Cross-Sectional Study

Sedatives and Opioids Best Practices: An Approach to the Use of Technological Tools

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Disclaimer: This research was funded by Universidad de La Sabana, MED-305-2021.

Conflict of interest: Each author certifies that he or she, or a member of his or her immediate family, has no commercial association (i.e., consultancies, stock ownership, equity interest, patent/licensing arrangements, etc.) that might pose a conflict of interest in connection with the submitted article.

Article received: 11-11-2023
Revised article received: 11-02-2024
Accepted for publication: 12-09-2024

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Background: The formulation of opioid medications is becoming increasingly common among hospitalized patients, due to the need for pain control or sedation during procedures. This phenomenon represents the possibility of an increase in adverse events, as demonstrated by monitoring through the Adverse Event Reporting System (FAERS). The importance of tools that unify information search and provide easy access for physicians is becoming more evident. Thus, it is essential to assess the medical needs for information when using technological tools that can support clinical practice.

Objective: To characterize the main pharmacological and pharmaceutical needs of critical care physicians for the management of adult patients when administering sedative and/or opioid analgesic medications.

Study Design: A cross-sectional study.

Setting: A tertiary care setting in Bogotá and Chía, Colombia from October 1 through December 31, 2022.

Methods: Surveys were collected through Google Forms. The surveys were directed to physicians from Clinica Universidad de La Sabana and Clínia Nueva de Bogotá. These physicians perform sedation and analgesia procedures on adult patients in critical care services, including emergency departments, hospitalization units, surgical rooms, and adult intensive care units.

Results: Ninety-five percent of the respondents considered the use of technological tools necessary for support during their workday. Most respondents reported that these tools were helpful for information searches regarding dose adjustments of sedatives and opioid analgesics, especially in cases of renal disease, dose calculations for rotation, and titration of opioids.

Limitations: Designed for academic purposes, the survey identified 4 key areas requiring improvement: pharmacological knowledge, patient safety monitoring, specialized administration techniques, and practical application of knowledge during the administration of medication. The survey was conducted under the constraints of time and resources, limiting the sample to 2 institutions based on accessibility and feasibility.

Conclusions: The study highlights the need for the development of technological tools to support medical services in the safe use of sedative and opioid analgesic medications. The evaluation of specific pharmacological and pharmaceutical knowledge related to this group of medications is crucial.

Key words: Adverse Event Reporting System (FAERS), opioids, drug administration, analgesic, clinical pharmacology

Pain Physician 2025: 28:E165-E172

The use of opioids to induce sedation and analgesia in patients is becoming increasingly common. Studies show that, for various reasons, up to one in every 3 patients admitted to a hospital may receive an initial prescription of opioid medications, and the rate of long-term use may reach up to 30% (1). Understanding the implications of opioid formulation is crucial, including the necessary dose adjustments based on the patient's pathological conditions, weight, and age, as well as short- and long-term side effects and the need for patient monitoring and follow-up (2). These therapies are used widely in intensive care units, surgical rooms, and emergency departments, where specialists are increasingly using opioid formulations. Prevalence studies in Colombia show that these medications are even used to manage pain associated with acute and chronic diseases (3). Therefore, it is essential to understand how this formulation is carried out and what tools specialists use when administering it.

According to reports from the Food and Drug Administration (FDA) Adverse Event Reporting System (FAERS), at least 15 opioid medications are associated with adverse events, including some cases related to mortality (4). Physicians face significant challenges making decisions related to opioid prescriptions, and perspectives may vary when prescribing them (5). These issues emphasize the increasing need for training processes and skill maintenance for sedation, not only within specialties like anesthesiology but across all hospital settings. Thus, the use of available and easily accessible tools for all medical personnel, whether specialized or nonspecialized, is crucial (6), as is continuous academic growth for all health care professionals in the administration of opioid medications.

Conducting surveys regarding the perception of needs concerning the use of opioid medications in different critical areas of adult patient management is essential. As evidenced in other studies, such as the 2010 project conducted by Shavit (7), the spectrum of strategies for medication sedation and dichotomous approaches for oxygen supplementation and monitoring is broad, indicating the need for unified knowledge to reduce short- and long-term adverse effects associated with the use of this group of medications (8). While data research is vital for safe care, the difficulty in identifying practical information and its integration can create a knowledge gap, suggesting the necessity of creating information tools for safer clinical practice on patients (9).

The management of opioids and decision-making in medical settings pose fundamental challenges (10,11). The distinction between hospitalized and outpatient patients, along with the transition between the groups, is an ongoing topic of discussion. Over the past 2 decades, various health care systems in different countries have faced difficulties related to opioid use. Despite their acknowledged potential risks, opioids continue to be valuable tools in addressing the complexity of intraoperative, postoperative, and outpatient medical care (10). It is emphatically important for authors to provide a more detailed perspective on opioid management in diverse clinical contexts, highlighting the necessary approaches to address this persistent challenge in health care (11).

As part of the continuous education processes and technological development at Universidad de La Sabana, an ongoing macro-project aims to design and develop an app for the pharmacotherapeutic optimization of sedative and analgesic medications for adult patients in critical areas. The intent is to improve patients' quality of life by strengthening their health conditions and experiences with the service, as well as to enhance productivity and sustainability at Clínica Universidad de La Sabana, aiming to reduce per capita health care costs and provide better service to society.

