

Designing a pediatric emergency triage and action program

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Abstract

BACKGROUND In Japan, non-pediatricians face many instances in which they must see children, partly due to the uneven distribution of pediatricians among urban and rural areas. We aimed to develop and examine the effect of a model simulation-based training program in pediatric primary care for non-pediatric medical and ancillary personnel who express misgivings about seeing pediatric patients in an emergency setting due to their perception of their lack of training in this area. **METHODS** We instituted a series of workshops on common pediatric emergency situations, first with physicians, and later also including ancillary personnel, as a form of interprofessional education. The entire program was constructed around Design-based Research. **RESULTS** Feedback from attendees and facilitators was mostly positive, leading us to open the workshops to ancillary personnel. **CONCLUSIONS** From a training point of view, this epistemological investigation was successful in mitigating anxieties in individuals about seeing pediatric emergency patients. The effects on patient care remain to be studied.

Background

The Swedish physician Nils Rosen von Rosenstein founded modern pediatrics as a medical specialty in the 18th century, independent from internal medicine.¹ Developments in pediatric research have led to advances in pediatric care and, from the perspective of medical education, have led to the creation of pediatrician training programs.² As medicine and medical training become more specialized, each specialist is exposed less and less to other medical specialties. Recently, physicians other than pediatricians have become hesitant to examine children, particularly in developed countries, where lawsuits for medical errors are common.³

In Japan, unlike other developed countries, non-pediatricians face many instances in which they must see children. This is partly because of the uneven distribution of pediatricians among urban and rural areas.⁴ Formal training programs for general practitioners (GPs) working in pediatric primary care settings were not available before the Japanese Primary Care Association began to establish pediatric training sites in 2009.⁵ Currently, a relatively large number of physicians—especially physicians in rural areas—have no choice but to see children despite having no pediatric training after completing their initial postgraduate training program.⁶ This indicates the need for systematic training for non-pediatricians who are required to see children in primary care settings. We hypothesized that, if simulation training programs could standardize pediatric clinical practices by non-pediatricians, it would improve the quality of care and help solve the disparities between the pediatric healthcare available in urban versus rural areas. We therefore aimed to develop a model simulation-based training program in pediatric primary care for non-pediatricians.

Here, we describe the process and outcome of designing a simulation training program using a Design-based Research (DBR) approach, design science⁷ as an epistemology, and the conceptual framework of “mastery learning.”^{8–10}

Methods

Context

In Japan, physicians who are not pediatric specialists are often required to examine children. For example, according to a report by Kuwahara,¹¹ 58% of non-pediatricians actually examine children. There are three reasons for this. First, pediatricians in Japan suffer from exhaustion; there is an average of 3.8 pediatricians per hospital in Japan,^{12,13} which is lower in comparison to other countries.^{14,15} Second, since the education system for GPs in Japan was established later than in other countries, non-pediatricians previously had to provide primary care to children. Recently, the “general practitioner” system was listed as the 19th basic medical specialty in Japan (a “primary care” system was previously in place, but was not considered one of the approved medical specialties), which leads to the expectation that general practitioners will be closely involved in the care of

children. Lastly, Japan has a system in which local municipalities supplement part or all of the cost of pediatric examination and treatment at medical facilities. Thus, the cost of pediatric medical care is extremely low, and in some communities is even free. Many physicians who are involved in after-hours primary medical care are family physicians or emergency physicians rather than pediatricians. Thus, there are occasions in which physicians who are not specialists in pediatrics provide after-hours medical care to children.

Design-based Research

We adopted DBR as the methodology for this study of theory-led development of the Pediatric Emergency Triage and Action Program (PETAP). DBR is a methodology of educational research that takes place in actual educational settings.¹⁶ It approaches complex problems about learning phenomena in a real learning context.⁷ One of the characteristics of DBR is that it is conducted in continuous cycles of design, enactment, analysis, and redesign, always with the goal of improving educational practice.¹⁷ A second important characteristic is that the design of the learning environment is based on theoretical principles, aimed at advancing theories.¹⁸ Thus, it is argued that DBR could help to bridge the gap between research and practice in medical education.¹⁶

Phase 1: Designing the initial version of PETAP

In 2009, we developed and implemented the first version of PETAP for residents in the emergency medicine rotation in Iizuka Hospital (Table 1). PETAP is a 6.5-hour, case-based, off-the-job simulation training program dealing with the initial assessment of pediatric patients by a health care provider.

