Using the March of Dimes "Becoming a Mom" Prenatal Program to Improve Maternal Attitudes and Knowledge

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Abstract

Background. Premature birth, low birth weight, birth defects, and Sudden Infant Death Syndrome were identified as issues contributing to infant mortality in Kansas by the state's Blue Ribbon Panel. The March of Dimes *Becoming a Mom (BAM)* prenatal program was implemented in four counties identified with high infant mortality rates and significant birth numbers (Geary, Saline, Sedgwick, and Shawnee) by the Kansas Blue Ribbon Panel. The purpose of this study was to identify the changes in prenatal attitudes, knowledge, and health outcomes among BAM program participants.

Methods. A collaborative community-based model incorporating multidisciplinary teams was created to address the health disparity gap in birth outcomes. Patients participated in multiple prenatal education sessions using a curriculum developed by the March of Dimes. A pre-/post-test design was implemented for the prenatal sessions. Changes in attitudes were assessed using descriptive statistics. Paired t-tests were used to assess the difference in knowledge questions from pre- and post-tests. Health outcomes were analyzed using descriptive statistics.

Results. Participants were 69% White, 87% spoke English, 64% were under age 26, 41% were employed full time, 45% had some high school or had a diploma, 39% had Medicaid, and 49% were enrolled in WIC (N=114). Participants demonstrated a statistically significant increase in knowledge among 14 out of 32 questions including: identifying signs of preterm labor, what to do during preterm labor, postpartum symptoms, and baby sleep position. There were also changes in prenatal attitudes including: need for prenatal care as soon as possible, continuing prenatal care when feeling healthy and not smoking during pregnancy. Relative frequencies were tabulated for week of delivery, infant birth weight, type of delivery, and presence of maternal and infant medical conditions.

Conclusion. The March of Dimes BAM program participants reported improvements in prenatal knowledge. The BAM program can improve maternal knowledge through a community-based collaborative model of care. The combined prenatal education program with quality prenatal care can result in better maternal and child health outcomes.

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Introduction

Infant mortality rates in the United States have declined in recent years.[1] However, the mortality rate among Kansas infants remains higher than the national average, 7.5 deaths per 1000 births versus 6.7 deaths for 1000 births, respectively.[1] The leading causes of infant death include short gestation, low birth weight, sudden infant death syndrome, and maternal complications of pregnancy.[2-3] Additionally, there continues to be a disparity in infant mortality by race/ethnicity, marital status, and maternal education.[3] In underserved communities, frequently comprised of ethnic

minority populations with decreased education and income, it may be particularly important to provide optimal prenatal care to address the social and environmental contributors of infant mortality.

Group prenatal care has the potential to impact some of the leading causes of infant death.[4-5] Group prenatal care has been established as a method to educate women about prenatal care without the time constraints of a traditional prenatal appointment. Patients learn by hearing about other group member's experiences and concerns, as well as participating in group discussions, which lead to social enrichment.[6] Group prenatal care has increased self-worth and self-confidence for participants.[7] In a randomized controlled trial, Ickovics et al.[8] found that group prenatal education improved patient outcomes when compared to those in traditional prenatal care. Additionally, they identified multiple areas where group prenatal care is more beneficial than traditional prenatal care in areas such as scheduling, continuity of care, community building, less cost, and more provider-patient time.

A recent review paper evaluated previous studies that have compared group and individual prenatal care and found favorable outcomes related to group prenatal care.[9] However, these studies focused primarily on the "Centering Pregnancy" group prenatal model. They lacked evidence describing how group prenatal care produces better outcomes than traditional prenatal care. They suggested that future research should look at other group prenatal programs with a focus on how the group educational setting is optimal.

The CenteringPregnancy® group pre-natal model and curriculum has been well described and evaluated.[4,7,10-13] However, while this program has proven effective, it may be economically infeasible for use in underserved communities or for widespread implementation. Additionally, as acknowledged by the CenteringPregnancy® investigation team, one model of group care may not be equally as effective for specific ethnic populations or in differing cultural and community settings.[14] Therefore, the March of Dimes set forth to create a community collaborative model for prenatal education designed to meet the needs of various cultures and women in the community setting.

The Kansas Blue Ribbon Panel on Infant Mortality was formed in June 2009 with the purpose of identifying key issues contributing to Kansas infant mortality rates to provide recommendations to the Kansas Department of Health & Environment.[15] A statewide evaluation was conducted to identify those communities with both high infant mortality rates and significant birth numbers. The counties were Sedgwick, Geary, Shawnee, and Wyandotte. According to this evaluation, the leading causes for infant mortality in Kansas were premature birth/low birth weight, birth defects, and Sudden Infant Death Syndrome (SIDS).

Immediately following these recommendations, the Kansas Chapter of the March of Dimes developed plans for implementing birth disparities programs in targeted communities across the state with the philosophy that every effort should be made to prevent the occurrence of preterm birth and reduce the associated infant mortality rate. The purpose of implementing this program was to advance patient education, assist and augment existing public health services, and clinically intervene in prenatal and pre/interconception periods. The primary goal of the program was to decrease preterm birth by increasing awareness of causal factors while changing the attitudes and behaviors to impact community-specific risk factors and to implement prevention strategies.

Two priority areas were targeted in Kansas: eliminating birth disparities and eliminating elective birth procedures (a delivery performed for a nonmedical reason such as induction or cesarean section). The community health education component utilizes the March of Dimes *Becoming a Mom* and *Comenzando bien* curricula within the county health department or other community setting. The clinical component utilizes the March of Dimes 39 Weeks Toolkit, a tested program that provides a road map to assist with system evaluation, prevent elective birth procedures, and reduce the instance of early-term births and neonatal intensive care admissions. Both programs have standardized evaluation tools to evaluate knowledge and maternal and infant health outcomes. The programs are in place in four locations across the state of Kansas, however, no control group is being evaluated for comparison.

The purpose of this study was to identify the changes in prenatal attitudes, knowledge, and health outcomes among program participants using the March of Dimes *Becoming a Mom* (MOD-BAM) group prenatal protocol in various locations in Kansas. This study was unique in that previous group prenatal research has not documented the benefits of the BAM program for Kansas despite poor birth outcomes across the state.

Methods

Participants. The MOD-BAM program was implemented in four counties (Geary, Sedgwick, Saline, and Shawnee) across Kansas with staggered implementation dates. These counties met specific implementation criteria (e.g., an organized group made up of various stakeholders and other pre-planning logistics). The evaluation focused on participant data from July 1, 2013 through Dec. 31, 2013 among those that collected both pre- and post-test data.

Measures. Group prenatal program participants' attitudes, knowledge, and breastfeeding intentions were assessed with a pre- (given at initial prenatal session) and post-test (given at final prenatal session). Prenatal attitudes were assessed with four questions on a Likert scale asking about smoking and alcohol use during pregnancy and two questions related to the importance of prenatal care. There were 31 knowledge questions asking participants to identify signs of preterm labor, steps to take when experiencing preterm labor, postpartum symptoms, and general prenatal health (Appendix A lists the prenatal knowledge questions). Birth health outcomes were collected from participants' medical records by designated clinical personnel involved with the community-based project. The number of women breastfeeding was obtained through self-report data.

Analysis. Descriptive analysis assessed attitude changes from pre- and post-test. Paired t-tests were used to assess knowledge differences from pre- to post-test. Descriptive statistics were used to describe health outcomes compared to Kansas averages and breastfeeding intention and follow through. All analyses were conducted with IBM SPSS version 20.[16]

Results

Given the staggered implementation of the program, there were 323 participants during the study time period. The majority of the participants were not at the program completion stage, therefore, ineligible to take the post-test. However, 114 participants completed the MOD-BAM program during the study time period as indicated by having both pre- and post-test data.

Participants were predominately White (69.3%), English speakers (86.6%), under age 26 (64.0%), Medicaid recipients (38.9%), and employed full-time (40.7%). Only 29.5% had a high school diploma.

Almost half were in the Women, Infants, and Children program (WIC; Table 1).

Participant attitudes changed favorably for the importance of prenatal care questions and smoking and only slightly for alcohol use during pregnancy. On the pre-test, 51.8% of participants strongly agreed that a woman who gets prenatal care as soon as she finds out she is pregnant will have a healthier pregnancy; on the post-test, 65.8% strongly agreed. On the pre-test, 69.9% of participants strongly agreed that a pregnant woman should go for prenatal care even if she feels healthy; on the post-test, 88.5% strongly agreed. On the pre-test, 65.8% of participants strongly agreed that smoking during pregnancy is harmful to a baby’s health; on the post-test, 88.6% strongly agreed. There was a slight positive attitude change related to alcohol use during pregnancy from pre- to post-test; women strongly disagreed they can drink alcohol during pregnancy without harming their baby (86.7% and 87.8%, respectively).

Table 1. Participant characteristics (N=114).

Race/ Ethnicity	N (%)	**Education**	N (%)
White	79 (69.3)	Some high school	17 (15.2)
Black	13 (11.4)	High school diploma	33 (29.5)
Hispanic	20 (17.5)	Some college	28 (25.0)
Other	2 (1.8)	College graduate	25 (22.3)
Language		Advanced degree	9 (8.0)
English	97 (86.6)	**Insurance**	
Spanish	15 (13.4)	Private	38 (33.6)
Age		Medicaid	44 (38.9)
<16	3 (2.6)	Tricare	8 (11.5)
16-20	31 (27.2)	Uninsured	13 (11.5)
21-25	39 (34.2)	Other (not specified)	10 (8.8)
26-30	27 (23.7)	**Employment**	
31-35	11 (9.6)	Full-time	44 (40.7)
36-40	2 (1.8)	Part-time	26 (24.1)
40+	1 (0.9)	Not employed	38 (35.2)
Enrolled in WIC	54 (48.6)		

Participants demonstrated a statistically significant increase in knowledge among 12 of 31 questions which focused on identifying signs of preterm labor, action to take during preterm labor, identifying postpartum symptoms, drug use while pregnant, and baby sleep position (Table 2). Participants had significant knowledge gains pre- to post-test in identifying all six signs of preterm labor correctly, including contractions (78% to 91%; $p = 0.001$), bleeding (83% to 91%; $p = 0.019$), baby pushing down (72% to 88%; $p = 0.007$), backache (66% to 89%; $p < 0.001$), belly cramps (48% to 89%; $p < 0.001$), and cramps that feel like a period (65% to 93%; $p < 0.001$). Ninety-three percent of participants correctly identified on the post-test that they should rest if they are experiencing preterm labor ($p = 0.019$). Correct responses on the post-test revealed that 67.6% of participants identified that excessive bleeding was not normal ($p = 0.049$), 92.3% identified that differences in

bladder control is normal (p = 0.033), and 76.9% identified that night sweats are normal (p = 0.002). All participants correctly identified that using drugs while pregnant is harmful and that babies should be put to sleep on their back (p = 0.045 and p = 0.001, respectively). Among knowledge questions related to nutrition, including fruit, vegetable, and calcium intake, the importance of breast milk, and the importance of interacting with the baby, participants scored correctly pre- and post-test.

Table 2. Significant changes in prenatal knowledge.

