Reuse of Adverse Effect Reports from the French National Agency of Medicines: A Visual Analytic Tool to Improve Patient Safety.

Claire Saint-Dizier, Florian Dufrenois, Emeric David, Maxime Bubrovszky, Antoine Lamer

Digital Health and Informatics Innovations for Sustainable Health Care Systems
J. Mantas et al. (Eds.)

doi:10.3233/SHTI240632

Reuse of Adverse Effect Reports from the French National Agency of Medicines: A Visual Analytic Tool to Improve Patient Safety

Chloé SAINT-DIZIER[a,b,1], Florian DUFRENOIS[a], Emeric DAVID[a,b,c], Maxime BUBROVSZKY[a] and Antoine LAMER[a,b,c]
[a] *Fédération régionale de recherche en psychiatrie et santé mentale (F2RSM Psy), Hauts-de-France, Saint-André-Lez-Lille, France*
[b] *Univ. Lille, CHU Lille, ULR 2694-METRICS: Évaluation des Technologies de santé et des Pratiques médicales, Lille, France*
[c] *Univ. Lille, UFR3S - Ingénierie et Management de la Santé, 59000 Lille, France*
ORCiD ID: Chloé Saint-Dizier https://orcid.org/0009-0004-5274-2943

Abstract. Adverse drug reaction are defined as "harmful or unpleasant reaction, resulting from an intervention related to the use of a medicinal product". In France, adverse effects due to medicines are reported to the French National Agency of Medicines (ANSM) by the healthcare professionals or consumers. The objective of this study was to implement a tool that facilitates the utilization of ANSM reports by synthesizing information to effectively inform prescribers and users. We focused on 3 psychotropic classes: antidepressants, antipsychotics and anxiolytics. We extracted relevant data from the ANSM website through a webscraping process, based on the names of molecules in these 3 classes: antidepressants, antipsychotics, and anxiolytics. We implemented a web interface with R Shiny that provides three panels: (i) a presentation of the active ingredient with the fewest reports for a selected adverse effect category, (ii) the adverse reactions for a selected active ingredient ranked in descending order, and (iii) a comparison of two active ingredients where, for each adverse effect, the active ingredient with the fewest reported adverse drug events (ADEs) is displayed. Our application allows for synthesizing information to effectively inform prescribers and users. In the ANSM existing interface, molecules can only be viewed one by one, and the ratio needs to be calculated manually, making it difficult to compare molecules. It is important to note that this is not a prescription assistance device but rather for informational purposes. In the future, the application may be expanded to include other categories of molecules. Finally, the indicators provided by our tool could be compared to those from other pharmacovigilance databases.

Keywords. Data reuse, Patient Safety, Adverse drug effect, Psychotropics

[1] Corresponding Author: Chloé Saint-Dizier, 211 Rue du Général Leclerc, 59350 Saint-André-lez-Lille, France; E-mail: chloe.saintdizier@f2rsmpsy.fr.

1. Introduction

Adverse drug effects (ADE) are defined as "harmful or unpleasant reaction, resulting from an intervention related to the use of a medicinal product" [1]. Adverse drug effects (ADEs) can have implications for patient safety and treatment tolerability, particularly by increasing the risk of morbidity and mortality, although they may or may not cause patient distress or discomfort. [2]. Adverse drug reactions may occur during inpatient care [2], as well as outpatient care [3].

Pharmacovigilance is the monitoring and assessment of drug safety to ensure the safe and effective use of medications. [4]. The pharmacovigilance systems allow the identification and prevention of the risks associated with use of a drug, especially of recently marketed drugs [5]. In France, adverse effects due to medicines are reported to the French National Agency of Medicines (ANSM) by the healthcare professionals or consumers [6]. The ANSM provides a querying interface for these reports, molecule by molecule, for ADE occurring between 2014 and 2022.

The objective of this study was to implement a tool that facilitates the utilization of ANSM reports, by synthesizing information to inform prescribers and users effectively.