The learning objectives were: (1) to acquire the necessary knowledge about important symptoms to prevent overlooking preventable disease or death; (2) to conduct the initial management of patients with poor status or unstable vital signs; and (3) to know the appropriate time to consult with a pediatrician. The program consisted of a 15-min lecture followed by a 30-min role-playing session focusing on the following themes: (1) triage essentials; and the management of patients with (2) fever, (3) febrile convulsions (FCs), (4) wheezing, (5) abdominal pain, (6) nausea and vomiting, and (7) rash. The learning strategies included role playing with mannequins and the use of simulated scenarios involving the presentation of photos and videos of children. Facilitators played the roles of family members, and provided the participants with information. After the end of each role play, the facilitators made efforts to deepen understanding by giving the participants feedback. Simulated scenarios and mannequins were used from the beginning, with the facilitator playing the role of the simulated patient (simulated parent) during the role play.

Phase 2: Enactment and analysis

As we attained a high level of satisfaction from the participants, we continued to conduct the program while making minor revisions. We began holding workshops as part of the lifelong learning programs of several medical associations in 2010, and then expanded the program to several facilities. By the end of 2013, we had implemented the program 40 times for 933 participants in total. In 2014, we selected the location of future workshops from among requesting regions without bias with regard to region or to urban or rural area. To analyze the initial version of the PETAP from the perspective of medical education principles and theories, we conducted two focus groups for ten facilitators of our program in January and eight in June in 2014. The focus groups, which reviewed PETAP up to 2013, were subject to purposive sampling by members, including the authors, who participated as facilitators at least twice between 2009 and 2013.

Program data were evaluated by the first author (TM) using the thematic analysis method. HN discussed the identified themes with TM after a separate reading of the transcripts.

Phase 3: Redesign, reenactment and reanalysis

Based on the results of the analyses, we developed the second version of the PETAP (Table 1) in August 2014, and implemented it 15 times for 346 participants and 15 times for 367 participants in 2014 and 2015, respectively. For program evaluation, we conducted seven focus groups for participants at six institutions: (1) four participants on December 9, 2014; (2) seven participants on December 11, 2014; (3) six participants on June 15, 2015; (4) six participants on June 23, 2015; (5) nine participants on July 6, 2015; and (6) 14 participants on July 7 and 8, 2015. All focus groups were convened at least 3 months after completing the program. We asked how the program influenced their performance in daily clinical practice. Discussions were recorded and transcribed and the data were analyzed in the same way as for the first version. We discussed the results with facilitators (9 pediatricians and 6 general practitioners) in Feb 2015 in Tokyo, Kyoto, and Fukuoka. External evaluations were conducted by a pediatrician and a general physician who had completed master's degree programs in medical education through observation and individual interviews on Oct 14, 2015 and Apr 30, 2016. In addition, we conducted online surveys of participants for their evaluation of the program.

Phase 4

Based on the results of the phase 3 analyses, we again revised the program and developed the third version of PETAP (Table 1) in June 2016. This version includes ancillary providers. We are currently implementing this version of the program in various institutions.

Results

The process of developing the PETAP is described below. Specific focus group data that were used to revise the program are shown in Table 1.

Participants

As the contents of the course became known to GPs, they expressed the desire to participate, and as a result, the number of GPs attending PETAP increased. Medical students and nurses were also among the participants in Version 3.

Setting

As more and more primary care physicians participated, the training was changed to an emergency outpatient setting. As more ancillary professionals, such as nurses, began to participate, the settings became more diverse and included locations that provide health guidance and handle telephone calls.

Learning objectives

When this wide variety of medical practitioners and ancillaries began to participate, we determined that it was necessary to revise the learning objectives such as those regarding initial care in an urgent setting for each type of participant.

Learning contents

The learning contents have not been changed since the program was developed. There was debate over whether rash should also be included, but based on the current duration of the entire course, it is not currently included. We briefly considered anaphylaxis in triage.

