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Are We Prepared? A Cross Sectional Study of Preparedness in Fayette County Kentucky for a Pediatric Mass Casualty Incident

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Introduction

Many efforts related to emergency preparedness stemmed from lessons learned from the military¹. As a consequence of this, much of the focus of emergency preparedness relates to adult issues. This is commonly seen in the preparedness of medical operations related to disaster situations. Although a much smaller proportion of the population, the number of potential pediatric victims during a disaster situation is substantial. According to data from the 2010 census, 21% of the Fayette County population is under the age of 18; this yields an estimate of 62,118 children residing in Fayette County². To put these numbers into perspective, the number of children living in Fayette County is enough to fill 93% of the capacity of Commonwealth Stadium and would fill Rupp Arena 2.5 times over³.

Children are vulnerable to the same threats as their adult counterparts. However it can be argued that they are more susceptible to many of these threats since so many of them rely on adult supervision and care giving¹. Children can be uniquely affected by hazardous materials due to their smaller body size, location closer to ground level and their increased minute ventilation⁴. Just like adults, children are at risk for injuries due to severe meteorological events, natural disasters, infectious disease threats and public violence. While many people probably think about the implications and potential for pediatric disaster planning, it is not a subject that many people feel comfortable putting into practice. It becomes the proverbial "elephant in the room:" people understand that the problem is there but do not take steps to acknowledge the problem and overcome it.

Prior to embarking on any significant planning for response to pediatric disasters, the Division of Emergency Management in Lexington Kentucky wanted to obtain background information on the community of emergency responders. The purpose of this study was to

determine the comfort level of emergency responders, physicians and nurses to respond to a pediatric mass casualty incident (PMCI) in Fayette County. In addition, identification of past training experiences and desires for future training experiences were surveyed.

Methods

A cross-sectional study of emergency responders, emergency physicians, pediatric physicians and emergency nurses was conducted from 29 July 2014 to 29 August 2014. The Medical Institutional Review Board of the University of Kentucky exempted this study. A mass casualty situation, related to pediatrics, was defined as a situation involving more than two simultaneous pediatric casualties. This definition was operationalized based on emergency medical services capacity of carrying two patients per ambulance on a routine basis.

Three versions of an Internet-based survey were created in REDCap, a secure online data repository and survey tool managed at Vanderbilt University. The survey consisted of perception questions related to PMCI issues, based on a five point Likert scale. The scale was divided into strongly agree, agree, neutral, disagree and strongly disagree. In addition, a 10 patient triage exercise was included in the survey, consisting of five adult patients and five pediatric patients. Survey versions were specific for occupation: emergency responder, physician, nurse. The survey for emergency responders included firefighters, firefighter paramedics, fire officers and emergency management personnel. Emergency management personnel were excluded from taking the triage portion of the survey since it was thought not to be in their scope of practice to perform triage in the field. An anonymous electronic link was created for each version of the survey. This link was distributed to the various recipients via nursing managers, physician

medical directors and the division of emergency management. The survey remained open for one month with two electronic reminders sent to potential participants.

Statistical analysis of the response rate was performed using an online sample size evaluation tool from Raosoft (<http://www.raosoft.com/samplesize.html/>). This was used to evaluate the response rate as well as the margin of error of the survey. Descriptive statistics were used to describe the demographics of the survey population. The Likert scale questions were dichotomized for analysis. The strongly agree and agree groups were collapsed into a single variable called "agree," while the categories neutral, disagree and strongly disagree were collapsed into a single variable called "disagree" to facilitate analysis using chi-square tests. To evaluate triage ability, an overall score of correctly triaged victims, as well as adult and pediatric sub-scores were tabulated. Descriptive statistics of these scores, paired t-test analysis of the adult and pediatric triage sub-scores, as well as analysis of variance between occupation groups was performed. SPSS 22 was used for statistical analysis and figure generation.

Results

Sample Population

A total of 409 surveys were sent between the three different groups with 111 total responses. There were 10 incomplete surveys thus yielding 101 complete surveys for analysis; these respondents included 52 emergency responders, 20 nurses and 29 physicians. The response rate for the survey was

