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OVER THE COUNTER (OTC) MEDICATIONS: SAFETY, ACCESSIBILITY, AND REGULATORY CONSIDERATIONS

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ABSTRACT

Over-the-counter medicines play a key role in public health, as they provide readily available and convenient options for self-medication. This review examines the safety, accessibility, and regulatory aspects of over-the-counter medicines. Safety considerations include the potential risks and benefits of self-medication, including side effects, interactions with other medications, and the importance of appropriate use. Accessibility examines the widespread availability of over-the-counter medicines, enabling people to manage minor health problems independently. Regulatory aspects include the regulatory framework for the manufacture, distribution and sale of over-the-counter medicines and emphasize the need for strong regulatory oversight to ensure product efficacy and consumer protection. A thorough understanding of these aspects is important for health care providers, regulators, and consumers to make informed decisions, promote responsible use of over-the-counter medications, and promote overall public health.

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INTRODUCTION

OTC medicines play an important role in modern healthcare, providing people with readily available and convenient options for various health problems without a prescription. These medicines, which are readily available in pharmacies, grocery stores and other stores, serve many common ailments (1). The importance of OTC medicines lies in their ability to enable people to self-treat minor health problems, which contributes to the overall efficiency and flexibility of health systems. The widespread use of over-the-counter medications indicates their popularity and acceptance among consumers. OTC medicines offer a wide range of solutions for everyday health needs, from pain relief and allergy treatment to cough and cold treatment (2). The over-the-counter availability of these medicines improves public health by enabling rapid intervention for minor illnesses, reducing the burden on health services, and providing people with a quick and direct way to treat their health problems. In this review, we try to familiarize ourselves with various aspects related to over-the-counter medicines (3). By examining their importance in healthcare, understanding patterns of widespread use and accessibility, and highlighting the main goals of our assessment, we aim to provide a comprehensive overview of the role of over-the-counter medicines in modern healthcare. Our goals include investigating the safety aspects of over-the-counter drug use, understanding the regulatory frameworks governing these drugs, and assessing the overall public health impact of over-the-counter drug availability. With this research, we aim to provide valuable insight into the dynamics of over-the-counter medicines and their impact on both individuals and the wider healthcare system (4).

Safety of OTC medication: -

OTC medications, while generally considered safe when used as directed, necessitate a thorough understanding of potential risks, side effects, and interactions to ensure responsible and safe usage.

1. Common Side Effects: OTC medications can cause side effects that range from mild to severe. It is very important that consumers are aware of these possible reactions, which may include gastrointestinal disturbances, drowsiness or allergic reactions (5). Understanding the expected side effects allows people to make informed decisions about their health.

2. Potential Interactions: OTC medications may interact with other medications, both prescription and over the counter, and some medical conditions (6). For example, interactions between OTC pain relievers and blood thinners can pose risks. Consumers should consult a physician to identify possible interactions and avoid adverse effects.

3. Risks and Overdose: Misuse or overdose of OTC drugs can cause serious health risks. An overdose of certain ingredients, such as acetaminophen, can cause liver damage (7). Consumers should strictly adhere to recommended dosages and avoid combining products with similar active ingredients to avoid accidental overdose.

4. Patient education: Patient education plays a key role in promoting the safe use of over-the-counter medications. Healthcare providers and pharmacies must actively educate consumers about proper use, potential risks and the importance of reading and understanding product labels. This includes guidance on appropriate dosages for age, contraindications and seeking professional medical attention (8).

5. Monitoring and reporting of side effects: Consumers should be encouraged to monitor their reactions to over-the-counter medications and report any unexpected or serious side effects immediately (9). This feedback loop helps to continuously assess security and allows regulators to act in a timely manner when needed.

6. Pregnancy and breast-feeding: People who are pregnant or breast-feeding should use OTC medications with caution. Some ingredients may pose a risk to a developing fetus or breastfed baby (10). Consulting a doctor before using over-the-counter medications during pregnancy or breastfeeding is important for the safety of both mother and baby.

7. Age Issues: Age considerations are critical to OTC safety. Children and the elderly can have unique reactions to medications. Dosages often vary by age, and some over-the-counter medications may not be suitable for certain age groups (11). Parents should carefully follow age-specific guidelines, and older adults should be wary of possible interactions with prescription medications they may be taking.

