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REVIEW ARTICLE

Prevention of drug diversion and substance use disorders among anesthesiologists: a narrative review

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Abstract Diversion of substances from the care of the intended patient is a significant problem in healthcare. Patients are harmed by the undertreatment of pain and suffering, transmission of disease, as well as the risk associated with impaired vigilance. Healthcare providers may be harmed by the physical and mental impact of their addictions. Healthcare systems are placed in jeopardy by the legal impact associated with illegal routes of drug release including sanction and financial liability and loss of public trust. Healthcare institutions have implemented many measures to reduce diversion from the perioperative area. These efforts include education, medical record surveillance, automated medication dispensing systems, urine drug testing, substance waste management systems, and drug diversion prevention teams. This narrative review evaluates strengths, weaknesses, and effectiveness of these systems and provides recommendations for leaders and care providers.

Introduction

Drug diversion is the illegal distribution or abuse of prescription drugs or their use for purposes not intended by the prescriber.[1] Areas considered among the highest risk include the central hospital pharmacy, procedural areas, emergency departments, surgical centers, and remote care locations.[2] The perioperative environment is a significant source of diversion of highly potent substances. Such action by anesthesia team members and other healthcare workers may result in substance use disorders by the individual diverting substances, inadequate pain management for the patient

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from whom substances were diverted, or even a direct threat to the health and life of the patient under the care of individuals who are impaired by substances via the impact on performance or through transmission of communicable diseases.[3] Diversion also impacts the healthcare systems through fines imposed by regulatory bodies and erosion of the trust that society places in those institutions that hold the safety of the public in their hands.

This narrative review introduces points of vulnerability for drug diversion in healthcare and the impact that diversion has on patients, providers, and systems. We explore methods to deter anesthesiologists from initiating the use of substances, prevent healthcare workers from diverting those substances from the perioperative area, and detect individuals that may be diverting substances for their personal use. The efforts to be reviewed include education, medical record surveillance, substance control methods, drug testing, substance waste management, drug diversion prevention teams, and the role of the pharmacy system.

We searched the PubMed database for English papers with no data limit. Our search strategy included terms such as "substance use disorder", "drug abuse, "drug diversion", "perioperative", "anesthesia", "anesthesiology", "anaesthesia", "anaesthesiology", "anesth*", "anaesth*", "drug testing", "drug screening", and "substance abuse detection". Boolean operators AND and OR were used. The reference list of selected articles was also screened for other relevant papers. Google News was also assessed using similar terms for news and relevant material not published in scientific journals, such as Center for Disease Control (CDC) recommendations.

Points of vulnerability for drug diversion within health-systems

Drug diversion within health-systems may occur at multiple phases through which controlled pharmaceuticals travel. Purchasing by the facility or system through the final physical destruction of unused substances creates multiple "points of vulnerability" (Table 1). Points of vulnerability include those associated with the central pharmacy system including initial ordering, receiving and logging, procurement, storage, preparation, and dispensing to patients in the case of prescription medications or satellite pharmacies, unit medication cabinets, or automated medication dispensing systems. Points of vulnerability associated with the perioperative environment include obtaining substances from the pharmacy or drug dispensing system, preparation within the operating room, administration to the patient, and wastage of residual medications.

Risk of diversion within the inpatient pharmacy system occurs at four common process points according to a study of vulnerabilities for drug diversion by de Vries et al.[4] The process points where vulnerabilities were identified include procuring controlled substances for the inpatient system, receiving from vendors, packaging controlled substances into unit doses, and delivery of controlled substances to automated dispensing cabinets on different wards within the hospital. Three categories of Critical Failure Modes (CFM) are identified: handling, data entry, and verification.

Table 1 Points of vulnerabilities to drug diversion.