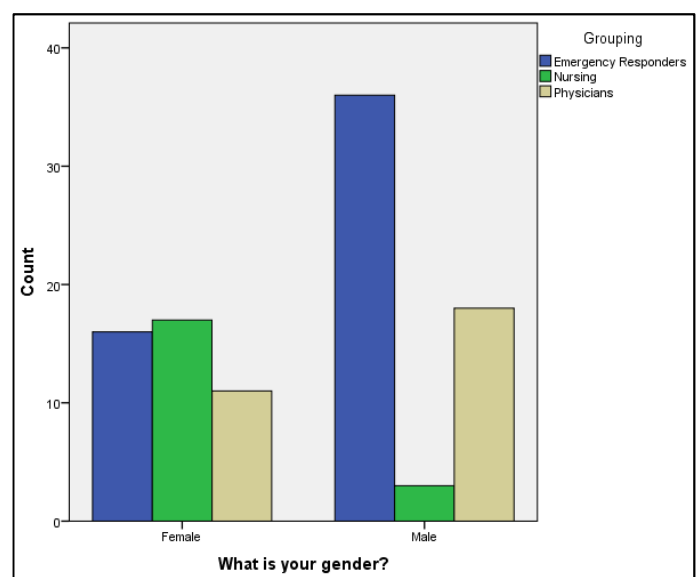


Figure 1: Graph of distribution of occupation group versus gender

24.7% with a margin of error equal to $\pm 7.95\%$. Males comprised 56% of respondents and to be the majority of emergency responders. Distribution of occupational groups versus gender is shown in Figure 1. The mean age of the survey population was 42.5 ± 10.6 years with the median

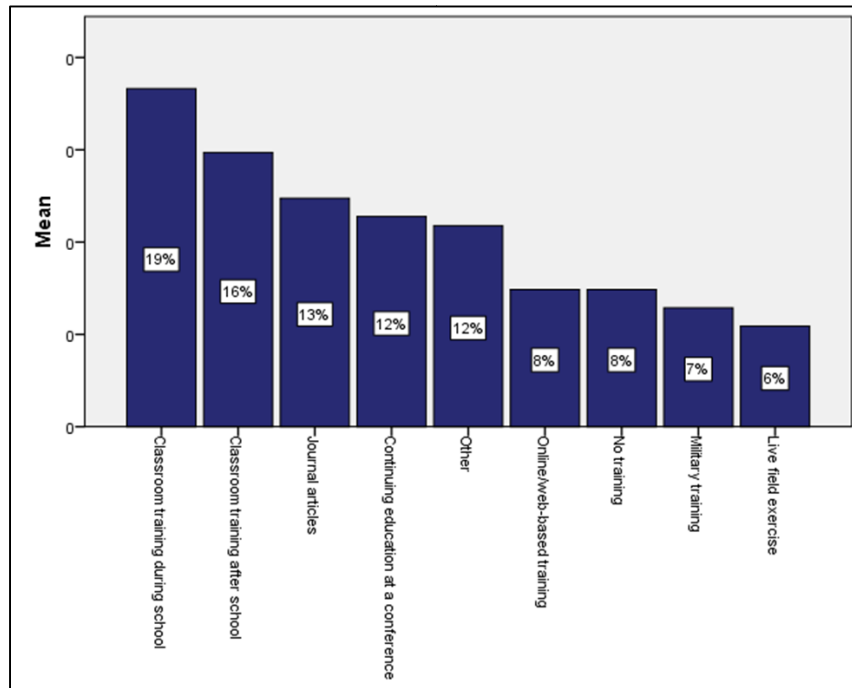


Figure 2: Distribution of past PCMI training experiences

age of 41 years (range = 24 to 66 years old). The mean length of service in their respective occupations was 12.6 ± 9.1 years with the median of 10 years (range = 0 to 44 years). When queried about PMCI experience, 32% of respondents stated they had never been in a

pediatric mass casualty

incident while 66% of the group surveyed had participated in less than five pediatric mass casualty incidents. Didactic classroom training was the dominant form of PMCI training, with 35% of respondents having participated in some form of didactic training; 84% of respondents stated they would benefit from additional classroom training. Only 8% of respondents reported no training at all.

Perceptions Surrounding Pediatric Mass Casualty Incidents

When questioned as to the likelihood of the PMCI event occurring in Fayette County, 75% of those surveyed believed a mass casualty event involving children will occur ($p < 0.001$). The majority of responders do not carry the same confidence in the perception of county and