8. Preexisting conditions: People with chronic conditions such as diabetes, heart disease, or kidney problems should be aware of the choice of over-the-counter medications. Some over-the-counter medications can worsen existing conditions or interact with prescription medications. Healthcare providers can provide personalized guidance based on the individual and medical history.

9. Allergies and Sensitivities: Patients with known allergies or sensitivities should carefully check the ingredients of OTC medications to avoid possible allergic reactions (12). This is especially important for people who are allergic to common ingredients such as aspirin or certain dyes.

10. Duration of use: OTC drugs are usually intended for short-term use. Long-term or excessive use can lead to addiction, mask health problems, or cause unwanted side effects. Health professionals can guide people on the appropriate duration of treatment and recommend further evaluation of persistent symptoms.

11. Combination medications: Some over-the-counter medications are combinations that contain several active ingredients. Consumers should use caution when using multiple medications at the same time to avoid accidentally exceeding recommended doses or consuming double active ingredients.

12. Proper Storage and Disposal: Storing over-the-counter medications according to package instructions is critical to maintaining their effectiveness and preventing accidental ingestion, especially by children. In addition, proper disposal of expired or unused medications helps prevent environmental contamination and reduces the risk of accidental exposure (13).

13. Regulatory Compliance: Compliance with regulatory guidelines and standards is essential to ensure the safety of over-the-counter medications. Regulatory agencies such as the FDA constantly monitor the market for safety issues and act when necessary. Consumers should choose products that have passed official inspection and approval.

Accessibility and availability of OTC medication: -

1. Regional differences: Availability of over-the-counter drugs varies by region and health system. Developing countries often have regulatory frameworks in place that facilitate widespread availability, while developing countries may have problems with regulatory infrastructure and distribution networks. Compared to urban centres, access to rural areas can be limited (14).

2. Implications for Self-Care: OTC availability enables people to engage in self-care, allowing them to quickly treat common health problems without a prescription from a healthcare provider. Such accessibility increases personal autonomy in managing milder illnesses, promotes a sense of control over one's health and well-being, and reduces the burden on primary care.

3. Impact on public health: The widespread availability of over-the-counter medicines has a positive impact on public health, encouraging early intervention and timely treatment of milder illnesses. This, in turn, can help prevent more serious health problems and reduce the strain on the health infrastructure. OTC medications are a key part of public health strategies, especially when treating common illnesses such as pain, allergies, and the common cold.

4. Economic considerations: Economic factors play an important role in OTC sales. The affordability of these drugs can affect individuals and the ability to buy and use them effectively. In some cases, OTC options can be more cost-effective than prescription options, making them a preferred option for individuals without comprehensive health insurance (15).

5. Regulatory practices: The regulatory environment and practices surrounding over-the-counter drugs affect their availability. Strict regulations can limit OTC drugs, while more permissive policies can expand over-the-counter drugs. Regulatory frameworks also help ensure the safety and efficacy of over-the-counter medicines, balancing availability, and consumer protection.

6. Pharmacies and retail networks: The availability of non-prescription drugs is closely related to the reach and distribution capacity of pharmacies and retail networks. Urban areas tend to have more pharmacies, making self-medication easier. Conversely, rural, or underserved areas may face challenges due to limited health infrastructure.

7. Awareness and education of consumers: Usability does not only depend on physical availability, but also of consumers; awareness and understanding of over-the-counter medications (16). Initiatives promoting health literacy and educating the public on the appropriate use of OTC drugs contribute to maximizing their accessibility by ensuring informed decision-making.

8. Global Disparities: Accessibility to OTC medications extends beyond regional differences to global disparities. Developing countries may face challenges in ensuring widespread availability due to factors such as limited healthcare infrastructure, regulatory constraints, and economic constraints. International efforts to improve access to essential OTC medications are crucial for addressing global health needs.

9. Telemedicine and online environments: The rise of telemedicine and online platforms has affected the availability of self-medication. Virtual consultations and e-pharmacies offer convenient ways for individuals to access over-the-counter medications, especially in areas where physical presence of pharmacies is limited (17). However, this change raises concerns about potential abuse or insufficient consultation, underscoring the importance of responsible online practices.

