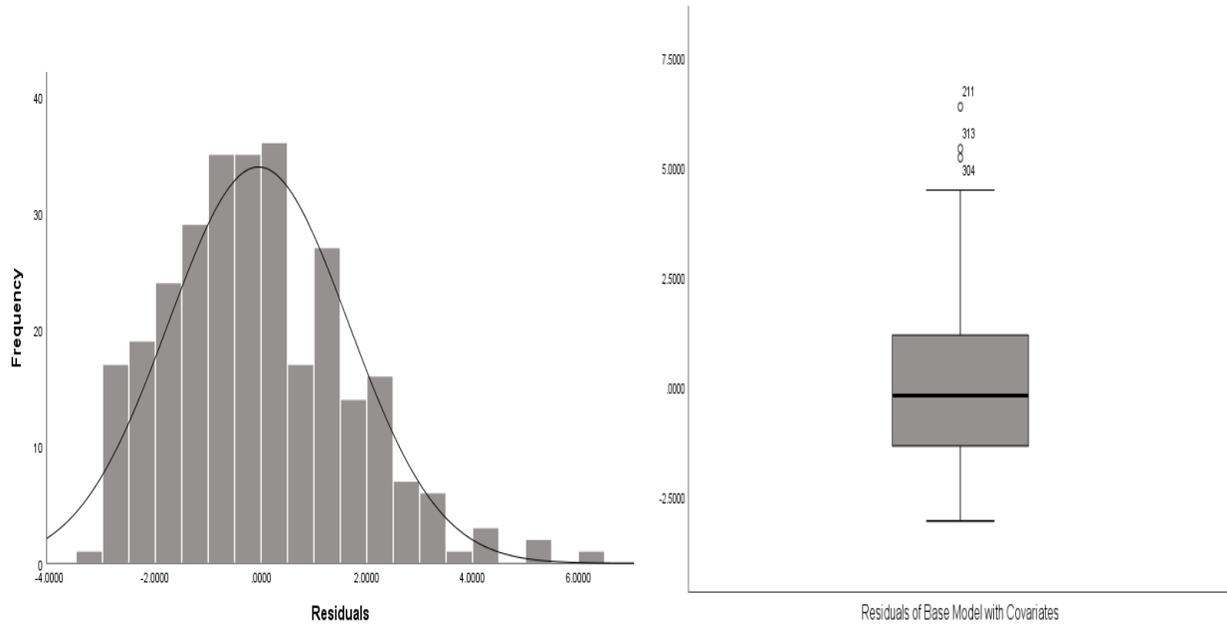


Figure 3. Histogram and boxplot of the residuals of the base multilevel model with covariates

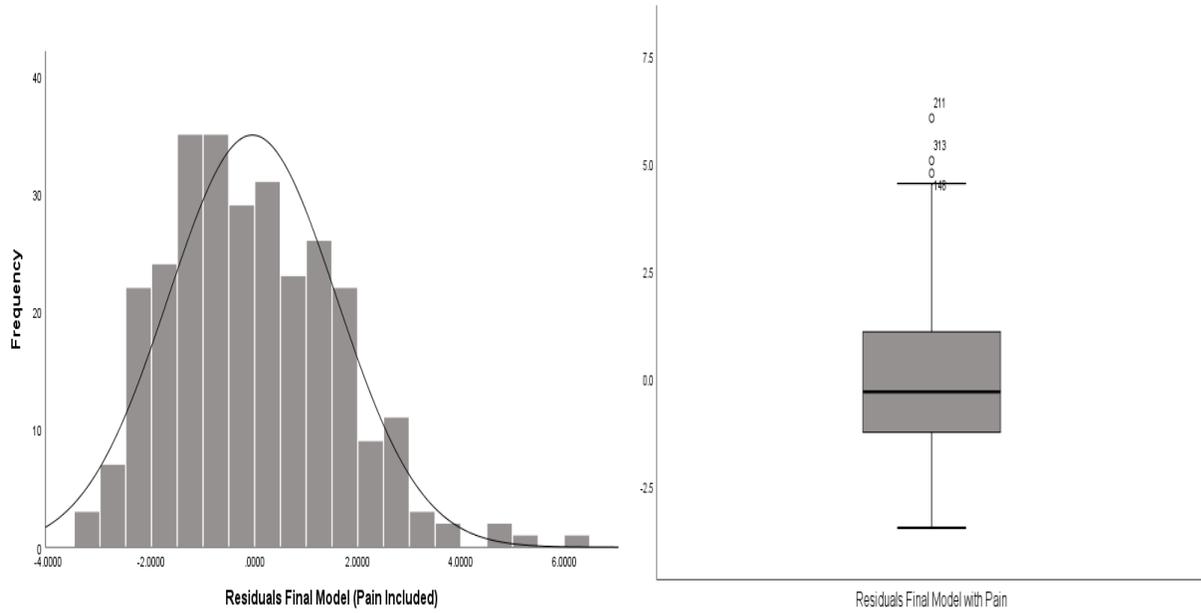


Figure 4. Histogram and boxplot of the residuals of the final model.

The third assumption is homogeneity of variance, which refers to if the spread of psychotropic medication was consistent across F1, C1, and C2. Residuals and predictive values were standardized. The standardized predictive values were graphed against the standardized residual values. The cloud-like formation demonstrates that the dataset met the assumption of homogeneity of variance.

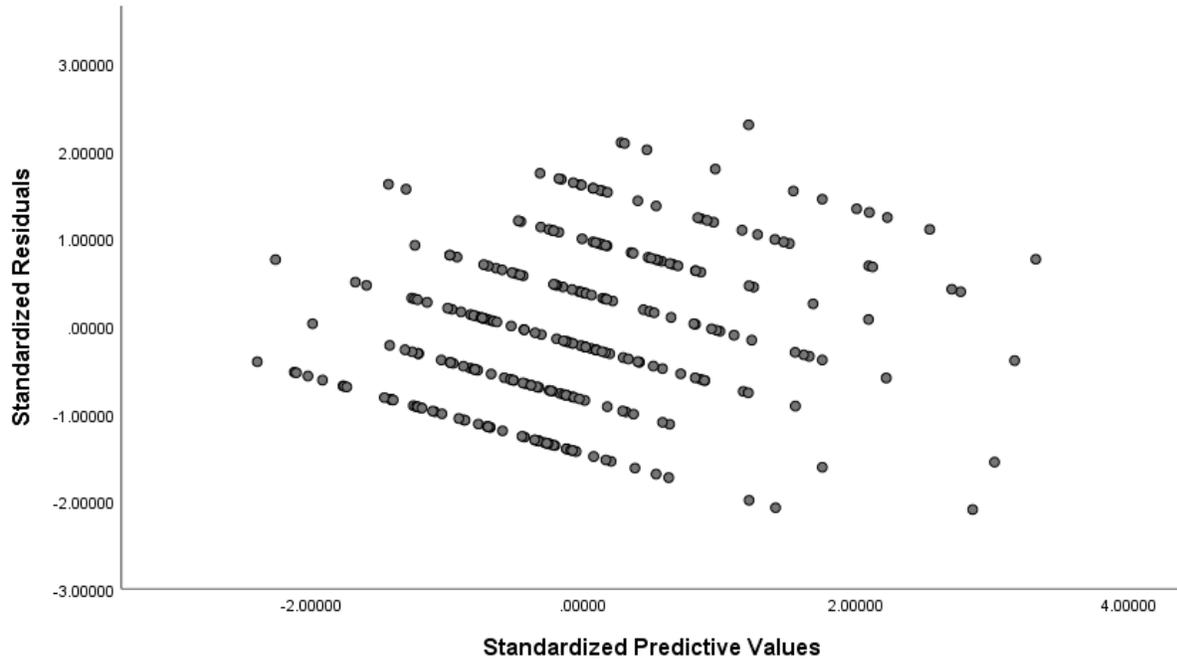


Figure 5. The standardized predictive values plotted against the standardized residuals values from the final model.

The independence assumption was tested by a regression model that was completed with all the IVs (excluding the time variables), and the psychotropic medication as the outcome variable. The Durbin-Watson value was 1.245, given that this falls between one and three indicate that the model did not violate the independence assumption. Lastly, multicollinearity was tested by examining the relationships between all the variables (Table 4), which indicated that the variables were not highly correlated.

**Variable creation.** To ensure that the most appropriate variables were considered for the model, additional variables were calculated based on the measures available in the interRAI-ID. A mental health status variable was calculated by summing the total presence or absence of cognitive disorders, psychotic disorders, mood disorders, and anxiety disorders. A health status

variable was created that summed the presence or absence of asthma, cerebral palsy, epilepsy or seizure disorder, hypothyroidism, and traumatic brain injury. Lastly, a CB variable was created by summing relevant measures on the Behavioural Symptoms section of the interRAI-ID. Relevant measures were determined based on the BPI (Rojahn et al., 1989). This included the summation of verbal abuse, socially inappropriate and disruptive behaviour, inappropriate public sexual behaviour or disrobing, self-injurious behaviour, destructive behaviour, pica, intimidation of others or threatened violence, violence to others, or extreme behaviour disturbance. An additional composite CB variable was created for C1 and C2 that included physical abuse as well as there was not a physical abuse variable available for F1.

For all the created variables, bivariate correlations were conducted to compare the total number of psychiatric diagnoses and the DRS and NSS scale, the total number of medical diagnoses and the pain and CHESS scales, and the total CB composite to the ABS.

**Mean calculations.** The mean number of psychotropic medications were calculated for all participants across each point in time (F1= facility 1; C2 = community 1, and C3 = community 2). A line graph was used to display the mean numbers of psychotropic medications across F1, C1, and C2.

#### **Multilevel model.**

**Null model.** The null model was conducted by running a mixed model analysis with total psychotropic medications entered as the dependent variable. No fixed or random effects were entered. The Toeplitz heterogeneous matrix was selected as the covariance pattern. Maximum likelihood (ML) was used as the estimated method. Toeplitz heterogeneous matrix and ML were used for all models.

***Null growth model.*** To determine the appropriate null growth model, three time variables were created: a time variable with three points in time (time; F1 = 0; C1 = 1; C2 = 2) and two dummy time variables to compare facility to community change (FC Change; F1 = 0, C1 = 1; C2 = 1), and within community change (CC Change; F1 = 0; C1 = 0; C2 = 1). Exploratory analyses were conducted to determine the best fit for the null growth model. For instance, certain variables were inputted as either random or fixed effects. The most appropriate null growth model was selected based on two components: 1) model convergence; and 2) lowest AIC and BIC scores. The most appropriate null growth model had the variables FC and CC change entered as fixed effects and time inputted as a random effect.

***Base model with covariates.*** A second model was created that incorporated the covariates age and adaptive functioning (IADL-Perf). These variables were grand mean centered by subtracting the mean from each variable. These covariates were selected to control for individual characteristics differences and were therefore entered as fixed effects to account for within-individual variation.

***Base with substantive predictors.*** Following the creation of the base model with covariates, other variables and their interactions with the time variables were entered one at a time as fixed effects and examined as separate models. Relevant variables were grand mean centered by subtracting the mean value from the variable. Given that this analysis was primarily exploratory, predictors were entered in one at a time to limit predictors to an acceptable level for the sample size. For instance, the DRS variable and the interactions with FC and CC change were entered into the basic model as predictors of fixed effects. Following, DRS was removed from the model, and the CPS was entered as a fixed effect and so on. This method was completed for the following variables: CPS, DRS, NSS, CHESS, pain, ABS, total psychiatric

diagnoses, and total medical diagnoses. This strategy was completed to examine which variables best predict the usage of psychotropic medication over time and across settings. Transformed variables were entered in as their non-transformed versions to ensure that interpretations of the outcomes were clear (e.g., non-transformed DRS was entered rather than the square root version).

If the model did not converge with certain predictors, the predictor was entered independently of the FC and CC interactions. This strategy was completed for NSS and the total number of diagnoses. For NSS, the model did not converge following this change. Given that NSS was similar for each participant (e.g., 86 participants did not experience a change in the NSS from F1 to C1), the NSS was entered as a fixed variable. The NSS in the facilities was used as the fixed measure for this variable. This measure was entered without the interactions with FC and CC change.