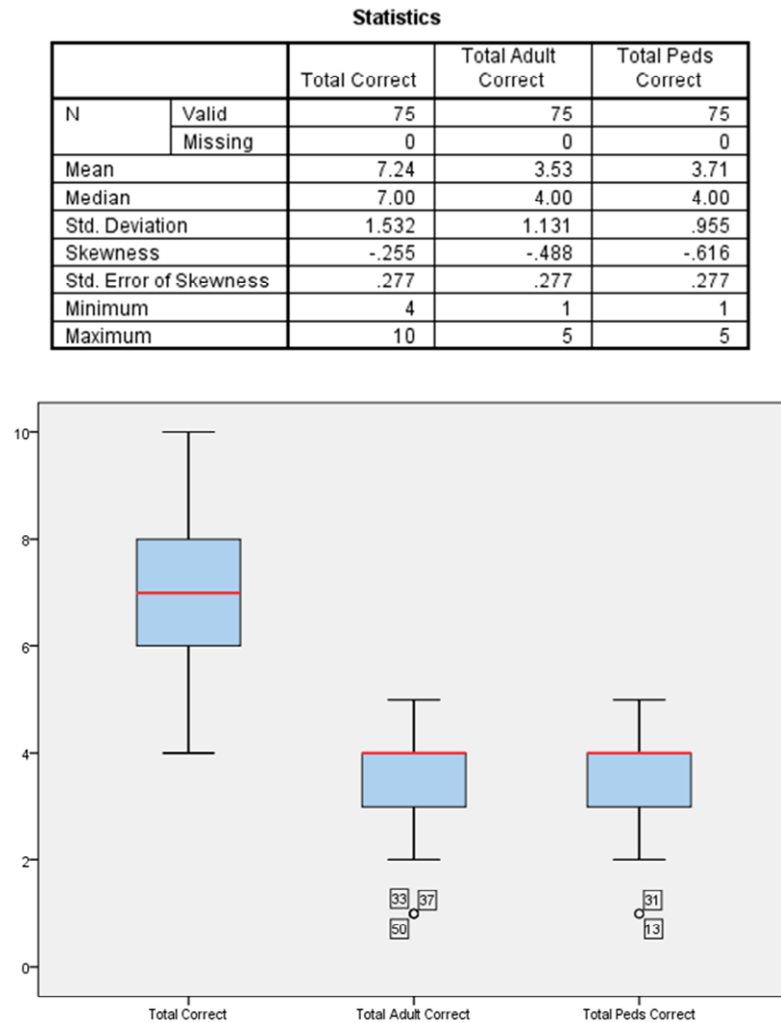
facility preparedness; 63% of respondents believe the county as a whole is unprepared for a pediatric mass casualty incident ($p<0.05$) and only 50% of physicians and nurses believe that their individual facilities are prepared for a large-scale pediatric disaster ($p=0.921$). Perceptions of personal performance do not suffer from this doubt; 63% of responders feel well prepared to respond during a pediatric disaster ($p<0.01$), 63% feel confident in their abilities to triage adult patients ($p=0.01$) and 78% feel confident in their ability to triage pediatric victims ($p<0.001$). When queried about the benefit of a pediatric mass casualty exercise, 93% believe the county would benefit from a live exercise ($p<0.001$) and 93% state they would gain personal benefit as a professional from participating in a pediatric mass casualty incident ($p<0.001$).

Triage Exercise

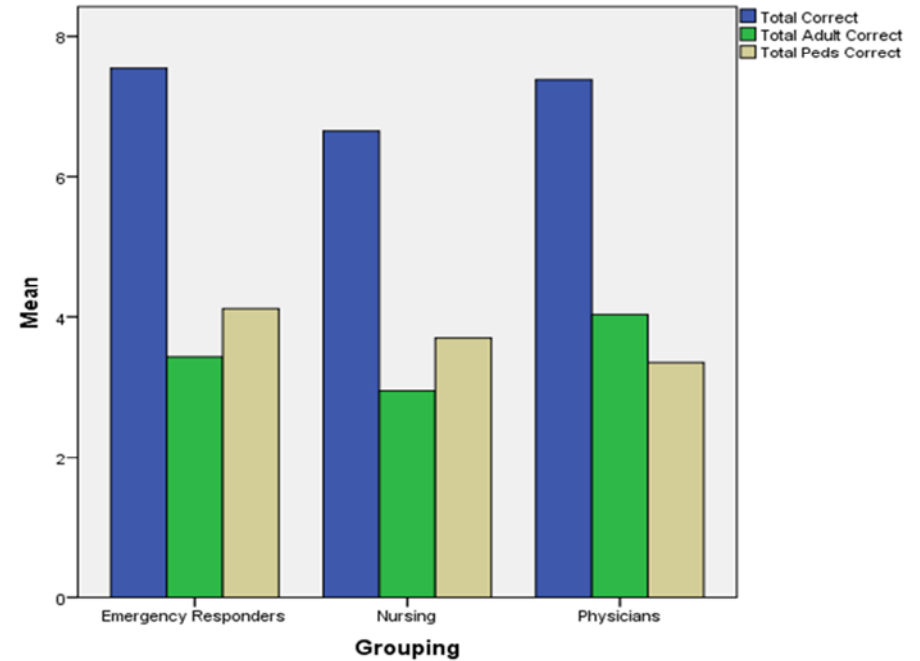
A total of 75 surveys contained complete data for the triage exercise. The average score for the entire exercise for all occupational groups was 7.2 ± 1.5 (median=7, range=4-10); a perfect score was 10. For the adult triage sub-score, the mean was 3.5 ± 1.1 (median=4, range=1-5). The pediatric triage sub-score showed similar results with a mean of 3.7 ± 0.9 (median=4, range=1-5). The paired t-test analysis of adult and pediatric scores were not significant ($p=0.296$). When the scores were evaluated by occupational group, aggregate scores were no different across all groups. However, statistically significant differences were noted in the sub-score analyses with physicians outperforming all other groups in adult triage and emergency responders outperforming the others in pediatric triage (Figure 3).