10. Cultural and Social Factors: Cultural and social factors can affect the availability of over-the-counter medications. Cultural beliefs, stigma associated with certain health conditions, and social attitudes toward self-care can influence individuals and willingness to self-medicate and use it. Adapting education and accessibility to address these cultural nuances is critical to effective health care.

11. Non-traditional outlets: Over-the-counter drugs are not limited to traditional pharmacies. Some countries permit the sale of certain OTC drugs in non-traditional outlets such as convenience stores or supermarkets. While this expands accessibility, it also raises questions about the quality of advice and information available to consumers in such settings.

12. Supply Chain Resilience: The resilience of the supply chain is vital for maintaining the accessibility of OTC medications, especially during times of crisis or emergency. Disruptions in the supply chain, whether due to natural disasters or global health emergencies, can impact the availability of essential medications. Building flexible supply chains is critical to ensuring the continued availability of over-the-counter medicines.

13. Switching over-the-counter drugs: Switching over-the-counter drugs refers to the process of converting prescription drugs to OTC status. This can expand the range of over-the-counter options available but requires careful consideration of the safety and appropriateness of self-medication. Regulatory agencies have a key role in evaluating and approving such changes to ensure consumer safety.

14. Involvement of pharmacists: The role of pharmacists in the availability of self-care products is important. In many areas, pharmacists serve as essential health professionals who can provide guidance on the selection, use, and potential interactions of over-the-counter medications (18). Collaboration between pharmacists and regulatory agencies promotes safe and information-based OTC.

15. Consumer Empowerment: Empowering consumers through health education and advocacy initiatives enhances their ability to navigate OTC options responsibly. Increased awareness of available OTC medications, potential risks, and the importance of seeking professional advice when needed contributes to a more informed and health-conscious population.

Regulatory framework of OTC medication (19): -

1. Legal Overview:The regulatory environment governing OTC drugs varies around the world, but typically includes government agencies responsible for the safety, effectiveness, and proper labelling of these drugs. Regulatory bodies such as the US Food and Drug Administration (FDA) in the US or the European Medicines Agency (EMA) in Europe establish guidelines for the approval, labelling and marketing of over-the-counter medicines.

2. Role of regulatory agencies:Regulatory agencies play a key role in protecting public health by establishing and enforcing standards for over-the-counter drugs. They assess the safety and efficacy of active ingredients, review product labels and monitor post-marketing surveillance data. In addition, regulatory agencies provide guidance on appropriate use, dosages, and potential interactions, which encourages informed consumer choices.

3. Ensuring Safety and Efficacy:The regulatory approval process for over-the-counter drugs involves a rigorous evaluation of scientific data demonstrating the safety and efficacy of the product. This includes the drug and its intended use, possible side effects and its suitability for self-administration without a doctor or supervision. Continuous monitoring ensures that any security issues that arise are resolved quickly[20].

4. Labelling and Packaging Requirements:Regulatory agencies establish labelling standards for over-the-counter drugs to provide clear and accurate information to consumers. This includes instructions for use, dosage recommendations, possible side effects and contraindications. Packaging requirements are intended to prevent accidental misuse, especially by children, and may include child-resistant packaging for certain products.

5. Differences in Global Regulations: Regulatory frameworks for over-the-counter drugs can vary significantly from country to country. While some countries adopt strict criteria and strictly regulate OTC markets, others may follow a more permissive approach. These differences affect over-the-counter drugs, the level of consumer education required, and the overall safety profile of over-the-counter drugs.

6. Impact on consumer choices:Regulatory differences can affect consumer choices regarding product availability, affordability, and safety. In areas with strict regulations, consumers can rest assured that the OTC options available are safe. Conversely, in areas with less strict control, there may be a need to increase consumer awareness and discretion.

7. Regulatory Adjustments and Transition:Regulatory authorities periodically reassess the status of certain drugs and may consider transitioning prescription drugs to self-medication based on safety profiles and public health considerations. The purpose of such adjustments is to expand consumer access to certain medicines while maintaining safety standards.

8. Harmonization Efforts:Efforts to harmonize regulatory standards aim to harmonize practices worldwide, facilitating consistent oversight of over-the-counter drugs. Organizations such as the International Council for Harmonization of Technical Requirements for Medical Products for Human Use (ICH) work to develop common guidelines to streamline regulatory processes and ensure global safety and efficacy.