Learning strategies

We increased the sense of reality by using photos of children's (patient's) faces on a tablet (when showing video of the sound of a child with asthma breathing and an abdominal ultrasound of intussusception of the intestine). However, some participants pointed out the limitations of photographs and videos. We also implemented methods that included multidisciplinary cooperation through the participation of nurses. One specific example of this was the use of the "Help Card" (a tool that makes it easier for nurses participating together to consult with physicians).

Assessment

Since PETAP was first developed, it has never been subject to an overall assessment. The participants conducted self-assessments based on observations of the examinations of other participants and offered feedback to each other. The creation of an overall assessment remains a task for the future.

Facilitation

We discussed how to teach just prior to the course, but as part of our revisions, we also created a teaching guide for facilitators.

Authorization

The program has expanded and is currently being conducted with the authorization of associations such as the Japan Primary Care Association and the Society of Ambulatory and General Pediatrics of Japan.

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The current structure and schedule of PETAP are shown in Figures 1 and 2.

Theory testing – Standardizing practices by simulation training

Standardization of healthcare has been influenced by the format of the electronic health records used at facilities where the program has been run repeatedly. However, courses are held without much standardization, and external experts have expressed their opinion about the validity of the program. Example comments include:

"The fact that there is no standardized facilitation manual is both an advantage and a disadvantage. In other well-known courses (e.g. ACLS,¹⁹ PALS²⁰), teaching methods other than the approved methods are not allowed, and so in the course the

participants learn in a standardized way. Although there was discussion, I had the impression that one of the goals was to standardize everything.” (June 2014, a pediatrician in Hokkaido)

“Although electronic medical records are now being used, when you type into an electronic chart, the first thing that comes up is something like a structured format in writing when you see children ... and when you check that and consult with a pediatrician, it is used in the discussion, so I think it is very useful.” (Jan. 2014, a pediatrician in Kyoto)

“Now, even though standardization has occurred, it has not been completed. I think this amount of standardization is enough.” (April 2016, a general internist in Tochigi)

Discussion

We created a pediatric emergency education program called PETAP for non-pediatricians who are involved in primary care. The current form was constructed by carrying out changes based on feedback from the participants in this study in the context of Japanese medicine and medical education.

Strengths and limitations

The major strength of this study is that in the 9 years since the program’s development (2009–2017) the program has been conducted a total of 106 times and has had a total of 2413 participants. A second strength is that it can be implemented continually at low cost and without the use of expensive simulations.

In general, simulation courses are standardized so that only certified instructors provide feedback.¹⁰ However, this type of standardization may result in a loss of diversity in the education provided.²¹ This program promotes peer-assisted learning through peer feedback²² and was intentionally designed without an excessive amount of standardization, allowing for different contexts. This is another of the program’s strengths.

In Japan, which has a culture that is strongly influenced by collectivist ideas that emphasize relationships, the behavior of others has a major effect.²³ One of the strengths of this program is that, by watching other participants actually provide medical care, participants learn about pediatric care via a hidden curriculum that is independent of the contents taught in the program itself. This type of method is likely to be effective in a country with a culture that is strongly influenced by collectivist ideas.

There are reports²³⁻²⁶ on the utilization of interprofessional education (IPE) using advanced cardiac life support (ACLS¹⁹) and other types of simulation-based education, such as this program. The fact that this program uses IPE is one of its major strengths, particularly today, when IPE is increasingly viewed as important.²⁷ Analysis of the specific types of participants in the program between 2009 and 2016 indicates that 66% were physicians and 31% were nurses. In recent years, there has been an increasing trend in the number of pharmacist and paramedic participants. This program provides a forum for IPE.

Limitations

Since PETAP is conducted in a single country, its transferability to other countries may be a limitation. However, since it is not a high-cost simulation program, it can be generalized for many countries.

Since assessment of the program was carried out by a focus group using qualitative data, it is unclear whether the program participants experienced improvement in their pediatric care after undergoing training with the program. If possible, empirical research that shows, for example, improved results compared with a group of subjects who did not take the course at Level 4 of Kirckpatrick's curriculum evaluation²⁸ should be conducted in the future.

Another limitation of this study is that, like other simulation-based programs, the program is human resource-intensive.