Pharmacy	
Procurement (ordering, purchasing, receiving)	Unauthorized orders Packaging slips removed from records
Storage	Replacement of substances with similar appearing medications, liquids
Preparation	Product switch (saline for medication) Substance dilution Removing small volumes of substance "Accidental" product damage or discard
Prescribing	Verbal orders
Wastage	Expired substances diverted Returned substances retained for personal use False documentation of wastage
Operating room	
Preparation	Theft Dilution Saline substitution Obtaining substances under another providers credentialing or name Unsecured substances switched by another individual
Administration	Lack of administration to patient Documentation False documentation of usage or amount administered
Wastage	Substance switch or dilution prior to disposal Substance removed from waste containers Theft of biohazard boxes Collaboration between providers to divert drugs

Substance handling refers to preparation, movement of substances from place to place, wastage, and general substance security. Data entry is entering information into electronic databases, maintaining records, and assuring inventory counts. Verification is the use of a second provider or technology (scanners) to check the work or accountability of another individual. Anonymous discussions with pharmacists monitored due to substance-related impairment noted six primary means that substances are diverted.[5] Diversion tactics included direct diversion of expired substances, changing inventory records to hide missing medications, forging prescriptions, practicing "sleight of hand" to acquire substances during work, stealing substances (despite surveillance), and taking unused substances that patients return for disposal.[5]

The same CFMs can apply to substance control in the perioperative period. Substance handling weaknesses include product loss or theft before patient use or during wastage, drug dilution, or solution substitution. Data entry failure modes include falsifying anesthetic records during patient

care, during provider transition, or as a part of the wastage process to fabricate dishonest drug usage. Verification failure modes include obtaining substances under another provider's identification, collaboration with another provider to misrepresent use or wastage, or altering anesthesia records after care.

Impact of diversion of substances in the perioperative period

Diversion of drugs in the perioperative period places providers, patients, and institutions at risk via the delivery of care while impaired, by failure to adequately treat pain and provide comfort, reduced clinical vigilance, and the potential exposure of patients to bloodborne pathogens.[1,3] Most healthcare leaders and executives recognize that diversion is a problem in healthcare facilities, but few believe that the problem exists in their own facility.[6]

The incidence of Substance Use Disorders (SUD) among faculty and resident physicians in anesthesiology is between 1−2%.[7-9] The incidence among resident physicians appears to be increasing according to a study by Warner et al.[10] The retrospective study examined SUD among resident physicians between 1975 and 2009. Other than a small reduction in the incidence of SUD between 1996–2002, the highest incidence has been reported since 2003 (2.87 per 1000 resident-years). The cumulative incidence of relapse was 43%. Death is the presenting indication of a problem in many of these cases.[11] Individuals in anesthesia who survive the initial SUD episode have a 40% risk of relapse, and nearly 20% will die of the disease.[12] A recent study of Brazil reported that most anesthesiologists (82.1%) have known of an anesthesia provider with a substance use disorder, and 23% admitted to personal use at some point in their lives.[13] These incidences appear to persist despite the increased implementation of measures such as education and substance control via automated dispensing machines.[9] Fewer studies have been performed among nurse anesthetists. Bell et al noted that up to 10% of nurse anesthetists admitted misuse of anesthetic agents at some point during their career.[14] Among student nurse anesthetists the reported incidence is 0.65%.[15] Pharmacists are not immune to the problem of diversion. Most cases of diversion in pharmacies are controlled substances by technicians for personal use.[16]

Opioids and alcohol have been the most common substances of misuse by anesthesiologists, but other substances of abuse are appearing.[10,12] A retrospective study of SUD among anesthetists in Australia and New Zealand published in 2014 revealed that propofol exceeded opioids (41% of cases vs. 32%).[17] Wischmeyer et al. showed a fivefold increase in propofol abuse over two decades in academic anesthesiology training in the United States.[18]