9. Monograph system:Some regulatory agencies, such as the US FDA, use a monograph system for over-the-counter drugs. A monograph is a set of standards that define the approved ingredients, dosages, formulations and labeling for a particular group of OTC products. Manufacturers can develop products following these monographs without individual prior approval, streamlining the regulatory process[21].

10. post-marketing surveillance:Regulatory agencies conduct post-marketing surveillance to monitor the safety of over-the-counter drugs once they are on the market. This ongoing evaluation includes the collection and analysis of data on adverse events, new side effects, and other safety concerns. Based on the results of post-marketing surveillance, regulatory measures such as withdrawal from the market or updating the labeling may be implemented.

11. Educational Initiatives:Regulatory agencies often work with healthcare professionals and industry stakeholders to implement educational initiatives aimed at both healthcare providers and consumers [22]. These efforts increase awareness of the proper use of over-the-counter medications, potential risks, and the importance of consulting health care professionals when appropriate.

12. Regulatory Challenges:There are challenges in the regulatory environment, such as keeping up with the rapidly evolving pharmaceutical industry, emerging technologies and new formulations. Finding a balance between ensuring safety and promoting innovation can be difficult, requiring constant adaptation of regulatory frameworks [23].

13. Switching from a prescription drug to an OTC drug requires a thorough review by regulatory authorities:This evaluation considers the drug and safety profile, the potential for abuse, and the feasibility of self-diagnosis and therapy. Successful switches expand OTC options but require careful consideration to avoid unintended consequences.

14. Global harmonization challenges:Achieving global harmonization of regulatory standards is associated with challenges arising from different health systems, cultural differences, and different levels of regulatory infrastructure around the world. Despite efforts at harmonization, achieving a single global standard is an ongoing and complex endeavor.

15. Counterfeit and substandard products: Regulatory agencies have a key role to play in combating the spread of counterfeit and substandard over-the-counter drugs [24]. Strict enforcement of quality control measures, inspections and cooperation with law enforcement agencies are necessary to prevent the spread of potentially harmful counterfeit products on the market.

16. Consumer Reporting Systems:Regulatory agencies often establish systems that allow consumers to report adverse events or concerns about over-the-counter drugs. These reporting mechanisms facilitate continuous monitoring of product safety and provide valuable information for official decision-making.

17. Digital Health Technologies:The emergence of digital health technologies, including health applications and wearables, will bring new considerations for regulatory agencies. These technologies can facilitate self-diagnosis or medication administration, necessitating updates to prescriptions to ensure their safety and effectiveness.

Consumer behaviour and decision-making regarding OTC medication: -

- 1. Health literacy:** Consumer decisions about over-the-counter medications are influenced by the level of health literacy, including understanding medical information, dosage instructions, and potential side effects [26]. People with higher levels of health literacy tend to be more empowered to make informed choices and use over-the-counter medications effectively.
- 2. Symptom recognition:** Consumer decisions often begin with symptom recognition. The ability to accurately identify symptoms and match them with appropriate over-the-counter medications influences product selection. This highlights the importance of health education and information campaigns to strengthen symptom recognition.
- 3. Advertising and Marketing:** Advertising and marketing play an important role in shaping consumer choices. Effective communication through media channels, online platforms and points of sale affects brand awareness and perceived effectiveness. A clear and balanced message in advertising increases consumer confidence in OTC products [27].
- 4. Package Design and Information:** Package design and information for OTC drugs influence consumer decisions. Clear and user-friendly packaging with easy-to-understand dosage instructions and possible side effects increases consumer confidence. Package design can also convey a sense of reliability and trustworthiness.
- 5. Brand Loyalty:** Consumer loyalty to certain OTC brands is often influenced by positive past experiences, recommendations or perceptions of the brand and its credibility. Marketing strategies that build and maintain trust help build brand loyalty among consumers [28].
- 6. Pharmacist recommendations:** The recommendations of pharmacists and health professionals have a significant weight in the decision of consumers. Consumers often seek advice from pharmacists when choosing over-the-counter medications and rely on their knowledge to help them find the products that best suit their needs.
- 7. Cultural factors:** Cultural factors, including beliefs about health and wellness, attitudes toward self-care, and traditional healing methods, may influence preferences for OTC medications. Some cultures may prefer herbal or alternative medicine, which affects the types of over-the-counter medications chosen.
- 8. Cost considerations:** Economic factors, including the cost of over-the-counter drugs, influence consumer decisions. Affordability can be a key factor in product selection, especially in areas with disparities in health coverage and financing.
- 9. Peer and Family Influence:** Recommendations from peers, friends or family often influence consumer decision making. Words and personal experiences shared on social media can influence the perception of over-the-counter medications and product choices.
- 10. Perceived Severity of Condition:** Perceived severity of a health condition can influence consumer decisions. For minor ailments or symptoms, consumers may be more willing to choose OTC alternatives. However, for more serious or persistent illnesses, seeking professional medical attention may be the priority.
- 11. Online Information and Reviews:** Consumers are increasingly relying on online information and reviews to make decisions about over-the-counter medications. User-generated reviews and information from reputable health websites increase consumer knowledge and influence purchase choices. Understanding these factors provides insight into consumer behaviour and decision-making processes related to over-the-counter medications. For healthcare providers, marketers, and regulators, identifying these effects is critical to developing effective communication strategies, ensuring safe use, and promoting responsible consumer choice in OTC settings.