	Pretest	Posttest	*p*-value
Preterm labor signs	% correct	% correct	
Contractions	78.4	90.8	0.001
Bleeding	82.5	90.8	0.019
Baby pushing down	72.3	88.4	0.007
Backache	66.3	88.7	< 0.001
Belly cramps	47.8	89.2	< 0.001
Period like cramps	65.0	88.9	< 0.001
Preterm labor action-rest	82.4	92.6	0.019
Postpartum symptoms			
Bleeding	53.4	67.6	0.049
Bladder control	84.0	92.3	0.033
Night sweats	55.6	76.9	0.002
Drugs use while pregnant	96.4	100.0	0.045
Baby sleep position	85.7	100.0	0.001

Although not statistically significant, there were several areas where participants had low or diminished knowledge scores from pre- to post-test. Those areas included action to take during preterm labor: doing nothing and waiting for an hour or two for symptoms to go away (78% to 77%), postpartum fever (80% to 83%), baby blues (84% to 87%), nonstop crying (73% to 74%), panic (65% to 68%), lack of interest in baby (81% to 78%), drug use before pregnancy (89% to 84%), and waiting before getting pregnant again (12% to 15%).

During the reporting period, there were 31 birth outcomes abstracted from participants' medical records (Table 3). On three of the four outcome indicators, the MOD-BAM participants had better outcomes than those in the state overall. Program participants had a higher percentage of vaginal births compared to the state average (81% vs 70%, respectively). There were fewer low birth weight babies (6.5% vs 7.2%, respectively) and more program participants initiated breastfeeding than in the state overall (93% vs 82%). For gestational age, program participants had a higher percentage of prematurely born infants than in the state overall (13% vs 9%, respectively).[17]

Figure 1 shows the percent of women intending to breastfeed both pre- and post-test and the percentage of women who reported actually breastfeeding after giving

birth. 83% of women reported they planned to breastfeed at pre-test and that increased to 86% at post-test. The actual percentage of women breastfeeding was 84%.

Table 3. Relative frequency of maternal and infant health outcomes among women participating in the *Becoming a Mom/Comenzando Bien* program.

Outcome	N (%)
Weeks baby delivered	
<37 weeks	4 (12.9)
37-39 weeks	13 (41.9)
>39 weeks	14 (45.2)
Low birth weight infant (< 5lb 8 oz)	
Yes	29 (93.5)
No	2 (6.5)
Vaginal delivery	
Yes	25 (80.6)
No	6 (19.4)
Induction	
Yes	16 (51.6)
No	14 (45.2)
Missing	1 (3.2)
Cesarean delivery	
Yes	5 (16.1)
No	21 (67.7)
Missing	5 (16.1)
Maternal medical condition	
Yes	6 (19.4)
No	18 (58.1)
Missing	7 (22.6)
Infant medical condition	
Yes	6 (19.4)
No	21 (67.7)
Missing	4 (12.9)

Discussion

The study findings demonstrated positive gains in prenatal attitudes, knowledge, and outcomes for participants in the *Becoming a Mom* program. Significant knowledge improvements included preterm birth and safe sleep; both are important factors related to infant mortality. Overall, there were knowledge gains in recognizing preterm labor, what action to take when experiencing preterm labor, postpartum symptoms, drug use while pregnant, and appropriate baby sleep positioning. A recent systematic review assessing the group model of prenatal care suggested that prenatal knowledge gains and health outcomes improvements show promise.[18] However,

the authors cautioned the interpretation of the findings due to the lack of published evidence and quality of the studies. The majority of studies were quasi-experimental or non-experimental in design. Our preliminary findings suggested the MOD-

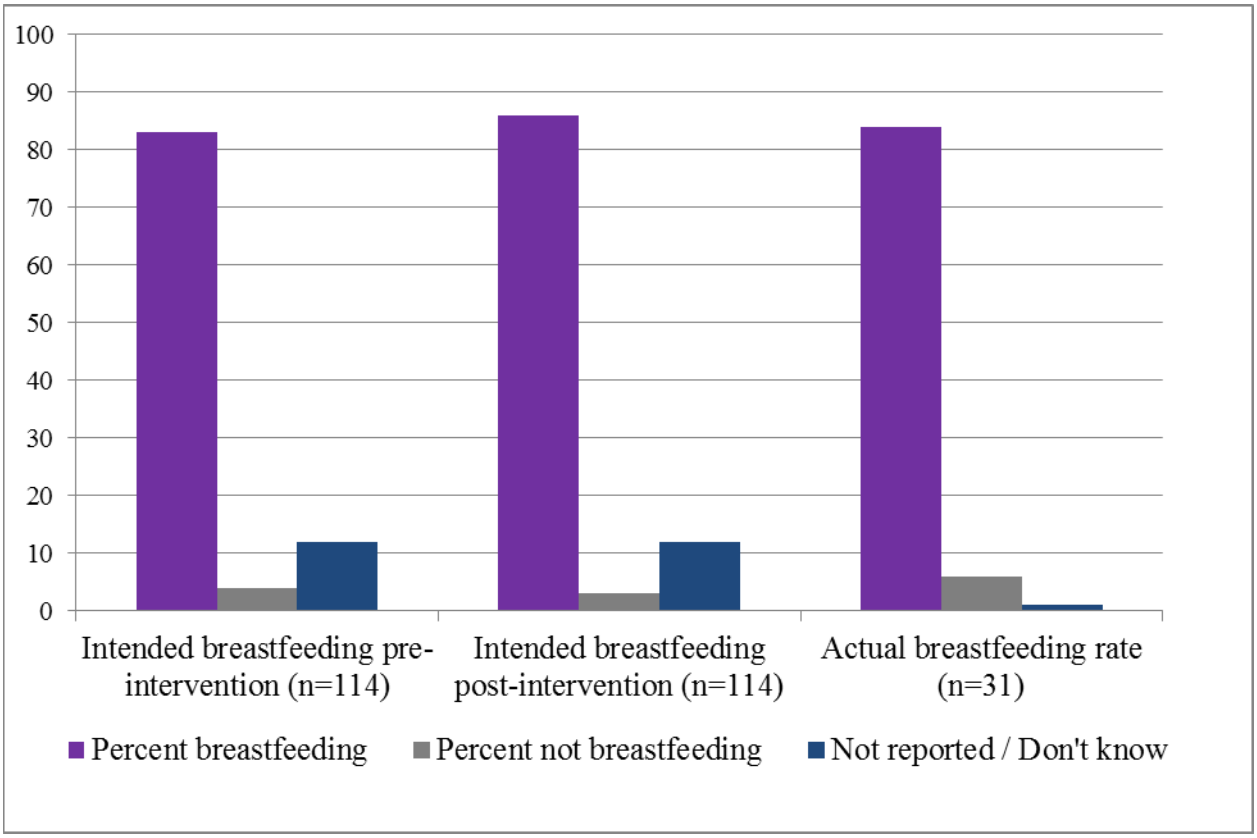

Figure 1. Percent of women intending to breastfeed pre-intervention and post-intervention and percent reporting breastfeeding after giving birth.

BAM program can improve maternal and child health outcomes when combined with quality prenatal healthcare. Vaginal delivery rate was 10.8% higher among participants. Breastfeeding initiation was reported by almost all participants, 11% more than the Kansas average. These findings supported the use of an enhanced community-based model of care using the March of Dimes curriculum.

There were several limitations to our study. Loss to follow-up and participant decay limited available data for program analysis. Multiple-site community-based programs often have a lack of program implementation fidelity. Each community implemented the *Becoming a Mom* group prenatal care in a way befitting their population, but not necessarily consistently between sites. The use of consistent evaluation tools and data collection procedures were used to mitigate these limitations.

Additional educational focus is warranted on actions to take during preterm labor besides rest; identifying normal verses abnormal postpartum symptoms such as fever, fatigue, baby blues, crying, panic, needing to nap, and lack of interest in baby; drug use before pregnancy; smoking; use of pain medication during labor; and baby's brain growth phase. As with most educational programs, there is room for improvement. The following topics warrant

additional education to strengthen prenatal knowledge and improve birth outcomes: not waiting to call a provider if experiencing preterm labor, five of the ten signs of postpartum symptoms, not using drugs before pregnancy, and waiting before becoming pregnant again. Previous studies have shown that prenatal knowledge leads to better birth outcomes such as birth weight and gestational age.[8,10,15,19-21] Since the majority of knowledge gaps identified by the present study relate to postpartum symptoms, it will be important to emphasize the postpartum phase of pregnancy during prenatal sessions.

The March of Dimes *Becoming a Mom* group prenatal care has proven a viable, affordable model for educating pregnant women about prenatal health. In the Kansas counties where the MOD program was implemented, attitudes and knowledge of the participants changed favorably. Gaining knowledge through this collaborative community program about their pregnancies facilitated healthier choices by the participants, resulting in better birth and infant outcomes. Patients that acquired knowledge felt empowered to become active participants in their health and at the group meetings, resulting in better pregnancy outcomes.

Various aspects of MOD group prenatal care, such as increasing patient-provider time, scheduling ease, being cost-effective, and collaborating with other health professionals, are beneficial to the providers as well as the patients.[5,7-9,14,18,21] The increased interaction allows providers to address potential social, psychological, and behavioral issues with the patients and potentially improve the health of the pregnancy and birth outcomes since those patients who see their provider more have more trust and communication than those with less frequent interactions.[22] Since the MOD program teaches women about resources in the community based on their needs, they can have access to other health professionals which can enhance the services available to them, such as nutritional information, health education, and social services. These additional resources can increase the patient's health literacy aiding in improvement of maternal/ fetal outcomes.

As residency programs generally are comprised of a more diverse patient population with many health and social issues, this MOD program could be beneficial to the health outcomes of their pregnant patients. This program could be instituted in residencies and would provide assistance to communities that have poor maternal and fetal health outcomes while providing medical residents with the benefit of learning good perinatal care as well as learning to structure group visits. Group visits have shown successful outcomes with illnesses such as diabetes, obesity, asthma, and COPD. With this group visit structure, residents could conduct additional research with the focus of improving other perinatal and postnatal health outcomes of their patients. By using the group visit structure, education could be concentrated on the areas of concern to aid in favorable attitude and knowledge change and improvement of their community's perinatal and postnatal health outcomes. With wider implementation of the MOD program in other communities and residency programs with ethnic diversity, birth outcomes and maternal/fetal health could be improved and potentially decrease racial disparities of poor perinatal outcomes in these communities.

