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## **Access to non-prescription medicines via vending machines: key considerations to help transfer the self-care concept to the next generation while managing safety risks**

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## Abstract

**Objectives:** Non-prescription vending machines are automated self-service systems that are increasingly used to dispense these medicines. Whilst regulatory health academics have devoted considerable attention to non-pharmacy medication outlets in Gulf Cooperation Council countries and others, the public health literature on these vending machines remains lacking. Whilst non-prescription vending machines undoubtedly provide a number of benefits, they are not without their risks, which include polypharmacy and medication interactions. **Methods:** The purpose of this article is to provide a framework for further investigation of the function, advantages, and practical constraints of non-prescription vending machines. **Key findings:** Overall, more research is required to determine the optimal balance between achieving the benefits of non-prescription vending machines whilst avoiding unnecessary constraints on regulatory bodies and vending machine providers but minimizing patient harm. **Conclusions:** Further studies are also required to assess the consequences of these policy experiments. Specifically, there is a need to better understand the extent to which vending machines can provide beneficial and reasonable access to non-prescription medicines to enhance the quality of life of the population especially during pandemics.

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## 1. Introduction

The economic development observed in many regions of the world has intensified a trend toward liberalization of medicinal products, prompting an increase in non-pharmacy trade and the emergence of non-pharmacy medicinal outlets for non-prescription medicines increasing access and availability to these medicines [1 - 3]. In addition, in developing countries with high co-payment levels, non-prescription medicines help provide symptom relief without having to cover the costs of seeing a physician, waiting to see a physician with potential impact on wages, and transport costs in addition to the costs of possible medicines [4-9]. This includes the increasing use of non-prescription medicines for self-limiting conditions including coughs and colds where antibiotics are inappropriate [2,4, 10-12]. As a result, there is appreciable use of non-prescription medicines among developing countries [3]. However, there can be concerns among pharmacists with their increasing role advising patients [13,14]. Non-pharmacy outlets are non-registered terminals located in a number of settings including gas stations, drugstores, and supermarkets, at which non-prescription medications can be dispensed without the requirement of a license or inspection for safe drug storage [3, 15].

Dispensing medicine via non-prescription vending machines is an emerging trend that is gaining in popularity [12, 13]. These vending machines incorporate self-service and automated systems to supply non-prescription medicines. They provide a means by which companies can make everyday medicines and associated items, including aspirin, paracetamol, ibuprofen, and indigestion and heartburn treatments readily available. Since these medicines are often compact and adequately wrapped, they can be distributed from small machines. The vending mechanism for non-prescription medicines is simple to use, and can be entirely mechanical, battery-operated, or connected to the main electrical supply. Consequently, they represent a viable method of

medication distribution. In addition, medicines dispensed by these vending machines may be cheaper as less overheads [13]. Non-prescription vending machines may also help to reduce unnecessary visits to physicians, which is particularly important during any pandemic.

A small number of medicines are accessible for retail sale outside of pharmacies among various European Union nations under specific conditions but without always strong market control [15,16]. For example, medicines can only be sold in pharmacies in Bulgaria, while some non-prescription medicines are available through vending machines that are solely operated and owned by pharmacies [15]. However, in Ireland, it is illegal to sell pharmaceuticals through vending machines or any other mechanically or electronically controlled self-service equipment [17]. In the United Kingdom, medicines can be purchased at retail establishments such as local shops, kiosks, supermarkets, and petrol stations, though medicines must be sold in their original, unopened packaging with limits on the purchased quantity although this may not always be supervised especially with self-paying kiosks [16]. Furthermore, the sale of non-prescription medicines via vending machines is permitted provided the machines are located in spaces where they cannot be accessed by unauthorized persons including children. However, there are concerns with respect to adherence among non-pharmacy outlets to these regulations with high rates of non-adherence being reported [15]. In Norway, non-prescription medicines are sold in pharmacies and licensed “medicine stores,” which are local pharmacy outlets, with the owner of the medicine stores accountable for all staff training [18]. However to date, very few non-prescription medicines that have been certified by the Norwegian Medicines Agency have been endorsed for sale in gas stations, kiosks, supermarkets, and grocery stores [19]. The endorsed non-prescription medicines are though available via vending machines if wished [19].

