# Supplementary Material

Article Title: Diversion of controlled drugs in hospitals: a scoping review of contributors and safeguards

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Published in Journal of Hospital Medicine, 2019

This document provides the search terms used in the scoping review for 6 databases:

1. Medline
2. CINAHL
3. EMBASE
4. Psychinfo
5. SCOPUS
6. Web of Science

In addition, we include the search terms used to search the grey literature at the bottom of this document.

Please note, that the search strategy format varies by database, but with the advice of our information scientist, we aimed to include three broad concepts in each search. The clearest example of this logic is present in the MEDLINE search.

* **Row 1 through 29**: Identify articles related to drug diversion or substance use disorder AND controlled drugs (with the specific drug classes drawn from Schedule I of the Canadian Controlled Drugs and Substances Act)
* **Row 30**: Articles that describe controlled drugs in the context of a stage of the medication use process
* **Row 31 through 40**: Articles discussing patient safety or risk management AND medication related errors

The final rows (41 through 45) limit the results to hospital settings, and human populations only. Non-English articles were manually removed.

Bullets 2 and 3 above were included to help collect articles that discuss controlled drugs with respect to patient safety or stages of the medication-use process. This would allow us to capture articles that may address issues related to controlled drug inventory or handling related to diversion without naming ‘diversion’ directly.

To the degree possible, we attempted to replicate these search terms in the other databases. However, our information scientist modified or broadened the searches when the search interface was not as flexible, or if the results from that database were low.

## MEDLINE

Search conducted on June 11, 2018.

|  |  |
| --- | --- |
| 1. exp Prescription Drug Diversion/ |  |
| 2. exp "Drug and Narcotic Control"/ or exp Opioid-Related Disorders/ or exp Substance-Related Disorders/ |  |
| 3. exp Drug Prescriptions/ |  |
| 4. ((controlled substance\* or Anabolic Agent\* or Benzodiazepine\* or Opium or Coca or Methadone or Methadyl Acetate or Thiophene\* or Morphinan\* or Benzimidazole\* or Phencyclidine\* or Pirinitramide\* or Fentanyl\* or Tilidine\* or Benzodioxole\* or Pyrrolidine\* or Methamphetamine\* or Designer Drug\* or Amphetamine\* or Flunitrazepam\* or Phenol\* or Benzamide\* or Psychotropic Drugs\* or Phenylpiperidines or Phenazepines or Phenalkoxams or Thiambutenes or Moramides or Benzazocines or Ampromides or 4-hydroxybutanoic acid or MT-45 or AH-7921 or W-18) adj2 (trafficking or deviation or deflection or digression or theft or fraud or forgery or cheek\* or hidden\* or stole\* or steal\* or divers\* or addict\* or misuse\*or abus\* or workaround\* or access\* or tamper\* or pilfer\* or adulterat\*)).ti,ab,mp. |  |
| 5. 1 or 2 or 3 or 4 |  |
| 6. exp "hypnotics and sedatives"/ or exp narcotics/ or exp analgesics, opioid/ or exp tranquilizing agents/ |  |
| 7. exp Anabolic Agents/ or exp Benzodiazepines/ |  |
| 8. exp Opium/ |  |
| 9. exp Coca/ |  |
| 10. exp Methadone/ |  |
| 11. exp Methadyl Acetate/ |  |
| 12. exp Thiophenes/ |  |
| 13. exp Morphinans/ |  |
| 14. exp Benzimidazoles/ |  |
| 15. exp Phencyclidine Abuse/ or exp Phencyclidine/ |  |
| 16. exp Pirinitramide/ |  |
| 17. exp Fentanyl/ |  |
| 18. exp Tilidine/ |  |
| 19. exp Benzodioxoles/ or exp Pyrrolidines/ or exp Methamphetamine/ or exp Designer Drugs/ |  |
| 20. exp Methamphetamine/ |  |
| 21. exp Amphetamines/ |  |
| 22. exp Flunitrazepam/ |  |
| 23. exp Phenols/ |  |
| 24. exp Benzamides/ or exp Psychotropic Drugs/ |  |
| 25. (Phenylpiperidines or Phenazepines or Phenalkoxams or Thiambutenes orMoramides or Benzazocines or Ampromides or 4-hydroxybutanoic acid or MT-45 or AH-7921 or W-18).ti,ab,mp. |  |
| 26. 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21 or 22 or 23 or 24 or 25 |  |
| 27. 5 and 26 |  |
| 28. exp Hospitals/ |  |
| 29. 27 and 28 |  |
| 30. ((controlled substance\* or Anabolic Agent\* or Benzodiazepine\* or Opium or Coca or Methadone or Methadyl Acetate or Thiophene\* or Morphinan\* or Benzimidazole\* or Phencyclidine\* or Pirinitramide\* or Fentanyl\* or Tilidine\* or Benzodioxole\* or Pyrrolidine\* or Methamphetamine\* or Designer Drug\* or Amphetamine\* or Flunitrazepam\* or Phenol\* or Benzamide\* or Psychotropic Drugs\* or Phenylpiperidines or Phenazepines or Phenalkoxams or Thiambutenes orMoramides or Benzazocines or Ampromides or 4-hydroxybutanoic acid or MT-45 or AH-7921 or W-18) adj2 (destruction or procurement or prescrib\* or dispensing or administrat\* or disposal or management or storage or preparation or mixing or admix\*)).ti,ab,mp. |  |
| 31. exp Risk Management/ |  |
| 32. safety/ or patient harm/ or patient safety/ or exp safety management/ |  |
| 33. exp medication errors/ or Medication Reconciliation/ or Defensive Medicine/ |  |
| 34. exp computing methodologies/ |  |
| 35. exp Pharmacy Service, Hospital/ or exp Clinical Pharmacy Information Systems/ or exp Medication Systems, Hospital/ or exp Drug Information Services/ |  |
| 36. drug labeling/ or drug packaging/ or drug storage/ |  |
| 37. 31 or 32 |  |
| 38. 33 or 34 or 35 or 36 |  |
| 39. 37 and 38 |  |
| 40. 39 and 5 |  |
| 41. 39 and 26 |  |
| 42. 40 or 41 |  |
| 43. 29 or 30 or 42 |  |
| 44. 43 and 28 |  |
| 45. limit 44 to (humans and yr="2005 -Current") |  |

