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A State-wide survey of Emergency Departments' Adoption and Implementation of the Ohio Opioid Prescribing Guidelines and Opioid Prescribing Practices

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TITLE PAGE

A State-wide Survey of Emergency Departments' Adoption and Implementation of the Ohio Opioid Prescribing Guidelines and Opioid Prescribing Practices

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ABSTRACT

Study Objective

To evaluate the implementation of the Ohio Emergency and Acute Care Facility Opioids and Other Controlled Substances (OOCS) Prescribing Guidelines and their perceived impact on local policies and practice.

Methods

The study design was a cross-sectional survey of ED medical directors, or appropriate person identified by the hospital, perception of the impact of the Ohio ED Opioid Prescribing Guidelines on their departments practice. All hospitals with an ED in Ohio were contacted throughout October and November, 2016. Distribution followed Dillman's Tailored Design Method, augmented with telephone recruitment. Hospital chief executive officers were contacted when necessary to encourage ED participation. Descriptive statistics were used to assess the impact of opioid prescribing policies on prescribing practices.

Results

A 92% response rate was obtained (150/163 EDs). In total, 112 (75%) of the respondents stated that their ED has an opioid prescribing policy, is adopting one, or is implementing prescribing guidelines without a specific policy. Of these 112 EDs, 81 (72%) based their policy on the Ohio ED Opioid Prescribing Guidelines. The majority of respondents strongly agreed/agreed that the prescribing guidelines have increased the use of the prescription drug monitoring program (86%) and have reduced opioid prescribing (71%).

Conclusion

This study showed that the Ohio ED Opioid Prescribing Guidelines have been widely disseminated and that the majority of EDs in Ohio are using them to develop local policies. The majority of respondents believed that opioid prescribing guidelines increased reduced opioid prescribing. However, prescribing practices still varied greatly between EDs.

ARTICLE SUMMARY

Strengths and limitations of this study

- All Emergency Departments (EDs) in hospitals in Ohio were included in the study
- A large response rate of 92% (150/163) was obtained for the survey
- Survey reported ED Medical Directors' perceptions of prescribing practices in their ED
- Survey results are self-reported and may be influenced by recall or social desirability bias

INTRODUCTION

Background

Drug overdoses are the leading cause of unintentional death in the United States (U.S.), driven largely by opioids.[1] The number of opioid-related overdose deaths has nearly tripled from 1999-2014, with over 15,000 opioid-related overdose deaths occurring in 2015.[1,2] Although the number of prescription opioids sold in the U.S. quadrupled from 1999-2010, a slight decline has been observed in 2011.[1,3] However, in 2015, the morphine milligram equivalents (MME) dispensed per capita was still three times as high as it was in 1999.[3] It is now widely acknowledged that the rise of opioid prescribing is a contributing factor to the opioid epidemic.[1]

In 2015, Ohio had the fifth highest rate of prescription opioid-related overdose deaths and highest number of prescription opioid-related overdose deaths in the U.S.[4] Ohio has persistently had high overdose deaths over the last decade and has been comprehensive in its approach to reduce them.[5,6] Many state-based initiatives were developed by the Governor's Cabinet Opiate Action Team (GCOAT) and have also included the development of numerous opioid prescribing guidelines. This includes the Ohio Emergency and Acute Care Facility Opioids and Other Controlled Substances (OOCS) Prescribing Guidelines, referred to as the Ohio ED Opioid Prescribing Guidelines, in 2012.[7] Similar guidelines have been released by the American College of Emergency Physicians (ACEP) in 2012.[8] The Ohio guidelines were endorsed and publicized by nine organizations, including the Ohio chapter of the ACEP, the Ohio State Medical Association and the Ohio Hospital Association.[7]

Physicians working in ED may require assistance as it has been estimated that up to 42% of EDs may be misused by patients.[9] Development and dissemination of high-quality clinical practice guidelines can assist physicians in making informed prescribing decisions while mitigating the risks associated with medications, such as opioids. A qualitative study of 61 emergency physicians presented at the

2012 national ACEP research and education conference found that, in general, physicians viewed opioid prescribing guidelines in EDs favorably.[10] They believed the guidelines assisted in standardizing practice patterns at the institutional level, reduced the frequency and dosage of opioid prescriptions, improved patient safety, and protected them from liability and patient complaints. However, it was also noted that many physicians were unaware of specific recommendations listed in the guidelines.[10] Recent evidence further supports this as opioid prescribing has declined in Ohio by ED physicians since the release of the Ohio ED Opioid Prescribing Guidelines.[11] However, it is unknown which recommendations in the guidelines have led to this change and which ones may need to be refined. The Ohio Department of Health (ODH) contracted with our research team to evaluate the extent to which the Ohio ED Opioid Prescribing Guidelines have been implemented in hospitals with an ED in Ohio.[7] As a result, this study aimed to evaluate the implementation of the Ohio ED Opioid Prescribing Guidelines and their perceived impact on hospital policies and practices.

METHODS

Study design, setting, and survey development

The study design was a cross-sectional survey of ED medical directors, or appropriate person identified by the hospital, in all Ohio hospitals with an ED throughout October and November 2016. A ten-question survey based on the Ohio ED Opioid Prescribing Guidelines was developed by experts on the research team who have experience in survey design and opioid prescribing in EDs. A literature review and input from ODH also ensured content and face validity of the survey. The survey instrument included primarily closed-ended questions using a Likert-scale to evaluate the implementation of the guidelines and local opioid policies. Once developed, the survey was pre-tested for key elements of accessibility, usability, and understandability by five ED medical directors and physicians. The final survey was then made available as a paper version and a web-based version using *REDCap* (Research Electronic Data Capture). The study was approved by the Institutional Review Board (IRB) at the University of Cincinnati and at the ODH.

Selection of participants

The survey was designed to be completed by one person at each hospital ED in Ohio. The survey targeted ED medical directors or those identified by ED personnel as the most appropriate person to complete the survey. Hospitals with an ED in Ohio were identified through the ODH Office of Health Assurance and Licensing. As of September 2016, 271 hospitals were registered in Ohio; 164 of these hospitals had an ED; however one hospital had closed just prior to the study commencement. Hospitals' mailing addresses, phone numbers, and an e-mail address for their respective chief executive officer (CEO) were obtained from hospital registration reports.

Survey distribution followed Dillman's Tailored Design Method, a mixed-mode method including postal mail and e-mail, augmented by telephone interviews.[12] All hospitals in Ohio with an ED were initially telephoned (Day 0) to inform potential participants about the survey and to offer to

complete the survey over the phone. If potential participants were unavailable or unable to complete the survey over the phone, a letter was mailed with a web-link to the survey and a $10 incentive (Day 1). A letter containing a $10 incentive was also mailed to the hospital's CEO asking the CEO to pass the survey web-link to the potential participant (Day 1). Three days later (Day 4), the letters were followed up with an e-mail to both the potential participant and the hospital's CEO. If no response was received, a reminder e-mail was sent on Day 10, a hard copy of the survey was mailed on Day 18, and a final reminder e-mail was sent on Day 22. To further increase the response rate, a reminder was sent to rural hospitals through the ODH State Office of Rural Health and to ED physicians through the Ohio Chapter of the ACEP. These e-mails were sent on Day 4 with a reminder sent a week later. The most senior ED physicians' responses were used for hospitals where the ED medical director could not be contacted or identified.

Analysis

All survey data were managed using *REDCap.*[13] Hospitals were classified as being urban or rural based on the Federal Office of Rural Health Policy definition. Descriptive statistics, reported as percentages, were used to summarize the demographics and survey responses. All analyses were performed using Stata SE 13.1 (StataCorp, College Station, TX).

RESULTS

Characteristics of study subjects

ED personnel at 163 hospitals were contacted to participate in this study and 150 responses were received; yielding 92% response rate. Amongst those that responded, 57% (86/150) were from urban hospitals and 43% (64/150) were from rural hospitals. Table 1 shows the characteristics of respondents and their hospitals. The ED medical director completed the survey for 79% (119/150) of the EDs. For the remaining EDs, either an emergency physician (13%, 19/150), an ED nursing director (6%, 9/150), or a pharmacist (2%, 3/150) completed the survey.

Main results

Implementation of Ohio opioid prescribing policy

Overall, 75% (112/150) of respondents stated that their ED either had an opioid prescribing policy, was in the process of adopting one, or was implementing guidelines without a specific policy. Of these 112 EDs, 72% (81/112) based their policy and practices on the Ohio ED Opioid Prescribing Guidelines. Other prescribing guidelines on which respondents based their policies and practices were the ACEP guidelines (34%, 38/112), the CDC guidelines (29%, 32/112), and the AAEM guidelines (13%, 15/112).

Among the EDs that reported developing or having an opioid prescribing policy, the majority strongly agreed/agreed that the guidelines have increased the use of Ohio's prescription drug monitoring program (86%) and the Ohio ED Opioid Prescribing Guidelines have reduced inappropriate opioid prescribing (71%). The other potential benefits of the Ohio ED Opioid Prescribing Guidelines are displayed in Figure 1.

The most common strategies used to implement opioid prescribing policies and guidelines were developing educational materials, adapting the educational materials locally to their patient

population, and using local opinion leaders to encourage opioid prescribing policy and guideline implementation (Figure 2).

Opioid prescribing practices

Table 2 shows respondents' perceptions of opioid prescribing practices for pain in the last month in their EDs. For the management of acute pain, respondents rarely (<5% of patients) used IV meperidine, provided a prescription for long-acting or controlled-release opioids, or replaced opioids that were lost, destroyed or stolen as recommended in the guidelines. However, one-third of respondents (33%) reported writing an opioid prescription for more than three days for 5% or more of their acute pain patients. For the management of chronic pain, respondents rarely (<5% of patients) used IV meperidine, provided a prescription for long-acting or controlled-release opioids, replaced opioids that were lost, destroyed or stolen, or provided replacement doses of opioid replacement therapy as recommended in the guidelines. However, 64% of respondents reported using intramuscular (IM) or IV opioids in 5% or more of their chronic pain patients. Also, approximately one-third of respondents provided a prescription for opioids in 5% or more of their chronic pain patients that: (1) had received an opioid prescription from another provider, and (2) had previously presented with the same problem in the last month.