Economic consideration of OTC medication use: -

- 1. Affordability and Availability:** Over-the-counter medications are often more affordable and available than prescription medications, making them cost-effective for individuals [29]. The lower price point allows consumers to address common health concerns without the higher costs associated with prescription drugs.
- 2. Reduce the burden on the healthcare system:** The use of OTC drugs can help reduce the burden on healthcare systems by allowing people to self-treat minor illnesses. This can reduce the need for doctors and consultations for conditions that can be treated safely and effectively without prescription drugs.
- 3. Consumer Choice and Empowerment:** The affordability of over-the-counter medications gives consumers the freedom to make independent health care decisions. This empowerment is especially important for people who have limited access to health care or who are looking for quick and convenient solutions to minor health problems.
- 4. Preventing Unnecessary Healthcare Costs:** OTC medications can help prevent unnecessary healthcare costs by allowing people to treat symptoms early, potentially preventing minor problems from escalating into more serious conditions. Timely use of over-the-counter medications can reduce the need for expensive medical procedures.
- 5. Cost-effectiveness for minor illnesses:** Over-the-counter medications are generally considered cost-effective for treating minor illnesses and general health conditions. The financial benefits are especially evident when comparing the cost of purchasing over-the-counter drugs with potential costs associated with doctors, diagnostic tests and prescription drugs for similar conditions.
- 6. Potential financial burden of chronic diseases:** Although over-the-counter medications are cost-effective for short-term use, people with chronic conditions may face a financial burden if they rely solely on over-the-counter options. Continued long-term use of OTC medications to treat chronic conditions can accumulate costs over time, which can affect overall affordability for some people.
- 7. Insurance Considerations:** Insurance can affect the availability and affordability of over-the-counter medications. Some insurance plans may cover certain over-the-counter medications, while others may require individuals to pay the full cost. Understanding the nuances of insurance coverage is important for people looking for cost-effective healthcare solutions.
- 8. Quality and Efficacy Concerns:** It is important to balance the affordability of over-the-counter drugs with quality and effectiveness. Cheaper options may not always offer the same performance as their more expensive counterparts. Consumers and healthcare providers must balance financial considerations with desired treatment outcomes.

9. Effect of Market Competition:Market competition among manufacturers of OTC drugs can affect affordability. Increased competition can lead to lower prices, making certain over-the-counter drugs more economically available. On the other hand, monopolies or limited competition can lead to higher prices.

10. Public health and productivity: Timely availability of affordable over-the-counter drugs promotes public health and productivity. By enabling people to quickly address their health concerns, over-the-counter medicines support overall well-being and reduce the financial impact of sick leave.

Health care professional involvement in guiding OTC medication choice: -

1. Pharmacist consultations:Pharmacists play a key role in the selection of over-the-counter medications. Through consultations, they assess individual health needs, provide information about available OTC options, and make recommendations based on the individual and their symptoms and medical history. Pharmacists help people navigate the wide range of OTC products and ensure they are making informed decisions [30].

2. Patient education:Patient education for healthcare professionals, especially pharmacists, is critical to making informed decisions. This includes explaining the purpose, possible side effects, proper use, and precautions or contraindications of over-the-counter medications. The training gives people the opportunity to treat themselves responsibly and seek professional help if necessary.