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Keywords: preconception care, health knowledge, attitudes, practice, prenatal education, Kansas

APPENDIX A: Prenatal knowledge questions

1	Sign of preterm labor: Contractions that make your belly tightening up like a fist every 10 minutes or more. (Y/N)
2	Sign of preterm labor: Change in the color of your vaginal discharge or bleeding from your vagina. (Y/N)
3	Sign of preterm labor: The feeling that your baby is pushing down. (Y/N)
4	Sign of preterm labor: Low, dull back pain. (Y/N)
5	Sign of preterm labor: Belly cramps with or without diarrhea (Y/N)
6	Sign of preterm labor: Cramps that feel like your period. (Y/N)
7	Should a pregnant woman do the follow if she is experiencing preterm labor: Call her health care provider right away. (Y/N)
8	Should a pregnant woman do the follow if she is experiencing preterm labor: Stop what she is doing and rest on her left side for one hour. (Y/N)
9	Should a pregnant woman do the follow if she is experiencing preterm labor: Drink 2-3 glasses of water or juice (not coffee or soda). (Y/N
10	Should a pregnant woman do the follow if she is experiencing preterm labor: Do nothing, and wait for an hour or two to see if the symptoms go away. (Y/N)
11	Should women take multivitamins with folic acid or prenatal vitamins after having a baby? (Y/N)
	Are the following postpartum symptoms normal for a mother to experience after delivery? (Y/N)
12	Bleeding more than a pad in an hour

13	Fever
14	Differences in bladder control
15	Night sweats
16	Fatigue (being tired)
17	Baby blues for a day or two
18	Nonstop crying
19	Panic for no reason
20	Needing to nap
21	Lack of interest in your baby
22	Is it important for a pregnant woman to eat more fruits and vegetables? (Y/N)
23	It is important for a pregnant woman to eat more calcium rich foods like cheese, corn tortillas, broccoli and milk? (Y/N)
24	Using drugs before getting pregnant is harmful to my future baby's health? (Y/N)
25	Using drugs once during my pregnancy is harmful to my baby's health? (Y/N)
26	It is ok to let people smoke around me while I am pregnant or around my baby once he/she is born? (Y/N)
27	I have a choice whether or not to use pain medication during labor and delivery? (Y/N)
28	Are the last few weeks of pregnancy from week 36 to week 39 important for my baby's brain growth and development? (Y/N)
29	Talking to, signing to, touching and smiling at your baby will help him/her form into a secure baby and child. (Y/N)
30	Is breast milk best for a baby? (Y/N)
31	How will you lay your baby down to sleep: (multiple choice)

Dental-Related Emergency Department Visits and Community Dental Care Resources for Emergency Room Patients

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Abstract

Background. The number and cost of dental-related visits to Emergency Departments (ED) is a significant issue nationwide. A better understanding of the treatment provided to ED patients presenting with dental complaints and community dental resources is needed.

Methods. A three-tiered approach included: 1) a 12-month retrospective chart review for dental-related ICD-9 visit codes at an urban academic ED in Kansas City; 2) surveys of 30 providers at the same ED regarding the dental patient process and treatment; and 3) telephone surveys of 16 Kansas City area safety net clinics regarding service access.

Results. Out of 49,276 ED visits, 676 were related to dental conditions (70 were repeat dental ED visits). Most patients were female (54%), white (45%), age 20-39 (65%), and self-pay (56%). The most prevalent codes utilized were dental disorder not otherwise specified (NOS; 57%), periapical abscess (22%), and dental caries NOS (15%). Nearly all providers (97%) felt comfortable seeing patients with dental complaints. Chart review indicated that patients received a dental screen/exam during 80% of the encounters, with medication provided to 90% of the patients. Over two-thirds of the providers (N = 23/30) regularly prescribed antibiotics and pain medications for their ED dental patients. ED providers performed dental procedures in 63% of the patient cases. The most common procedures included dental blocks (N = 16 providers) and incision and drainage (N = 4 providers). Only two of the 16 safety net clinics provided comprehensive dental care, almost all (94%) clinics required patients to call to schedule an appointment, and there was a two to six month waiting period for 31% of the clinics.

Conclusion. The limited scope of dental treatment in the ED, coupled with poor availability of safety-net dental resources, may result in dental exacerbations and suboptimal patient clinical outcomes. The enhancement of safety-net dental service accessibility is crucial to reducing dental ED visits and improving dental health, particularly among low-income, self-pay populations.

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Introduction

The number of dental related visits to Emergency Departments (EDs) has been an increasing problem nationwide. Between 1997 and 2000, an estimated 2.95 million dental related visits were made to EDs across the country.[1] There also has been a disproportionate increase in ED use for dental-related conditions between 2001 and 2008: approximately a 41% increase for dental related ED visits compared to a 13% for all other causes and conditions.[2] Furthermore, many patients return multiple times for the same dental complaints.[3] Repeat visits to EDs may be due, in part, to the limited dental training provided in medical school.[4]

In recent years, there has been an increased interest in preparing physicians to provide comprehensive dental care, though the results of these efforts remain to be seen.[4] Such movements come from the understanding that poor oral health outcomes are linked to multiple general health problems, including systemic illness such as cardiovascular disease.[5] Efforts to integrate medicine and dentistry include reports published by the Institute of Medicine, the Department of Health and Human Services, and the American Association of Medical Colleges that identify the role of physicians in addressing dental problems and outline medical school curriculum objectives.[4]

On a national level, oral health requirements were added to family medicine residency programs by the Accreditation Council for Graduate Medical Education (ACGME) to increase oral health training.[6] Dental-related ED visits are associated with millions of dollars in cost.[7,8] In 11 hospitals in Kansas City, Missouri, the costs associated with dental-related visits to the ED added up to $6.9 million during a six-year period (2001-2006).[8] From 2001-2006, 19,316 Kansas City residents visited one of the 11 EDs for dental-related complaints; this accounted for 1.7% of all the hospitals ED visits.[8] The Kansas City, Missouri population in 2006 was 435,825 people.[8] Of the study population, 76.8% of the ED dental-related visits were by self-pay and Medicaid patients.[8]

Many patients do not go to dental offices for treatment. Barriers to dental care include high cost, lack of desired appointment availability, lack of accessibility to discounted services for patients with no insurance, fear of dentists, lack of trust in dentists, language barriers, and lack of transportation.[9,10] As a result, the ED becomes the primary place where many patients receive dental care. EDs are used most commonly for dental problems by young adults, who have no dental insurance, come from low-income families, and do not have a regular dentist.[11-13] Many patients understand that they are unlikely to get definitive dental treatment in EDs or physician offices, however, they expect that physicians can treat the problem, at least temporarily.[13,14]

Dental-related ED visits are an increasing nationwide problem that is understudied. The goals of this study were to identify the number and types of dental-related ED visits at a Kansas City urban academic tertiary care ED during 2012, identify the process of treatment and referral of patients for dental-related problems at this ED, and identify the dental safety-net community resource availability in the greater Kansas City area.

Methods

This study involved three tiers of data collection: a retrospective chart review, an ED provider survey, and a safety-net clinic telephone survey. A retrospective chart review at the University of Kansas Medical Center Emergency Department, an urban

academic tertiary care ED, examined all the medical records during the 2012 calendar year. The patients were selected for inclusion based on ICD-9 codes: disorders of tooth development and eruption (520.0-520.9), diseases of hard tissues of teeth (521.0-521.9), diseases of pulp and periapical tissues (522.0-522.9), gingival and periodontal diseases (523.0-523.9), dentofacial anomalies including malocclusion (524.0-524.9), and other diseases and conditions of the teeth and supporting structures (525.0-525.9). Diagnoses and their associated ICD-9 codes were recorded by the ED providers. Disorders of tooth development and eruption, diseases of hard tissues of teeth, diseases of pulp and periapical tissues, gingival and periodontal diseases, and other diseases and conditions of the teeth and supporting structures were of particular interest as these codes are fairly comprehensive for dental complaints. Hospital electronic medical records and a data extractor were used to isolate the patient population. After the data were extracted, the resultant dataset was analyzed based on patient demographics, patient insurance status, and most common dental complaints.

Two different surveys were conducted to gather additional information. The first survey was administered to all emergency department providers at the University of Kansas Medical Center Emergency Department: 38 physicians and five nurse practitioners. The University of Kansas Medical Center is a Level I Trauma Center that treats approximately 120 patients daily and 54,000 patients annually.[15]A written survey was distributed to the providers and collected by medical students. The survey included six self-reported questions that examined the number of dental patients seen per month, treatments they provided, and resources given to patients for follow-up. The questions were in multiple-choice format with the option to write in additional information. The survey provided to ED providers was designed to identify the process of treatment and referral of patients at the University of Kansas Medical Center Emergency Department for dental-related problems.

A telephone survey was administered to safety-net clinics in the greater Kansas City area to gather additional data regarding the availability of dental resources in the area for patients. Medical students utilized a standard call script and dental community resource survey developed for this project. Inclusion criteria for safety-net clinics included proximity within 30 miles of the University of Kansas Medical Center ED. Twenty clinics were contacted to participate in the survey. The community resource assessment included six questions regarding the process of dental patient referral, length of wait time, dental services provided, and fees charged. Descriptive summary statistics were used to analyze all data collected. The University of Kansas Medical Center IRB approved the project.

Results

Emergency Department patient chart review. During 2012, the University of Kansas Hospital ED incurred 49,276 patient visits. Of these, 676 visits were associated with dental-related complaints, representing 1.4% of all ED visits. The 676 patient visits were comprised of 575 patients. Of the visits, 171 (25.3% of total visits) were return visits with 70 patients returning to the ED multiple times for dental related complaints.

Of the 575 de-duplicated patient records, females were slightly more represented at 54% (see Table 1). Approximately, 45% of the patients were Caucasian, 39% were African American, and 15% represented other races/ethnicities. The mean age was 34-35 years with the most common age

range being 20-39 (65% of the patients). With respect to insurance status, 56% of patients were Private/Self Pay, 26% had Kansas or Missouri Medicaid, 8% had Kansas or Missouri Medicare, and 10% had another form of insurance.

Medicare does not cover routine dental care or dental procedures, including bi-yearly dental check-ups, cleanings, or caries filling. However, Medicare does cover ED visits.[16] In both Missouri and Kansas, dental services are a benefit which is covered by Medicaid but with important coverage limitations, especially for adults. Kansas adults seeking dental services with Medicaid are limited to emergency treatment for relief of pain and infection.[17] Missouri adults seeking dental services with Medicaid are limited to coverage only for facial trauma or the treatment of health-impacting disease or medical condition unless they are pregnant or blind.[17] Of the patients who returned to the ED for dental complaints, six patients met criteria for both Private/Self Pay and Medicaid. These patients received Medicaid after their earlier visit to the ED. Additionally, one patient met criteria for both the Private/Self Pay and other.

Table 1. Characteristics of 575 patients presenting at the emergency department with dental-related conditions in 2012.

Characteristics	***Number (%)***
Sex	
Male	265 (46.1%)
Female	310 (53.9%)
Race/Ethnicity	
White	260 (45.2%)
Black or African American	226 (39.3%)
Other	86 (15.0%)
Declined	3 (0.5%)
Age Range in Years*	
0 to 9	11 (1.9%)
10 to 19	24 (4.2%)
20 to 29	199 (34.5%)
30 to 39	173 (30.0%)
40 to 49	89 (15.4%)
50 to 59	58 (10.1%)
60 +	23 (4.0%)
Insurance Status	
Private/Self Pay	326 (56.0%)
Medicaid	150 (25.8%)
Medicare	49 (8.4%)
Other	57 (9.8%)
Number of Dental-Related Visits to ED Per Patient	
1	505 (87.8%)
2	51 (8.9%)
3	11 (1.9%)
4	6 (1.0%)

5+	2 (0.4%)

* One patient met criteria for both the 10-19 and 20-29 group. One patient met criteria for both the 20-29 and 30-39 group.
**Six patients met criteria for both Private/Self Pay and Medicaid. One patient met criteria for both Private/Self Pay and Other.

