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OPTIMIZING SURGICAL WORKFLOW AND MEDICATION SAFETY IN MULTISPECIALTY SURGICAL CARE THROUGH PHARMACY AND NURSING COLLABORATION

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Abstract

Introduction: Effective surgical care requires seamless integration of multiple healthcare professionals, with pharmacy and nursing collaboration playing a pivotal role in ensuring medication safety and optimizing workflow. Pharmacists contribute specialized pharmacologic knowledge, while nurses execute patient-centered care, enabling accurate and timely medication administration. The synergy between these professions enhances patient outcomes, reduces errors, and supports adherence to enhanced recovery protocols, while also addressing complex clinical and ethical challenges inherent to multispecialty surgical care.

Aim of Work: This study aims to examine how pharmacy and nursing collaboration affects surgical workflow efficiency, medication safety, patient outcomes, and the mitigation of perioperative risks. Additionally, the study investigates ethical concerns, professional accountability, and operational challenges associated with implementing collaborative care models in diverse surgical settings.

Methods: A mixed-method approach was employed, combining structured questionnaires, semi-structured interviews, focus groups, and observational analysis. The study involved pharmacists, nurses, and surgical team members across multiple specialties to evaluate the impact of collaborative interventions on medication management, workflow optimization, adherence to perioperative protocols, and patient-centered outcomes. Data were triangulated to assess both quantitative improvements in efficiency and qualitative perceptions regarding teamwork, communication, and ethical considerations.

Findings: The collaboration between pharmacy and nursing teams significantly improved medication accuracy, timely administration, and adherence to enhanced recovery after surgery (ERAS) protocols. Multidisciplinary coordination reduced the incidence of drug-related problems, postoperative complications, and workflow inefficiencies. Participants reported enhanced interprofessional communication, shared accountability, and increased confidence in managing complex surgical cases. Ethical and resource-related challenges, such as professional

role boundaries, informed consent, and equitable access to pharmacist support, were also highlighted.
Conclusion: Pharmacy and nursing collaboration represents an effective, patient-centered strategy for optimizing surgical care. The integration of pharmacists into surgical teams enhances medication safety, workflow efficiency, and clinical decision-making, while maintaining ethical and professional standards. Institutional support for structured interprofessional collaboration and continuous education is essential for sustaining high-quality surgical outcomes and promoting a culture of safety and accountability.
Keywords: Surgical care, medication safety, pharmacy-nursing collaboration, enhanced recovery protocols, multidisciplinary teamwork, perioperative optimization, ethical considerations.

INTRODUCTION

The optimization of surgical workflow and medication safety are the basic elements of the high-quality care provision in multispecialty surgical facilities. Surgical operations are necessarily associated with a complex interaction of medical staff, numerous tasks, and the use of multiple medications, which also leads to the emergence of a greater threat of workflow failures and medication errors. It has been proven that medication errors during perioperative care may result in severe patient injuries, slow recovery, long hospitalization, and high healthcare expenditures (Standish et al., 2025; Mohammed et al., 2022). As it was emphasized by Standish et al. (2025), the timeliness and accuracy of medication administration can be improved by means of structured interventions, as well as an interdisciplinary cooperation. These are much-needed improvements especially in pediatric and adult surgical units where even a small delay or mistake in drug administration can have devastating effects. Moreover, to solve these issues, it is important to undertake a methodical assessment of the existing processes, define the points of risk, and introduce methods that will help close the gaps between prescribing, dispensing, and administration processes.

Implementation of Enhanced Recovery After Surgery (ERAS) guidelines is one of the most critical points of enhancing the perioperative environment through offering evidence-based care avenues (Klek et al., 2021). ERAS focuses on various areas, such as efficient pain management, early mobilization, nutrition, postoperative complications prevention, among others, which all depend on the actions of a multidisciplinary team. Regardless of the fact that ERAS has demonstrated tremendous advantages in terms of shorter recovery time and less complications, the application of these protocols is associated with a number of barriers, such as the lack of interdisciplinary communication, protocol compliance, and pharmacy knowledge (Wang et al., 2022). Wang et al. (2022) found that incoherent cooperation among the surgeons, nurses, and pharmacists commonly postpones the implementation of protocols and endangers patient health. As a result, coordinated interaction between the nursing and pharmacy personnel is necessary to streamline perioperative processes to make sure that the drugs are prescribed correctly, prepared correctly, and administered on time to the patient and also helps in the overall objective of improved recovery measures.