Opioid prescribing procedure

Table 3 shows respondents' perceptions of tasks performed, recommended in the guidelines, for any opioid prescription written in the last month in their EDs. Large variations were reported from EDs around Ohio. For example, 23% of EDs provided written information on the addictive nature of opioids to more than 95% of their patients that received an opioid prescription, while another 23% of EDs never did. Some recommendations in the guidelines were also largely not implemented. Over 80% of EDs reported that they never get patients who are prescribed an opioid to sign a pain

agreement, and 44% reported that they never receive a consultation from the hospital's palliative or pain service.

DISCUSSION

This study found that the majority of Ohio EDs are aware of the need to improve appropriate opioid prescribing and either have a hospital-based opioid prescribing policy, are in the process of adopting one, or are implementing guidelines without a specific policy. Most EDs are aware of the Ohio ED Opioid Prescribing Guidelines and are using them to be more judicious in opioid prescribing decisions. The results of this study demonstrate that ED medical directors, and their delegates, in Ohio believe that the Ohio ED Opioid Prescribing Guidelines have at least been partially implemented and have formed the basis for hospital level prescribing policies. Factors suggesting that the Ohio ED Opioid Prescribing Guidelines were influential include the number of respondents who reported familiarity, perceived impact in terms of improved opioid prescribing and an increase in the use of the Ohio prescription drug monitoring program. These findings are consistent with recent evidence that indicated a decline in opioid prescribing by Ohio ED physicians since the release of the Ohio ED Opioid Prescribing Guidelines.[11] This successful implementation of the guidelines may, in part, be due to the multi-stakeholder input that led to the development of the guidelines and broad support from professional societies and government officials. The fact that they are being implemented so widely indicates that the guidelines offer reasonable advice to ED physicians.

Although respondents generally reported their ED practices aligned with the Ohio ED Opioid Prescribing Guidelines, variability in ED prescribing practices was also observed. The largest variability in ED prescribing practices was the percentage of patient with chronic pain treated with IM or IV opioids. Also, large variability was observed in the percentage of patients being given a prescription for an opioid for more than 3 days, regardless if it was for chronic or acute pain. Furthermore, similar variability in ED practices were observed regarding if a prescription for opioids was provided to patients with chronic pain even though they had previously presented with the same problem or had received an opioid prescription from another provider in the last month. Such prescribing variability may highlight that these specific guideline recommendations may need to be

revised to provide clinicians with guidance on which clinical scenario they apply to. This additional clarity will further support clinicians and standardize practices to improve opioid prescribing

It is also acknowledged that ED physicians make a relatively small contribution to the overall number of opioids prescribed. In Ohio, ED physicians write approximately 5% of all opioid prescriptions.[14] Hence, guidelines aimed at primary care practitioners that commonly prescribe opioids should also be implemented, such as those developed by the GCOAT[15,16] or the CDC.[17] However, Barnett et al.[18] showed that long-term opioid use is associated with initial exposure from high-intensity ED prescribers. As ED prescribers do not regularly prescribe opioids long-term, it is hypothesized that conversion to long-term use may be driven by clinical "inertia," whereby outpatient clinicians renew previous prescriptions. Our findings suggest that ED physicians may initiate clinical "inertia" due to the fact that approximately 30% of respondents acknowledged that they prescribed opioids to at least 5% of patients that presented with the same problem in the last month. Despite the low number of opioid prescriptions written in EDs, it is important to acknowledge that the EDs are a source of repeat as well as first-time opioid exposures.

These findings should be considered in light of multiple limitations. In particular, we note that the survey included self-reported data which could be influenced by recall or social desirability bias. The survey reported ED Medical Directors' perceptions of prescribing practices in their ED, which may not accurately reflect individual-level ED prescribing patterns. Also, the introduction of the Ohio ED Opioid Prescribing Guidelines occurred in parallel with other national and state-based interventions,[6,8] so it is not known if the Ohio ED Opioid Prescribing Guidelines changed prescribers' views on opioid prescribing or equipped already motivated prescribers with a tool to defend their decision to limit opioid prescriptions. The latter would be consistent with a prior report which indicated that ED physicians used guidelines as a communication tool to protect themselves from liability and patient complaints rather than using them to influence their decision making process.[10]

In conclusion, this study showed that the Ohio ED Opioid Prescribing Guidelines have been widely disseminated, with the majority of EDs in Ohio using them to develop hospital-based opioid prescribing policies. The majority of respondents believed that opioid prescribing guidelines have increased the use of the Ohio prescription monitoring program and have reduced inappropriate opioid prescribing. Although the implementation of the Ohio ED Opioid Prescribing Guidelines is promising, further efforts to promote responsible opioid prescribing in other specialties is also required.

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AUTHOR CONTRIBUTIONS

JP and NM conceived the study and designed the study protocol in collaboration with ML, EH, EW, SC, JB, KK and JD. JP, RM, CC and ET undertook recruitment and data collection. JP and RM performed the statistical analyses and drafted the article. All authors contributed substantially to its revision. JP takes responsibility for the paper as a whole. All authors attest to meeting the four ICMJE.org authorship criteria: (1) Substantial contributions to the conception or design of the work; or the acquisition, analysis, or interpretation of data for the work; AND (2) Drafting the work or revising it critically for important intellectual content; AND (3) Final approval of the version to be published; AND (4) Agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

COMPETING INTERESTS

None declared

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DATA SHARING

No additional data available

ETHICS APPROVAL

The study was approved by the Institutional Review Board (IRB) at the University of Cincinnati and at the ODH.

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TABLES

Table 1. Characteristics of respondents and their hospitals (N=150)

Respondents' position	**n**	**%**
Medical Director	119	79.3
Emergency Physician	19	12.7
Nursing Director	9	6.0
Pharmacist	3	2.0
Rural		
Urban	86	57.3
Rural	64	42.7
Region of Ohio		
Central	21	14.0
Northeast	48	32.0
Northwest	34	22.7
Southeast	15	10.0
Southwest	32	21.3
Hospital funding type		
Non-government not-for-profit	130	86.7
Government non-federal	16	10.7
Investor-owned for-profit	4	2.7
Hospital classification		
Short-term acute hospital	115	76.7
Critical access hospital	32	21.3
Children's hospital	3	2.0

Table 2. Respondents' perception of frequency of opioid treatment in the last month in their emergency department (n=134)[*#]

	Never	1-4%	5-24%	25-49%	≥50%
Provided to patients with acute pain			**n (%)**		
IV[#] meperidine	114 (85)	13 (10)	5 (4)	0 (0)	0 (0)
Opioid prescription that:					
is long-acting or controlled-release	110 (82)	18 (13)	2 (1)	0 (0)	0 (0)
replaces those lost, destroyed, or stolen	91 (68)	31 (23)	4 (3)	0 (0)	0 (0)
is for more than a 3-day supply	30 (22)	49 (37)	30 (22)	15 (11)	3 (2)
Provided to patients with chronic pain					
IM or IV[#] opioids	6 (4)	34 (25)	52 (39)	24 (18)	9 (7)
IV meperidine	118 (88)	11 (8)	0 (0)	0 (0)	0 (0)
Replacement doses of opioid substitution therapy	121 (90)	5 (4)	1 (1)	0 (0)	0 (0)
Opioid prescription that:					
is long-acting or controlled-release	113 (84)	16 (12)	1 (1)	1 (1)	0 (0)
replaces those lost, destroyed, or stolen	97 (72)	26 (19)	3 (2)	0 (0)	0 (0)
is for more than a 3-day supply	52 (39)	43 (32)	23 (17)	10 (7)	0 (0)
Opioid prescription for:					

patients who received an opioid prescription within past month	27 (20)	49 (37)	36 (27)	9 (7)	2 (1)
patients who presented with the same problem within past month	20 (15)	64 (48)	30 (22)	9 (7)	0 (0)

*Although there were 134 respondents, some responded as "Do not know" or did not complete this specific question and are not represented in the table.

#IV=Intravenous, IM=Intramuscular. Questions were based on the Ohio Emergency and Acute Care Facility Opioids and Other Controlled Substances (OOCS) Prescribing Guidelines

Table 3. Respondents' perception of tasks performed when giving an opioid prescription in the last month in their emergency department (n=134)[*#]

	Never	1-4%	5-24%	25-49%	50-74%	75-95%	>95%
Task performed	**n (%)**						
Confirmed identity by photo identification	23 (17)	4 (3)	9 (7)	2 (1)	5 (4)	23 (17)	31 (23)
Searched the Ohio prescription monitoring program	1 (1)	8 (6)	17 (13)	25 (19)	27 (20)	33 (25)	16 (12)
Completed urine or other drug screen	16 (12)	50 (37)	37 (28)	7 (5)	3 (2)	4 (3)	1 (1)
Obtained records from other providers	16 (12)	39 (29)	24 (18)	17 (13)	8 (6)	8 (6)	7 (5)
For chronic pain patients, contacted their routine opioid prescriber	7 (5)	54 (40)	34 (25)	16 (12)	9 (7)	1 (1)	1 (1)
For patients who visit the ED frequently, conducted a case review or management	30 (22)	30 (22)	21 (16)	13 (10)	5 (4)	18 (13)	2 (1)
Obtained a consultation from the hospital's palliative or pain service	59 (44)	50 (37)	10 (7)	2 (1)	0 (0)	0 (0)	1 (1)
Had patients sign a pain agreement	108 (81)	14 (10)	3 (2)	1 (1)	0 (0)	1 (1)	1 (1)
Provide patients with written information on:							
addictive nature of opioids	31 (23)	16 (12)	5 (4)	10 (7)	4 (3)	13 (10)	31 (23)
potential dangers of the opioid misuse	31 (23)	21 (16)	5 (4)	10 (7)	3 (2)	13 (10)	31 (23)
appropriate storage and disposal of opioids	43 (32)	14 (10)	8 (6)	8 (6)	3 (2)	4 (3)	24 (18)

the facility's policy regarding the prescribing of opioids	44 (33)	14 (10)	18 (13)	13 (10)	5 (4)	6 (4)	7 (5)

*Some rows do not add up to 100% (n=134) as "do not know" or incomplete responses are not included in the table.