***Final model and model evaluation.*** The final model was selected based on the information criterion as well as which variables were significant predictors. Given that the primary focus of this examination was exploratory, strategies were used to ensure that predictor ratios remained at reasonable levels. First, individual predictors were evaluated separately prior to their inclusion in the multilevel model. Predictors that were not interacting with any changes in the model were removed from the analysis. Secondly, for all the multilevel models, the information criteria, including the Akaike's Information Criteria (AIC), -2 Log Likelihood, and Schwarz's Bayesian Criterion (BIC) were examined to determine the most models that best fit the data. The residuals of each model were also saved and graphed to ensure all models were normally distributed. The predicted values of each model were also saved. For the significant predictors, the variables were binned as follows: CHESS = not at all unstable and unstable;

Pain= no pain and pain; CPS= intact to intact borderline, mild to moderate, and moderate to severe; total diagnoses= no diagnosis, 1 diagnosis, or more than 1 diagnosis. Mean plots were created to examine the changes in the predictive scores over time and across settings for various levels of each predictor.

### **Post Hoc Analyses**

Given the lack of influence of CB on psychotropic medication usage, post hoc analyses were conducted to examine potential differences between the CB measure used (ABS) and the BPI. A comparison between ABS and BPI was conducted at C1 given that this point in time represented the larger community sample size and because the BPI had been conducted at this point in time. Pearson correlations were conducted to compare the ABS to the BPI. Secondly, interquartile ranges were examined across ABS and BPI to evaluate differences in the spread of participants' scores across each variable.

## **Results**

### **Evaluating Variables**

Descriptive summaries of relevant variables are reported in Table 2. Age, the total number of psychotropic medications, total medical diagnoses, total psychiatric diagnoses, CPS, and IADL-Perf appeared to be relatively normally distributed, with skewness and kurtosis values remaining between -2 and 2. The following variables were transformed using the square root function: DRS, NSS, ABS, CHESS, and Pain. After transforming these values, skewness and kurtosis values were improved (between -2 and 2 for all variables excluding NSS).

Table 2

*Descriptive Summary of Variables*

Variables	<i>N</i>	<i>M</i>	<i>SE</i>	<i>SD</i>	<i>Min.</i>	<i>Max.</i>	<i>Skewness</i>	<i>Kurtosis</i>
Age at C1	119	55.05	0.73	8.00	33.43	77.10	0.53	0.46
Total number of psychotropic medications	318	2.33	0.11	1.91	0.00	9.00	0.60	-0.19
Total medical diagnoses	315	0.91	0.05	0.80	0.00	3.00	0.61	-0.08
Total psychiatric diagnoses	313	0.46	0.04	0.76	0.00	3.00	1.57	1.65
Total behaviour composite	315	4.84	0.29	5.08	0.00	23.00	1.42	1.83
IADL Performance	290	31.28	0.64	10.90	0.00	48.00	-0.49	-0.02
ADL Hierarchy	316	3.39	0.09	1.53	0.00	6.00	-0.12	-0.24
CPS	316	4.13	0.08	1.43	0.00	6.00	-0.76	-0.16
DRS	316	1.58	0.12	2.21	0.00	12.00	1.84	3.51
DRS (Square Root)	316	0.86	0.05	0.92	0.00	3.46	0.58	-0.79
NSS	316	0.59	0.09	1.53	0.00	8.00	2.93	8.42
NSS (Square Root)	316	0.31	0.04	0.71	0.00	2.83	2.10	3.07
ABS	316	2.39	0.14	2.42	0.00	12.00	1.26	2.00
ABS (Square Root)	316	1.23	0.05	0.94	0.00	3.46	-0.05	-1.07
CHESS	316	0.32	0.04	0.64	0.00	4.00	2.45	7.06
CHESS (Square Root)	316	0.27	0.03	0.49	0.00	2.00	1.43	0.57
Pain	313	0.45	0.04	0.75	0.00	3.00	1.58	1.57
Pain (Square Root)	313	0.36	0.03	0.56	0.00	1.73	1.04	-0.63

**Mean Calculations and Descriptives**

The mean number of psychotropic medications varied across each point in time ( $M = 2.18$ ,  $M = 2.29$ , and  $M = 2.04$  for F1, C1, and C2, respectively; Table 3). Figure 6 displays an increase from F1 to C1 and a small decrease from C1 to C2.

Table 3

*Mean Calculations of Psychotropic Medication Usage*

Point in Time	$M$	$SD$	95% Confidence Interval	
			Lower Bound	Upper Bound
Total psych F1	2.1795	2.0936	1.7075	2.6515
Total psych C1	2.2949	1.8099	1.8868	2.7029
Total psych C2	2.0385	1.7014	1.6549	2.4221

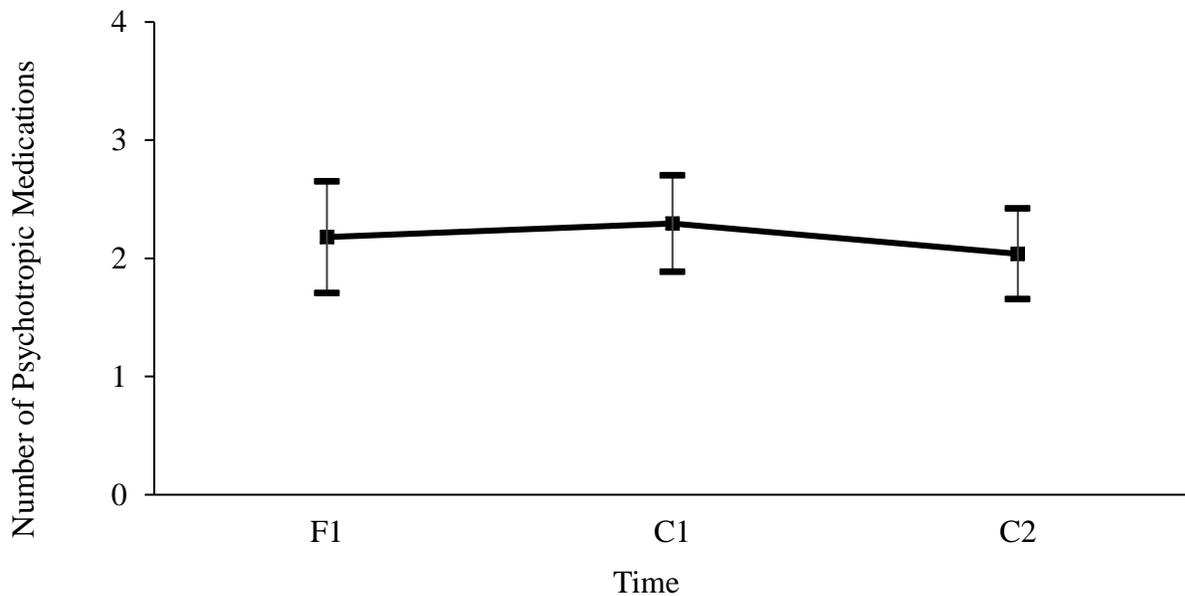


Figure 6. The mean number of psychotropic medications across F1, C1, and C2.

### Correlational Analysis

The relationships between each predictor and psychotropic medication were examined using Pearson correlations (Table 4). There were consistent positive relationships between the total number of psychotropic medications and the total number of psychiatric diagnoses, total medical diagnoses and depression symptoms. The total number of psychiatric diagnoses was the most highly correlated with psychotropic medication ( $r = .24; p < .01$ ), followed by total medical diagnoses ( $r = .17; p < .01$ ), and depression symptoms ( $r = .12; p < .05$ ). Only adaptive function was negatively correlated with the total number of psychotropic medications ( $r = -.12; p < .05$ ). Therefore, an increase on the adaptive functioning scale was associated with a decrease in psychotropic medications. However, the adaptive functioning scale is inverted, and therefore, better adaptive functioning was associated with a higher number of psychotropic medications. Age, cognitive performance, CB, pain, negative symptoms, and health instability were not associated with the total number of psychotropic medications ( $p > .05$ ).

Table 4 also included correlations between the variables and other potential predictors (not including psychotropic medication). Consistent positive relationships were found between aggression and total number of psychiatric diagnoses ( $r = .19; p < .01$ ), depression symptoms ( $r = .43; p < .01$ ), pain ( $r = .15; p < .01$ ), negative symptoms ( $r = .22; p < .01$ ), and health instability ( $r = .27; p < .01$ ). Therefore, individuals with more psychiatric diagnoses, depression and negative symptoms, pain, and health instability tended to have higher levels of aggression. In contrast, age was inversely related to aggression ( $r = -.11; p < .05$ ).

Depression symptoms were also highly correlated across several variables. In addition to the high correlation with aggression, depression symptoms were positively correlated with the number of psychiatric diagnoses ( $r = .32; p < .01$ ), pain ( $r = .30; p < .01$ ), negative symptoms ( $r$

= .36;  $p < .01$ ), and health instability ( $r = .20$ ;  $p < .01$ ). Therefore, individuals with higher levels of CB, pain, negative symptoms, health instability and psychiatric diagnoses were more likely to exhibit depression symptoms when compared to individuals with lower scores on the ABS.

Lastly, depression symptoms were negatively correlated with cognitive performance. Therefore, as cognitive performance increased, depression symptoms decreased ( $r = -.11$ ;  $p < .05$ ).

Overall, the correlation analysis demonstrated that only certain characteristics were correlated with the total number of psychotropic medications. Further, aggression and depression symptoms were the variables most frequently correlated significantly with other variables. Nonetheless, all the significant correlations were between  $-.1$  and  $.43$ . Therefore, the significant relationships between all the variables were considered to be only weak or moderate in strength (Agolu, 2018).

Table 4

*Pearson Correlations of Potential Variables*

Variables	1	2	3	4	5	6	7	8	9	10	11
1. Total number of psych meds	-	-.10	.24**	.17**	-.07	.10	-.12*	.12*	.01	.05	.06
2. Age	-	-	-.04	.01	.08	-.11*	.03	-.03	-.03	-.12*	.13*
3. Total number of diagnoses	-	-	-	-.04	-.11*	.19**	.03	.32**	.03	.23**	.12*
4. Total medical diagnoses	-	-	-	-	.12*	.03	.07	-.03	.02	.01	-.03
5. CPS	-	-	-	-	-	-.10	.02	-.11*	-.09	.08	-.05

6. ABS	-	-	-	-	-	-	-	-.02	.43**	.15**	.22**	.27**
7. IADL- Perf	-	-	-	-	-	-	-	.01	.04	.05		-.16**
8. DRS	-	-	-	-	-	-	-			.30**	.36**	.20**
9. Pain	-	-	-	-	-	-	-				.18**	.23**
10. NSS	-	-	-	-	-	-	-					.22**
11. CHES	-	-	-	-	-	-	-					

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Note. \* $p < .05$ . \*\* $p < .001$

**Examining potential variables compared to the interRAI-ID.** The total number of psychiatric diagnoses was compared to NSS and DRS to ensure an appropriate measure was used to capture mental health status (Table 5). Overall, total number of psychiatric diagnoses appeared to be more normally distributed (skewness= 1.57; kurtosis= 1.65) when compared to NSS (skewness= 2.93; kurtosis= 8.42) and DRS (skewness= 1.84; kurtosis= 3.51). Bivariate correlations were conducted to compare the total number of psychiatric diagnoses to DRS and NSS (Table 5). Kendall’s tau correlations were examined. NSS and DRS were significantly correlated with one another at a lower level ( $\tau = 0.251, p = .000$ ;  $\tau = 0.331, p = .000$ , respectively). Given that the variables were only moderately correlated, the total number of psychiatric diagnoses was considered as a potential predictor of the total number of psychotropic medications.