Whilst regulatory health authorities and academics have paid considerable attention to pharmacy and non-pharmacy outlets in Gulf Cooperation Council (GCC) countries, there are limited publications to date regarding the public health impact of non-prescription vending machines in GCC countries. Available publications regarding non-prescription vending machines among GCC countries is scarce. However, available studies argue that the automated machines have two key effects. First, non-prescription vending machines can result in time-efficiency. For example, the Covid-19 pandemic led to mass hospitalizations and infections, which occupied healthcare workers and led to burnout [20,21]. GCC nations including Saudi Arabia used the automated machines to reduce the time healthcare workers spent handing out prescriptions, reducing patients' waiting time and leading to time efficiency [22-24]). Alongside this, non-prescription vending machines can increase patient satisfaction, for example, automated machines in UAE provide on-demand medicines and medical products at airports and train stations, reducing the need for queueing at hospitals or pharmacies and thereby increasing patient satisfaction [25]. Overall, available evidence regarding the impact of non-prescription vending machines on patients in the Gulf; however, these machines can lead to time efficiency and patient satisfaction.

The potential for increased efficiency and patient satisfaction with vending machines for non-prescriptions is important given the continual rise in non-communicable diseases (NCDs) among GCC countries, coupled with concerns with the lack of healthcare professionals in these countries and currently high patient co-payment levels [26,27]. However, this has to be balanced against the safety and potential misuse of non-prescription medicines including cough and cold medicines especially among children [1,3,14, 28-31].

Alongside this, there are concerns with possible side-effects and other issues that may occur from the chronic use of medicines to treat acid-related stomach disorders [32-34]. This includes increasing polypharmacy and associated concerns especially in the elderly [36-39]. We

sought to address these challenges by providing policy and other suggestions for the future with respect to vending machines for non-prescription medicines. This builds on the experience of the co-authors enhanced by a narrative review of current publications in this area. We have initially chosen to concentrate our proposals among GCC countries as this builds on the experience of the co-authors as well as concerns with rising rates of NCDs among GCC countries. However, we believe the comments made will be applicable across countries to stimulate research in this important area.

## **2. Current Regulatory Issues Affecting non-prescription Vending Machines**

Policies governing non-prescription medicines face multiple challenges, of which enforcing regulations is paramount given current concerns [16-18,40]. Increased capacity among the regulators is required to administer and monitor any permits, which is similar to the situation regarding the selling of antibiotics in community pharmacies and drug stores without a prescription despite current legislation [4,5,41-44]. Furthermore, the presence of a non-prescription vending machine should necessitate strict quality regulations and administration beyond current standards for non-pharmacy outlets. However, while the additional infrastructure requires financial investment, a reasonable and healthy vending strategy could potentially produce new jobs through their development, installation and servicing. In addition, make these medicines more accessible outside of community pharmacy hours especially for those patients who have difficulties accessing community pharmacies during the day [45]. There are though concerns defining what constitutes a “safe non-prescription vending machine” given current issues. Alongside this, assessing whether this definition will allow for reasonable self-care especially where there are current concerns with readily accessing non-prescription medicines.

An increase in the availability of non-prescription vending machines will likely lead to a rise in self-medication practices, building on existing trends [3,9,46]. This trend will be enhanced by the current pandemic with some patients reluctant to access healthcare services for fear of interacting with patients with COVID-19 [45]

As mentioned, a number of non-prescription- medicines, including those sold in the non-pharmacy sector, have the potential to cause patient harm as well as possible addiction [1,15, 28-31,47,48]. For instance, cough and cold medicines containing dextromethorphan or pseudoephedrine can cause hallucinations increasing its misuse, which in turn can increase heartbeats, dizziness, and blurred vision [49]. There are also concerns with drug: drug and drug:age interactions with elderly patients taking non-prescription medicines [36,38,39]. However, restrictions on the sale of cough and cold remedies in the US have resulted in a decline in unintentional ingestion and therapeutic errors with most side-effects minor when they occur [50,51].

