European Neuropsychopharmacology 57 (2022) 36–38

www.elsevier.com/locate/euroneuro

INSIGHTS

Neuroscience-based nomenclature of psychotropics: Progress report

Joseph Zohar[a,*], **Daniel Minkin Levy**[b]

[a] *Department of Psychiatry, Sheba Medical Center, Tel-Hashomer, and Sackler School of Medicine, Tel Aviv University, Tel Aviv, Israel*
[b] *The Jerusalem Mental Health Center, Jerusalem, Israel*

Received 25 November 2021; received in revised form 4 January 2022; accepted 9 January 2022

KEYWORDS
Psychopharmacology;
Nomenclature;
Teaching

For *European Neuropsychopharmacology*

The introduction of chlorpromazine, the first medication used for psychosis, and iproniazid, the first medication used for depression, preceded the discovery of their mechanisms by years (Ban, 2006). This gap between neuroscientific knowledge and clinical practice led to the use of a disease-based terminology for psychotropics - terms such as "antipsychotics," "antidepressants," "anxiolytics," and "mood stabilizers" were widely used. As newer agents were developed, names that are not indicative of pharmacological activities such as "first generation," "second generation," "selective" and others were added, in part due to commercial motives.

The discrepancy between the indication-based nomenclature and the clinical use of psychotropics led to confusion. We often prescribe "antidepressants" for anxiety and "antipsychotics" for depression (Solmi et al., 2020). Using these misnomers, may also be associated with decrease adherence, and facilitating stigma (Volkow et al., 2021).

Moreover, grouping all the "antidepressants" in one class does not represent the true versatility of this group, which holds 12 pharmacologically different subgroups. On the other side, separating the gamma-Aminobutyric acid positive allosteric receptor modulators (GABA-enhancers) to "hypnotics" and "sedatives" does not support rational evidence-based prescribing as well.

To address these issues, the European College of Neuropsychopharmacology (ECNP) initiated in 2008, in collaboration with four scientific organizations (The American College of Neuropsychopharmacology [ACNP], the Asian College of Neuropsychopharmacology [AsCNP], the International College of Neuropsychopharmacology [CINP], and the International Union of Basic and Clinical Pharmacology [IUPHAR]) a "Nomenclature Taskforce". The idea was to try to come up with updated classification. The task force decided to replace the disease-based nomenclature with pharmacology driven one (Zohar et al., 2014a). In 2014, the first edition of Neuroscience-based Nomenclature (NbN) was

* Corresponding author.
E-mail address: jozohar@gmail.com (J. Zohar).