SUDs among perioperative personnel can threaten the well-being and health of the patients who entrust their care to our hands.[19] Grissinger reported the case of an impaired healthcare worker desperate for controlled substances who died after obtaining and injecting an unknown solution from a biohazard box, which was later determined to be a neuromuscular blocking agent.[20] Berge et al reported the impact of diversion of substances on the health of patients at the Mayo Clinic in Rochester, MN.[3] Events included diversion of substances during a procedure resulting in excruciating pain and anxiety for the patient and Transmission of Hepatitis C (HCV) by impaired providers.[3] The largest hospital-related HCV outbreak ever recorded in the US concluded that the 32 confirmed cases were linked to drug diversion by an impaired healthcare technician.[21] Many cases of infectious disease transmission related to drug diversion by impaired providers have been reported.[22-25] The United States Centers for Disease Control and Prevention reported on 13 outbreaks of communicable diseases between 1983–2018 directly associated with drug diversion by healthcare providers.[26,27]

Diversion can occur even when institutions establish practices directed towards prevention of diversion.[28] The reputation of an institution is threatened when diversion of substances occurs. Berge et al noted that the diversion of drugs by healthcare workers induced risk by "failure to prevent, recognize, or address signs of drug diversion or of an impaired or addicted employee".[3] Healthcare facilities have paid millions of dollars in fines due to failure to maintain inventory control, accurate records, and strict security over substances.[29] The Massachusetts General Hospital paid $2.3 million in fines related to diversion of substances by healthcare providers for personal use.[30] Although the inciting event was unrelated to anesthesia practice, multiple errant practices were identified during the ensuing audit including a physician writing prescriptions for a patient without maintaining records and medical staff failing to secure medications, including keeping medications with them while at lunch.

Education

Education on the risks of SUD among healthcare providers has long been the primary focus of institutional efforts to reduce SUD and diversion.[9] These efforts have included data presentations, videos such as the Wearing Masks series, and presentations by healthcare providers who have entered recovery and discussed their journey.[31]

The amount of educational time devoted to SUD education varies among academic programs. Lutsky et al reported that in 1991 between 47% and 89% of anesthesia programs devoted at least one lecture to the topic of substance abuse.[32] Only 33% of programs had an identifiable formal substance abuse program or committee at the time of the study. A second study revealed that 70% of anesthesiologists considered their hospitals' drug control policies as fair or poor.[33] The widely cited survey of SUD among anesthesiologists published in 2002 showed that despite an increase in the number of hours of education devoted to SUD, the incidence of cases of SUD did not decrease over the study period.[9] There was also no difference in the incidence of SUD among programs that devoted more time to education than those that had less dedicated time. In 2013, Boulis et al surveyed academic programs in Canada and found that although mandatory education of residents was required by 75% of programs, less than 10% required training for fellows or faculty.[8] A recent survey of professionals in infection control, public health, and pharmacy reported that only 25%

Table 2 Critical components to education in healthcare provider SUD and diversion.

Awareness of SUD incidence and impact on providers, patients, and healthcare systems
Indicators of colleague impairment by substances
Indicators of diversion
Formal substance handling protocols and expectations
Policies regarding practice and record surveillance
Routes of confidentially raising concerns about a potentially impaired colleague or diversion
Routes to seek care for personal SUD

of faculty and staff received training in diversion and nearly half did not know if their facility had an internal mechanism to report diversion.[34] The Cleveland Clinic instituted a formal process focused on active prevention of SUD.[35] The components included mandatory educational programs for all members of the department on a recurring basis and enhanced skill building for the detection of impairment.[35] However, these efforts have never been shown to result in a direct correlation to a reduction in SUD. Still, nearly 50% of respondents in the survey by Boulis et al believed that additional education is effective in reducing SUD.[8]

Web-based instruction on substance abuse and diversion may hold promise. Web-based material may be distributed to a large number of individuals whose work schedules and availability are not suitable for in-person learning, allows workers to train at their convenience, facilitates easy tracking of compliance, is easy to update, simplifies assessment of effectiveness, and may include novel delivery of education. Web-based education does not allow learners to pose questions, is subject to technological problems or web access. The Department of Pharmacy and Pharmacy Administration at the University of Sciences in Philadelphia designed an online module focused on the effectiveness of web-based education on SUD and drug diversion.[36] A significant gain in knowledge was noted by participants, but the study was not designed to assess long-term retention of knowledge.[36]

