Adolescents' and Parents' Perspectives on Utilizing the MedSMARxT Families intervention in Emergency Departments for Opioid Medication Safety Education: Mixed Methods Study

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Abstract

Background: The opioid crisis has significantly impacted adolescents and families. This is attributed in part to increased opioid prescriptions in pediatric Emergency Departments (EDs) due to acute pain and injuries. Although EDs frequently prescribe opioids, no preventative interventions have been implemented to educate adolescents and their families on safe opioid use. This study evaluates the MedSMA?T Families intervention, which consists of a serious game and a personalized Family Medication Safety Plan (FMSP) with the aim to reduce opioid misuse. The MedSMA?T Families intervention was developed to educate adolescents and adults prescribed opioids on safe practices such as opioid storage and disposal.

Objective: This study aimed to characterize adolescents' and parents' perspectives on implementing the MedSMA?T Families intervention in the ED to improve opioid education and safety among adolescents.

Methods: A total of 93 participants, including 16 children and 77 parents, were recruited from the Pediatric ED at a tertiary academic hospital to play the MedSMA?T game in the ED. A total of 16 participants, including 8 children and 8 parents, were followed up with interviews. Participants engaged with a serious game – Adventures in PharmaCity – and an FMSP. Data were collected through gameplay observation and 75-minute semi-structured interviews via Zoom. In-game data was analyzed using descriptive analysis and qualitative data was analyzed using thematic analysis with NVivo 14.

Results: Parents spent an average of 21 minutes playing the game, while children spent an average of 22 minutes. Families appreciated game design and noted usability challenges and suggested enhancements for more gameplay instructions. Participants reported increased knowledge of opioid safety, highlighted the importance of communication with healthcare providers, and suggested a mobile app for medication management. The FMSP was perceived as valuable for promoting awareness of safe practices and connected well to the knowledge gained from the game.

Conclusions: The MedSMA?T Families intervention was well received as a beneficial educational tool to educate adolescents and their families on safe opioid use. Additionally, it highlights the need for more accessible digital tools. This feedback indicates a strong interest in improving educational resources to ensure safe opioid management.

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resources to ensure safe opioid management.

Introduction

Pediatric emergency departments (EDs) are considered the best practice models for the emergency care of children.[1-5] Patients frequently visit the ED for acute pain,[6] including headaches, back pain, stomach discomfort, musculoskeletal injuries, postoperative pain, and pain associated with cancer. The use of opioids, conventional nonnarcotic medications (such as acetaminophen and nonsteroidal anti-inflammatory medicines), and nonpharmacological treatments including distraction techniques are among the most common treatments used by emergency physicians for pain management. Despite alternative pain control methods, opioids are commonly used in and prescribed from the ED for moderate to severe pain. Concordantly, adolescent prescription opioid misuse is an increasing concern in the United States (US).[7] Nearly 60,000 opioid-related pediatric visits occurred throughout U.S. emergency departments from 2014 to 2017.[8] In 2017, a public health emergency was declared due to the increased use and overdose incidences from opioids.[9] It is posited that an increased regulatory focus on pain management, aggressive pharmaceutical marketing, and the initial low concern for opioid addiction from prescription opioids has contributed to this crisis.[10-15]

The use of prescription opioids increases the risk of opioid abuse in the future.[16–22] Persons with opioid use disorder commonly report that they were first exposed to opioids through a legitimate prescription, frequently from an ED.[16–22] As a result, the future risks and exposure to prescription opioids have significantly increased for individuals in their youth and adolescence. From 2019 to 2020, prescription opioid-involved death rates increased by 17%.[23,24] Adolescents who report having a valid prescription for a narcotic painkiller by the time they are in the 12th grade are far more likely to abuse these prescription drugs later on.[25,26] Youth who report using opioids for non-medical purposes before reaching adulthood are similarly at risk for abuse.[27] The rate of opioid misuse and opioid-related deaths among pediatric patients has increased along with the rise in opioid

prescribing,[17] in addition to increased hospitalizations attributable to opioid use.[28]

Given the opioid crisis among adolescents in the United States and the increased risk of opioid misuse in this age group, it is crucial to address these issues effectively. Our two-part intervention, MedSMARxT Families, aims to reduce the epidemic of opioid misuse by educating adolescents and their families who have been prescribed opioids from the ED. This intervention consists of an adolescent-tailored serious game entitled MedSMARxT: Adventures in PharmaCity, as well as a family-focused tool called the Family Medication Safety Plan (FMSP), which is a personalized tool for family education.[29] Together, these resources help increase awareness about safe opioid use and provide educational information on safe opioid storage and disposal. This study investigates the effectiveness of the implementation of the MedSMARxT Families intervention in the ED by exploring the perceptions of adolescents and their families regarding the MedSMARxT game and the FMSP.