#Questions were based on the Ohio Emergency and Acute Care Facility Opioids and Other Controlled Substances (OOCS) Prescribing Guidelines

FIGURES

Figure 1. Strategies used to implement opioid prescribing policies and guidelines (n=106)[*#]

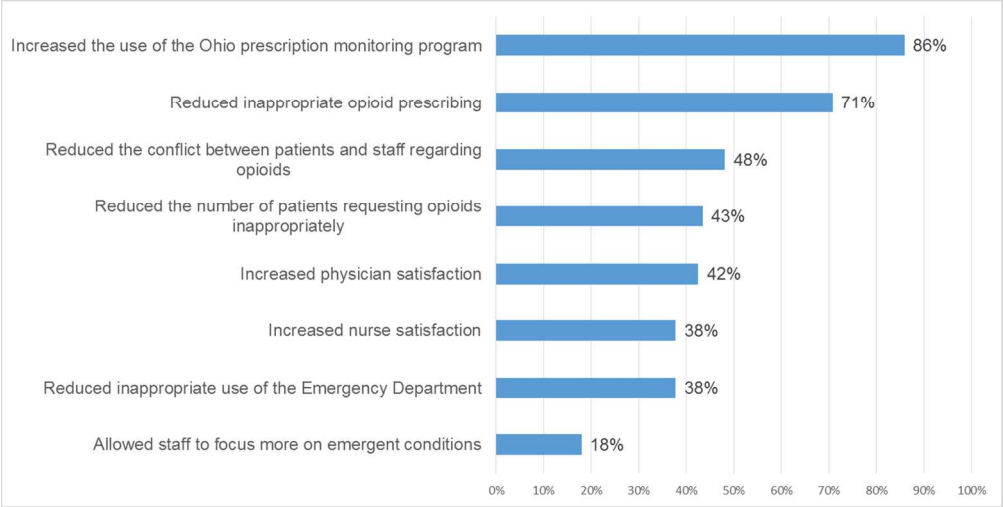
[*] Respondents could chose more than one strategy.

[#] Respondents from six hospitals that have an opioid prescribing policy or guidelines did not respond to this question.

Figure 2. Perceived impact of the Ohio ED Opioid Prescribing Guidelines from respondents that follow an opioid prescribing policy (n=106)*

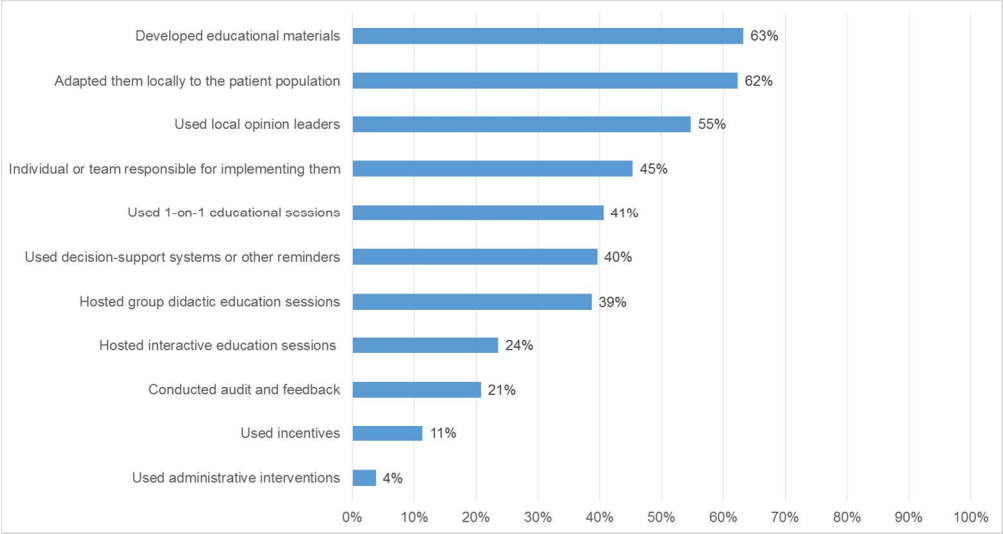
* Respondents from six hospitals that have an opioid prescribing policy or guidelines did not respond to this question.

Ohio ED Opioid Prescribing Guidelines is also known as Ohio Emergency and Acute Care Facility Opioids and Other Controlled Substances (OOCS) Prescribing Guidelines



Strategies used to implement opioid prescribing policies and guidelines (n=106)*#

* Respondents could chose more than one strategy.
# Respondents from six hospitals that have an opioid prescribing policy or guidelines did not respond to this question.



Perceived impact of the Ohio ED Opioid Prescribing Guidelines from respondents that follow an opioid prescribing policy (n=106)*

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TITLE PAGE

A State-wide Cross Sectional Survey of Emergency Departments' Adoption and Implementation of the Ohio Opioid Prescribing Guidelines and Opioid Prescribing Practices:

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ABSTRACT

Study Objective

To evaluate the implementation of the Ohio Emergency and Acute Care Facility Opioids and Other Controlled Substances (OOCS) Prescribing Guidelines and their perceived impact on local policies and practice.

Methods

The study design was a cross-sectional survey of ED medical directors, or appropriate person identified by the hospital, perception of the impact of the Ohio ED Opioid Prescribing Guidelines on their departments practice. All hospitals with an ED in Ohio were contacted throughout October and November, 2016. Distribution followed Dillman's Tailored Design Method, augmented with telephone recruitment. Hospital chief executive officers were contacted when necessary to encourage ED participation. Descriptive statistics were used to assess the impact of opioid prescribing policies on prescribing practices.

Results

A 92% response rate was obtained (150/163 EDs). In total, 112 (75%) of the respondents stated that their ED has an opioid prescribing policy, is adopting one, or is implementing prescribing guidelines without a specific policy. Of these 112 EDs, 81 (72%) based their policy on the Ohio ED Opioid Prescribing Guidelines. The majority of respondents strongly agreed/agreed that the prescribing guidelines have increased the use of the prescription drug monitoring program (86%) and have reduced opioid prescribing (71%).

Conclusion

This study showed that the Ohio ED Opioid Prescribing Guidelines have been widely disseminated and that the majority of EDs in Ohio are using them to develop local policies. The majority of respondents believed that opioid prescribing guidelines increased reduced opioid prescribing. However, prescribing practices still varied greatly between EDs.

ARTICLE SUMMARY

Strengths and limitations of this study

- All Emergency Departments (EDs) in hospitals in Ohio were included in the study
- A large response rate of 92% (150/163) was obtained for the survey
- Survey reported ED Medical Directors' perceptions of prescribing practices in their ED
- Survey results are self-reported and may be influenced by recall or social desirability bias

INTRODUCTION

Background

Drug overdoses are the leading cause of unintentional death in the United States (U.S.), driven largely by opioids.[1] The number of opioid-related overdose deaths has nearly tripled from 1999-2014 and was mainly associated with prescription opioids and heroin during this time.[1] Opioid-related deaths have continued to rise from 2014-2015.[2] Although prescription opioid related deaths still remain a concern, this rise was primarily driven by illicit fentanyl and heroin.[2] Despite reductions in opioid prescribing in some parts of the U.S, the morphine milligram equivalents (MME) dispensed per capita in 2015 remained three times as high as it was in 1999.[3] It is now widely acknowledged that the rise of opioid prescribing is a contributing factor to the opioid epidemic.[1]

In 2015, Ohio had the fifth highest rate of prescription opioid-related overdose deaths and highest number of prescription opioid-related overdose deaths in the U.S.[4] Ohio has persistently had high overdose deaths over the last decade and has been comprehensive in its approach to reduce them.[5,6] Many state-based initiatives were developed by the Governor's Cabinet Opiate Action Team (GCOAT) and have also included the development of numerous opioid prescribing guidelines. This includes the Ohio Emergency and Acute Care Facility Opioids and Other Controlled Substances (OOCS) Prescribing Guidelines, referred to as the Ohio ED Opioid Prescribing Guidelines, in 2012.[7] Similar guidelines have been released by the American College of Emergency Physicians (ACEP) in 2012.[8] The Ohio guidelines were endorsed and publicized by nine organizations, including the Ohio chapter of the ACEP, the Ohio State Medical Association and the Ohio Hospital Association.[7]

Physicians working in ED may require assistance as it has been estimated that up to 42% of EDs may be misused by patients.[9] Development and dissemination of high-quality clinical practice guidelines can assist physicians in making informed prescribing decisions while mitigating the risks associated

with medications, such as opioids. A qualitative study of 61 emergency physicians presented at the 2012 national ACEP research and education conference found that, in general, physicians viewed opioid prescribing guidelines in EDs favorably.[10] They believed the guidelines assisted in standardizing practice patterns at the institutional level, reduced the frequency and dosage of opioid prescriptions, improved patient safety, and protected them from liability and patient complaints. However, it was also noted that many physicians were unaware of specific recommendations listed in the guidelines.[10] Recent evidence further supports this as opioid prescribing has declined in Ohio by ED physicians since the release of the Ohio ED Opioid Prescribing Guidelines.[11] However, it is unknown which recommendations in the guidelines have led to this change and which ones may need to be refined. The Ohio Department of Health (ODH) contracted with our research team to evaluate the extent to which the Ohio ED Opioid Prescribing Guidelines have been implemented in hospitals with an ED in Ohio.[7] As a result, this study aimed to evaluate the implementation of the Ohio ED Opioid Prescribing Guidelines and their perceived impact on hospital policies and practices.

METHODS

Study design, setting, and survey development

The study design was a cross-sectional survey of ED medical directors, or appropriate person identified by the hospital, in all Ohio hospitals with an ED throughout October and November 2016. A ten-question survey based on the Ohio ED Opioid Prescribing Guidelines was developed by experts on the research team who have experience in survey design and opioid prescribing in EDs. A literature review and input from ODH also ensured content validity of the survey. The survey instrument included primarily closed-ended questions using a Likert-scale to evaluate the implementation of the guidelines and local opioid policies. Questions were chosen to correspond with each recommendation in the guideline. Additional questions focused on the respondents' demographic details, strategies used to implement the guidelines and the perceived benefits of the guidelines. Once developed, the survey was pre-tested for key elements of accessibility, usability, and understandability by five ED medical directors and physicians. The final survey was then made available as a paper version and a web-based version using *REDCap* (Research Electronic Data Capture). The study was approved by the Institutional Review Board (IRB) at the University of Cincinnati and at the ODH.

Selection of participants

The survey was designed to be completed by one person at each hospital ED in Ohio. The survey targeted ED medical directors or those identified by ED personnel as the most appropriate person to complete the survey. Hospitals with an ED in Ohio were identified through the ODH Office of Health Assurance and Licensing. As of September 2016, 271 hospitals were registered in Ohio; 164 of these hospitals had an ED; however one hospital had closed just prior to the study commencement. Hospitals' mailing addresses, phone numbers, and an e-mail address for their respective chief executive officer (CEO) were obtained from hospital registration reports.