Potential health status variables were also examined to ensure the most appropriate health status was selected for the model. Bivariate analyses were used to compare the health status variables for the total number of medical diagnoses, pain scale and CHES. Kendall’s tau correlations were examined to compare Pain and CHES to the total number of medical diagnoses (Table 6). Overall, the total number of medical diagnoses was not significantly correlated with either Pain or CHES ( $p > .05$ ). Given that the total number of medical diagnoses was fairly normally distributed (Table 3), this variable was included as a potential measure of health status.

CB variables were investigated to determine the most appropriate variables to include. Bivariate analyses were conducted to compare the total behaviour composite (based on the BPI) to the ABS. Kendall’s tau was calculated to compare ABS and total behaviour. ABS and the behaviour composite had a strong, significant correlation ( $\tau = .633, p = .000$ ; Table 7). In addition, the composite CB variable that included physical abuse for C1 and C2 was compared to the ABS for C1 and C2, respectively. Both variables were also highly correlated ( $\tau = .705, p = .000$  for C1;  $\tau = .640, p = .000$  for C2). Given the strong correlation, the ABS was the only measure used for measuring CB, as ABS is a validated measure (Martin et al., 2007).

Table 5

*Kendall’s Tau Correlations for Mental Health Status*

Variable	1. Total psychiatric diagnoses	2. DRS	3. NSS
1. Total psychiatric diagnoses	-	.241**	.180**
2. DRS	-	-	.241**
3. NSS	-	-	-

*Note.* \* $p < .05$ . \*\* $p < .001$

Table 6

*Kendall's Tau Correlations for Health Status*

Variable	1. Total medical diagnoses	2. Pain	3. CHESS
1. Total medical diagnoses	-	.042	-.017
2. Pain	-	-	.213**
3. CHESS	-	-	-

*Note.* \* $p < .05$ . \*\* $p < .001$

Table 7

*Kendall's Tau Correlations for Challenging Behaviour*

Variable	1. Total behaviour composite	2. ABS
1. Total behaviour composite	-	.633**
2. ABS	-	-

*Note.* \* $p < .05$ . \*\* $p < .001$

**Multilevel Model**

Multilevel modeling of psychotropic medication usage was conducted over four steps to represent a picture of the transition from the institution to community settings. The first step included creating a model that represented the person-to-person changes in psychotropic medication usage over time. Second, a model was formed to characterize the total number of psychotropic medications over time. Third, relevant covariates and demographics were entered as fixed effect variables to predict psychotropic medication changes. Lastly, substantive

predictors that were the primary targets for analysis were entered to examine polypharmacy dynamics across the study period.

**Null model.** For the fixed effects, the intercept was significant with an estimate of 2.317 ( $p = .000$ ), thereby indicating that the model converged (Table 8). The estimates of the covariance parameters (Table 9) demonstrated that across F1, C1, and C2, participants were significantly different from one another ( $p = .000$  for all three points in time). These results demonstrated that using a multilevel model was appropriate as individuals in this population were receiving statistically different numbers of psychotropic medications across each point in time. Table 14 displays that -2 Log Likelihood, the AIC, and the BIC. These values are 1178.310, 1190.310, and 1212.833, respectively. These values were compared to later models to ensure that the model fit with the data more effectively as predictors were added. Figure 1 displays the histogram of the residuals in the null model, which appeared to be positively skewed. However, skewness and kurtosis scores were acceptable, with values of 0.603 and -0.188 respectively. Only participant 211 was considered an outlier based on the boxplot (Figure 1).

Table 8

*Type III Tests of Fixed Effects for the Null Model*

<b>Fixed Effects</b>					
Variable	Estimate	SE	df	t	p
Intercept	2.317	0.148	123.865	15.628	.000

*Note.* \* $p < .05$ . \*\* $p < .001$

Table 9

*Estimates of Covariance Parameters of the Null Model*

		<b>Random Effects</b>			
		Estimate	SE	Wald Z	<i>p</i>
Repeated Measures	Index 1	4.680	0.612	7.649	.000**
	Index 2	3.232	0.419	7.710	.000**
	Index 3	2.702	0.401	6.744	.000**
	TPH rho 1	0.680	0.043	15.706	.000**
	TPH rho 2	0.592	0.073	8.106	.000**

*Note.* \* $p < .05$ . \*\* $p < .001$

**Null growth model.** The fixed results are listed in Table 10. When individuals moved from the facility to the community, there was not a significant change in the number of psychotropic medications used across settings ( $p = 0.783$ ). However, over time in the community, the number of psychotropic medications decreased by 0.285 ( $p = 0.047$ ). The random effects summary is listed in Table 11. Participants were significantly different from one another in F1 and C1 (Estimate = 4.481,  $p = 0.000$ ; Estimate = 2.554,  $p = 0.000$  respectively). Further, TPH rho 1 and 2 were also statistically significant (Estimate = 0.692,  $p = 0.000$ ; Estimate = .843,  $p = .031$ , respectively). The variance over time (e.g., the slope of each participant's trajectory) was significantly different across participants (Estimate = 0.398;  $p = .031$ ). The -2 Log Likelihood, AIC, and BIC values can be found in Table 14 (1170.572, 1188.572, and 1222.430, respectively). Both -2 Log Likelihood and AIC were lower in the null growth model, suggesting a better fit when compared to the null model. The residuals of the null

were positively skewed (Figure 2) but skewness and kurtosis values were 0.143 and 0.285, respectively.

Table 10

*Type III Tests of Fixed Effects for the Null Growth Model*

Fixed Effects					
Variable	Estimate	SE	Df	t	p
Intercept	2.317	0.148	123.865	15.628	.000**
FC Change	0.042	0.151	133.873	0.275	.783
CC Change	-0.285	0.143	195.348	-1.995	.047*

Note. \* $p < .05$ . \*\* $p < .001$

Table 11

*Estimates of Covariance Parameters of the Null Growth Model*

Random Effects					
		Estimate	SE	Wald Z	p
Repeated Measures	Index 1	4.481	0.580	7.730	.000**
	Index 2	2.554	0.444	5.747	.000**
	Index 3	1.225	0.657	1.864	.062
	TPH rho 1	0.692	0.052	13.234	.000**
	TPH rho 2	0.902	0.261	3.454	.001**
Time	Variance	0.398	0.184	2.162	.031*

Note. \* $p < .05$ . \*\* $p < .001$

**Base model with covariates.** Similar to the previous models, from F1 and C1 to C2 (CC Change), the total number of psychotropic medications decreased by 0.279 ( $p = .033$ ; Table 12). Age and adaptive functioning were not significant predictors of psychotropic medication usage ( $p = .077$  and  $.915$ ). In terms of the random effects, individuals were significantly different from one another at F1 and C1 (Estimate = 4.446,  $p = .000$ ; Estimate = 2.760,  $p = .000$ ; Table 13), which indicated that the use of the multilevel model was appropriate to implement. TPH rho 1 and 2 were also significant (Estimate = .783,  $p = .000$ ; Estimate = .843,  $p = .000$ , respectively). The -2 Log Likelihood, AIC, and BIC were 1025.058, 1047.058, and 1087.427, respectively (Table 14). Therefore, all three criteria were lower than the null growth model, suggesting that adding these covariates significantly improved the fit of the growth model and contributed meaningfully to the person-to-person estimates of change over time. The residuals of the base model with covariates were examined. The histogram (Figure 3) was normally distributed, with skewness and kurtosis values of 0.616 and 0.438. Only one case (211) was considered an outlier based on the boxplot of the residuals (Figure 3).

Table 12

*Type III Tests of Fixed Effects for the Base Model with Covariates*

Fixed Effects					
Variable	Estimate	SE	df	t	p
Intercept	2.578	0.205	110.431	12.593	.000**
FC Change	-0.106	0.146	117.244	-0.726	.469
CC Change	-0.279	0.129	175.612	-2.154	.033*
Age	-0.034	0.019	124.651	-1.786	.077
Adaptive functioning	-0.001	0.007	164.659	-0.107	.915

Note. \* $p < .05$ . \*\* $p < .001$

Table 13

*Estimates of Covariance Parameters of the Base Model with Covariates*

		Random Effects			
		Estimate	SE	Wald Z	<i>p</i>
<u>Repeated Measures</u>	Index 1	4.446	0.631	7.050	.000**
	Index 2	2.760	0.516	5.351	.000**
	Index 3	1.692	1.180	1.435	.151
	TPH rho 1	0.783	0.054	14.624	.000**
	TPH rho 2	0.843	0.300	2.807	.005*
<u>Time</u>	Variance	0.273	0.298	0.915	.360

Note. \* $p < .05$ . \*\* $p < .001$

**Base model with covariates and substantive predictors.** The base model was repeatedly evaluated with each predictor entered into the model one at a time. Certain variables (i.e., CPS, total diagnoses, NSS), were entered into the model without their interactions. NSS was entered as a fixed variable (at F1) rather than a repeated measure (at F1, C1, and C2) due to the model not converging. The results from each of these models can be found in Table 15. DRS, ABS, sex, total medical diagnoses, and the interactions of each of these variables with FC change and CC change did not produce any significant relationships ( $p > .05$ ) in relation to psychotropic medication use or change in use over time. In contrast, CPS, CHESS, CHESS interactions with FC change, Pain, and total psychiatric diagnoses were significant predictors of the total number of psychotropic medications when inputted into the base model.

CPS, the total number of psychiatric diagnoses, and pain were significant predictors, but only when examining the variable without its interactions with FC and CC change. Every one point of CPS was associated with 0.142 fewer psychotropic medications ( $t = -2.610$ ,  $df = 204.528$ ,  $p = .01$ ; Table 15). Therefore, when individuals displayed more impairments in cognitive performance (i.e., short-term memory, decision-making, expression, and self-performance), psychotropic medication usage was lower. The total number of psychiatric diagnoses significantly predicted psychotropic medication usage (Table 15). Each one-point increase in total psychiatric diagnoses was associated with a 0.300 increase in total psychotropic medications ( $t = 2.763$ ,  $df = 228.078$ ,  $p = .006$ ). Pain was also a significant predictor of the total number of psychotropic medications (Table 15). An increase of one point on the pain scale was associated with an increase in 0.606 psychotropic medications ( $t = 2.534$ ,  $df = 110.173$ ,  $p = .013$ ).

The CHES significantly predicted psychotropic medications; however, the influence of this measure varied depending on the setting and time. When examining the CHES independent of interactions with FC and CC changes, a 1 unit increase on the CHES was associated with a 0.785 increase in psychotropic medications ( $t = 3.010$ ,  $df = 104.105$ ,  $p = .003$ ; Table 15). However, this relationship differed when examining the interaction between CHES and certain points in time. When individuals transitioned from the facility to the community, an increase in one point on the CHES (less health stability; worse health) resulted in a decrease in 0.733 psychotropic medications ( $t = -2.617$ ,  $df = 141.791$ ,  $p = .01$ ). These findings suggested that when individuals were moving from the facilities to the community, worse health was associated with a decrease in the total number of psychotropic medications. The interaction between CHES and CC change was not significant ( $p = .834$ ).

The information criterion (-2 Log Likelihood, AIC, and BIC) were compared across each potential model (Table 16). The information criterion range between 1005.895 to 1013.952, 10031.939 to 1041.952, and 1075.388 to 1090.636 for -2 Log Likelihood, AIC, and BIC respectively. CPS, Total Psych Diagnoses, CHESS (with interactions), and pain (with interactions) appeared to be the models with the lowest -2 Log Likelihood (1007.939, 1007.516, 1007.867, and 1005.895, respectively), AIC (1031.939, 1031.516, 1035.876, 1033.895), and BIC scores (1075.811, 1075.388, 1087.051, and 1085.079, respectively). As such, CPS, total psychiatric diagnoses, CHESS + interactions, and Pain + interactions were included in the final model.