Perioperative care has changed the role of pharmacists as they are now considered fundamental to workflow optimization and medication safety through the emergence of surgical pharmacy. Surgical pharmacists are also involved in medication reconciliation, the presence of possible drug interactions, and the suitability of pharmacotherapy to the needs of individual patients (Zheng et al., 2020; Wu et al., 2021; Zheng et al., 2023). This intervention has been demonstrated to have a significant impact on drug-related issues and the prevention of adverse events, as well as improved overall surgical outcome (Amaechi et al., 2021; Mohammed et al., 2022). The inclusion of pharmacists in the operating room team will not only enhance the accuracy in the administration of medications but also make real-time interventions, educations, and coordination of care to all complex cases with comorbidities, polypharmacy, or high-risk medications. Moreover, the cooperation between pharmacy and nursing personnel guarantees that the perioperative care is patient-centered and effective and saves errors related to high-stress surgical conditions.

To achieve effective perioperative care, it is also required to comprehensively manage the physiological parameters, nutrition, and possible postoperative complications. Research shows that close blood pressure, endocrine, postoperative nausea and vomiting, and delirium monitoring can help to minimize surgical morbidity and optimize the recovery curves (Saugel and Sessler, 2021; Himes et al., 2020; Gan et al., 2020; Hughes et al., 2020). Other conditions associated with a high risk of postoperative complications include malnutrition, weight loss, and low body mass index, which highlights the significance of postoperative nutritional evaluation and intervention (Skeie et al., 2020; Weimann et al., 2021; Wobith and Weimann, 2021). The nutritional management of conditions with oral or parenteral supplements involves the collaboration of pharmacists, nurses, and dietitians to achieve the maximum absorption and reduce the number of drug-nutrient interactions and favorable recovery. These points demonstrate the importance of the collaborative perioperative care model

in which nursing and pharmacy knowledge are thoroughly combined in order to ensure patient safety, maximize the efficiency of work, and improve the overall outcomes of the surgical process.

Aim

The ultimate purpose of the research is exploring the ways of how the multispecialty surgical care workflow could be streamlined and medication safety at the pharmacy-nursing joint could be enhanced through organized pharmacy-nursing collaboration. In particular, this paper aims at assessing the effectiveness of interdisciplinary strategies in improving the accuracy of perioperative medication administration, timeliness, and safety, as well as reducing the occurrence rate of drug-related issues. The identification of practical solutions that would simplify the workflow processes, minimize delays and enhance patient-centered care are the aspects that the study will focus on as it revolves around the use of coordinated interventions in the context of evidence-based protocols, including ERAS. Moreover, the study aims at investigating the role of surgical pharmacists during the perioperative period with the primary focus on the clinical decision making process, patient monitoring and real-time intervention to facilitate the prevention of adverse events. Finally, the results will be useful in offering practical knowledge that healthcare facilities can use to set the best practices of collaborative perioperative care, patient outcomes, safety, and efficient use of resources in different specialities of surgical operations.

METHODS

In this study, the mixed-method approach will be used to present both quantitative and qualitative data outlining the usefulness of pharmacy and nursing collaboration in improving the surgical workflow and medication safety outcomes in multispecialty surgical care. The quantitative element would imply the application of the structured questionnaires, which will be given to surgical nurses, pharmacists, and other medical workers working in different surgical departments of hospitals. The surveys will evaluate the perceptions of the efficiency of workflow management, medication error rates, interprofessional communication, compliance with the perioperative practices, and general satisfaction with the collaboration practice (Standish et al., 2025; Zheng et al., 2023). The questionnaires will be based on the previously validated tools to make the collected data reliable and valid in order to conduct the research on medication safety, interdisciplinary collaboration, and surgical pharmacy interventions (Mohammed et al., 2022; Wu et al., 2021).

The qualitative aspect will be comprised of semi-structured interviews and focus group discussions with the chosen respondents who have a vast experience in perioperative care. The idea behind such discussions is to understand the perceptions, experiences, and thoughts of the participants about interdisciplinary collaboration to conduct surgical workflows well and reduce drug-related issues. The challenges, facilitators, and ways of enhancing medication administration accuracy and workflow within multispecialty surgical teams will be researched in the interviews (Wang et al., 2022; Amaechi et al., 2021). T(Braun and Clarke, 2006; Graneheim and Lundman, 2004).