## CINAHL

Search conducted on June 11, 2018. We manually excluded articles before 2005.

|  |  |
| --- | --- |
| **#**  | **Query**  |
| S46  | S25 OR S27 OR S29 OR S43 OR S45  |
| S45  | S24 AND S44  |
| S44  | S22 AND S32  |
| S43  | S3 AND S42  |
| S42  | S32 AND S41  |
| S41  | S33 OR S34 OR S35 OR S36 OR S37 OR S38 OR S39 OR S40  |
| S40  | (MH "Drug Storage")  |
| S39  | (MH "Drug Packaging")  |
| S38  | (MH "Drug Labeling")  |
| S37  | (MH "Drug Information Services")  |
| S36  | (MH "Medication Systems") OR (MH "Emergency Medical Service Communication Systems") OR (MH "Patient Record Systems")  |
| S35  | (MH "Computing Methodologies")  |
| S34  | (MH "Medication Reconciliation")  |
| S33  | (MH "Medication Errors") OR (MH "Treatment Errors")  |
| S32  | S30 OR S31  |
| S31  | (MH "Safety")  |
| S30  | (MH "Risk Management") OR (MH "Risk Taking Behavior")  |
| S29  | S24 AND S28  |
| S28  | TX ( ((controlled substance\* or Anabolic Agent\* or Benzodiazepine\* or Opium or Coca or Methadone or Methadyl Acetate or Thiophene\* or Morphinan\* or Benzimidazole\* or Phencyclidine\* or Pirinitramide\* or Fentanyl\* or Tilidine\* or Benzodioxole\* or Pyrrolidine\* or Methamphetamine\* or Designer Drug\* or Amphetamine\* or Flunitrazepam\* or Phenol\* or Benzamide\* or Psychotropic Drugs\* or Phenylpiperidines or Phenazepines or Phenalkoxams or Thiambutenes orMoramides or Benzazocines or Ampromides or 4-hydroxybutanoic acid or MT-45 or AH-7921 or W-18) N2 (destruction or procurement or prescrib\* or dispensing or administrat\* or disposal or management or storage or preparation or mixing or admix\*)) ) OR TI ( ((controlled substance\* or Anabolic Agent\* or Benzodiazepine\* or Opium or Coca or Methadone or Methadyl Acetate or Thiophene\* or Morphinan\* or Benzimidazole\* or Phencyclidine\* or Pirinitramide\* or Fentanyl\* or Tilidine\* or Benzodioxole\* or Pyrrolidine\* or Methamphetamine\* or Designer Drug\* or Amphetamine\* or Flunitrazepam\* or Phenol\* or Benzamide\* or Psychotropic Drugs\* or Phenylpiperidines or Phenazepines or Phenalkoxams or Thiambutenes orMoramides or Benzazocines or Ampromides or 4-hydroxybutanoic acid or MT-45 or AH-7921 or W-18) N2 (destruction or procurement or prescrib\* or dispensing or administrat\* or disposal or management or storage or preparation or mixing or admix\*)) ) OR AB ( ((controlled substance\* or Anabolic Agent\* or Benzodiazepine\* or Opium or Coca or Methadone or Methadyl Acetate or Thiophene\* or Morphinan\* or Benzimidazole\* or Phencyclidine\* or Pirinitramide\* or Fentanyl\* or Tilidine\* or Benzodioxole\* or Pyrrolidine\* or Methamphetamine\* or Designer Drug\* or Amphetamine\* or Flunitrazepam\* or Phenol\* or Benzamide\* or Psychotropic Drugs\* or Phenylpiperidines or Phenazepines or Phenalkoxams or Thiambutenes orMoramides or Benzazocines or Ampromides or 4-hydroxybutanoic acid or MT-45 or AH-7921 or W-18) N2 (destruction or procurement or prescrib\* or dispensing or administrat\* or disposal or management or storage or preparation or mixing or admix\*)) )  |
| S27  | S24 AND S26  |