In addition, misinterpretation of pain or other symptoms can result in the overuse of non-prescription pain medications, leading to concerns with hypertension and heart disease, GI bleeding, hepatotoxicity and potentially poisoning [28,29,52-56]. There can also be excessive use of acetaminophen as well as paracetamol during the cold and influenza season in a minority of patients, which can cause concern [57,58]. Published studies have also shown an increase in the number of adverse events from non-analgesic non-prescription medicines over time [47,59]. Furthermore, studies have found that patients who do not read the medical advice that accompanies medications can experience detrimental repercussions due to a lack of awareness of their dosing regimes or the management principles of their ailment generally [60, 61]. These can be addressed through the help of community pharmacists and other healthcare professionals [48,53,62].

Inappropriate polypharmacy, which involves a patient taking multiple medications simultaneously, is also an issue especially if patients are also self-treating with non-prescription medicines [36,37]. Older patients have the highest risk of polypharmacy as they are frequently treated with a variety of medications [37,38]. It is currently estimated that approximately half of all older people use one or more medications that are deemed medically essential [39]. However, the likelihood of medication interactions increases with the number of medicines prescribed, with the risk of interactions at 50% in elderly patients who take five to nine different medicines and rising to 100% when taking 20 or more [39]. In addition, polypharmacy in the elderly, exacerbated by the presence of several diseases and the influence of advertising, can increase hospitalizations, falls, and cognitive impairment as well as impair physical functioning [37,63]. The use of non-prescription medicines in the elderly adds to this.

### **3. Potential Frameworks and Research to Advance Non-Prescription Vending Machine Policies**

Given the documented concerns, including side-effects, that can occur with non-prescription medicines, it is increasingly essential that policies for vending machines are closely scrutinized. Several measures can potentially be implemented to ensure that local government legislation and policies encourage healthy and safe access to pertinent medicines via non-prescription vending machines given their possible benefits in terms of access and possibly lower costs. One fundamental condition should be the requirement for owners of vending machines to secure a license or permission from the local government before operating one, which can subsequently be revoked when there are concerns. Before permits are issued, the location and content of the vending machines should be also subjected to inspection by the local health



department or an alternative recognized body. Currently, regulations detailing the inspection and compliance of non-prescription vending machines in the GCC vary from nation to nation. For example, the UAE entrusts its health ministry to guide automation in the Emirates, including the inspection and compliance of non-prescription vending machines [64]. In most GCC nations, the regulatory bodies use the legislation for regulating outlets that sell non-prescription medicines over-the-counter to guide the inspection and compliance of non-prescription vending machines [65]. As a result, the first requirement for non-prescription vending machines is a general business permit. Secondly, regulatory bodies should mandate that the automated machines should only dispense medicines that do not require assessment or supervision by pharmacists before the sale [66]. Thirdly, the regulatory bodies require that the packages of the medicines should capture nine key elements. These include the product name, active ingredients, purpose, the disease targets, possible side-effects, warnings, instructions for taking the medicine, storage requirements, and inactive ingredients [67]. Vendor permits can be issued at a cost, and municipal regulations can impose a limit on the number of vending permits that are issued at any given time. Furthermore, on a holistic level, towns can implement restrictions on the total number of vending machine permits that are issued at any particular time. This will prevent the saturation of non-prescription medicine vending machines increasing potential harm to patients.

In addition, local governments should also impose restrictions on the location of non-prescription medicines vending machines. This can include prohibiting any placement near schools.

