

ORIGINAL RESEARCH

Use of an Emergency Medical Pictorial Communication Book During Simulated Disaster Conditions

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ABSTRACT

During disasters, the needs of victims outstrip available resources. Rapid assessment of patients must be performed; however, language barriers can be an impediment to efficient patient assessment, especially if interpreter resources are limited. Dependency on interpretive services requiring technology such as telephones, cell phones, and video conferencing may be inefficient, as they may be unavailable during disaster conditions. A low-tech, portable tool that aids in communication with non-English speakers would be beneficial. The medical emergency communication (MEC) book, developed at Children's Hospital Los Angeles, has the potential to be a useful tool in this capacity.

The goal of this pilot study was to compare the accuracy of a newly developed disaster-focused medical history obtained from Spanish-speaking patients or caregivers using the MEC book, compared to a control group with whom no book was used. Our hypothesis was that use of the MEC book improves accuracy of medical history taking between English-only speaking health care workers and Spanish-speaking patients better than a monolingual clinician trying to take a medical history without it. We anticipated a higher overall score in the group of subjects whose histories were taken using the MEC book than in the control group. Patient satisfaction with the MEC book also was measured. (*Disaster Med Public Health Preparedness*. 2013;7:475-480)

MATERIALS AND METHODS

The MEC book is a pictorial guide that has graphic representations of pertinent medical situations and written text in 7 of the most commonly spoken (in Southern California) local languages that correspond to the pictures. The book enables the user to take a basic medical history and to explain procedures and disposition to a patient (see Figure 1). The book attempts to cluster situational questions, so likely follow-up questions can be addressed without an exhaustive search through the rest of the book. For example, when asking about allergies to medications, nearby pictures and text refer to rashes and difficulty breathing. The book is divided into sections on history taking and symptoms, diagnostic testing and procedures, and disposition. One page has letters and numbers to allow patients to point to these items to spell a medication or person's name or to communicate a phone number or the dosage of a medication.

Design and Study Population

This prospective, hospital-based study took place at Children's Hospital Los Angeles, an urban tertiary care university emergency department (ED) with approximately 65 000 visits per year. The study took

place in the waiting area of the ED from July to December 2010. Inclusion criteria required that (1) the patient and parent or caregiver were Spanish-only speaking; (2) their triage acuity level was minor (lowest level), as based on institutional triage guidelines; and (3) they were waiting to see the physician in the waiting room. Exclusion criteria were (1) English-speaking caregiver, family member, friend, or patient; (2) non-Spanish foreign language speaking caregiver, family member, friend, or patient; (3) triage severity greater than minor; and (4) the physician was ready to see the patient.

To determine whether the patient or caregiver spoke English, the triage nurse asked the parent in English, "Can you talk to the doctor in English?" If their response was "yes," they were not included in the study, as they understood the question asked in English. If the patient or caregiver told the triage nurse in Spanish only that they do not speak English, or if they did not answer the triage nurse (inferring they did not understand the question), they qualified for the study. The nurse would then page the medical student research assistant and Spanish interpreter for consent to participate in the study.

Spanish-speaking subjects were chosen because they represent the largest non-English speaking minority seen in the hospital's ED, and because in-person interpreter services were available 24 hours a day, 7 days a week. Subjects underwent verbal consent and were given a written consent sheet before participation in the study. Subjects were informed that this was not part of the actual physician's visit, and that a nonmedical physician research assistant and a medical interpreter would be asking them questions.

Subjects were randomized by a computerized randomization program into 2 interventions, but the research assistant was blinded as to which intervention would be performed until after consent was obtained. A questionnaire was created with the following 10 historical questions deemed important in the event of a disaster:

1. Chief complaint (primary symptom)
2. Age of child (years, months, or weeks)
3. Duration of symptoms (No. of days or hours)
4. Who is the historian (relation to patient)
5. Allergies? (yes/no)
6. Taking medications? (yes/no)
7. Is patient having pain? (yes/no)
8. Fever present? (yes/no)
9. Difficulty breathing present? (yes/no)
10. Vomiting present? (yes/no)

The time for the research assistant (RA) to obtain the information was limited to 2 minutes to mimic disaster time constraints. The RA was allowed use of the MEC book according to study randomization and/or body language, charades, or gestures to obtain the best information possible within the 2-minute time frame. The RAs self-reported that they have no Spanish-speaking skills. Time was kept by an administrative assistant with a stopwatch. The RA wrote down the answers or circled the "unable to obtain" choice if no answer was given. Afterward, the Spanish interpreter asked the subject the same 10 questions and was allowed as much time as needed to obtain the answers to the historical questions. The interpreter's list of answers was considered the gold standard by which the RA's answers were determined to be correct or incorrect. The primary outcome of the study was to compare the correct percentage scores between the control group (no MEC book) with the intervention group (MEC book). The secondary goal of the project was to determine parental satisfaction with the book. To measure this, subjects rated their satisfaction on a 5-point Likert scale: from 1, not at all; to 5, the most possible, to the following questions:

- How confident are you the physician understood what you were trying to tell him/her?
- Could you understand what the physician was trying to tell you?
- If a translator is not available, would you like to use a book such as this to help you communicate? (MEC book group only)

The Children's Hospital Los Angeles Institutional Review Board (IRB) approved the study.