Survey distribution followed Dillman's Tailored Design Method, a mixed-mode method including postal mail and e-mail, augmented by telephone interviews to maximize the response rate.[12] Dillman's Tailored Design Method is based on Social Exchange theory, which focuses on establishing trust, increasing benefits and decreasing costs, to improve response rates.[12] One strategy recommend by Dillman is to provide participants with a token of appreciation in advance. This token can be as small as $2 as it not only increases the benefit, but establishes trust.[12] A $10 incentive was chosen as it was the smallest amount that could be pre-loaded on a prepaid credit card.

All hospitals in Ohio with an ED were initially telephoned (Day 0) to inform potential participants about the survey and to offer to complete the survey over the phone. If potential participants were unavailable or unable to complete the survey over the phone, a letter was mailed with a web-link to the survey and a $10 incentive (Day 1). A letter containing a $10 incentive was also mailed to the hospital's CEO asking the CEO to pass the survey web-link to the potential participant (Day 1). Three days later (Day 4), the letters were followed up with an e-mail to both the potential participant and the hospital's CEO. If no response was received, a reminder e-mail was sent on Day 10, a hard copy of the survey was mailed on Day 18, and a final reminder e-mail was sent on Day 22. To further increase the response rate, a reminder was sent to rural hospitals through the ODH State Office of Rural Health and to ED physicians through the Ohio Chapter of the ACEP. These e-mails were sent on Day 4 with a reminder sent a week later. The most senior ED physicians' responses were used for hospitals where the ED medical director could not be contacted or identified.

Analysis

All survey data were managed using *REDCap.*[13] Hospitals were classified as being urban or rural based on the Federal Office of Rural Health Policy definition. Descriptive statistics, reported as percentages, were used to summarize the demographics and survey responses. All analyses were performed using Stata SE 13.1 (StataCorp, College Station, TX).

RESULTS

Characteristics of study subjects

ED personnel at 163 hospitals were contacted to participate in this study and 150 responses were received; yielding 92% response rate. Amongst those that responded, 57% (86/150) were from urban hospitals and 43% (64/150) were from rural hospitals. Table 1 shows the characteristics of respondents and their hospitals. The ED medical director completed the survey for 79% (119/150) of the EDs. For the remaining EDs, either an emergency physician (13%, 19/150), an ED nursing director (6%, 9/150), or a pharmacist (2%, 3/150) completed the survey.

Main results

Implementation of Ohio opioid prescribing policy

Overall, 75% (112/150) of respondents stated that their ED either had an opioid prescribing policy, was in the process of adopting one, or was implementing guidelines without a specific policy. Of these 112 EDs, 72% (81/112) based their policy and practices on the Ohio ED Opioid Prescribing Guidelines. Other prescribing guidelines on which respondents based their policies and practices were the ACEP guidelines (34%, 38/112), the CDC guidelines (29%, 32/112), and the AAEM guidelines (13%, 15/112).

Among the EDs that reported developing or having an opioid prescribing policy, the majority strongly agreed/agreed that the guidelines have increased the use of Ohio's prescription drug monitoring program (86%) and the Ohio ED Opioid Prescribing Guidelines have reduced inappropriate opioid prescribing (71%). The other potential benefits of the Ohio ED Opioid Prescribing Guidelines are displayed in Figure 1.

The most common strategies used to implement opioid prescribing policies and guidelines were developing educational materials, adapting the educational materials locally to their patient

population, and using local opinion leaders to encourage opioid prescribing policy and guideline implementation (Figure 2).

Opioid prescribing practices

Table 2 shows respondents' perceptions of opioid prescribing practices for pain in the last month in their EDs. For the management of acute pain, respondents rarely (<5% of patients) used IV meperidine, provided a prescription for long-acting or controlled-release opioids, or replaced opioids that were lost, destroyed or stolen as recommended in the guidelines. However, one-third of respondents (33%) reported writing an opioid prescription for more than three days for 5% or more of their acute pain patients. For the management of chronic pain, respondents rarely (<5% of patients) used IV meperidine, provided a prescription for long-acting or controlled-release opioids, replaced opioids that were lost, destroyed or stolen, or provided replacement doses of opioid replacement therapy as recommended in the guidelines. However, 64% of respondents reported using intramuscular (IM) or IV opioids in 5% or more of their chronic pain patients. Also, approximately one-third of respondents provided a prescription for opioids in 5% or more of their chronic pain patients that: (1) had received an opioid prescription from another provider, and (2) had previously presented with the same problem in the last month.

Opioid prescribing procedure

Table 3 shows respondents' perceptions of tasks performed, recommended in the guidelines, for any opioid prescription written in the last month in their EDs. Large variations were reported from EDs around Ohio. For example, 23% of EDs provided written information on the addictive nature of opioids to more than 95% of their patients that received an opioid prescription, while another 23% of EDs never did. Some recommendations in the guidelines were also largely not implemented. Over 80% of EDs reported that they never get patients who are prescribed an opioid to sign a pain

agreement, and 44% reported that they never receive a consultation from the hospital's palliative or pain service.

DISCUSSION

This study found that the majority of Ohio EDs are aware of the need to improve appropriate opioid prescribing and either have a hospital-based opioid prescribing policy, are in the process of adopting one, or are implementing guidelines without a specific policy. Most EDs are aware of the Ohio ED Opioid Prescribing Guidelines and are using them to be more judicious in opioid prescribing decisions. The results of this study demonstrate that ED medical directors, and their delegates, in Ohio believe that the Ohio ED Opioid Prescribing Guidelines have at least been partially implemented and have formed the basis for hospital level prescribing policies. Factors suggesting that the Ohio ED Opioid Prescribing Guidelines were influential include the number of respondents who reported familiarity, perceived impact in terms of improved opioid prescribing and an increase in the use of the Ohio prescription drug monitoring program. These findings are consistent with recent evidence that indicated a decline in opioid prescribing by Ohio ED physicians since the release of the Ohio ED Opioid Prescribing Guidelines.[11] This successful implementation of the guidelines may, in part, be due to the multi-stakeholder input that led to the development of the guidelines and broad support from professional societies and government officials. The fact that they are being implemented so widely indicates that the guidelines offer reasonable advice to ED physicians.

Although respondents generally reported their ED practices aligned with the Ohio ED Opioid Prescribing Guidelines, variability in ED prescribing practices was also observed. The largest variability in ED prescribing practices was the percentage of patient with chronic pain treated with IM or IV opioids. Also, large variability was observed in the percentage of patients being given a prescription for an opioid for more than 3 days, regardless if it was for chronic or acute pain. Such prescribing variability may highlight that these specific guideline recommendations may not be practical or that respondents generally do not agree with them. A revision of these statements and guidance on which clinical scenario they apply to may ensure the guidelines support best practices.

Furthermore, similar variability in ED practices were observed, including the use of Ohio's prescription drug monitoring program and education provided to patients. The largest variation in ED practices was observed for opioid prescriptions being provided to patients with chronic pain even though they had previously presented with the same problem or had received an opioid prescription from another provider in the last month. This lack of standardization in the care and information patients receive is concerning and requires additional investigation to identify their cause.

It is also acknowledged that ED physicians make a relatively small contribution to the overall number of opioids prescribed. In Ohio, ED physicians write approximately 5% of all opioid prescriptions.[14] Hence, guidelines aimed at primary care practitioners that commonly prescribe opioids should also be implemented, such as those developed by the GCOAT[15,16] or the CDC.[17] However, Barnett et al.[18] showed that long-term opioid use is associated with initial exposure from high-intensity ED prescribers. As ED prescribers do not regularly prescribe opioids long-term, it is hypothesized that conversion to long-term use may be driven by clinical "inertia," whereby outpatient clinicians renew previous prescriptions. Our findings suggest that ED physicians may initiate clinical "inertia" due to the fact that approximately 30% of respondents acknowledged that they prescribed opioids to at least 5% of patients that presented with the same problem in the last month. Despite the low number of opioid prescriptions written in EDs, it is important to acknowledge that the EDs are a source of repeat as well as first-time opioid exposures.

Identifying patients that are using EDs for repeat prescriptions is particularly challenging. There is currently no mechanism in Ohio for ED physicians to track patients that move from one ED to another. Although the increased use of Ohio's prescription drug monitoring program could assist with this, it is not mandatory for ED physicians in Ohio to review their records if they prescribe for fewer than seven days.[19] Our results highlight the variability of the programs utilization, with only 12% of respondents stating they used it for more than 95% of their patients prescribed an opioid in

the last month. To further complicate the situation, these programs usually do not include information from other states. With neighbouring states like West Virginia and Kentucky, having the highest and 6th highest rate of opioid-related death rates in the U.S. respectively,[4] tracking patients that move between EDs and states is beyond the current healthcare systems capabilities.

These findings should be considered in light of multiple limitations. In particular, we note that the survey included self-reported data which could be influenced by recall or social desirability bias. The survey reported ED Medical Directors' perceptions of prescribing practices in their ED, which may not accurately reflect individual-level ED prescribing patterns. This data is also not generalizable outside of Ohio and did not include EDs not affiliated with hospitals. Furthermore, information related to the morphine milligram equivalent per prescription was not obtained, which may provide additional insight into the influence of the guidelines. Also, the introduction of the Ohio ED Opioid Prescribing Guidelines occurred in parallel with other national and state-based interventions,[6,8] so it is not known if the Ohio ED Opioid Prescribing Guidelines changed prescribers' views on opioid prescribing or equipped already motivated prescribers with a tool to defend their decision to limit opioid prescriptions. The latter would be consistent with a prior report which indicated that ED physicians used guidelines as a communication tool to protect themselves from liability and patient complaints rather than using them to influence their decision making process.[10]

In conclusion, this study showed that the Ohio ED Opioid Prescribing Guidelines have been widely disseminated, with the majority of EDs in Ohio using them to develop hospital-based opioid prescribing policies. The majority of respondents believed that opioid prescribing guidelines have increased the use of the Ohio prescription monitoring program and have reduced inappropriate opioid prescribing. Although the implementation of the Ohio ED Opioid Prescribing Guidelines is promising, further efforts to promote responsible opioid prescribing in other specialties is also required.

