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REVIEW

Over-the-Counter Drugs: Misuse and Safety Implications

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ABSTRACT

Although over-the-counter (OTC) drugs are regarded as relatively safe and effective for self-treatment, their growing prevalence and accessibility raise concerns about misuse, addiction, and adverse health consequences. This narrative review provides a current overview of OTC drugs with misuse potential and their associated safety implications. OTC drugs commonly misused include sedative antihistamines, cough mixtures, caffeine-containing products, fat burners, analgesics, laxatives, antidiarrheal medications, and decongestants, which can be harmful when improperly used, often due to recreational purposes and lack of awareness. Patterns of OTC drug misuse typically start with therapeutic use, followed by dose escalation, and are particularly concerning in vulnerable populations such as pregnant women, adolescents, children, older adults, and individuals with mental health conditions. Effective management of OTC drug use in these groups is constrained by public perception of safety, easy accessibility, insufficient oversight, limited healthcare access, and a lack of adequate professional guidance. Emerging alternatives such as probiotics and nutraceuticals offer safer options for OTC drugs, although further research is still needed to establish their effectivity and safety. Ultimately, a multifaceted, patient-centered approach, incorporating pharmacological advancements, behavioral insights, and robust public health interventions, will be crucial to mitigating OTC drug misuse and improving overall health outcomes.

Keywords: Over-the-Counter Drugs; OTC Medications; Misuse; Safety Implications; Public Health

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1. Introduction

Over-the-counter (OTC) drugs are defined as therapeutics that are deemed safe and effective for public use without a medical prescription [1]. Although typically available on pharmacy shelves, these medications can also be accessible through non-pharmacy outlets, including grocery stores, convenience shops, and even the internet [1,2]. OTC drugs provide a convenient means of self-treatment for common health issues, allowing consumers to freely and effortlessly select from a wide range of products, some of which may carry potential for misuse. In fact, the problematic use of OTC drugs is notably prevalent among adults [3], and increasingly widespread among younger populations [4]. For instance, a recent cross-sectional study conducted in Japan estimated a 1.5% prevalence of OTC drug abuse among high school students, with higher risk linked to factors such as school dissatisfaction, parental absence, and environmental stress [5]. Therefore, this trend raises significant concerns regarding abuse, dependence, and associated harms, especially given that adolescence is a period characterized by curiosity and experimentation with new substances [6]. In this respect, it should also be noted that earlier initiation of substance use increases the likelihood of such experimentation evolving into a consolidated addiction [6].

A recent systematic review identified key risks regarding OTC drug misuse among adults, particularly sedative antihistamines, analgesics, and cough mixtures, leading to significant physical, psychological, and social consequences, including hospitalization and even death [3]. Moreover, similar threats have been identified among adolescents, with growing cases of acute drug poisoning from multi-ingredient cold medications and caffeine, commonly purchased from drugstores and OTC vendors [4]. Additional OTC drugs that have been identified as commonly employed for misuse and abuse are decongestants, fat burners, laxatives, and antidiarrheal medications [7–10]. These findings highlight that factors like low health literacy, poor knowledge, and insufficient patient information drive improper use, underscoring the need for improved public education, enhanced pharmacist oversight, and further research into harm reduction, especially for vulnerable populations and online sales. In particular, the increasing incidence of adolescent overdoses further emphasizes the urgent need for preventive measures, with vendors playing a pivotal role in raising awareness and reducing poisoning rates. Nevertheless, recreational motives are not trivial in this context and, beyond misuse such as exceeding recommended dosages or combining multiple products, they may lead to intentional abuse and addiction, exacerbating the associated risks. As these behaviors often go unnoticed until significant harm has occurred, it becomes crucial to not only focus on prevention and education but also on early detection and intervention. Furthermore, a coherent analysis of the regulatory systems governing OTC drugs could be essential.

On the other hand, OTC drugs, despite the concerns outlined earlier, should not be viewed as inherently unsafe or risky pharmacological agents, but rather as potential tools that, when used with awareness and responsibility, can improve our daily lives. Unlike unregulated street substances of abuse, which often present significant risks due to their unknown composition and unpredictable dosages, OTC drugs are subject to stringent regulatory controls that ensure their safety and efficacy. For instance, the ongoing fentanyl crisis illustrates the dangers of illicit substances, which are frequently mixed with other drugs (e.g., alternative opioids, stimulants) and can lead to recurrent polysubstance use and fatal overdoses [11]. In contrast, pharmacy drugs, while requiring responsible use, constitute the controlled option par excellence for managing health issues and even offer a more reliable and safe alternative for individuals struggling with addiction or experiencing cravings, as they are subject to strict regulatory oversight and have more predictable effects when used appropriately. Thus, regulated substances play a pivotal role in public health, but it is essential to maintain vigilance regarding their misuse, ensuring that they are consumed responsibly and within the prescribed guidelines.

In essence, although OTC drugs are regarded as relatively safe and effective for self-treatment, their growing prevalence and accessibility raise concerns about misuse, addiction, and adverse health consequences. Despite their extensive use, many aspects of their impact on overall health remain unknown to the general public. Therefore, the increasing recognition of the role of OTC drugs among the global population underscores the need for a closer ex-

amination of their potential negative outcomes. Building on these considerations, this narrative review provides a current overview of OTC drugs with misuse potential and their associated safety implications.

2. Method

A non-systematic, narrative approach was adopted to examine the misuse of OTC drugs and associated safety implications. Between August and September 2025, literature searches were conducted across the PsycINFO, PubMed, and ResearchGate databases, using a variety of keywords related to the topic. The following search terms were used: "over-the-counter drugs", "OTC medications", "misuse", "abuse", "adolescents", "vulnerable populations", "safety", "antihistamines", "cough syrups", "caffeine", "fat burners", "analgesics", "laxatives", "antidiarrheal medications", "decongestants", "healthcare", "pharmacy", "probiotics", and "nutraceuticals". No restrictions were applied on language or publication date. The search strategy was iteratively refined to ensure the retrieval of relevant literature. To supplement the database searches, pre-identified studies were also included. Duplicates were removed before screening. The selection process consisted of two stages: first, screening titles and abstracts for eligibility, and second, reviewing full texts to assess relevance and extract key information. Articles in languages other than English or Spanish were translated using online tools. Inclusion criteria focused on studies addressing OTC drug misuse, its health risks, safety concerns related to misuse, and potentially associated insights on the topic. Conference abstracts, theses, and non-retrieved articles were excluded. Studies focusing uniquely on non-human populations or lacking empirical or theoretical relevance were also excluded. The selected literature was synthesized thematically to provide a current overview of OTC drug misuse and its safety concerns. As a narrative review, a formal quality assessment of the included studies was not performed.