Table 14

*Information Criteria for All Models*

Information Criteria	Null Model	Null Growth Model	Base Model with Covariates	Final Model
-2 Log Likelihood	1178.310	1170.572	1025.058	988.341
AIC	1190.310	1188.572	1047.058	1026.341
BIC	1212.883	1222.430	1087.427	1095.804

Table 15

*Potential Predictors and their Interactions with Time Variables*

Variable + Base Model	Estimate	SE	df	t	p
CPS	-0.144	0.128	110.050	-1.125	.263

CPS * FC Change	-0.014	0.131	122.891	-0.107	.915
CPS * CC Change	0.041	0.096	160.452	0.428	.669
CPS	-0.142	0.055	204.528	-2.610	.01*
DRS	0.023	0.118	107.994	0.195	.846
DRS * FC Change	0.041	0.119	113.854	0.342	.733
DRS * CC Change	-0.097	0.062	166.225	-1.566	.119
Total Psych Diagnoses	0.300	0.109	228.078	2.763	.006*
ABS	0.023	0.068	104.165	0.337	.737
ABS * FC Change	0.005	0.077	141.915	0.059	.953
ABS * CC Change	-0.037	0.056	163.848	-0.649	.517
Pain	0.606	0.239	110.173	2.534	.013*
Pain * FC Change	-0.503	0.263	137.698	-1.911	.058
Pain * CC Change	-0.104	0.177	152.853	-0.587	.558
CHESS	0.785	0.261	104.105	3.010	.003*
CHESS * FC Change	-0.773	0.295	141.791	-2.617	.010*
CHESS * CC Change	-0.038	0.193	146.313	-0.198	.843

Total Medical Diagnoses	0.204	0.198	116.789	1.033	.304
Total Med Diagnoses * FC Change	0.011	0.194	128.380	0.054	.957
Total Med Diagnoses * CC Change	0.055	0.160	153.641	0.347	.729
NSS- Static	0.169	0.190	129.684	0.893	.374
Sex	-0.033	0.416	109.501	-0.080	.936
Sex * FC Change	0.106	0.305	118.445	0.348	.728
Sex * CC Change	-0.310	0.261	171.444	-1.192	.235

*Note.* \* $p < .05$ . \*\* $p < .001$

Table 16

*Information Criterion for the Base Model with Substantive Predictors*

Models	Information Criterion		
	-2 Log Likelihood	AIC	BIC
CPS + Interactions	1007.759	1035.759	1086.943
CPS	1007.939	1031.939	1075.811
DRS + Interactions	1011.452	1039.452	1090.636
NSS fixed measure	1013.838	1037.838	1081.710
Total Psych Diagnoses	1007.516	1031.516	1075.388

ABS + Interactions	1013.952	1041.952	1093.136
Pain + Interactions	1007.867	1035.867	1087.051
CHESS + Interactions	1005.895	1033.895	1085.079
<u>Total Medical Diagnoses + Interactions</u>	<u>1010.794</u>	<u>1038.794</u>	<u>1089.978</u>

Note. \* $p < .05$ . \*\* $p < .001$

**Final model.** Age and adaptive functioning were entered as covariates. CPS, total psychiatric diagnoses, CHESS, CHESS \* FC Change, CHESS \* CC Change, Pain, Pain \* FC Change, and Pain \* CC Change were entered as potential predictors. The distribution of the final model was examined (Figure 4). The histogram of the residuals (Figure 4) were normally distributed, with skewness, and kurtosis values were 0.588 and 0.299, respectively. The boxplot also demonstrated only a few outliers (case 211, 313, and 146). Table 17 displays the fixed effects of the final model. When individuals transitioned from the facility to the community, psychotropic medications decreased by 0.389 ( $p = .012$ ). Further, when individuals were visited for follow-up in the community, psychotropic medications also decreased by 0.261 ( $p = .045$ ). Age and adaptive functioning were not significant predictors of psychotropic medication usage ( $p = .114, p = .875$ ).

Table 17

*Type III Tests of Fixed Effects for the Final Model*

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Fixed Effects					
Variable	Estimate	SE	df	t	p

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Intercept	2.683	0.207	129.933	12.946	.000**
FC Change	-0.389	0.153	120.034	-2.543	.012*
CC Change	-0.261	0.129	172.085	-2.018	.045*
Age	-0.030	0.019	120.420	-1.591	.114
Adaptive functioning	-0.001	0.007	161.335	-0.157	.875
CPS	-0.132	0.053	205.325	-2.463	.015*
Total psychiatric diagnoses	0.271	0.108	227.292	2.517	.013*
CHESS	0.639	0.260	103.794	2.461	.015*
CHESS * FC Change	-0.765	0.293	137.806	-2.612	.010*
CHESS * CC Change	0.077	0.200	151.267	0.385	.701
Pain	0.512	0.235	104.774	2.183	.031*
Pain * FC Change	-0.416	0.260	133.476	-1.602	.111
Pain * CC Change	-0.038	0.185	160.735	-0.204	.838

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Note. \* $p < .05$ . \*\* $p < .001$

Table 14 displays the information criteria for the final model. Both the AIC and the -2 Log Likelihood decreased when compared to the earlier models, suggesting an improvement in the fit of the model. The BIC increased by 8.377 when compared to the base model. However, the increase in the BIC was by less than 10, which provided support for the final model representing the best fit for the growth model. Table 18 demonstrated that at F1, C1, TPH rho 1

and TPH rho 2, participants differed significantly from one another ( $p = .000$  for F1, C1, and TPH rho 1, TPH rho 2 = .013). Therefore, using a multilevel analysis was appropriate for this final model as participants were significantly distinct from one another across various points in time.

Table 18

*Estimates of Covariance Parameters of the Base Model with Covariates*

		Random Effects			
		Estimate	SE	Wald Z	<i>p</i>
<u>Repeated Measures</u>	Index 1	3.985	0.567	7.035	.000
	Index 2	2.535	0.514	4.936	.000
	Index 3	1.577	1.255	1.257	.209
	TPH rho 1	0.789	0.060	13.224	.000
	TPH rho 2	0.865	0.348	2.483	.013
<u>Time</u>	Variance	0.275	0.317	0.869	.385

*Note.* \* $p < .05$ . \*\* $p < .001$

CPS was a significant predictor of psychotropic medication, in that, when CPS increased by 1-unit, psychotropic medication usage decreased by 0.132 ( $p = .015$ ; Table 17). No significant relationships were found when examining CPS with either time variables ( $p > .05$ ). The predictive values were visually displayed across time when CPS was binned into low, medium and high sections (intact, mild to moderate, moderate to severe; Figure 7). The lowest trend line represented the highest CPS score, which suggested that when individuals had a higher CPS

score (moderate to severe), the mean predictive value of psychotropic medications was lower (Figure 7). Lastly, the confidence intervals ranged depending on CPS score. Individuals in the range of intact to intact borderline tended to have the largest variability in terms of psychotropic medications.

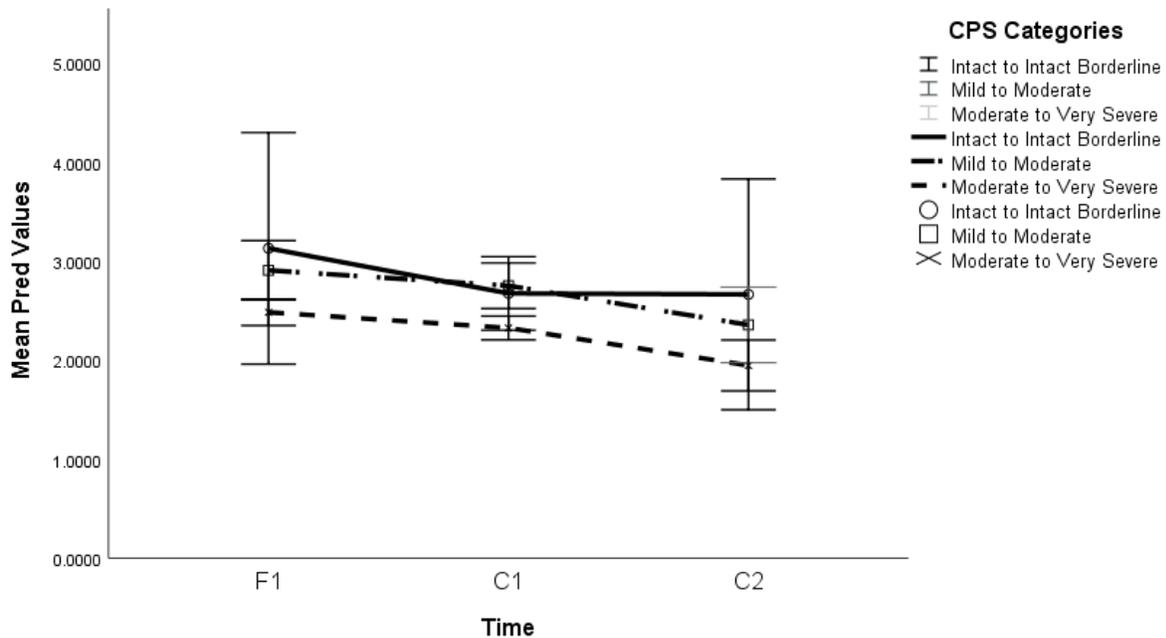


Figure 7. Mean plot of the predictive values over time for CPS. CPS was divided into three categories.

Total psychiatric diagnoses displayed a positive correlation with psychotropic medication. When the number of psychiatric diagnoses increased by 1, psychotropic medication increased by 0.271 ( $p = .013$ ; Table 17). These results were also demonstrated by the mean plot of binned total diagnoses over time (no diagnosis, one diagnosis, more than one diagnosis; Figure 8). The highest trend line was the “more than one diagnosis” category. Therefore, individuals with more than one diagnosis were more likely to receive a higher number of psychotropic medications when compared to the no diagnosis and one diagnosis subgroups. In C2, large confidence intervals were present when examining the predictive mean number of

psychotropic medications for individuals with more than one psychiatric diagnosis. This finding may have emerged due to the reduction in the number of participants from 120 to 78.

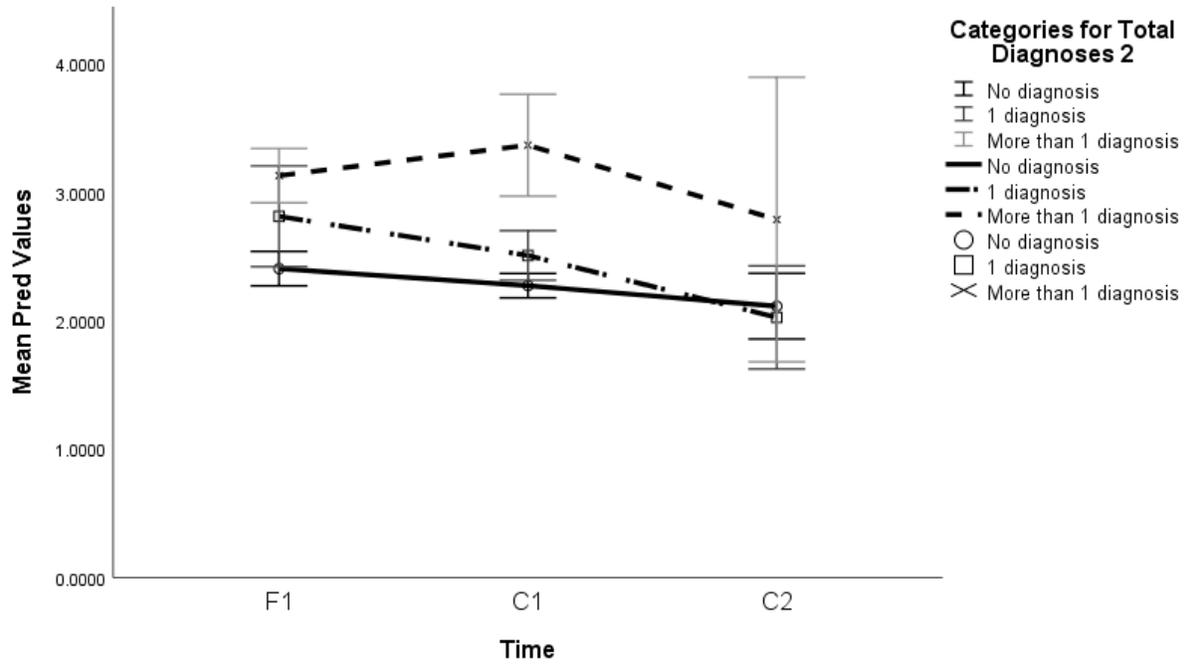


Figure 8. Mean plot of the predictive values over time for total psychiatric diagnoses.