Methods

Study Design, Setting and Population

The University Institutional Review Board (IRB) approved this study, and written consent was obtained from all participants. Families were recruited from a Pediatric ED at an academic hospital in Wisconsin. Eligibility criteria included the ability to speak, read, and understand English, access to a computer, tablet, or mobile phone with videoconferencing ability, and having been prescribed an opioid medication from the ED. Data was collected through mobile gameplay, interviews, and the creation of a family medication safety plan with child-parent dyads. Recruitment flyers were displayed in high-volume areas throughout the department. Emergency Department Research Coordinators (EDRCs) presented the study and distributed fliers at pre-shift huddles. If a child between the ages of 12-18 in the ED was prescribed an opioid medication, the EDRC team screened and approached families for participation. If families consented, the research team contacted participants by email at least three times to arrange a Zoom gameplay and interview session.

The MedSMART: Adventures in PharmaCity serious game follows the story of an anthropomorphized sheep as they navigate making safe decisions regarding prescription opioids.[29] Correct opioid-related choices progress the story forward, while unsafe opioid-related choices rewind the story to allow the player to re-attempt the level and learn from their mistakes. In level 1, the player learns about safe opioid storage and the consequences of sharing opioids with friends. Level 2 provides background information and enhances the game storyline by adding a real-life scene about being in pain and forgetting there was an important assignment due that day. In level 3, the player learns not to take others' prescription opioid medications. Level 4 teaches the player about the purpose of Narcan® (a medicine that rapidly reverses an opioid overdose) and demonstrates the consequences of sharing opioids with others. Level 5 outlines safe opioid disposal. The game experience is inherently designed to improve adolescents' decision-making about safe opioid use.

The personalized FMSP is a tool for families to record important information about their medications and create a plan for safe use, storage, and disposal.[29] The FMSP is designed to promote communication among families and providers or parent-child dyads as they complete and review the plan. It also serves as a tool for families to reference important medication information in one location and note any questions they have for their healthcare team.

Five MedSMART Families features facilitate family communication and adolescent opioid safety. These include: (1) engaging and interactive delivery through game-based learning; (2) realistic gameplay scenarios where adolescents and parents practice making safe medication choices in various community settings, including at school, in their neighborhoods, and at home; (3) a space for important medication information such as side effects, drug-drug interactions, dosage instructions, and reasons for use; (4) a section for proper storage and disposal information and planning; and (5) an area for positive communication, allowing families to ask questions about medications for their providers. The FMSP is displayed in Figure 1.

Study Protocol

Data was collected between February 2023 and June 2023 until data saturation was reached. Similar to a previous study on Pharmacist's perspectives of MedSMART, data saturation was achieved at 12 participants. However, data collection continued to 16 participants to ensure no new data or themes emerged from the data set. A member of the research team observed child-parent dyads as they played the game and became familiar with the FMSP for 30-minutes during the virtual meeting sessions. Following that, there was a 75-minute semi-structured follow-up interview with the participants. The goal of observation during games was to record any problems that arose during gameplay and to step in if there was a technological error. Zoom was used to record both the interview and the gameplay. The interview audio recordings were professionally transcribed verbatim.

Data Analysis

A descriptive analysis was conducted to analyze the quantitative in-game data. This included reporting the mean and the standard deviation of the total time spent playing the game, the number of distinct levels played, and the number of distinct levels completed. It also included the number of opioid-related decisions or actions that resulted in game failure. Additionally, it reported the number of opioid-related decisions or actions that contributed to game progress and the total time spent playing levels 1-5.

Measures

A standard semantic inductive technique was used to examine qualitative data to investigate aspects associated with child-parent dyads' viewpoints regarding the design and implementation of the intervention. With this method, implementation and iterative design patterns could be explored and defined based on participant answers.