Given all the above, this study aims to characterize the main pharmacological and pharmaceutical needs of critical care physicians for the management of adult patients when administering sedative and/or opioid analgesic medications.

Methods

This study is a descriptive and cross-sectional investigation involving the collection of surveys during the period from October 1, 2022, to December 31, 2022. The surveys were directed to physicians from Universidad de La Sabana de Chía and Clínica Nueva de Bogotá, who perform sedation and analgesia procedures on adult patients in critical care services, including emergency departments, hospitalization units, surgical rooms, and adult intensive care units. A total of 63 surveys were collected using Google Forms. These surveys were sequentially administered as doctors agreed to participate in the study. Of a total of 100 surveys sent, 63 were answered. Importantly, at the time of the study, the survey was implemented to the best of our ability given the circumstances and available resources. Although the sample was limited to 2 institutions, this choice was based on feasibility and accessibility at that

specific time. We acknowledge that expanding the survey to more institutions would have been ideal, but time and resource constraints led us to use the best feasible strategy under the circumstances.

To meet the inclusion criteria for this research, physicians needed to work in critical care areas for patients over 18 years old, including emergency departments, hospitalization units, surgical rooms, and adult intensive care units. Individuals excluded from this study consisted of physicians attending to patients under 18 years old, nonmedical personnel, and personnel from noncritical care areas such as outpatient services and/or external consultations.

A survey of 20 questions, comprising both qualitative and quantitative characteristics, was conducted. Of these, 16 questions were multiple-choice with multiple or single responses, and 4 questions were open-ended (supplementary to the survey). To determine the characteristics that appeared most frequently in the respondents' opinions, an analysis of frequency and prevalence was performed, and word cloud graphics for qualitative responses were created. Data processing was carried out through PivotTables in Microsoft Excel.

Prior to the survey application, a validation of the survey was conducted, and a pilot test was performed with experts in the use of opioid medications. Subsequently, corrections were made to the survey format.

The study had the approval of the Institutional Ethics Committee of the Clínica Universidad de La Sabana, along with the anonymous administration of the survey and informed consent (July 15, 2021). The study did not require informed consent for participants. Their participation was voluntary, and the beginning of the survey asked recipients if they wanted to respond to it.

Results

The surveys were administered to different specialist physicians working in the emergency departments, hospitalization units, surgical rooms, and intensive care units of both Clínica Universidad de La Sabana from Chía and Clínica Nueva from Bogotá. The aim was for the specialists to provide their opinions regarding the use of sedative and opioid medications in adult patients. Among the respondents, 30% were anesthesiologists. Of the rest, 22% were intensive care specialists, 19% were general practitioners, 11% were internists, 6% were family physicians, and 5% were clinical physicians. A small percentage of respondents were neurologists and emergency medicine physicians, each comprising 3% of the total (Fig. 1).

As for the respondents' levels of experience, 51% of the surveyed physicians had been working as specialists for less than 5 years, while approximately 24% had more than 11 years of experience in their respective specialties (Suppl. Fig. 1S). Fifty-six percent of the respondents identified mobile phones as their primary means of seeking consultation or support, whereas personal computers were the second most popular choice, accounting for 30.8% of the total. Tablets came in third, representing 13.1% of the participants (Fig. 2). Additionally, 95% of the physicians considered the use of technological resources helpful in optimizing their work processes (Suppl. Fig. 2S).

The results showed that most physicians required support in dose adjustments for renal disease and dose calculations for opioid rotation and titration. Only 8% and 5% of the respondents required support in the management of adverse events and in mechanisms of action, respectively (Table 1).

On the subject of pharmaceutical considerations at the time of prescription and administration, 26% of the surveyed physicians stated that they required support in determining the type of solution for dilution preparation, while 23% reported needing assistance with medication type, presentation, and pharmaceutical form (Suppl. Table 1S).

Regarding the use of sedative and opioid analgesic guidelines, 29% of the respondents were familiar with

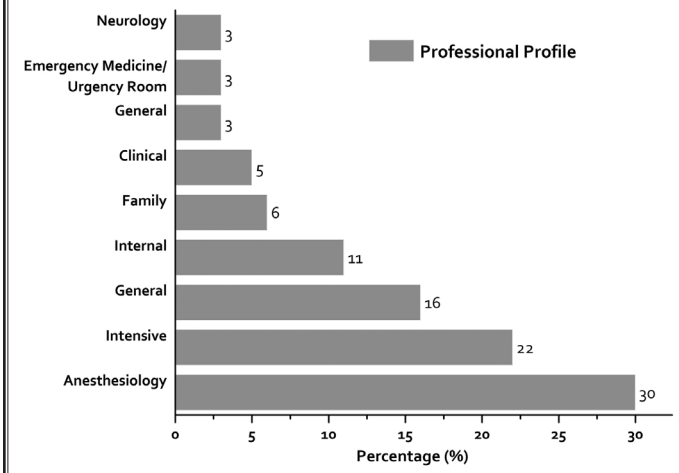


Fig. 1. *Profile of medical specialists who participated in the survey.*

the Colombian critical care and intensive care medicine guidelines, and 25% were familiar with the guidelines from the Colombian Society of Anesthesia for patients over 12 years old. Both sets of guidelines were consulted by the same proportion of respondents. Only 6% were not familiar with any guidelines (Suppl. Table 2S). According to the usage of these guidelines, respondents stated that they mostly consulted information related to dosing, rotation, titration, interactions, and adjustments based on comorbidities (Fig. 3). Respondents also reported consulting additional information from other sources (Suppl. Table 3S). This additional information included adjustments for comorbidities, opioid rotation, pharmacological interactions, and guidelines specific to each patient's age (Fig. 1).

