Promoting dental patient safety toward judicious medication usage: a review

Promoção da segurança do paciente odontológico em relação ao uso criterioso de medicamentos: uma revisão

Promoción de la seguridad del paciente odontológico en relación con el uso juicioso de medicamentos: una revisión

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ABSTRACT
Objective: This critical review aimed to review strategies for health promotion and patient safety regarding the usage of drugs prescribed by dental practitioners. Methods: Manual searches were conducted on PubMed, Embase, and in the Cochrane database of systematic reviews using the keywords “dentistry”, “medication error”, “drug-related side effects and adverse reactions”, and “patient safety”. Publications by the World Health Organization, and the World Dental Federation were also searched to organize this review. Results: Several approaches have been identified to promote patient safety, including continuum education and training of practitioners, interdisciplinary work with clinical pharmacists, and electronic tools to aid practitioners in prescribing the adequate therapeutic regimen avoiding dosage errors and checking for potential drug interactions. Conclusion: Medication errors are common in dentistry, as such, it is fundamental that health professionals, patients, governments, and communities commit to advancing improvements and medication safety.

Keywords: drug-related side effects and adverse reactions, medication errors, inappropriate prescribing, medication systems, patient safety.

RESUMO
Objetivo: Esta revisão crítica teve como objetivo revisar estratégias para promoção da saúde e segurança do paciente em relação ao uso de medicamentos prescritos por dentistas. Métodos: Foram realizadas buscas manuais no PubMed, Embase e no banco de dados de revisões sistemáticas da Cochrane utilizando as palavras-chave "odontologia", "erro de medicação", "efeitos colaterais relacionados a medicamentos e reações adversas" e "segurança do paciente". Publicações da Organização Mundial da Saúde e da Federação Dentária Mundial também foram pesquisadas para organizar esta revisão. Resultados: Várias abordagens foram identificadas para promover a segurança do paciente, incluindo educação e treinamento contínuos dos profissionais, trabalho interdisciplinar com farmacêuticos clínicos e ferramentas eletrônicas para auxiliar os profissionais na prescrição do regime terapêutico adequado, evitando erros de dosagem e verificando possíveis interações medicamentosas. Conclusão: Erros de medicação são comuns na odontologia, portanto, é fundamental que profissionais de saúde, pacientes, governos e comunidades se comprometam com a melhoria e segurança dos medicamentos.

Palavras-chave: efeitos colaterais e reações adversas relacionados a medicamentos, erros de medicação, prescrição inadequada, sistemas de medicação, segurança do paciente.

RESUMEN
Objetivo: Esta revisión crítica tuvo como objetivo revisar las estrategias de promoción de la salud y seguridad del paciente con respecto al uso de medicamentos recetados por los odontólogos. Métodos: Se realizaron búsquedas manuales en PubMed, Embase y en la base de datos Cochrane de revisiones sistemáticas utilizando las palabras clave «odontología», «error de medicación», «efectos secundarios y reacciones adversas relacionados con los medicamentos» y «seguridad del paciente». También se buscaron publicaciones de la Organización Mundial de la Salud y de la Federación Dental Mundial para organizar este examen. Resultados: Se han identificado varios enfoques para promover la seguridad del paciente, incluida la educación continua y la capacitación de los profesionales, el trabajo interdisciplinario con farmacéuticos clínicos y las herramientas electrónicas para ayudar a los profesionales a recetar el régimen terapéutico adecuado, evitar errores de dosificación y verificar posibles interacciones farmacológicas. Conclusión: Los errores de medicación son comunes en la odontología, por lo que es fundamental que los profesionales de la salud, los pacientes, los gobiernos y las comunidades se comprometan a avanzar en las mejoras y la
seguridad de la medicación.

**Palabras clave:** efectos secundarios y reacciones adversas relacionados con medicamentos, errores de medicación, prescripción inadecuada, sistemas de medicación, seguridad del paciente.