3. OTC Drugs with Potential for Misuse

Patterns of OTC drug use with misuse potential reveal several recurring trends [12]. In most cases, these medications are initially consumed for their intended therapeutic purposes, such as relieving pain, managing allergy symptoms, or alleviating cough and cold discomfort. However, some individuals subsequently employ OTC drugs as substitutes when other substances of choice are not readily available, reflecting their accessibility and relatively low stigma compared to illicit drugs [13,14]. In addition, OTC medications are often misused as enhancers to intensify the psychoactive effects of alcohol or other substances, a behavior particularly noted among young populations [15]. Furthermore, certain OTC drugs are used as alternative addictive agents, especially in contexts where individuals seek to avoid detection in routine drug testing, capitalizing on their legal status and ease of purchase. Misuse may also emerge in healthcare-related contexts, when these substances are recommended or tolerated in ways that inadvertently reinforce patterns of dependency [12]. Additional patterns could include self-escalation of doses beyond recommended ranges to achieve stronger therapeutic or psychoactive effects, experimentation with alternative routes of administration (e.g., intranasal, rectal, or intravenous) to enhance absorption or intensity of effects, and recreational polydrug combinations with multiple OTC and prescription drugs to produce synergistic effects. Some users may also engage in intermittent binge use, taking the substances sporadically in high doses to mimic the effects of illicit drugs, or employ them for cognitive or performance enhancement. Collectively, these patterns underscore the importance of examining specific categories of OTC drugs that are frequently implicated in misuse, in order to better understand their public health implications.

3.1. Sedative Antihistamines

Among OTC drugs, sedative antihistamines represent a group with notable potential for misuse. Some of the most commonly reported drugs in this category, frequently implicated in non-therapeutic use, include chlorpheniramine, dimenhydrinate, diphenhydramine, and promethazine [10]. Additional antihistamines, such as brompheniramine, doxylamine, and pheniramine, have also been identified as having misuse potential and related harms, as evidenced in postmortem analyses of pediatric populations between 2010 and 2020, which highlighted

age-specific trends and the occurrence of unintentional intoxications, recreational misuse, and suicidal overdoses [16]. In addition, postmortem data from England (2000–2019) highlight the risks associated with OTC sedative antihistamines. Among 1537 cases with antihistamine detections, the majority involved OTC sedative antihistamines (85.2%), often used in combination with other central nervous system (CNS) depressants (94.8%). Although antihistamine-related deaths have risen over time, a significant proportion were classified as suicides (20.9%), reflecting both intentional and unintentional misuse [17]. Similar trends have been reported in the United States, where among 92,033 overdose deaths during 2019–2020, 14.7% were antihistamine-positive and 3.6% antihistamine-involved [18].

Antihistamines are commonly used to treat allergies, pruritus, or vertigo, and their sedative effects have led to their use as sleep aids or anxiolytics. Individuals who misuse these drugs report desired effects such as calming sensations, mild euphoria, and tremor suppression, and in some instances, recreational use for hallucinogenic effects has been observed at high doses [19]. Rebound insomnia was reported as a withdrawal symptom by individuals who were dependent on the sedative antihistamine doxylamine. Individuals also abuse sedative antihistamines to improve sleep and relaxation, to achieve mental-altering effects, and sometimes mix the medication with drinks (e.g., soft drinks, alcohol) or with water-pipes (Narghile) to potentiate these effects [3]. In addition, high-dose misuse of dimenhydrinate, diphenhydramine, and promethazine has been reported, occasionally involving intramuscular or intravenous administration, often in combination with other substances [10]. Such practices have been associated with severe anticholinergic effects, cardiac conduction abnormalities, delirium, and psychotic symptoms, highlighting the potential for serious toxicity. Furthermore, dependence and withdrawal symptoms, including insomnia, nausea, craving, anxiety, irritability, and gastrointestinal distress, have also been described, with gradual tapering reported as an effective detoxification strategy [10,19]. The management of these symptoms may also require supportive care or pharmacologic intervention with antipsychotics, benzodiazepines, or benztropine [10].

Overall, OTC sedative antihistamines, although widely used and generally safe at recommended doses, carry a significant potential for misuse and related harms. Vulnerable populations, including children, adolescents, and individuals with psychiatric comorbidities, could be particularly at risk. Misuse can result in a range of adverse outcomes, from psychoactive effects and dependence to unintentional intoxication and, in severe cases, fatal outcomes. Furthermore, these medications represent an easily accessible means to carry out suicidal acts, particularly when combined with other substances in high quantities. Based on the aforementioned, the role of alcohol as a widely accessible and socially accepted legal recreational substance with clearly harmful effects should be emphasized, particularly among adolescents, who often consume it to the point of exceeding reasonable limits [20]. Indeed, alcohol consumption can potentiate the CNS effects of OTC sedative antihistamines, such as chlorpheniramine, diphenhydramine, and doxylamine, leading to increased drowsiness, sedation, and impaired motor skills [21,22]. Consequently, the co-ingestion of alcohol with these medications poses a heightened risk for severe accidental toxicity and intentional self-harm, underscoring the critical need for targeted prevention and education strategies.

3.2. Cough Mixtures

Acute cough is among the most common reported symptoms of upper respiratory tract infections worldwide, and many individuals self-prescribe OTC cough medicines for themselves or their children [23]. Although numerous products exist, evidence for their efficacy remains mixed. In addition, safety concerns have led to the withdrawal of certain OTC cough medicines containing antihistamines and antitussives for children under six years. Other withdrawals, such as the non-narcotic antitussive clobutinol in the EU due to cardiac risks, underscore the potential harms of these agents if misused [23]. In this context, among the cough syrups most commonly implicated in misuse and recreational use are those containing codeine and promethazine hydrochloride, as well as dextromethorphan (DXM).

Reports of the misuse of codeine and promethazine hydrochloride cough syrup began in the early 1990s. More recently, a mixture based on this cough syrup combined with alcohol or soft drinks, commonly known as lean, purple drank, or sizzurp, has become widely known and pop-

ular in certain social circles of individuals who engage in this type of consumption, a group that should not be considered negligible [15,24,25]. Lean use seems to be prevalent among adolescents and young adults, driven by its glamorization in popular culture and its association with a party lifestyle, even with the significant risks of addiction, overdose, and harm when consumed alone or in combination with other substances [26,27]. Indeed, data from the National Survey on Drug Use and Health, spanning 2007–2019, indicate that the majority of lean users are within the age range of adolescence to early adulthood, exhibiting high rates of substance use disorder, with many of these consumers engaging in risky behaviors such as driving under the influence [28]. Despite early media portrayals that associated lean use primarily with African-American teenagers, athletes, or rappers, epidemiological evidence shows that misuse is more heterogeneous and not confined to these stereotyped groups [25]. This misrepresentation in popular discourse may contribute to ethnic-cultural stigmatization and bullying, particularly among adolescents who belong to or identify with this demographic group, reinforcing social biases and potentially exacerbating harm beyond the pharmacological risks [29]. In this respect, among young populations, these pharmacological risks can include brain abnormalities such as increased volume in the mid-posterior region of the corpus callosum and decreased homotopic functional connectivity in the medial orbitofrontal cortex, which are linked to impulsive behavior and correlate with the duration of codeine-containing cough syrup abuse [30].