Relationship to other research

The pediatric simulations PALS²⁰ and PEARS²⁹, which were provided by the American Heart Association (AHA), are well-known. The differences between these programs and PETAP are as follows: 1. PETAP is focused on the primary care of diseases frequently encountered in primary and secondary emergency care, without specialization for cardiopulmonary resuscitation or the primary care and treatment of severe diseases such as shock; 2. it assumes primary care medical standards rather than those of emergency care centers; and 3. it discusses home care in scenarios in which patients are able to return home as well as short-term case presentations in scenarios that require referral to a pediatrician. These three points are the major differences between this program and other programs.

The implications for medical care are as follows: in resource-poor settings with few physicians, a limited absolute number of pediatricians, and an unbalanced distribution of pediatricians throughout the regions of Japan, training opportunities in pediatric care for physicians are essential to ensure the quality of medical care. We hope that this program will be used as a pediatric simulation-based education model program in other countries with limited medical resources. We also believe that it can be used in the context of pediatric care education for all medical students, including those who are unlikely to become pediatricians after graduation (this program is already being implemented at Kyoto University). We also believe it can be utilized for the education of ancillary medical professionals, such as nurses. Given that few studies in the medical education field use DBR, the establishment of this study as a DBR model with clear linkage of theory to practice may result in the further development of DBR in future research in medical education.

Abbreviations

ACLS: advanced cardiac life support

DBR: design-based research

FC: febrile convulsion

GP: general practitioner

IPE: interprofessional education

PETAP: pediatric emergency triage and action program

PALS: Pediatric Advance Life Support

Declarations

Ethics approval and consent to participate

Ethical approval for this study was granted by the Institutional Review Board of the Graduate School of Medicine, Kyoto University. Consent to participate was obtained from all interviewees with the consent forms.

Consent for publication

Not applicable

Availability of data and material

Not applicable

Competing interests

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Authors' contributions

Dr. Mogi and Dr. Nishigori conceptualized and designed the study, drafted the initial manuscript, and reviewed and revised the manuscript.

Dr. Kodama and Dr. Doi collected data, carried out the initial analyses, and reviewed and revised the manuscript.

Dr. Konishi conceptualized and designed the study, coordinated and supervised data collection, and critically reviewed the manuscript for important intellectual content.

All authors approved the final manuscript as submitted and agree to be accountable for all aspects of the work.