Alongside this, introducing a legal requirement that the owners of vending machines relocate them after a certain amount of time as this can potentially limit owners from attracting regular customers thereby increasing their need to go to pharmacies for non-prescription medicines on occasions to enhance compliance with any prescribing guidance. Furthermore, similar to sales of certain non-prescription medicines in community pharmacies and other stores, there should be restrictions of the quantity of these medicines that can be purchased at any one time from

vending machines to avoid any potential harm, which would be the case with paracetamol. This is because patients can be unaware that medicines sold from vending machines can contain analgesics that generate harmful effects when combined with medicine including anticoagulants and antihypertensives [68]. Nonetheless, monitoring the utilization of non-prescription medicines is challenging given that these medications do not require prescriptions, limiting the ability of healthcare professionals to advise patients [44,53]. To help address concerns, non-prescription medicines dispensed in vending machine should have clear labels detailing the medicines they contain including analgesics and advising regarding key side-effect issues. Secondly, the vending machines should have contact details that patients can call to receive further explanations about the medicines they are taking including dosing regimens, as well as asking for help when they experience harmful side-effects. For instance, dosing advice on proton pump inhibitors (PPIs) can include instructions not to consume them less than 30 minutes prior to a meal [69]. In addition, lifestyle changes are also advised to reduce the potential for patients to become refractory to PPIs, with the implications for possible serious consequences [70,71]. It is estimated currently that up to 40% to 50% of patients do not comply with optimal timing of PPIs, with poor compliance leading to failure, which needs to be addressed going forward [70,72].

However, research is still required to assess the consequences of these policies and ascertain if these suggested rules could result in useful and logical access to non-prescription vending machines, and whether they improve patients' quality of life at a community level whilst minimizing harm. Alongside this, health authorities can deliver educational initiatives in school, community and other settings to inform potential patients of appropriate use of medicines as well as potential harm with some non-prescription medicines [73]. Such initiatives can also be used to teach people to read and understand the labels on the medicines dispensed and apply them correctly [47]. In addition, healthcare authorities can potentially ask the owners to request patients' contact details when

they purchase non-prescription medicines in this way. These details can also be used to reinforce the messages that advise the patients on using medicines they purchase [47].

The long-term viability of such projects must also be assessed for their impact on access to medicines, especially where there are concerns with access to regular healthcare as well as pharmacists, and issues of affordability. As mentioned, non-prescription vending machines may help to reduce unnecessary visits to community pharmacists and physicians, particularly important during any pandemic [13]. However, this has to be balanced against advice community pharmacists can give addressing some of the misinformation regarding possible effective treatments for COVID-19 and their consequences, reinforcing preventative measures as well as potentially administering vaccines [74-77]. In addition, providing guidance on dosing regimens and potential drug interactions and side-effects.

As a result, help determine the function, advantages, and practical constraints of non-prescription medicine vending machines. In view of this, help determine the appropriate balance between achieving their full potential whilst cognizant of the potential for patient harm. This includes the potential concealment of symptoms of severe disorders through the continued unsupervised use of non-prescription medicines. As a result, causing patients' diagnoses to be delayed with concerns for their future morbidity and mortality.

To establish the instruments needed to perform necessary local policy modifications, technical skills and guidance from the legal community are also required. To achieve a healthy non-prescription medicine vending machine policy approved by local government authorities, the advocates of these machines may well require buy-in from a variety of stakeholders, including members of the business community, law enforcement professionals, community pharmacists, physicians and health department officials. Community pharmacists and physicians because there is typically no access to healthcare professionals at vending machines.

## **Conclusion and next steps**

Despite the favorable aspects of self-treatment, its hazards, including adding to polypharmacy and medication interactions, must be addressed before non-prescription vending machines become more prevalent across countries.

Systematic educational initiatives are required to prevent the adverse consequences of incorrect self-treatment using non-prescription vending machines and enhance public knowledge of their potential risks. When accessing these medicines through a vending machine at a convenience shop, patients must be informed that these medicines have both therapeutic and harmful effects, as they should at community pharmacies.

Information campaigns, television commercials, or booklets and brochures accessible at pharmacies or from primary care physicians can all be useful educational tools to be more widely distributed. Action taken at the regulatory level to control the non-pharmacy distribution of medicinal products, such as restrictions on package sizes or maximum sizes sold, as well as the placement of pharmaceuticals in separate areas from other goods, can also have a significant impact on patients' understanding of the risks associated with non-prescription vending machines, and need to be considered going forward. These are activities for the future.

### ***Competing interests***

All authors declare that they have no conflict of interest.

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