Among the 70 patients (12.5%) presenting to the ED on multiple occasions during the study period, the majority (85%; N = 53) presented twice. Of these 53 dually-presenting patients, 45 had Medicaid or Private/Self Pay insurance (see Table 2). Of the patients who presented three times to the ED, 11 of 13 patients (84%) had Medicaid or Private/Self Pay. Of patients that presented four times to the ED for dental-related complaints, six of seven patients (85%) had Medicaid or were Private/Self Pay. Four patients presented five or more times for dental-related complaints and all had Medicaid or were Private/Self Pay. Of all repeat ED patients, 85% represented the Medicaid and Private/Self Pay insurance statuses.

Table 2. Insurance status of patients that presented two or more times for dental-related conditions in 2012.

Number of Repeat Visits	***Medicaid***	***Medicare***	***Private/Self Pay***	***Other***
2[a]	27	5	28	3
3[b]	4	1	7	1
4[c]	1	1	5	
5 or more[d]	2		2	
Percentage	31.2%	9.1%	54.6%	5.2%

a. 2 patients met criteria for both Medicaid and Private/Self Pay.
b. 1 patient met criteria for both Medicaid and Private/Self Pay and 1 patient met criteria for both Private/Self Pay and Other.
c. 1 patient met criteria for both Medicaid and Private/Self Pay.
d. 2 patients met criteria for both Medicaid and Private/Self Pay.

The most common dental-related complaints in the ED characterized by ICD-9 codes associated with patient encounters are presented in Table 3. The ICD-9 codes are largely used for medical billing purposes. From the ICD-9 codes, it is unknown if only the symptoms were addressed or if the actual problem was addressed. Most commonly, dental disorder NOS represented 57% of all the dental-related ED visits. Periapical abscess and dental caries NOS represented 37% of all dental-related ED visits. Other dental-related conditions comprised 6% of all patient diagnoses.

Table 3. Most common ICD-9 codes for dental-related conditions presenting at the emergency department in 2012.

ICD-9 Code	*Description*	*Number (%)*
525.90	Dental Disorders NOS*	386 (57.1%)
522.50	Periapical Abscess	146 (21.6%)
521.00	Dental Caries NOS*	100 (14.8%)
522.40	Acute Apical Periodontitis	9 (1.3%)
523.10	Chronic Gingivitis-Plaque Induced	8 (1.2%)
520.60	Tooth Eruption Syndrome	7 (1.0%)
Others	Others	20 (3.0%)

*NOS = Not Otherwise Specified.

Emergency Department provider survey. Due to time restraints and provider availability, 68% of attending and resident physicians (N = 26) and 80% of nurse practitioners (N = 4) completed the provider survey (30 of 43 providers; see Table 4). The most common complaints reported by providers were tooth pain (87%) and abscess (13%). The providers reported that most patients would receive a dental screen/exam to assess pain, swelling or bleeding (80%), have a procedure performed (63%), or receive medications (antibiotics and pain relief; 90%). Dental blocks to ease pain during examination and to facilitate incision/drainage procedures, along with incision and drainage, comprised the scope of procedures performed. Two-thirds of the providers (N = 23/30) reported prescribing both antibiotics and pain medication; four providers did not specify the prescriptions given. Every provider gave information about local, free dental clinics. Nearly all of the providers (96%) stated feeling either comfortable or very comfortable with providing symptom relief for patients with dental complaints.

Table 4. Provider survey results from 4 Nurse Practitioners and 26 ED physicians.

Topics	*Number (%)*
Monthly Number of Patients with Dental Related Conditions Seen	
0 to 10	20 (66.7%)
11 to 20	7 (23.3%)
21 to 30	2 (6.7%)
31 to 40	1 (3.3%)
41 +	0 (0%)
Most Common Complaint	
Tooth Pain	26 (86.7%)
Caries	2 (6.7%)
Dental abscess	4 (13.3%)
Periodontal disease/ gingivitis	0 (%)
Other	0 (0%)
Extent of Exam	
History	17 (56.7%)
Dental History	11 (36.7%)

Dental screen/ exam	24 (80.0%)
Imagining	1 (3.3%)
Labs	2 (6.7%)
Procedures*	19 (63.3%)
Medications**	27 (90.0%)
Follow-Up Information Provided to Patients	
Make an Appointment for Patient	5 (16.7%)
Handout with Free Dental Clinics	29 (96.7%)
Handout with Other Community Clinics	14 (46.7%)
Encourage to see dentist	3 (10.0%)
Comfort Level	
Very Comfortable	16 (53.3%)
Comfortable	13 (43.3%)
Uncomfortable	1 (3.3%)
Very Uncomfortable	0 (0%)

**Written in procedures included 16 providers performed dental blocks, 4 performed I&D's, 2 did not specify.*

***Written in medications included 23 providers prescribed an antibiotic and pain medications, 4 did not specify.*

Safety net clinic survey. Table 5 describes the results from the safety net clinic telephone survey. There were 20 local clinics within 30 miles of the ED that were contacted to participate in the survey. Of the 20 clinics, 16 (80%) clinics participated. Of the 16 clinics surveyed, 15 (93.8%) required a patient personally call to schedule an appointment. Four (25%) clinics had an emergency walk-in system available to provide emergency care. The wait time for an appointment varied from days to weeks at six (37.5%) of the clinics. There was a two to six month waiting period for five (31.3%) of the clinics. Four (25%) clinics provided same day emergency appointments, however, only a few same-day emergency patients can be seen in one day.

A majority of the clinics provided cleaning (68.8%), emergency services (62.5%), extractions (56.3%), and dentures (56.3%). Only two (12.5%) clinics offered comprehensive dental services inclusive of oral surgery. Of the clinics surveyed, 75% accepted new patients with no form of insurance, 68.8% of clinics accepted new patients who have private insurance, ten (62.5%) clinics accepted Kansas Medicaid patients, and nine (56.3%) clinics accepted Missouri Medicaid patients. Medicare was not included in this assessment due to lack of coverage by Medicare for dental care. Two clinics (12.5%) were not accepting new patients at the time of the survey. Fees charged varied among clinics: seven clinics (43.8%) calculated fees using a sliding scale based on income. Spanish interpreters were available at ten clinics (62.5%). Ten clinics (62.5%) had access to an interpretation phone line.

Table 5. Telephone survey results from 16 safety net clinics.

Topics	***Number (%)***
How to Schedule Appointment	

Call	15 (93.8%)
Emergency Walk-in	4 (25%)
Walk-in	3 (18.8%)
Have to be established patient	3 (18.8%)
Through outreach programs	1 (6.3%)
Appointment Wait Time*	
Varies – same day to weeks	6 (37.5%)
Months (2-6)	5 (31.3%)
Same day emergency only; only several patients seen	4 (25%)
Call first of month	2 (12.5%)
48 hours	1 (6.3%)
Services Provided*	
Cleaning	11 (68.8%)
Emergency	10 (62.5 %)
Extractions	9 (56.3%)
Dentures	9 (56.3%)
Fillings	8 (50%)
Crowns	8 (50%)
Sealants	8 (50%)
X-rays	7 (43.8%)
Oral Exam	7 (43.8%)
Fluoride Treatment	5 (31.3%)
Oral Health Education	4 (25%)
Root Canals	3 (18.8%)
Bridges	2(12.5%)
Comprehensive Care	2 (12.5%)
Oral Surgery	2 (12.5%)
Gum Disease	1 (6.3%)
Mouth and Dental Injuries	1 (6.3%)
Deep cleaning	1 (6.3%)
Mouth guard plate	1 (6.3%)
Child Oral Care	1 (6.3%)
Oral Hygiene Instruction	1 (6.3%)
Implant Restoration	1 (6.3%)
Blood pressure screening	1 (6.3%)
Nutritional counseling	1 (6.3%)
Insurance Category of New Patients Accepted	
No Insurance	12 (75%)
Private Insurance – varies by provider	11 (68.8%)
KS Medicaid	10 (62.5%)
MO Medicaid	9 (56.3%)
Not accepting new patients	2 (12.5%)
Fees Charged*	
Sliding scale based on income	7 (43.8%)
Discount varies based on age and insurance status	3 (18.8%)

First visit fee > $100	2 (12.5%)
Donation only	1 (6.3%)
$10	1 (6.3%)
Interpreter Services	
Spanish	10 (62.5%)
Phone line	10 (62.5%)
Cambodian	1 (6.3%)
Hmong	1 (6.3%)
Somali	1 (6.3%)
Hindi	1 (6.3%)
None	1 (6.3%)

**2 clinics did not provide information on these topics.*

Discussion

In a Midwestern, academic, tertiary care emergency department that is not affiliated with a dental school, patient visits for dental conditions comprised one percent of all visits over a one-year period. A sizable proportion of these ED dental-related visits were repeat visits (12%) and over two-thirds were uninsured, self-pay, or Medicaid patients. Patients seeking out emergent dental care from the ED received, in large part, symptom management treatment and subsequent referral to a safety-net community dental care provider. Our survey of safety-net dental clinics revealed a long waiting period for appointment scheduling (two to six months) for one-third of the clinics. Overall, these results highlighted an unmet safety-net dental clinic need that is forcing low-income patients with limited alternatives into emergency departments for dental symptom management (such as severe dental pain or inflammation) and limited resolution of the underlying dental problem.

Previous studies have established that dental related visits to the ED cost the health care system millions of dollars.[1,2] Approximately 44% of Americans lack dental insurance and this has contributed to the increase of ED use for dental complaints.[1] In addition, ED visits for dental care (over 41%) are increasing disproportionately compared to all other medical conditions (13%) that are seen in the ED.[2] In a single Kansas City, Missouri ED, dental-related issues totaled $6.9 million during a six-year period (2001-2006).[5] Nationwide, patients are using the ED for their dental care due to barriers which prevent them from obtaining proper oral healthcare. Lack of dental insurance, limited access to discounted services for the uninsured, lack of desired appointment availability, lack of trust in dentists, lack of transportation, fear of dentists, and language barriers are some of the common barriers preventing people from obtaining preventive oral healthcare.[6,7]

The majority of patients who visit the ED for dental care are Medicaid and self-pay patients. Access to preventive and restorative dental care is lacking for those without insurance and those covered by public programs. Although most of these patients use the ED for acute dental pain and infection control, the underlying dental problem often is not resolved. In contrast, people with commercial dental insurance rarely use hospital EDs for dental problems.[4] This study found that 82% of dental-related ED patients in 2012 were self-pay or Medicaid patients. While financial cost is one of the reasons patients go to the ED for dental complaints, there are additional barriers that hinder preventive oral health

care, such as lack of access to safety-net dental clinics, lack of insurance, time constraints, fear, and language barriers.[1]

Safety-net clinics and community dentists provide low cost dental care and accept Medicaid patients. However, there are not enough clinics or providers to meet the dental demands. Only 20 dental safety net clinics exist for the entire Greater Kansas City area. These clinics are limited in staff and time, making the process of obtaining an appointment a challenge. With the surveyed clinics reporting appointment wait times ranging from days to months, it appears that a provider shortage exists. Furthermore, only two of the surveyed clinics provided comprehensive care (inclusive of preventive care to oral surgery), suggesting patients who are unable to access a comprehensive care clinic (for preventive care, x-rays, fillings, oral surgery and extractions, root canal therapy crowns, bridges, or partials and dentures) may need to visit more than one clinic to address multiple or more serious dental problems. Anecdotally, during the safety-net clinic survey calls, it was discovered that for most of the clinics, the appointment protocol involved an initial evaluation visit followed by subsequent visits to address the dental problem. As such, multiple initial visits may be necessary for patients who seek care at multiple clinics due to the need for comprehensive care that may not be offered in the initial clinic visited by the patient. It may be necessary for patients to take multiple days off of work or school to receive the proper dental care.