3. Risk Assessment: Health professionals conduct risk assessments to determine if over-the-counter medications are appropriate for an individual. This requires consideration of factors such as age, pre-existing diseases, medical history and possible interactions. By tailoring recommendations based on individual risk profiles, healthcare professionals increase the safety of self-medication.

4. Identifying red flags:Health professionals help people identify red flags; which indicate when professional medical attention is needed. This involves educating patients about symptoms that may indicate more serious health problems and making sure they understand when self-medication is appropriate and when additional medical care is needed.

5. Review of self-medication practices:Regular reviews of self-medication practices with health professionals help ensure that people are using self-medication correctly. This includes a discussion of the duration of use, potential risks, and health changes that may require adjustments to the self-medication program.

6. Medication Reconciliation:Medication reconciliation performed by healthcare professionals involves reviewing the patient and their complete medication list, including over-the-counter medications. This process helps identify potential interactions between over-the-counter medications and prescription medications, minimizing the risk of side effects.

7. Help choose medications:Health professionals help people choose the best over-the-counter medications for their needs. Considering the specific symptoms and medical history of the individual, health professionals ensure a tailored approach to drug selection, maximizing effectiveness and minimizing risks.

8. Ongoing follow-up:Ongoing follow-up by healthcare professionals is essential for people using over-the-counter medications, especially those with chronic conditions. Regular check-ins provide an opportunity to evaluate the effectiveness of self-care treatments, address any problems that may arise, and make changes to the overall health care plan.

9. Integration with Electronic Health Records (EHR):Integrating over-the-counter drug use information with Electronic Health Records (EHR) improves continuity of care. Healthcare professionals can collect a comprehensive medical history, which facilitates more informed decision-making and treatment coordination.

10. Communication problems:Effective communication between healthcare professionals and patients is crucial to ensure informed decision making. Time constraints during appointments, language barriers and different health abilities can cause problems. Strategies to improve communication effectiveness are needed to overcome these barriers.

11. Community Outreach and Education Programs:Health professionals participate in community outreach and education programs to increase public awareness of over-the-counter medications. These initiatives aim to improve health literacy, encourage responsible self-care practices, and reinforce the importance of consulting health professionals for individualized guidance.

12. Evaluation of current practices: The effectiveness of current practices to ensure informed decisions about self-treatment can be evaluated based on patient outcomes, compliance rates, and adverse events. Continuous feedback and improvements in training strategies, communication methods and technology integration help optimize these practices.

Emerging trends and innovation in the OTC medication market: -

1. Digital Healthcare Integration:Integration with digital healthcare technologies is an emerging trend in the OTC market. This includes mobile apps, wearables and smart devices that provide personalized health information, medication reminders and real-time monitoring. Digital platforms improve availability, adherence, and self-management of over-the-counter medications.

2. E-commerce and telehealth:The rise of e-commerce platforms and telehealth services has changed the distribution and availability of over-the-counter medications. Online shopping and telehealth counselling provide convenient options for people to obtain over-the-counter medications, especially in areas with limited physical pharmacy infrastructure.

3. Personalized over-the-counter medications:The trend toward personalized healthcare extends to over-the-counter medications. Companies are exploring formulations tailored to specific demographics, such as age groups, gender, or health status. This individualized approach aims to improve the effectiveness of over-the-counter medications to meet individual needs.

4. Alternative delivery systems:Innovations in drug delivery systems such as transdermal patches, sublingual tablets and dissolvable strips offer alternatives to traditional oral dosage forms. These innovations improve ease of use, improve absorption and can provide faster relief, affecting the availability and effectiveness of over-the-counter medications.

5. Functional foods and supplements:The convergence of OTC drugs with functional foods and supplements is a growing trend. By combining traditional OTC ingredients and nutrients, the products aim to treat health problems holistically. This trend is consistent with a broader focus on wellness and preventive health care.

6. Package durability: Durability is becoming a key aspect of OTC drug packaging. Innovations include environmentally friendly packaging materials, reduction of packaging waste and efforts to minimize the environmental impact of product disposal. Sustainable packaging meets consumer demands for environmentally conscious products.