| S26  | TX ( ((controlled substance\* or Anabolic Agent\* or Benzodiazepine\* or Opium or Coca or Methadone or Methadyl Acetate or Thiophene\* or Morphinan\* or Benzimidazole\* or Phencyclidine\* or Pirinitramide\* or Fentanyl\* or Tilidine\* or Benzodioxole\* or Pyrrolidine\* or Methamphetamine\* or Designer Drug\* or Amphetamine\* or Flunitrazepam\* or Phenol\* or Benzamide\* or Psychotropic Drugs\* or Phenylpiperidines or Phenazepines or Phenalkoxams or Thiambutenes or Moramides or Benzazocines or Ampromides or 4-hydroxybutanoic acid or MT-45 or AH-7921 or W-18) n2 (trafficking or deviation or deflection or digression or theft or fraud or forgery or cheek\* or hidden\* or stole\* or steal\* or divers\* or addict\* or misuse\*or abus\* or workaround\* or access\* or tamper\* or pilfer\* or adulterat\*)) ) OR TI ( ((controlled substance\* or Anabolic Agent\* or Benzodiazepine\* or Opium or Coca or Methadone or Methadyl Acetate or Thiophene\* or Morphinan\* or Benzimidazole\* or Phencyclidine\* or Pirinitramide\* or Fentanyl\* or Tilidine\* or Benzodioxole\* or Pyrrolidine\* or Methamphetamine\* or Designer Drug\* or Amphetamine\* or Flunitrazepam\* or Phenol\* or Benzamide\* or Psychotropic Drugs\* or Phenylpiperidines or Phenazepines or Phenalkoxams or Thiambutenes or Moramides or Benzazocines or Ampromides or 4-hydroxybutanoic acid or MT-45 or AH-7921 or W-18) n2 (trafficking or deviation or deflection or digression or theft or fraud or forgery or cheek\* or hidden\* or stole\* or steal\* or divers\* or addict\* or misuse\*or abus\* or workaround\* or access\* or tamper\* or pilfer\* or adulterat\*)) ) OR AB ( ((controlled substance\* or Anabolic Agent\* or Benzodiazepine\* or Opium or Coca or Methadone or Methadyl Acetate or Thiophene\* or Morphinan\* or Benzimidazole\* or Phencyclidine\* or Pirinitramide\* or Fentanyl\* or Tilidine\* or Benzodioxole\* or Pyrrolidine\* or Methamphetamine\* or Designer Drug\* or Amphetamine\* or Flunitrazepam\* or Phenol\* or Benzamide\* or Psychotropic Drugs\* or Phenylpiperidines or Phenazepines or Phenalkoxams or Thiambutenes or Moramides or Benzazocines or Ampromides or 4-hydroxybutanoic acid or MT-45 or AH-7921 or W-18) n2 (trafficking or deviation or deflection or digression or theft or fraud or forgery or cheek\* or hidden\* or stole\* or steal\* or divers\* or addict\* or misuse\*or abus\* or workaround\* or access\* or tamper\* or pilfer\* or adulterat\*)) )  |
| S25  | S23 AND S24  |
| S24  | (MH "Hospitals+")  |
| S23  | S3 AND S22  |
| S22  | S4 OR S5 OR S6 OR S7 OR S8 OR S9 OR S10 OR S11 OR S12 OR S13 OR S14 OR S15 OR S16 OR S17 OR S18 OR S19 OR S20 OR S21  |
| S21  | (MH "Flunitrazepam")  |
| S20  | (MH "Amphetamines")  |
| S19  | (MH "Methamphetamine")  |
| S18  | (MH "Fentanyl")  |
| S17  | (MH "Piroxicam")  |
| S16  | (MH "Controlled Substances") OR (MH "Substance Withdrawal, Controlled") OR (MH "Substance Abuse Control (Saba CCC)")  |
| S15  | (MH "Phencyclidine")  |
| S14  | (MH "Benzocaine")  |
| S13  | (MH "Morphine")  |
| S12  | (MH "Thioridazine")  |
| S11  | (MH "Methamphetamine")  |
| S10  | (MH "Methadone")  |
| S9  | (MH "Cocaine")  |
| S8  | (MH "Opium")  |
| S7  | (MH "Tranquilizing Agents")  |
| S6  | (MH "Naloxone") OR (MH "Naltrexone")  |
| S5  | (MH "Narcotics")  |
| S4  | (MH "Hypnotics and Sedatives")  |
| S3  | S1 OR S2  |
| S2  | TX (Prescription Drug\*) W2 (Diversion) OR TI (Prescription Drug\*) W2 (Diversion)  |
| S1  | (MH "Prescriptions, Drug")  |