Sample Size and Statistics

Demographic characteristics of subjects randomized to the MEC book or no book group were compared with a Fisher exact test for categorical variables and *t* test or Wilcoxon rank sum test for continuous variables. The primary outcome variable, number of correct scores, was calculated for each subject as the number of answers obtained by the RA that were in agreement with those obtained by the Spanish interpreter. The group means were compared with the 2-sample *t* test. Additional analyses compared the groups on the percent of correct answers (vs incorrect or unable to respond) for each of the 10 questions and on the percent unable to obtain information, using the 2-sided Fisher exact test.

The sample size was calculated to achieve 80% power, with 2-sided $\alpha = 0.05$. To detect a moderate sized (1/2 SD) difference, 64 subjects per group were needed; group means were compared using a 2-sample *t* test. Statistical analyses were performed using SAS version 9.2 software.

RESULTS

During the study period from July to December 2010, a total of 128 subjects were interviewed. The MEC book was used with 65 subjects, and no MEC book was used with 62 subjects. Data for the medical history questions were incomplete in 1 interview, and data for parental education levels were missing for 12 mothers and 27 fathers. Groups were similar in terms of how much time subjects had lived in the United States, educational achievement, patient and parental ages, and number of people living in the home (see Table 1).

Overall, scores for subjects interviewed using the MEC book were higher than those interviewed without it. The mean raw score (number of correct questions of 10 total questions) for the control group was 6.58 (± 1.77), while the MEC book group had a mean of 7.49 (± 2.29) ($P = .013$). The breakdown for correct answers for each of the 10 questions with and without use of the book is presented in Table 2.

Differences in 2 of the 10 questions (chief complaint and allergies to medications) determined the overall difference seen in the scores. Using the book, the English-speaking interviewer was almost twice as likely to identify correctly the chief complaint, a vital piece of information that in most histories leads to the appropriate follow-up questions and guides the course of the interview. A history of allergies was also more likely to be correctly identified using the book, thereby avoiding a potentially catastrophic medical error. In addition, 6 of 10 questions had a significantly higher percentage of "unable to obtain information" responses when the book was not used, suggesting that without the book the

FIGURE 1

Sample content of the medical emergency communication book used in the study.

0 1 2 3 4 5 6 7 8 9 10			
11 12 13 14 15 16 17 18 19 20			
10 20 30 40 50 60 70 80 90 100			
100 200 300 400 500 600 700 800 900 1000			

 problem problema problema 问题 문제 Problema मुरिक्कल Problem	 fever fiebre lagnat 发烧 열 ହୃଦ୍‌ପୂ बुखार Fieber	 rash roncha rases 皮疹 발진 गुलु त्वचा का Ausschlag	 heart corazon puso 心脏 심장 ଉଁର୍ତ୍ତ୍ତ हृदय Herz	 lungs pulmones baga 肺脏 폐 ପାଁଳିପ फेफड़े Lunge
 bleeding sangre durnudugo 出血 출혈 Bluten	 throat garganta lalamunan 咽喉 인후 କିଁକିଁକି गला Hals	 cough tos ubo 咳嗽 기침 ହୁଅ खासी Husten	 dizzy mareado hilo 眩晕 현기증 ଶିଳ୍ପାଳାମା चक्कर आना Schwindel	 seizure ataque kombulsion 痉挛 발작 ଲୁୟା जकड़न Krampfanfall
 ears, eyes oidos, ojos tainga, mata 耳朵, 眼睛 귀, 눈 ଓଧିଗୁଣ୍ଡିପ ଓଧିଗୁଣ୍ଡିପ कानए आँखें Ohren, Augen	 belly panza tian 腹部 복부 ନ୍ଦାଘାଘି उदर/पेट Bauch	 diarrhea diarrhea pagtatate 腹泻 설사 ଇନ୍ଧ डायरिया Durchfall	 vomiting vomitar suka 呕吐 구토 ଫାହାମା उल्टी होना Erbrechen	

TABLE 1

Group Characteristics			
Variables	No MEC Book (n = 62) No. (%)	MEC Book (n = 65) No. (%)	P
Male patient	41 (67.2)	33 (51.6)	.101
Born in US	56 (90.3)	56 (86.2)	.586
Mean No. years in US	5.62	5.57	.729
Mean patient age (y)	6.11	6.43	.593
Mean No. mother's years of education	6.74	6.64	.666
Mean No. father's years of education	6.47	6.51	.990
No. of people in home	5.06	4.62	.258

Abbreviation: MEC, medical emergency communication.