The benefit of education to reduce the incidence of SUD in healthcare providers is debatable. The finding that programs with more education do not necessarily have lower rates of SUD and the observation that despite increases in education over time has not resulted in a reduction in SUD, does not negate the potential benefits. Educational efforts should include several key components including the incidence of SUD, impact, signs, reporting mechanisms, as well as means to obtain personal help (Table 2). Educational programs should also clearly identify routes that individuals can use to anonymously report suspicions of drug diversion or colleague impairment.

Medical record surveillance

Automated Operating Room Information Management Systems (ORIMS), Anesthesia Information Management Systems (AIMS), and automated medication dispensing systems are in widespread use in modern operating rooms, procedural areas, and patient care locations. Analysis of data from information management systems can reveal indicators of practices or medication distribution patterns that are potential indicators of diversion of drugs. Epstein et al utilized a mining approach to evaluate data obtained from the operating room ORIMS, AIMS, and automated medication dispensing system (Pyxis™, Becton, Dickenson, and Company, Franklin Lakes, New Jersen, USA).[37] Data was utilized to determine whether two index cases of known diversion could have been detected earlier with medication record surveillance. Drug transactions after completion of the anesthetic and drug transactions occurring in locations away from the actual point-of-care were findings that indicated diversion in the two index cases. High use of opioids, high wastage of controlled substances, and transactions on canceled cases were not associated with diversion. A follow-up study in 2011 reported the identification of two individuals that were diverting drugs from the workplace.[38] Those individuals' frequency of abnormal transactions fell more than two standard deviations from normal and prompted further investigation.

Surveillance of drug transactions is challenged by a high percentage of discrepancies between dispensed controlled substances and what is documented as administered to the patient. Vigoda et al found that discrepancies were discovered in 15% of records.[39] Discrepancies were found in the AIMS system (8%) and the automated medication dispensing system (10%).[39] Most errors were related to incorrect documentation of medication wastage in the medication dispensing system (35%) or documenting the medication in AIMS (40%). Careful hand-offs between care providers as well as case duration have been identified as a significant source of controlled substances documentation errors.[40]

Shah et al demonstrated a significant reduction in the incidence of controlled substance discrepancies through development of an automated web-based software application and measured by the number of missing controlled substance medications and medication kit return errors.[41] A similar approach was also described in a pediatric surgical center.[42] The use of health-system data coupled with machine learning and advanced analytics has been shown to be highly accurate in detecting transactions involving a high risk of diversion.[43] Machine learning detected diversion an average of 160 days (median 74 days) faster.

It is critical that implementation of a surveillance system include a process to resolve discrepancies and investigate patterns of suspicious transactions. The American Society of Health-Systems Pharmacists recommends that pharmacy discrepancies be resolved by the end of the work shift and that discrepancies which cannot be resolved be reported to pharmacy and patient care leadership, reviewed, and resolved

within 24–72 hours. These requirements can apply to perioperative discrepancies.[2]

Drug testing

The number of healthcare providers with SUDs as well as the impact on the safety of patients has led to calls for drug testing to become a standard part of medical practice.[44] Defense of drug testing among healthcare providers may serve several purposes including deterrence from initiating the use of substances via pre-placement (pre-employment) testing, surveillance for personal illicit use (random testing), and to detect whether a substance is present when a healthcare provider's performance may indicate a potential SUD (reasonable suspicion or "for cause"). Others have gone so far as to suggest that drug testing should occur after a critical event while others have argued against such a practice.[45,46] Acceptance of drug testing is variable. Sousa et al. reported that over 80% of surveyed physicians believed that drug testing could improve provider and patient safety.[13] Individuals with a personal history of SUD were less likely to believe in the benefit. This contrasts with Boulis et al., which indicated nearly 79% of respondents did not perceive a role for drug testing as an effective measure to reduce SUD.[8]