## EMBASE

Search conducted on June 12, 2018.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 1. | exp prescription drug diversion/ |  |  |  |  |
| 2. | (Drug and Narcotic Control).mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword, floating subheading word, candidate term word] |  |  |  |  |
| 3. | exp opiate addiction/ |  |  |  |  |
| 4. | exp drug dependence/ |  |  |  |  |
| 5. | 2 or 3 or 4 |  |  |  |  |
| 6. | exp prescription/ |  |  |  |  |
| 7. | ((controlled substance\* or Anabolic Agent\* or Benzodiazepine\* or Opium or Coca or Methadone or Methadyl Acetate or Thiophene\* or Morphinan\* or Benzimidazole\* or Phencyclidine\* or Pirinitramide\* or Fentanyl\* or Tilidine\* or Benzodioxole\* or Pyrrolidine\* or Methamphetamine\* or Designer Drug\* or Amphetamine\* or Flunitrazepam\* or Phenol\* or Benzamide\* or Psychotropic Drugs\* or Phenylpiperidines or Phenazepines or Phenalkoxams or Thiambutenes or Moramides or Benzazocines or Ampromides or 4-hydroxybutanoic acid or MT-45 or AH-7921 or W-18) adj2 (trafficking or deviation or deflection or digression or theft or fraud or forgery or cheek\* or hidden\* or stole\* or steal\* or divers\* or addict\* or misuse\*or abus\* or workaround\* or access\* or tamper\* or pilfer\* or adulterat\*)).ti,ab,mp. |  |  |  |  |
| 8. | 1 or 5 or 6 or 7 |  |  |  |  |
| 9. | exp hypnotic agent/ |  |  |  |  |
| 10. | exp narcotic agent/ |  |  |  |  |
| 11. | exp narcotic analgesic agent/ |  |  |  |  |
| 12. | exp tranquilizer/ |  |  |  |  |
| 13. | exp anabolic agent/ |  |  |  |  |
| 14. | exp benzodiazepine derivative/ |  |  |  |  |
| 15. | exp opiate/ |  |  |  |  |
| 16. | exp coca/ |  |  |  |  |
| 17. | exp methadone/ |  |  |  |  |
| 18. | exp acetylmethadol/ |  |  |  |  |
| 19. | exp thiophene derivative/ |  |  |  |  |
| 20. | exp morphinan derivative/ |  |  |  |  |
| 21. | exp benzimidazole derivative/ |  |  |  |  |
| 22. | exp phencyclidine abuse/ |  |  |  |  |
| 23. | exp phencyclidine receptor/ or exp phencyclidine/ or exp phencyclidine derivative/ or exp phencyclidine dependence/ |  |  |  |  |
| 24. | exp piritramide/ |  |  |  |  |
| 25. | exp fentanyl/ |  |  |  |  |
| 26. | exp tilidine/ |  |  |  |  |
| 27. | exp 1,3 benzodioxole derivative/ |  |  |  |  |
| 28. | exp pyrrolidine derivative/ |  |  |  |  |
| 29. | exp methamphetamine dependence/ or exp methamphetamine/ |  |  |  |  |
| 30. | exp designer drug/ |  |  |  |  |
| 31. | exp methamphetamine/ |  |  |  |  |
| 32. | exp amphetamine derivative/ |  |  |  |  |
| 33. | exp flunitrazepam/ |  |  |  |  |
| 34. | exp phenol derivative/ |  |  |  |  |
| 35. | exp benzamide derivative/ |  |  |  |  |
| 36. | exp psychotropic agent/ |  |  |  |  |
| 37. | (Phenylpiperidines or Phenazepines or Phenalkoxams or Thiambutenes orMoramides or Benzazocines or Ampromides or 4-hydroxybutanoic acid or MT-45 or AH-7921 or W-18).ti,ab,mp. |  |  |  |  |
| 38. | 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21 or 22 or 23 or 24 or 25 or 26 or 27 or 28 or 29 or 30 or 31 or 32 or 33 or 34 or 35 or 36 or 37 |  |  |  |  |
| 39. | 8 and 38 |  |  |  |  |
| 40. | exp hospital/ |  |  |  |  |
| 41. | 39 and 40 |  |  |  |  |
