

Fear, Anxiety And Compensatory Overdosing: Understanding Emotional Triggers Of Over-The-Counter Medication Misuse

¹Sarah Fathima Khateeb, ²Fathima Rislal Mohamed Riyas, ³Madiha Thasneem Nazurudeen, ⁴Rania Thowfeeque Shaikh, ⁵Aayisha Shimasa Mohamed Niyas, ⁶Muntaha Nadeem

^{1,2,5,6}Tbilisi State Medical University, Tbilisi, Georgia

³University of Georgia, Tbilisi, Georgia

⁴Ivane Javakhishvili Tbilisi State University, Tbilisi, Georgia

*(graduated from Tbilisi State Medical University)

¹sarah.khateeb247@gmail.com; ²rislariyas13@gmail.com; ³thasneemadiha8@gmail.com; ⁴raniathowfeeque@gmail.com;

⁵aayishashimasa.as@gmail.com; ⁶muntahandm@gmail.com

¹<https://orcid.org/0009-0004-4542-0161>; ²<https://orcid.org/0009-0006-2459-6023>; ³<https://orcid.org/0009-0003-1849-7481>; ⁴<https://orcid.org/0009-0004-5409-5743>; ⁵<https://orcid.org/0009-0005-7314-4931>; ⁶<https://orcid.org/0009-0009-0796-3284>

Corresponding author: Sarah Fathima Khateeb, sarah.khateeb247@gmail.com



Abstract: Over-the-counter medications are often widely used as a form of self-management for various commonly occurring symptoms due to their perceived safety, convenience, and affordability. However, their unguarded availability has raised concerns regarding misuse among the adolescent and young adult population. This misuse is linked not only to pharmacological factors but also to emotional distress, which may compel individuals to engage in misuse and contribute to patterns of compensatory overdosing.

Keywords: Over-the-counter medications; OTC misuse; self-medication; anxiety; fear; emotional distress; compensatory overdosing; adolescents; young adults; codeine; dextromethorphan; antihistamines; dependence; public health.

Introduction

Over the counter (OTC) medications refer to drugs that are sold directly to consumers without the requirement of a prescription from a doctor. Over the years, these medications have gained popularity among the public for self-care due to their accessibility and perceived safety, helping individuals manage common ailments such as pain, fever, cough, and other primary symptoms without medical supervision. However, unsupervised access to certain medications has teetered on the edge of misuse and is now increasingly associated with use in ways not directed on the label, in higher doses, or for non-therapeutic effects. This behaviour can lead to multifactorial physical, psychological, and social harms. Such misuse has prompted recent systematic analyses to highlight the prevalence and complexity of OTC medication misuse, ranging from simple overuse to compounding co-use with other substances, dependence, and harm at both individual and population levels. ^[1]

Although the consumption of OTC medications initially stemmed from limited regulation and widespread availability, recent studies accentuate the role of emotional stress, together with anxiety, fear, and perceived stress, in significantly influencing how people use over-the-counter medicines for purposes beyond what is stated on the label. For example, a recent large network analysis of over 600,000 adolescents by Elise and colleagues examined the association between OTC analgesic use and symptoms of anxiety and

depression, such as feeling “suddenly scared,” “sleep problems,” and feeling that “everything is a struggle,” even after taking OTC medication. These findings imply that emotional distress correlates with patterns of misuse. ^[2]

Correspondingly, a narrative review examining factors associated with OTC misuse among young people aged 14 to 25 years highlights misuse arising from “sensation-seeking” recreational use and the co-use of alcohol with illicit drugs. This behaviour is linked more closely to coping mechanisms than to purely physiological needs. ^[3]

Beyond emotional dependence, the consequences of misuse raise serious concerns regarding the adverse effects of certain medications, urging action to address this growing issue. A recent systematic review of OTC cough medicines containing dextromethorphan and sedative antihistamines highlights associated neuropsychiatric effects, including anxiety, panic, and even psychotic symptoms when taken in excessive amounts. This demonstrates that misuse itself may increase emotional distress, leading to a codependent cycle of emotional distress and continued misuse. ^[3]

Overall, recent findings support the idea that OTC medication misuse is not merely a pharmacological or regulatory issue but one that significantly affects emotional experiences and coping strategies among underinformed individuals. Emotional factors such as fear, anxiety, and stress may act as precipitating or reinforcing elements that begin with seemingly harmless self-medication and escalate beyond safe limits, increasing the risk of serious public health implications. Therefore, understanding the emotional triggers of OTC medication misuse among adolescents and young adults is essential for developing effective interventions, psychosocial health communication, and educational strategies to address the full spectrum of OTC misuse.

OBJECTIVE

This literature review aims to examine the psychological, neurobiological, sociocultural, behavioural, ethical, and public health dimensions of OTC medication misuse and to emphasize the role of emotional distress and anxiety-driven behaviours in adolescents and young adults.

METHOD

This narrative review article compiles data from contemporary literature obtained from PubMed and the Cochrane Library, focusing on systematic reviews, observational studies, epidemiological investigations, and public health reports examining all aspects of OTC medication misuse.

RESULTS

The evidence points toward a significant contribution of emotional distress to the misuse of OTC medications through maladaptive coping behaviours, misinterpretation of benign bodily sensations as signs of a serious medical emergency, reassurance-seeking, and compensatory overdosing. Medical fear and anxiety may also contribute to impaired decision-making, leading individuals to exceed recommended dosages.

CONCLUSION

OTC medication misuse is a multifactorial phenomenon that stems from misinformation, health-related anxiety, emotional distress, and sociocultural influences. Effective prevention and management of these manifestations should integrate comprehensive strategies, including medication safety initiatives, pharmacist-led monitoring, public awareness campaigns, and evidence-based medication policies. Such measures are essential to reducing the growing burden of OTC medication misuse among adolescents and young adults.