Pain displayed a positive relationship between psychotropic medication usage. When Pain increased by 1, psychotropic medication increased by 0.512 ( $p = .031$ ; Table 17). These results were visually displayed when Pain was divided into no pain and pain subcategories (Figure 9). The pain category produced the higher trendline across F1, C1, and C2 when compared to the no pain category. No significant relationships were found when Pain was examined with its interactions with the time variables ( $p > .05$ ).

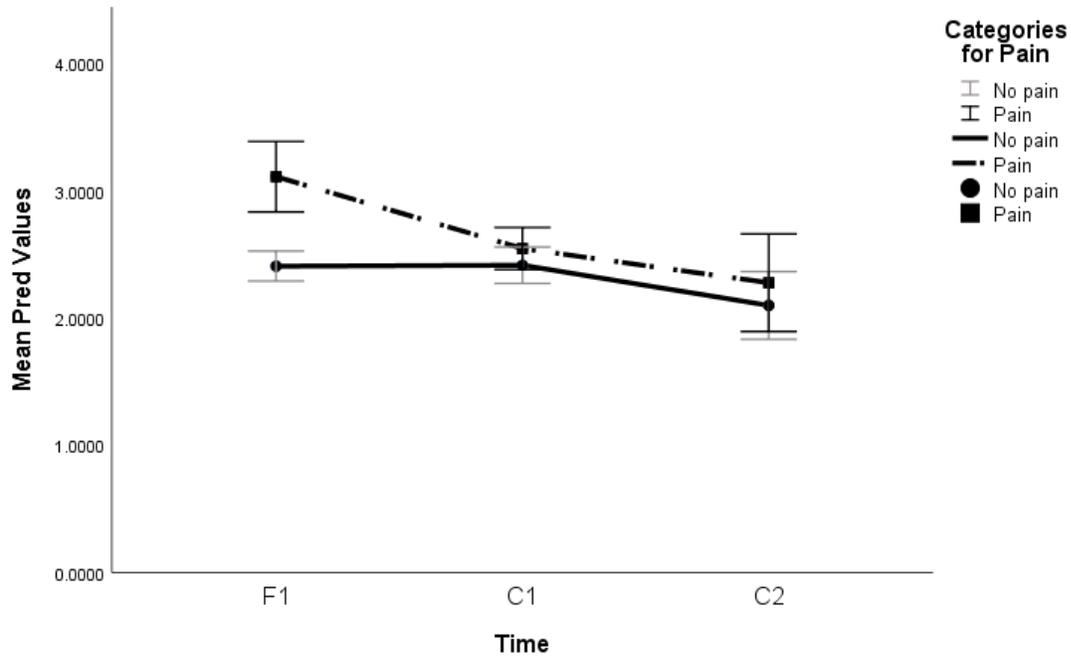


Figure 9. Mean plot of the predictive values over time for pain.

The relationship between CHES and psychotropic medication varied across settings and over time. Overall, when the CHES score increased by 1, (the participant had worse health) psychotropic medication increased by 0.639 ( $p = .015$ ; Table 17). This relationship was not consistent when examining the interactions of CHES with time. When individuals transitioned from the facility to the community (FC Change), an increase in the CHES by 1 resulted in a decreased in psychotropic medication usage by 0.765 ( $p = .010$ ). Therefore, when individuals exhibited more health stability (better health) during this transition, the number of psychotropic medications was higher. CHES and CC change was not significant ( $p = .701$ ). These results were also demonstrated by the mean plot (Figure 10). The graph suggests that in F1 when CHES was “unstable”, the predictive number of psychotropic medications was higher than “not at all unstable”. However, individuals with an unstable CHES and those that were not at all

unstable appeared to have similar predictive values in C1 and C2. These findings aligned with Table 17, which indicated that the CHESS interaction with FC Change was inversely related to psychotropic medication usage (Estimate = -0.765,  $p = .010$ ).

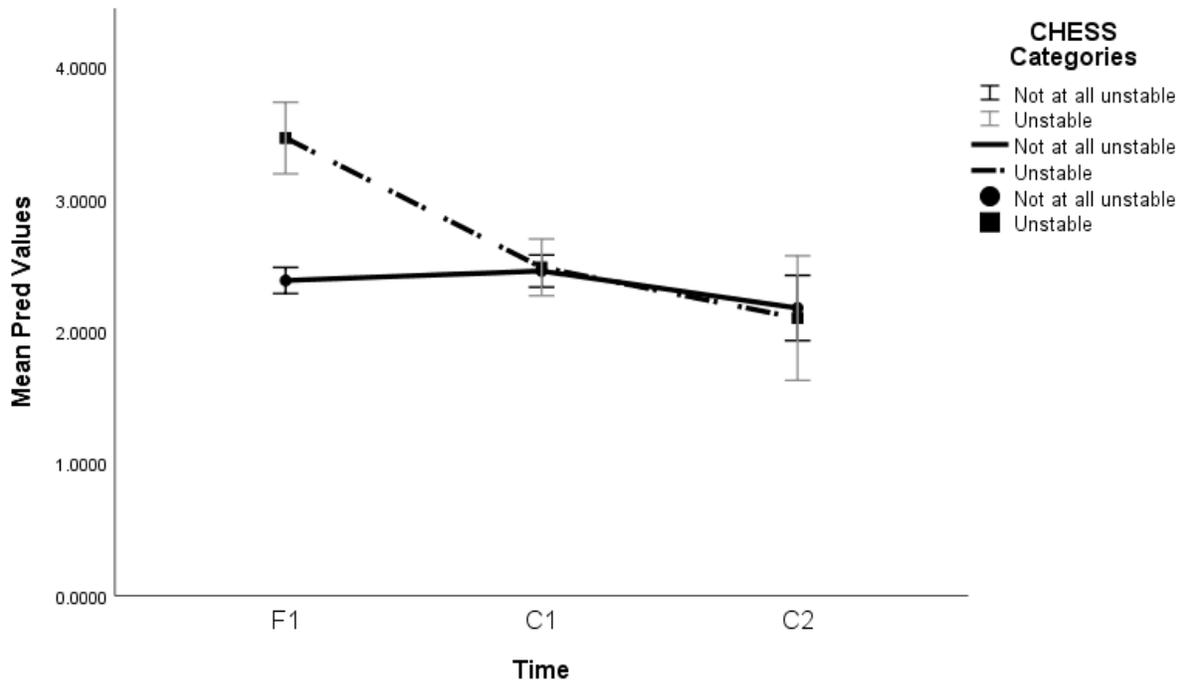


Figure 10. Mean plot of the predictive values for CHESS over time.

**Post Hoc Analyses**

In order to further investigate the anomalous finding that CB did not predict the total number of psychotropic medications in our sample, post hoc analyses were conducted to examine the differences between the ABS (used in this study) and the BPI (used in other studies) in C1. First, a Pearson correlation analysis was conducted to examine the relationship between the BPI and the ABS at C1. The BPI and the ABS at C1 were not significantly correlated ( $p = .099$ ; Table 19).

Table 19

*Pearson Correlations of ABS, BPI, and Psychotropic Medications at CI*

Variables	1	2	3
1. ABS	-	.155	.229*
2. BPI	-	-	.304**
3. Total psych meds	-	-	-

*Note.* \* $p < .05$ . \*\* $p < .001$

Secondly, interquartile ranges were examined across BPI and ABS (Figure 11, Figure 12, Table 20). The interquartile ranges for ABS were 0, 2, and 4 for 25%, 50%, and 75%, respectively. For the BPI scale, the 25% score was 8, followed by 17 and 31 for the 50% and 75% scores, respectively. These findings suggested that there were discrepancies across the distribution of the variables. For the ABS, the 25% quartile was 0. This result showed that 25% of the participants received scores of zero on the ABS. In contrast, the 25% quartile for the BPI was 8, which demonstrated that the lowest scoring individuals did not receive mostly scores of 0 on the BPI. For ABS, the median was 2 on the 12-point ABS scale. Conversely, for the BPI, the median score was 17 on the 66-point BPI measure. Lastly, the 75% quartile score for ABS was 4. In contrast, the 75% score on the BPI was 31. These findings emphasized that participants overall scored lower on the ABS than the BPI. This analysis lends supports to the lack of correlation across these scales, which indicated that the ABS did not measure CB in a way that aligned with the BPI.

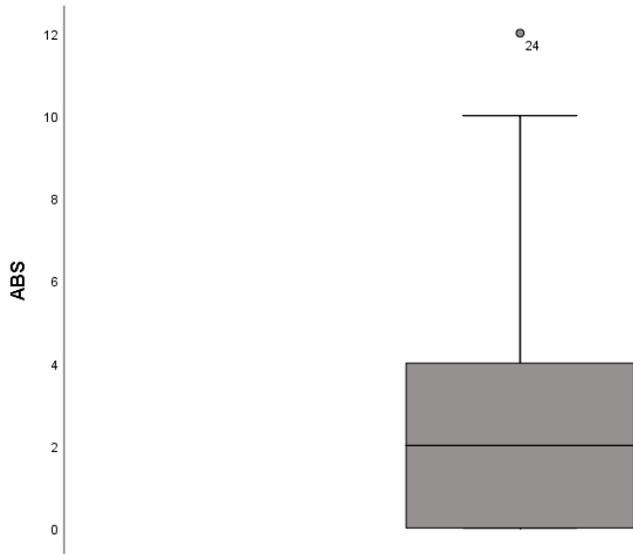


Figure 11. Boxplot of ABS at C1.

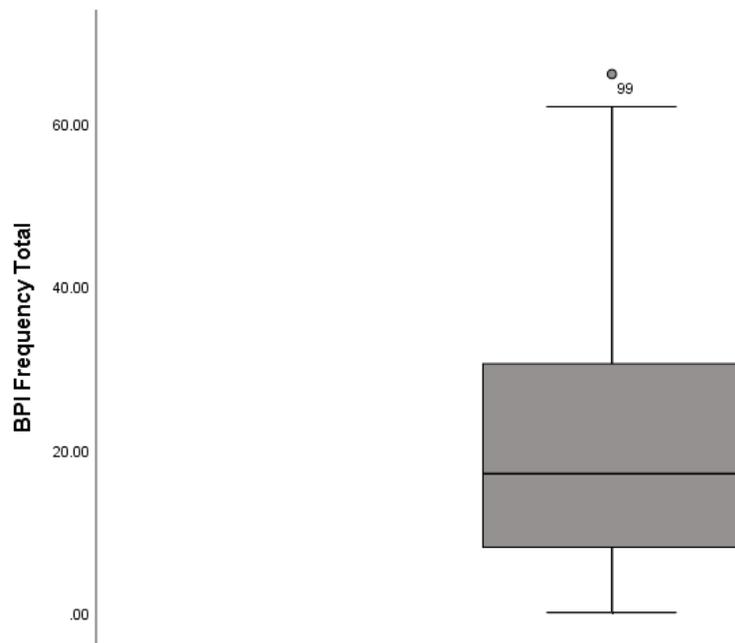


Figure 12. Boxplot of BPI at C1.

Table 20

*Interquartile Ranges of ABS and BPI at CI*

		Scales	
		ABS	BPI
<i>N</i>		119	115
Minimum		0	0
Maximum		12	66
Percentiles	25%	0	8
	50%	2	17
	75%	4	31

**Summary of Findings**

The findings of the multilevel model demonstrated that some that some individual characteristics contributed positively or negatively to the total number of psychotropic medication while others were not significant predictors.

Health instability, pain, and total psychiatric diagnoses predicted higher numbers of psychotropic medication. Health instability contributed most to the model, in that, when health instability increased, psychotropic medications increased by 0.639. Pain also contributed to model. When pain symptoms went up by one unit, medication usage increased by 0.512. Total psychiatric diagnoses positively influenced psychotropic medications. When an individual had one more diagnosis, psychotropic medications increased by 0.271. Given that health instability, pain, and psychiatric diagnoses were scored on a scale from zero to four (see measures), it can be concluded that health instability and pain influenced the model more than the number of psychiatric diagnoses.