2. Methods

In this study, we focused on 3 psychotropic classes: anxiolytics, antidepressants and antipsychotics [8]. We extracted relevant data from the ANSM website through a webscraping process, based on the names of molecules in these 3 classes [7]. These data are in open-access. They are aggregated and do not contain personal information. The extracted data were transformed and loaded into a relational database with the following elements: molecules, consumption rates, ADE reports, categories and sub-categories of ADE, and commercial products (Figure 1). The titles of molecules and ADE labels were simplified for easier reading, and for each ADE, we computed a ration from the number of reports and the number of consumptions. We implemented a web interface with R Shiny and the R package shinydashboard.

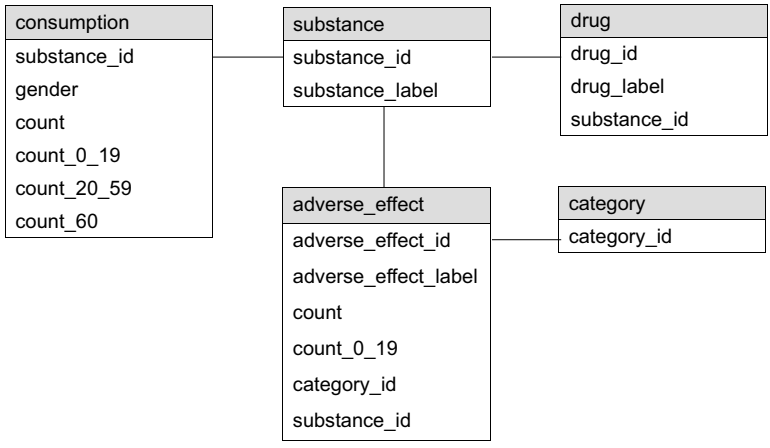

Figure 1. Data model

3. Results

The database covers 26 antidepressants, 27 antipsychotics and 15 anxiolytics. The median (Q1 ; Q3) number of ADE per active ingredient was 1146 (120 ; 3278) for antidepressants, 932 (495 ; 2760) for antipsychotics and 1716 (406 ; 6293) for anxiolytics. It corresponds to 42 (20.5 ; 75), 187 (61 ; 330) and 40 (17 ; 56) reports for 1,000,000 deliveries, respectively.

The sides effects are grouped into 27 major categories (e.g., Cardiac disorders, Hepatobiliary disorders, Nervous system disorders, etc.). For each drug class, the greatest number of adverse effects was reported in the nervous system disorders family, in particular for the adverse event disorders of consciousness.

The web application is structured into 3 tabs. The first tab displays the adverse reactions for a selected active ingredient, ranked according to descending order (Figure 2). The second tab presents the active ingredients for which the less number of reports for a selected adverse effect category (Figure 3). After selection of active ingredient, the application proposes the list of the commercial products. Finally, the third tab enables the comparison of two active ingredients and presents, for each adverse effect, the number of reports for each molecules and each ADE (Figure 4). The number of reports may be detailed inside an ADE category, for example gastrointestinal disorders (Figure 5).