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AUTHOR CONTRIBUTIONS

JP and NM conceived the study and designed the study protocol in collaboration with ML, EH, EW, SC, JB, KK and JD. JP, RM, CC and ET undertook recruitment and data collection. JP and RM performed the statistical analyses and drafted the article. All authors contributed substantially to its revision. JP takes responsibility for the paper as a whole. All authors attest to meeting the four ICMJE.org authorship criteria: (1) Substantial contributions to the conception or design of the work; or the acquisition, analysis, or interpretation of data for the work; AND (2) Drafting the work or revising it critically for important intellectual content; AND (3) Final approval of the version to be published; AND (4) Agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

COMPETING INTERESTS

None declared

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DATA SHARING

No additional data available

ETHICS APPROVAL

The study was approved by the Institutional Review Board (IRB) at the University of Cincinnati and at the ODH.

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TABLES

Table 1. Characteristics of respondents and their hospitals (N=150)

Respondents' position	**n**	**%**
Medical Director	119	79.3
Emergency Physician	19	12.7
Nursing Director	9	6.0
Pharmacist	3	2.0
Rural		
Urban	86	57.3
Rural	64	42.7
Region of Ohio		
Central	21	14.0
Northeast	48	32.0
Northwest	34	22.7
Southeast	15	10.0
Southwest	32	21.3
Hospital funding type		
Non-government not-for-profit	130	86.7
Government non-federal	16	10.7
Investor-owned for-profit	4	2.7
Hospital classification		
Short-term acute hospital	115	76.7
Critical access hospital	32	21.3
Children's hospital	3	2.0

Table 2. Respondents' perception of frequency of opioid treatment in the last month in their emergency department (n=134)[*#]

	Never	1-4%	5-24%	25-49%	≥50%
Provided to patients with acute pain			**n (%)**		
IV[#] meperidine	114 (85)	13 (10)	5 (4)	0 (0)	0 (0)
Opioid prescription that:					
is long-acting or controlled-release	110 (82)	18 (13)	2 (1)	0 (0)	0 (0)
replaces those lost, destroyed, or stolen	91 (68)	31 (23)	4 (3)	0 (0)	0 (0)
is for more than a 3-day supply	30 (22)	49 (37)	30 (22)	15 (11)	3 (2)
Provided to patients with chronic pain					
IM or IV[#] opioids	6 (4)	34 (25)	52 (39)	24 (18)	9 (7)
IV meperidine	118 (88)	11 (8)	0 (0)	0 (0)	0 (0)
Replacement doses of opioid substitution therapy	121 (90)	5 (4)	1 (1)	0 (0)	0 (0)
Opioid prescription that:					
is long-acting or controlled-release	113 (84)	16 (12)	1 (1)	1 (1)	0 (0)
replaces those lost, destroyed, or stolen	97 (72)	26 (19)	3 (2)	0 (0)	0 (0)
is for more than a 3-day supply	52 (39)	43 (32)	23 (17)	10 (7)	0 (0)
Opioid prescription for:					

patients who received an opioid prescription within past month	27 (20)	49 (37)	36 (27)	9 (7)	2 (1)
patients who presented with the same problem within past month	20 (15)	64 (48)	30 (22)	9 (7)	0 (0)

*Although there were 134 respondents, some responded as "Do not know" or did not complete this specific question and are not represented in the table.

#IV=Intravenous, IM=Intramuscular. Questions were based on the Ohio Emergency and Acute Care Facility Opioids and Other Controlled Substances (OOCS) Prescribing Guidelines

Table 3. Respondents' perception of tasks performed when giving an opioid prescription in the last month in their emergency department (n=134)[*#]

	Never	1-4%	5-24%	25-49%	50-74%	75-95%	>95%
Task performed	**n (%)**						
Confirmed identity by photo identification	23 (17)	4 (3)	9 (7)	2 (1)	5 (4)	23 (17)	31 (23)
Searched the Ohio prescription monitoring program	1 (1)	8 (6)	17 (13)	25 (19)	27 (20)	33 (25)	16 (12)
Completed urine or other drug screen	16 (12)	50 (37)	37 (28)	7 (5)	3 (2)	4 (3)	1 (1)
Obtained records from other providers	16 (12)	39 (29)	24 (18)	17 (13)	8 (6)	8 (6)	7 (5)
For chronic pain patients, contacted their routine opioid prescriber	7 (5)	54 (40)	34 (25)	16 (12)	9 (7)	1 (1)	1 (1)
For patients who visit the ED frequently, conducted a case review or management	30 (22)	30 (22)	21 (16)	13 (10)	5 (4)	18 (13)	2 (1)
Obtained a consultation from the hospital's palliative or pain service	59 (44)	50 (37)	10 (7)	2 (1)	0 (0)	0 (0)	1 (1)
Had patients sign a pain agreement	108 (81)	14 (10)	3 (2)	1 (1)	0 (0)	1 (1)	1 (1)
Provide patients with written information on:							
addictive nature of opioids	31 (23)	16 (12)	5 (4)	10 (7)	4 (3)	13 (10)	31 (23)
potential dangers of the opioid misuse	31 (23)	21 (16)	5 (4)	10 (7)	3 (2)	13 (10)	31 (23)
appropriate storage and disposal of opioids	43 (32)	14 (10)	8 (6)	8 (6)	3 (2)	4 (3)	24 (18)

the facility's policy regarding the prescribing of opioids	44 (33)	14 (10)	18 (13)	13 (10)	5 (4)	6 (4)	7 (5)

*Some rows do not add up to 100% (n=134) as "do not know" or incomplete responses are not included in the table.

#Questions were based on the Ohio Emergency and Acute Care Facility Opioids and Other Controlled Substances (OOCS) Prescribing Guidelines

FIGURES

Figure 1. Strategies used to implement opioid prescribing policies and guidelines (n=106)[*#]

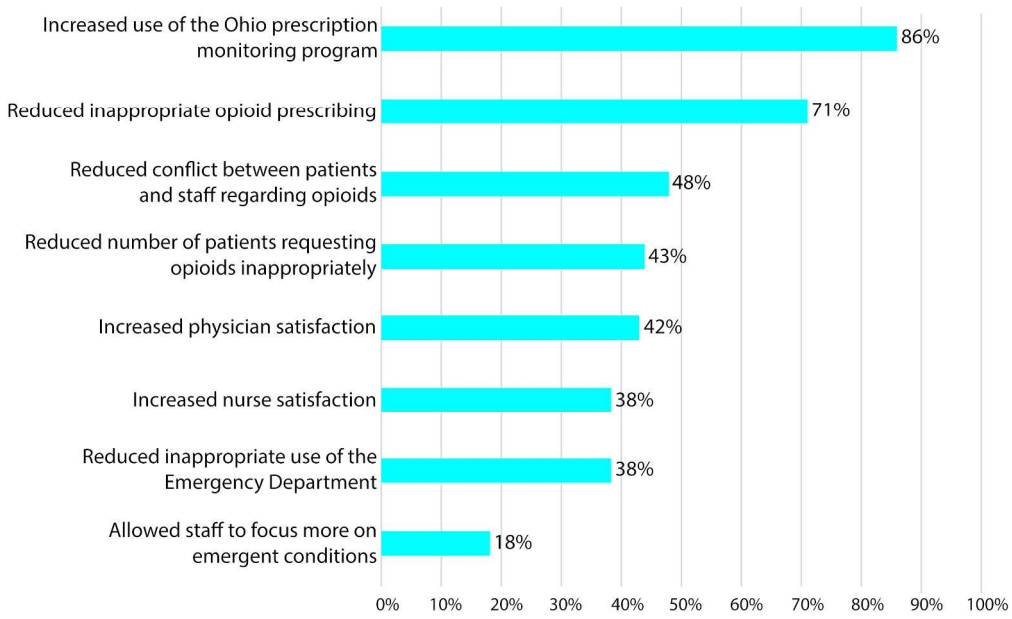
[*] Respondents could chose more than one strategy.

[#] Respondents from six hospitals that have an opioid prescribing policy or guidelines did not respond to this question.

Figure 2. Perceived impact of the Ohio ED Opioid Prescribing Guidelines from respondents that follow an opioid prescribing policy (n=106)*

* Respondents from six hospitals that have an opioid prescribing policy or guidelines did not respond to this question.

Ohio ED Opioid Prescribing Guidelines is also known as Ohio Emergency and Acute Care Facility Opioids and Other Controlled Substances (OOCS) Prescribing Guidelines



Strategies used to implement opioid prescribing policies and guidelines (n=106)*# ┼ ┼ * Respondents could chose more than one strategy. ┼ # Respondents from six hospitals that have an opioid prescribing policy or guidelines did not respond to this question. ┼

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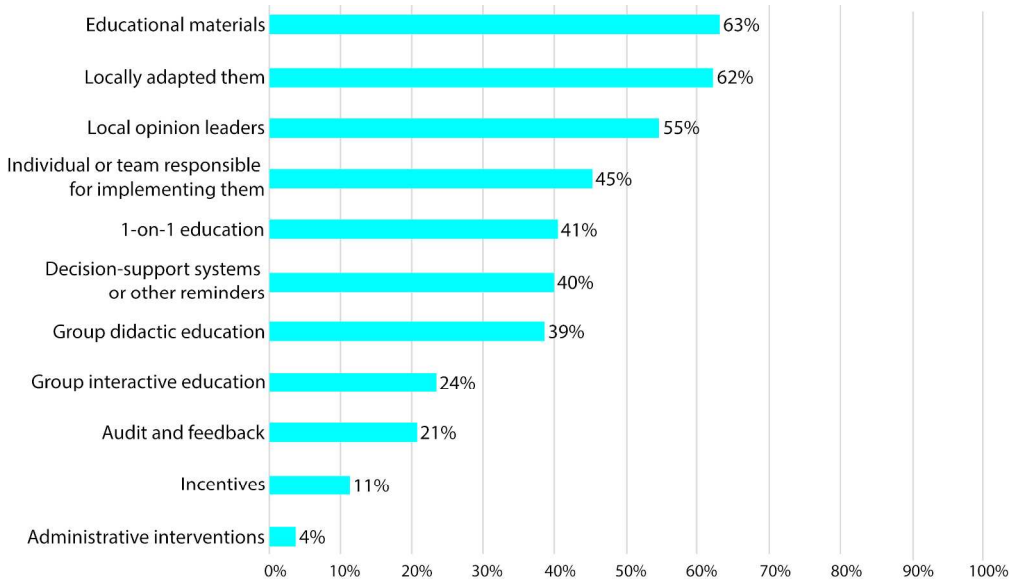