Other individual characteristics were inversely related to the total number of psychotropic medications. The interaction between health instability and facility to community change negatively predicted the number of psychotropic medications. Therefore, when health instability increased (participants had worse health) as individuals transitioned from the facility to the community by a unit of one, psychotropic medication decreased by 0.765. This finding demonstrated that the influence of health instability changed across time and settings. Lastly, cognitive performance was inversely related to psychotropic medication. When the cognitive performance scale increased by one (individuals had lower cognitive performance), psychotropic medication decreased by 0.132. However, the health instability measure was scored from zero to four while cognitive performance was evaluated from zero to six. The differences in scales should be noted when considering the influences of each predictor.

Lastly, certain characteristics did not predict the number of psychotropic medications despite being expected to. In particular, aggression did not influence the model. Similarly, although the number of psychiatric diagnoses influenced the model, negative and depression symptoms did not. These findings may have emerged due to the types of measures that were used in the study.

### **Discussion**

This study examined changes in psychotropic medication usage among a group of individuals with ID who experienced deinstitutionalization in Ontario. Specifically, this study evaluated individual characteristics that predicted the number of psychotropic medications prescribed. Three research questions were investigated using descriptive summaries, correlational analyses, and multilevel models. This discussion outlines the answers to these

research questions, the wider implications of the results, strengths and limitations of the study, and steps for future research.

Descriptive statistics were examined to evaluate the mean number of psychotropic medications at each point in time. Correlational analyses were conducted to investigate any relationships between individual characteristics and psychotropic medication usage. Multilevel analyses were implemented to examine predictors of the number of psychotropic medications over time. The final multilevel model was developed from four main models. The first model, or null model, only consisted of the outcome variable, the total number of psychotropic medications. The second model (null growth model) included the FC and CC change variables entered as fixed effects, and time (F1, C1, C2) entered as a random effect. The base model added age and adaptive functioning as fixed effects. Base models with substantive predictors were tested, which included entering one variable and its interaction with FC and CC changes one at a time into the model. This process was completed for each potential predictor. The individual characteristics that did not contribute to this particular model were CB, the total number of medical diagnoses, depression symptoms, negative symptoms, adaptive functioning, age, and sex. The final model was created based on the information criterion values and the significance of predictors. This final model included age, adaptive functioning, health instability, the interactions between health instability and FC and CC changes, Pain, the interactions between Pain and FC and CC changes, and total psychiatric diagnoses as fixed effects. Cognitive performance, health instability, the interaction between health instability and FC Change, Pain, and the total number of psychiatric diagnoses predicted the number of psychotropic medications.

**Research Question 1: What is the mean number of psychotropic medication usage across each point in time?**

The means of psychotropic medication frequencies were high across each point in time in this sample. These findings suggested that after relocating to the community, the number of psychotropic medications increased but over time, psychotropic medication usage decreased below the frequencies at the facilities. Nonetheless, these results emphasized the high number of psychotropic medications currently prescribed to individuals with ID in Ontario.

The high numbers of psychotropic medications prescribed to this population aligned with previous studies that examined psychotropic medication usage among individuals with ID who experienced deinstitutionalization (McGillivray & McCabe, 2005; Nottestad & Linaker, 2003). Nottestad and Linaker (2003) examined psychotropic medication trends following deinstitutionalization. In both 1987 and 1995, the authors found that 50% and 54% of the participants were prescribed psychotropic medications, respectively. McGillivray and McCabe (2005) examined psychotropic medications among individuals living in the community and institutions in 1993 and 2000. The authors determined that the number of psychotropic medications per person ranged from 1.4 to 1.72. Both the current study and the McGillivray and McCabe (2005) study included pro re nata (PRN; as needed) psychotropic medications in the analyses. Therefore, the slightly higher number of psychotropic medications in the current sample may be linked to the fact that individuals who were still residing in Ontario institutions may have presented with a higher number of health and mental health challenges when compared to the participants in the McGillivray and McCabe (2005) study, in that this more recent sample had increased access to healthcare, mental healthcare, and medication than their counterparts from roughly a decade earlier.

The changes in the number of psychotropic medications before and after deinstitutionalization varied depending on the study (McGillivray & McCabe, 2005; Nottestad & Linaker, 2003). McGillivray and McCabe (2005) indicated that in 1993, individuals living in the institutions and community were prescribed, on average, 1.4 and 1.45 psychotropic medications, respectively. In the 2000 sample, individuals who resided in the institution were prescribed, on average, 1.72 psychotropic medications while individuals living in the community were prescribed an average of 1.51 psychotropic medications. These findings suggested increased total numbers of psychotropic medication among individuals residing in facilities when compared to community living. However, the current study found that an initial increase in the number of psychotropic medications followed by a subsequent decrease in the number of psychotropic medications over time in the community. The initial increase in the number of psychotropic medications may have occurred due to individuals experiencing the major life change of relocating to community settings. However, over time, the total number of psychotropic medications decreased, possibly due to individuals adapting to their new community settings. In contrast, Nottestad and Linaker (2003) did not find any changes in either the frequency of people using psychotropic medications or dosage of psychotropic medications following relocation to community settings. These differences between the current study and past studies may have occurred as psychotropic medications were examined across three points in time rather than two. It is possible that, if previous studies had included additional points in time, they may have detected similar changes as individuals adjusted to community settings.

**Research Question 2: What is the relationship between psychotropic medication, age, sex, cognitive performance, adaptive behaviour, medical diagnoses, serious health conditions, pain, psychiatric diagnoses, depression, pain, and challenging behaviour?**

To examine the relationships between psychotropic medications and the potential variables of interest, Pearson correlations were conducted. The total number of psychiatric diagnoses, total medical diagnoses, and adaptive functioning were significantly correlated to the total number psychotropic medications. Age, adaptive functioning, cognitive performance, CB, pain, anhedonia, and health instability were not significantly correlated with the number of psychotropic medications.

In the current study, demographic variables, such as age and sex, were not significantly correlated with the number of psychotropic medications. The lack of correlation between sex and psychotropic medication aligned with previous studies as both Deb et al. (2015) and O'Dwyer et al. (2016) determined that sex was not significantly associated with daily antipsychotic dosages and polypharmacy status, respectively. Further, when Sheehan et al. (2015) conducted a univariable analysis, they determined that sex was not significantly associated with new antipsychotic prescriptions. In contrast, the lack of significant relationships between age and psychotropic medication usage did not align with previous studies (Deb et al., 2015; O'Dwyer et al., 2016; Sheehan et al., 2015). Deb et al. (2015) found that age was significantly correlated with daily antipsychotic dosage. Similarly, O'Dwyer et al. (2016) and Sheehan et al. (2015) determined that the age was significantly associated with polypharmacy status and new antipsychotic prescriptions, respectively. The findings from the current study may have differed from previous studies because age was entered as a continuous variable, rather than categorized into age groups.

Better adaptive functioning was positively correlated with polypharmacy. In contrast, cognitive functioning was not correlated with the total number of psychotropic medications. Better adaptive functioning (i.e., a lower score on the IADL-Perf) was associated with a higher number of psychotropic medications. However, the magnitude of this association was low ( $r = -.12$ ). These findings could suggest that, in this sample, individuals with more skills may not have experienced better mental health or benefitted from other types of therapy not accessible to those with fewer skills. Although Deb et al. (2015) did not examine adaptive functioning and cognitive performance, specifically, the authors determined that the severity of ID was not significantly correlated with antipsychotic dosage. Therefore, the findings in the current study may not have aligned with previous research due to the implementation of different measures.

The total number of medical diagnoses was positively correlated with polypharmacy, while health instability and pain were not. These findings suggested that individuals experiencing more medical challenges may be prescribed more psychotropic medications. Conversely, Sheehan et al. (2015) examined types of medical diagnoses, rather than a total number. The authors found that dementia was significantly associated with antipsychotic prescription incidence in univariable analyses, while epilepsy was not associated. Additionally, O'Dwyer et al. (2016) conducted bivariate analyses and found that specific chronic diseases (i.e., neurological, gastrointestinal, joint disease, endocrine disease, and hypertension) as well as reported pain were associated with polypharmacy. Therefore, both the current study and previous research demonstrated that, to a certain extent, psychotropic medication may be associated with health status variables.

Depression symptoms and the number of psychiatric diagnoses were significantly correlated with the total number of psychotropic medications. In contrast, anhedonia was not

significantly correlated with the number of psychotropic medications. Certain studies found a significant relationship between psychiatric diagnoses and psychotropic medication usage (e.g., O'Dwyer et al., 2016; Sheehan et al., 2015), while other studies did not (e.g., Deb et al., 2015; Perry et al., 2018). O'Dwyer et al. (2016) determined that mental health was significantly associated with polypharmacy status. Sheehan et al. (2015) also reported that severe mental illness, autism, depression, and anxiety were significantly associated with the incidence of antipsychotic medications in a univariable analysis. These findings were similar to the current study as the presence of mental health diagnoses was significantly associated with the total number of psychotropic medications. Further, scores on the DRS in the current study were significantly correlated with the total number of psychotropic medications, which is consistent with Sheehan et al. (2015)'s finding that the presence of depression was significantly associated with new antipsychotic prescriptions. In contrast, both Deb et al. (2015) and Perry et al. (2018) determined that psychiatric co-morbidity did not produce significant correlations with antipsychotic medication daily dosage and the use of psychotropic medication, respectively. Therefore, the results of these studies indicated that psychotropic medication may be prescribed to manage CB, rather than to treat psychiatric diagnoses (Deb et al., 2015; Perry et al., 2018). In contrast, the findings of O'Dwyer et al. (2016), Sheehan et al. (2015) and the current study suggest that, to a certain extent, a link between psychotropic medication and psychiatric diagnoses exist.

In the current study, the total number of psychotropic medications was not significantly associated with CB. Past research was not consistent with these findings as most demonstrated a significant correlation between CB and psychotropic medications (e.g., Bowring et al., 2017a; Deb et al., 2015). Bowring et al. (2017a) conducted Chi-square analyses to examine the

relationships between CB and psychotropic medication. CB was associated with psychotropic medication, as individuals with CB were twice as likely to be receiving psychotropic medication. Similarly, Deb et al. (2015) reported that the severity of aggressive behaviour, property destruction, and SIB were significantly correlated with daily antipsychotic dosage. The current study examined the total number of psychotropic medications, rather than antipsychotic dosage (Deb et al., 2015) or defined daily dosage (Bowring et al., 2017a), which could account for the different results. It is also possible that the psychotropic medication was having the desired effect of decreasing CB for some individuals, which could have impacted the results.

**Research Question 3: Does age, sex, cognitive performance, adaptive behaviour, medical diagnoses, serious health conditions, pain, psychiatric diagnoses, depression, pain, and challenging behaviour predict the total number of psychotropic medications? What are the relative influences of each variable? Do these influences change over time and across settings?**

With the use of a multilevel model, this study demonstrated that over time and across settings, the total number of psychotropic medications decreased. This change was shown by the total number of psychotropic medications decreasing when the time variables (FC and CC change) were included in the final model. Health instability, pain, and the total number of psychiatric diagnoses were positively related to psychotropic medication usage. Cognitive performance and the interaction between health instability and facility to community change were inversely related to polypharmacy. Lastly, aggression (as measured using the ABS) did not predict psychotropic medication, despite the hypothesis that it would (Bowring et al., 2017a; Nottestad & Linaker, 2003; Perry et al., 2018). Similarly, age, sex, adaptive functioning,

negative symptoms, depression symptoms and total number of medical diagnoses did not contribute to the model.