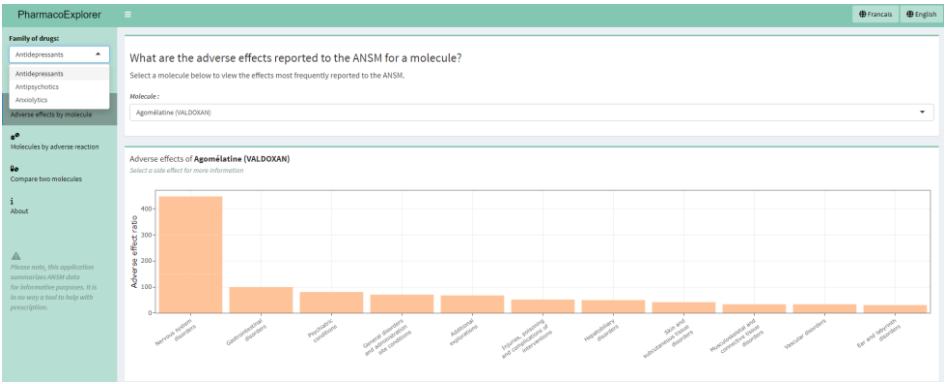

Figure 2. Adverse effects reported by active ingredient

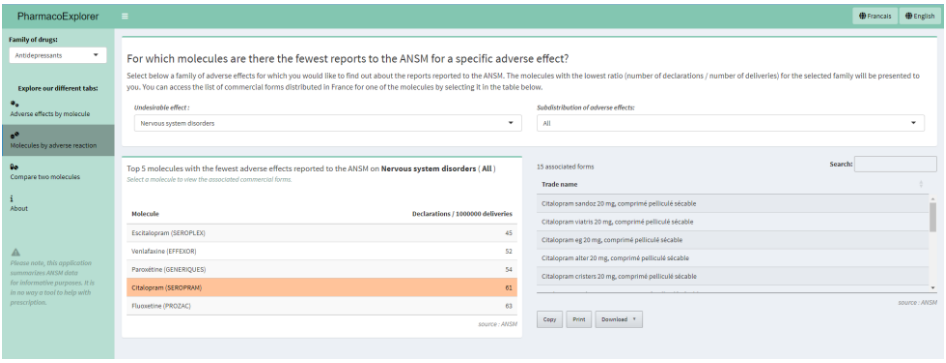

Figure 3. Ranking of active ingredient by reported adverse effects

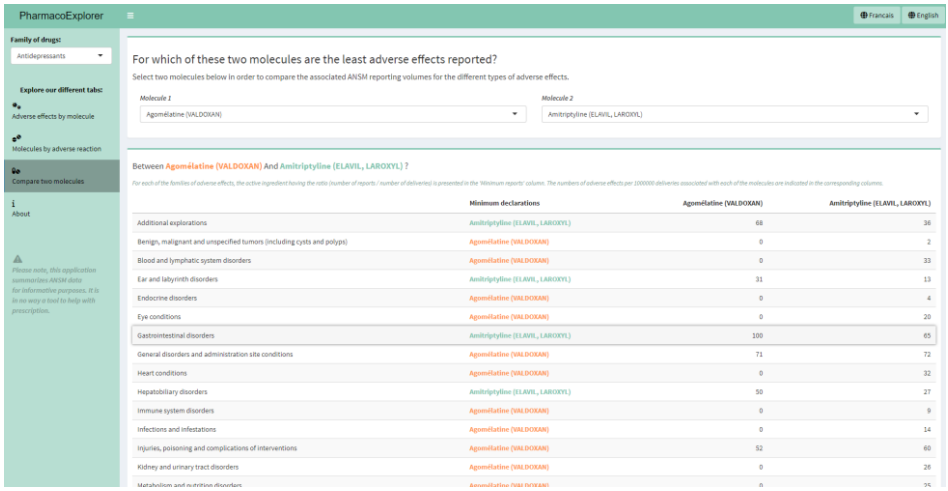

Figure 4. Comparison of the number of adverse drugs reactions between Agomélatine and Amitriptyline