DXM is a broadly used cough suppressant found as an OTC drug that has also been frequently misused, particularly by adolescents seeking it as a legal alternative to illicit substances [31]. Although DXM misuse was notably prevalent in the early 2000s, public health interventions have contributed to a decline in abuse-related calls [32], suggesting the effectiveness of these measures in reducing misuse rates, while still leaving the possibility that some groups continue or begin using this drug. The recreational effects of DXM, particularly when consumed at supratherapeutic doses, include intoxicating and psychedelic experiences. These arise from its antagonism of N-methyl-D-aspartate receptors, which at high doses mimic the dissociative hallucinogenic activity of substances such as phencyclidine and ketamine, further explaining its appeal among young populations seeking a legal, non-therapeutic drug option [33]. The supratherapeutic doses of DXM can constitute 5 to 10 times the recommended amount, and are facilitated by its legal status, low cost, and easy availability in stores and in internet. Abuse, especially when combined with other substances, carries significant psychological and physiological risks, and may produce false-positive PCP results on drug screenings, complicating detection and clinical management [34]. Regarding DXM misuse, dosages can reach up to 4920 mg, and concomitant substances frequently include alcohol, cannabis, benzodiazepines, LSD, opioids, ecstasy, cocaine, and phencyclidine/ketamine [10]. Autonomic (e.g., mydriasis, tachycardia, palpitations), gastrointestinal, neurological (e.g., amnesia, nystagmus, ataxia, seizures, dystonia), and psychiatric symptoms (e.g., euphoria, agitation, confusion, hallucinations, delusions) have been observed in the context of its use. Psychiatric comorbidities commonly include substance use disorders, mood disorders, schizophrenia, and suicidal ideation. In this respect, most cases require hospitalization with supportive care and treatment with antipsychotics such as haloperidol, risperidone, or olanzapine [10]. Moreover, DXM-dependent individuals exhibit notable alterations in both cortical thickness and subcortical gray matter volumes compared to healthy controls. Specifically, increases in cortical thickness have been reported in regions such as the precuneus, prefrontal cortex, and occipital and temporal cortices, alongside enlarged volumes of the thalamus and pallidum. These structural changes correlate with the age of first DXM use and measures of impulsivity, suggesting that early exposure to the drug may contribute to brain alterations associated with heightened impulsive behavior [35].

Considering the aforementioned, it is conceivable to assert that cough syrups not only serve their primary role in alleviating cough, but also occupy a certain prominence within the framework of recreational drugs. The accessibility of cough syrups is influenced by varying regulatory frameworks and contextual factors. Although these preparations are primarily marketed for symptomatic relief of cough, the underlying question arises whether individuals truly require such medications for therapeutic purposes or if their desire to use them is driven by a curiosity to explore novel psychoactive experiences, which constitutes a

specific type of motivation that is particularly concerning among adolescents, a demographic group characterized by marked sensation-seeking tendencies [6].

3.3. Caffeine-Containing Products

Caffeine, known as 1,3,7-trimethylxanthine, is one of the most widely consumed psychoactive substances worldwide, with estimates suggesting that nearly 80% of the global population regularly consumes it [36]. Naturally found in coffee beans, tea leaves, cocoa, and kola nuts, it is also synthetically produced and incorporated into a wide range of OTC products, including medicines, soft drinks, and energy beverages [36]. The consumption of caffeine-containing products (CCP) is rising globally, driven primarily by motivations such as enhancing memory, concentration, vigilance, and physical performance, reflecting a long-standing human desire to improve cognitive and physical abilities [37,38]. CCP exerts stimulating effects on the CNS, including increased locomotor activity and anxiogenic-like responses. Beyond these effects, CCP also modulates several neurotransmitter systems, including dopamine, noradrenaline, serotonin, glutamate, acetylcholine, and gamma-aminobutyric acid (GABA) [38]. Its use is highly prevalent in diverse populations [39,40], underscoring the need to promote patterns of healthy consumption, particularly among children, adolescents, and young adults, who are most susceptible to adverse effects. For these groups, excessive intake, especially through energy drinks, can lead to symptoms such as weakness, tremors, insomnia, tachycardia, headaches, or mood disturbances. While low (≤3 mg/kg) to moderate (3–6 mg/kg) caffeine consumption may be tolerated by young adults without significant side effects, CCP and energy drink use is not recommended at any dosage for children and adolescents [41].

In line with the aforementioned, the widespread use of CCP, particularly energy drinks, raises growing concerns regarding their safety profile and potential mental health impact. Evidence suggests that energy drink consumption may exacerbate or even trigger psychiatric symptoms, including psychosis, in vulnerable individuals, although causal links remain difficult to establish given potential confounding factors such as socioeconomic status and comorbid conditions [42]. Although acute caffeine toxicity is rare, pediatric populations can be affected, with severe manifestations such as seizures, rhabdomyolysis, or cardiac complications reported in cases of overdose [43]. In addition to direct toxicological risks, caffeine may interact synergistically with other stimulants, such as phenylethylamines, producing amphetamine-like effects that raise questions about its abuse potential in combination formulations [44]. From a pharmacokinetic perspective, caffeine is highly bioavailable across beverages, and consumption of a single energy drink can approach upper safe intake levels for adolescents, underscoring their vulnerability to excessive exposure [45]. This is particularly concerning given the documented association between frequent consumption of high-caffeine drinks and adverse mental health outcomes, including depressive symptoms, stress, and suicidal ideation among young populations [46]. Moreover, the combination of caffeine with other common energy drink constituents, such as taurine or glucuronolactone, has been linked to cardiovascular and pharmacological interactions, which may complicate treatment in clinical contexts [47].