Psychological Mechanisms Driving Compensatory Overdosing

Compensatory overdosing is a distinct behavioural phenomenon which refers to the misuse and consumption of OTC drugs beyond recommended doses, to manage biological symptoms as well as psychological discomfort. While there are undeniable biological and sociocultural factors at play, psychological mechanisms play a critical role in linking emotional distress to excessive dosing, thus providing critical insight into how otherwise safe medications become sources of harm. Fear and anxiety especially, function as central catalysts in this behaviour, influencing symptom interpretation, risk perception and decision-making processes which then increase the likelihood of overdose related harm.

When patients suffer from persistent physical symptoms such as pain, fever, insomnia, gastrointestinal discomfort, etc, fear and anxiety often arise in response. Anxiety, especially, often amplifies the biological symptoms as well as increases focus on bodily sensations, which further affect interpretation of symptoms and may even lead to normal biological behaviour being misconstrued as signals of serious pathology. The relationship of health anxiety with symptom interpretation bias is well-recorded in multiple studies. ^{[4][5]} Furthermore, individuals with anxiety disorders prove to be even more susceptible to such behaviours and are more likely to make more serious, ‘catastrophic’ somatic attributions to symptoms, and less likely to generate non-threatening normalising explanations. ^[6]

Anxiety has a significant effect on cognitive processing and decision making. Individuals under emotional distress are more likely to revert to an emotional decision rather than an analytical one. This, coupled with the general prevalent belief that more medication is better as shown by several studies, ^{[7][8]} has noticeable effects on OTC medication dosage and misuse, particularly when initial dosage doesn't provide rapid symptomatic relief. The non-prescription status of OTC medications reinforces the relative safety of the drugs and thus, increasing dosage is seen as a viable option, even with widespread dissemination of information relating to dosage size.

Emotion-driven decision making further leads to misuse through negative reinforcement loops as witnessed in general drug addiction. Anxiety and fear are emotionally adverse states and medication can be used as an avoidance strategy and as a means of alleviating not just physical symptoms, but psychological discomfort. Thus, even partial relief, whether pharmacologically, or placebo driven, can reinforce the belief that increasing the dosage provides relief. Learning and conditioning processes play a vital role here as previous experiences where over-medication coincided with symptomatic relief can condition individuals to associate emotional relief with increased medication intake. Even an absence of true pharmacological benefit proves to be unimportant to the patient as this conditioning lands outside conscious awareness and is more implicit. Escalation patterns over time can lead to turning the medication into a conditioned response to emotional distress, rather than a carefully considered response to biological symptoms.

Misinterpretation of dosing guidelines and drug labels are common ^[9] and these can be further exacerbated by fear and anxiety which can compromise attentional focus, comprehension and adherence to instructions. Acute panic in these situations can be characterized by diminished capacity for future oriented thinking. Patients may misread, ignore or intentionally disregard dosing labels in favour of the perceived immediate need for medication. They may rely on anecdotal or online references for their dosage. Individuals may even partake in “just in case” dosing, consuming additional medication for fear of deterioration. Such behaviour is often impulsive and poorly regulated, further increasing risk.

As mentioned earlier, individuals with anxiety disorders are more likely to have symptom bias and thus are at an increased risk to OTC misuse. ^[6] To elaborate further, the processes mentioned are modulated by individual vulnerability factors such as high trait anxiety, poor distress tolerance and health anxiety disorders. Symptom interpretation bias leads to engaging in maladaptive coping behaviours. This is especially true for individuals with limited coping mechanisms who may rely on pharmacological solutions for emotional comfort rather than behavioural or cognitive strategies. Situational stressors also play a role, which shows that these behaviours are possible even in individuals who have no history of substance abuse, emphasizing the need for a separate framework focusing on OTC medication. Here, the relatively “safe” reputation of OTCs plays an important role in trivialising the side effects and infantilising it in comparison to general substance abuse.

Intolerance of uncertainty can be defined as “dispositional incapacity to endure the aversive response triggered by the perceived absence of salient, key, or sufficient information, and sustained by the associated perception of uncertainty.” It has been implicated as an important contributing factor to health anxiety and individuals with high IU may respond to it in maladaptive ways, such as stress and excessive certainty-seeking behaviours. ^[10] Individuals with IU are more likely to react with greater anxiety and fear in uncertain health-related contexts which makes it a relevant psychological precursor to OTC misuse. ^[11] Research on healthcare workers in Korea during the Covid-19 pandemic shows that IU directly influenced anxiety and this relationship was mediated by reassurance-seeking behaviours. ^[12] Conversely, individuals may instead overuse OTC medication as a form of reassurance-seeking behaviour. Excessive dosing thus operates as a maladaptive coping strategy used to restore psychological comfort rather than as a pharmacological necessity.

From a clinical perspective, compensatory overdosing driven by fear and anxiety is often overlooked as healthcare professionals often focus on intentional overdosing, substance abuse or self-harm. However, failure to identify and use this pathway limits opportunities for preventive counselling and early intervention. Routine assessment of emotional state as well as medication within common clinical visits could be vital in picking up risk factors and such, at risk individuals, allowing for arresting of maladaptive coping strategies at earlier intervals which can limit damage caused and provide a more effective patient experience. Furthermore, the proliferation of information regarding the effect of the emotional state on medication misuse could prove helpful.

It is vital to understand that while psychological stressors provide an important foundation to limiting OTC misuse, there are sociocultural, behavioural and biological factors which have an equal effect on medication misuse. Addressing these mechanisms holistically is essential to combating compensatory overdosing.