1 INTRODUCTION

Patient safety is the cornerstone of the provision of health care in various settings. It involves a framework to cultivate healthcare environments that consistently and effectively mitigate risks, minimize avoidable harm, enhance error prevention, and reduce the impact of harm when it does occur. Patient harm is a large and growing global public health challenge, which may arise from every point in the process of care, such as misdiagnosing, unsafe surgical procedures, and medication errors (World Health Organization [WHO], 2021).

Medication error can cause adverse drug reactions (ADR), which are a leading cause of morbidity and mortality, affecting millions of patients each year. ADR encompass a spectrum of unwarranted ranging from mild, self-limiting symptoms to life-threatening events (Coleman; Pontefract, 2016). They can occur due to administration of the wrong drug or dosage, drug-drug interactions, allergies, or intolerance to medication. These unintended and potentially harmful responses to drugs pose significant risks to patient safety and have been recognized as a major concern by regulatory bodies, healthcare professionals, and policymakers (Coleman; Pontefract, 2016; Leite et al., 2021). Understanding and addressing ADR are crucial endeavors in improving medication safety and enhancing the overall quality of patient care.

The impact of ADR on public health, healthcare systems, and costs is substantial. ADR-related hospitalizations, emergency department visits, and additional medical interventions not only strain healthcare budgets but also disrupt patients’ lives and compromise their trust in healthcare providers (Jiang et al., 2022). A worldwide analysis of the WHO pharmacovigilance database recorded 23 million ADR from 2010 to 2019. Out of these, 43,685 resulted in deaths (Montastruc et al., 2021). Systematic reviews estimated the prevalence of ADR in primary care facilities (8.32%; 95% CI: 7.82, 8.83) (Insani et al., 2021), and hospitals (5.64%; 95% CI: 5.63–5.66%) (Stausberg, 2014). Watson et al. (2019) conducted a comprehensive analysis investigating the disparities in spontaneous reporting of ADR between genders worldwide. Over 50 years (1967 – 2018), there were records of 15 million ADR, with females accounting
for 60% (Watson et al., 2019). Additionally, the yearly cost associated with medication errors has been estimated at USD 42 billion (WHO, 2009).

In their clinical practice, dental practitioners frequently prescribe drugs to manage a range of painful inflammatory conditions, oral infections, and dental fear or anxiety. Previous research showed that dentists have limited knowledge about pharmacology leading to medication errors (Teoh; Mccullough; Moses, 2022). In Brazil, Cruz et al. (2023) reported a high frequency of potential drug interactions involving psychotropics. The result of such interactions may change the desired effects of the medications or ADR. Teoh et al. (2019), found that overprescribing of antibiotics was identified in 55% of cases, with the frequency ranging from 13% to 88% depending on the situation (Teoh et al., 2019). Moreover, medical advancements and new pharmaceutical products continuously emerge, making it difficult for dentists to possess a comprehensive understanding of all drugs. Consequently, this leaves room for potential prescription errors, including incomplete knowledge of contraindications, or unawareness of a patient's pre-existing medications (Teoh; Mccullough; Moses, 2022).

The prevention, early detection, and management of ADR thus emerge as key steps towards promoting patient safety. Therefore, a comprehensive and multifaceted safety strategy, as proposed by the WHO, is needed. In 2017, the WHO Global Patient Safety Challenges focused on ‘Medication without harm’ depicts four domains: (1) patients and the public, (2) health care professionals, (3) medicines and (4) systems and practices of medication, which should be addressed to reduce errors, medication-related harm and strengthen measurement and safety monitoring systems (WHO, 2017). Thus, we aimed to review strategies for health promotion and patient safety regarding the usage of drugs prescribed by dental practitioners based on the WHO’s framework.