In the final model, age and sex were not significant predictors of the total number of psychotropic medications. These findings differed from other studies that implemented multivariate analyses (Bowring et al., 2017a; Tsiouris et al., 2013). In 2017, Bowring et al. conducted a generalised linear model to examine the associations between psychotropic medications and certain individual characteristics. The authors found that older age predicted psychotropic medication usage ( $RR = 1.05, p < .001$ ). Additionally, male sex increased the number of antipsychotic medications prescribed ( $RR = 2.42, p = .005$ ). In contrast, Tsiouris et al. (2013) conducted a multivariate analysis and determined that sex did not significantly predict the number of psychotropic medications. Although age did not predict the incidence of psychotropic medication, individuals who had received medications previously had a decrease in rate of 6% medications per year. The current study examined the number of psychotropic medications, rather than only antipsychotic medications or the likelihood of starting psychotropic medications. Including specific classes of psychotropic medication or other outcome variables, such as psychotropic medication incidence, may have revealed different relationships.

In the current study, better cognitive performance predicted higher numbers of psychotropic medication. Bowring et al. (2017a) determined that when severe-profound ID was included in a generalised linear model, this variable did not predict psychotropic medication usage. In contrast, O'Dwyer et al. (2017) examined psychotropic medication following deinstitutionalization among adults with ID with a multinomial logistic regression. The authors determined severe/profound ID significantly predicted psychotropic medication (odds-ratio;  $OR = 2.26; p = .032$ ). Lastly, Tsiouris et al. (2013) determined that IQ differences did not increase

the number of psychotropic medications. Therefore, previous research was mixed in terms of the influence of individual characteristics on psychotropic medication, which aligned with the current study as cognitive performance was significant while adaptive functioning was not. However, given the lack of consistent measures, direct comparisons across studies were difficult, as these studies did not specifically use measures on the interRAI-ID.

For the overall model, health instability predicted higher numbers of psychotropic medications. Therefore, the less stable an individual's health (worse health), the more medications he or she was prescribed. O'Dwyer et al. (2016) examined various types of health conditions and found that neurological, endocrine, and hypertension diseases were significant predictors of polypharmacy in a multinomial logistic regression. Further, in 2000, Robertson et al. determined that certain health-related variables, such as not having impaired mobility and epileptic fits predicted antipsychotic and antianxiety psychotropic medications, respectively (Partial  $r = .1646$ ;  $p < .0001$ ; Partial  $r = .1192$ ;  $p > .01$ ). While the current study found that health instability positively predicted the total number of psychotropic medications, total medical diagnoses did not influence the overall model. Therefore, the presence of epilepsy, in contrast to Robertson et al. (2000), did not predict psychotropic medication. Variables relating specifically to health stability were not explored in other multivariate analysis studies (e.g., Bowring et al., 2017a; O'Dwyer et al., 2017; Nottestad & Linaker, 2003; Robertson et al., 2000).

The magnitude and direction of health instability as a predictor of polypharmacy changed across settings and over time. For the overall model, health instability positively predicted polypharmacy. In contrast, individuals who transitioned to the community with lower health instability (i.e., more stable health) were prescribed higher numbers of psychotropic medications. In 2000, Robertson et al. found that improved mobility predicted psychotropic medication usage.

Participants who engaged in CB with improved mobility could potentially be perceived as more dangerous to themselves, staff, and other residents. This finding could be linked to the current study, in that individuals with more stable health were more likely to be prescribed psychotropic medications when transitioning from the facility to the community than individuals with worse health. It is possible that if an individual had more severe health problems, he or she was less mobile and in turn, received less psychotropic medication to manage CB. Secondly, it is possible that individuals with worse health received less psychotropic medications when entering the community as health symptoms may have been treated more effectively in community settings due to the enhanced transition planning for this group of individuals.

Pain was a positive predictor of psychotropic medication. This finding aligns with previous research conducted by Myers and Myers (2017). The author reported that when an individual experiences pain and is not able to communicate this distress, CB may emerge as a form of communication. Similarly, Charlot et al. (2011) examined non-psychiatric health concerns among individuals with dual diagnoses residing in in-patient settings. The authors indicated that physical distress arising from biomedical problems may increase CB. In the current study, the number of psychotropic medications was significantly correlated with the number of medical problems. Although the current study did not find a predictive relationship between medical diagnoses and the total number of psychotropic medications, pain was a significant predictor. Therefore, it is possible that individuals with ID with more pain communicated this distress with CB. This notion was further supported by the fact that pain was significantly correlated with aggression.

The number of psychiatric diagnoses slightly predicted polypharmacy. Many studies suggested that mental health diagnoses predict psychotropic medication usage (Bowring et al.,

2017a; Nottestad & Linaker, 2003; Tsiouris et al., 2013). Bowring et al. (2017a) reported that the presence of a psychiatric diagnosis predicted psychotropic medications in a generalised linear model. When Nottestad and Linaker (2003) conducted a stepwise regression, certain types of psychiatric disorders were significant predictors of the defined daily dosage of neuroleptic medications. In particular, adjustment and affective disorder increased psychotropic medication dosage ( $\beta = .21, p = .032$ ;  $\beta = .21, p = .032$ , respectively). Lastly, Tsiouris et al. (2013) determined that bipolar and psychosis disorders were predictors associated with the use of antipsychotic, mood-stabilizer, and antianxiety medications. The presence of depression was also a significant predictor associated with using antidepressants.

These previous findings aligned with the current study as psychiatric diagnoses predicted psychotropic medication. However, an analysis of specific psychiatric diagnoses as predictors, (e.g., the presence of schizophrenia) was not conducted in the current study. Although the DRS and NSS were used as potential predictors, these scales were not used as dichotomous variables that represented having a depression diagnosis or not. Perhaps analyzing the presence or absence of specific diagnoses may have revealed stronger relationships with psychotropic medication usage. The predictive relationship between psychiatric diagnoses and the total number of psychotropic medications suggested that psychotropic medications may have been appropriately prescribed to treat psychiatric conditions for a significant portion of the sample. It is possible that the transition planning and funding process for these study participants afforded them more access to health and mental health care than more recent population-based samples in Ontario. For example, Lunsky et al. (2017) recently reported that 28.91% of their sample of ( $N = 20,316$ ) were prescribed antipsychotic medications without having a psychiatric diagnosis.

CB did not significantly predict the number of psychotropic medications in this model. These findings contradicted many studies that examined the influence of CB on psychotropic medication usage (Bowring et al., 2017a; Nottestad & Linaker, 2003; Robertson et al., 2000; Tsiouris et al., 2013). Nottestad and Linaker determined that CB was the most influential predictor of neuroleptic dosage. Similarly, Bowring et al. (2017a) found CB to be a significant predictor associated with psychotropic medication usage ( $RR = 1.565, p = .02$ ). Certain classes of psychotropic medication have also been predicted by CB variables (Robertson et al., 2000). For instance, more CB (Aberrant Behaviour Checklist; ABC; Aman, Burrow, Wolford, 1995) was associated with the regular use (non-PRN) antipsychotic medication (Partial  $r = .1533, p < .0001$ ) and antianxiety medication usage (Partial  $r = .2900, p < .0001$ ). Similarly, Tsiouris et al. (2013) found aggression to be a significant predictor associated with antipsychotic, antidepressant, mood-convulsant, and antianxiety medications ( $p < .001$ ).

CB may not have predicted the total number of psychotropic medications due to the use of the ABS. CB is frequently measured by using the BPI (Bowring et al., 2017a; Bowring et al., 2017b). In the current study, the ABS scale from the interRAI-ID was used to measure CB. Given the circumstances of the FI study, new data collection did not begin until C1, and the BPI was not used in the facility. The current study also examined a CB variable that was somewhat modeled after the BPI by adding up the number of CBs that were endorsed on the interRAI-ID. That variable was highly correlated with the ABS and would likely have produced similar findings to the ABS scale, so the scale was retained in the model. Post hoc analyses of the relationship between the BPI and the ABS at C1 were carried out to help to decipher this seemingly anomalous result.

Post hoc analyses revealed that ABS may not have represented all types of CB. At C1, the BPI was not significantly correlated to the ABS. This finding indicated that the BPI and the ABS may have measured different aspects of CB. The BPI targeted aggression/destructive behaviour, SIB, and stereotypy while the ABS only measured aggression. A recent total population study found that of the 18.1% of individuals with ID engaged in CB, 10.9% and 7.5% of individuals with ID engaged in stereotyped and self-injurious behaviours (Bowring et al., 2017b;  $N = 265$ ). These types of CB were not captured by the ABS. It is possible that if the BPI was used to measure for CB rather than the ABS, CB may have predicted the number of psychotropic medications in the model. In this study, aggression did not predict the total number of psychotropic medications. In contrast to the current study, other researchers examined changes across specific classes of psychotropic medications, such as antipsychotic medications (Robertson et al., 2000; Tsiouris et al., 2013) or dosages of psychotropic medications (Nottestad & Linaker, 2003).

### **Implications of the Findings**

This study will add to the current breadth of research that examines psychotropic medication among former residents in Ontario. Many studies did not evaluate changes in outcomes of deinstitutionalization after the individuals had been living in the community for an extended period (McGillivray & McCabe, 2005; Nottestad & Linaker, 2003; Robertson et al., 2000). By observing changes over time in the community, the field may better understand how former residents have adapted to the major life changes of deinstitutionalization. Despite over 50 years of research, there are still jurisdictions providing institutional care. These findings lend support to previous research and policies recommending deinstitutionalization of individuals with ID and encourage other jurisdictions to embark on this process.

This study highlights the importance of conducting multivariate analyses to understand the influence of various characteristics on polypharmacy. Many variables that were significantly correlated with the total number of psychotropic medications, including aggression, adaptive functioning, and depression symptoms, did not predict polypharmacy in the final model. Although certain variables, such as aggression, may not have influenced polypharmacy due to measure limitations, the differences across statistical analyses should be noted. This study lends support to the continued use of multivariate analyses to understand predictors of polypharmacy rather than only investigating bivariate relationships. Secondly, the incorporation of a multilevel model ensures that the current study accounts for within-person variation while examining between-person changes.

This study is impactful as it is the first multilevel model applied to examine psychotropic medication changes among individuals with ID who experienced deinstitutionalization. No studies to date were found that implemented a multilevel model to examine psychotropic medication usage among this group of individuals. Although other studies implemented multilevel analyses to examine psychotropic trends among individuals living in nursing homes (Mazieres, Lapeyre-Mestre, Vellas, Barreto, & Rolland, 2015; Sonntag, Matschinger, Angermeyer, & Riedell-Heller, 2005), these participants did not have ID diagnoses. Further, certain studies examined psychotropic medications with multilevel analyses among individuals with ASD, but only among children (Rubin, Feudtner, Localio, & Mandell, 2009). Therefore, this study expands the breadth of research examining psychotropic medication patterns among individuals with ID by accounting for both within and between- subject changes over time. This could be applied to treatment model by providing a longitudinal analysis across multiple points in time that compare an individual to the population level.

In addition to increasing the breadth of psychotropic medication research, applying this knowledge practically and clinically is important. Many studies emphasized that individuals with ID have a history of being prescribed multiple psychotropic medications (Sheehan et al., 2015; Sullivan et al., 2018). Individuals with ID face increased risk of side effects of psychotropic. Continually improving prescribing practices among individuals with ID is critical as individuals with ID may not always be able to advocate for prescribing practices changes (Sullivan et al., 2018). This research provides evidence that can inform prescribing practices in Ontario by influencing physicians and policymakers' decisions when treating individuals with ID. Specific consideration could be made towards individuals exhibiting characteristics that predict a higher number of psychotropic medications, such as worse health, pain and having more than one psychiatric diagnosis. This could include informing the revision of current guidelines as well as teaching physicians to recognize potential biases when working with individuals with ID.

Health status variables, including health instability and pain, predicted psychotropic medication in this model. This finding indicated that for the overall model, as health instability worsened, the number of psychotropic medications increased. Similarly, as an individual experienced more pain, the number of psychotropic medications he or she received increased. It is critical that these health variables are considered as potential setting events for CB as the presence of certain symptoms could increase the likelihood that an individual engages in CB. For instance, Moss et al. (2005) reported that seven out of eight children with Cornelia de Lange syndrome exhibited self-injurious behaviour when certain setting events were present, such as extreme fatigue. Similarly, Carr et al. (2003) found menstrual discomfort to be a biological setting event for severe CB. These studies highlighted the importance of considering health variables when treating CB.