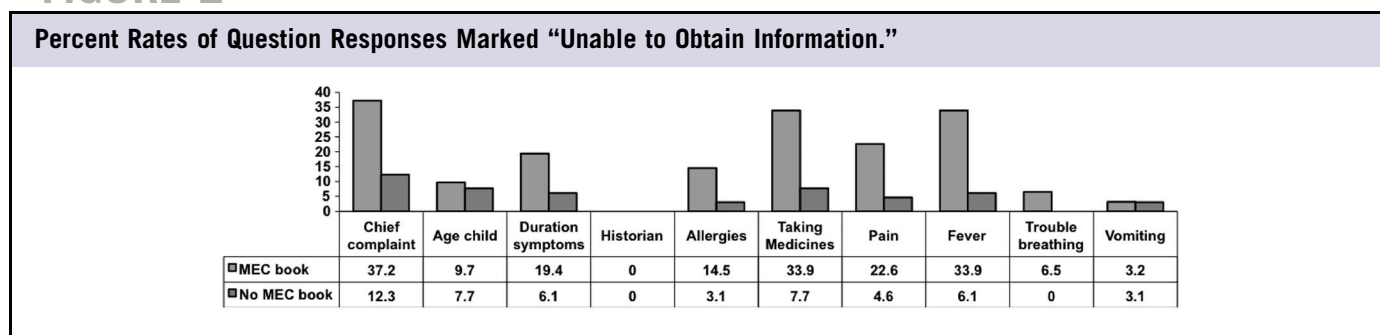
TABLE 2

Questions Correctly Answered			
Questions	No MEC Book (n = 62) No. (%)	MEC Book (n = 65) No. (%)	P
Chief complaint	22 (35.5%)	40 (61.5)	.0044 ^a
Age of child	46 (74.2%)	50 (76.9)	.8368
Duration of symptoms	41 (66.1%)	42 (64.6)	1.0
Historian	56 (90.3%)	58 (89.2)	1.0
Allergies	39 (62.9%)	52 (80)	.0482 ^a
Taking medicines	25 (40.3%)	37 (56.9)	.0764
Pain	41 (66.1%)	52 (80)	.1083
Fever	36 (58.1%)	45 (69.2)	.1934
Trouble breathing	53 (85.5%)	61 (93.8)	.0736
Vomiting	54 (87.1%)	58 (89.2)	.5809

Abbreviation: MEC, medical emergency communication.

^a Statistically significant.

FIGURE 2



information gathered was not necessarily incorrect but rather it could not be ascertained at all (Figure 2). (Table 3).

There was no statistical difference in parental perception of whether the physician or research assistant understood them more when using the MEC book or not ($P = .1390$). Parents also did not state that they understood the physician or research assistant more when using the MEC book than when not using it, although this approached statistical significance ($P = .06$). Subjects who were interviewed using the MEC

book overall rated their satisfaction levels as very high (4.66 on the 5-point Likert scale) (see Table 3).

DISCUSSION

Limited English proficiency (LEP) is defined as a self-report of speaking English "less than very well." Disparities in children's health and health care are associated with both speaking a language other than English at home and having limited English proficiency.¹ Language barriers in the health

TABLE 3

Parental Satisfaction Questionnaire	No MEC Book		MEC Book		P
	N	Mean	n	mean	
Physician understanding parent	62	3.76	65	4.05	.1390
Parent understanding physician	62	3.69	65	4	.0656
Book utility	n/a	n/a	65	4.66	n/a

Abbreviation: n/a, not available.

care setting are a growing issue in the United States. Twenty percent of the US population older than age 5 years speaks a language other than English at home.¹ At 39.5%, California has more residents with LEP than any other state.² A disproportionately large number of all people between the ages of 18 and 40 years who speak a language other than English at home speak Spanish. In the United States, LEP individuals are a vulnerable population during disasters.

Current disaster preparedness plans do not adequately address the needs of individuals with low English proficiency. Emergency response to disaster conditions is complicated when LEP is a factor.² Few medical interpreters have training in disaster preparedness, and LEP populations may not understand warnings or directives sent out by public health officials.³ The MEC book helps bridge this communication gap. Our results show an increase in accuracy of history taking using the MEC book compared with subjects who were interviewed without it. The MEC book was designed for use in situations in which interpretive services are overwhelmed or completely unavailable, and not when a trained medical or even an ad hoc interpreter is available. To our knowledge, no published studies have investigated similar methods of alternate communication in spite of a need to communicate with LEP patients in a disaster setting.