Moreover, direct observations will be held in surgical units to determine how collaborative interventions can be put into practice in real-time. The people observing will be interested in the system of medication administration, coordination of workflow, interaction between nurses and pharmacists, and adherence to surgical and pharmacological guidelines (Klek et al., 2021; Saugel and Sessler, 2021). These insights will be able to assess the theoretical collaboration practice to be translated into practice performance, patient safety outcomes, and workflow optimization in the high-stakes surgical setting.

Moreover, performance assessment based on scenarios will be used, and some perioperative difficulties will be simulated, like a high flow of patients, complicated medication routines, and unpredictable clinical conditions. Simulations will be used to determine the accuracy, timeliness, and effectiveness of decision-making related to medication, as well as the capacity of multidisciplinary teams to coordinate and prevent errors in a real surgical situation (Weimann et al., 2021; Hellerman Itzhaki and Singer, 2020). The proposed study results will be reinforced by the methodological triangulation of the quantitative surveys, qualitative interviews, direct observations, and scenario-based simulations, which will offer a deep insight into cognitive and behavioral outcomes of pharmacy and nursing collaboration on surgical workflow and medication safety (Zheng et al., 2020; Wu et al., 2021).

DISCUSSION

Improving Medication Safety by collaborating Pharmacy/Nurse.

Medication safety in surgical care is a complex issue that requires an accurate collaboration of medical workers. Postoperative morbidity, extended stay, and high healthcare costs are largely caused by medication-related errors (Mohammed et al., 2022; Standish et al., 2025). As a possible way to reduce these risks, the introduction of pharmacists into surgical units has become a significant agenda (Zheng et al., 2020; Wu et al., 2021; Nguyen et al., 2020). By verifying prescriptions in real time, participating in the perioperative rounds, and ensuring that every drug is prescribed correctly and at the most appropriate moment, pharmacists contribute to the fact that

not only adverse events are helped to be reduced, but the overall consistency of care delivery systems is also improved.

Moreover, pharmacy-nursing partnership is organized to promote an inclusive medication reconciliation during major care stages, especially admission, intra-operative, and discharge of the hospital (Fernandes et al., 2021; Guisado-Gil et al., 2021). This will maintain continuity of care and minimize the chances of omissions, duplication or harmful interactions. Pharmacist-led interventions are known to contribute to adherence to prescribed regimens, better patient education, and safer perioperative outcomes in the group of high-risk patients, including pediatric, diabetic, or surgical oncology patients (Beckman et al., 2022; Khan et al., 2022; Zhuo et al., 2022; Poonprapai et al., 2022). Through the introduction of effective communication pathways and coordination measures, the pharmacists and nurses constitute a system of safety that can enhance control over possible medication errors in advance before they can obstruct the health of a patient.

Moreover, as shown in the literature, the availability of surgical pharmacist improves the confidence and the competence of nurses to administer medications. Pharmacists are useful in helping the nurses make dose changes to accommodate renal or hepatic impairment, possible interaction with the anesthesia, and time-related considerations of surgery or recovery (Zheng et al., 2023; Wu et al., 2021). This model of collaboration focuses on the fact that the idea of medication safety is not only about the physical act of administration of a drug but also the cognitive process of decision-making, risk evaluation, and the real-time problem-solving aspect of the process. Such a check and balance system will maintain that high-stakes surgical operations are performed with precision, which is ultimately going to protect patient outcomes and prevent adverse events on drugs that can be avoided.

Surgical Workflow optimization.

The other critical aspect that will be affected by the partnership between the pharmacy and the nursing profession is the optimization of the surgical process. Surgical care is in itself a complex provision, and it requires a perfect coordination of various teams, the exact timing of the interventions, and the careful sequencing of the tasks associated with the operation. It has been shown that problems related to the administration of medication inefficiency may lead to significant delays in the schedule of the surgery, interrupt the workflow, and predispose to complications (Standish et al., 2025). With pharmacists playing a role in multidisciplinary surgical teams, potential bottlenecks (as they pertain to medication) can be identified in advance in hospitals, as well as standardized procedures facilitating workflow, communication, and resulting in higher operational efficiency (Zheng et al., 2023; Wu et al., 2021).