| 42. | ((controlled substance\* or Anabolic Agent\* or Benzodiazepine\* or Opium or Coca or Methadone or Methadyl Acetate or Thiophene\* or Morphinan\* or Benzimidazole\* or Phencyclidine\* or Pirinitramide\* or Fentanyl\* or Tilidine\* or Benzodioxole\* or Pyrrolidine\* or Methamphetamine\* or Designer Drug\* or Amphetamine\* or Flunitrazepam\* or Phenol\* or Benzamide\* or Psychotropic Drugs\* or Phenylpiperidines or Phenazepines or Phenalkoxams or Thiambutenes orMoramides or Benzazocines or Ampromides or 4-hydroxybutanoic acid or MT-45 or AH-7921 or W-18) adj2 (destruction or procurement or prescrib\* or dispensing or administrat\* or disposal or management or storage or preparation or mixing or admix\*)).ti,ab,mp. |  |  |  |  |
| 43. | exp risk management/ |  |  |  |  |
| 44. | exp safety/ |  |  |  |  |
| 45. | exp patient harm/ |  |  |  |  |
| 46. | exp patient safety/ |  |  |  |  |
| 47. | 44 or 45 or 46 |  |  |  |  |
| 48. | exp medication error/ |  |  |  |  |
| 49. | exp medication therapy management/ |  |  |  |  |
| 50. | exp defensive medicine/ |  |  |  |  |
| 51. | 48 or 49 or 50 |  |  |  |  |
| 52. | exp computer analysis/ |  |  |  |  |
| 53. | exp hospital pharmacy/ |  |  |  |  |
| 54. | exp medical information system/ |  |  |  |  |
| 55. | exp drug information/ |  |  |  |  |
| 56. | 53 or 54 or 55 |  |  |  |  |
| 57. | exp drug labeling/ |  |  |  |  |
| 58. | exp drug packaging/ |  |  |  |  |
| 59. | exp drug storage/ |  |  |  |  |
| 60. | 57 or 58 or 59 |  |  |  |  |
| 61. | 43 or 47 |  |  |  |  |
| 62. | 51 or 52 or 56 or 60 |  |  |  |  |
| 63. | 61 and 62 |  |  |  |  |
| 64. | 8 and 63 |  |  |  |  |
| 65. | 38 and 63 |  |  |  |  |
| 66. | 64 or 65 |  |  |  |  |
| 67. | 41 or 42 or 66 |  |  |  |  |
| 68. | 40 and 67 |  |  |  |  |
| 69. | limit 68 to (human and yr="2006-current") |  |  |  |  |
| 70. | exp anxiety disorder/ |  |  |  |  |
| 71. | exp mood disorder/ |  |  |  |  |
| 72. | exp bipolar disorder/ |  |  |  |  |
| 73. | exp calculation/ |  |  |  |  |
| 74. | exp drug efficacy/ |  |  |  |  |
| 75. | exp dose/ |  |  |  |  |
| 76. | exp smoking/ |  |  |  |  |
| 77. | exp smoking cessation/ |  |  |  |  |
| 78. | exp schizophrenia/ |  |  |  |  |
| 79. | exp jail/ |  |  |  |  |
| 80. | 69 not 70 not 71 not 72 not 73 not 74 not 75 not 76 not 77 not 78 not 79 |  |  |  |  |
| 81. | exp HIV/ |  |  |  |  |
| 82. | exp psychosis/ |  |  |  |  |
| 83. | exp antipsychotics/ |  |  |  |  |
| 84. | 80 not 81 not 82 not 83 |  |  |  |  |
| 85. | exp dose response/ |  |  |  |  |
| 86. | exp anticonvulsive agent/ |  |  |  |  |
| 87. | 84 not 85 not 86 |  |  |  |  |
| 88. | exp antibiotic agent/ |  |  |  |  |
| 89. | 87 not 88 |  |  |  |  |
| 90. | adverse drug reaction.ti,ab,mp. |  |  |  |  |
| 91. | adverse drug event.ti,ab,mp. |  |  |  |  |
| 92. | 89 not 90 not 91 |  |  |  |  |
| 93. | exp community care/ |  |  |  |  |
| 94. | 92 not 93 |  |  |  |  |
| 95. | exp infection/ |  |  |  |  |
| 96. | 94 not 95 |  |  |  |  |
| 97. | exp biological therapy/ |  |  |  |  |
| 98. | exp sexual dysfunction/ |  |  |  |  |
| 99. | exp drug dose regimen/ |  |  |  |  |
| 100. | exp rating scale/ |  |  |  |  |
| 101. | exp pain scale/ |  |  |  |  |
| 102. | exp scoring system/ |  |  |  |  |
| 103. | 96 not 97 not 98 not 99 not 100 not 101 not 102 |  |  |  |  |
| 104. | limit 103 to yr="2017" |  |  |  |  |
| 105. | limit 104 to yr="2017 - 2018" |  |  |  |  |
| 106. | 103 and 105 |  |  |  |  |

## PSYCHINFO

Search conducted on June 11, 2018.