Symbols and pictorial depictions of concepts have been in use since prehistorical times. From cave paintings to Egyptian hieroglyphics to modern day icons seen in airports, on roads, and on computer screens, graphics have allowed people from different language backgrounds, cultures, and even time periods to effectively communicate with one another. The role of using symbols to aid in medical communication has been investigated in previous research. In a review of the role of pictures in health care communication, Houts et al cite ample evidence that pictures can increase the comprehension of health care information, but caution against using pictures that are too detailed, as this may confuse the patient into focusing on irrelevant details.⁴ Some of the drawings in the MEC book may have been ambiguous to the interviewees. The presence of text in 7 of the most common regional foreign languages adjacent to the graphics offset some of these deficiencies. For example, a static drawing may not convey a

complex experience such as difficulty breathing. Studies looking at the effects of pictorial aids in medication use found that combining pictures and written words were superior to text alone.^{5,6}

Subjects in both arms of this study had little problem understanding the questions relating to a specific demonstrable physical act (eg, coughing, vomiting). The use of the MEC book helped most subjects ascertain information when the concept was more abstract (eg, fever, allergies). Cowgill et al, in a review of symbol usage in health care settings for people with LEP, state that “the more concrete a message, and the more the graphic relates to its intended message, the more intuitively that message will be understood.”⁷

It would be interesting to see how the book would perform with a language more distantly related to English, such as Korean or Armenian. We speculate that the differences between intervention and control groups would be magnified. Many words in English and Spanish are cognates—they sound nearly alike in both languages (eg, vomit-vomito, medicine-medicina, mom-mama, allergies-alergias). This factor may have led to increased understanding among non-MEC book users, which would have downplayed the efficacy of the MEC book. Some questions had nearly all the same answers (eg, caregivers were almost always mothers of patients), making it unlikely for our RA to get the answer wrong). Perhaps our choice of questions made it easy for the RA to perform a charade or gesture that clued the interviewee to what they were being asked about (for example, acting out a patient vomiting is difficult to be misconstrued).

Our goal was to create a short questionnaire that would be relevant under disaster conditions. While better than no book at all, using the book was by no means a method of obtaining error-free communication. Even though using the book doubled the accuracy in obtaining the correct chief complaint, 60% accuracy is not an ideal way to practice medicine. However, in a mass casualty setting, the book increases the ability to communicate in an affordable, portable way that does not depend on technology or electricity. Having a cheap, reproducible tool to aid in communication with LEP patients is an important facet of the MEC book. Covering the cost of interpretation and translation services is a significant problem. The cost of professional interpreter services varies widely by the type of interpreter and local market conditions. Onsite professional interpreter charges range from \$25 to \$100 per hour; and for phone-based interpreters, the charges range from \$1.60⁸ to \$4.50 per minute.⁹

Future studies evaluating the book's effectiveness should be determined in other aspects of care, such as explaining procedures, using other languages, emergency medical services, and in various disaster scenarios. Smart phone applications are in development for use of the MEC book by

emergency medical services staff, such as first responders (paramedics, fire, police) and ED workers.

Limitations

Some of our patients may have had some English competency not adequately screened for by our methods. Our study did not address the rates of literacy among subjects, so it is not completely clear whether the pictures or text (or a combination of both) was the source of increased understanding between patient and interviewer. Our simulation of a mass casualty event may have overestimated (or underestimated) the time that an actual health care provider would have to obtain the historical information from a patient. We can be certain that stress levels of the controlled ED setting are not as high as would be in a true disaster setting, which might alter the accuracy of the book. Pictographs are inherently limited in that there are simply not symbols for many abstract concepts. As stated previously, the MEC book did not completely bridge the language barrier gap. However, the tool demonstrated improved accuracy in communicating basic historical medical information for mass casualty situations in an inexpensive, portable manner.

CONCLUSIONS

Use of the MEC book increases accuracy of an emergency medical history taken by an English-only speaking health care provider from a Spanish-only speaking patient. This tool is not as accurate as having an actual Spanish interpreter, and should only be used in situations in which no Spanish-speaking interpreter is available. The MEC book is an inexpensive, portable, and technology independent tool that can be helpful in a disaster setting with limited translation services. Subjects who used the book were satisfied with it and recommended it when no interpreter was available.

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Author's Disclosures

Children's Hospital Los Angeles (CHLA) holds the copyright to the medical emergency communications (MEC) book used in the study; and Micky Heinrichs, MD (former employee of CHLA and creator of the book), is eligible to receive royalties from its sale. Dr. Heinrichs and CHLA may gain financially from the book's sale or commercialization. For questions regarding this disclosure, please contact Office of Research Compliance (323-361-5760).

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