When inquired about the information or support they wanted to receive to improve their work when administering sedative and opioid analgesic medications, the respondents mentioned that they would expect information on dosing, rotation, opioid weaning, titration, and interactions (Suppl. Fig. 3S).

As for the monitoring of risks associated with the use of sedative and opioid analgesic medications, 94% of the respondents considered patient monitoring necessary (Suppl. Fig. 4S). Among them, 39% indicated that the best strategy was a basic monitor that included measurements of heart rate, oxygen saturation, blood pressure, and respiratory rate. However, 30% agreed that the use of clinical tracking scales was also a suitable monitoring strategy (Table 2).

Furthermore, concerning administration, 71% of the respondents agreed that all sedative and opioid analgesic medications should be administered only by specialized personnel (Suppl. Fig. 5S).

To maintain safety margins in the use of those medications, 78% of the respondents considered that resources should be optimized through unit-dose dispensing, meaning that medications should be dispensed directly by the pharmacy service of the institution. Only 22% believed that multiple doses, such as in the complete commercial presentation of the medication, could be managed (Suppl. Fig. 6S). Fifty-four percent of the respondents believed that daily formulation could be accomplished by calculating the projected dose for 24 hours and formulating the quantity of ampoules accordingly. However, 8% considered that a standard formulation in a fixed number of ampoules, regardless of the dose, could be used (Suppl. Fig. 7S).

Forty-four percent of the respondents reported that they were unfamiliar with the protocols for continuous infusion mixtures of sedative and opioid analgesic medications (Suppl. Fig. 8S). When inquired about

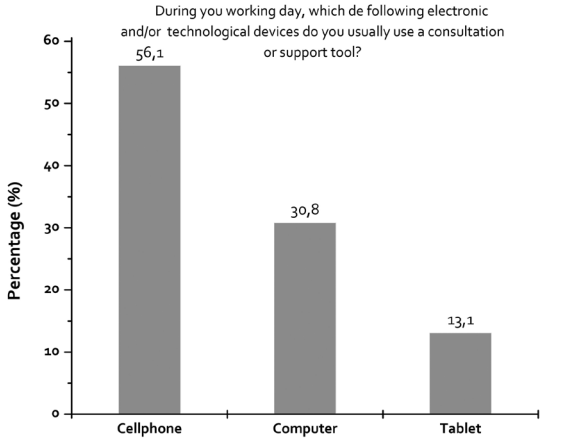


Fig. 2. *Type of device used as a support tool.*

Table 1. *Regarding clinical considerations that must be evaluated when prescribing and administering sedative drugs and opioids analgesics, which one do you consider to require support?*

Clinical Consideration	Percentage (%)
Dose adjustments in renal disease	16
Dose calculation at the time of opioid rotation	15
Dose adjustments in liver disease	14
Dose adjustments according to comorbidities	13
Dose adjustments according to age	11
Dose adjustments according to weight	9
Adverse effects	8
Mechanisms of action	5

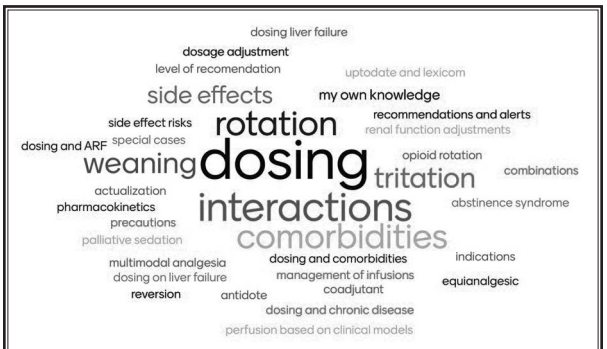


Fig. 3. *Information most frequently consulted from management guides.*

pharmacological considerations to be accounted for in the prescription and administration of these medications in continuous infusion, 33% of respondents stated that they required support in the form of information regarding pharmacological interactions. Eighteen percent reported needing information about toxicity, and 16% answered that they required information regarding the medications' half-life (Table 3).

When asked about the current evaluation strategies available for preventing complications, 63% of the respondents stated that those strategies were not adequate to fulfill that objective. They mostly attributed the shortcomings to the lack of monitoring and follow-up on adverse events, and restrictions on modifying patients' medical histories. Some also mentioned the impact of the lack of tools, insufficient personnel, challenges in dose tracking, and fear of using the medications, among other reasons (Figs. 4,5).

Discussion

The present study was conducted as part of a project to develop the faculties of engineering, medicine, and education at Universidad de La Sabana. The project aimed to create a supportive app for optimizing pharmacotherapy in the use of sedative and opioid analgesic medications for adult patients in critical inpatient areas (12). The "design thinking" methodology was employed as the initial step in the app's development, encompassing both the theoretical and clinical aspects of specialized medical practice (13). To achieve this goal, a diagnostic process was conducted among health care professionals who met the inclusion criteria, aiming to determine the most important elements to include in the app's design.

