

Predicting Future Use of Psychotropic Drugs in Long-Term Care Residents

Objective

To predict future use of psychotropic drugs in long-term care (LTC) residents by using machine learning (Random Forest).

Practice Points

1. Psychotropic drugs can alter the mind, emotions, or behaviours and are widely used in LTC Facilities.
2. The quality of life and safety of a resident may be affected by the use of these drugs. Efforts to reduce the use of these drugs, particularly antipsychotics and benzodiazepines, must be made.
3. Machine learning is a branch of artificial intelligence and computer science which uses data to help identify patterns and make decisions with minimal human intervention. It is a method that has been applied and can be utilized in various clinical areas such as disease detection and predictions.

Data (PIs: V. Abodunrin, L. Pena-Castillo)

Assessments provided were recorded by the RAI-MDS and these data from 36 LTC Facilities in Newfoundland and Labrador (NL) were obtained from the NL Centre for Health Information from 1 Apr 2016 – 9 Sep 2021. The COVID-19 pandemic started in the province on Mar 16 2020 and continued beyond Jul 2021.

The data used for analysis comprised of assessments from 5,316 residents in LTC. A total of 71 variables describing demographic and clinical characteristics were assessed to predict future use of psychotropic drugs.

Results

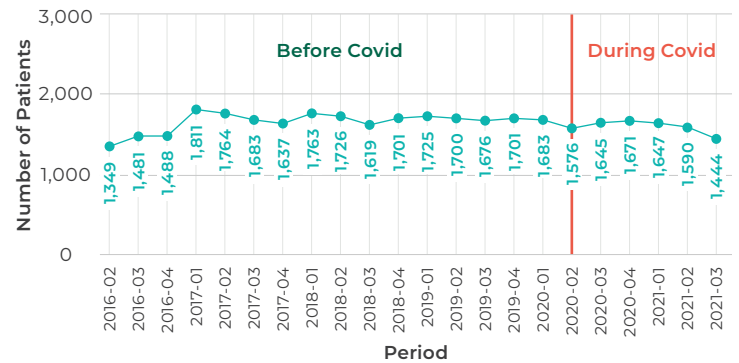


Figure 1. Number of Assessments on Residents by Quarter from 2016–2021

- The average number of assessments on residents in LTC Facilities was 1,657 before COVID-19 and 1,600 during the first 5 quarters of COVID-19.

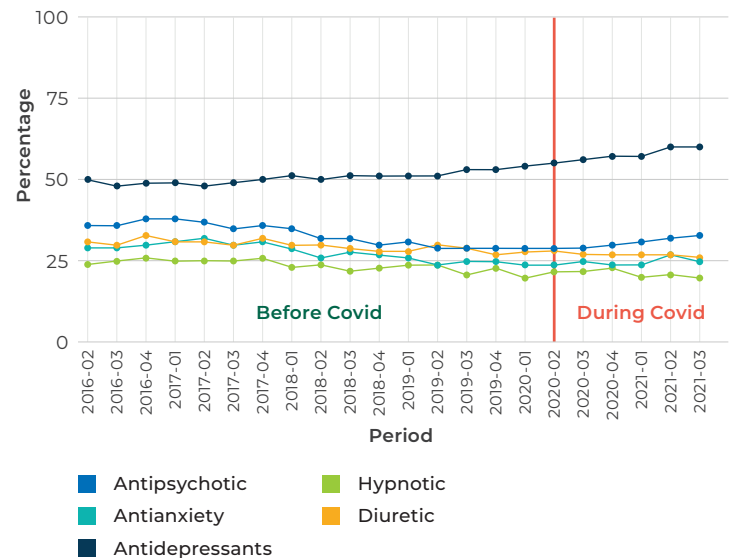


Figure 2. Percentage of Residents Using Psychotropic Drugs in Each Quarter from 2016–2021

- The percentage of LTC residents using psychotropic drugs remained constant from 2016–2021. However, there was a slight increase of 10%, most noticeably after the onset of COVID-19 in the percentage of residents using antidepressants.

Table 1. Average Precision and Accuracy of the Random Forest (RF) Model to Predict Future Use of Antipsychotics and Benzodiazepines in LTC Residents

Drug	Precision (PPV)	Accuracy
Antipsychotics	0.70	0.77
Benzodiazepines	0.61	0.73

- The precision (positive predictive value (PPV)) gives the indication of how effectively a test is able to repeat the same result. It ranged from 70% in antipsychotics to 61% in benzodiazepines.
- The accuracy gives the percentage of correct predictions the model made. It ranged from 77% accuracy in antipsychotics to 73% accuracy in benzodiazepines.

Table 2. Top 5 Variables Based on Mean Accuracy Decrease for Antipsychotics

Variable	Mean Accuracy Decrease
Age	0.0098
Number of Medications (Last 7 days)	0.0081
Delusions	0.0065
Cognitive Performance Scale	0.0055
Over 85 years of Age	0.0039

Table 3. Top 5 Variables Based on Mean Accuracy Decrease for Benzodiazepines

Variable	Mean Accuracy Decrease
Number of Medications	0.0123
Depression	0.0081
Use of Antidepressants	0.0068
Cognitive Performance	0.0042
Age	0.0033

- The mean accuracy decrease coefficient shows how the variables exclusion would impact the accuracy of the overall RF model. The more the accuracy declines, the more important the variable.

- Age, number of medications and cognitive performance were common variables that were important in predicting antipsychotic and benzodiazepine usage.

Conclusions

1. The machine learning model was more effective in predicting usage of anti-psychotics in LTC residents with a precision of 70% and accuracy of 77%.
2. The impact of the COVID-19 pandemic on the usage of psychotropic drugs only noticeably impacted antidepressants.
3. Machine Learning could be a tool to assist clinicians and health care providers to identify situations in which alternatives to antipsychotic medications should be considered for residents of LTC.