A possible solution to assist in appointment scheduling might involve utilizing ED case-managers to make follow-up appointments for dental patients prior to ED discharge. However, with clinic appointment scheduling only available during business hours, after-hour ED patients would have to coordinate with the case manager at a later time to schedule a clinic appointment, which places an additional barrier in the process. Another potential solution would be to extend the dental clinic service hours into the evening, which may alleviate the burden for people who cannot afford to take time off from work or school.

Limitations of this study included its retrospective design looking only at a 12-month period. This study did not incorporate follow-up. The study focused on an ED located in an urban academic medical center without an affiliated dental school. This study also may not be generalizable to other EDs within the region or state. However, our results do resemble previously reported data and insurance status of patients visiting the ED for dental-related complaints. Lastly, our data were extracted from a large database and there is possibility of human error both as it was entered into the mainframe system and as it was extracted for this study.

In conclusion, these findings have important health care implications. The number of patients with dental-related complaints seen in the ED might be reduced if more accessible and affordable dental care were available. ED physicians provide acute care for these patients, but until the root cause of the problem is rectified, these patients will continue going to the ED for dental care due to the limited safety-net clinical dental care infrastructure in the Kansas City metro area. In Kansas, one of the largest unmet health needs is the lack of access to dental care.[19] While extended care permit dental hygienists are recognized in Kansas, their scope of practice is limited. Extended care permit dental hygienists are those with a requisite number of hours of practice experience, who obtain a permit to provide more types of care to underserved populations (e.g., provide temporary fillings, make denture adjustments, smooth sharp teeth, extract lose baby teeth, and apply

local anesthetics in certain situations). No extended care permit dental hygienists practice in the dental health professional shortage county in which the ED included in this study is located. The concept of mid-level dental providers in Kansas has been debated for several years but has yet to receive legislative traction. However, the admission of mid-level dental providers in Kansas could contribute to the solution for reducing emergency room utilization for emergent dental care.

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Keywords: emergency medical services, dental care, oral health, medically uninsured

Using Simulation to Improve Medical Students' Comfort with Selected Pediatric Procedures

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Abstract

Background. Simulation in pediatrics is described often in more procedurally-heavy areas, such as in intensive care, emergency medicine, and neonatology. However, there is a paucity of literature related to simulation in general pediatrics. We sought to improve students' comfort with and knowledge about selected procedures using simulation mannequins during their pediatric rotation.
Methods. During a workshop, third year medical students received a lecture on male circumcisions, lumbar punctures, the Ortolani and Barlow maneuvers, and ear examinations. Following the lecture, the students were given hands-on instruction and feedback on the techniques for performing ear and hip exams, lumbar punctures, and circumcisions. Students took a pre- and post-encounter assessment regarding their confidence level, procedural knowledge, and perceived usefulness of the training. Wilcoxon Signed Rank tests were used to determine changes in the students' confidence levels and knowledge. Alpha was set at 0.05 for all comparisons.
Results. Sixty medical students (100%) participated in the study during the 2012/2013 academic year. Confidence and knowledge increased significantly on all procedures following the simulation experience ($p < 0.001$). Perception of usefulness of the training also increased significantly at post-test ($p = 0.019$).
Conclusion. Medical students benefited from using simulation to demonstrate and practice common pediatric procedures, both in their confidence and knowledge. The use of simulation for general pediatric procedures should improve patient safety, as well as remove some of the anxiety of performing procedures in actual clinical scenarios.
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Introduction

Medical students frequently voice concerns regarding their comfort level in performing some of the most basic and essential procedures encountered during their pediatric rotation. A well-proven way to increase learners' skills and comfort is through the use of simulations,[1-3] which improve patient safety[4] and decrease medical student anxiety when performing a procedure for the first time in an actual clinical situation.[5, 6]

Third year medical students on their pediatrics rotations have varied exposure to and comfort levels with infants and children as patients. There are many challenges facing students as they approach three of the most common procedures: ear and hip exams, lumbar punctures, and circumcisions.[7]

Ear/hip exams. The ear and hip examinations can be difficult with real moving (and often crying) patients. It is helpful to practice looking through the ear canal to the tympanic membrane of a

mannequin prior to looking in the ear canal of a child with an ear infection. Looking at pictures of ear pathology in textbooks or discussing what a dislocated infant hip feels like does not substitute for hands-on experience.

Lumbar puncture. Students may have had previous experience performing lumbar punctures on adult patients, but unique skills are needed for success with the infant patient.[8] Among pediatric interns, only one-third have performed a lumbar puncture on an infant, fewer than 75% have observed the procedure, and confidence and competency uniformly are rated low.[9-11] Despite this, entering interns perform this procedure frequently and early in their training programs.[7]

Circumcision. Students would benefit from a simulation experience prior to performing a circumcision on an actual patient, particularly when they may feel like they are being observed closely by a parent. Simulation models for circumcision are a relatively recent development, but early research suggests that they increase the learner's comfort with the procedure.[12] Additionally, some medical students do not have the opportunity to perform a circumcision on a newborn, so they benefit from learning to perform a circumcision in a simulated experience.

The purposes of simulation include training and practicing procedures in a safe environment and assessing procedural skills. It is used at all levels, throughout the traditional medical school years,[13,14] as well as in graduate medical education.[5, 15-17] As more interest has developed in interprofessional learning, the use of simulation has spread to other areas of medical education as well.[18-20] A PubMed search for articles published in the last five years related to the use of simulation in medical education returned hundreds of articles. Simulation in pediatrics is described often in the more procedurally-heavy areas such as intensive care, emergency medicine, and neonatology.[4,21] However, there is a scarcity of literature related to the use of simulation to teach medical students to perform the most common procedures in pediatrics. To determine if simulation also can be used to increase medical student comfort in basic examination and procedural skills, a simulation session was added to the medical student curriculum.

Methods

Every six weeks, a new group of six to eight medical students rotated through the pediatrics department at our university. Part of one afternoon of this rotation was dedicated to learning to perform circumcisions, lumbar punctures, Ortolani and Barlow maneuvers, and ear examinations in a hands-on, experiential format. Students were instructed in the correct techniques for circumcisions and lumbar punctures and practiced these procedures on the models following instruction. Pediatricians were present to guide the medical students through the procedures and to offer immediate feedback on their technique. Additionally, students were instructed in proper examination techniques of neonates to assess for developmental dysplasia of the hips using the Ortolani and Barlow maneuvers. Students then practiced these maneuvers on an infant mannequin. Finally, the students were instructed in the correct techniques to examine a patient's tympanic membrane and ear canal and were instructed in some techniques for positioning infants/toddlers to facilitate an easier and safer ear exam. Teaching included information on the diagnosis of tympanic membrane and ear canal pathology, aided by ear models with varying pathologies. Following the instruction, students practiced using the ear model.

Measurements. The students took a pre- and post-training assessment regarding confidence level and procedural knowledge. Short-answer questions regarding each procedure were used to evaluate knowledge and scored for accuracy by a physician. The experience was measured using a 6-point Likert scale (1 = not at all confident, 6 = very confident) to determine their level of confidence in their skills in circumcision, lumbar punctures, the Ortolani and Barlow maneuvers, and ear examinations, both before and after the simulations. A similar scale was used to assess the students' anticipated and perceived usefulness of the simulation experience. Finally, students were allowed to provide written feedback at the end of the post-assessment.

Participation in the research portion of the training (i.e., completing the assessment) was optional. Surveys were numbered to allow matching of pre-post surveys, while allowing responses to remain anonymous.

Statistical analysis. The Wilcoxon Signed Rank tests were used to contrast the pre- and post-experience to determine the change in the students' confidence levels and knowledge regarding the performance of these procedures. Data were summarized by dichotomizing the Likert-scale at the fifth level ("Confident") to ascertain how many students felt confident or very confident before and after the simulation. Both anticipated and perceived benefit of training were averaged for evaluation, and feedback responses were reviewed and summarized. Alpha was set at 0.05 for all comparisons. The study was approved by the university's Human Subjects Committee.

Results

Sixty medical students (100%) participated in the simulation training and the research study during the 2012/2013 academic year. University demographics in this class included 35 (58%) males with a mean age of 28 years (SD = 3 years). The majority were Caucasian (48; 80%) followed by African American/Black (3; 5%), Hispanic (3; 5%), and other (5; 8%). One participant did not identify a race/ethnicity (2%).

Prior to the simulation training, student confidence in the procedures was low for circumcision (median 1, IQR 1-2.75), lumbar puncture (median 1, IQR 1-2), and hip exam (median 2, IQR 1.25-4). Students were more confident with ear exams at baseline (median 4, IQR 3-4). Student confidence increased significantly on all procedures following the simulation experience ($p<0.001$; Figure 1). The highest levels of confidence after the experience were reported for ear (median 5, IQR 4-5) and hip exams (median 5, IQRs 4-6). Only one student (2%) reported a decrease in confidence performing the Ortolani or Barlow maneuver, with a confidence level of 6 (highest level) on the pretest and a 5 on the posttest. On evaluation of qualitative feedback, this student reported that the infant hip mannequin was too rigid and was not an accurate representation of real infant hips.

