

*Nicotine: The Molecule in Control – Neurobiological Dependence, Clinical Impact, and Multisector Interventions in Romania*

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**Abstract:**

Nicotine dependence represents a chronic, relapsing neurobiological disease with systemic clinical consequences and sustained public health impact. Despite significant advances in cardiovascular, respiratory, and endocrine care, smoking prevalence in Romania remains among the highest in the EU region, contributing substantially to premature morbidity and mortality. Estimates from recent epidemiological assessments indicate that approximately 27–34% of Romanian adults currently smoke, with increasing uptake of electronic nicotine delivery systems among adolescents. This pattern directly drives the national burden of COPD, ischemic heart disease, lung cancer, and metabolic dysfunction.

At the neurobiological level, nicotine exerts its addictive potential primarily through activation and upregulation of  $\alpha 4\beta 2$  nicotinic acetylcholine receptors within the mesolimbic dopaminergic system. Repeated exposure remodels reward circuitry, transitioning behavior from voluntary use to compulsive reinforcement. Withdrawal-induced dysphoria and conditioned environmental cues further perpetuate the dependence cycle.

Effective treatment requires a comprehensive, interdisciplinary approach integrating brief clinical intervention, pharmacotherapy (nicotine replacement therapy, varenicline, bupropion), and cognitive-behavioral strategies. In Romania, the national “STOP FUMAT” cessation program and dedicated Quitline services provide a strategic platform for scalable clinical integration, yet remain underutilized in everyday medical practice. Reinforcing smoke-free legislation, aligning taxation across nicotine products, and expanding cessation access within pulmonology, cardiology, and diabetes clinics could substantially reduce disease burden.

Recognizing nicotine dependence as a treatable medical disease—not a behavioral choice—is essential. Strengthening coordinated clinical and public health strategies can meaningfully support patients in overcoming addiction and achieving sustained cessation.