Neurochemical underpinnings and biological complications of OTC drug misuse

Among the classes of OTC medicine most commonly involved in misuse and abuse, opioids, CNS depressants and stimulants are primarily implicated. While they each have their own recreational highs, they all share the same benefit of being readily available without a prescription. Their presumed safety, paired with ease of procurement and a sense of self-care, results in dangerously heightened consumption. Most individuals regard biological tolerance as inefficacy of these drugs, causing them to ingest more than the recommended amounts.

Opioids

Of opioids, the most well-known are - codeine, dihydrocodeine, DXM and loperamide. These drugs work by interacting with the opioid receptors in brain and spinal cord of both the CNS and PNS, lessening the severity of pain sensation. They also modulate emotions, rendering the individual unable to handle distressing situations. ^[13] Historically, these medications have been used as relief from pain, cough and digestive issues, although modern day applications involve short-term pain reduction. A review of observational studies performed regarding the mean age, gender differences, and population disparities of opioid abuse (codeine, amidst other drugs not relevant to our review) placed males averaging 33 years of age as the prime misusers of OTC/POM opioids. This information pertains to studies conducted in Australia and parts of the UK. ^[17]

Dextrometorphan

In a systematic review article on OTC misuse, it was found that a derivative of codeine, Dextrometorphan, was the most commonly abused drug - either on its own or in DXM-containing cough mixtures. ^[14] Important to note is that most individuals misusing DXM had a psychiatric history of alcohol and other substance use disorders. Most frequently noticed complications ranged from mild to severe, including autonomic (mydriasis, tachycardia, palpitations), gastrointestinal, neurological (amnesia, nystagmus, ataxia, seizures, and dystonia) and psychiatric implications such as euphoric highs, agitation, confusion, illusions, hallucinations and delusions. ^[14]

Codeine

Marketed as a cough suppressant and analgesic, codeine is the world's most consumed opioid, with approximately 2% of admissions to substance abuse centres being codeine dependent patients. ^[15] Codeine exerts its narcogenic effects by binding primarily to μ -opioid receptor, with its sub-analgesic effects prominent at the κ receptors. Although sedating after a single dose, codeine tends to reinforce energetic highs upon continued intake, prompting individuals into addiction. Users describe a sense of dissociation/disconnection from oneself, often recounted as a dream-like floating sensation paired with mild hallucinations and/or out-of-body experiences. ^[15] When misused in conjunction with non-opioid analgesics, as is often the case, codeine toxicity escalates, involving lethal hepatotoxicity, GI disturbances like haemorrhages, ulcerations, hypokalaemia, metabolic acidosis and nephrotoxicity. ^[15] In Japan, codeine as a constituent of BRON (cough suppressant) is occasionally ingested along with methyl-ephedrine and caffeine, with a case reporting severe intoxication and respiratory acidosis requiring immediate hospitalisation. ^[14]

Codeine is also used in the synthesis of more potent and harmful narcogens, acting as a substrate for formulation of morphine and desomorphine. Desomorphine causes far more severe complications, ranging from jaw osteonecrosis, to gangrene/necrosis of limbs, vascular and hepatic/renal damages along with the known hallucinations. ^[15]

Dihydrocodeine

As with codeine, dihydrocodeine shows great affinity toward the μ receptor. Typically used in treatment of mild to moderate pain control, its misuse stems from its ability to stimulate a euphoric high with moderate transcends over the recommended dosage. An article on the pharmacological aspects of OTC drug use reports approved dosage of dihydrocodeine is ca. 7.5–15 mg every 4–6 h, not surpassing ca. 60 mg a day, while euphoria can be induced at a single dose of approximately 70 mg. Similar to codeine, respiratory depression remains a routine adverse effect, alongside less severe complications like dry mouth, drowsiness, headaches, nausea, and urinary retention. ^[15]

Loperamide

Loperamide's presumed innocence was formerly attributed to its synthetic composition, minimal penetration of the BBB and poor bioavailability. However, with revised research implicating it in the sudden peak in opioid poisonings, loperamide has been subjected to re-evaluation of its safety by the FDA. ^[15]

Cardiotoxicity is the most lethal side effect, manifesting as widened QRS complexes upon ingestion of large doses. Although its misuse is not primarily for non-medical purposes (it is used as a treatment for opioid withdrawal), it also has no documented analgesic effects, resulting in drug poisonings and attempted suicides. ^[15]

While the immediate effects of opioid misuse, presenting as drowsiness, decreased bowel movements, slowed breathing, nausea etc., may not seem alarming, prolonged misuse can cause life threatening complications such as LOC and coma. Sudden cessation manifests as typical withdrawals symptoms - restlessness, insomnia, chills, muscle and bone pain etc. ^[13] Another well documented concern in case of cessation of opioid intake after prolonged use is OIH - opioid induced hyperalgesia. This increased sensitivity to pain is attributed to sudden activation of NMDA receptors, succeeding increased glutamatergic signalling. OIH traps the individual in a vicious cycle of opioid dependence. Opioids also affect the respiratory centre in the brain, posing a potential risk of OD. ^[13] They interact with the μ -opioid receptors (MORs), causing a direct and detrimental inhibitory effect resulting in opioid induced respiratory depression (ORID). Three key sites in the brainstem that are affected by improper opioid intake and/or overdosing are - Pre-Bötzinger Complex, Parabrachial or the KF Nucleus and the Nucleus Tractus Solitarius (NTS). These nodes located within the respiratory network are responsible for generating a respiratory rhythm and modulating its rate and regularity.