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Tables

Table 1: The process of developing the PETAP

	Participant	Setting	Learning objectives	Learning contents	Learning strategy	Assessment	Facilitator	Authority
Version 1 (2009-2011)	Resident	Emergency department in hospital	1) Identifying critical diseases 2) If necessary, start initial management (e.g. giving oxygen or providing intravenous access)	Triage and management of patients with (2) fever, (3) febrile convulsion, (4) wheezing, (5) abdominal pain, and (6) nausea and vomiting, (7) rash	Using mannequins	Continuous formative assessment	No instruction guide Experience-based teaching	Program held at the clinical training hospital
	Needed by primary care physicians	Any setting where doctors have to see children	Different among facilities	Is it critical?	Simulations		Teach in their own style	Response to a workshop offer from an academic conference
	<i>"The main concept for residents in the early stages of their residency who do not examine children is making sure they do not overlook children." (Jan. 2014, Kyoto)</i> <i>"From a certain point, the focus was placed on family physicians involved in primary care and GPs, and subsequently on nurses...." (June 2014, Kyoto)</i>	<i>"The motivation (for starting the program) was the fact that first-year residents in 2008 began examining children in the emergency outpatient ward at Iizuka Hospital." (Jan. 2014, Kyoto)</i> <i>"Primary care physicians began to participate in the programs we were running, and as a result we started hearing comments like 'It's impossible to insert an intravenous line' and 'It is impossible to take a blood sample.' This was in 2011. So we made</i>	<i>"The course is for the purpose of deciding whether a patient is in danger or whether or not the patient can wait until morning, without jumping right to a diagnosis." (June 2014, Hokkaido)</i> <i>"I have honestly heard that if you pass a patient on to a pediatrician, in many cases, the Department of Pediatrics finds that the patient had a disease that could wait until morning and sends the patient home. So, although it is important to know which diseases should not be overlooked, I have heard the opinion that people in the Department of</i>	<i>"From among the signs that are frequently seen during (pediatric) emergency outpatient visits, we try to make sure the most acute (diseases) are not overlooked...." (Jan. 2014, Kyoto)</i> <i>"The symptom that has the highest needs is 'Rash'. Next is 'Not doing well'." (Jan. 2014, Kyoto).</i> <i>"But, if you think about the 6-hour framework, something has to be reduced." (Jan. 2014, Kyoto)</i>	<i>"I thought roleplay would be key because it is a simulation. Now, we are using dolls and laminated photos of children's faces. If only there were a scenario with a child with asthma, and a scenario of a child with intussusception of intestine who said that he had abdominal pain - of course, roleplays have limitations too - but if we tried that now, we could improve on it in the future. This time, we tried using an iPad" (June 2014, Hokkaido)</i> <i>"We used a very real simulator and did an extremely real simulation, so I had the feeling that I understood, but</i>	<i>"I felt that perhaps one of the advantages was the fact that I could see how others behave and use that to correct my own behavior." (Jan. 2014, Kyoto)</i>	<i>"The facilitator was very skilled, I thought...the facilitator maintained overall control while still making sure that learning was taking place...it is extremely difficult to verbalize facilitation and so I think it is difficult to learn...." (Jan. 2014, Kyoto)</i> <i>"The fact that you get to become one of the teachers very quickly was very good, and the fact that you learn as you teach ... compared to other courses, you do more learning as you teach ... on the other hand, that can be a disadvantage as well, but</i>	Program held at the academic conference Aug, 2010 Japan primary care association (JPCA) Jul, 2011 JPCA Aug, 2011 The Society of Ambulatory and General Pediatrics of Japan (SAGPJ)

		<p>some refinements and switched to a setting that is closer to primary care." (Jan. 2014, Kyoto)</p>	<p>Pediatrics would also appreciate it if there was some instruction on sending patients home when they have diseases that do not warrant a hospital stay." (Jan. 2014, Kyoto)</p> <p>"It is necessary to have the ability to make a presentation (when consulting with a pediatrician) when it is determined that the patient cannot be sent home." (June 2014, Hokkaido)</p>		<p>I do not think I'll really understand unless I examine an actual patient myself. So, it isn't really necessary to be overly focused." (June 2014, Hokkaido)</p>		<p>the quality of those who teach is quite different." (June 2014, Hokkaido)</p>	
Version 2 (2011-2014)	<p>Resident</p> <p>Primary care physician</p>	<p>Emergency department in hospital</p> <p>Urgent Care Center</p> <p>Clinic</p>	<p>1) Same</p> <p>2) If necessary, start oxygen supplementation and intravenous access if possible;</p> <p>early consultation</p>	<p>Triage and management of patients with (2) fever, (3) febrile convulsion (FC), (4) wheezing, (5) abdominal pain, and (6) nausea and vomiting</p>	<p>Mannequins</p> <p>Photo of child's face (looking ill)</p>		<p>Sharing schedule and content information before the program using communication methods such as Skype</p>	<p>Clinical training hospital</p> <p>Academic conference</p>
	<p>More diversity</p>	<p>Any setting where other healthcare professionals see pediatric patients</p>	<p>When and how to consult with pediatricians</p>	<p>Also common disease</p>	<p>Lack of physical findings</p>		<p>Quality of facilitation</p>	<p>Continuing professional development</p>
	<p>"I worked in an NICU, but I spent 8 years treating only neonates. Originally, I was in adult wards as well, but despite the fact that nurses are supposed to be generalists, I worked in many fields that I had never studied, so I</p>	<p>"Now I'm a Japanese Red Cross Society Infant Safety Advisor and so sometimes I teach in the local community. That is why I do not want to teach mothers to do the wrong thing, and as I get many questions, I want to be well informed.</p>	<p>"Regarding the use of drugs, nurses think that this does not fall under their area of responsibility. However, I thought that the workshop was very good by the end. If we are going to be required to do that sort of thing, however, I wonder if we really should be doing it." (June</p>	<p>"The triage scenario used anaphylaxis in triage 1, but as there is a lot of public concern about food allergies... after the simulation ended, I learnt about how to treat patients with the EpiPen, but it is better to use the EpiPen at exactly the right dosage</p>	<p>"T&A itself is both teaching pediatrics and providing a framework for multidisciplinary cooperation, right? In that sense, it is a mixture, and since it is something that you might be subjected to, it is better to be aware that people might find that you cannot do it,</p>	<p>"The participants probably ultimately felt that they confidently achieved the partial verbalization and noticed things during the pair feedback that was part of the process. However, I think it would be better to</p>	<p>"We discussed all this in the pre-meeting, but if there was a written version like a facilitator manual or an SP manual of some kind, then even people who are not able to participate in the web conference might come, so it should be left in that</p>	<p>Sep, 2012 JPCA</p> <p>Jul, 2013 JPCA</p> <p>Jun, 2014 JPCA</p> <p>Aug, 2012-2014 SAGPJ</p> <p>Jan, 2014 Japan Medical</p>