One of the authors analyzed the in-game and the interview data and independently coded each transcript using inductive thematic analyses via NVivo 14, a software program used for qualitative research. After becoming familiar with the data, one of the authors created draft codes and met with

the principal investigator to further discuss, improve, and complete the master codebook. The verbatim transcripts were coded, exported, and compiled to highlight prevalent themes. The principal investigator examined codes and their frequency, utilizing this information to identify the dataset's main themes and subthemes.

Results:

A total number of 93 participants, including 16 children and 77 parents, played the MedSMART game in the ED and provided the in-game data. Sixteen participants, including 8 children and 8 parents, were followed up with interviews. The average time spent playing the game from in-game data for children was 22 minutes (SD = 4.97) with an average of completing 4 out of the 5 levels in the game. On average, child participants made 5 opioid-related decisions/actions during the game process that led to game progress from correct decisions. Alternately, this group made 3 opioid-related decisions/actions that resulted in game failure indicating incorrect decisions, based on different scenarios in the game.

Regarding the in-game data for parents, the average time spent playing the game was 21 minutes (SD = 8.06) with an average of completing 3 out of the total 5 levels in the game. On average, participants made 3 opioid-related decisions/actions during the game process that led to game progress from correct decisions. This same group made, on average, 2 opioid-related decisions/actions that resulted in game failure indicating incorrect decisions based on different scenarios in the game. Table 1 represents the in-game data analysis results for child participants and Table 2 represents the in-game data analysis results for parents.

Four main themes were identified in the MedSMART game. The first theme was titled ‘User Experience’. Three subthemes were then extracted from the data which were: ‘Usability’, ‘Suggestions for Improvement’, and ‘Target Audience’.

Regarding ‘usability’, parents mostly expressed having a hard time figuring out how to play the game and what they were supposed to do as the next steps. Children tended to have a more positive

experience once they became familiar with the game instructions. One child mentioned, *"I really liked the art style. It was really cute. I think the controls were easy to manage and to get the hang of." -Child 6.*

The second subtheme was ‘Suggestions for Improvement’ which included providing more interaction with scenarios throughout the game, more complexity in gameplay, more educational content on Narcan®, and providing more guidance on emergency situations related to that.

The last subtheme was ‘Target Audience’. Feedback emphasized that the game’s target demographic seemed more suitable for children under 12 years old. One parent stated, *"… I think if you're looking for giving it to demographics that are above the age of 12, or adults, it needs to be a game that would capture that attention." -Parent5.*

The second main theme identified was ‘Educational Learning and Value’. Two subthemes extracted from this theme were ‘Learnings’ and ‘Perceived Goals’. In the ‘learnings’ category, participants highlighted significant takeaways from their experience playing the game and increasing their knowledge on important educational content. This included proper and safe disposal, storage methods, and side effects of opioids. One parent admitted, *"I liked just learning more about the opioids. I did not know that you could take unused or expired prescriptions back to a pharmacy. " -Parent 7.*

Regarding the ‘Perceived Goals’, the educational aims were positively received such as teaching the significance of not letting peer pressure decide especially when children are at school and educating on safe medication management. As one parent stated, *"I thought it was a good way to teach people how to maintain and manage their medications and keep it out of the hands of other kids and the scenarios of not using other kids’ medications in school or in the home or on the bus." -Parent 4.*

The third theme included ‘In-game Elements’ with subthemes of ‘Character Perception’ and ‘Scenario Evaluation’. For ‘Character Perception’, while the child participants appreciated the realistic and fun character design, several parents found them too juvenile and more appropriate and

appealing for 12 years or under.

In the ‘Scenario Evaluation’, participants perceived the game scenarios to be realistic and relatable, and simulated real-world situations specifically different scenarios that could happen at schools. This reportedly made it a more engaging learning experience. One child noted, *"I feel like they were pretty good and just showing different situations that you could easily have any common ones at school." -Child 8.*

The last theme recognized was ‘Educational Gaming Experiences’ with two subthemes as ‘Interest in Educational Games’ and ‘Perceived Value’. Regarding the first subtheme, ‘Interest in Educational Games’, general enthusiasm was found for educational gaming among both parents and children. Participants mostly indicated that playing educational games is enjoyable if they find an element of fun and engagement in the gameplay. As one child shared, *"I don't mind playing games that are educational as long as they are fun." -Child 1*.