Antihistamines

The misuse of antihistamines, especially OTC formulations, is under-documented in literature. However, emerging evidence suggests potential for risk, especially when used in conjunction with OTC opioids. Dimenhydrinate, diphenhydramine and promethazine are the most relevant for discussion. Previous analysis into the pharmacological aspect of antihistamine misuse has shed light on the sedative effects of antihistamines at therapeutic dosages. Contrarily, at supra-therapeutic dosages, these drugs cause anticholinergic poisoning, resulting in paradoxical CNS stimulation. This manifests as feelings of euphoria, and/or auditory and visual hallucinations, when consumed in larger amounts. ^[15]

Promethazine

Promethazine, and other such drugs, are ingested along with alcohol to further enhance detrimental effects. One study reports the growing consumption of 'purple drank', a concoction prepared by mixing promethazine-codeine containing cough syrup with candy, alcohol and soft drinks to produce a purple coloured drink, intended to provide the consumer with feelings of euphoria. ^[15] Commonly reported complications of this drink are arrhythmias (manifesting as QT prolongation on the ECG), delirium, psychoses, substance dependence, and withdrawal syndrome. Tardive dyskinesia, resulting from the antagonism of D2 dopaminergic receptors, is also noticed.

Studies recount drug-induced delirium as the prominent psychiatric symptom, treated predominantly with antipsychotics and benzodiazepines. ^[14] Additionally, when promethazine is used singularly, cases are often treated within healthcare facilities, but patients misusing this drug jointly with opioids require emergency management.

Dimenhydrinate (DH)

Physical symptoms associated with DH misuse are generally mild and manageable, such as mydriasis, flushing, restlessness, mild tachycardia, and/or ataxia. Psychiatric symptoms, however, ranged from recreational effects to drug-induced delirium with paranoia, though incoherence, auditory and visual hallucinations, agitation and anxiety, among others. Characteristic withdrawal symptoms are evident in patients upon sudden cessation of chronic use. ^[14] In almost all reports of DH misuse, treatment was mainly supportive.

Diphenhydramine (DPH)

Adverse effects affiliated with chronic improper use of DPH are more or less similar to those noticed in DH misuse. It also shows similarities to promethazine, in that QT prolongation is evident in misusers. A systematic review article reported adolescent females as the primary abusers of this drug. Usage attempted to provide relaxation, calmness and improved sleep, but individuals quickly steepened doses, with maximum dosages of 2000 mg / day being recorded. ^[14] Acute intoxication results in distressing psychotic symptoms, psychomotor agitation, disorientation etc. As noted with misuse of promethazine, abuse of OTC DPH formulations results in anticholinergic toxicity.

Neurochemistry of addiction

Communications within the brain occur through a series of tightly knit connections, culminating in a singular mesocorticolimbic reward circuitry. Simply put, addiction develops in the presence of a reward stimulus - an impetus that releases dopamine into the nucleus Accumbens (NAcc). Neurogenic projection from the ventral tegmental area (VTA) release dopamine into the NAcc, which consists mainly of GABAergic medium spiny neurons. Research indicates that virtually all drugs result in the release of dopamine, in addition to their individual recreational effects. The NAcc, associated with conditioned behaviours, along with the prefrontal cortex, increases sensitivity to drugs. As addiction progresses, this learned behaviour elicits aid from the anterior cingulate and orbitofrontal cortices to identify correlations between drug-induced rewarding behaviours and stimuli in the surrounding environment, triggering relapse months or even years after abstinence. ^[16]

As discussed above, all classes of drugs seek to reinforce dopamine release. They employ varied mechanisms, with opioids activating the μ -receptors, thereby inhibiting VTA's GABA interneurons and resulting in dopamine release. DXM, an opioid in essence, follows a slightly different approach, choosing NMDA antagonism, leading to altered glutamergic modulation, and thus indirectly facilitating dopamine release. Conversely, antihistamines do not rely heavily on receptor modulation, choosing instead to disinhibition cortical function, and enable dopamine reinforcement through signalling pathways.

Overtime, desensitisation resulting from down-regulation of receptors, as well as decreased D2 dopamine availability in the striatum, results in development of biological tolerance toward the drugs. A detrimental, and dangerously unavoidable factor of addiction, is the formation of synaptic plasticity, involving structural remodelling of synaptic pathways. The compensatory up-regulation of glutamergic signalling means drug consumption is observed even in the absence of initial reward. This change of stimulus from dopamine release to drug-seeking behaviour is attributed to the areas of striatum involved in the progression of addiction - namely the ventral striatum driving reward-dependent use in the early stages, and dorsal striatum consolidating the habit in chronic stages.

The misuse/abuse of OTC drugs has become rampant in recent times, owing to ease of procuring said drugs. It is essential to limit their purchase without prescriptions. Withdrawal from chronic usage is not without consequences, with many individuals relapsing after years of abstinence. Although not typically life-threatening, withdrawal can still result in severe complications. ^{[13],[14]}

Sociocultural and behavioral contributors to OTC misuse

Sociocultural and behavioral contributors are the social practices, beliefs, norms and conditions which impact a person's attitude towards sickness, emotional distress, symptoms, and medication safety, often expressed through fear, anxiety and performance

stress, which can lead to misuse of the over-the-counter medications. Factors such as personal problems, relationship issues, loneliness, childhood trauma, low self-esteem, unemployment are some of the common reasons for OTC misuse. Misunderstanding OTC medicine instructions has been linked to inappropriate dosing and repeated use, which has led to OTC misuse, primarily in elderly and diverse groups, often due to low education level in developing countries and some developed countries. ^[1]