|  |  |
| --- | --- |
| 1. exp Prescription Drugs/ |  |
| 2. (Drug and Narcotic Control).mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures] |  |
| 3. exp Drug Addiction/ or exp Drug Usage/ or exp Drug Abuse/ or exp Drug Laws/ |  |
| 4. exp Drug Rehabilitation/ or exp Drug Dependency/ |  |
| 5. exp Opiates/ |  |
| 6. 1 or 2 or 3 or 4 or 5 |  |
| 7. exp PRESCRIPTION DRUGS/ |  |
| 8. ((controlled substance\* or Anabolic Agent\* or Benzodiazepine\* or Opium or Coca or Methadone or Methadyl Acetate or Thiophene\* or Morphinan\* or Benzimidazole\* or Phencyclidine\* or Pirinitramide\* or Fentanyl\* or Tilidine\* or Benzodioxole\* or Pyrrolidine\* or Methamphetamine\* or Designer Drug\* or Amphetamine\* or Flunitrazepam\* or Phenol\* or Benzamide\* or Psychotropic Drugs\* or Phenylpiperidines or Phenazepines or Phenalkoxams or Thiambutenes or Moramides or Benzazocines or Ampromides or 4-hydroxybutanoic acid or MT-45 or AH-7921 or W-18) adj2 (trafficking or deviation or deflection or digression or theft or fraud or forgery or cheek\* or hidden\* or stole\* or steal\* or divers\* or addict\* or misuse\*or abus\* or workaround\* or access\* or tamper\* or pilfer\* or adulterat\*)).ti,ab,mp. |  |
| 9. 1 or 6 or 7 or 8 |  |
| 10. exp hypnotic agent/ or exp narcotic agent/ or exp narcotic analgesic agent/ or exp tranquilizer/ or exp anabolic agent/ or exp benzodiazepine derivative/ or exp opiate/ or exp coca/ or exp methadone/ or exp acetylmethadol/ or exp thiophene derivative/ or exp morphinan derivative/ or exp benzimidazole derivative/ or exp phencyclidine abuse/ or exp phencyclidine receptor/ or exp phencyclidine/ or exp phencyclidine derivative/ or exp phencyclidine dependence/ or exp piritramide/ or exp fentanyl/ or exp tilidine/ or exp 1,3 benzodioxole derivative/ or exp pyrrolidine derivative/ or exp methamphetamine dependence/ or exp methamphetamine/ or exp designer drug/ or exp methamphetamine/ or exp amphetamine derivative/ or exp flunitrazepam/ or exp phenol derivative/ or exp benzamide derivative/ or exp psychotropic agent/ |  |
| 11. (Phenylpiperidines or Phenazepines or Phenalkoxams or Thiambutenes or Moramides or Benzazocines or Ampromides or 4-hydroxybutanoic acid or MT-45 or AH-7921 or W-18).ti,ab,mp. |  |
| 12. 10 or 11 |  |
| 13. exp HOSPITALS/ |  |
| 14. ((controlled substance\* or Anabolic Agent\* or Benzodiazepine\* or Opium or Coca or Methadone or Methadyl Acetate or Thiophene\* or Morphinan\* or Benzimidazole\* or Phencyclidine\* or Pirinitramide\* or Fentanyl\* or Tilidine\* or Benzodioxole\* or Pyrrolidine\* or Methamphetamine\* or Designer Drug\* or Amphetamine\* or Flunitrazepam\* or Phenol\* or Benzamide\* or Psychotropic Drugs\* or Phenylpiperidines or Phenazepines or Phenalkoxams or Thiambutenes orMoramides or Benzazocines or Ampromides or 4-hydroxybutanoic acid or MT-45 or AH-7921 or W-18) adj2 (destruction or procurement or prescrib\* or dispensing or administrat\* or disposal or management or storage or preparation or mixing or admix\*)).ti,ab,mp. |  |
| 15. exp Risk Management/ |  |
| 16. exp SAFETY/ |  |
| 17. exp Professional Ethics/ or exp Errors/ or exp Professional Liability/ |  |
| 18. 15 or 16 or 17 |  |
| 19. exp Professional Liability/ or exp Legal Processes/ |  |
| 20. (((((medication adj error\*) or medication) adj management) or defensive) adj medicine).ti,mp,ab. |  |
| 21. 19 or 20 |  |
| 22. exp Computers/ or exp Computer Applications/ |  |
| 23. exp Technology/ or exp Computer Applications/ or exp Information Systems/ or exp Information Technology/ or exp Telemedicine/ or exp Medical Records/ |  |
| 24. 22 or 23 |  |
| 25. exp Information/ or exp Labeling/ |  |
| 26. (drug adj2 (labeling or packaging)).ti,mp,ab. |  |
| 27. 25 or 26 |  |
| 28. 15 or 18 |  |
| 29. 21 or 24 or 27 |  |
| 30. 28 and 29 |  |
| 31. 9 and 30 |  |
| 32. 12 and 30 |  |
| 33. 31 or 32 |  |
| 34. 9 or 14 or 33 |  |
| 35. 13 and 34 |  |
| 36. limit 35 to (human and yr="2005 -Current") |  |