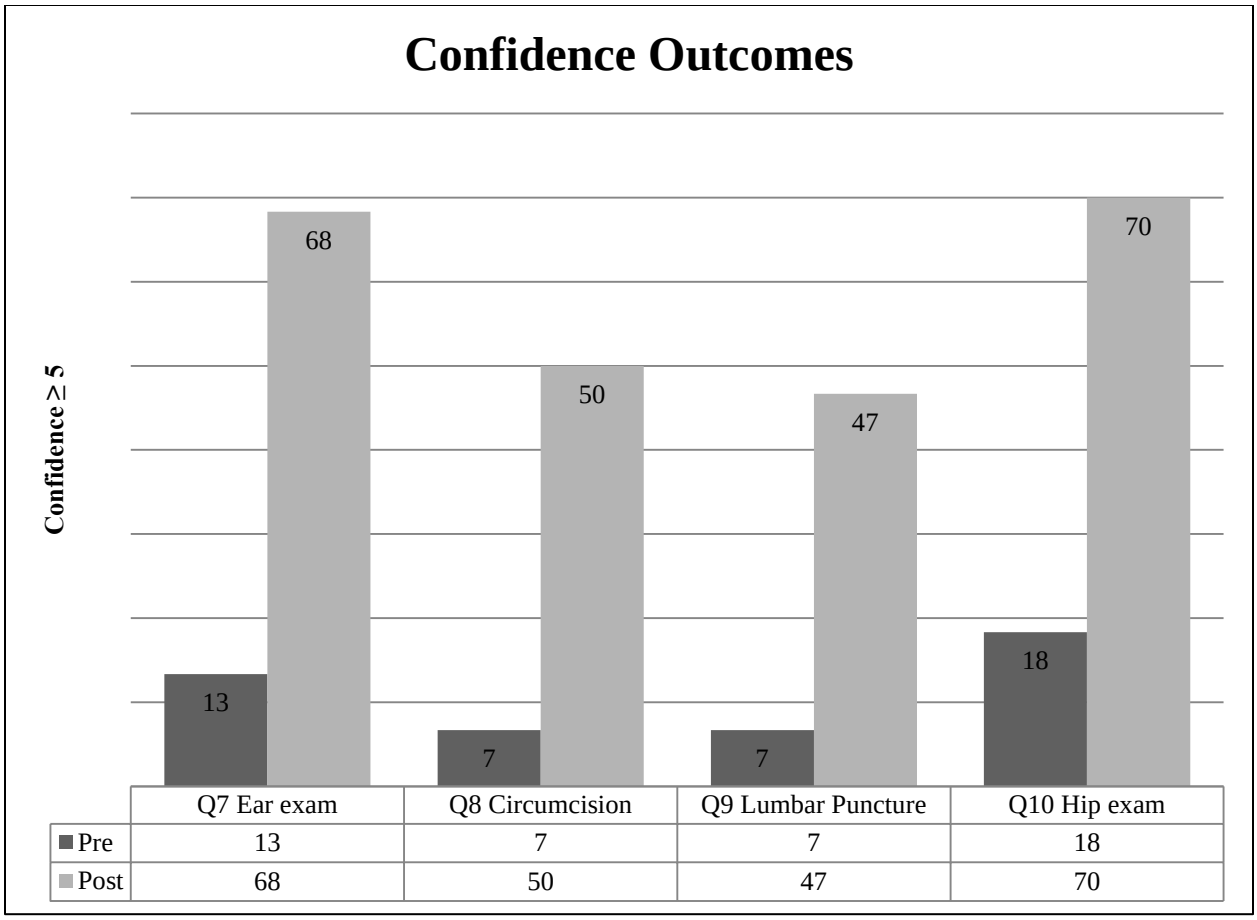

Figure 1. Confidence outcomes pre- and post-simulation training.

Knowledge measured before the simulation training indicated fewer than 50% of students were able to answer four out of six items. Greater than 50% of students were able to identify risks of both circumcision and lumbar puncture. Only three students (5%) were able to answer all six knowledge questions correctly prior to the training. Student knowledge increased significantly following the experience ($z = -6.977$, $p < 0.001$; Figure 2). On post-examination, 44 students (73.3%) correctly answered all six knowledge questions. Greater than 80% of students responded correctly on each of the items after the training. Inexplicably, one student (2%) had a lower score on the post knowledge assessment, with four items correct on the pre-test and only two correct on the post-test.

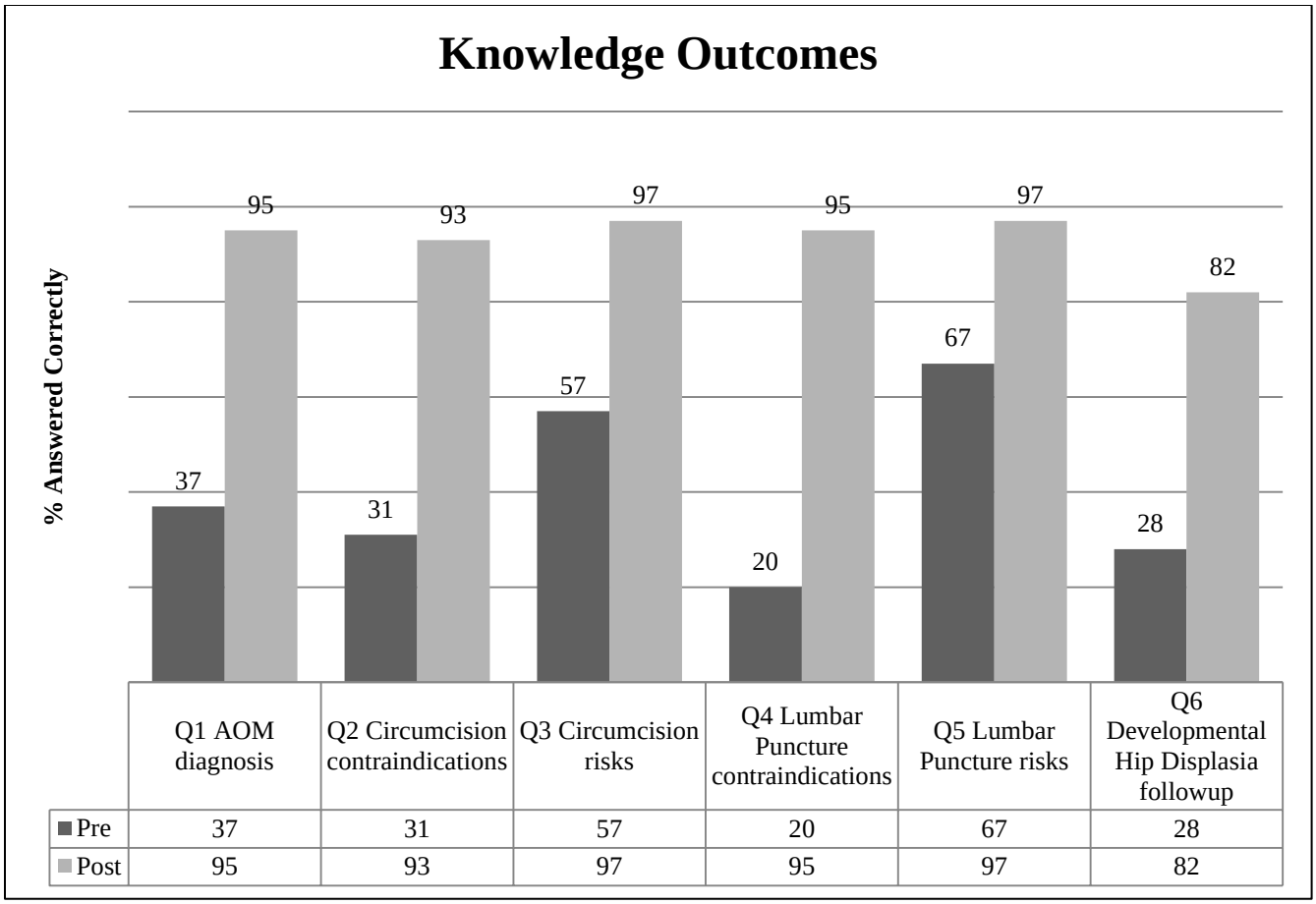

Figure 2. Knowledge outcomes pre- and post-simulation training.

Fifty-nine students (98%) reported "useful" or "very useful" when asked about perceived benefit of the training. Twenty-six students left qualitative feedback. Among the qualitative responses, 22 (85%) expressed gratitude for the training or described it as "helpful" and/or "useful" and three (12%) expressed a desire for more practice. Two students provided constructive criticism: the firmness of the hip mannequin (above) and a recommendation to use fellow students as models for ear exams. The anticipated benefit of training was high (87% identified it as "useful" or "very useful") at pre-test, but still increased significantly after training ($Z = -2.353$, $p = 0.019$) with 98.3% of subjects rating the training as "useful" or "very useful" at post-test (Figure 3).

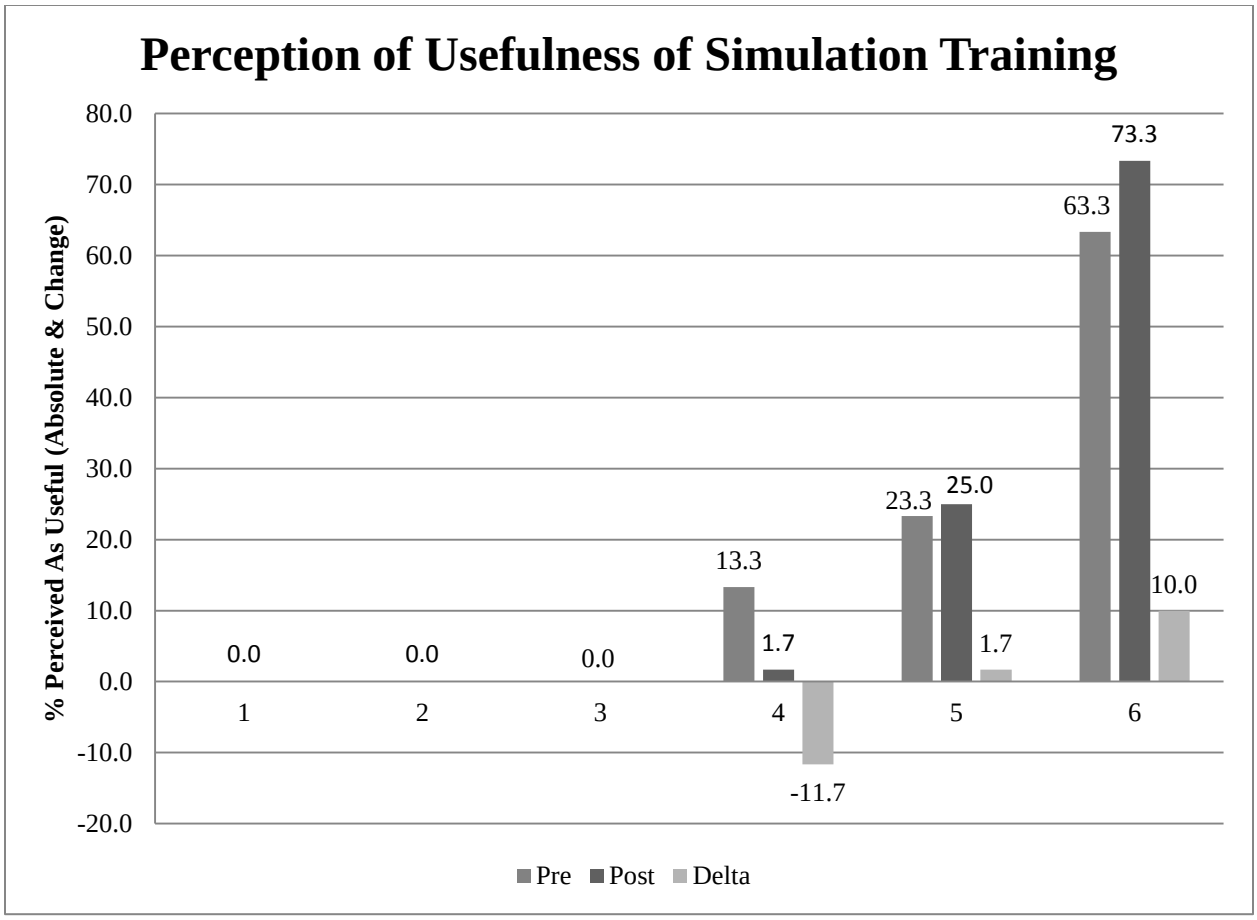

Figure 3. Students' perception of usefulness of activity.

Discussion

These results showed that medical students' knowledge and confidence grew through participating in the simulation experience. The medical students valued the opportunity to learn the proper techniques to perform these procedures. In spite of high perceived value at pre-test, a significant increase was present at post-test. In addition, student comments indicated the learning opportunity was valuable. The reason one medical student ranked his/her confidence in performing the Ortolani and Barlow maneuvers lower after the simulation may be because the mannequin used was quite stiff, making it more difficult than it is in real life to assess for a positive examination. However, the purpose of the simulation is to teach the general principles of how to perform the examination, while allowing the learners to perfect the skill when they are in the clinics and wards. Future simulation mannequins may benefit through exploration of more analogous materials and more life-like feel, especially with regards to flexibility.