The normalized use of OTC medications has also increased the risks of misuse, not only in individual socioeconomic situations but also within family, school and workplace settings. Pharmaceuticalisation, family and peer association also play a major role in OTC misuse considering it to be a valid strategy to meet social expectations, manage stress, reduce anxiety and maintain performance. Moreover, the idea of pleasure and performance improvement among young adults which follows the misuse of prescription drugs has similar context and mechanism to OTC drugs, overlapping their pathways. ^[18]

Repeated use of OTC medications to relieve pain-related conditions has also increased its inappropriate dosing and misuse. Pain is one of the most common symptoms reported worldwide, its related conditions like headache disorders and lower back pain contribute significantly towards global disability among people. Pain is recurring and persistent which leads to anxiety and functional impairment, burden to retain day-to-day activities, and fear of symptom progression, that makes patients depend on OTC medication for self-administration. In some instances, due to lack of awareness, individuals tend to administer excessive dosage in order to enhance their quality of life, potentially resulting in detrimental health consequences. Moreover, post-operative pain is another crucial situation for OTC analgesic misuse. Inadequate pain management, fear of symptom perseverance, and lack of follow-up give rise to prolonged use of analgesics beyond recommended doses, causing adverse effects. ^[19]

Academic stress is a common phenomenon among students, usually leading to coping mechanisms that impact their health negatively. Self-medication under stress and anxiety, particularly the use of Non-Steroidal Anti-Inflammatory Drugs (NSAIDs), paracetamol, sleep aids and analgesics is commonly used to enhance their academic performance. According to research, 61% of students tend to avoid professional consultation due to time constraints and opt for self-medication during periods of high academic pressure, justifying this behavior as a means of maintaining their performance. These behaviors along with a lack of mental health support and health education, peer and family pressure have led to immense OTC misuse. ^[20]

The concept of OTC medication use in workplace settings to manage stress and maintain work ability has become common. People use dietary supplements and medicines as part of their routine to manage the professional pressure, fear and anxiety. This phenomenon has become socially normalized and continues to affect the health of workers. The reciprocal relationship between work related factors and pharmaceuticalisation of work performance has contributed to increased distribution and OTC medication use and misuse. ^[21]

Structural oppression is also an important sociocultural determinant of OTC misuse. Sexual and gender minorities (SGMs) are often exposed to discrimination which has caused increased engagement in maladaptive coping behaviors like substance misuse, alcohol misuse and OTC medication misuse. The continuous discrimination, social stigma and easy access to OTC medications has made OTC misuse an escape among sexual and gender minorities. ^[22]

Digital platforms and mass media drastically influenced how individuals approach the data regarding OTC medications. In the digital era, online materials such as social media, health websites, and digital advertisements have emerged as eye-catching through which users gather information about OTC medicines, displacing traditional dependence on health care professionals, while these platforms can theoretically promote public awareness towards drug addiction, what truly happens is that the availability of information ends up advocating for unsupervised self-medication, which can be dangerous especially, when one considers the possibility of misinformation. ^[23]

Furthermore, this may lead to inappropriate consumption patterns, namely excessive dosing, long term usage, or dependence on OTC medications as a replacement to professional medical counselling. This can increase the risk of adverse drug reactions, drug interactions, and delayed diagnosis of underlying medical conditions. ^[23]

Moreover, the impact of communication channels differs among various demographic categories. Research suggests that younger individuals are more inclined to obtain OTC medicinal data from mass media and non-professional sources, such as peer and online

communities, which may perpetuate uncertain behaviors and misconception about medication safety. Conversely, older individuals tend to lean more towards the professional sources, such as physicians and pharmacists, generating more regulated drug usage patterns. Inclusively, these findings stress the significant sociocultural and behavioral effect of digital media advertising and social communication networks on OTC medication utilization, emphasizing their pivotal function of perpetuating abuse. ^[23]

Ethical consideration

The widespread availability of OTC medicines raises ethical questions regarding the balance between individual autonomy and the role of healthcare systems to prevent harm associated with misuse and dependence. Although OTC are available with the intention to support self-medication and reduce burden on health care system, it doesn't ethically justify misuse which can lead to harm.

Legally, personal autonomy allows consumers the rights to consume what they want provided they are not harming others. ⁽²⁴⁾ This develops the debate about personal autonomy against public health concerns. Free-choice and misuse become ethically ambiguous as once dependence develops the "misuse" is driven by craving and not informed decision making ⁽¹⁾ and the notion that they are protected under "right to do wrong" becomes ethically unstable. ⁽²⁴⁾ This weakens the argument that consumers are simply exercising freewill. ⁽¹⁾

OTC medicines are intended to enable self-treatment without the need for medical consultation, and it is sometimes argued that drugs such as codeine are necessary to protect the right to health by alleviating pain or cough. ⁽²⁴⁾ In this context, up-scheduling codeine could be seen as controlling access to healthcare. However, non-codeine OTC alternatives with similar therapeutic effects are vastly available and do not risk dependence. Therefore, access to healthcare does not need free access to codeine but instead access to safe and effective treatments. Since codeine is available by prescription, up-scheduling protects public health without denying necessary care. ⁽²⁴⁾ Up-scheduling codeine does not deny the right to health; there are safer non-codeine alternatives and codeine remains assessable by prescription when clinically justified. ⁽¹⁾ Providing OTC codeine with pharmacist oversight balances patient autonomy with public safety. ⁽²⁹⁾