## SCOPUS

Search conducted on June 11, 2018.

| **History Count** | **Search Terms** |
| --- | --- |
| 13 | ( ( ( drug  AND diversion\*  AND  controlled  AND substance\* ) )  OR  ( ( TITLE-ABS-KEY ( drug  AND  diversion\* )  AND  TITLE-ABS-KEY ( controlled  AND  substance\* ) ) )  OR  ( ( TITLE-ABS-KEY ( "medication use process\*" )  AND  TITLE-ABS-KEY ( ( controlled  AND  substance\* ) ) ) )  OR  ( TITLE-ABS-KEY ( "drug diversion" ) )  OR  ( TITLE-ABS-KEY ( "safety "  AND  "controlled substance\*" ) )  OR  ( TITLE-ABS-KEY ( ( medication  AND use )  AND  ( controlled  AND substances ) ) ) )  AND  ( TITLE-ABS-KEY ( hospitals ) )  AND  ( LIMIT-TO ( PUBYEAR ,  2018 )  OR  LIMIT-TO ( PUBYEAR ,  2017 ) OR  LIMIT-TO ( PUBYEAR ,  2016 )  OR  LIMIT-TO ( PUBYEAR ,  2015 )  OR  LIMIT-TO ( PUBYEAR ,  2014 )  OR  LIMIT-TO ( PUBYEAR ,  2013 )  OR  LIMIT-TO ( PUBYEAR ,  2012 )  OR  LIMIT-TO ( PUBYEAR ,  2011 )  OR  LIMIT-TO ( PUBYEAR ,  2010 )  OR  LIMIT-TO ( PUBYEAR ,  2009 )  OR  LIMIT-TO ( PUBYEAR ,  2008 )  OR  LIMIT-TO ( PUBYEAR ,  2007 )  OR  LIMIT-TO ( PUBYEAR ,  2006 )  OR  LIMIT-TO ( PUBYEAR ,  2005 ) )  ... |
| 12 | ( ( ( drug  AND diversion\*  AND  controlled  AND substance\* ) )  OR  ( ( TITLE-ABS-KEY ( drug  AND  diversion\* )  AND  TITLE-ABS-KEY ( controlled  AND  substance\* ) ) )  OR  ( ( TITLE-ABS-KEY ( "medication use process\*" )  AND  TITLE-ABS-KEY ( ( controlled  AND  substance\* ) ) ) )  OR  ( TITLE-ABS-KEY ( "drug diversion" ) )  OR  ( TITLE-ABS-KEY ( "safety "  AND  "controlled substance\*" ) )  OR  ( TITLE-ABS-KEY ( ( medication  AND use )  AND  ( controlled  AND substances ) ) ) )  AND  ( TITLE-ABS-KEY ( hospitals ) )  ... |

|  |  |
| --- | --- |
| 11 | ( ( drug  AND diversion\*  AND  controlled  AND substance\* ) )  OR  ( ( TITLE-ABS-KEY ( drug  AND  diversion\* )  AND  TITLE-ABS-KEY ( controlled  AND  substance\* ) ) )  OR  ( ( TITLE-ABS-KEY ( "medication use process\*" )  AND  TITLE-ABS-KEY ( ( controlled  AND  substance\* ) ) ) )  OR  ( TITLE-ABS-KEY ( "drug diversion" ) )  OR  ( TITLE-ABS-KEY ( "safety "  AND  "controlled substance\*" ) )  OR  ( TITLE-ABS-KEY ( ( medication  AND use )  AND  ( controlled  AND substances ) ) )   |
| 9 | TITLE-ABS-KEY ( hospitals )   |
| 8 | TITLE-ABS-KEY ( ( medication  AND use )  AND  ( controlled  AND substances ) )   |
| 7 | TITLE-ABS-KEY ( "safety "  AND  "controlled substance\*" )   |
| 5 | TITLE-ABS-KEY ( "drug diversion" )   |
| 4 | ( TITLE-ABS-KEY ( "medication use process\*" )  AND  TITLE-ABS-KEY ( ( controlled  AND  substance\* ) ) )   |
| 2 | ( TITLE-ABS-KEY ( drug  AND  diversion\* )  AND  TITLE-ABS-KEY ( controlled  AND  substance\* ) )   |
| 1 | ( drug  AND diversion\*  AND  controlled  AND substance\* )   |

## Web of Science

Search conducted on June 11, 2018. Articles before 2005 were manually excluded.



## Grey Literature Searches

As described in the Background section of our article, we included grey literature in our review because substantive discussions regarding drug diversion have occurred in news articles, conferences, theses and other reports. Excluding these sources from the review ignores important forays into understanding drug diversion, especially because the existing evidence and research into how it occurs is not strong enough to enter the peer-reviewed literature.