Among the results, it was highlighted that 95% of the respondents considered the use of technological re-

Table 2. *Which of the following monitoring strategies do you consider necessary for the administration of sedatives and opioid analgesics to adults in different critical care areas?*

Monitoring Strategies	Percentage (%)
Basic monitor (heart rate, oxygen saturation, blood pressure, respiratory rate)	39
Use of clinical monitoring scales (RAM, EAD, respiratory rate, heart rate)	30
Basic monitoring (electrocardiogram, capnograph, blood pressure, oximetry)	18
Monitor including capnograph	8
Pulse oximetry is sufficient, with manual blood pressure measurement	4

Table 3. *Of the pharmacological considerations that should be evaluated at the time of prescribing and administering sedative and opioid analgesic medications through continuous infusion, which do you consider to require support?*

Pharmacological Consideration	Percentage (%)
Pharmacological interactions	33
Toxicity	18
Half-life time	16
Distribution volume	13
Pharmacodynamics	13
Pharmacological group	7

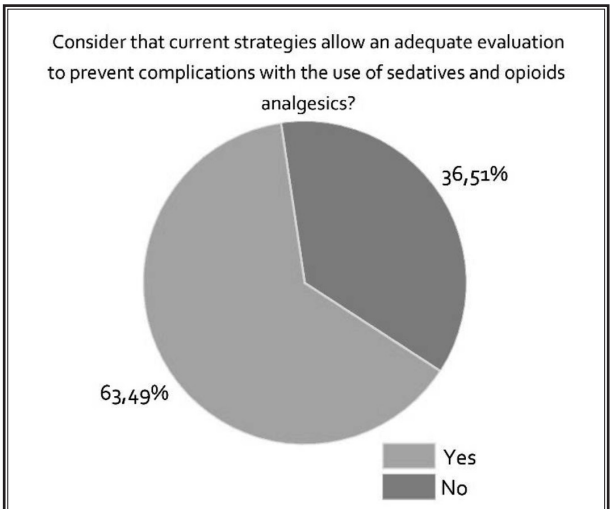


Fig. 4. *Current strategies considered for adequate evaluation in the prevention of complications with the use of opioid sedatives and analgesics.*

Fig. 5. *Situations in which support is required to improve safety when using sedatives and opioid analgesics.*

sources helpful in optimizing their work processes. Regarding the information most sought after by medical specialists, the need for support in areas such as dosing, rotation, opioid weaning, titration, and interactions was emphasized (14). These findings indicate the need for and relevance of technological support through applications to improve patients' pharmacological safety. The use of technological aids is essential for continuous medical education on opioid usage, since studies have shown that a lack of proper training can lead to fears among medical personnel concerning sedative and opioid analgesic medications (15).

The study also shows that the use of opioid analgesic therapies has increased in various hospital areas, given those methods' safety and efficacy in managing pain during different procedures (16,17). The application of sedation for medical procedures demonstrably induces an altered state of consciousness, allowing patients to tolerate painful or unpleasant procedures (2). However, sedation also requires careful monitoring and follow-up to ensure patient safety.

In the context of digital health, the transformation of health care has become increasingly important, especially during critical periods such as the COVID-19 pandemic (18,19). The study participants, who were experts in the use of sedative and opioid analgesic medications, showed a high utilization of technological resources (1,9). Nonetheless, there is a need to unify and evaluate this information and propose constant reviews of existing digital tools and clinical adherence guidelines, since they have demonstrated significant benefits in ensuring patient safety (20,21).

The formulation and administration of sedative and opioid analgesic medications require individualized patient assessment (22,23). The study participants demonstrated knowledge of existing guidelines for these medications and sought information regarding dosing, rotation, titration, interactions, and adjustments based on comorbidities. The implementation of such guidelines has been shown to be highly beneficial for patients and reduce medication costs without compromising quality of care (24,25).

As for the safety of these medications, monitoring during and after administration is crucial (26). The study revealed a preference for noninvasive monitoring, with 39% of respondents considering a basic monitor that included measurements of heart rate, oxygen saturation, blood pressure, and respiratory rate as the best strategy (8,27). These measures have been recommended for identifying early respiratory and hemodynamic adverse events during procedures (28).

Furthermore, a significant percentage (71%) of the respondents believed that sedative and opioid analgesic medications should be administered only by specialized personnel (19,29). While this matter is controversial, studies have shown that the probability of adverse events during sedation depends more on the level of the professional's experience than that specialist's level of education (7).

The use of unit-dose dispensing has been seen as a safety measure for patients (21), although it may represent additional costs for the health care system, depending on the implementation strategies used by pharmacists (30).

Finally, mobile applications have been implemented in Colombia for both medical professionals and patients, although challenges exist concerning network access and the requisite knowledge for optimal utilization (31). The effectiveness and safety of these apps for health care professionals hinge on the apps' content and their capacity to offer current information as changes in medicine continue (12). Prescribing, converting, monitoring, and administering drugs safely require a substantial foundation of education, knowledge, and expertise. Over the past decades, the variety of the tools practitioners have employed indicates the significance of the aforementioned factors. It is acknowledged that simple printed forms must give way to advanced technology.