The impact of health issues on challenging behaviour is supported by Sullivan et al.'s (2018) guideline regarding CB. The authors stated that possible health problems should be considered when evaluating CB. To enhance these guidelines, individuals facing increased health risks and daily pain should have a higher frequency of check-ins with their physicians. Sullivan et al. (2018) indicated that reviews for medication usage should occur every three months. For individuals with health instability and daily pain, evaluating the influence of these psychotropic medications more frequently could ensure that these medications are not mismanaged and overprescribed to treat CB. Secondly, physicians should be trained to recognize this potential bias among individuals with ID. Emphasis should continue for evaluating biological causes of CB, such as pain and medical diagnoses, prior to prescribing psychotropic medications to manage these behaviour changes. These strategies align with the Behaviour Analyst Certification Board (BACB; 2014) Professional and Ethical Compliance Code, which stated that medical consultation should occur to rule out the possibility that biomedical conditions caused the CB. This strategy should be applied when physicians are treating CB, in that, health conditions and pain should be ruled out prior to prescribing psychotropic medications to reduce CB.

Another important finding in this study was that the number of psychiatric diagnoses predicted the number of psychotropic medication usage. As psychiatric diagnoses increased, the number of psychotropic medications increased as well. Additionally, in C2, the number of psychotropic medications prescribed among individuals with more than one psychiatric diagnosis was widely distributed. Sullivan et al. (2018) described how psychiatric disorders should be screened continually by monitoring changes in behaviour and mental state. This screening process is particularly relevant for individuals with mental illness comorbidities as they could be prescribed psychotropic medication across different classes to treat multiple psychiatric

symptoms. As such, this group faces a risk of overmedication and side effects from polypharmacy combinations (Lunsky et al., 2017). However, Sullivan et al. (2018) did not provide specifics regarding how frequently these assessments should be conducted. Given that individuals with more than one diagnosis are more likely to receive large ranges of psychotropic medications than individuals with one diagnosis or no diagnoses, more consistent monitoring may be beneficial to ensure that medications are prescribed for treating psychiatric symptoms appropriately.

This study emphasizes the importance of using the biopsychosocial approach when assessing and treating individuals with ID. This approach considers CB to be influenced by biological, psychological, and socioenvironmental factors (Gardner, Griffiths, & Hamelin, 2012). In the current study, health status variables, including health instability and pain, predicted the number of psychotropic medications. This finding could be directly linked to the biological component of the triad of the biopsychosocial model. It is possible that more pain or health conditions increased the likelihood that participants engaged in CB and as a result, led to increased psychotropic medications. Conversely, the number of psychiatric diagnoses and cognitive performance fall within the psychological component of the triad. Psychological variables that contribute to CB may include the excess of certain characteristics or a lack of central processing skills (Gardner et al., 2012). For instance, an individual with a schizophrenia diagnosis may respond differently to distress-producing conditions than an individual without that diagnosis. Although Sullivan et al. (2018) briefly mentioned the biopsychosocial approach, limited information is provided to help professionals conduct assessments within this model. Future prescribing policies may include additional information and training for physicians and

mental health professionals to teach them how to assess individuals with ID within the biopsychosocial model.

The social component of the biopsychosocial triad relates to the environmental conditions, relationships, settings and other external variables that may influence CB. Behaviour analytic approaches focus on determining the function of CB and selecting corresponding treatments (Hanley, Iwata, & McCord, 2003). Research has found that the use of interventions based on the results of functional analyses were more predictive of successful outcomes than the specific type of behavioural intervention (National Institutes of Health, 1991), highlighting the importance of considering the function of CB when designing treatments. One such intervention includes functional communication training (FCT; Carr & Durand 1985). FCT is a function-based procedure that uses differential reinforcement to teach appropriate communicative responses while extinguishing CB. FCT is a well-established intervention for CB among children with ID and or ASD and probably efficacious with adults (Kurtz et al., 2011). Although multiple researchers emphasized the importance of including function-based interventions during treatment (Gardner et al., 2012; Kurtz et al., 2011), psychotropic medications are frequently relied on despite not targeting the function of CB. In fact, Cox and Virues-Ortega (2015) determined that psychotropic medications might induce changes in the function of CB. Therefore, physicians and behaviour analysts should be wary of the risks related to the use of psychotropic medication in isolation. Behaviour analysts should also consider that polypharmacy may influence the function of CB and therefore, psychotropic medication changes could impact the effectiveness of behavioural interventions. As such, behaviour analysts need to work collaboratively with medical professionals to monitor the impact of medication on treatment effectiveness.

The findings of this study could be used to teach individuals with ID, their family members, and support workers how to advocate for the most effective and least restrictive treatment. This is particularly important as Singh et al. (1996) emphasized that support staff and parents should be involved in decision making processes related to pharmacological intervention. Identifying individual characteristics that influence polypharmacy may help individuals with ID, family members, and support workers, understand the risk factors of polypharmacy. Sullivan et al. (2018) emphasized a person-centered approach when treating individuals with ID. The authors also discussed how to improve communication with patients and caregivers and that patients should be involved during primary care treatment. Although broad recommendations and tools were provided (e.g., Communicating Effectively tool), more thorough efforts could be made to involve clients and caregivers in the primary care process. This improved communication with individuals with ID is critical, especially considering the higher frequencies and large ranges of psychotropic medications among individuals with increased cognitive performance (e.g., intact to borderline intact).

Sullivan et al. (2018)'s guidelines included educating the persons and caregivers about the appropriate use of medications. Therefore, an explanation of characteristics that may increase an individual's risk of polypharmacy should be emphasized. Specific training could be provided to individuals with ID, caregivers, and support workers to ensure appropriate questions are asked when psychotropic medications are adjusted across an individual's life span. For instance, this could involve using behavioural skills training to teach staff, family members and individuals with ID how to recognize risk factors and to ask appropriate questions during primary care visits. Potential questions to be asked may include "Have underlying medical conditions been ruled out?" or "Are we sure that he is not engaging in CB because he is in pain?". Behavioural skills

training could be effective as this strategy has successfully been used to teach social and safety skills to adults with ID and other disabilities (Kornacki, Ringdahl, Sjostrom, & Nuerberger, 2013; Miltenberger et al., 1999) and to train staff (Parsons, Rollyson, & Reid, 2012).

### **Strengths**

Strengths of this study lie in the sampling of the participants. This population consisted of individuals who previously lived in three different institutions across Ontario. As such, this study included participants that relocated from various institutions, which contrasts other deinstitutionalization studies (e.g., Nottestad & Linaker 1999; 2003). Further, when individuals transitioned to community settings, participants relocated to various locations in Ontario. Therefore, this representation across Ontario reduced sampling biases related to location and institutions.

This study consisted of a multivariate analysis that examines predictors of psychotropic medication, which is a suggested method for improving current research regarding psychotropic medications among individuals with ID (Stortz et al., 2014). In particular, the use of a multilevel model that accounts for within-person variation while examining between-person change is a strength of the study. This is important because no studies to date have explored psychotropic medication patterns among individuals with ID following deinstitutionalization using this type of model (Mazieres et al., 2015; Rubin et al., 2009; Sonntag et al., 2005).

### **Limitations**

Several limitations arose during the development and implementation of this study. Primarily, for a multilevel model to be conducted, the variables of interest have to be consistent over time. For F1, the only measure collected was the interRAI-ID. As such, to examine this model across these three points in time using a multilevel model, only measures found on the

interRAI-ID could be included. Incorporating other validated measures may have revealed more variables with predictive relationships with psychotropic medication usage. Secondly, direct comparisons could be more easily made when referring to other studies that examined psychotropic medication predictors (Bowring et al., 2017a; Robertson et al., 2000; Tsiouris et al., 2003).

Another limitation of this study was that the total number of psychotropic medications was chosen as the outcome variable, rather than other medication related variables such as dosage, medication class, or the correspondence between medication classes and diagnoses. Selecting dosages as an outcome measure may have provided a more thorough understanding regarding the relationship between individual characteristics, (e.g., health, CB, adaptive functioning), and psychotropic medication dosage (Nottestad & Linaker, 2003). Examining specific classes of psychotropic medications (e.g., antianxiety, antipsychotic, anticonvulsant) as the outcome measure may have yielded different relationships as well. Additionally, including the alignment between diagnoses and medication classes within the model might have strengthened the findings. Finally, it is noted the outcome variable was not the presence or absence of polypharmacy and therefore, specific conclusions relating to polypharmacy cannot be drawn.

Other limitations arose when certain predictors were created by summing variables on the interRAI-ID. The total number of psychiatric diagnoses variable was created by adding the presence or absence of cognitive, mood, psychotic, and anxiety disorders. If a participant had more than one of these types of diagnoses (e.g., two anxiety diagnoses), this would be counted as only one diagnosis. Also, other disorders (e.g., trauma-related disorders, personality disorders) were not included. As such, this variable may have underestimated the number of mental health diagnoses for this population. Similarly, the total medical diagnoses variable consisted of

summing the presence or absence of certain health conditions to represent a summary of health status (i.e., asthma, cerebral palsy, diabetes mellitus, epilepsy or seizure disorder, hypothyroidism, and traumatic brain injury), however other health conditions were not included, potentially under representing the health needs of the sample.

This sample was restricted to individuals with ID who were relocated from the facilities to communities in Ontario, therefore the results might not generalize to other community samples. The majority of measures used in this study were completed by proxy by support staff, as only a small number of individuals with ID in the sample had the requisite communication skills (Condillac et al., 2012). Though respondent had considerable experience in supporting the participant, they could have allowed biases to influence their responses. However, studying only those individuals with ID who had the skills to respond firsthand would leave a substantial portion of individuals with ID out of this research and would not have been representative of the individuals who were relocated as part of the Facilities Initiative.

### **Future Steps**

Future directions include considering other outcome variables related to psychotropic medication usage, such as classes of psychotropic medication, dosage values, or incidence rates. An additional outcome variable could include examining polypharmacy specifically by dichotomizing psychotropic medication usage into groups of individuals receiving two or more psychotropic medications and individuals receiving less than two medications. If data could be collected at an additional point in time, the richer measures (i.e., BPI, etc.) could be used to inform the model, rather than only the interRAI-ID. The use of these measures may also prove to be beneficial as more direct comparisons could be made across studies that implemented similar measures (Bowring et al., 2017a). Separating PRN and regular medications, rather than

examining these medications together, may be an effective future step in understanding differences in predictors for both types of psychotropic medications. Further, considering the influence of general medications (non-psychotropic medication) could enhance the model of overall medication usage among individuals with ID. Lastly, this study included the last point in time for the facility for participants. Access to interRAI-ID data is available from all individuals who remained in the facilities from 2005 to 2008, and therefore, multiple data points within the institution are available for some participants. By incorporating these additional points of time into a multilevel analysis, a more thorough analysis of psychotropic medication changes over time could be obtained.

### **Summary and Conclusions**

In this study, a multilevel model revealed that the number of psychotropic medications decreased as individuals adjusted to living in their new communities. Cognitive performance, mental health status, pain and health conditions predicted the total number of psychotropic medications. However, the influence of worse health on the number of psychotropic medications changed as individuals transitioned into community settings. Understanding these predictors of medication usage may help policy makers to develop or revise recommendations and guidelines and could potentially inform prescribing practices among physicians. The knowledge of risk factors can also be conveyed to individuals with ID and their caregivers. With this knowledge, family members, support agencies, and individuals with ID may increase their abilities to advocate for changes and improvements in psychotropic medication management. Lastly, despite the evidence of improved outcomes following deinstitutionalization, jurisdictions continue to care for individuals with ID in institutional settings. This study contributes to the body of research supporting the deinstitutionalization of individuals with ID by emphasizing the

improvements in psychotropic medication management among individuals who relocated from facility to community settings in Ontario.

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