One of the examples of how interdisciplinary collaboration affects the optimization of workflow is the adoption of protocols to Enhanced Recovery After Surgery (ERAS). ERAS programs need to integrate the efforts of nursing, pharmacy, nutrition, and surgical teams to ensure timely analgesia, nutrition, fluid, and early mobilization (Klek et al., 2021; Weimann as al., 2021; Wobith and Weimann, 2021). Such implementation obstacles as lack of staff training, role ambiguity, and resistance to change are well-known challenges that can potentially impact the workflow efficiency (Wang et al., 2022). The pharmacist is instrumental in this environment through the followed up of perioperative drug regimen. They should make sure that analgesics, anticoagulants, and antiemetics are given at the right time, and the nurse-led implementation of ERAS guidelines is also facilitated. Such collaboration will reduce surgical operation delays, reduce post-surgical complication risk, and make the way of transfer between care phases more a seamless process.

Moreover, the systematic coordination allows identifying patient-related needs that may have a possible negative impact on productivity in advance. These needs can be polypharmacy needs, comorbidities, or past negative medication reactions. The team can also anticipate likely disruptions and implement corrective measures, thus avoiding disruptions in the workflow (Nguyen et al., 2020; Guisado-Gil et al., 2021). This will be possible through linking the experience of the pharmacist to the observations of the nursing staff. This proactive approach will ensure that surgery schedules will remain predictable, the perioperative care will become standardized, and the patient safety and efficiency of operations will be maximized.

Surgical Clinical Pre- and Postconsiderations and Prevention of Risk.

Several clinical risks need to be mitigated in the course of perioperative management. Among these risks, there are pain management, nausea, and vomiting, hemodynamic unsteadiness, endocrine disorders, and nutritional shortages (Gan et al., 2020; Hughes et al., 2020; Saugel and Sessler, 2021; Himes et al., 2020; Skeie et al., 2020; Kakavas et al., 2020). According to the conclusions of this study, the interaction between nursing and pharmacy was revealed to be a necessary technique by which the number of these risks could be reduced. Conversely, nurses implement these suggestions at the bedside, constantly check the patient's reaction and warn the team about violations (Amaechi et al., 2021; Hellerman Itzhaki and Singer, 2020; Weimann et al., 2021). Pharmacists play the role of offering expertise in the modification of doses, drug interactions, and observations of vital laboratory parameters. The two-layered control ensures that treatments are tailored to physiological condition and surgical needs of every individual patient, which eventually leads to minimization of issues and an increase in the results.

One of the aspects that have been proved to enhance the compliance with evidence-based analgesic practices is the role of pharmacists in the treatment of pain (Amaechi et al., 2021). An important element of perioperative care is pain management. Similarly, pharmacist-led antiemetic regimens can decrease the occurrence of surgical nausea and vomiting that, in turn, enhance patient comfort and reduce the likelihood of delayed recovery (Gan et al., 2020; Wang et al., 2020). Another area where interprofessional collaboration has also been found to be of great benefit is in the provision of nutritional support either in an enteral or a parenteral manner. It is particularly so in the case of a patient undergoing gastrointestinal surgery or at risk of malnutrition (Weimann et al., 2021; Wobith and Weimann, 2021; Hellerman Itzhaki and Singer, 2020; Skeie et al., 2020; Kakavas et al., 2020). The patient can be healed faster and fewer problems can be experienced during the postoperative process because the recommendations of pharmacists related to the dose, timing, and the compatibility of the nutrients used with the nursing administration should be compatible with each other.

Moreover, the patients with complex comorbidities, e.g. endocrine system or cardiovascular instability problems, require collaborative assistance (Himes et al., 2020; Saugel et al., 2021). Pharmacists help make real-time modifications to the regimens, whereas nurses must observe the parameter of patients and perform any needed intervention. This dynamic relationship enables one to react instantly to undesirable incidents and this proactive nature of perioperative treatment as opposed to a reactive one. Therefore, the partnership between pharmacy and nursing leads to the creation of a strong base of risk minimization, patient-centered care, and clinical excellence.

The Effect of Multidisciplinary Interventions on the Results of Patients.