According to the last subtheme of ‘Perceived Value’, participants valued the game’s educational potential and the effective incorporation of educational content in an engaging format that captures attention and interest while increasing knowledge and awareness. One child mentioned, *"I've played some other educational games, and I think there are just many different pathways you can go down with different consequences." -Child 8*. Table 3 presents further feedback on themes, subthemes, and additional illustrative quotes for the MedSMART game.

Three main themes were identified as a result of thematic analysis for the FMSP. The first theme was ‘Routine Medication Management’ with two subthemes, ‘Medication Safety Practices at Home’ and ‘Communications with Healthcare Providers’. ‘Medication Safety Practices at Home’ reported various practices in terms of the storage and disposing of opioids to maintain safety and securing medication management strategies. One parent stated, *"I have a lockbox that has some actually, old medicines that need to be taken to a drop box in it. But otherwise, everything is pretty accessible." -Parent5.* One child noted, *"We keep them in a cabinet or a special door. We don't really take them*

unless we need to." -Child 7.

For ‘Communications with Healthcare Providers’, parents highlighted the significance of effective communication with healthcare providers regarding medications and different questions they may have. They mostly reported using digital platforms such as MyChart to communicate with their doctors and reaching out to their pharmacists asking prescription related questions. One parent reported, *"… it's mostly by MyChart, you can just, send the doctor a message and they're pretty fast at responding back. Unless it's something you need an immediate [response], then you call." -Parent 4*. Another parent mentioned, *"I used to talk to the pharmacist about it. I usually also ask about if I am on any other medications or vitamins if it is all okay, whether or not I have to take it with food, trying to figure out a schedule of when I need to take it, writing it down as to when I took it last, if I forget, I can look back at that log to see when the last time is that I took it." -Parent 2.*

The second theme was ‘FMSP Usability’, including a subtheme identified as ‘FMSP Implementation Setting’. Participants had a perception that healthcare providers would play an important role in implementing the FMSP. Many participants shared different ways for providing information about the FMSP to patients, such as adding prescriptions from doctors’ offices, being implemented through MyChart in after-visit summaries, as a printout in your medication bags at the pharmacy or being advertised at schools. One parent noted, *"… it could be something in your after-visit summary that they print out or put on MyChart for you. Your pharmacist could print one out and put it in your medication bags." -Parent 6.*

A child suggested, *" I feel like pharmacies or doctor's offices [would] be good? Even if there was an ad or commercial, could bring it up at school too, or health class or advisory?" -Child 6.*

The second subtheme was ‘Recommendations for Platform Enhancement’. Participants provided insightful comments on improving the usability of the FMSP. Many stated that an app on mobile devices would facilitate medication tracking, making it more convenient to have medication reminders and logs accessible. One parent reported, *"I think an app would be most useful because*

you have your phone with you all the time, and if you are away from home, and you have medication with you, that you take, you would be able to track it, when you took it. If you had any side effects, you could maybe even set an alarm on your phone, through the app that would tell you or remind you now is time to take your medication. and then you can maybe check it off so that you know that you took it at that time, and you can look back and see the times that you have taken it." -Parent 2. A child also suggested improvements such as *"Well if it's in an app, on a phone or computer, or if you have an Apple Watch." -Child 4.*

The third and the last theme identified was 'FMSP Usage', with two subthemes of 'Awareness and Education' and 'The Correlation Between the MedSMARt Game and the FMSP'. For 'Awareness and Education', participants perceived the FMSP as a useful and beneficial tool for increasing their awareness and knowledge about medication safety practices such as safe disposal, storage, and use of opioids. As one parent mentioned, *"Knowing where else to dispose of them. It'd be easier for me to go to the pharmacy because I go there to pick up medications and I can just dispose of them through the pharmacy. And for some people working through it with their pharmacist or even a pharmacy tech for there's a lot of low health literacy out there. " -Parent 4.* Children also echoed the desire for similar tools for safety.

'The Correlation Between the MedSMARt Game and the FMSP' subtheme indicated a perceived connection between the knowledge gained form the MedSMARt game and the principles of the FMSP. One parent remarked, *"… it made it easier because already have to think about medication storage and disposal because you'd already gain some knowledge. " -Parent 8.* Participants emphasized the educational value of the game and that learning from the game reinforced key safety messages, such as not sharing opioids and adhering to prescribed dosages. Table 4 presents themes, subthemes, and additional illustrative quotes for the FMSP.