Perceived impact of the Ohio ED Opioid Prescribing Guidelines from respondents that follow an opioid prescribing policy (n=106)*┼ ┼ Perceived impact of the Ohio ED Opioid Prescribing Guidelines from respondents that follow an opioid prescribing policy (n=106)*

246x141mm (300 x 300 DPI)

STROBE Statement—Checklist of items that should be included in reports of ***cross-sectional studies***

	Item No	Recommendation	Page number
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	3
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	5-6
Objectives	3	State specific objectives, including any prespecified hypotheses	6
Methods			
Study design	4	Present key elements of study design early in the paper	7-8
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	7-8
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	7
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	7
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	7
Bias	9	Describe any efforts to address potential sources of bias	8
Study size	10	Explain how the study size was arrived at	7
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	8
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	8
		(*b*) Describe any methods used to examine subgroups and interactions	NA
		(*c*) Explain how missing data were addressed	NA
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	NA
		(*e*) Describe any sensitivity analyses	NA
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	9
		(b) Give reasons for non-participation at each stage	9
		(c) Consider use of a flow diagram	NA
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	9, 20
		(b) Indicate number of participants with missing data for each variable of interest	9-11, 21-24
Outcome data	15*	Report numbers of outcome events or summary measures	9-11
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	9-11

		(*b*) Report category boundaries when continuous variables were categorized	NA
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	NA
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	NA
Discussion			
Key results	18	Summarise key results with reference to study objectives	12
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	14
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	14
Generalisability	21	Discuss the generalisability (external validity) of the study results	14
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	16

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

BMJ Open

A State-wide Cross Sectional Survey of Emergency Departments' Adoption and Implementation of the Ohio Opioid Prescribing Guidelines and Opioid Prescribing Practices

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TITLE PAGE

A State-wide Cross Sectional Survey of Emergency Departments' Adoption and Implementation of the Ohio Opioid Prescribing Guidelines and Opioid Prescribing Practices:

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Data sharing statement

No additional data available

ABSTRACT

Study Objective

To evaluate the implementation of the Ohio Emergency and Acute Care Facility Opioids and Other Controlled Substances (OOCS) Prescribing Guidelines and their perceived impact on local policies and practice.

Methods

The study design was a cross-sectional survey of ED medical directors, or appropriate person identified by the hospital, perception of the impact of the Ohio ED Opioid Prescribing Guidelines on their departments practice. All hospitals with an ED in Ohio were contacted throughout October and November, 2016. Distribution followed Dillman's Tailored Design Method, augmented with telephone recruitment. Hospital chief executive officers were contacted when necessary to encourage ED participation. Descriptive statistics were used to assess the impact of opioid prescribing policies on prescribing practices.

Results

A 92% response rate was obtained (150/163 EDs). In total, 112 (75%) of the respondents stated that their ED has an opioid prescribing policy, is adopting one, or is implementing prescribing guidelines without a specific policy. Of these 112 EDs, 81 (72%) based their policy on the Ohio ED Opioid Prescribing Guidelines. The majority of respondents strongly agreed/agreed that the prescribing guidelines have increased the use of the prescription drug monitoring program (86%) and have reduced opioid prescribing (71%).

Conclusion

This study showed that the Ohio ED Opioid Prescribing Guidelines have been widely disseminated and that the majority of EDs in Ohio are using them to develop local policies. The majority of respondents believed that opioid prescribing guidelines increased reduced opioid prescribing. However, prescribing practices still varied greatly between EDs.

ARTICLE SUMMARY

Strengths and limitations of this study

- All Emergency Departments (EDs) in hospitals in Ohio were included in the study
- A large response rate of 92% (150/163) was obtained for the survey
- Survey reported ED Medical Directors' perceptions of prescribing practices in their ED
- Survey results are self-reported and may be influenced by recall or social desirability bias

INTRODUCTION

Background

Drug overdoses are the leading cause of unintentional death in the United States (U.S.), driven largely by opioids (66%), both prescription and illicit.[1,2] In total, 40% of opioid related deaths are due to a prescription opioid, with the remainder primarily driven by heroin and illicitly manufactured fentanyl (IMF).[3] Although heroin and IMF related deaths are the primary cause of opioid-related deaths in the U.S, there are significant geographic variations in opioid prescribing practices and involvement of specific opioid compounds in overdose deaths.[2,4] Reducing unnecessary exposure to prescription opioids may prevent the development of opioid use disorder that is later supplemented or replaced by illicit opioids.[5] This has led to the implementation of multiple strategies aimed at improving opioid prescribing around the U.S.[2,6] Such strategies appear to be improving the situations in some states, as the rate of overdose deaths involving a prescription (age-adjusted) have steadied from 2011-2015[5] and the annual opioid prescribing rate has decreased from 2012 to 2015.[4]

This paper will focus on strategies used in the Emergency Room setting in Ohio, as Ohio had the third highest rate of prescription opioid-related overdose deaths and highest number of prescription opioid-related overdose deaths in the U.S in 2016.[7] Ohio has persistently had high overdose deaths over the last decade and has been comprehensive in its approach to reduce them.[5,8] Many state-based initiatives were developed by the Governor's Cabinet Opiate Action Team (GCOAT) and have also included the development of numerous opioid prescribing guidelines. This includes the Ohio Emergency and Acute Care Facility Opioids and Other Controlled Substances (OOCS) Prescribing Guidelines, referred to as the Ohio ED Opioid Prescribing Guidelines, in 2012.[9] Similar guidelines have been released by the American College of Emergency Physicians (ACEP) in 2012.[10] The Ohio guidelines were endorsed and publicized by nine organizations, including the Ohio chapter of the ACEP, the Ohio State Medical Association and the Ohio Hospital Association.[9]

Physicians working in ED may require assistance as it has been estimated that up to 42% of EDs may be misused by patients.[11] Development and dissemination of high-quality clinical practice guidelines can assist physicians in making informed prescribing decisions while mitigating the risks associated with medications, such as opioids. A qualitative study of 61 emergency physicians presented at the 2012 national ACEP research and education conference found that, in general, physicians viewed opioid prescribing guidelines in EDs favorably.[12] They believed the guidelines assisted in standardizing practice patterns at the institutional level, reduced the frequency and dosage of opioid prescriptions, improved patient safety, and protected them from liability and patient complaints. However, it was also noted that many physicians were unaware of specific recommendations listed in the guidelines.[12] Recent evidence further supports this as opioid prescribing has declined in Ohio by ED physicians since the release of the Ohio ED Opioid Prescribing Guidelines.[13] However, it is unknown which recommendations in the guidelines have led to this change and which ones may need to be refined. The Ohio Department of Health (ODH) contracted with our research team to evaluate the extent to which the Ohio ED Opioid Prescribing Guidelines have been implemented in hospitals with an ED in Ohio.[9] As a result, this study aimed to evaluate the implementation of the Ohio ED Opioid Prescribing Guidelines and their perceived impact on hospital policies and practices.

METHODS

Study design, setting, and survey development

The study design was a cross-sectional survey of ED medical directors, or appropriate person identified by the hospital, in all Ohio hospitals with an ED throughout October and November 2016. A ten-question survey based on the Ohio ED Opioid Prescribing Guidelines was developed by experts on the research team who have experience in survey design and opioid prescribing in EDs. A literature review and input from ODH also ensured content validity of the survey. The survey instrument included primarily closed-ended questions using a Likert-scale to evaluate the implementation of the guidelines and local opioid policies. Questions were chosen to correspond with each recommendation in the guideline. Additional questions focused on the respondents' demographic details, strategies used to implement the guidelines and the perceived benefits of the guidelines. Once developed, the survey was pre-tested for key elements of accessibility, usability, and understandability by five ED medical directors and physicians. The final survey was then made available as a paper version and a web-based version using *REDCap* (Research Electronic Data Capture).[14] The study was approved by the Institutional Review Board (IRB) at the University of Cincinnati and at the ODH.

Selection of participants

The survey was designed to be completed by one person at each hospital ED in Ohio. The survey targeted ED medical directors or those identified by ED personnel as the most appropriate person to complete the survey. Hospitals with an ED in Ohio were identified through the ODH Office of Health Assurance and Licensing. As of September 2016, 271 hospitals were registered in Ohio; 164 of these hospitals had an ED; however one hospital had closed just prior to the study commencement. Hospitals' mailing addresses, phone numbers, and an e-mail address for their respective chief executive officer (CEO) were obtained from hospital registration reports.

Survey distribution followed Dillman's Tailored Design Method, a mixed-mode method including postal mail and e-mail, augmented by telephone interviews to maximize the response rate.[15] Dillman's Tailored Design Method is based on Social Exchange theory, which focuses on establishing trust, increasing benefits and decreasing costs, to improve response rates.[15] One strategy recommend by Dillman is to provide participants with a token of appreciation in advance. This token can be as small as $2 as it not only increases the benefit, but establishes trust.[15] A $10 incentive was chosen as it was the smallest amount that could be pre-loaded on a prepaid credit card.

All hospitals in Ohio with an ED were initially telephoned (Day 0) to inform potential participants about the survey and to offer to complete the survey over the phone. If potential participants were unavailable or unable to complete the survey over the phone, a letter was mailed with a web-link to the survey and a $10 incentive (Day 1). A letter containing a $10 incentive was also mailed to the hospital's CEO asking the CEO to pass the survey web-link to the potential participant (Day 1). Three days later (Day 4), the letters were followed up with an e-mail to both the potential participant and the hospital's CEO. If no response was received, a reminder e-mail was sent on Day 10, a hard copy of the survey was mailed on Day 18, and a final reminder e-mail was sent on Day 22. To further increase the response rate, a reminder was sent to rural hospitals through the ODH State Office of Rural Health and to ED physicians through the Ohio Chapter of the ACEP. These e-mails were sent on Day 4 with a reminder sent a week later. The most senior ED physicians' responses were used for hospitals where the ED medical director could not be contacted or identified.