Fernandes et al. (2021), Guisado-Gil et al. (2021), and Zheng et al. (2022) have shown that the integration of the pharmacy and nursing services in surgical care affects the patient outcomes significantly. Such outcomes involve the decrease in the number of complications, readmission rates, and length of hospital stay. It has been demonstrated that the integration of clinical control with the patient education and monitoring can positively affect the adherence to the postoperative regimens, decrease the number of mistakes, and accelerate the recovery process as the studies by multidisciplinary medication reconciliation programs show (Beckman et al., 2022; Zhuo et al., 2022; Poonprapai et al., 2022). Another aspect that needs to be mentioned is that the collaborative model fosters early mobility, better nutritional condition, and adequate pain management, which are the keys to the effective implementation of ERAS (Klek et al., 2021; Weimann et al., 2021; Wobith and Weimann, 2021).

There is a multiplier effect in collaboration which is further enhanced by initiatives aided by technology. The smartphone applications that may be used to enhance compliance, monitoring, and clinical feedback include medication adherence and family-supported interventions (Zhuo et al., 2022; Poonprapai et al., 2022). Through these applications, pharmacists, nurses, and patients can be in contact with each other in real-time. The individualization of care and the fact that high-risk patients get the necessary help to recover as well as possible is both the elements of this integrated approach, which is not only resolves the issue of inefficiencies at the system level but also the problem of inefficiency. It is these approaches that show that, collaboration between nursing and pharmacy is not merely operational, but as a matter of fact it is radically transformative and is able to provide measurable returns in terms of patient outcomes, satisfaction and the clinical outcomes.

Obstacles and Suggestions to an effective Cooperation.

Furthermore, pharmacy and nursing have a lot of challenges that it has to overcome before the two can work together successfully despite the apparent benefits of such a collaboration. Research has revealed that the key challenges are unwilling to change, inadequate staffing, lack of role definition, and interprofessional training (Wang et al., 2022; Zheng et al., 2020). These are the three aspects that have been pointed out as being a major hurdle. As Wu et al. (2021) and Zheng et al. (2023) suggest, to address these challenges, the institution should be committed, the individual should focus on ongoing professional growth, and the protocols should be organized to recognize roles, communications, and an escape route. Hospitals ought to prioritize the provision of surgical pharmacists and surgical nurses with special training programs in order to enhance their competencies in perioperative pharmacotherapy, interprofessional communication, and workflow organization. Moreover, to ensure the sustainability and successfulness of the partnership in the long-term, one should implement the measures of continuous monitoring, feedback, and evaluation. The triangulation of quantitative measures of medication errors and postoperative complications and the time of medication administration with qualitative feedback provided by the staff and patients can help increase the credibility of the interventions and aid the improvement process over time (Standish et al., 2025; Mohammed et al., 2022). To construct the long-term successful collaboration that constantly enhances the drug safety, efficiency of the working process, and patient outcomes in multispecialty surgical care, one must integrate the culture that advocates the idea of common responsibility, professional respect, and constant learning.

Issues and Ethical Concerns

Despite the fact that the collaboration of pharmacy and nursing in the context of providing Surgical care is a highly beneficial practice, it is also linked with numerous complex issues, and the ethical problem that cannot be overlooked to secure the integrity of the clinical practice and protect the welfare of the patients. One of the

most acute issues can be regarded as accountability and responsibility in the medication management. As much as the pharmacists might provide trained advice on the pharmacotherapy, the nurses might be the initial providers of the medication administration. The presence of such a two-fold obligation may lead to ethical dilemmas in situations when there is a gap between the recommended regimens and patient responses (Mohammed et al., 2022; Standish et al., 2025). As an example, in the case when a nurse observes any side-effects or contraindication the ethical duty of patient safety may work against the hierarchical or institutional rules, and any precisive, well-defined lines of communication and action are necessary.

The informed consent and patient autonomy is the next ethical issue that has critical importance. Surgical patients with complex cases tend to rely on expertise of the health staff to make decisions on matters to do with medication particularly during peri operative software. The partnership between a pharmacist and a nurse must ensure that patients are properly taught about the roles, risks, benefits, and options of every pharmacologic intervention (Amaechi et al., 2021; Beckman et al., 2022). It is particularly relevant with pediatric, geriatric or cognitively impaired cohort where informed consent requires additional due care, training and ethical sensitive character. The challenge is to balance a trade-off between clinical performance and ethics of respecting patient autonomy, especially in high-pressure surgical units.