The Massachusetts General Hospital (MGH) first reported that a program which included random drug testing of anesthesiology residents was feasible in 2008.[47] The program was initiated to reduce the incidence of SUD among trainees. Since the time of the initial publication, other institutions have followed with their own programs including the Cleveland Clinic,[35] Vanderbilt University Medical Center,[48] and the University of Colorado. More than half of pharmacy programs have implemented drug screening to reduce SUD.[49]

Drug testing in medicine has shown success. Lange et al reported the results of pre-employment drug testing at Johns Hopkins Hospital in 1989 and 1991.[50] The positive rate was 10.8% in 1989 before the establishment of a formal pre-employment testing program. Testing was performed without identifying information on the individual tested. After the establishment of a formal program, the incidence was reduced to 5.8%. The study concluded that "pre-employment drug testing can serve as a deterrent for a drug-using person applying for employment".[50] A follow-up report of the MGH program published in 2018 demonstrated a significant reduction in the incidence of SUD but cautioned that a larger multi-center clinical trial was necessary to determine the true effectiveness.[51] Darbishire et al. reported testing in pharmacy students detected 2.2 events per 100 students annually.[43]

Arguments against drug testing include the possibility of false positive and false negative results. Errors can occur at any phase of the test process. Pre-analytic errors include incorrect labeling of a specimen, incorrect ordering of a test, use of a wrong container for collection, or adulteration of a specimen.[52] Analytical errors include assay cross-reaction with a pharmacologically or structurally unrelated molecule or impaired binding of the antigen (drug or metabolite) to the detection antibody. Post-analytical errors are logistical errors such as incorrect interpretation of a test result such as considering a result positive despite the quantitative level falling below the threshold required for a positive result. Tests may also fail to reveal the presence of a substance if the urine level falls below a positive threshold due to test timing. False positive results have been reported in drug testing physicians.[47,53] A study of a single year of pre-employment drug testing in a healthcare system revealed an initial positive rate of 5% which was reduced to 2.2% after discussion with a Medical Review Officer (MRO).[54] Most cases of "false" positive results were due to unreported prescription medications. The incidence of false positive results is far lower when appropriate protective measures are applied including notification of individuals regarding testing protocols, substances to be screened, consequences for positive tests, and adherence to established guidelines.

Two aspects of confirmation are critical to interpretation of urine screening results. Immunoassay testing alone is insufficient to determine whether a test is truly positive. Confirmation must occur via gas chromotography/mass spectroscopy which also determines quantitative level. It is also imperative that positive tests are then scrutinized by a certified MRO. The MRO evaluates the report and speaks to the individual to determine whether there is a legitimate reason for a positive test result such as a prescription or consumption of another substance. It is cautioned that even results confirmed as positive by a MRO do not determine the abuse, misuse, or diversion of a substance, only the presence of a substance. Results should then be presented to the individual in a coordinated intervention.

Urine drug testing is becoming more widespread in medicine and success has been demonstrated. Programs should inform applicants for employment that urine drug screening is a component of diversion prevention, which substances are included in testing, and the process for a failed test. Programs are encouraged to maintain quality standards including specimen collection by trained personnel, split sampling at the time of collection, strict chain of custody from collection to testing at an accredited laboratory, result review by a MRO, and professional intervention for an individual who tests positive for a substance or is subject to testing for reasonable cause. It is critical that institutions evaluate the validity of any positive results to avoid false accusations of SUD or diversion.

Substance waste management

Residual substances after administration create another point of vulnerability for diversion. Additionally, remaining anesthetic and controlled substances contribute to the tremendous cost of healthcare. A recent study estimated an overall medication wastage rate of 38%.[55] Wastage rates for individual substances with a high risk of diversion include morphine (26.3–57.5%),[56,57] propofol (15.2–54.8%),[55-57] diazepam (10%),[57] midazolam (19–46%).[55,57]

Rules for wastage of substances are regulated beyond mere local practices. The United States Drug Enforcement Agency (DEA) as well as the Environmental Protection Agency (EPA) have an interest in the proper disposal of substances. A study in 2013 evaluated wastewater

Table 3 Weak points in witnessed wasting.