2 METHODS

This critical review investigated and synthesized the current scientific literature on various aspects related to the safety of patients under pharmacotherapy. The references included in this paper were primarily found through PubMed and Embase. The manual search employed a combination of medical subject headings (MeSH terms) and keywords: ‘drug-related side effects and adverse reactions’, ‘medication errors’, ‘inappropriate prescribing’, ‘medication systems’, ‘patient safety’, ‘health promotion’, and ‘dental care’. Publications by the WHO, and the World Dental Federation were also searched. References in English, with no restriction date of publication were deemed eligible.
3 RESULTS

3.1 PATIENTS AND THE PUBLIC

The WHO considers patient safety the reduction of any risk of harm related to healthcare (WHO, 2009). With a large number of medication errors around the world, the WHO, in 2017, made medication safety its third global patient safety challenge, as medication errors can result in patient harm, hospital admissions, and increased healthcare costs (Teoh; McCullough; Moses, 2022; WHO, 2021).

Of the four Challenge domains, the ‘patients and the public’ domain highlights that patients and the public do not always have medication knowledge. Often, they just receive the medicine and use it, without having training and information on how to carry out treatment safely and effectively (WHO, 2021). Dresch, Amador, Heineck (2016) carried out a cross-sectional study to characterize patients' level of awareness regarding medications prescribed in public dental services in Porto Alegre. Using a score, 55% of the sample presented a regular level of knowledge, 34% insufficient, and 11% good, with a percentage of patients unable to report data to guarantee the effectiveness and safety of drug therapy. There is a need for work to improve the health literacy and attitudes of dental patients towards medication use (Rameshkumar et al., 2022).

3.2 HEALTH CARE PROFESSIONALS

Pharmacotherapy plays a pivotal role as one of the essential complementary therapies in dental treatment. When a dentist prescribes some medication, it is crucial to possess extensive and in-depth knowledge of various aspects, including commercial names, active ingredients, indications for use, primary drug interactions, and potential side effects (D'Anna et al., 2022). Any shortcomings in this context may demonstrate fragile and negligent conduct, which can be attributed to errors in dosage, imprecise written instructions, illegible handwriting, uncertainty in dosage determination, administration methods, treatment duration, and other related factors (Araghi et al., 2015; Silva et al., 2022).

Developing solid knowledge in pharmacology is important throughout the dental program as it helps cultivate the competence of providers while prescribing. Nevertheless, a study conducted by Costa et al. (2013) revealed that 45% of undergraduate dental students often experience uncertainties regarding medication. In Brazil, Lisboa et al. (2015) estimated that...
only 13% of prescriptions for antibiotic prophylaxis were correct regarding the generic name, dose, and length of antibiotic use. In the United States, between 2011 and 2015, 8 out of 10 antibiotics prescribed for infection prophylaxis before dental visits were unnecessary (Suda et al., 2019). Overprescribing of antimicrobials is a public health issue. An analysis using data from 204 countries reported that approximately 5 million deaths due to microbial resistance were reported in 2019 (Antimicrobial Resistance Collaborators, 2022).

One concerning issue related to drug usage is drug interactions. Oliveira et al., (2023) estimated that there were 359 interactions identified in a single Brazilian oral service, with most of them being classified as "monitor closely". This highlights the limited ability of dentists to recognize inappropriate drug combinations that endanger patients’ safety.

3.3 MEDICINES AND SYSTEMS

The names, packaging, and information provided for medication can often be complex, making it difficult to understand and differentiate between them. This confusion surrounding look-alike, sound-alike (LASA [e.g., Novolin®, Novolog®]) names and misleading packaging is a common source of mistakes and harm. In the United Kingdom, where more than 1 billion prescriptions are given annually, it was estimated that LASA errors may amount to as many as 2.2 million cases per year (Bryan et al., 2021). Those mistakes can result in toxicity due to overdosing, adverse effects of an unintended medication, and exacerbation of the disease for which the intended drug was given.