Limitations of this study included that students were not evaluated on their ability to perform the techniques in simulated environments or on actual patients following the simulation and that no comparison group was included. There is a wide field of evidence already examining both correlations between procedural confidence and ability as well as simulation training and procedural competency.

A major strength was participation of the entire cohort in the study. In addition, consistency of trends in the data as both knowledge and confidence increased

significantly for all procedures suggests a reliability of the measures. The medical students believed they benefited from this experience, gaining both knowledge regarding the procedures and confidence in their ability to perform these procedures. The use of simulation to teach general pediatric procedures is a helpful tool to allow medical students to learn in a safe environment. In an era in which patient safety is paramount, having learners practice procedures on a mannequin is a relief for many educators so they can identify how well a learner can perform a procedure prior to performing it on an actual patient. Similarly, it is often a relief for learners gaining experience in a low-risk setting prior to performing procedures on real patients, particularly with the possibility of the added clinical stress of having parents stand over them while they perform a procedure for the first time. While this study was not designed to evaluate changes in performance, future studies could supplement this work by evaluation with standardized patient scenarios to students using a pre-post design and/or a control group of solely didactic learners. Further research should be done to assess the long-term impact of this type of simulation training, both on the learners' success in a pediatric residency program and further into the future when they are practicing as medical providers.

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*Keywords***:** anatomic models, medical education, pediatrics

Comparative Effectiveness and Safety of Empiric Ampicillin plus Gentamicin or Empiric Piperacillin-Tazobactam in the Neonatal Intensive Care Unit

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Abstract

Background. This study was designed to assess piperacillin tazobactam (PT) as an alternative to ampicillin and gentamicin (AG) in neonates with suspected systemic infection.

Methods. A retrospective, unmatched population of AG (2007-2009) and PT (2009-2012) exposed infants were evaluated for initial effectiveness, adverse events, and subsequent morbidities or mortality. Data included gestational age, birth weight, sex, Apgar score, length of hospital stay, glomerular filtration rate for days 1 and 2, duration on mechanical ventilation, duration on oxygen therapy, incidence of sepsis (blood or cerebrospinal fluid culture positive), incidence of ventilator associated pneumonia, and incidence of necrotizing enterocolitis. All positive blood cultures during the study period were reviewed. Data about specific microorganisms and sensitivity to antibiotics were collected.

Results. No significant differences in demographics or initial Apgar scores were noted. There were no significant differences in systemic rash or diaper rash. PT was associated with higher glomerular filtration rate on day two. Four infants had early onset sepsis with ampicillin resistant *E. coli*. One of these, in the PT group, had intermediate sensitivity to gentamicin as well.

Conclusion. Use of PT as the initial empiric antibiotic was not associated with increased adverse outcomes. The challenge of ampicillin resistant *Escherichia coli* should encourage others to consider this change.

KS J Med 2015; 8(2):80-83.

Introduction

The most common antibiotic combination used for therapy of presumed early-onset neonatal sepsis is ampicillin and gentamicin (AG), based upon the rationale that the majority of bacterial pathogens are sensitive to this combination. The most prevalent gram positive organism is Group B Streptococcus, although this organism has been in decline coinciding with increased intrapartum ampicillin.[1-4] The most frequent gram negative bacteria are *Escherichia coli*, followed by *Haemophilus influenza* and Citrobacter species.

There are many concerns regarding the use of AG. The recommended dose is potentially insufficient to treat *Listeria meningitis*.[5,6] Antenatal exposure and prolonged postnatal ampicillin exposure increase the risk of necrotizing enterocolitis (NEC).[1-4,7-9] In addition, ampicillin increases bleeding times through a direct effect on platelets.[1] However, the most important concerns are ototoxic and renal toxic effects of gentamicin, gentamicin resistance in late

onset infection and emergence of ampicillin and gentamicin resistant *E. coli*. Given the lack of controlled experiences, the use of PT in infants less than two months is not included in the package insert.

Due to these concerns, our institution changed from AG to piperacillin-tazobactam **(**PT) for routine empiric coverage of suspected early onset of sepsis. The impact of PT was monitored in our very low birth weight (VLBW) infants. Results showed no increase in major morbidities or significant adverse events. PT was associated with a transient increase in glomerular filtration rate during exposure and decreases in NEC and diaper rash when compared with AG.[1] Therefore, a study was designed to assess whether PT was associated with altered outcomes in infants with greater than 1500 grams birth weight.

Methods

A retrospective unmatched, cohort study was conducted to compare effectiveness and safety following the change from AG to PT at the Wesley Medical Center (WMC) Neonatal Intensive Care Unit (NICU). WMC switched from AG to PT in January 2010.

An unmatched comparison of AG exposed infants with PT exposed infants was conducted in the populations from two years prior (2007-2009) and three years after (2009-2012) the change in antibiotic policy. Cohorts were evaluated for effectiveness, congenital infection, adverse events, subsequent morbidities and mortality. During these two periods, there were no changes in the indications for initiation of antibiotic coverage.

Data were collected from inborn infants with the birth weight greater than 1500 grams, who had suspected systemic infection and were receiving AG (12/20/2007-12/31/2009) or PT (12/20/2009-12/31/2012). Patients with Methacillin Resistant *Staphylococcus Aureus* colonization were excluded from the study.

Study data included gestational age, birth weight, sex, Apgar score, length of hospital stay, glomerular filtration rate (GFR) for days 1 and 2, duration on mechanical ventilation, duration on oxygen therapy, incidence of sepsis (blood or cerebrospinal fluid culture positive), incidence of ventilator associated pneumonia (clinical and radiographical change), and incidence of NEC (clinical and radiographic changes). All positive blood cultures in the study period were reviewed. Data about specific microorganisms and sensitivity to antibiotics were reviewed and collected.

Statistical methods included Mann-Whitney U-test, t-test and analysis of variance (ANOVA) for nominal and continuous variables. Chi-square analysis was used for categorical variables. Descriptive statistics were stratified by group.

Results

A total of 1682 patients were identified, 653 exposed to AG and 1029 exposed to PT. No significant differences in demographics or initial Apgar scores were noted (Table 1). There were no significant differences in systemic or diaper rash. PT was associated with higher GFR on day 2. Four infants had early onset sepsis with ampicillin resistant *E. coli* (3AG/1PT). One of these, in the PT group, had intermediate sensitivity to gentamicin as well. One additional PT infant had *Haemophilus influenzae* sepsis at birth which was sensitive to ampicillin.

Table 1. Demographics and Apgar Scores

Variable	AG	PT	Test Statistic
N	653	1029	
Birth Weight – 25th, 50th, 75th percentile	1.88, 2.20, 2.70	1.93, 2.24, 2.72	U=1.29, p=0.20
Gestational Age – 25th, 50th, 75th percentile	32, 34, 35.5	33, 34, 35	U=1.32, p=0.19
Male – N (%)	356 (55%)	590 (57%)	X2(1)=1.29, p=0.26
Caesarian - N (%)	348 (53%)	565 (55%)	X2(1)=0.38, p=0.54
Apgar <7 at 1 minute – N (%)	232 (36%)	357 (35%)	X2(1)=0.10, p=0.75
Apgar <7 at 5 minutes - N (%)	66 (10%)	107 (10%)	X2(1)=0.04, p=0.85
GFR day 1 – 25th, 50th, 75th percentile	13.86, 16.02, 18.45	14.49, 16.56, 18.9	U=2.692, p=0.007
GFR day 2 – 25th, 50th, 75th percentile	11.34, 13.55, 15.48	12.57, 15.12, 17.82	U=6.612, p<0.001
Mortality - N (%)	7 (1%)	12 (1%)	X2(1)=0.03, p=0.86
NEC - N (%)	4 (0.6%)	4 (0.4%)	X2(1)=0.42, p=0.52

Discussion

PT as an empiric choice for suspected neonatal sepsis was not associated with any adverse outcome and can be used successfully as a monotherapy. Patients receiving AG had a lower GFR, consistent with our previous study in which this was transient and not sustained.[1] We did not abstract GFR beyond the exposure period. There are some limitations to this study. It is a retrospective, unmatched comparison study, and as such cannot be used to assert causation. However, in our previous study,[1] matching did not alter results; therefore, we determined it was necessary for the present study. The current challenge of ampicillin resistant *E. coli* should encourage others to consider this change.

Acknowledgments

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Keywords: neonatology, sepsis, anti-bacterial agents, ampicillin, piperacillin

Use of Cultured Yogurt with Probiotics Causing Septic Shock and Intra-abdominal Abscesses

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Introduction

Cultured yogurts and probiotics are a $28 billion worldwide industry[1] and are relatively cheap and readily available to consumers in supermarkets, pharmacies, and hospitals. They come in a variety of different forms, including commercial yogurts and capsules, and are well known in the baking and brewing industries. Many health care providers recommend cultured yogurts/probiotics for patients with altered bowel flora to restore the functional integrity of the bowel. There have been multiple adult randomized controlled trials[2-7] of marginal quality that have shown the ability of these agents to prevent diarrhea associated with antibiotic usage and have been proposed to be used in conditions such as Crohn's disease and other inflammatory bowel conditions.[8]

Despite harboring live bacteria and/or fungi, cultured yogurts and probiotics are an uncommon cause of infection in humans[9] and generally have been deemed effective and safe.[2] They are considered the "good bacteria" by many and, by definition, should be beneficial to the ingesting host. However, with an increase in the population at risk for chronic and debilitating diseases with exposure to significant risk factors, such as the use of immunosuppressive drugs and broad spectrum antibiotics, parenteral nutrition, and use of central venous catheters, the number of reported cases of infections due to these agents over the last century is clearly on the rise.[10]

Case Report

A 61-year-old male with a history of testicular germ cell cancer status post allogenic stem cell transplant and neutropenic from immunosuppressive therapy presented with abdominal pain and fever. Temperature was 100.1°F, blood pressure 128/68 mm Hg, pulse rate 85 beats per minute, and respiratory rate 18 times per minute. Initial blood count revealed a white blood cell count of 1.3 K/uL, platelet count of 20 K/uL, and an absolute neutrophil count of 0. A comprehensive metabolic panel (CMP) showed glucose of 110 mg/dL, creatinine of 1.58 mg/dL, sodium of 129 mEq/L, and albumin of 2.9 g/dL. Alpha fetal protein was 771 IU/mL. Urine culture showed no growth and *Clostridium difficile* toxin B by polymerase chain reaction was positive. Chest x-ray showed developing infiltrate and pulmonary edema (Figure 1).

The patient was started on metronidazole and improved over the course of the next few days, then suddenly deteriorated and was transferred to the medical intensive care unit with septic shock and respiratory failure requiring mechanical ventilation. Blood and sputum cultures showed *S.*

cerevisiae. Subsequently, the patient's wife reported that she had been encouraged by the nursing staff and dietitians to feed her husband cultured yogurt sprinkled with probiotic powder to restore bowel flora. Aspiration (due to altered mental status), gastrointestinal tract translocation (due to altered mucosal integrity from *clostridium difficile*-associated diarrhea), and severe immunocompromised state (from chemo-therapy) likely contributed to his deterioration. He recovered with voriconazole therapy which was based on sensitivities.

Figure 1. Chest x-ray showed developing infiltrate and pulmonary edema.