	<p>was motivated to get at least a little exposure to other fields.” (July 2015, Tottori)</p> <p>“I was a student when I attended the program. I did not take it because I wanted to be involved in pediatrics or anything like that. I had nothing like that on my mind when I attended. I still do not have much involvement with pediatrics, so what I learned was like a “model.” Maybe not exactly like a “manual,” but I thought of it as an example of how I should go about a medical examination.” (July 2015, Tottori)</p>	<p>That’s why I participated.” (June 2015, Nagahama)</p> <p>“For example, we have as many telephone consultations as we do examinations. However, I have a feeling that there are more areas in the gray zone, such as questions about certain symptoms related to what I learned.” (June 2015, Nagahama)</p>	<p>2015, Nagahama)</p>	<p>and then evaluate...and I think it should be based on the correct process up until the device is introduced, so we switched from the original triage items to a detailed scenario.” (Feb. 2015, Tokyo)</p> <p>“The groups always referred to the text but no reference was made to the text during the scenario, so I felt as though I didn’t really understand how to use drugs throughout the entire program.” (Feb. 2015, Kyoto)</p>	<p>right?” (Feb. 2015, Tokyo)</p> <p>“I’d be happy if we had a Help Card. If doctors do not understand or if they are unable to understand beyond a certain point, it is better for them to be able to express themselves, because it is difficult for nurses when they are unable to express what they mean. This not the TV show “Who Wants to Be a Millionaire?” so there is no option to “Ask the Audience” or “Phone-a-Friend” so the Help Card makes things easier.” (June 2015, Nagahama)</p>	<p>have some kind of system where you have points that you can check to see if you successfully completed the learning tasks either during the process or at the end.” (April 2016, Tochigi)</p>	<p>form.” (Feb. 2015, Kyoto).</p> <p>“The fact that there were some people who had done facilitating in the past and the fact that there were some nurses among a large number of doctors made it a bit difficult for the nurses.” (Feb. 2015, Fukuoka)</p>	<p>Association in Kyoto</p>
<p>Version 3 (Now)</p>	<p>Resident Primary care physician (Junior - senior) Nurse Junior pediatrician</p>	<p>Emergency department in hospital Urgent Care Center Clinic Nurse triage</p>	<p>In addition to Version 2, consider the timing of the consultation with the pediatrician.</p>	<p>In addition to Version 2, strive to enhance the list of disease entities associated with rash</p>	<p>iPad includes *SimMon (iApp) *Breath sounds *Ultrasound videos</p>		<p>In addition to Version 2, *Facilitation guide *Prepare the FAQs</p>	<p>Clinical training hospital Academic conference Japan Medical Association</p>