3.4. Fat Burners

Fat burners are nutritional supplements sold as OTC drugs that often include a combination of diverse substances, such as L-carnitine, forskolin, caffeine, fucoxanthin, chromium, conjugated linoleic acids, green tea extract, capsaicin, hydroxycitric acid, *Garcinia cambogia*, ephedra, pyruvate, leucine, and taurine [48]. Despite their widespread availability and popularity, the effectiveness of fat burners in promoting weight loss and improving cardiometabolic health remains limited. Systematic reviews suggest that thermogenic supplements may induce small reductions in body mass and fat mass, but their impact is generally less pronounced than that achieved through exercise or combined diet and exercise regimens alone [49]. These products are typically marketed as natural and safe, with active ingredients such as green tea, *G. cambogia*, and usnic acid. However, reports of severe adverse effects, including hepatotoxicity and, in extreme cases, fulminant liver failure, highlight that "to be natural" does not guarantee safety [50–52]. Certain compounds previously used as fat burners, such as 2,4-dinitrophenol, demonstrate extreme toxicity, reinforcing the need for regulatory oversight [53]. More recently, GLP-1 receptor agonists, initially developed as antidiabetic medications, have entered the weight-loss

supplement landscape, particularly among bodybuilders who combine them with anabolic agents. While these compounds may displace traditional fat burners in some communities, their misuse carries risks such as hypoglycemia and other metabolic disturbances [54]. Among more widely used ingredients, green tea extract has been studied in combination with exercise, showing only modest additive effects on weight, body mass index, and fat reduction, with little impact on lipid profiles [55]. Collectively, these findings underscore that fat burners are popular and perceived as beneficial, but their actual efficacy is often limited, and their safety profile requires careful consideration.

3.5. Analgesics

Analgesics and anti-inflammatory OTC drugs are among the most commonly used self-medication options, frequently employed to manage pain associated with diverse health-related conditions. Evidence suggests that these drugs can influence neurosensory responses, as reported in studies where prior intake of analgesics, particularly ibuprofen, altered sensory thresholds and subjective perception of stimuli [56]. They are also routinely used for procedural pain, such as in rubber band ligation for external hemorrhoids, where OTC analgesics effectively managed post-procedural discomfort in the majority of patients [57]. Medications such as ibuprofen, diclofenac, and aspirin represent a major subgroup of OTC analgesics that are widely utilized for headache, musculoskeletal pain, and post-operative discomfort. However, safety remains as an issue, particularly regarding potential masking of infection symptoms, highlighting the need for careful monitoring and pharmacist guidance [58]. In addition to patient safety, the environmental impact of these drugs has emerged as a concern, with ecotoxicological studies showing that commonly used analgesics and antipyretics, including paracetamol, can adversely affect aquatic organisms [59]. In clinical populations, OTC analgesics also constitute a substantial proportion of treatments for chronic conditions such as diabetic peripheral neuropathic pain, contributing to increased healthcare utilization and costs [60]. In this respect, surveys in diverse populations indicate a high prevalence of self-medication with analgesics, underscoring the importance of public health education [61]. Special considerations are necessary in patients with chronic liver disease, in which drugs such as paracetamol are preferred at standard doses, while other types of analgesics or painkillers (e.g., tramadol, codeine) may pose significant hepatotoxic or unpredictable risks [62]. Moreover, in conditions such as hidradenitis suppurativa, OTC analgesics are commonly used, although their efficacy may be limited in patients with more severe disease due to altered pain pathways [63]. Thus, the widespread self-administration of OTC analgesics emphasizes the need for responsible use and ongoing safety monitoring.

3.6. Laxatives

OTC laxatives are widely used for the self-management of constipation, with patients often trying multiple products before consulting healthcare providers [64,65]. The main classes include osmotic agents (e.g., polyethylene glycol, magnesium salts), bulk-forming fibers (e.g., psyllium, SupraFiber), stimulant laxatives (e.g., senna, bisacodyl, sodium picosulfate), fruit-based laxatives, and newer options such as yogurt with galacto-oligosaccharides [66,67]. Systematic reviews indicate strong evidence supporting polyethylene glycol and senna as first-line OTC treatments, while moderate evidence supports fiber supplements, fruit-based products, stimulant laxatives, and magnesium-based formulations [66,67]. Overall, these agents are generally well tolerated, with common adverse events including diarrhea, bloating, abdominal pain, and nausea [67,68]. Despite their widespread use, a substantial proportion of patients report limited symptom relief or satisfaction with OTC treatments, highlighting a need for customized approaches and consideration of prescription alternatives in chronic idiopathic constipation [64,65]. Stimulant laxatives, although effective for short-term use, are not recommended for prolonged use due to potential colonic damage and other safety concerns [69]. Regulatory bodies such as the US Food and Drug Administration (FDA) have approved additional OTC options, including castor oil, reflecting the expanding range of available agents [70,71]. In this context, pharmacists play a crucial role in guiding patients on appropriate selection and use, optimizing efficacy, safety, and adherence [72]. Nevertheless, it is important to note that the FDA warns that excessive use of OTC laxatives containing sodium biphosphate or sodium phosphate, sold as Fleet or under store-brand and generic names, can cause severe

electrolyte imbalances and dehydration, particularly in young children, older adults, patients with impaired kidney or bowel function, those who are already dehydrated, and individuals taking medications that affect renal function [7].

3.7. Antidiarrheal medications

Among OTC antidiarrheal medications, loperamide has emerged as the primary agent associated with misuse due to its mu-opioid receptor agonist properties. At therapeutic doses, loperamide acts peripherally in the gastrointestinal tract, exhibiting limited CNS penetration and historically low abuse potential. However, supratherapeutic intake (70–800 mg/day) can overwhelm P-glycoprotein efflux mechanisms, increase CNS concentrations, and produce opioid-like effects, including dependence and withdrawal symptoms [8,73,74]. The FDA has issued warnings regarding cardiotoxicity, conduction abnormalities, arrhythmias, and respiratory depression associated with excessive use, while European pharmacovigilance data indicate a growing incidence of misuse, intentional overdose, and serious cardiovascular adverse events [75,76]. The intake of loperamide has been associated with bradycardia, right bundle branch block, prolongation of the interval during which the ventricles of the heart contract and then recover, syncope, and fatalities, particularly among individuals with polysubstance abuse histories or underlying renal or gastrointestinal conditions [8,73,77,78]. Although loperamide is effective for acute non-specific, functional, and traveler's diarrhea, OTC use requires strict limitations, including administration only to adults and children over five years of age, a maximum treatment duration of 48 hours, and avoidance in the presence of fever or blood in the stool [79]. Despite its widespread dispensing in community pharmacies, concomitant advice on oral rehydration is infrequent, and substantial price variability exists between generic and brand-name preparations [80].