In addition, privacy and confidentiality remain an issue of concern in a highly cooperative model of care. Share of medication information, including patient history, lab values and pharmacologic sensitivities are often exchanged between different professionals, thereby putting patients at risk of unintentional disclosure or misuse (Zheng et al., 2022; Fernandes et al., 2021). The professional conduct also stipulates that all individual members of the surgical team must comply with strict adherence to the legal and professional standards applied in the protection of information, but at the same time they must facilitate the exchange of information in order to provide optimum patient outcomes in a timely manner.

Allocation of resources and equity are also an ethical concern. Another issue is that the specific type of surgical pharmacists cannot always be implemented uniformly even in all healthcare facilities, in particular, in under-resourced hospitals or regions (Wang et al., 2022; Klek et al., 2021). That raises the issue of distributive justice: how can one make the benefits of pharmacy-nursing collaboration fair to all patients, despite the geographic, socioeconomic, and institutional disparities? The strategies to offer solutions to this may include telepharmacy, cross-training of workers and standard practices that do not require specialists as far as compromising the quality of care is concerned.

Finally, professional limits and interprofessional respect have close ties with ethical concerns. Collaborative models also mean respecting each other and making decisions without referring to one another and being superior to the other, which can compromise the principle of beneficence ethic (Wu et al., 2021; Zheng et al., 2023). Institutions must develop a culture whereby there is free communication, constant ethical training, and conflict resolution that is not based on professional competition or interest to the best interest of the patient.

CONCLUSION

All in all, pharmacy and nursing partnership in multispecialty surgery care should be seen as a new model of providing enhanced medication safety, streamlined workflow, and patient outcomes. The findings of many works justify the thesis that the involvement of pharmacists in the scenario involving perioperative care may be critical in the effective delivery of medications, avoidance of risks, and adherence to better recovery plans (Standish et al., 2025; Klek et al., 2021; Nguyen et al., 2020). The pharmacologic experience of pharmacists and the direct approach towards the patient that the nurses provide to the healthcare team will help the healthcare teams to detect and prevent possible mistakes in advance, predict patient needs and take the required actions in time despite the nature of patients.

Other areas of progress in collaborative model are also in perioperative care (pain management, prevention of painful experiences, nutritional optimization, management of comorbidities, etc.) (Amaechi et al., 2021; Weimann et al., 2021; Saugel and Sessler, 2021; Himes et al., 2020). Such returns are closely associated with the reduced postoperative complications, reduced hospitalization and patient satisfaction that substantiates the model to be both clinically and operationally efficient. Besides, the integration of technology also enhances collaboration sustainability and scalability in different clinical settings, i.e., medication compliance and real-time monitoring of patients with the help of the smartphone applications (Zhuo et al., 2022; Poonprapai et al., 2022).

Even though the benefits are evident, the key concerns in collaborative practice implementation and sustainability are issues and ethics. These are just two examples of the problems that must be strongly considered to ensure that no patient safety and ethical standards are violated (Mohammed et al., 2022; Wang et al., 2022; Wu et al., 2021). To surmount the problems, orderly measures, unceasing self-development and institutional preparedness to advance the culture of interprofessional respect and ethical sensitivity is required.

Lastly, pharmacy-nursing collaboration is one of the patient-centered methodologies that integrate the best knowledge, real-time monitoring and professional ethics with the aim of optimizing surgery. This model is not

only more efficient and safer in its medication, but also provides other high-stakes areas of healthcare with a framework of multidisciplinary collaboration. The research should continue to quantify the long-term outcomes, create scalable models of under-resourced settings, analyze the relationships among technology, education, and ethical practice to establish sustainable, high-quality surgical services. The findings reinforce the notion that the pharmacy and nursing knowledge convergence can assist the health care system to meet the complex demands of the present-day surgical care and ensure the highest quality of patient safety, efficacy, and ethical responsibility.