We conducted several online web searches for grey literature, as outlined below.

1. Quicklaw (<https://guides.library.utoronto.ca/cri425/quicklaw>) is a Canadian electronic legal database holding court decisions and other case law records. We suspected cases related to drug diversion might provide further insight into how drug diversion is perceived and handled in the legal system. Our searches included:

* July 5, 2017: drug AND diversion AND hospital
* July 6:
	+ Controlled substances AND theft AND hospital date aft 2005 limit Ont
	+ Drug&steal&nurse&hospital&date aft 2005 limit Ont
	+ Opioid AND theft AND hospital date aft 2005 limit Ont

2. Canadian Agency for Drug and Technology in Health (CADTH) (<http://www.cadth.ca>) produces reviews and health technology assessments on a variety of healthcare topics. We sought to determine if any existing reports related to drug diversion had been conducted by CADTH. We searched their website for drug diversion on July 4, 2017.

3. Newsstream (<https://guides.library.utoronto.ca/cndnewsstream>) contains a database Canadian new media articles. Given the importance of understanding how drug diversion is perceived and reported to the public, and to also capture incidents of widespread harm from diversion, we searched Newsstream for drug AND diversion AND hospital after 2005 on July 6, 2017.

4. The Library Archives of Canada Theses (<https://www.bac-lac.gc.ca/eng/services/theses/Pages/theses-canada.aspx>) was searched for drug AND diversion on July 11, 2017. As an emerging topic of study, we suspected drug diversion might be a topic of student theses, which were likely to present literature related to how it occurs in hospital settings.

5. We joined the very active mailing list of the International Health Facility Diversion Association ([www.ihfda.org](http://www.ihfda.org)) and attended the annual conference in 2017 and 2018. As a result, a number of relevant news media stories, regulatory documents, and conference presentation slide decks were identified from this group and its membership. For example, discussions sometimes cited new guidance documents (such as the roadmap for reducing controlled substance diversion produced by the California Hospital Association in 2015). In addition, the power point presentations from expert speakers at each annual conference were posted on the IHFDA website for members only.

6. Google scholar ([www.scholar.google.com](http://www.scholar.google.com)) is a search engine that indexes a variety of peer-reviewed academic journals, but also dissertations, preprints, abstracts, technical reports, and patents. Google scholar was searched with these search terms (timeframe set to 2005 to ‘present’):

* June 29, 2017: Canadian drug diversion
* July 4, 2017: Drug diversion hospital
* July 19, 2017: omnicell diversion
* July 24, 2017: ptsd nursing drug diversion

We did not place any language restrictions on our search, but only reviewed articles published in English. Patents and citations were allowed in the search results. We focused on the first 3 pages of search results. We confirmed the veracity of articles by inspection of the home website of the journal of publication, and used UlrichsWeb to determine if the journal articles were peer-reviewed or non-peer-reviewed.

7. Duck Duck Go (<https://duckduckgo.com>) is a search engine that compiles results from multiple search engines, and does not personalize search results depending on its users. As a result, all users should receive the same results with the same search term, thereby avoiding automatic search filtering by the search engine. We searched Duck Duck Go with these terms (and manually excluded articles prior to 2005):

* June 30, 2017: Canada hospital drug diversion

We followed the same restrictions as indicated for the Google Scholar results above. However, unlike Google Scholar, Duck Duck Go does not return only scholarly material, but all other sources, including news media reports, press releases, and reports or other promotional material from industry. We reviewed the articles for relevant criteria, as defined by our inclusion criteria in the Study Selection section of our article.

8. We conducted a manual search of a convenience sample of Ontario regulatory and legal bodies to identify reporting requirements related to hospital drug diversion. We selected Ontario organizations (with the exception of some federal agencies) because they were based in the home jurisdiction of the authors. Ontario is the most populous province in Canada, and served as a general case for our review of these requirements. A comprehensive review of each province or territory in Canada would require a review of 3 to 5 organizations per jurisdiction, and its own larger review. We selected the professional colleges for the health professions most commonly discussed with respect to controlled drugs in hospitals (e.g., physicians, pharmacists, nurses).

To this end, on September 27, 2017, we undertook manual searches on the websites of the following organizations searching for “reporting requirements”

* College of Nurses of Ontario
* College of Physicians and Surgeons of Ontario
* Ontario College of Pharmacists
* Health Canada
* Canadian Medical Protective Association
* Ontario Ministry of Health

9. In the course of delivering various presentations and updates on our research (and in other related research studies we are conducting), several colleagues and collaborators recommended articles to us. For example, we interviewed several drug diversion experts and hospital administrators, and they suggested particular references to review. In addition, we have written grant proposals to study the topic of drug diversion further, and several co-investigators shared articles they came across in their own research related to drug diversion. These references were included if they met our inclusion criteria.