Merely because they can be obtained legally, doesn't mean consuming them is safe. ⁽¹⁾ Consumers are often uninformed about dangers of OTC misuse, unlike tobacco packaging which have its dangers printed on the boxes. Those who are only looking for a psychostimulant effect aren't fully informed about addiction or acute poisoning. ⁽²⁴⁾ Overconfidence can lead to unsafe self-medication, raising questions about responsibility and harm prevention, lack of awareness increases risk of harm. ⁽²⁸⁾ OTC misuse is commonly seen in young adults who are looking to engage in risky behaviour. It is also a coping mechanism to deal with psychological and social burdens. ⁽²⁴⁾

People often self-medicate on account of minor illnesses, easy access and convenience. This brings out the ethical issues of unsupervised drug use, misuse and possible harm. High amounts of non-healthcare professionals who self-medicate, further increased ethical concerns of unsupervised access to OTC. ⁽²⁷⁾ A large number of consumers reported never being instructed by pharmacists regarding dosage, side effects or asked about personal history on allergies or pregnancy, revealing gaps in supervision and ethical responsibility. Vast majority had misinterpretations of antibiotics despite being highly educated. These indicate the importance of targeted interventions, better management and public health education to promote safe practice and to reduce misuse and harm. ⁽²⁶⁾

Different ethical issues raised by OTC misuse were associated with finances, family relations, stigma and professional responsibilities. Misusers experienced financial consequences like job loss, stealing money or drugs and causing secondary harm to friends and family. ⁽²⁵⁾

Family members would often act as the official caregiver, by providing encouragement, monitoring use, restricting access and supporting recovery. Most often than not, this burden is overlooked and why interventions need to be holistic, including the misuser and their support network. Family members may also lose trust in healthcare professionals and are discouraged from seeking guidance, adding another layer of ethical concern. ⁽²⁵⁾

Pat practice of judging customers by appearance lead to stigma, with some individuals being denied of analgesia while others not informed.^[29] Intervention should be supporting beneficence and maleficence, they should be effective and balanced. Therefore, avoiding unnecessary restriction for appropriate medical use.^[1]

A constant challenge is that terminologies like misuse, abuse and dependence are often used incorrectly, making understanding studies the true problem. Authors argue that a standard definition needs to be set for future research purposes.^[1]

Risk Assessment

OTC are drugs that can be purchased without prescriptions with aims to promote self-care and reduce healthcare costs.^[24] They are widely available through pharmacies, supermarkets, petrol stations, and online platforms. OTC are typically safe if used as directed, however they contain active ingredients that can cause harm if misused. Misuse is most commonly observed among adults.^[1]

Types of OTC:

A variety of OTC products have been identified as having misuse potential. These are codeine-based drugs, cough products such as dextromethorphan, sedative antihistamines such as diphenhydramine, decongestants and laxatives.^[24] Analgesics, with or without codeine, sedative antihistamines, and dextromethorphan-containing cough syrups are among the most frequently misused OTC products. In most scenarios, they are started from medical use before it becomes harmful.^[1] Opioids, and antihistamines are often reported and are a priority for monitoring and regulatory intervention. Antihistamines remain under-recognized as drugs of misuse despite increasing evidence linking them to significant harm.^[1]

Misuse starts with legitimate medical use leading to intentionally taking higher dose of OTC than recommended or using it for longer than needed. Abuse is the illegitimate use of medication to achieve mind altering effects. Dependence is characterized by frequent use of medication with desire to continue despite knowing the harms and can't quit voluntarily.^[1]

Although medications are meant for symptom relief, some possess psychoactive effects that causes misuse.^[24] People misuse these medications to achieve desired psychoactive effect.^[1] Aggressive pharmacy marketing may normalize frequent use and increase risk.^[27] Misuse has been stated among the elderly population in both developed and developing countries, with some faking and exaggerating symptoms.^[1]

The average age for acute poisoning from OTC misuse is approximately 20 years old.^[24] Reported frequency rates include 16.2% for misuse, 2% for abuse, and 7.2% for dependence. Country-specific data demonstrate variability, with reported misuse, abuse, and dependence rates of 6.8%, 0.8%, and 17.8% in France, and 19.3%, 5.1%, and 2% in the UK. Pharmacy customers in Scotland were prescribed codeine-containing analgesics and sedative antihistamines and found misuse in almost all of participants. In Germany, individuals consumed OTC medicines for longer than needed.^[1] Worldwide, self-medication prevalence ranges from 11.2% to 93.7%, a study should most of Thailand's working-age population reporting self-medication, primarily using NSAIDs and antibiotics.^[26] Findings indicated that participants practiced self-medication without professional guidance, more than half shared medicines among family members, some used analgesics beyond recommended duration, others frequently consumed antibiotics OTC despite regulations, exceeded the recommended daily dose of analgesics, and used cough syrups recreationally.^[27] In the UAE, a cross-sectional study of university students with a total of 2355 students. The mean age was 20.94 and 76.3% were female. More than half of the participating students (57.5%) reported using OTC medicines during the past 90 days of conducting the study.^[28] Non-medical use of any codeine product is four to eight times higher in European countries where it is available over the counter than in countries where the medication is available only by prescription.^[29]

OTC misuse causes physical, mental, and socio-economic harm. Psychological effects include stress, anxiety and exhaustion, while social consequences include stigma, isolation and relationship strain, including effects on children. Financial burdens from repeated and hidden purchases. Physical harms like gastrointestinal bleeding, nephrotoxicity, hypokalaemia, headache, respiratory depression, and cardiac arrhythmias.^[25] Non-oral routes of administration increased risks of infection and overdose. Other consequences include overdoses, accidents, criminal activity, withdrawal complications, and unintentional excessive intake of OTC products.^[1] These harms effect beyond just the user.^[1]