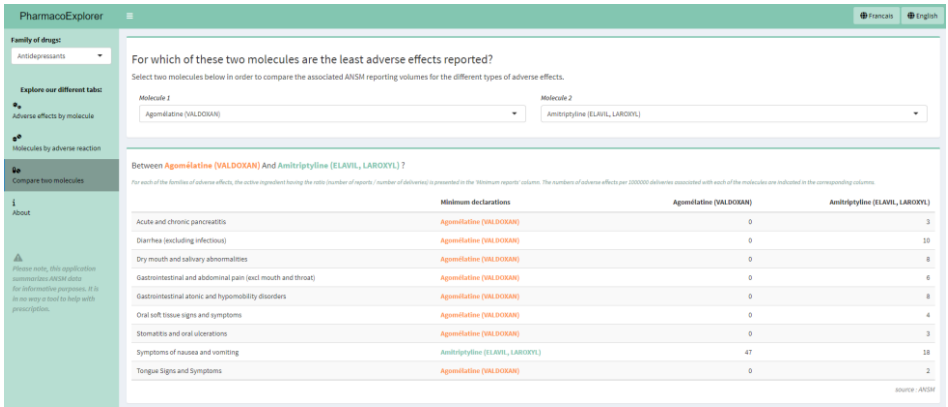

Figure 5. Comparison of the number of gastrointestinal adverse drugs reactions between Agomélatine and Amitriptyline

4. Discussion and Conclusions

Our application allows for synthesizing information to effectively inform prescribers and users. In the ANSM existing interface, molecules can only be viewed one by one, and the ratio needs to be calculated manually, making it difficult to compare molecules. It is important to note that this is not a prescription assistance device but rather for informational purposes. Thus, this tool could be used to initiate a new treatment for a patient with comorbidities or when there is a choice between several molecules. It could also be helpful in changing an ongoing treatment following adverse effects reported by the patient.

This application aligns with the transparency policy of public institutions to make the data produced within these institutions available to the community.

The ADE documented in the ANSM website are limited to what is reported, which is likely underestimated. Additionally, the categories of ADEs reported by the ANSM are not precise and could be refined. Since the initial users are French, the application was developed in French to enhance usability and prevent evaluation bias. However, it

is possible to develop it in English as well. In the future, the application may be expanded to include other categories of molecules. Finally, the indicators provided by our tool could be compared to those from other pharmacovigilance databases.

References

[1] Edwards IR and Aronson JK. Adverse drug reactions: definitions, diagnosis, and management. Lancet. 2000;356:1255–1259. doi:10.1016/S0140-6736(00)02799-9.

[2] Bates DW, Levine DM, Salmasian H, Syrowatka A, Shahian DM, Lipsitz S, Zebrowski JP, Myers LC, Logan MS, Roy CG, Iannaccone C, Frits ML, Volk LA, Dulgarian S, Amato MG, Edrees HH, Sato L, Folcarelli P, Einbinder JS, Reynolds ME, and Mort E. The Safety of Inpatient Health Care. N Engl J Med. 2023;388:142–153. doi:10.1056/NEJMsa2206117.

[3] Kessler C, Ward MJ, and McNaughton CD. Reducing Adverse Drug Events. JAMA. 2016:316:2092–2093. doi:10.1001/jama.2016.16392.

[4] Fornasier G, Francescon S, Leone R, and Baldo P. An historical overview over Pharmacovigilance. Int J Clin Pharm. 2018;40:744–747. doi:10.1007/s11096-018-0657-1.

[5] Montané E, and Santesmases J. Adverse drug reactions. Med Clin (Barc). 2020;54:178–184. doi:10.1016/j.medcli.2019.08.007.

[6] Abou Taam M, Jacquot B, Ferard C, Thery A-C, Mounier C, Grandvuillemin A, Jonville-Béra A-P, and Perault-Pochat M-C. The French pharmacovigilance surveys: A French distinctiveness, a real input. Therapies. 2021;76:441–447. doi:10.1016/j.therap.2020.05.011.

[7] Glez-Peña D, Lourenço A, López-Fernández H, Reboiro-Jato M, and Fdez-Riverola F. Web scraping technologies in an API world. Brief. Bioinformatics. 2014;15:788–797. doi:10.1093/bib/bbt026.

[8] Diaz L, Eiden C, Jouanjus E, Frauger E, Fouilhé N, Djezzar S, Gibaja V, Boucher A, Le Boisselier R, Libert F, Caous A-S, Monzon E, Guerlais M, Daveluy A, Fauconneau B, and Peyrière H. Alprazolam misuse: Analysis of French Addictovigilance Network data from 2011 to 2020. Therapie. 2023;S0040-5957(23);00030–6. doi:10.1016/j.therap.2023.02.002.