7. Changing prescription drugs without a prescription:Constant switching of some prescription drugs without a prescription is an ongoing trend. This process expands the range of available OTC options and gives consumers more options to treat certain health conditions without a prescription.

8. Blockchain for Supply Chain Transparency:Blockchain technology is being explored to improve transparency and traceability in the supply chain of over-the-counter drugs. This innovation aims to reduce the risk of counterfeit products and ensure that consumers receive genuine and safe self-medication.

9. Artificial intelligence (AI) in self-diagnosis:Artificial intelligence applications are being developed to help people self-diagnose minor ailments and choose appropriate self-medication. AI-powered chatbots and virtual health assistants provide information, answer questions and guide users to make informed decisions about self-care.

10. Genetic testing of drug response:Genetic testing to determine individual responses to medications is gaining traction. This personalized medicine approach helps people understand how their genetic makeup may affect their response to certain over-the-counter medications, allowing for more tailored and effective choices.

11. Proactive health solutions:OTC drugs are increasingly positioned as proactive health solutions, not just reactive medicine [31]. Products designed to support general health, boost immunity, or address lifestyle issues are changing the way consumers perceive over-the-counter medications.

12. Regulatory adaptations to innovation:Regulators adapt to innovative OTC products. This includes developing guidelines for new formulations, ensuring safety and efficacy, and considering new technologies to support the responsible use of over-the-counter medicines.

Challenges and concern associated with OTC mediation: - [32]

1.Potential for abuse and self-diagnosis:One of the main concerns with over-the-counter medications is the potential for abuse. Individuals may misdiagnose or misuse medications, leading to side effects or inadequate treatment. Limited awareness or health literacy can contribute to this challenge.

2.Inadequate labelling and consumer understanding:Clarity and comprehensibility of over-the-counter drug labelling is a challenge. Inadequate understanding of dosage instructions, possible side effects and contraindications can lead to inappropriate use. Improving label design and adding user-friendly information are critical for consumer safety.

3. Risk of drug interactions:When used concurrently with prescription or other over-the-counter medications, over-the-counter medications pose a risk of drug interactions. Individuals may not be fully aware of potential interactions, which emphasizes the need for healthcare professionals to comprehensively evaluate treatment regimens.

4. Limited regulatory control in some regions: Regulatory control varies around the world and certain regions may have limited availability of over-the-counter drugs. This lack of control can lead to the availability of potentially dangerous products, raising concerns about the quality and effectiveness of over-the-counter medications.

5. Over-reliance on over-the-counter medications for chronic conditions:People with chronic conditions can face challenges when they rely solely on over-the-counter medications without proper medical supervision. Excessive self-medication for ongoing health problems can lead to delayed or inadequate treatment, which worsens the condition over time.

6. Lack of consumer safety education:Deficiencies in consumer education about the safe use of over-the-counter medications add to the problem. The lack of importance of possible risks, correct doses, and consultation with health professionals, when necessary, can endanger the safety of consumers.

7. Counterfeit and Counterfeit Products:The availability of fake or counterfeit OTC products is a major problem. In areas where regulatory enforcement is lax, there is a risk of low-quality or counterfeit drugs entering the market, endangering the health of unsuspecting consumers.

8. Packaging and consumption hazards for children:Inadequate packaging and attractive appearance of some over-the-counter medicines pose risks especially to children. Accidental ingestion due to unclear labeling or easily accessible packaging can lead to accidental poisoning and emergency.

9. Risks related to the Internet and online sales:The growth of online sales of non-prescription drugs presents problems with product authenticity, quality control and accurate information. Consumers who buy medicines online may face risks related to fake products that can put their health at risk.

10. Global Health Disparities in Access: There are disparities in access to over-the-counter medicines around the world. In some regions, access to essential over-the-counter medicines can be limited, affecting public health, and increasing health inequalities.

11. Pressure on health systems:The widespread availability of over-the-counter drugs can lead to increased self-medication, which can put additional pressure on health systems when people cannot find professional guidance for more serious health problems.

12. Resistant Strains and Antibiotic Overuse:The overuse of OTC antibiotics, especially in areas with lax regulation, raises concerns about the emergence of antibiotic-resistant strains. Improper use without proper medical supervision can cause public health problems.