https://doi.org/10.1016/j.euroneuro.2022.01.002

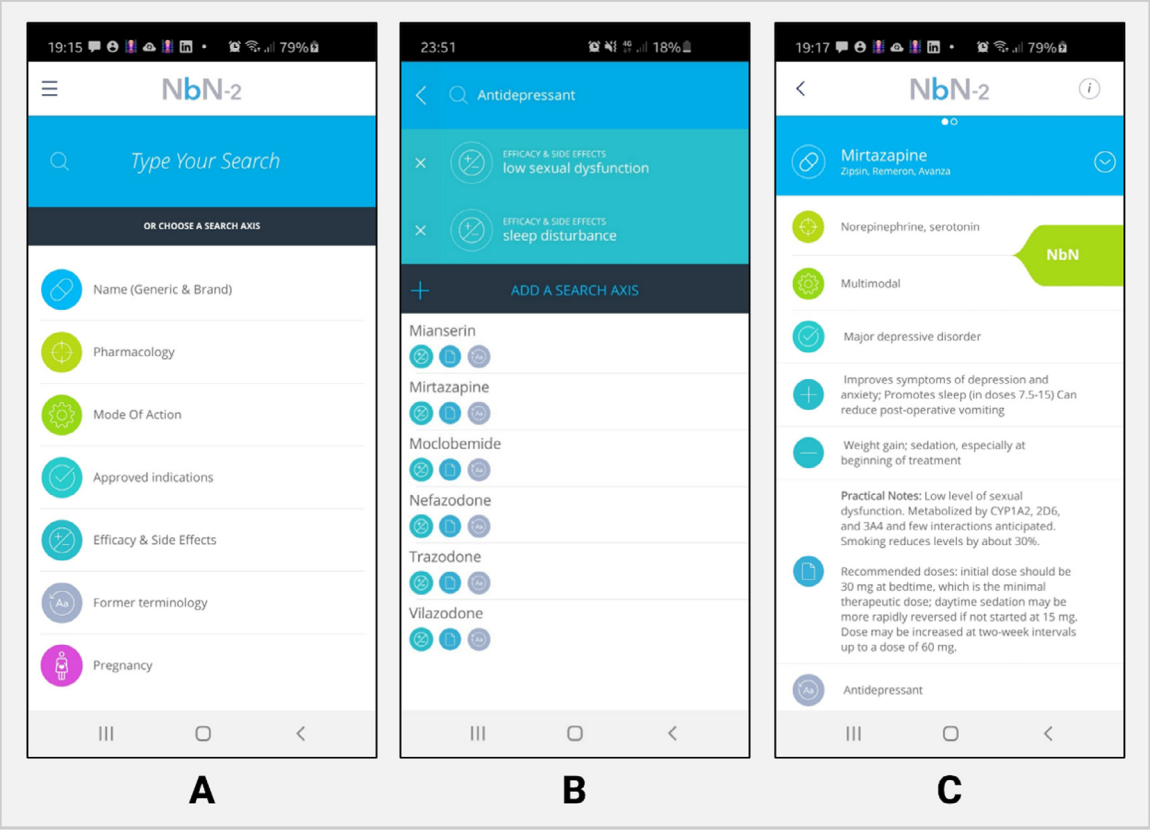

Fig. 1 The use of the NbN app. 1-A shows the app home screen; 1-B shows the search results after filtration by two axes; 1-C shows the drug information screen.

published (Zohar et al., 2014b).

In NbN, each drug is attributed to two domains that reflect clinically relevant neuroscientific properties: The *Pharmacology* domain and The *Mode of Action (*MoA) domain. The *Pharmacology* domain represents the neurotransmitter, molecule, or system that is being modulated. The *Mode of Action (*MoA) domain details the effect an agent has on its Pharmacology domain (e.g., receptor antagonist, reuptake inhibitor, enzyme modulator). A medication can be assigned to more than one Pharmacology or MoA domains. Among the 147 medications currently listed in NbN, 10 pharmacological domains and 9 modes of action were identified (Zohar et al., 2015)

The task force that assembled NbN has been aware of the shortcuts of defining the pharmacological domains and MoA for many of the medications. However, it has been decided that it is better to present the clinically relevant cutting edge scientific interpretation as we need to treat our patients now and cannot wait for the definitive conclusion. As new insights are being revealed and new agents are being developed, an update process is done on a yearly basis to keep the nomenclature up to date. The last updated version is NbN3 (nbn2r.com, released December 2021).

As of 2021, NbN has been endorsed by many additional psychiatric organizations, including the American Psychiatric Association (APA), the European Psychiatric Association, the Japanese Society of Psychiatry and Neurology (JSPN), the German Association for Psychiatry, Psychotherapy and Psychosomatics (DGPPN), and the Spanish Psychiatry Society (SEP) to name a few. This recognition was accompanied by supporting editorials in leading peer-reviewed journals, including Lancet Psychiatry (editorial, 2016), Biological Psychiatry (Krystal et al., 2016), Neuropsychopharmacology (Blier et al., 2017), and Journal of the American Academy of Child and Adolescent Psychiatry (Sultan et al., 2018), to name a few. The support of these organizations and journals encouraged the inclusion of NbN in clinical and academic practice.

Importantly, NbN was recently added to major international textbooks and handbooks for psychiatry, including Kaplan and Sadock's Comprehensive Textbook of Psychiatry 11th edition (in preparation), Tasman's Psychiatry 5th edition (in press), New Oxford Textbook of Psychiatry 3rd edition (2020), Clínica Psiquiátrica 2nd edition (2021), Stahl's Essential Psychopharmacology 5th edition (2021), Stahl's Prescribing Guide 6th edition (2020), and Seminars in Clinical Psychopharmacology 3rd edition (2020).

The transition from disease-based terminologies to pharmacology-driven nomenclature represents not only a change of terms and habits but of a mode of thought. In order to facilitate this process, a special app was developed. The app was launched in late 2014, targeting an estimate of 200,000 practicing psychiatrists worldwide. The app has a search-based interface that serves as a gateway to the new terminology while incorporating important clinical and neuroscientific information. In addition to the pharmacol-

ogy and MoA domains, the app includes information about the indications, efficacy, side effects, "practical notes" (including dosing), neurobiology, and pregnancy safety of each drug (Zohar et al., 2015) (Figure 1). In 2018 an additional app which was designated for practitioners treating children and adolescents - NbN c&a - was released.