Figure 3: Statistical Analyses of Triage Exercise: A) Descriptive analysis and box plot for the composite , adult and pediatric scores. Three outliers were noted in the adult scores and two were noted in the pediatric scores; these outliers did not significantly affect the results of the analyses and were included in the analysis. Paired t-test analysis of the adult and pediatric sub-scores showed no statistical difference. B) One way Analysis of Variance (ANOVA) comparing the total, adult and pediatric triage scores by occupational group. Although no difference was present in the composite scores, significant differences were noted in the adult and pediatric scores by occupational group.

A



B



| ANOVA | | | | | | |
|---------------------|----------------|----------------|----|-------------|-------|------|
| | | Sum of Squares | df | Mean Square | F | Sig. |
| Total Correct | Between Groups | 9.841 | 2 | 4.920 | 2.162 | .122 |
| | Within Groups | 163.839 | 72 | 2.276 | | |
| | Total | 173.680 | 74 | | | |
| Total Adult Correct | Between Groups | 14.405 | 2 | 7.202 | 6.461 | .003 |
| | Within Groups | 80.262 | 72 | 1.115 | | |
| | Total | 94.667 | 74 | | | |
| Total Peds Correct | Between Groups | 8.141 | 2 | 4.071 | 4.934 | .010 |
| | Within Groups | 59.406 | 72 | .825 | | |
| | Total | 67.547 | 74 | | | |

Conclusions:

Lexington/Fayette County is well served by a large group of well-trained emergency providers with significant overall experience. Personnel who work in the medical and emergency preparedness community appear personally ready to respond to the challenge of a PMCI in Fayette County Kentucky. However, significant doubt exists about the performance of the community as a team. This doubt is a significant concern and needs to be addressed. By participating in a live exercise involving a significant number of pediatric patients, the community response infrastructure will be able to assess field operations, institutional medical operations, community teamwork, standard operating procedures for each involved group and remediate deficiencies within occupational groups. The vast majority of responders in the survey see the benefit of a live exercise; they want an exercise to grow as a professional and be better prepared to serve the community. The ideal method to attain this training has yet to be determined. A follow up survey is planned to assess the methods of education the individual occupational groups want to best foster learning.

Planning an exercise is a significant event. While creating a stand-alone PMCI exercise would be ideal, dovetailing onto an existing exercise would allow for more rapid implementation. Modifying an existing exercise, such as CSEPP, would allow for initial assessments of infrastructure while planning for a pediatric specific exercise is planned.

Triage performance showed overall good performance. A surprising paradox was noted in the results. Most emergency response efforts are focused on adults. It was surprising that the emergency responders did better with pediatric triage rather than adult triage and vice versa for physicians. Some of the comments from the survey speak of a “teddy-bear” triage program

instituted to train fire fighters on pediatric triage. Triage is certainly a skill that is lost if not practiced. The algorithms for triage in adults and children are similar, but have distinct differences. Emphasizing training on the method used less frequently may cause an inadvertent deficiency in the other. Also, groups who routinely deal with one major age group may think they are experts on the algorithm for their most frequent age group and may short-change training on the most common age group. For example, if a provider takes care primarily of adults, they assume they know the adult triage algorithms and focus more on the pediatric pathways, thus neglecting review of the adult pathways. Determining the ideal method to fill the training gaps, prior to a live exercise requires a second survey to query the occupational groups as to the best learning method for their constituents

This study is subject to some bias and limitations. First, the margin of error was slightly larger than desired. However, based on typical estimates of internet survey response rates, this is an excellent response and the margin of error should not significantly impact the main findings of the study. Relying on respondents to recall past training events make the study subject to recall bias; however this does not appear to change the general tone of the population which is that a PMCI exercise is necessary.

Benjamin Franklin once said: “failing to plan is planning to fail.” The children of Fayette County and their families rely on a professional, well trained emergency response force to help them cope during disastrous time. Failing to plan a pediatric-centric exercise is a guaranteed plan for failure. In addition to a pediatric-centric exercise, future directions of this project should be to regionalize the survey to other communities to allow them to assess their readiness posture. Addressing these issues will allow us to move from a posture of “are we ready?” to a position of “we are ready!”

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