According to the WHO, 2 billion people have no access to essential medicines in developing countries (WHO, 2017). Abbas et al. (2020) reported great variability in access to drugs from several therapeutic groups in Europe. Hence, the processes of logistics, storage, and disposal are fundamental in ensuring that the right product is available at the point of care (WHO, 2021). The absence of careful planning and limited supply compel prescribers to modify pharmacotherapy, resulting in drug replacements or substitutions that may significantly influence disease management and patient recovery. Accurate and timely access to medication is a critical component of healthcare systems. The logistics of medications encompass an array of activities, spanning supply chain management, transportation networks, warehousing, inventory control, and regulatory compliance. Challenges associated with these stages can potentially compromise medication quality, increase costs, and jeopardize patient safety. Despite that, very little research has been conducted into this domain occurring in dental practice (Teoh; Mccullough; Moses, 2022).
3.4 SYSTEMS AND PRACTICES OF MEDICATION

Ensuring access to medicines requires a complex system involving numerous stakeholders and disciplines, from policies and pharmacy to economics, each with its own set of responsibilities and challenges. Nevertheless, health systems are usually fragmented, and in several nations, it is underfunded, facilities have limited autonomy and not always is possible to secure medication quality. Then, implementing practices, such as electronic medical/dental records, barcode scanning technology, and medication reconciliation processes might minimize errors, improve accuracy, and enhance the overall safety of medication management (Ozawa et al., 2019).

Also, creating a culture of transparency, open communication, and reporting is essential for identifying and addressing any potential risks or harm. This includes establishing surveillance systems for reporting adverse drug reactions, near misses, and medication errors. By actively collecting and analyzing such data, risks can be identified, and strategies devised to prevent similar incidents in the future (WHO, 2011).

4 DISCUSSION

To address unsafe medication practices and medication errors, a multifaceted approach engaging individuals and institutions should be deployed. It has been shown that most patients have little knowledge about their medication, while prescribers face challenges in determining the most appropriate drug regimen. Additionally, many locations experience medication shortages or encounter issues related to logistics, storage, and drug quality. Therefore, to overcome the current situation, we presented and discussed some successful initiatives that aim to reduce errors and promote patient safety.

The ‘patients and the public’ domain was developed to create strategies to address the problem of patient safety and consequently prioritize their well-being (WHO, 2017). As solutions presented to promote dental patient safety, Côrrea, Souza, Reis et al. (2020) highlighted the importance of creating policies that encourage patients to increase awareness of the risks and adverse effects that medications can cause. Furthermore, the patient must encourage a culture of safety, as they are not only an active participant in their care but also act as a link between care and the community (Sammer et al., 2010).

Understanding the purpose of the medication and how it will contribute to dental treatment is part of building patient education. When there is no understanding of the
information transmitted by the dentist or when the information is not passed on, the patient's clinical condition may worsen; non-adherence and treatment failure; increased likelihood of adverse effects, among others. Correct administration raises the chances of successful treatment (Bailey et al., 2015).

With the development of pharmaceutical industries and the increase in life expectancy, the number of medications taken, specially by older adults, make polypharmacy a concern when carrying out treatment and consequently in the drug interactions that may occur (Delalibera et al., 2015). It is important that the patient when consulting, provide the names of all the medications they are taking. This action will make it easier for the dentist to make the best decision and reduce the chances of adverse effects occurring. Health literacy is an essential part of dental practice, helping patients become active partners in their treatment and promoting the safety and effectiveness of dental care. Open dialogue and creating an environment conducive to questions are key aspects of patient education about medications (Ho et al., 2023).

Many strategies are available in the literature to improve medication safety by addressing the domain of ‘health care professionals’. Given that prescribing medications often cause uncertainty, both during and after graduation, it may be beneficial to modify the curriculum of dental programs to address medication errors (Araghi et al., 2015). Teoh et al. 2021 proposed a multimodal approach wherein providers were exposed to targeted education and an online prescribing tool designed to alert dentists to potential drug-related issues. The implementation of this approach resulted in a significant reduction in the inappropriate use of antibiotics and painkillers, as well as some improvements in the prescribing knowledge and confidence of practitioners (Teoh et al., 2021).

The growing number of drugs available in the market poses a challenge for dental practitioners to easily access the necessary drug information for evidence-based prescribing. Consequently, online drug databases (e.g.: Merative Micromedex®, Medscape®, and DrugBank) have become a critical tool for healthcare professionals. By providing thorough drug information, these databases enable better decision-making, save searching time for professionals, and identify potential drug interactions (Silva et al., 2013). Despite the potential benefits of those tools, some literature points out variations in the quality and comprehensiveness of many sources. Therefore, clinicians must carefully select a drug database, critically evaluate the provided evidence, and consider its relevance to each patient. In certain cases, consulting multiple sources may be necessary (Silva et al., 2013).