3.8. Decongestants

OTC nasal decongestants, including oxymetazoline, xylometazoline, phenylephrine, and propylhexedrine, are widely used for allergic rhinitis and upper respiratory tract infections, with oxymetazoline and xylometazoline being the most commonly reported agents [81–83]. These medications are generally considered safe when used as directed but, at the same time, they can carry risks of misuse, abuse, and various adverse effects. Chronic or excessive intranasal oxymetazoline use may result in rhinitis medicamentosa and, in rare cases, long-term use disorder with persistent cravings despite medical intervention [81]. Xylometazoline formulations combined with hyaluronic acid have shown improved mucoadhesive properties and barrier function in vitro, although clinical studies are needed to confirm their therapeutic advantages [82]. Systemic adverse events, including hemorrhagic stroke, have been associated with xylometazoline intoxication, underscoring the importance of dose monitoring and toxicological assessment in suspected cases [84]. Less well-studied OTC decongestants, such as (-)-methamphetamine in Vicks Vapor Inhalers, raise concerns regarding pharmacokinetics, forensic detection, and potential misuse [85]. In turn, oral decongestants, particularly pseudoephedrine and phenylephrine, have been linked to rare but serious events such as acute ischemic colitis [86,87]. Regulatory scrutiny has also revealed that some OTC decongestants, such as phenylephrine HCl, may have limited efficacy relative to alternative therapies [87,88]. Propylhexedrine misuse has been associated with severe cardiovascular and psychiatric complications [89]. Despite these concerns, patients frequently self-manage allergic rhinitis with OTC decongestants, often without guidance from healthcare professionals, contributing to potential overuse and suboptimal outcomes [83,90,91]. Intranasal corticosteroids remain the most effective pharmacologic treatment for nasal congestion, but their OTC availability is underutilized due to misperceptions regarding safety, sensory attributes, and administration technique [91–93]. Without any doubt, pharmacists play a crucial role in guiding appropriate use, addressing patient concerns, and optimizing adherence to evidence-based therapies in the context of OTC decongestant use [91,93].

4. Safety Considerations Regarding OTC Drugs

4.1. Biological and Motivational Insights

Drug use represents a complex interplay between neurobiological mechanisms and motivational dynamics, which can help contextualize the misuse of OTC medi-

cations. Drugs that modulate neurotransmission (e.g., by enhancing dopamine release, altering serotonin or norepinephrine activity, or engaging GABAergic pathways) can temporarily produce feelings of pleasure, relaxation, or heightened alertness. Over time, repeated exposure may contribute to neuroadaptations that alter receptor sensitivity, reward processing, and even structural aspects of the brain, potentially influencing cognition, decision-making, and impulse control [94,95]. These neurobiological changes interact dynamically with individual motivational processes. Behavior may initially be driven by curiosity or hedonic pursuit, seeking the novel effects of the substance, but can evolve as external incentives, environmental cues, and perceived rewards or punishments shape ongoing use [6]. In this respect, motivation is not static. It reflects a dynamic balance between intrinsic and extrinsic motives, which together may help explain why some individuals continue substance use despite awareness of potential harms. Thus, understanding biological and motivational dynamics within the context of drug consumption constitutes the first step for anticipating potential safety risks associated with OTC drug misuse.

Identifying pharmacological targets to mitigate substance use disorders remains a challenging task, but advances in precision medicine offer promising novel options for intervention. The development of biomarkers capable of monitoring drug responses, together with pharmacogenomic profiling, may enable personalized approaches to managing susceptibility to misuse and adverse reactions [96]. In the context of OTC drugs, integrating pharmacogenomics with emerging research on the human microbiome, could provide pivotal insights into individual risk profiles and behavioral susceptibilities. In fact, evidence indicates a bidirectional relationship between substance use and the gut microbiome (GM), in which substance exposure can alter microbial composition and GM dysbiosis may modulate behavioral and physiological responses to drugs [97]. This underscores the potential of microbiome-targeted strategies, either through modulation of microbial communities or monitoring microbial metabolites, as complementary approaches for prevention or early intervention in OTC drug misuse. From a safety perspective, this integrated understanding reinforces the importance of proactive measures in OTC drug management. Recognizing individual vulnerabilities, psychosocial influential factors, as well as safer therapeutics that could inform educational campaigns, community pharmacy initiatives, and regulatory policies aimed at promoting responsible use.

4.2. Vulnerable Populations

OTC drug use represents a significant public health concern among vulnerable populations such as pregnant women, adolescents, children, older adults, and individual with mental health conditions. Pregnant women frequently self-medicate to alleviate pregnancy-related ailments, with studies reporting prevalence rates of approximately 36–38% [98,99]. The widespread use of OTC medications, especially analgesics, carries potential risks for both the mother and the developing fetus, emphasizing the need for the obstetrician-gynecologist in charge of monitoring the pregnant woman to provide precise guidelines and ongoing advice [98,99]. Factors associated with OTC drug utilization in this population may include limited health insurance coverage, gravidity, and the presence of pregnancy-related complications [98]. Adolescents similarly exhibit high rates of OTC drug use, often driven by perceptions of safety, easy accessibility, and experimentation, with reported prevalence exceeding 97% over the previous year in recent surveys conducted in diverse geographical contexts [100,101]. Misuse of OTC drugs among this group has been linked to adverse outcomes, including unintentional poisoning, emergency department visits, and predisposition toward abuse and dependence of other drugs [4,101–105]. Pediatric populations are also at risk, particularly in children under six years old. Indeed, certain cough and cold preparations are contraindicated for this population due to potential severe adverse effects [103,104,106]. However, the COVID-19 pandemic and associated restrictions on healthcare access influenced patterns of pediatric exposure to OTC medications in the United States. During this period, children under six years experienced a significant increase in exposure, rising by 0.1–0.6 cases per million individuals per month compared with pre-pandemic levels, while children aged 6–12 years exhibited similar trends, although less pronounced [102]. In Turkey, maternal behaviors also contributed to pediatric OTC use during the COVID-19. In a descriptive cross-sectional study, nearly half of surveyed mothers reported administering OTC medications to their

children. Factors associated with this practice included child age (48–72 months), nursery attendance, perceived underweight status, and regular pediatric visits [106]. Older adults, in turn, are among the largest consumers of OTC medications, and misuse is particularly prevalent in this population. Various studies indicate that more than 50% of adverse drug events in older adults involve OTC drugs, with frequent misuse stemming from drug-drug interactions, drug-age interactions, and drug-disease interactions [107–109]. For instance, older adults often self-medicate with sleep aids, pain relievers, and other OTC drugs, but these may lead to adverse effects, such as drug interactions and inappropriate dosing [107]. Notably, older adults with comorbidities such as cardiovascular diseases are more likely to use OTC medications, which increases the risk of interactions with prescribed medications [108]. In addition, individuals with mental health conditions with insufficient awareness may employ OTC drugs to self-medicate, potentially exacerbating their conditions, as drugs such as antihistamines or DXM can induce psychotic symptoms [110]. In fact, it has been reported that prescription and non-prescription drug use is prevalent among individuals with mental health conditions, such as eating disorders and schizophrenia, which can lead to significant mental health and physical complications [111,112]. All these findings underscore the critical role that healthcare providers, pharmacists, and targeted public health interventions play in mitigating the risks associated with OTC medication use among vulnerable populations.