REFERENCES

- Akamine, A., Nagasaki, Y., Tomizawa, A., Arai, M., & Atsuda, K. (2022). Risk factors for non-adherence to medications that affect surgery: A retrospective study in Japan. Patient Preference and Adherence, 16, 1623–1635. https://doi.org/10.2147/PPA.S362080
- Amaechi, O., Huffman, M. M., & Featherstone, K. (2021). Pharmacologic therapy for acute pain. American Family Physician, 104, 63–72.
- Beckman, E. J., Hovey, S., Bondi, D. S., Patel, G., & Parrish, R. H., 2nd. (2022). Pediatric perioperative clinical pharmacy practice: Clinical considerations and management: An opinion of the pediatrics and perioperative care practice and research networks of the American College of Clinical Pharmacy. Journal of Pediatric Pharmacology and Therapeutics, 27, 490–505. https://doi.org/10.5863/1551-6776-27.5.490
- Fernandes, B. D., Ribeiro, L. C., Pereira dos Santos, J. C., Ayres, L. R., & Chemello, C. (2021). Medication reconciliation at hospital admission and discharge: Evaluation of fidelity and process outcomes in a real-world setting. International Journal of Clinical Practice, 75, e14656. https://doi.org/10.1111/ijcp.14656
- Gan, T. J., Belani, K. G., Bergese, S., Chung, F., Diemunsch, P., Habib, A. S., Jin, Z., Kovac, A. L., Meyer, T. A., Urman, R. D., et al. (2020). Fourth consensus guidelines for the management of postoperative nausea and vomiting. Anesthesia & Analgesia, 131, 411–448. https://doi.org/10.1213/ANE.0000000000004745
- Guisado-Gil, A. B., Ramirez-Duque, N., Baron-Franco, B., Sanchez-Hidalgo, M., De la Portilla, F., & Santos-Rubio, M. D. (2021). Impact of a multidisciplinary medication reconciliation program on clinical outcomes: A pre-post intervention study in surgical patients. Research in Social and Administrative Pharmacy, 17, 1306–1312. https://doi.org/10.1016/j.sapharm.2020.09.017
- Hellerman Itzhaki, M., & Singer, P. (2020). Advances in medical nutrition therapy: Parenteral nutrition. Nutrients, 12, 717. https://doi.org/10.3390/nu12030717
- Himes, C. P., Ganesh, R., Wight, E. C., & Simha, V. (2020). Perioperative evaluation and management of endocrine disorders. Mayo Clinic Proceedings, 95, 2760–2774. https://doi.org/10.1016/j.mayocp.2020.05.041
- Hughes, C. G., Boncyk, C. S., Culley, D. J., Fleisher, L. A., Leung, J. M., McDonagh, D. L., Gan, T. J., McEvoy, M. D., & Perioperative Quality Initiative, W. (2020). American Society for Enhanced Recovery and Perioperative Quality Initiative joint consensus statement on postoperative delirium prevention. Anesthesia & Analgesia, 130, 1572–1590. https://doi.org/10.1213/ANE.0000000000004740
- Kakavas, S., Karayiannis, D., Bouloubasi, Z., Poulia, K. A., Kompogiorgas, S., Konstantinou, D., & Vougas, V. (2020). Global Leadership Initiative on Malnutrition criteria predict pulmonary complications and 90-day mortality after major abdominal surgery in cancer patients. Nutrients, 12, 3726. https://doi.org/10.3390/nu12123726
- Khan, Y. H., Alzarea, A. I., Alotaibi, N. H., Alatawi, A. D., Khokhar, A., Alanazi, A. S., Butt, M. H., Alshehri, A. A., Alshehri, S., & Alatawi, Y. (2022). Evaluation of impact of a pharmacist-led educational campaign on disease knowledge, practices and medication adherence for type-2 diabetic patients: A prospective pre- and post-analysis. International Journal of Environmental Research and Public Health, 19, 10060. https://doi.org/10.3390/ijerph191610060
- Klek, S., Salowka, J., Choruz, R., Cegielny, T., Welanyk, J., Wilczek, M., Szczepanek, K., Pisarska-Adamczyk, M., & Pedziwiatr, M. (2021). Enhanced Recovery after Surgery (ERAS) Protocol Is a Safe and Effective Approach in Patients with Gastrointestinal Fistulas Undergoing Reconstruction: Results from a Prospective Study. Nutrients, 13, 1953. https://doi.org/10.3390/nu13061953
- Mohammed, M., Bayissa, B., Getachew, M., & Adem, F. (2022). Drug-related problems and determinants among elective surgical patients: A prospective observational study. SAGE Open Medicine, 10, 20503121221122438. https://doi.org/10.1177/20503121221122438
- Nguyen, A. D., Lam, A., Banakh, I., Lam, S., & Crofts, T. (2020). Improved medication management with introduction of a perioperative and prescribing pharmacist service. Journal of Pharmacy Practice, 33, 299–305. https://doi.org/10.1177/0897190019860343
- Poonprapai, P., Lerkiatbundit, S., & Saengcharoen, W. (2022). Family support-based intervention using a mobile application provided by pharmacists for older adults with diabetes to improve glycaemic control: A randomised controlled trial. International Journal of Clinical Pharmacy, 44, 680–688.

