

Long-acting injectable neuroleptics are exhibiting a lower carbon footprint than daily oral medication

Long-acting injectable (LAI) antipsychotics were introduced in the late 1960s to address one of the major challenges in the treatment of chronic psychotic disorders such as Schizophrenia: poor adherence to daily oral medication. Early depot formulations, such as Fluphenazine decanoate and Haloperidol decanoate, allowed antipsychotic drugs to be administered intramuscularly at intervals of several weeks. Over time, newer second-generation LAIs - including Risperidone, Paliperidone palmitate and Aripiprazole - were developed with improved tolerability profiles. The main advantage of LAIs is the maintenance of stable plasma drug levels, which reduces the risk of relapse associated with missed oral doses. In addition, LAIs facilitate monitoring of treatment adherence by clinicians and can reduce hospitalization rates in patients with severe mental illness. As a result, they have become an important option in the long-term management of schizophrenia and other chronic psychotic disorders.¹

However, oral medicines generally have a lower environmental footprint than injectable formulations. Tablets or capsules require simpler manufacturing processes, less sterile infrastructure, and typically fewer energy-intensive steps than injectable products. In addition, oral medicines avoid the need for single-use materials such as syringes, needles, vials, and associated medical waste. They also reduce the logistical and healthcare resources required for administration in clinical settings. For these reasons, this is generally more environmentally sustainable to use oral medication instead of injectables.

In this context, Ecovamed and the Rouvray Hospital, in Normandy, France, which is specializing in mental health, have conducted an in-depth assessment of the carbon footprint of schizophrenia treatment to compare oral and injectable treatment, in order to understand if long-acting injectables could bring enough medical benefits that would make them more environmentally friendly than daily oral medication.

Scope of the study

The functional unit of this study is one year of treatment after a first schizophrenia diagnosis at the hospital. The long-acting injectable and *per os* options of three neuroleptic drugs have been compared: Aripiprazole, Haloperidol and Risperidone/ Paliperidone. A cradle-to-grave approach has been selected and the system boundaries include all life cycle stages of the treatment: production of the medicine

¹ Manchanda R *et al.* Long-acting injectable antipsychotics: evidence of effectiveness and use. Can J Psychiatry. 2013, 58, 55-135.

and its purchase at the pharmacy, a monthly follow-up medical consultation and the potential relapse with hospitalization for some patient (see. Figure).

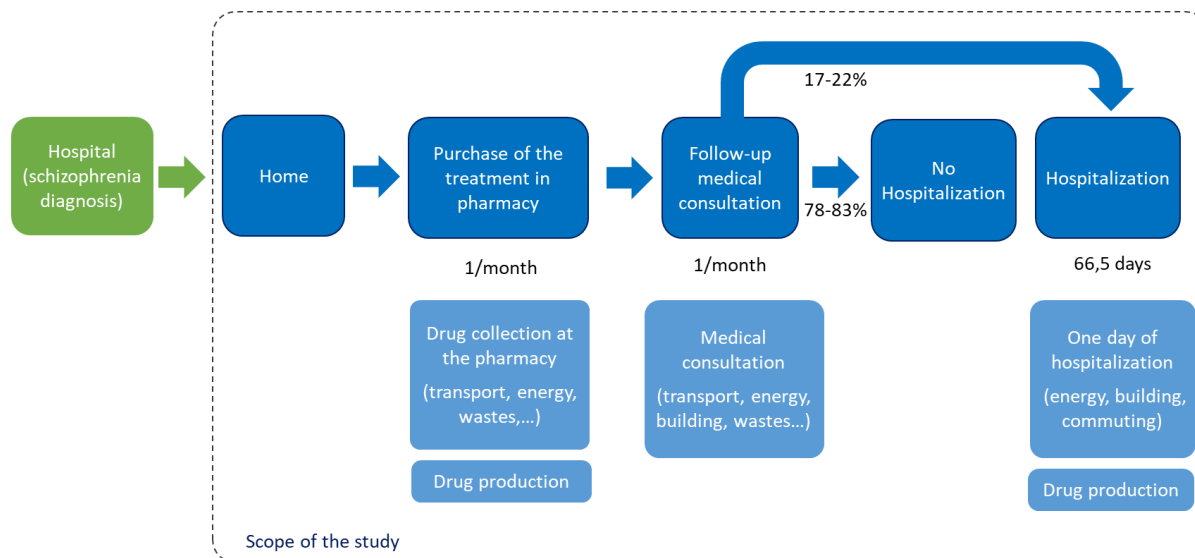


Figure 1 : system boundaries of the study.

As mentioned in introduction, the main advantage of long-acting injectable neuroleptics is the reduction of the risk of relapse associated with missed oral doses. A systematic review on the efficacy and safety of long-acting injectable versus oral antipsychotics in the treatment of patients with early-phase schizophrenia-spectrum disorders is giving a 17% average relapse for patient having LAIs treatment and an average 21.6% for patients under oral medication.⁴ Based on Rouvray Hospital statistics, the average hospital stay in case of relapse is 66.5 days, so the environmental impact of the relapse can be assessed thanks to the daily carbon footprint of an hospital stay, which has been derived from several hospital carbon accountings.