Diversion weak point	Potential fix
False documentation of complete use of a substance with diversion of full vial	Return of all full and empty vials.
False documentation of full use with partial diversion of remaining substance	Video recording of operating room practices.
Return of substituted fluid (saline)	Qualitative analysis of returned substances
Return of diluted substance	Quantitative analysis of returned substance
False documentation of waste observation	Formal sanction of individuals falsely documenting observation. Requirement for all waste observation to occur in pharmacy. Video recording of waste.
Collaboration by witnessing and wasting individual	Video recording of waste.

from two hospitals in New York.[58] Three drugs accounted for 87.5% of the total wasted (midazolam, acetaminophen-codeine, and fentanyl). Stackelberg et al. evaluated the effectiveness of conventional waste treatment and determined that many contaminants survive treatment and end up in potable water sources.[59]

The practice of "witnessed wasting" is common in operating rooms. Witnessed wasting involves one individual attesting that a volume of residual controlled substance is expelled from a syringe into a container from which it cannot be retrieved for use. The American Society of Health-System Pharmacists guidelines suggest that in high-risk areas or when high-risk controlled substances (fentanyl) are wasted that an authorized healthcare worker witness and that the amount initially obtained match that documented as administered plus that wasted.[2] Several weak points exist in this process (Table 3).[60] The provider may simply document that a substance was used and take the substance for personal use. Providers may divert portions of a substance rather than administer it to a patient. Providers may also return diluted or substituted solutions rather than appropriate medication and concentration. Finally, collaboration between two providers that are diverting substances can occur.

Diversion of unused substances from biohazard ("sharps" boxes) has been reported. Individuals who are desperate for a substance have been known to search through collection containers for small amounts of controlled substances from discarded vials, primarily opioids.[3,20] Controlled substances should be disposed in a system that makes the drug irretrievable and ineffective. There are commercially available products that chemically neutralize liquid pharmaceuticals without the need for water or incineration.[60] These systems render discarded substance impossible to retrieve but do not impact substance that remain within a discarded vial.

Drug diversion prevention teams

The significant role that diversion of drugs can play in the well-being of healthcare workers, patients, and colleagues has resulted in calls to establish formal processes to manage suspected and confirmed diversion.[61] The Mayo Clinic has established the Medication Diversion Prevention Committee (MDPC) to lead efforts.[61] The organization also created smaller groups known as Drug Diversion Response Teams (DDiRT) which fall under the MDPC. The DDiRT teams include members of the MDPC, pharmacy, security and safety, and a physician chair of the MDPC. Any organization employee who suspects diversion can initiate an investigation. A suspected event prompts notification of the MDPC and the Director of Pharmacy. The director then performs a preliminary investigation. If no evidence of diversion is found, the case is closed. If suspicion remains, the DDiRT follows a formal course to investigate. Further action includes an employee interview, additional surveillance, and drug testing, as the DDiRT believes is appropriate. Senior institutional leadership is notified as necessary.

The action plan after the DEA investigation at the Massachusetts General Hospital included creation of the drug diversion prevention team as well as the establishment of a drug diversion compliance position.[30]

The American Society of Health-Systems Pharmacists established guidelines for prevention of diversion within healthcare facilities. The guidelines define the many responsibilities of the Controlled Substances Diversion Prevention Program Committee including leadership, policy development, routine auditing of data that could indicate diversion, investigation of suspected incidences of diversion, quality improvement, communication to patients potentially impacted by controlled substances, and others.[62]

The importance of the health-system pharmacy

Health-system pharmacies maintain primary responsibility for substance procurement, prescribing, preparation and dispensing, and wastage.[2] The importance of involvement of pharmacy leadership in prevention of diversion is critical for success. An all-inclusive Controlled Substances Diversion Prevention Program (CSDPP) focuses on the safety of patients and providers while assuring adherence to federal laws, state regulations, and accrediting agency guidelines. The American Society of Health-Systems Pharmacists have developed Guidelines on Preventing Diversion of Controlled Substances.[2] These guidelines address core elements such as legal and regulatory requirements. System-level controls include human resources, technology and monitoring and surveillance, and investigations into suspected diversion. Individual level controls include chains of custody and wastage.