Those apps are available free of charge and have been downloaded, so far, by over 84,000 psychiatrists worldwide.

In addition to the option in the NbN app to sort medications by former terminology, and in order to assist authors, a glossary illustrates the transition from the traditional, disease-based terms (e.g., mood stabilizers, anxiolytics) to NbN was developed (Zohar et al., 2015).

As mentioned, Disease-based terminology is a source of confusion for patients as well: The prescription of a drug labeled after a disorder from which the patient does not suffer may contribute to low treatment adherence and to mistrust towards psychiatry (Volkow et al., 2021). To address this issue, The NbN patient and family app (NbN p&f), which will be released at the beginning of 2022, will serve as a platform to provide patients and their families accurate, updated and approachable information regarding the prescribed medication, promoting better doctor-patient communication.

In conclusion, since its inception in 2008, NbN has received broad recognition from leading scientific, professional, and educational organizations. This ECNP-lead initiative helps to bridge the impressive development in neuroscience to clinical practice, research, and also communication with the patients - paving the way for the ECNP moto "*For the science and treatment of disorders of the brain*".

References

Ban, T.A., 2006. The role of serendipity in drug discovery. Dialog. Clin. Neurosci. 8 (3), 335–344. doi:10.31887/DCNS.2006.8.3/tban.

Blier, P., Oquendo, M.A., Kupfer, D.J., 2017. Progress on the neuroscience-based nomenclature (NbN) for psychotropic medications. Neuropsychopharmacology 42 (10), 1927–1928. doi:10.1038/npp.2017.33.

Krystal, J.H., Abi-Dargham, A., Barch, D.M., Bullmore, E.T., Carter, C.S., Geschwind, D.H., Harrison, P.J., Nestler, E.J., Stein, M.B., 2016. Biological psychiatry and biological psychiatry: cognitive neuroscience and neuroimaging adopt neuroscience-based nomenclature. Biological psychiatry. Cognit. Neurosci. Neuroimag. 1 (4), 300–301. doi:10.1016/j.bpsc.2016.03.007.

Solmi, M., Bodini, L., Cocozza, S., Seeman, M.V., Vieta, E., Dragioti, E., Carvalho, A.F., Fusar-Poli, P., 2020. Aripiprazole monotherapy as transdiagnostic intervention for the treatment of mental disorders: An umbrella review according to TRANSD criteria. Eur. Neuropsychopharmacol. 41, 16–27. doi:10.1016/j.euroneuro.2020.09.635.

Sultan, R.S., Correll, C.U., Zohar, J., Zalsman, G., Veenstra-VanderWeele, J., 2018. What's in a name? Moving to neuroscience-based nomenclature in pediatric psychopharmacology. J. Am. Acad. Child Adolesc. Psychiatry 57 (10), 719–721. doi:10.1016/j.jaac.2018.05.024.

The Lancet Psychiatry, 2016. Naming names. The lancet. Psychiatry, 3 (6), 489. doi:10.1016/S2215-0366(16)30072-4.

Volkow, N.D., Gordon, J.A., Koob, G.F., 2021. Choosing appropriate language to reduce the stigma around mental illness and substance use disorders. Neuropsychopharmacology 46 (13), 2230–2232. doi:10.1038/s41386-021-01069-4.

Zohar, J., Nutt, D.J., Kupfer, D.J., Moller, H.J., Yamawaki, S., Spedding, M., Stahl, S.M., 2014a. A proposal for an updated neuropsychopharmacological nomenclature. Eur. Neuropsychopharmacol. 24 (7), 1005–1014. doi:10.1016/j.euroneuro.2013.08.004.

Zohar, J., Stahl, S., Moller, H.J., Blier, P., Kupfer, D., Yamawaki, S., Uchida, H., Spedding, M., Goodwin, G., Nutt, D., 2014b. NbNomenclature – Neuroscience based Nomenclature (NbN). Cambridge University Press, University Printing House, Cambridge CB2 8BS, United Kingdom ISBN 978-1-107-48254-8.

Zohar, J., Stahl, S., Moller, H.J., Blier, P., Kupfer, D., Yamawaki, S., Uchida, H., Spedding, M., Goodwin, G.M., Nutt, D., 2015. A review of the current nomenclature for psychotropic agents and an introduction to the neuroscience-based nomenclature. Eur. Neuropsychopharmacol. 25 (12), 2318–2325. doi:10.1016/j.euroneuro.2015.08.019.