Studies report polypharmacy being common and its associated risks.^[25] OTC being used with illicit drugs increases risk of drug interaction, physical and mental harm and drug related deaths. It may also sustain withdrawal symptoms complicating management and risks.^[1]

Pharmacists should suspect misuse when repeated purchasing. Risk assessment identifies vulnerable populations, including elderly individuals, those with low income or literacy, and users of codeine analgesics, sedative antihistamines, dextromethorphan, and pseudoephedrine. Key risk factors include long-term use, high-dose consumption, combining OTC medicines with other drugs or illicit substances, and red-flag behaviours such as exaggerated symptoms.^[1] These individuals self-select the drugs rather than seeking professional advice.^[26] Unsafe self-medication included reliance on leftover medications, informal sources of drug information, and failure to consult pharmacists or read drug information leaflets. Another behavioural risk factor seen in students of medical background are more confident in self-diagnosis, less likely to seek advice, leftover drugs, ignoring labels, high-frequency use, perceived poor health as behavioural trigger, skipping leaflets.^[28]

Retail drug stores might not be willing to act or have regulations as most of them sell OTC for profit and revenue. Online purchasing is another issue as it's an easy access for anyone buy drugs and there's less rule enforcement so there is a risk of misuse.^[24] Online purchasing is another issue as it's an easy access for anyone buy drugs and there's less rule enforcement so there is a risk of misuse.^[1] The availability of multiple pharmacies, online sellers, and dealers creates regulatory gaps, and increased pharmacy density has been associated with higher rates of self-medication.^[26]

As of Aug 2022, Japan has regulations on codeine under consideration. Up-scheduling involves placing OTC medicines under prescription-only or full regulation, but this study was mainly on requirement of prescription. Since 2010, codeine has been rescheduled in Canada, Australia (2018) and in parts of Europe. Since 2018, Australia has a 50.8% decrease in poison centre calls and 53% decrease in hospitalization while the use of other dependent drugs did not increase, similar trends were seen in Canada and Ireland.^[24] Regulatory changes alone are insufficient and may cause unintended harm, there needs to be increased awareness in OTC misuse and its harm.^[1]

Self-medication is commonly due to minor illness and easy access to pharmacies. Between 0.6% and 6.6% of users have experienced adverse effects and a lot of them had misunderstandings regarding antibiotics remain prevalent, highlighting the need for education.^[26]

Pharmacies can perform screening tests using guidelines like the 4-item codeine dependence scale to perform. Risk can be quantified with sensitivity of 76% and specificity of 48% according to the DSM-5 opioid use disorder. An approach with precaution where all customers are treated as potentially at risk will help reduce stigma and bias. Validation studies are done to see consistency and strong discriminatory performance of the CDS. Additional assessment of pain, mental health and use of health care service can provide more information on risk associated with codeine dependence.^[29]

Intervention

Before 2022 in Japan, codeine regulation was limited to cough syrup formulas, but other codeine drugs were under no regulations and later they introduced regulations for all codeine drugs, but drug scheduling itself didn't change.^[24] In Ireland they had pharmacists follow a criterion, including follow up on sales, codeine doses and medical reviews for continues uses, a 62% decrease of codeine poisoning was seen. On the other hand, in 2010, Australia unscheduled codeine as a pharmacy-only medicine focused on increasing pharmacist involvement rather than restricting availability. In USA, pharmacists believe making drugs like pseudoephedrine prescription-only would reduce drug abuse, suggesting stronger controls are needed.^[1]

Measures taken to reduce OTC misuse including restricting package sizes, pharmacists providing explanation to point of sale, keeping drugs behind the counter. Although there were changes seen they didn't show any significant improvements. Pharmacists face other issues where they can't identify high risk individuals and people with addiction seek less strict sellers, raising concerns where sellers prioritize sales over safety.^[24]

Mental health support might help but again won't effectively change anything. Education about these drugs maybe be effective to some extent but is limited due to the fact that it is very easily accessible, legal and considered safer than the illegal drugs. Social media also plays a role in sharing about dangers of OTC but they can also share how to increase psych effective nature of drugs increasing risk of overdose and addiction. Banning or blocking this content may be justified but some influencers also post recovery supportive content. So censoring isn't the answer but better regulation. Up scheduling of drugs might be the most effective as it makes codeine accessible legally but only with a doctor prescription. Doctors should be careful with what and how much they prescribe, and sudden restrictions can cause withdrawal issues. ^[24]

Another study showed that interventions should be holistic, include friends and family who are affected, with intervention like childcare and support, removing high risk drugs from prescriptions, withdrawal managements and financial support. ^[25]

Interventions to reduce OTC misuse that were implemented across healthcare settings including community pharmacy, general practice and addiction centres. Pharmacists play a central role in reclassing codeine-containing analgesics as problematic, pharmacists' action to reduce OTC abuse physician referral, shifting to a more convenient medicine, monitoring and registering sales, denying sales, limiting sales, providing restricted pack size, storing products out of customers' sight and increasing vigilance. Many cases of misuse can be resolved at the pharmacy level without referral. ^[1] Pharmacists asking consumers reasons for purchasing codeine and providing info about dosage and side effects are all early interventions. Pharmacists are key to reducing misuse, preventing escalation, and guiding safer use. ^[29]

Clinical interventions focus on early identification and management of dependence through screening in primary care, patient education, gradual withdrawal protocols, and referral to specialist addiction services when required. Additional harm minimization strategies include the development of abuse-deterrent formulations and integrated care models linking pharmacies, general practice, and addiction services. ^[1]