Conclusion and recommendations

Diversion of drugs from health systems including the perioperative environment has significant negative effects on patients, healthcare personnel, organizations, as well as the general trust the public holds in systems designed for their care. The anesthesiologist's experience and input are critical to preventing diversion and its impact (Fig. 1). Healthcare organizations are encouraged to develop comprehensive controlled substance diversion prevention programs that harness the knowledge and skills of leadership, pharmacists, and anesthesiologists. Critical components of such programs include education, medical record surveillance, tamper-proof secure substance waste management systems, and drug diversion prevention teams trained to provide oversight of prevention efforts and investigation of events (Table 4).

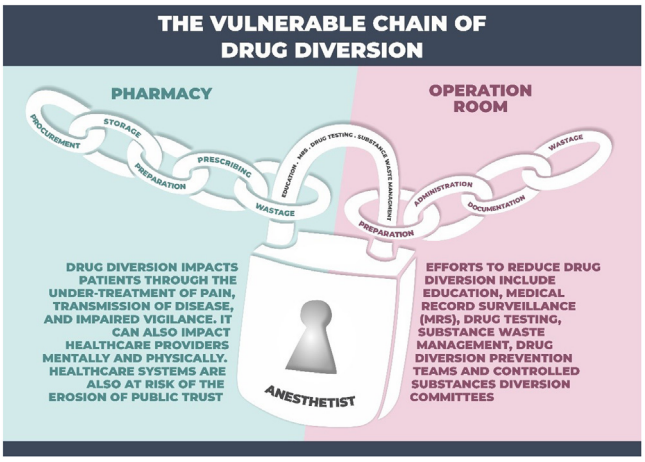

Figure 1 The vulnerable chain of drug diversion.

Table 4 Recommendations for prevention of drug diversion and substance use disorders among anesthesiologists

Focus	Recommendations
Education	Program should institute mandatory substance use disorders and drug diversion prevention education sessions. Such sessions should address indicators of diversion, impairment, and impact as well as protocols for management of substances abuse, record surveillance, and means to report concerns.
Medical record surveillance	Programs should establish ongoing surveillance of medication records and include controlled substance between drug transactions. The effectiveness of automated information management systems should be harnessed to estabish unbiased daily reports. Indicators of diversion including mismatch between drug transactions and location of care, transactions after hours, and frequent errant documentation should trigger local investigation.
Urine drug screening	Programs should consider development of urine drug screening programs which include pre-placement, random, and "reasonable suspicion" components. Drug screening should meet regulatory standards including strict chain-of-custody, testing through credentialed laboratories, and review of results through a certified review officer (MRO). Drug screening must be accompanied by a formal system to adress results with the healthcare provider in the form of a formal intervention.
Substance waste management	Programs should establish formal policies which address medication return, wastage, and disposal. Waste practices should include verification and documentation. Controlled substance waste systems should include security that renders substances irretrevable and inactive. Return and waste policies should define management of drug discrepancies, a clear time frame, and penalty for violation.
Drug diversion prevention team (DDPT)	Institutions should estabilish drug diversion prevention teams, which are responsible for investigation of any suspected drug diversion. Teams assess medical records, interview individuals, perform additional surveillance, and enforce event specific drug testing if indicated.
Controlled Substances Diversion Prevention Committee	Hospitals should establish a multidisciplinary controlled substance diversion prevention committee to establish policy, assure compliance with regulations, oversee DDPTs, and assess the impact of interventions focused on reduction for drug diversion.

Declaration of Competing Interest

The authors declare no conflicts of interest.

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