- 13. Environmental effects of drug disposal:** Improper disposal of unused or expired over-the-counter drugs causes environmental problems. Drug residues in water and soil can have ecological effects that emphasize the need for responsible disposal.
- 14. Problems with polytherapy:** With OTC drugs, the risk of multiple drug use can be a concern. Some people may not fully disclose their use of over-the-counter medications to health care professionals, which can lead to drug interactions or overlapping treatments.
- 15. Age Considerations:** Age-related factors such as differences in metabolism and sensitivity to medications can cause problems. The elderly may be more sensitive to adverse effects, and the pediatric population may require special formulations and dosages adapted to their age and weight.
- 16. Cultural and language barriers:** Cultural and language barriers can prevent effective communication about over-the-counter medications. Limited language skills and cultural differences can lead to misunderstandings that affect individuals; ability to accurately understand dosage instructions and safety information.
- 17. Ease of Availability of Over-the-Counter Medications:** While the availability of over-the-counter medications is an advantage, it can also contribute to challenges. Allowing people to obtain over-the-counter medications can lead to excessive self-medication without professional help, potentially overlooking underlying health problems.
- 18. Complexity of the OTC landscape:** The sheer variety of OTC products available can be overwhelming for consumers. The complexity of the product world, including the many brands and formulations, can make it difficult for individuals to make informed choices, which can lead to the selection of inappropriate or unnecessary medications.
- 19. Inadequate post-marketing surveillance:** Challenges in post-marketing surveillance can jeopardize the identification of safety concerns with new over-the-counter drugs. There can be delays in identifying and treating side effects, which affects the overall safety profile of certain over-the-counter medications.
- 20. Regulatory lag in adapting to innovation:** Rapid innovation in the pharmaceutical industry can overwhelm regulatory frameworks, causing problems with using new OTC products or delivery systems. This delay may hinder the ability of regulators to ensure the safety and efficacy of new OTC innovations.
- 21. Influence of Marketing and Advertising:** Aggressive marketing and advertising of over-the-counter drugs can influence consumer choices. Misleading advertising or emphasizing benefits without sufficient attention to potential risks can lead consumers to make uninformed decisions.
- 22. Psychosocial factors and self-diagnosis:** Psychosocial factors such as stress, anxiety or perceived urgency can lead people to self-diagnosis and self-medication. Emotional factors can override rational decision-making, leading to potential misuse or overuse of over-the-counter medications.
- 23. Continued use despite symptom resolution:** Individuals may continue to use over-the-counter medications even after symptoms have resolved, leading to unnecessary drug exposure and potential side effects. Lack of awareness of proper termination may contribute to this phenomenon.
- 24. Dosing Errors and Overuse:** Dosing errors, including underdosing or overdosing, can occur with over-the-counter medications. Individuals may miscalculate dosage, which reduces effectiveness or increases the risk of side effects. This risk is particularly important for multi-active products.
- 25. Impact of social media and misinformation:** Social media platforms can contribute to the spread of misinformation about over-the-counter drugs. Individuals may rely on anecdotal advice or unverified information, which can lead to inappropriate choices and potentially harmful consequences.
- 26. Global Health Emergencies and Storage:** Storage of over-the-counter medications can be a concern during global health emergencies [33]. Panic buying and hoarding can lead to shortages that affect access for those who need these drugs for routine self-care.

CONCLUSION

Examining OTC medications in terms of safety, availability, and regulatory considerations highlights the diversity of self-care in the health care setting. OTC medicines play a key role in providing people with easy-to-use solutions to self-manage common health problems. However, ensuring their safety, promoting accessibility, and maintaining adequate official oversight present ongoing challenges and opportunities.

Recommendation for future:

- Consumer education must be strengthened to inform individuals about the responsible use of self-medication.
- Improve regulatory oversight worldwide by adapting to innovation while maintaining high safety standards.
- Promotes shared decision-making, involving health professionals and consumers to make personal and informed choices.
- Use digital health tools to improve access, adherence and tracking of over-the-counter medications.
- Promotes packaging sustainability and responsible environmental practices

In conclusion, OTC medications are integral to self-care, offering accessible solutions for minor health concerns. Safeguarding their use involves a collective effort, incorporating education, regulation, and innovation. By addressing challenges and embracing opportunities, we can continue to advance the safety, accessibility, and regulatory considerations of OTC medications for the benefit of individuals and public health.

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