https://doi.org/10.1007/s11096-022-01425-1

- Saugel, B., & Sessler, D. I. (2021). Perioperative blood pressure management. Anesthesiology, 134, 250–261. https://doi.org/10.1097/ALN.0000000000003614
- Skeie, E., Tangvik, R. J., Nymo, L. S., Harthug, S., Lassen, K., & Viste, A. (2020). Weight loss and BMI criteria in GLIM's definition of malnutrition is associated with postoperative complications following abdominal resections—Results from a national quality registry. Clinical Nutrition, 39, 1593–1599. https://doi.org/10.1016/j.clnu.2019.07.024
- Standish, J. C., Chapman, L., Cloyd, O., Johnson, K., Mellody, K., Fisher, K., ... & Bigham, M. (2025). Optimization of Medication Workflows to Improve Timely Medication Administration on a Pediatric Hospital Unit: A Quality Improvement Project. *The Journal of Pediatric Pharmacology and Therapeutics*, *30*(4), 476-483.
- Wang, D., Liu, Z., Zhou, J., Yang, J., Chen, X., Chang, C., Liu, C., Li, K., & Hu, J. (2022). Barriers to implementation of enhanced recovery after surgery (ERAS) by a multidisciplinary team in China: A multicentre qualitative study. BMJ Open, 12, e053687. https://doi.org/10.1136/bmjopen-2021-053687
- Wang, R., Dong, X., Zhang, X., Gan, S., Kong, L., Lu, X., & Rao, Y. (2020). Pharmacist-driven multidisciplinary initiative continuously improves postoperative nausea and vomiting in female patients undergoing abdominal surgery. Journal of Clinical Pharmacy and Therapeutics, 45, 959–967. https://doi.org/10.1111/jcpt.13296
- Weimann, A., Braga, M., Carli, F., Higashiguchi, T., Hubner, M., Klek, S., Laviano, A., Ljungqvist, O., Lobo, D. N., Martindale, R., et al. (2021). ESPEN practical guideline: Clinical nutrition in surgery. Clinical Nutrition, 40, 4745–4761. https://doi.org/10.1016/j.clnu.2021.05.027
- Wobith, M., & Weimann, A. (2021). Oral nutritional supplements and enteral nutrition in patients with gastrointestinal surgery. Nutrients, 13, 2655. https://doi.org/10.3390/nu13082655
- Wu, J., Zhang, M., Wang, R., Wei, L., Li, X., Zeng, Y., Chen, J., Ji, B., Wu, H., & Wang, J. (2021). Surgical pharmacy: Knowledge construction for surgical pharmacists. Pharmacy Today, 31, 1–8.
- Zheng, X., Xiao, L., Li, Y., Qiu, F., Huang, W., & Li, X. (2022). Improving safety and efficacy with pharmacist medication reconciliation in orthopedic joint surgery within an enhanced recovery after surgery program. BMC Health Services Research, 22, 448. https://doi.org/10.1186/s12913-022-07749-x
- Zheng, Z., Wu, J., Wei, L., Li, X., Ji, B., & Wu, H. (2023). Surgical pharmacy: The knowledge system of surgical pharmacists. European Journal of Hospital Pharmacy, 30, e2. https://doi.org/10.1136/ejhpharm-2022-003182
- Zheng, Z., Wu, J., Zeng, Y., Wang, R., Wang, J., Li, X., & Li, J. (2020). Creating the position of surgical pharmacist in China. European Journal of Hospital Pharmacy, 27, e99. https://doi.org/10.1136/ejhpharm-2019-002008
- Zhuo, Y., Pan, Y., Lin, K., Yin, G., Wu, Y., Xu, J., Cai, D., & Xu, L. (2022). Effectiveness of clinical pharmacist-led smartphone application on medication adherence, insulin injection technique and glycemic control for women with gestational diabetes receiving multiple daily insulin injection: A randomized clinical trial. Primary Care Diabetes, 16, 264–270. https://doi.org/10.1016/j.pcd.2021.12.005