Patient and Public Involvement

This study was designed and conducted by the research team with assistance from the Ohio ODH. Patients and the public were not involved in this study

Analysis

All survey data were managed using *REDCap.*[14] Hospitals were classified as being urban or rural based on the Federal Office of Rural Health Policy definition. Descriptive statistics, reported as percentages, were used to summarize the demographics and survey responses. All analyses were performed using Stata SE 13.1 (StataCorp, College Station, TX).

RESULTS

Characteristics of study subjects

ED personnel at 163 hospitals were contacted to participate in this study and 150 responses were received; yielding 92% response rate. Amongst those that responded, 57% (86/150) were from urban hospitals and 43% (64/150) were from rural hospitals. Table 1 shows the characteristics of respondents and their hospitals. The ED medical director completed the survey for 79% (119/150) of the EDs. For the remaining EDs, either an emergency physician (13%, 19/150), an ED nursing director (6%, 9/150), or a pharmacist (2%, 3/150) completed the survey.

Main results

Implementation of Ohio opioid prescribing policy

Overall, 75% (112/150) of respondents stated that their ED either had an opioid prescribing policy, was in the process of adopting one, or was implementing guidelines without a specific policy. Of these 112 EDs, 72% (81/112) based their policy and practices on the Ohio ED Opioid Prescribing Guidelines. Other prescribing guidelines on which respondents based their policies and practices were the ACEP guidelines (34%, 38/112), the CDC guidelines (29%, 32/112), and the AAEM guidelines (13%, 15/112).

Among the EDs that reported developing or having an opioid prescribing policy, the majority strongly agreed/agreed that the guidelines have increased the use of Ohio's prescription drug monitoring program (86%) and the Ohio ED Opioid Prescribing Guidelines have reduced inappropriate opioid prescribing (71%). The other potential benefits of the Ohio ED Opioid Prescribing Guidelines are displayed in Figure 1.

The most common strategies used to implement opioid prescribing policies and guidelines were developing educational materials, adapting the educational materials locally to their patient

population, and using local opinion leaders to encourage opioid prescribing policy and guideline implementation (Figure 2).

Opioid prescribing practices

Table 2 shows respondents' perceptions of opioid prescribing practices for pain in the last month in their EDs. For the management of acute pain, respondents rarely (<5% of patients) used IV meperidine, provided a prescription for long-acting or controlled-release opioids, or replaced opioids that were lost, destroyed or stolen as recommended in the guidelines. However, one-third of respondents (33%) reported writing an opioid prescription for more than three days for 5% or more of their acute pain patients. For the management of chronic pain, respondents rarely (<5% of patients) used IV meperidine, provided a prescription for long-acting or controlled-release opioids, replaced opioids that were lost, destroyed or stolen, or provided replacement doses of opioid replacement therapy as recommended in the guidelines. However, 64% of respondents reported using intramuscular (IM) or IV opioids in 5% or more of their chronic pain patients. Also, approximately one-third of respondents provided a prescription for opioids in 5% or more of their chronic pain patients that: (1) had received an opioid prescription from another provider, and (2) had previously presented with the same problem in the last month.

Opioid prescribing procedure

Table 3 shows respondents' perceptions of tasks performed, recommended in the guidelines, for any opioid prescription written in the last month in their EDs. Large variations were reported from EDs around Ohio. For example, 23% of EDs provided written information on the addictive nature of opioids to more than 95% of their patients that received an opioid prescription, while another 23% of EDs never did. Some recommendations in the guidelines were also largely not implemented. Over 80% of EDs reported that they never get patients who are prescribed an opioid to sign a pain

agreement, and 44% reported that they never receive a consultation from the hospital's palliative or pain service.

DISCUSSION

This study found that the majority of Ohio EDs are aware of the need to improve appropriate opioid prescribing and either have a hospital-based opioid prescribing policy, are in the process of adopting one, or are implementing guidelines without a specific policy. Most EDs are aware of the Ohio ED Opioid Prescribing Guidelines and are using them to be more judicious in opioid prescribing decisions. The results of this study demonstrate that ED medical directors, and their delegates, in Ohio believe that the Ohio ED Opioid Prescribing Guidelines have at least been partially implemented and have formed the basis for hospital level prescribing policies. Factors suggesting that the Ohio ED Opioid Prescribing Guidelines were influential include the number of respondents who reported familiarity, perceived impact in terms of improved opioid prescribing and an increase in the use of the Ohio prescription drug monitoring program. These findings are consistent with recent evidence that indicated a decline in opioid prescribing by Ohio ED physicians since the release of the Ohio ED Opioid Prescribing Guidelines.[13] This successful implementation of the guidelines may, in part, be due to the multi-stakeholder input that led to the development of the guidelines and broad support from professional societies and government officials. The fact that they are being implemented so widely indicates that the guidelines offer reasonable advice to ED physicians.

Although respondents generally reported their ED practices aligned with the Ohio ED Opioid Prescribing Guidelines, variability in ED prescribing practices was also observed. The largest variability in ED prescribing practices was the percentage of patient with chronic pain treated with IM or IV opioids. Also, large variability was observed in the percentage of patients being given a prescription for an opioid for more than 3 days, regardless if it was for chronic or acute pain. Such prescribing variability may highlight that these specific guideline recommendations may not be practical or that respondents generally do not agree with them. A revision of these statements and guidance on which clinical scenario they apply to may ensure the guidelines support best practices.

Furthermore, similar variability in ED practices were observed, including the use of Ohio's prescription drug monitoring program and education provided to patients. The largest variation in ED practices was observed for opioid prescriptions being provided to patients with chronic pain even though they had previously presented with the same problem or had received an opioid prescription from another provider in the last month. This lack of standardization in the care and information patients receive is concerning and requires additional investigation to identify their cause.

It is also acknowledged that ED physicians make a relatively small contribution to the overall number of opioids prescribed. In Ohio, ED physicians write approximately 5% of all opioid prescriptions.[16] Hence, guidelines aimed at primary care practitioners that commonly prescribe opioids should also be implemented, such as those developed by the GCOAT[17,18] or the CDC.[19] However, Barnett et al.[20] showed that long-term opioid use is associated with initial exposure from high-intensity ED prescribers. As ED prescribers do not regularly prescribe opioids long-term, it is hypothesized that conversion to long-term use may be driven by clinical "inertia," whereby outpatient clinicians renew previous prescriptions. Our findings suggest that ED physicians may initiate clinical "inertia" due to the fact that approximately 30% of respondents acknowledged that they prescribed opioids to at least 5% of patients that presented with the same problem in the last month. Despite the low number of opioid prescriptions written in EDs, it is important to acknowledge that the EDs are a source of repeat as well as first-time opioid exposures.

Identifying patients that are using EDs for repeat prescriptions is particularly challenging. There is currently no mechanism in Ohio for ED physicians to track patients that move from one ED to another. Although the increased use of Ohio's prescription drug monitoring program could assist with this, it is not mandatory for ED physicians in Ohio to review their records if they prescribe for fewer than seven days.[21] Our results highlight the variability of the programs utilization, with only 12% of respondents stating they used it for more than 95% of their patients prescribed an opioid in

the last month. Without mandatory use of prescription drug monitoring programs in EDs, which may be administratively cumbersome, tracking patients that move between EDs is beyond the current healthcare systems capabilities.

These findings should be considered in light of multiple limitations. In particular, we note that the survey included self-reported data which could be influenced by recall or social desirability bias. The survey reported ED Medical Directors' perceptions of prescribing practices in their ED, which may not accurately reflect individual-level ED prescribing patterns. This data is also not generalizable outside of Ohio and did not include EDs not affiliated with hospitals. Furthermore, information related to the morphine milligram equivalent per prescription was not obtained, which may provide additional insight into the influence of the guidelines. Also, the introduction of the Ohio ED Opioid Prescribing Guidelines occurred in parallel with other national and state-based interventions,[5,10] so it is not known if the Ohio ED Opioid Prescribing Guidelines changed prescribers' views on opioid prescribing or equipped already motivated prescribers with a tool to defend their decision to limit opioid prescriptions. The latter would be consistent with a prior report which indicated that ED physicians used guidelines as a communication tool to protect themselves from liability and patient complaints rather than using them to influence their decision making process.[12]

In conclusion, this study showed that the Ohio ED Opioid Prescribing Guidelines have been widely disseminated, with the majority of EDs in Ohio using them to develop hospital-based opioid prescribing policies. The majority of respondents believed that opioid prescribing guidelines have increased the use of the Ohio prescription monitoring program and have reduced inappropriate opioid prescribing. Although the implementation of the Ohio ED Opioid Prescribing Guidelines is promising, further efforts to promote responsible opioid prescribing in other specialties is also required.

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AUTHOR CONTRIBUTIONS

JP and NM conceived the study and designed the study protocol in collaboration with ML, EH, EW, SC, JB, KK and JD. JP, RM, CC and ET undertook recruitment and data collection. JP and RM performed the statistical analyses and drafted the article. All authors contributed substantially to its revision. JP takes responsibility for the paper as a whole. All authors attest to meeting the four ICMJE.org authorship criteria: (1) Substantial contributions to the conception or design of the work; or the acquisition, analysis, or interpretation of data for the work; AND (2) Drafting the work or revising it critically for important intellectual content; AND (3) Final approval of the version to be published; AND (4) Agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

COMPETING INTERESTS

Dr. Lyons reports grants from Ohio Department of Health, during the conduct of the study; grants from Brightview Health Foundation, outside the submitted work.The remaining authors do not report any competing interests.

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DATA SHARING

No additional data available

ETHICS APPROVAL

The study was approved by the Institutional Review Board (IRB) at the University of Cincinnati and at the ODH.