Further review of records revealed another case of invasive *S. cerevisiae* infection in the same hospital that occurred within months of the above case. The patient was a liver transplant recipient who had previous abdominal surgery and also presented with abdominal pain and severe sepsis. Initial temperature was 98.5^{o}F, blood pressure 83/54 mm Hg, pulse rate 110 beats per minute, and respiratory rate 17 times per minute. Initial laboratory revealed a white blood count of 28.8 K/uL and a platelet count of 592 K/uL. A CMP showed glucose of 117 mg/dL, creatinine of 0.7 mg/dL, sodium of 135 mEq/L, and potassium of 4 mEq/L. Computed topography (CT) of the abdomen and pelvis showed 23 mm x 38 mm and 45 mm x 51 mm walled off areas suspicious for abscesses (Figures 2 and 3). CT-guided drainage and culture of the abscesses revealed *S. cerevisiae*.

This patient also was encouraged by the nurses and dietitians to eat cultured yogurt with probiotics to restore bowel flora. She was on an immunosuppressive transplant regimen and had previous bowel surgeries that likely contributed to the organism translocating through the gastrointestinal mucosa and contributed to abscess formation. This patient also improved with antifungal therapy.

Figure 2. Walled-off abscess located near the right rectum.

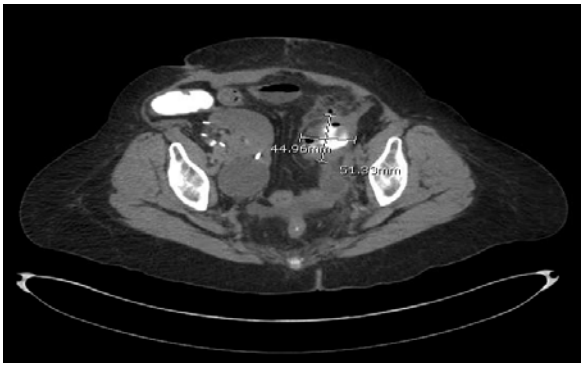

Figure 3. Large abscess in the left pelvis filled with contrast.

Discussion

Few cases of complications from *S. cerevisiae* have been reported. The number of documented infections from the ingestion of cultured yogurts and probiotics is increasing and considered an emerging type of infectious disease.[9] Since the mid-1900s,

roughly 60-100 cases of *S. cerevisiae* fungemia from cultured yogurts/probiotics have been identified.[9,11,12] Data released in the near future undoubtedly will show a higher number of cases of *S. cerevisiae* fungemia.

Probiotic-related fungemia may be asymptomatic or severe with unexplained fever, fungemia, endocarditis, pneumonia, liver abscess, peritonitis, and septic shock.[13] Although the vast majority of reported cases occur in patients who are critically ill with significant comorbidities, *S. cerevisiae* should be considered a potentially dangerous micro-organism as there are cases causing fungemia in immunocompetent patients as well.[9] Also, patients may not report they are ingesting cultured yogurt and probiotics as historically they have been viewed as benign, health promoting agents with no side effects. Patients should be asked about probiotic and cultured yogurt use when gathering historical data.

Enteral translocation of ingested micro-organisms (as in the cases described above) is a potential portal of entry into the bloodstream.[10] Approximately two-thirds of patients with *S. cerevisiae* fungemia had previous digestive tract disease.[12] Scant data, however, specifically document intra-abdominal abscess caused by *S. cerevisiae*, which makes the second case above unique.

According to the Infectious Disease Society of America (IDSA),[13] routine administration of available probiotics is not recommended to prevent primary *C. difficile* infection as there are limited data to support this approach and there is a potential risk of bloodstream infection. There is a potential benefit of using probiotics containing *S. cerevisiae* (subtype *boulardi*) with oral vancomycin to reduce the recurrence of *C. difficile*, however, the IDSA discourages routine usage of probiotics in critically ill patients and warns of potential fungemia if used in immunocompromised patients. Other national/international medical authorities (e.g., United Kingdom Health Protection Agency, American College of Physicians, World Gastroenterology Organization) have no definitive statements with regards to the overall safety of probiotic usage with antibiotic-associated diarrhea and *C. diff*-associated diarrhea.[2]

Conclusion

There is marginal randomized data on the effectiveness of probiotics to prevent antibiotic-associated and *C. difficile*-associated diarrhea. The recent increase in incidence and severity of disease caused by hypervirulent strains of *C. difficile* has prompted some clinicians to increase their use of probiotics as drugs in combination with standard antimicrobial drug therapy. However, many organizations, such as the IDSA, do not recommend the routine usage of probiotics due to potential complications.

Clinicians should be aware that probiotic dietary supplements are not required by the US Food and Drug Administration to undergo rigorous premarketing evaluations for efficacy or safety.[13] Furthermore, there have been multiple reports about complications such as fungemia from these agents. *Saccharomyces cerevisiae* should be considered as an emerging cause of nosocomially acquired yeast infection and the risks and benefits of probiotics should be carefully assessed, particularly in immuno-suppressed or critically ill patients.[9]

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Cannabinoid Hyperemesis Syndrome

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Introduction

Marijuana is used in the United States and worldwide.[1] It sometimes is used by patients, most generally illegally, for its antiemetic properties. Paradoxically, it actually can cause nausea and vomiting with abdominal pain in some patients. In recent years, there has been recognition of a new clinical condition known as Cannabinoid Hyperemesis Syndrome (CHS). This syndrome was first described in 2004 and is characterized by chronic cannabis use, cyclic episodes of nausea and vomiting, and the learned behavior of hot bathing or showering.[2] In some cases, polydipsia is present. We present the case of a young man who came to our emergency department with classic symptoms and history of this diagnosis of exclusion.

Case Report

A 22-year-old male with a past medical history of Gilbert syndrome presented to an academic medical center with a complaint of constant, sharp, diffuse abdominal pain, as well as nausea and vomiting of four days duration. The patient ranked his pain as 10/10 without relief. He had not eaten for several days as this worsened his symptoms. He denied fever, chills, diarrhea or bleeding. His jaundice was consistent with baseline due to Gilbert syndrome. He previously was hospitalized at a local hospital one month prior due to similar symptoms and later admitted that he had been hospitalized at several other local hospitals in the past with similar complaints, but generally had left against medical advice because they "did not let me shower enough". He admitted to heavy, daily marijuana use of 3-5 cigarettes ("joints") for the past three years. At times, he booked a hotel room for hot baths and showers during these pain episodes, which occurred every 1-2 months and lasted 4-5 days. His first episode occurred one year after his marijuana use increased significantly.

His urinary drug screen was positive for tetrahydrocannabinol (THC), but no other illicit substances. He was admitted to the hospital due to uncontrolled pain. In the emergency department, he requested a hot shower several times. At admission, he was asked to remain without food and drink for possible testing. Despite this request, he was observed drinking out of the sink in the radiology suite and getting out of the transport wheelchair to drink from a water fountain while returning to his room. During hospitalization, he was frequently in the shower, up to eight times a day, and was frequently unavailable to health care professionals.

A complete blood count, comprehensive metabolic profile, and lipase were within normal limits except for the elevated bilirubin which was consistent with his diagnosis of Gilbert Syndrome. An

abdominal ultrasound did not reveal cholelithiasis or ductal dilatation. A recent computed tomography scan of the abdomen/pelvis from an outside hospital was unremarkable and did not reveal a source for his pain.

An esophagogastroduodenoscopy revealed mid to distal esophagitis and he was started on a twice daily proton pump inhibitor. At the time of discharge, his abdominal pain, nausea, and vomiting were improved and the frequency of showering had decreased. No evidence of celiac disease or H. pylori was found. It was not thought that the esophagitis was the source of his symptoms as there is no known relationship between it and excessive showering. A gastric emptying study was not obtained during hospitalization due to narcotic use to control the pain and was scheduled to be done as an out-patient. A psychiatry consult was not obtained.

The patient was advised to quit marijuana usage and have a follow-up appointment with the consulting gastroenterologist for the gastric emptying study. A copy of a Canadian article on cannabinoid hyperemesis syndrome was given to the patient.[3] Unfortunately, he missed the gastroenterology appointment and gastric emptying study and was lost to follow-up. Approximately a year later, he presented to the ED with similar complaints and his family indicated he was smoking marijuana heavily again. He recently had been hospitalized twice at outside hospitals for similar presentations. According to his family, during his periods of marijuana abstinence, his nausea, vomiting and abdominal pain resolved.

Discussion

Cannabinoid hyperemesis syndrome (CHS) is characterized by cyclic episodes of abdominal pain, nausea, vomiting, and compulsive hot bathing or showering, with some descriptions include polydipsia.[2] Soriano-Co et al.,[4] building on the previous work of Sontineni et al,[5] suggested major and supporting features supporting the diagnosis. The major features included: (1) severe cyclic nausea and vomiting, (2) resolution with cannabis cessation, (3) relief of symptoms with hot showers or baths, (4) abdominal pain, and (5) weekly use of cannabis. Supportive features included: (1) age younger than 50 years, (2) weight loss of greater than 5 kg, (3) morning predominance of symptoms, (4) normal bowel habits, and (5) negative findings on diagnostic evaluation. The syndrome consists of three phases: pre-emetic or prodromal, hyperemetic, and recovery phase. The pre-emetic prodromal phase lasts for months or years and is characterized by early morning nausea, a fear of vomiting, and abdominal discomfort. The hyperemetic phase is characterized by complaints of intense and persistent nausea, vomiting and pain. During this phase patients classically take numerous hot showers or baths throughout the day. This behavior appears to be learned, as it is the only measure known to control symptoms, and therefore, it quickly becomes a conditioned behavior.[3]

The pathophysiology of CHS is unknown. Possible mechanisms of cannabinoid hyperemesis include toxicity resulting from marijuana's long half-life, its lipophilic properties, its ability to delay gastric emptying, and its dysregulation of thermoregulatory and autonomic equilibrium.[2] One hypothesis is that heavy exposure to THC results in supersaturation of cannabinoid receptors which results in a decrease in the number of receptors, a phenomenon known as desensitization, and their gabanergic effects, including nausea suppression, is diminished. The association between hot showering and symptom relief is understood less clearly, but may involve the fact that THC increases central body

temperature and hot water may result in a paradoxical perception of cold when cutaneous cold fibers are exposed to a hot stimulus.

Patients frequently have multiple hospitalizations and often fail to be diagnosed for a considerable time period, sometimes being diagnosed with cyclic vomiting syndrome (CVS).[6-8] Though both conditions have similar presentations, including cycles of vomiting and sometimes abdominal pain, with CVS patients frequently have migraine headaches and rapid gastric emptying times, whereas CHS is associated with delayed gastric emptying.

The recovery phase requires abstinence from marijuana usage to prevent the return of symptoms. Patient education is crucial in the treatment and ultimate resolution of this debilitating syndrome. The efficacy of outpatient treatment options, such as cognitive behavioral therapy for marijuana dependence, should be considered.[9]

Conclusions

The purpose of reporting this case of cannabinoid hyperemesis syndrome is to increase awareness of this likely underdiagnosed syndrome, its symptoms, including the peculiar need for frequent hot bathing, and characteristic phases. In patients with severe, intermittent abdominal pain who have a history of prolonged, heavy cannabis use, this diagnosis should be entertained.

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