While there are existing tools for pharmacologic dosing and discussions with pharmacists, our study contributes uniquely by addressing specific gaps in the literature. Our research focuses on the practical implementation of tools and their effectiveness in real-world scenarios, aiming to provide nuanced insights. Importantly, our outcomes extend beyond validating practices; they inform the development of a more objective technological tool tailored to align with physicians' preferences. This contribution adds significant value to the current discourse in the field, addressing a potential gap in the existing technological landscape.

Limitations

The limitations of this study include the academic nature of the survey tool, which was developed based on prior research into the needs of medical professionals and classified into 4 main areas: pharmacological knowledge requirements, monitoring of patient safety events, use and administration by specialized

personnel, and pharmaceutical knowledge at the point of administration. To mitigate the risk of collecting inadequate data, a pilot test was conducted with experts in the use of these medications, leading to subsequent adjustments in the survey. Based on this exercise and aligned with the study's objectives, additional open-ended and closed-ended questions were incorporated within each of these focus areas to enhance the triangulation of responses. The survey was conducted to the best of our knowledge, accounting for the time and resources available during the study. While we would have preferred to include more institutions, the limitations of feasibility and accessibility restricted us to only 2. Nonetheless, we acknowledge that our approach was the most practical, given these constraints.

Conclusions

The urgent demand for promoting the progress and implementation of technological devices that support medical services, especially in the safe management of sedative and opioid medications, should be emphasized (18). This need arises from the inherent complexity of these pharmacological agents, which require meticulous evaluation and monitoring by health care personnel (21).

In this context, it is crucial to have advanced technological tools that allow the collection, processing, and analysis of specific clinical, pharmacological, and pharmaceutical data for this group of medications. These technological resources are essential to improve the accuracy of the administration and prescription of sedatives and opioids (29), thereby contributing to optimizing the quality of medical care and reducing the risk of associated adverse events (20).

By utilizing specialized computer platforms (18), it is feasible to centralize relevant information about the pharmacokinetics and pharmacodynamics of these compounds as well as potential drug interactions and specific contraindications. Additionally, technological tools can facilitate monitoring and early detection of side effects and adverse reactions, empowering health care professionals to make informed and personalized decisions in each clinical case (19).

Furthermore, the development of mobile applications and integrated systems in health care institutions allows for improved communication among members of medical teams and enables rapid and secure sharing of information (2). In this way, collaboration and feedback among clinical pharmacology specialists and other health care professionals are strengthened, promoting continuous learning and the adoption of evidence-based practices (24).

It is important to emphasize that the implementation of these technological solutions requires proper training of medical and pharmaceutical personnel, as well as continuous system updates to adapt to advances in research and pharmacological knowledge (25). In this regard, training in and competent use of these tools are key investments for the future of clinical pharmacology and the continuous improvement of medical services related to the use of sedative and opioid medications (8).

In conclusion, the integration of technological tools in the field of clinical pharmacology is essential to address the complexity of sedative and opioid medications while strengthening specific pharmacological and pharmaceutical knowledge. These innovative solutions empower health care professionals with accurate and up-to-date information, enabling them to make informed decisions and improve safety and efficacy in the treatment of patients who require this type of medication.

Based on the results obtained from this study, future research can be conducted regarding the development of academic applications in medicine, aiming to achieve better outcomes for patient safety when using medications from different pharmacological groups with high risk of adverse reactions or narrow therapeutic margins.

Author Contributions

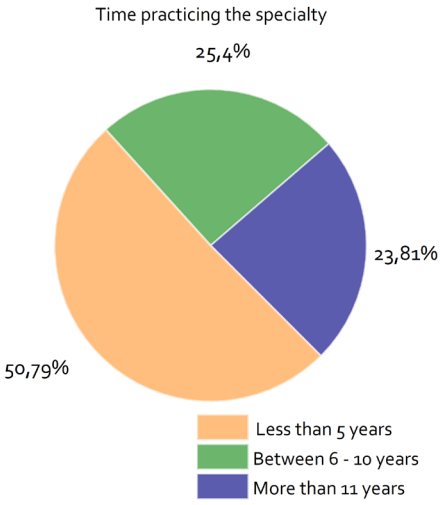
Conceptualization, C.G., D.J., M.P., M.-X.L., D.B., R.-H.B., P.V., and F.R.; methodology, C.G., D.J., M.P., M.-X.L., D.B., R.-H.B., P.V., and F.R.; validation, C.G., D.J., M.P., M.-X.L., D.B., R.-H.B., P.V., and F.R.; formal analysis, C.G., D.J., M.P., M.-X.L., D.B., R.-H.B., P.V., J.-M.Q, M.-M.L and F.R. resources, R.-H.B. data curation, C.G., M.P., D.J., L.B., R.-H.B. writing—original draft preparation, C.G., D.J., M.P., M.-X.L., D.B., R.-H.B., P.V., and F.R. and R.-H.B.; writing—review and editing, C.G., J.-M.Q., M.-M.L. and R.-H.B., supervision, M.-X.L. and R.-H.B.; project administration, R.-H.B.; funding acquisition, R.-H.B. All authors have read and agreed to the published version of the manuscript.