Carbon footprint of one year of schizophrenia treatment

The total carbon footprint of one year of schizophrenia treatment is ranging between 1 150 kgCO₂eq and 1 470 kgCO₂eq with the following main contributors (see Figure 2):

- Hospital stay (85-95%) in case of relapse
- Monthly medical consultation (3-4%), due to patient transport
- Production of the drugs (0.4-11%)
- Followed by travel to hospital, drug collection at pharmacy and end-of-life of packaging and medical devices.

The long-acting injectables are showing a **12-20% lower** carbon footprint over 1 year, due to the lower relapse rate, and even if the production of the drugs and medical devices are 1.5 to 12 times more impacting for injectable vs. oral medication. These results highlight that the environmental impact of one year of schizophrenia treatment is driven primarily by the relapse rate leading to hospitalization, rather than by the production of the drugs and their administration.

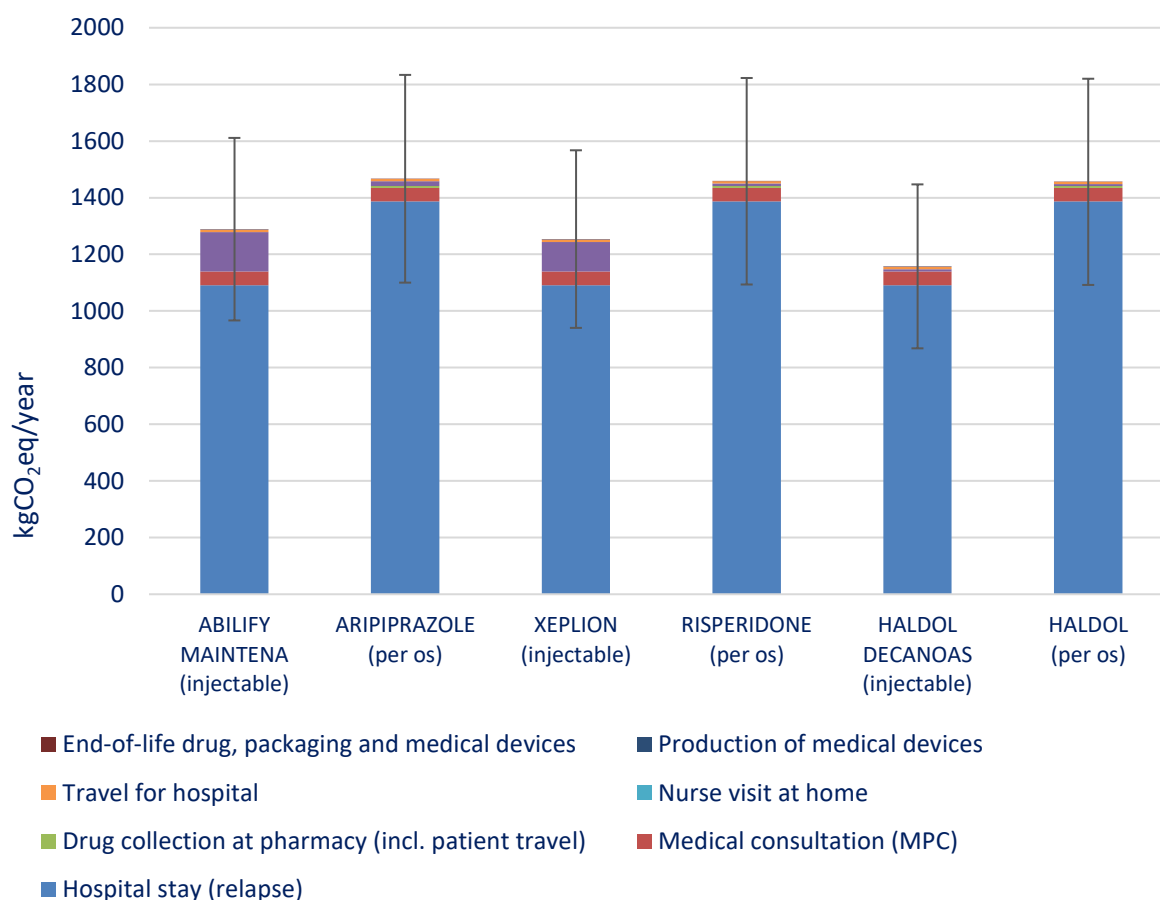


Figure 2 : carbon footprint comparison of long-acting injectable vs. oral treatment (carbon footprint in kgCO₂eq/year).

Conclusion

This study shows that injectable treatment may have a low carbon footprint than oral medication, if some medical benefits are associated to injectable and not oral treatment.

It also highlights the importance of treatment adherence to reduce the environmental impact of healthcare systems.

Long-acting technologies are not widely used in other therapeutic areas but it could be a focus on pharmaceutical research to improve quality of care and reduce care pathway environmental footprint. Ecovamed will communicate soon on other studies related to long-acting anti-injectives.

About Ecovamed

We are an innovative company created in 2020, with the ambition to contribute to sustainable health care. By relying on improved processs, **Ecovamed allows the healthcare industry and the chemical, polymer and biotechnology industries to efficiently assess the carbon footprint and LCA of their products**, which is the first step before setting greenhouse gases emission reduction plans. Ecovamed is also supporting health professionals to eco-design healthcare pathways. For more information on Ecovamed, visit www.ecovamed.com or contact us at contact@ecovamed.com.

Conflict of interest

Ecovamed provides services to the healthcare industry, including LCA and carbon footprint assessment of their products and support to reduce their greenhouse gas emissions. Ecovamed notably provides consulting services to medical device, pharmaceutical and equipment manufacturers.