Figures

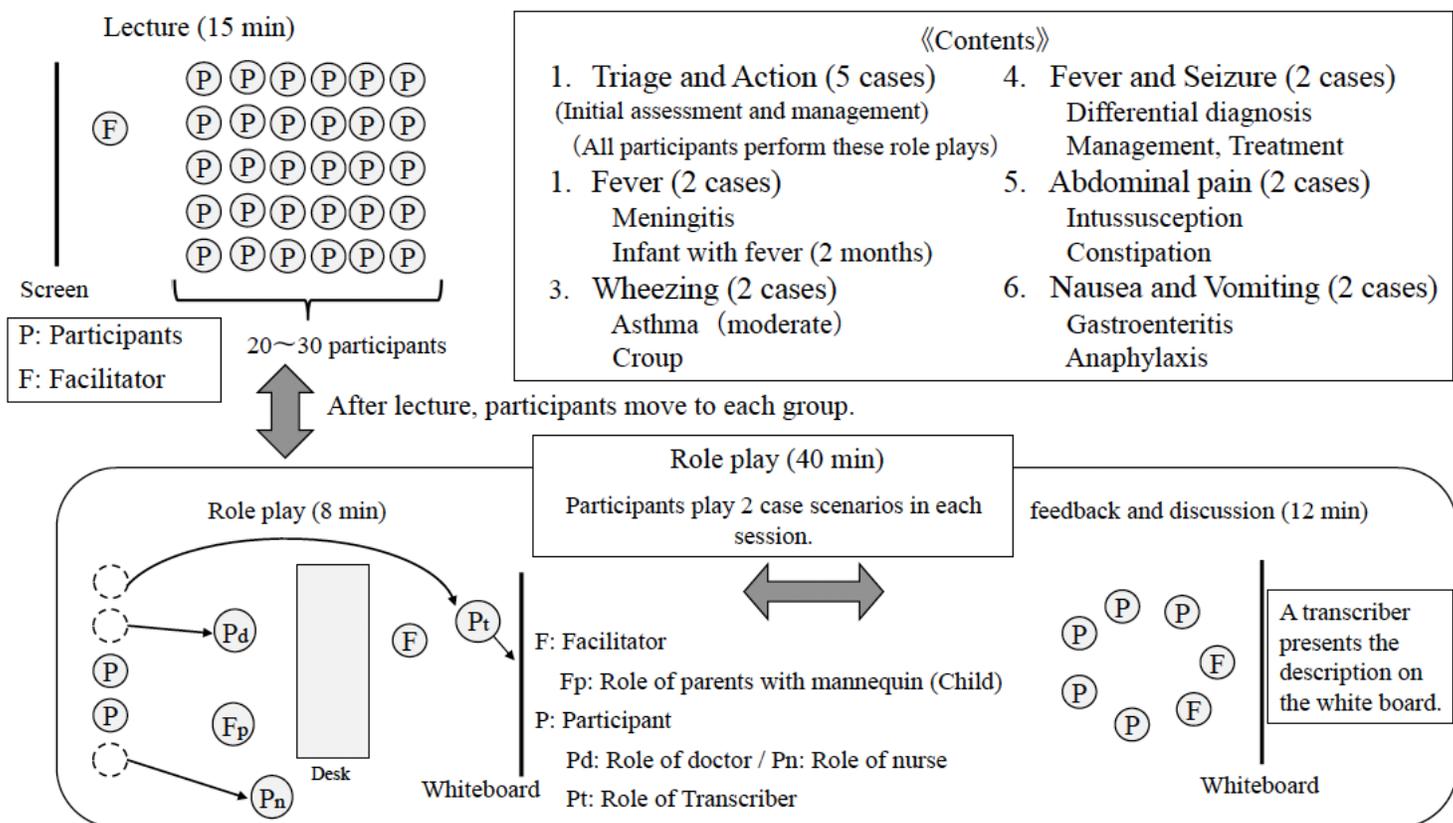


Figure 1

The structure of PETAP. All participants attend a lecture and then groups of five participants, with two to three facilitators, conduct a role play, which has been standardized

Schedule	
9:00-9:10	Introduction
9:10-9:25	Triage and Action (initial assessment) (L)
9:25-9:35	Demonstration (initial assessment)
9:40-10:40	Triage and Action (initial assessment) (R)
10:50-11:45	Fever (L→R)
11:55-12:50	Wheezing (L→R)
12:50-13:50	Lunch
13:50-14:45	Fever and Seizure (L→R)
14:55-15:50	Abdominal pain (L→R)
16:00-16:55	Nausea and Vomiting (L→R)
17:00-17:20 (20 min)	Wrap-up, questionnaire
L: Lecture, R: Role play	

Figure 2

The schedule of the PETAP