Acknowledgments

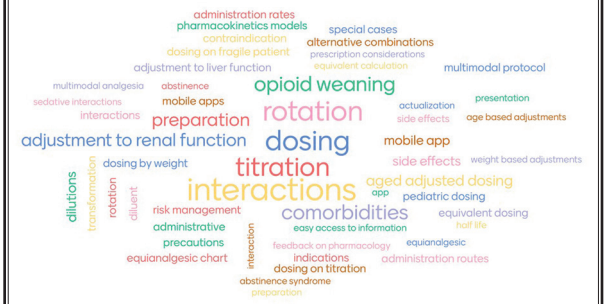
We would like to thank the Universidad de La Sabana, Clínica Universidad de La Sabana, and Clínica Nueva for supporting our work.

References

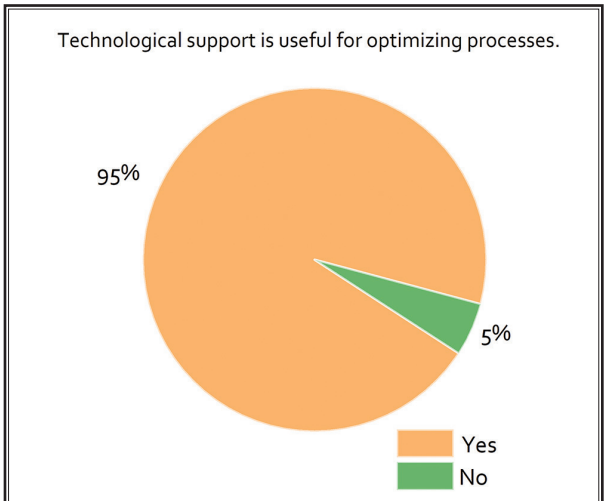
1. Barnett ML, Olenski AR, Jena AB. Opioid-prescribing patterns of emergency physicians and risk of long-term use. *N Engl J Med* 2017; 376: 663-673.
2. Godwin SA, Burton JH, Gerardo CJ, et al. Clinical policy: Procedural sedation and analgesia in the emergency department. *Ann Emerg Med* 2014; 63:247-258 e218.
3. Moyano J, Figueras A. A review of opioid prescription in a teaching hospital in Colombia. *J Pain Res* 2012; 5:237-242.
4. Veronin MA, Schumaker RP, Dixit RR, et al. Opioids and frequency counts in the US Food and Drug Administration Adverse Event Reporting System (FAERS) database: a quantitative view of the epidemic. *Drug Healthc Patient Saf* 2019; 11:65-70.
5. Khidir H, Weiner SG. A call for better opioid prescribing training and education. *West J Emerg Med* 2016;17: 686-689.
6. Mishra M, Pickett M, Weiskopf NG. The role of informatics in implementing guidelines for chronic opioid therapy risk assessment in primary care: A narrative review informed by the socio-technical model. *Stud Health Technol Inform* 2022; 290:447-451.
7. Shavit I LM, Cohen DM. . Sedation provider practice variation: A survey analysis of pediatric emergency subspecialists and fellows. *Pediatr Emerg Care* 2010;26: 742-747.
8. Smally AJ, Nowicki TA, Simelton BH. Procedural sedation and analgesia in the emergency department. *Curr Opin Crit Care* 2011;17: 317-322.
9. Schuers M, Griffon N, Kerdelhue G, et al. Behavior and attitudes of residents and general practitioners in searching for health information: From intention to practice. *Int J Med Inform* 2016;89: 9-14.
10. Chou R, Ballantyne J, Lembke A. Rethinking opioid dose tapering, prescription opioid dependence, and indications for buprenorphine. *Annals of internal medicine* 2019; 171:427-429.
11. Dowell D, Zhang K, Noonan RK, et al. Mandatory provider review and pain clinic laws reduce the amounts of opioids prescribed and overdose death rates. *Health Aff (Hope)* 2016; 35:1876-1883.
12. Santamaria-Puerto GA, Hernandez E, Suarez F. Aplicaciones de salud para móviles: Uso en pacientes de Medicina Interna en el Hospital Regional de Duitama, Boyacá, Colombia. *Rev Cuba Inf Cienc Salud, La Habana* 2016; 27:271-285.
13. Blackburn A. An evaluation of opioid use during acute hospital admissions. *Br J Nurs* 2020; 29:700-705.
14. Martens MJM, Janssen DJA, Schols J, et al. Opioid prescribing behavior in long-term geriatric care in the Netherlands. *J Am Med Dir Assoc* 2018; 19:974-980.
15. Charalambous A, Zorpas M, Cloconi C, et al. Healthcare professionals' perceptions on the use of opioid analgesics for the treatment of cancer-related pain in Cyprus: A mixed-method study. *SAGE Open Med* 2019; 7:2050312119841823.
16. Kelly JP, Cook SF, Kaufman DW, et al. Prevalence and characteristics of opioid use in the US adult population. *Pain* 2008; 138:507-513.
17. Homma Y, Norii T, Kanazawa T, et al. A mini-review of procedural sedation and analgesia in the emergency department. *Acute Med Surg* 2020; 7:e574.
18. Iyamu I, Xu AXT, Gomez-Ramirez O, et al. Defining digital public health and the role of digitization, digitalization, and digital transformation: Scoping review. *JMIR Public Health Surveill* 2021; 7:e30399.
19. Desveaux L, Saragosa M, Kithulegoda N, et al. Family physician perceptions of their role in managing the opioid crisis. *Ann Fam Med* 2019; 17:345-351.
20. Chambers L, Jaynstein J, Parry JA, et al. The effect of the orthopaedic trauma association's (OTA) pain management guidelines on opioid prescriptions, pain control, and refills in outpatient orthopaedic trauma surgery. *Eur J Orthop Surg Traumatol* 2022; 32:237-242.
21. Khalid L LJ, Xuan Z, Dossabhoy S, Kim Y, Crooks D, Shanahan C, Lange A, Heymann O, Lasser KE. Adherence to prescription opioid monitoring guidelines among residents and attending physicians in the primary care setting. *Pain Med* 2015; 16:480-487.
22. Huang KTL, Blazey-Martin D, Chandler D, et al. A multicomponent intervention to improve adherence to opioid prescribing and monitoring guidelines in primary care. *J Opioid Manag* 2019; 15:445-453.
23. Ibarra P, Galindo M, Molano A, et al. Recomendaciones para la sedación y la analgesia por médicos no anestesiólogos y odontólogos de pacientes mayores de 12 años. *Revi Colomb Anestesiol* 2012; 40:67-74.
24. Kilaru AS, Gadsden SM, Perrone J, et al. How do physicians adopt and apply opioid prescription guidelines in the emergency department? A qualitative study. *Ann Emerg Med* 2014; 64:482-489 e481.
25. Adam C, Rosser D, Manji M. Impact of introducing a sedation management guideline in intensive care. *Anaesthesia* 2006; 61:260-263.
26. Lange A, Lasser KE, Xuan Z, et al. Variability in opioid prescription monitoring and evidence of aberrant medication taking behaviors in urban safety-net clinics. *Pain* 2015; 156:335-340.
27. Tobias JD, Leder M. Procedural sedation: A review of sedative agents, monitoring, and management of complications. *Saudi J Anaesth* 2011; 5:395-410.
28. Godwin SA, Caro DA, Wolf SJ, et al; American College of Emergency Physicians. Clinical policy: Procedural sedation and analgesia in the emergency department. *Ann Emerg Med* 2005; 45:177-196.
29. Desveaux L, Saragosa M, Kithulegoda N, et al. Understanding the behavioural determinants of opioid prescribing among family physicians: A qualitative study. *BMC Fam Pract* 2019; 20:59.
30. Hanninen K, Ahtiainen HK, Suvikas-Peltonen EM, et al. Automated unit dose dispensing systems producing individually packaged and labelled drugs for inpatients: A systematic review. *Eur J Hosp Pharm* 2023; 30:127-135.
31. Santamaria-Puerto G, Hernandez E. Aplicaciones Médicas Móviles: Definiciones, beneficios y riesgos. *Revista Salud Uninorte* 2015; 31:599-607.