Interventions to reduce OTC medicine misuse include regulatory, pharmacy-based, clinical, and public health strategies. Regulatory approaches such as up-scheduling codeine as prescription-only have shown different levels of effectiveness, significant reductions in misuse and poisonings were seen in Ireland, whereas similar interventions in Australia were less effective, indicating that regulation alone may be not enough. At a population level, public health interventions aim to deliver education to at risk groups and improve regulation of online OTC sales. ^[1]

Studies show that if misusers are identified and supported, they respond positively. The need for improvements to healthcare provision were frequently commented. ^[1] Policy-level interventions recommendation include education, supervision, access to services. ^[26]

The need for public education and pharmacist-led intervention programs is reinforced by factors like perceived minor illness, convenience, and internet-based information. These factors also contribute to ethical challenges. Many participants have misunderstandings about antibiotic use and drug therapy, signifying risk of misuse and supporting the need for educational interventions and antibiotic use. Some participants experienced severe adverse drug reactions, and many illnesses were not fully treated, highlighting patient safety risks and the necessity for preventive measures to reduce harm. ^[26] In this study, interventions included cessation support, medical referrals, pharmacist counselling, and family education. After six months, patients transitioned to physician-guided therapy. Post-intervention outcomes were notable: unsupervised analgesic use decreased by 44%, antibiotic self-medication dropped by 53%, and pharmacist consultations increased by 48%. Patients also showed clear improvements in how they used medications. For example, more people read and understood labels correctly, fewer shared medicines with others, and most followed dosage instructions more carefully. Overall, the findings indicate that community-based interventions can help people make safer choices when taking medications. ^[27]

A range of pharmacist-based interventions are being implemented, these include pharmacist booths, drug safety drives, QR leaflets, wall posters, pharmacist counselling, education campaigns, household medicine audits, warning stickers. These promote awareness and safer medication use. ^{[27],[28]}

Non-confrontational tools play a role in early intervention. Brief, simple screening tools like the CDS allow pharmacists to intervene without stigmatizing the patient. Screening and brief intervention (SBI) enable pharmacists to ask simple questions to detect risk of dependence and provide counselling or referral. These tools are feasible and can be implemented in routine pharmacy visits. The CDS can be adapted for use in countries where codeine remains OTC.^[29]

The CDS provides a practical middle ground between current pharmacist practice and lengthy assessments. Even false positives (over-inclusive screening) can be useful by prompting conversations about codeine use.

High volume use, non-pain use and difficulty going without codeine are key discussion points with pharmacists. Reviewed by healthcare professionals, feedback confirmed the questions are appropriate and relevant for primary care and pharmacy settings. When comparing with AUDADIS-IV, CDS-positive cases associated with higher codeine and opioid use, lower pain self-efficacy, more GP visits, and higher pain 15 months later. AUDADIS-IV-positive cases associated with higher baseline anxiety and depression, but no long-term differences in pain outcomes. Suggests CDS may better identify long-term pain-related risk from problematic codeine use.^[29]

Conclusion:

Misuse of over-the-counter medications among adolescents and young adults is a concerning issue that along with physical symptoms management is closely related with emotional distress namely fear, anxiety and trauma related stressors.^{[30],[2]} Studies show that adolescents often use OTC medication at rates that raise public health concerns and the patterns linked suggest that emotional and psychological factors play a major contributing factor to this behaviour.^[32]

Evidence from a data study shows that adolescents exposed to traumatic events such as bullying, interpersonal violence and sexual abuse usually report higher frequencies of OTC analgesic use than their non-exposed peers which means that emotional distress linked to trauma may contribute to reliance on OTC medications as an accessible coping mechanism.^[30]

The relation between OTC analgesic use and symptoms like anxiety and depression also supports the role of emotional factors being involved with medication misuse. A study revealed that OTC use is strongly linked to somatic signs of psychological disturbances including sleep problems, muscular tension, feelings of being overwhelmed and sudden fear even after controlling the pain. This pattern shows us that adolescents may be using analgesics in an attempt to relieve these disturbances instead of just the pain.^[2]

There are also some gender differences seen in these links which supports the emotional aspect of OTC use more as there is a stronger relation between analgesic use and symptoms such as sleep disturbances and hopelessness in females meanwhile males show stronger relation with tension related symptoms. These findings are along with the fact that emotional distress may be expressed and managed differently across genders during adolescence, influencing patterns of self-medication.^[2]

A wide amount of self-medication practices among adolescents also shows that there are huge gaps in medication knowledge and risk awareness among them. Survey data suggests that while OTC use is nearly universal in some adolescent populations, a considerable amount of people lack adequate understanding of proper dosing, adverse effects and contraindications.^[31] These knowledge gaps increase the likelihood that emotionally driven medication use may lead to inappropriate dosing or repeated use without professional guidance and this has further been linked to physical harm, psychological consequences and delayed access to appropriate medical care. These risks highlight the importance of examining both the prevalence of OTC misuse as well as the underlying reasons which motivate them to take them.^{[32],[1]}

Emotional factors such as stress, psychological discomfort and inability to cope often can contribute to medication misuse.^[1] This is especially concerning in the case of adolescents given that medication habits formed during adolescence may go on into adulthood. This means that emotionally motivated OTC use at a very young age may be a sign of early stage into an unhealthy pattern of self-medication overuse behaviours.^{[30],[1]}

To summarise, addressing OTC medication misuse in adolescence requires thinking about its emotional and psychological aspects on behaviour and not just the pharmacological or educational issues.^{[32],[2]} Prevention efforts should include trauma informed approaches, mental health screening and targeted awareness that highlights the role of fear and anxiety in leading to compensatory

overdosing behaviours. By including emotional health considerations into medication safety strategies, healthcare systems may be able to better manage and reduce the risks associated with OTC misuse during this sensitive developmental period.

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