4.3. Systemic Determinants

Healthcare providers are often scarce in certain geographical contexts, and even when present, they may not always have the optimal conditions to ensure consistent oversight of OTC drug use, which would require substantial investment in the healthcare system. The global shortage of health workers, projected at 15 million in 2020, with significant disparities between high- and low-income regions, exacerbates this issue, especially in resource-constrained areas [113]. In many low- and middle-income countries, the insufficient supply of health professionals is compounded by challenges such as inadequate working conditions and low job satisfaction, further hindering their capacity to manage and monitor OTC drug use effectively [114]. Pharmacy employees, in turn, may sometimes act negligently, prioritizing sales over careful assessment of potential consumers, a trend potentially exacerbated by insufficient workplace wellbeing and low job satisfaction, with a high workload and inadequate salaries being common factors affecting performance in the sector [115]. Despite appearances, these employees carry significant responsibility. However, many retail outlets selling OTC products are staffed by individuals who lack formal pharmacological training [116]. Thus, even within pharmacies, the knowledge of some employees may be insufficient, particularly in areas related to drug safety and interactions, such as dietary supplements [117], and this is compounded by the absence of consistent regulatory oversight and competency assessments [118]. Moreover, inadequate employee engagement and insufficient professional development opportunities contribute to diminished care quality, as staff may be inadequately skilled to recognize and manage complex drug-related issues or identify early signs of health conditions. This underscores the need for targeted training programs and a more robust system to enhance professional competence and ensure the safe management of OTC drug use [119,120]. As evidenced by existing literature, when pharmacy staff lack the necessary training and motivation, the overall quality of care, especially in the evaluation and guidance on OTC medications, can be significantly compromised, ultimately undermining the regulatory oversight required to ensure safe medication practices [121,122].

Public health interventions can present limitations in the context of OTC drugs [123], and are frequently overshadowed by pharmaceutical advertising, which promotes the perception of safety without adequately highlighting potential risks for vulnerable populations. For instance, a study conducted in Ethiopia revealed that over half of the physicians perceived pharmaceutical marketing strategies as significantly influencing their prescribing behavior, further indicating how marketing practices, including direct advertising, shape perceptions and decisions related to drug use [124]. In fact, pharmaceutical advertising might actively encourage consumption, presenting OTC drugs as attractive consumer products rather than medications requiring caution. In Spain, for instance, safety warnings included in such advertisements typically appear at the end, in a very brief format, and are accompanied by repetitive messages

that may be ignored due to habitual exposure [125]. Thus, this presentation could diminish risk perception among the general public and vulnerable populations, further complicating efforts to promote safe use of OTC medications. A study conducted in Finland found that community pharmacists are aware of the potential abuse and misuse of OTC medicines, particularly in relation to products such as sedative antihistamines and laxatives, but they are often faced with barriers to providing adequate intervention, such as insufficient information about customers and limited communication between pharmacies [126]. Similarly, a study in Saudi Arabia emphasized that community pharmacists, despite recognizing the widespread misuse and abuse of OTC medicines, particularly analgesics and cough syrups, face challenges such as a lack of awareness about the extent of the issue and limited training on how to effectively manage it [127]. Moreover, in the context of low-income populations, a study in the United States found that health promotion activities could play a crucial role in improving health outcomes, but traditional research methods such as randomized controlled trials were often suboptimal for assessing the effectiveness of these interventions in community settings, thereby complicating efforts to evaluate public health programs effectively [128]. The importance of adapting research methods to community-based health promotion is further supported by findings from digital public health integration, where nontechnical challenges such as ethics, policy, and health equity, as well as technical issues such as fragmented systems, complicate the implementation of digital health strategies, which could offer new ways to address health disparities [129]. Furthermore, a review exploring the economic evaluation of community-based health promotion interventions highlights the limitations of traditional economic evaluation methods, proposing cost-consequence analysis as a more suitable approach to assess the complexity of these interventions and improve decision-making in public health policy [130]. As previously noted, this growing concern about OTC drug misuse is further exacerbated by the fact that marketing strategies for these products often downplay risks, thus reinforcing the perception of them as harmless consumer goods rather than substances that should be used with caution and professional guidance. Therefore, interventions should not only be evaluated through randomized controlled trials but must consider broader community contexts, the complexity of decision-making processes, and the incorporation of diverse evidence sources [131].

4.4. Emerging Agents as Potentially Safer OTC Options

4.4.1. Probiotics

Hill et al. [132] defined probiotics as live microorganisms that confer health benefits to the host when administered in adequate amounts, while psychobiotics are those that specifically offer mental health benefits [133]. Common probiotics include the family *Lactobacillaceae* and the genera *Bifidobacterium*, *Enterococcus*, *Lactococcus*, and *Streptococcus* [134]. Before use, probiotics must meet safety and functionality criteria, including genetic stability, acid and bile tolerance, gut adherence, non-pathogenicity, anti-genotoxic properties, and lactic acid production [135]. In this respect, probiotic safety is pivotal, particularly for vulnerable populations such as infants, the elderly, and immunocompromised individuals. Safety assessments include viability, genetic and phenotypic characterization, and tests for pathogenicity, toxin production, and contamination with harmful bacteria, mycotoxins, or heavy metals [136–138]. Clinical trials support the health benefits of probiotics, such as preventing diarrhea, Crohn's disease, constipation, infections, cancer, lactose intolerance, cystic fibrosis, dental caries, and oral diseases [139]. These benefits are primarily attributed to modulation of the GM, competitive exclusion of pathogens, and production of bacteriocins [140,141].

Probiotics are being extensively studied for their potential in treating anxiety and depression due to their anti-inflammatory properties and ability to restore neurotransmitter levels [142,143]. Clinical studies, such as those by Huang et al. [144] and Messaoudi et al. [145], have shown positive effects on psychological distress and depressive symptoms with minimal side effects. A recent meta-analysis by Sikorska et al. [146] found probiotics beneficial for depressed patients, but not definitively in healthy individuals. Conversely, Zhang et al. [147] reported that probiotics reduced stress levels in healthy individuals. Other studies, such as those by El Dib et al. [148] and Merkouris et al. [149], indicated improvements in depression and anxiety symptoms, although concerns about dosage, treatment timing,

and individual variability remain. Moreover, a 2025 study by Johnson & Steenbergen [150] on a multispecies probiotic found evidence of reduced negative mood after two weeks of supplementation.