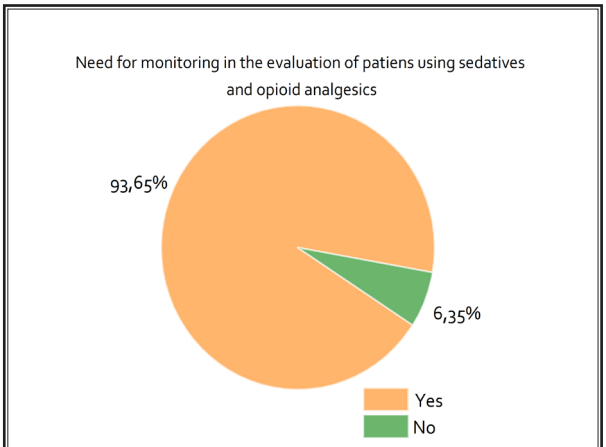
Suppl. Fig. 1S. *Time practicing the specialty.*.



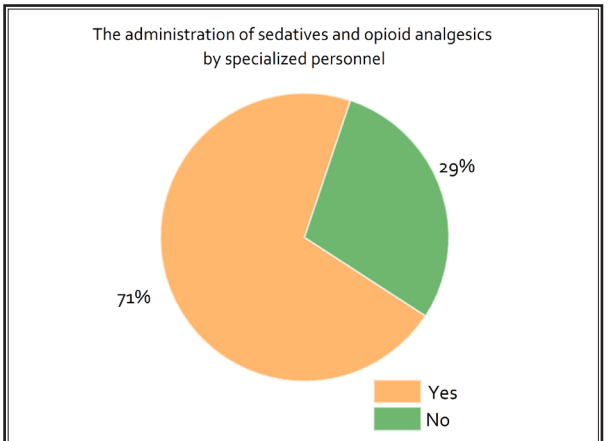
Suppl. Fig. 3S. *information or support they wanted to receive to improve their work when administering sedative and opioid analgesic medications,*