Discussion

As the opioid crisis continues, opioid education and prescribing practices continue to be a highlight

of investigation and improvement in EDs nationwide. This study sought to understand adolescents' and parents' perceptions on the MedSMARxT Families intervention for both gameplay and the FMSP. This study addresses this gap by exploring their valuable and novel insights regarding this intervention. It also demonstrates general acceptability and usefulness of the MedSMARxT Families intervention in educating parents and children presenting to an ED about opioid safety.

The findings from our study suggest that users found the game straightforward and smooth to play once they became familiar with the instructions. Participants were willing to have direct communication with healthcare providers and utilize digital tools to ensure appropriate medication management and opioid safety. Respondents' feedback suggested enhancements for the platform to be more user friendly, flexible, and tech-savvy to support and facilitate medication management. Our results also indicate a strong desire for ongoing education regarding medications and especially opioid management.

A previous study was conducted to explore ED staff perceptions on implementing the MedSMARxT Families intervention in the ED setting and assessing its feasibility within the context of the ED environment. It was reported that the game is more fun and age-appropriate for adolescents compared to the current educational materials used in the ED. ED staff believed that an interactive design and real-life scenarios helped with creating a unique approach to involve adolescents, as they are interested in technology-based games. Game availability as a phone app and translation to other commonly used languages among non-English speaking patients such as Spanish and Hmong were suggested. Additionally, it was reported that the FMSP is a good resource for families at home as it provides detailed information regarding safe opioid use, disposal, and storage that is often missed in patient education.[30]

Results are also consistent with a previous study on assessing adolescents' experiences and their suggestions for the use of the MedSMARxT game. This identified that adolescents were successful in identifying the game's aim which is promoting opioid medication safety. They had positive

impressions of the game's level, graphics, and characters. Participants recommended more instructions for how to play the game and create more game levels, which were implemented at that time.[31]

In another study that explored parents' perceptions of the MedSMART game, participants expressed positive reactions to the game characters and scenes depicted in the game. They thought scenarios were appropriate and realistic for adolescents and raised their awareness about safe strategies to store and dispose of opioids. Similar to the current results in our study, parents reported some challenges for navigating through the game. The slow pace of the game was viewed as a significant difficulty for gameplay. However, parents still recommended implementing the game in both healthcare and non-healthcare settings.[32]

Pharmacists' perceptions about the MedSMART game have also been previously examined. Results highlighted the age-appropriate language of the game for adolescents and the use of relatable characters in the game design. Pharmacists valued the interactive nature of the gameplay, which lead to active learning and recalling educational content.[33]

Adolescents have also found the FMSP to be an acceptable and useful tool for opening conversation about opioids and other medications with their parents.[34] Parents' also viewed utilizing the FMSP to promote proper opioid prescription practices with adolescents as demonstrated in this study, and reinforced the significance of a personalized family plan for safe medication management and practices at home.[35] Similarly, pharmacists' perceived the FSMP as a tool to encourage interactive opioid conversations between adolescents, families, and pharmacists as well. They believed that patients might use the FMSP as a visual cue to help think of what questions families should ask pharmacists.[36]

While there are similarities between other previous studies and our study, findings suggest significant positive impressions and key recommendations for future improvement of the intervention. Participants also highlighted important considerations for leveraging healthcare professionals to

implement the intervention in their healthcare settings. This would facilitate effective communication with healthcare providers and the use of this intervention for families.

Limitations

As child-parent dyads interviews were recorded via Zoom, participants might have been more likely to respond in a socially desirable manner, as opposed to non-visual phone interviewing. Another limitation is that all the participants interviewed were from one academic ED, which may not represent the sentiments of all EDs across the United States. Given the unique characteristics of ED settings and their vital role in intervention implementation, further research using a more diverse sample of ED settings is warranted to gain organizational-related information and adaptations.

Conclusions

In conclusion, participants found the MedSMART intervention to be a useful educational tool for adolescents and families who were prescribed opioids from an ED about safe opioid use, storage, and disposal. Participants offered insightful feedback on user experience and suggested future improvements regarding content and gameplay instructions. Participants appreciated the FMSP as an instructional tool. Future improvements were recommended, including making it available on mobile devices. There is a clear need for improved digital tools that promote opioid safety and highlight the significance of knowledge, instruction, and useful tactics for efficiently managing opioids and other medications in the home.

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Supplementary Files