Emerging research suggests that the GM influence sleep regulation through metabolites and neuroendocrine pathways [151,152]. Studies have examined the impact of probiotics on sleep quality, showing positive effects on sleep duration, quality, and latency. For instance, Takada et al. [153] reported improved sleep with *Lacticaseibacillus casei* Shirota supplementation, and Moloney et al. [154] found improved sleep quality with *Bifidobacterium longum* 1714. In addition, a meta-analysis by Ito et al. [155] of 15 clinical trials concluded that probiotics can positively affect sleep outcomes, although results on sleep duration and efficiency were inconclusive.

Constipation, often due to altered gut motility, is a common gastrointestinal issue. Probiotics have shown potential in improving gut motility, although the mechanisms remain unclear. Factors influencing motility include immune function, bile acid metabolism, mucus secretion, and the GM [156,157]. Probiotics may modify the GM to promote motility-stimulating hormones such as motilin and neuropeptide Y [158,159]. Clinical trials have shown probiotics such as *Bifidobacterium animalis* and *L. casei* Shirota improve stool frequency [160,161], while others report no GM alterations despite improvements in stool frequency [162]. Some probiotics may increase short-chain fatty acids (SCFAs), improving motility [163,164], but findings remain inconsistent [165]. Gong and Tang [166] found that *Lacticaseibacillus rhamnosus* GG improved gastric motility and nutrient absorption in elderly patients. Furthermore, probiotics such as VSL#3 may enhance mucin production [167], although not all strains have this effect [168].

Since the misuse of OTC drugs for conditions such as sleep disturbances, gastrointestinal issues, and adverse mental health states constitutes a growing concern, probiotics can constitute emerging alternatives. At present, probiotics and other microbial-based approaches are showing promising results for treating several brain-related disorders and even for improving cognitive function in older adults [169,170]. In addition, as previously stated, they may offer natural alternatives to OTC laxatives, anti-diarrheal medications, and sedative antihistamines, suggesting potential as safer treatments for a range of conditions, without the side effects often associated with pharmacological treatments. Nevertheless, further research is needed to confirm the safety and efficacy of probiotics and other microbial-based approaches, particularly in larger, more diverse populations, before they can be fully integrated as standard treatments for these conditions.

4.4.2. Nutraceuticals

Nutraceuticals, including both essential nutrients and non-essential bioactive compounds, offer a wide range of health benefits. These include protection against gastrointestinal and psychiatric disorders through their bioactive components such as anthocyanins, carotenoids, flavonoids, and polyamines [171]. Curcumin, the primary bioactive compound in turmeric (*Curcuma longa*), has demonstrated potential in treating mood disorders by modulating serotonin and dopamine levels and inhibiting glutamate release [172,173]. Its derivative, J147, shows antidepressant and anxiolytic-like effects, likely via monoamine neurotransmission [174]. However, its clinical application is limited by bioavailability and pharmacokinetic challenges, although it has an excellent safety profile [175]. Silexan, derived from *Lavandula angustifolia*, is an effective treatment for generalized anxiety disorder and exhibits antidepressant-like effects, partly through modulation of calcium channels, without the side effects of gabapentin [176,177].

The standardized extract EGb 761 from *Ginkgo biloba* has been extensively studied for its cognitive-enhancing properties. It contains terpenoids, flavonoids, and polyphenols that contribute to its anti-inflammatory and neuroprotective effects, making it beneficial for cognitive function and vascular dementia [178,179]. Ginseng, particularly its ginsenoside components, has been shown to support cognitive function, with specific ginsenosides, such as Rh1 and Rh2, exerting anti-apoptotic and antioxidant properties that benefit memory and learning [180,181].

Cannabidiol (CBD), a non-euphoric compound from *Cannabis sativa*, has demonstrated neuroprotective, anticonvulsant, and anxiolytic properties, showing promise in treating various mental health conditions, including mood disorders and neurodegenerative diseases [182]. A systematic review highlighted the potential of CBD for conditions such as anxiety, depression, and schizophrenia, although the evidence remains limited in certain contexts [183]. De-

spite these limitations, the clinical utility of CBD continues to grow, with reported benefits for managing multiple psychiatric disorders [184].

Overall, nutraceuticals such as curcumin, Silexan, *G. biloba*, ginseng, and CBD could serve as natural substitutes for diverse OTC products (e.g., CCP), due to their invigorating properties and their beneficial effects on brain function, mood, inflammation processes, and gastrointestinal health. Importantly, these compounds have shown to present fewer side effects compared to traditional pharmacological treatments. Furthermore, based on the principles of nutritional psychiatry, the beneficial effects of nutraceuticals on mental health, in conjunction with a well-planned diet, may make them optimal complements for the treatment of substance use disorders and other mental health conditions [185], which could stem precisely from the misuse or abuse of certain OTC drugs. However, although current evidence is encouraging, further research is essential to confirm their long-term safety, efficacy, and appropriate dosages before they can replace more widely used OTC options.

5. Recommendations and Final Remarks

The misuse of OTC drugs constitutes a public health concern, particularly among vulnerable populations, which is driven by patterns of self-medication and substance experimentation. Consequently, there is a need to implement educational and public health interventions focused on regulatory oversight, pharmacy staff training, research in areas related to substance use, increasing awareness of the associated purposes and risks, and addressing the influence of psychosocial factors involved. **Table 1** provides an overview of the patterns and potential risks associated with commonly misused OTC drugs.