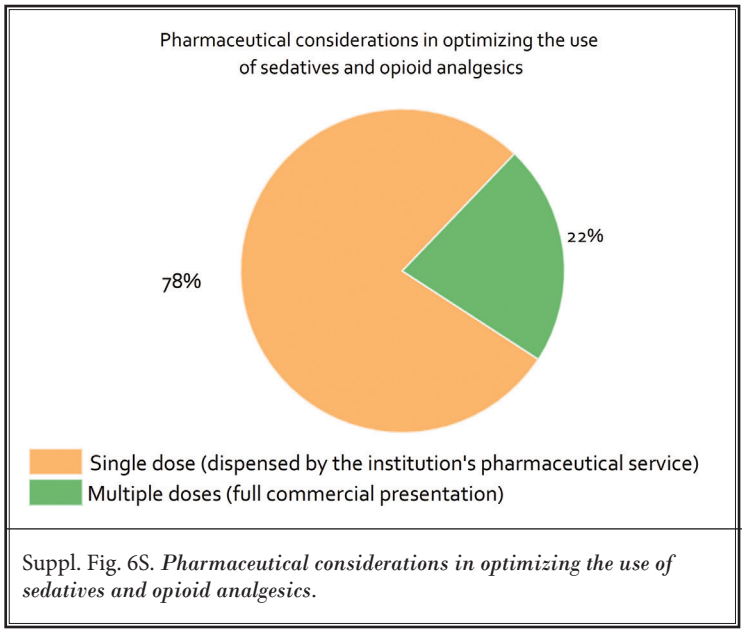
Suppl. Fig. 2S. *Technological support is usefule for optimizing processes.*



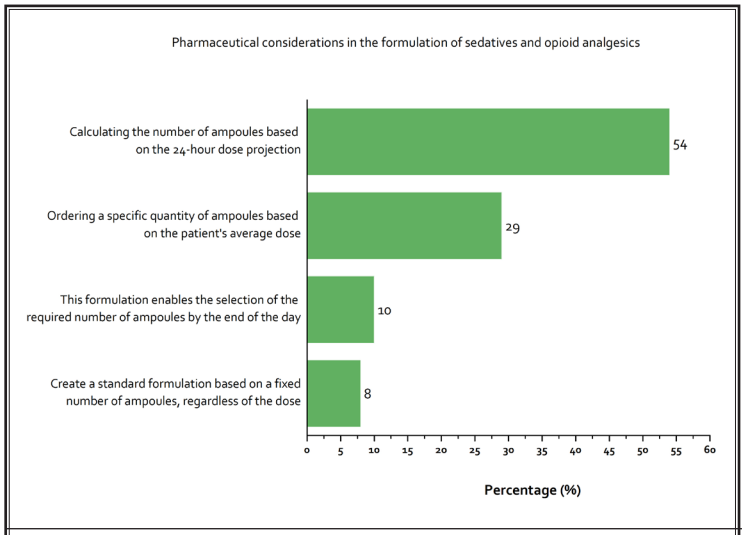
Suppl. Fig. 4S. *Need for monitoring in the evaluation of patients using sedatives and opioid analgesics.*



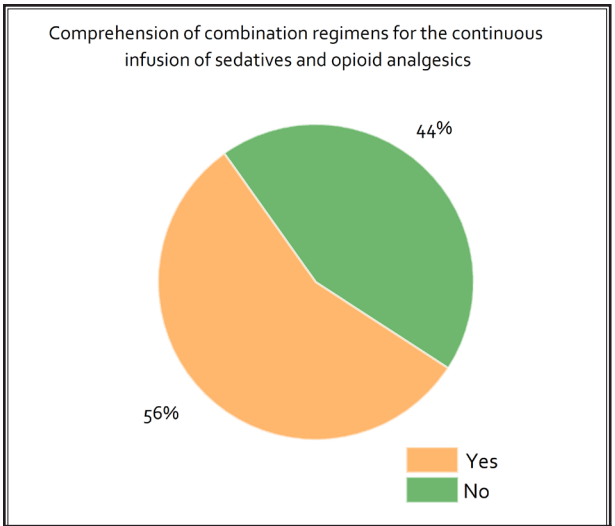
Suppl. Fig. 5S. *The administration of sedatives and opioid analgesics by specialized personnel.*



Suppl. Fig. 6S. *Pharmaceutical considerations in optimizing the use of sedatives and opioid analgesics.*



Suppl. Fig. 7S. *Pharmaceutical considerations in the formulation of sedatives and opioid analgesics.*



Suppl. Fig. 8S. *Comprehension of combination regimens for the continuous infusion of sedatives and opioid analgesics.*

Suppl. Table 1S. *Regarding the pharmaceutical consideration that must be evaluated when prescribing and administering sedative drugs and opioid analgesics, with which one(s) do you consider you require support?*

Pharmaceutical considerations when prescribing and administering sedative drugs and opioid analgesics	**Percentage (%)**
Type of solution for dilution preparation	26
Type of drug, presentation, and pharmaceutical form	23
Calculation for unit dose preparation	19
Drug inventory	12
Request for the preparation of unit doses by the pharmacy service	12
Information on the molecular characteristics of drug	8

Suppl. Table 2S. *Which de following guidelines for sedative and opioids analgesics in the critically ill adult patient do you know?*

Knowledge of guidelines for sedative and opioids analgesics in critically ill	**Percentage (%)**
Guide to critical medicine and intensive care in Colombia	29
Guidelines on the Colombian Society of Anesthesia for patients over 12 years of age	25
Institutional protocols	22
Intensive Care Medicine Guide.org	18
Do not know any guide	6
Another	0

Suppl. Table 3S. *Considering the previous question, which of the following guides is the one you consult and use most frequently?*

Guides on sedation for further consultation	**Percentage (%)**
Guide to critical medicine and intensive care in Colombia	28
Guidelines on the Colombian Society of Anesthesia for patients over 12 years of age	22
Prefer independent evaluation of evidence-based studies according to the patient's condition	18
Institutional protocols	16
Intensive Care Medicine Guide.org	11
Does not use any guide	4
Other	0