Another alternative for reducing prescription errors is the collaborative effort between dentists and clinical pharmacists. In high-income countries, it is common to have
multidisciplinary teams which, allows pharmacists to review medications prescribed by other healthcare professionals. They can also alert patients about possible ADR, and prevent drug interactions, among other things. According to a systematic review, the inclusion of pharmacists in multidisciplinary health teams and, improved communication between professionals significantly enhance the overall clinical experience, resulting in better health outcomes (Milosavljevic; Aspden; Harrison, 2018). This multidisciplinary approach in the dental practice has a positive influence on the quality of service provided to patients, ultimately improving their lives. Furthermore, a quasi-experimental study indicated the positive impact of clinical pharmacists in preventing medication errors (Júnior et al., 2021).

The domain ‘medicines’ encompasses naming, labeling, logistics, and availability of drugs. Many errors could be prevented if manufacturers considered risks for LASA errors when naming new drugs by adherence to regulatory guidance. One approach for differentiating LASA drug pairs is the use of tall man lettering (TML), which consists of the use of upper-case lettering for certain letters of medicines names. This has often been applied to syllables or groups of letters to draw attention to dissimilarities between similar names (e.g.: ePHEDrin; EPINEPHrin). Despite the recommendation for the approach, a systematic review of clinical trials revealed limited effectiveness of TML in reducing LASA errors. Clear labeling, segregating storage, and color coding also seem to reduce LASA errors (Bryan et al., 2021).

There are still numerous challenges that healthcare systems need to overcome to effectively enhance the medication management processes and subsequently ensure increased drug availability. Implementing robust quality inventory management software, information flow and visibility on stock, and collaboration among regulatory authorities, pharmaceutical manufacturers and human resources are some potential strategies to mitigate these challenges (Jaberidoost et al., 2013). Centralizing procurement for pharmaceuticals can yield cost savings and upturn the availability of health products in low-income and middle-income countries (Jaberidoost et al., 2013). Another potential point to action is implementing medication reverse logistic programs, which comprehend not only collecting expired medication and leftovers but also decreasing the negative impacts of incorrect chemical disposals (Lima et al., 2022).

The management of the ‘systems and practices of medication’ can indeed be complex and dysfunctional. However, by focusing on understanding and designing improvements in electronic systems, patient safety might be improved. Some systematic reviews assessed the effectiveness of interventions to reduce medication errors. Low- to moderate-certainty evidence suggests that electronic prescribing systems, barcoding for correct administering of medications, organizational changes, feedback on medication errors, and education of
professionals may reduce medication errors (AhsanI-Estahbanati; Gordeev; Doshmangir, 2022). Nevertheless, Carvalho et al. (2020) pointed out that investing in technologies such as automated drug dispensing systems is not enough if there is no investments in human resources. As such, it seems that high technology alone has limited effectiveness in preventing errors and promoting patient safety.

Implementing strong monitoring and surveillance programs improves the early detection of errors. It is crucial to invest in measures that promote the reporting of medication errors, which should include the staff and initiatives for identifying the underlying causes of such errors (Mutair, et al., 2021). The critical review of errors should be seen as an opportunity to learn and avoid similar future mistakes. However, it requires a collaborative effort among all stakeholders to foster a culture of safety, transparency, and continuous improvement in medication management, ultimately leading to better healthcare outcomes.

5 CONCLUSIONS

The implementation of the WHO framework for patient safety focused on the four domains related to the use of medicines, represents a significant advance in the search for safer and more effective practices in the health field. When addressing the ‘patients and the public’; ‘health care professionals’; ‘medicines’ and ‘systems and practices of medication’, the WHO offers a comprehensive framework that aims at reducing risks and improving the quality of care provided. Health professionals, patients, governments, and communities must commit to advancing improvements and medication safety for dental patients.

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