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TABLES

Table 1. Characteristics of respondents and their hospitals (N=150)

Respondents' position	**n**	**%**
Medical Director	119	79.3
Emergency Physician	19	12.7
Nursing Director	9	6.0
Pharmacist	3	2.0
Rural		
Urban	86	57.3
Rural	64	42.7
Region of Ohio		
Central	21	14.0
Northeast	48	32.0
Northwest	34	22.7
Southeast	15	10.0
Southwest	32	21.3
Hospital funding type		
Non-government not-for-profit	130	86.7
Government non-federal	16	10.7
Investor-owned for-profit	4	2.7
Hospital classification		
Short-term acute hospital	115	76.7
Critical access hospital	32	21.3
Children's hospital	3	2.0

Table 2. Respondents' perception of frequency of opioid treatment in the last month in their emergency department (n=134)[*#]

	Never	1-4%	5-24%	25-49%	≥50%
Provided to patients with acute pain			**n (%)**		
IV[#] meperidine	114 (85)	13 (10)	5 (4)	0 (0)	0 (0)
Opioid prescription that:					
is long-acting or controlled-release	110 (82)	18 (13)	2 (1)	0 (0)	0 (0)
replaces those lost, destroyed, or stolen	91 (68)	31 (23)	4 (3)	0 (0)	0 (0)
is for more than a 3-day supply	30 (22)	49 (37)	30 (22)	15 (11)	3 (2)
Provided to patients with chronic pain					
IM or IV[#] opioids	6 (4)	34 (25)	52 (39)	24 (18)	9 (7)
IV meperidine	118 (88)	11 (8)	0 (0)	0 (0)	0 (0)
Replacement doses of opioid substitution therapy	121 (90)	5 (4)	1 (1)	0 (0)	0 (0)
Opioid prescription that:					
is long-acting or controlled-release	113 (84)	16 (12)	1 (1)	1 (1)	0 (0)
replaces those lost, destroyed, or stolen	97 (72)	26 (19)	3 (2)	0 (0)	0 (0)
is for more than a 3-day supply	52 (39)	43 (32)	23 (17)	10 (7)	0 (0)
Opioid prescription for:					

patients who received an opioid prescription within past month	27 (20)	49 (37)	36 (27)	9 (7)	2 (1)
patients who presented with the same problem within past month	20 (15)	64 (48)	30 (22)	9 (7)	0 (0)

*Although there were 134 respondents, some responded as "Do not know" or did not complete this specific question and are not represented in the table.

#IV=Intravenous, IM=Intramuscular. Questions were based on the Ohio Emergency and Acute Care Facility Opioids and Other Controlled Substances (OOCS) Prescribing Guidelines

Table 3. Respondents' perception of tasks performed when giving an opioid prescription in the last month in their emergency department (n=134)[*#]

	Never	1-4%	5-24%	25-49%	50-74%	75-95%	>95%
Task performed	**n (%)**						
Confirmed identity by photo identification	23 (17)	4 (3)	9 (7)	2 (1)	5 (4)	23 (17)	31 (23)
Searched the Ohio prescription monitoring program	1 (1)	8 (6)	17 (13)	25 (19)	27 (20)	33 (25)	16 (12)
Completed urine or other drug screen	16 (12)	50 (37)	37 (28)	7 (5)	3 (2)	4 (3)	1 (1)
Obtained records from other providers	16 (12)	39 (29)	24 (18)	17 (13)	8 (6)	8 (6)	7 (5)
For chronic pain patients, contacted their routine opioid prescriber	7 (5)	54 (40)	34 (25)	16 (12)	9 (7)	1 (1)	1 (1)
For patients who visit the ED frequently, conducted a case review or management	30 (22)	30 (22)	21 (16)	13 (10)	5 (4)	18 (13)	2 (1)
Obtained a consultation from the hospital's palliative or pain service	59 (44)	50 (37)	10 (7)	2 (1)	0 (0)	0 (0)	1 (1)
Had patients sign a pain agreement	108 (81)	14 (10)	3 (2)	1 (1)	0 (0)	1 (1)	1 (1)
Provide patients with written information on:							
addictive nature of opioids	31 (23)	16 (12)	5 (4)	10 (7)	4 (3)	13 (10)	31 (23)
potential dangers of the opioid misuse	31 (23)	21 (16)	5 (4)	10 (7)	3 (2)	13 (10)	31 (23)
appropriate storage and disposal of opioids	43 (32)	14 (10)	8 (6)	8 (6)	3 (2)	4 (3)	24 (18)

the facility's policy regarding the prescribing of opioids	44 (33)	14 (10)	18 (13)	13 (10)	5 (4)	6 (4)	7 (5)

*Some rows do not add up to 100% (n=134) as "do not know" or incomplete responses are not included in the table.

#Questions were based on the Ohio Emergency and Acute Care Facility Opioids and Other Controlled Substances (OOCS) Prescribing Guidelines

FIGURES

Figure 1. Strategies used to implement opioid prescribing policies and guidelines (n=106)[*#]

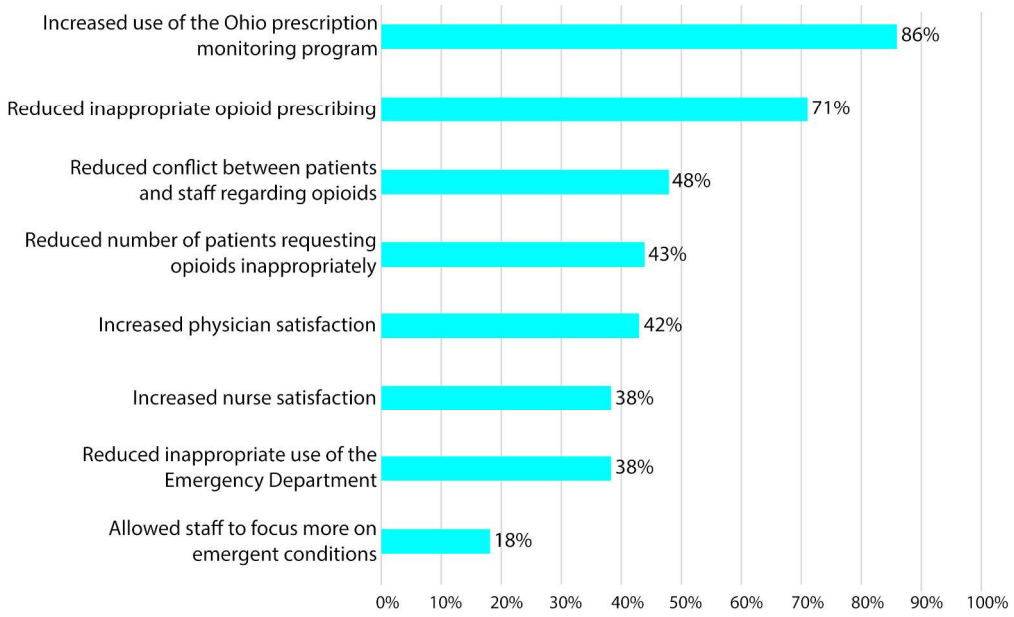
[*] Respondents could chose more than one strategy.

[#] Respondents from six hospitals that have an opioid prescribing policy or guidelines did not respond to this question.

Figure 2. Perceived impact of the Ohio ED Opioid Prescribing Guidelines from respondents that follow an opioid prescribing policy (n=106)*

* Respondents from six hospitals that have an opioid prescribing policy or guidelines did not respond to this question.

Ohio ED Opioid Prescribing Guidelines is also known as Ohio Emergency and Acute Care Facility Opioids and Other Controlled Substances (OOCS) Prescribing Guidelines



Strategies used to implement opioid prescribing policies and guidelines (n=106)*# ┼ ┼ * Respondents could chose more than one strategy. ┼ # Respondents from six hospitals that have an opioid prescribing policy or guidelines did not respond to this question. ┼

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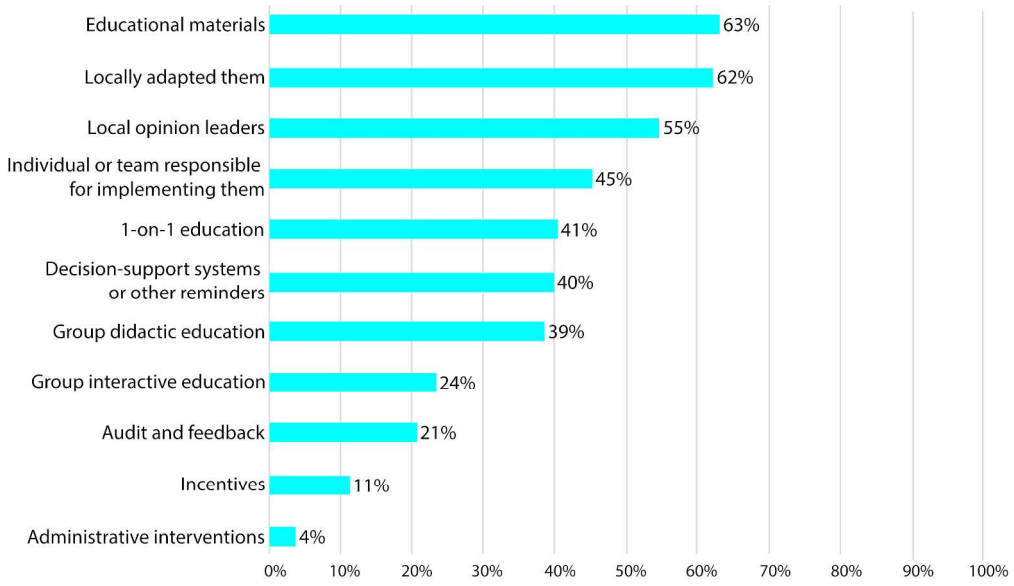

Perceived impact of the Ohio ED Opioid Prescribing Guidelines from respondents that follow an opioid prescribing policy (n=106)*┼ ┼ Perceived impact of the Ohio ED Opioid Prescribing Guidelines from respondents that follow an opioid prescribing policy (n=106)*

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STROBE Statement—Checklist of items that should be included in reports of ***cross-sectional studies***

	Item No	Recommendation	Page number
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	3
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	5-6
Objectives	3	State specific objectives, including any prespecified hypotheses	6
Methods			
Study design	4	Present key elements of study design early in the paper	7-8
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	7-8
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	7
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	7
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	7
Bias	9	Describe any efforts to address potential sources of bias	8
Study size	10	Explain how the study size was arrived at	7
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	8
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	8
		(*b*) Describe any methods used to examine subgroups and interactions	NA
		(*c*) Explain how missing data were addressed	NA
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	NA
		(*e*) Describe any sensitivity analyses	NA
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	9
		(b) Give reasons for non-participation at each stage	9
		(c) Consider use of a flow diagram	NA
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	9, 20
		(b) Indicate number of participants with missing data for each variable of interest	9-11, 21-24
Outcome data	15*	Report numbers of outcome events or summary measures	9-11
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	9-11

		(*b*) Report category boundaries when continuous variables were categorized	NA
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	NA
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	NA
Discussion			
Key results	18	Summarise key results with reference to study objectives	12
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	14
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	14
Generalisability	21	Discuss the generalisability (external validity) of the study results	14
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	16

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.