Considering the potential risks associated with the misuse of OTC drugs, it is essential to highlight the compounded dangers that arise from the combination of these substances, both among themselves and with other recreational or medicinal drugs. The concurrent misuse of multiple substances, whether intentional or inadvertent, often results in synergistic effects that amplify toxicity, increasing the risks of overdose, dependence, and severe health complications. This pivotal point calls for heightened vigilance and responsibility in both public health education and clinical practice. Furthermore, contemplating the landscape of substance misuse naturally brings attention to the consumption of illicit drugs, which represents another significant public health and social issue. Although it can be assumed that street drugs, by virtue of their common street names, are what they claim to be, the reality is far more complex. Cocaine, for instance, has become a widely recognized product, often associated with privilege, which serves to enhance its appeal [186–188]. However, the majority of street cocaine is adulterated with a variety of substances, many of which are often unrecognizable to the consumer. Indeed, several studies conducted worldwide consistently reveal that street cocaine is frequently mixed with a range of adulterants [189,190], including caffeine, phenacetin, benzocaine, lidocaine, dexamisole, levamisole, paracetamol, diltiazem, hydroxyzine, procaine, creatine, tetracaine, synephrine, and even fentanyl [191–195]. This raises the question of whether the real harm lies in the substances themselves, or rather in the unregulated nature of the illicit market, which allows for the adulteration of these substances and exposes users to dangerous and unknown compounds. If quality-controlled versions of these substances were made available within a well-regulated legal framework, the risks associated with street versions could be significantly reduced, shifting the focus from criminalization to public health. In the current environment, dangerous adulterants are mixed into illicit drugs, thereby heightening the risk of overdose and other severe health outcomes, with these illicit drugs potentially being more easily accessible than OTC drugs themselves. In fact, this has been recently exemplified by the crisis involving street fentanyl [11,196]. It is not surprising then that certain illicit drugs are regarded unfavorably, but society in turn widely accepts the use of stimulant-like drugs such as methylphenidate for children, often for conditions that may vary in severity [197]. In particular, the use of such substances is widely accepted when prescribed, highlighting the inherent contradiction in a system where individuals who may need these substances for legitimate instrumental purposes are frequently restricted from accessing them. In this context, OTC drugs represent substances that, due to their classification as medications and their accessibility, are likely to be perceived more favorably and are prone to misuse. This makes sense, as at least OTC drugs undergo consistent quality and safety controls. Nevertheless, given the widespread consumption re-

ported and the stigmatization related to substance abuse [20], this scenario reveals a societal hypocrisy and underscores the need to address three central issues. The first is the necessity for realistic education and awareness regarding the nature of drugs, their potential benefits and advantages for therapeutic and instrumental uses, their possibilities as recreational substances, the associated risks, and the promotion of healthy lifestyles from childhood, particularly within family and school environments. The second involves addressing the contextual and social factors that negatively impact the mental health of individuals, which can lead to drug consumption as a means of alleviating stress or emotional burden. The third is the continued focus on research, both at the pharmacological level and in other fields such as psychology, psychiatry, biology, and nutrition, to develop alternative treatments and complementary strategies for chronic health conditions that drive individuals to excessively consume certain OTC drugs. This research is crucial to expand knowledge in areas related to substance use and abuse but also to assess the health consequences of these substances in different populations, particularly in combination with other drugs. In this respect, probiotics and nutraceuticals have been highlighted as emerging agents that may provide safer alternatives with fewer adverse effects than OTC drugs for addressing certain conditions or symptoms. Thus, it is important to continue advancing research into these agents, as their potential health benefits encompass multiple areas, including those not directly or indirectly involved in conditions or dynamics related to the potential misuse of OTC drugs [198–200].

Table 1. Patterns and potential risks associated with commonly misused OTC drugs.

Drug Category	Specific OTC Drugs	Misuse Patterns	Potential Risks
Sedative antihistamines	Chlorpheniramine, dimenhydrinate, diphenhydramine, promethazine, brompheniramine, doxylamine, pheniramine.	Primarily abused for calming effects. Often combined with alcohol or other substances.	Respiratory depression, cardiac conduction abnormalities, delirium, psychotic symptoms, dependence, and fatal overdose.
Cough mixtures	Codeine, promethazine, dextromethorphan.	Primarily abused for dissociative, hallucinogenic, or euphoric effects. Often combined with alcohol or other substances.	Brain abnormalities, seizures, hepatotoxicity, psychotic symptoms, dependence, and fatal overdose.
Caffeine-containing products	Energy beverages, caffeine pills, soft drinks.	Used in excessive amounts to enhance alertness, memory, and physical performance.	Insomnia, tremors, headaches, mood disturbances, tachycardia, and cardiac issues.
Fat burners	L-carnitine, forskolin, caffeine, fucoxanthin, chromium, conjugated linoleic acids, green tea extract, capsaicin, hydroxycitric acid, *Garcinia cambogia*, ephedra, pyruvate, leucine, and taurine.	Primarily abused for rapid weight loss and muscle definition. Often combined with other substances.	Hepatotoxicity, liver failure, hypoglycemia, and severe toxicity.
Analgesics	Ibuprofen, diclofenac, aspirin, tramadol, paracetamol	Primarily abused for alleviating chronic pain, headaches, and musculoskeletal discomfort.	Hepatotoxicity, infection masking, kidney issues, and ecotoxicity.
Laxatives	Polyethylene glycol, magnesium salts, psyllium, senna, bisacodyl, sodium picosulfate, galacto-oligosaccharides.	Used in excessive amounts to relieve chronic constipation.	Electrolyte imbalances, dehydration, colonic damage, nausea, abdominal pain, and diarrhea.
Antidiarrheal medications	Loperamide	Primarily abused for opioid-like effects.	Cardiotoxicity, arrhythmias, bradycardia, syncope, respiratory depression, dependence, and fatal overdose.
Descongestants	Oxymetazoline, xylometazoline, phenylephrine, propylhexedrine.	Primarily abused for stimulant-like effects or relieving chronic nasal congestion.	Rhinitis medicamentosa, hemorrhagic stroke, acute ischemic colitis, cardiac issues, psychiatric complications, and dependence.

6. Conclusions

OTC drugs are an essential component of modern healthcare. They provide convenient, accessible, and effective treatment for a variety of conditions, enabling individuals to manage their health independently and alleviate symptoms without needing a prescription. However, the misuse of OTC drugs poses significant public health risks, exacerbated by their easy accessibility and diverse patterns of abuse. These medications have legitimate therapeutic roles, but their recreational use for cognitive or physical enhancement, as well as their inadequate use due to a lack of awareness or knowledge of potential adverse outcomes, often leads to harmful consequences, including dependency, severe health complications, and even fatalities. Vulnerable populations, such as adolescents, pregnant women, older adults, and individuals with mental health conditions, are particularly at risk, as they may self-medicate without proper oversight, increasing the likelihood of adverse effects and polydrug abuse. This highlights the urgent need for comprehensive prevention strategies, including public education and improved access to professional guidance. Furthermore, addressing the global disparities in healthcare resources and ensuring effective oversight in OTC drug use are pivotal to reducing the associated risks. Emerging alternatives, such as probiotics and nutraceuticals, show promise as safer options for managing common health conditions, although further research is needed to establish their efficacy and safety. Ultimately, a multifaceted, patient-centered approach, incorporating pharmacological advancements, behavioral insights, and robust public health interventions, will be crucial to mitigating OTC drug misuse and improving overall health outcomes.

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