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EVIDENCE SEARCH REPORT

RESEARCH QUESTION:	What are the pediatric triage protocols implemented during the COVID-19 pandemic, other pandemics, or in other resource-scarce situations?	**UNIQUE IDENTIFIER:** CAC061801-01 ESR

RESOURCES USED:

- CDC database
- CINAHL
- Google Scholar
- LitCovid
- MEDLINE
- MedRxiv
- Embase
- PHAC website
- PubMed
- WHO Global Research on COVID-19
- Technical Resources, Assistance Center, and Information Exchange (TRACIE)
- Canadian Association of Emergency Physicians (CAEP)
- PanSurg.org

LIMITS/EXCLUSIONS/INCLUSIONS:	English 2000-2020	**REFERENCE INTERVIEW COMPLETED:**	June 18, 2020
DATE:	July 2, 2020		
LIBRARIAN:	Brianna Howell-Spooner and Michelle Dalidowicz	**REQUESTOR:**	Dr. Melody Isinger

TEAM: Critical/ Acute Care

SEARCH ALERTS CREATED: N

CITE AS:
Howell-Spooner, B; Dalidowicz, M. What are the pediatric triage protocols implemented during the COVID-19 pandemic, other pandemics, or in other resource-scarce situations? 2020 Jul 2; Document no.: CAC061801-01 ESR. In: COVID-19 Rapid Evidence Reviews [Internet]. SK: SK COVID Evidence Support Team, c2020. 23 p. (CEST evidence search report)

LIBRARIAN NOTES/COMMENTS

As discussed, for the most part we did not include results that were focused on Emergency departments/scoring tools, the neonatal population, and disaster/mass trauma scenarios.

We included a few articles and resources that did not identify a particular population (pediatrics) as they might have generalizability regardless of the population.

SEARCH RESULTS

To obtain full-text articles email library@saskhealthauthority.ca.

SUMMARIES, GUIDELINES & OTHER RESOURCES

Ontario Health. Clinical Triage Protocol for Major Surge in COVID Pandemic. 2020, March28. https://med.uottawa.ca/pathology/sites/med.uottawa.ca.pathology/files/clinical_triage_protocol_for_major_surge_in_covid_pandemic_-_march_28_20205.pdf

Librarian's Note: Section on Paediatric Considerations, pg. 9

American College of Surgeons. COVID-19 Guidelines for Triage of Pediatric Patients. 2020, March 24. https://www.facs.org/covid-19/clinical-guidance/elective-case/pediatric-surgery

Northwest Healthcare Response Network. Scarce Resource Management & Crisis Standards of Care. 2019, July 10. https://nwhrn.org/wp-content/uploads/2019/07/Scarce-Resource-Management-and-Crisis-Standards-of-Care-Overview-and-Materials.pdf

Lucile Packard Children's Hospital. Preplanning Disaster Triage for Pediatric Hospitals. 2012, August 31. http://www.acphd.org/media/270195/hospital%20disaster%20triage%20pediatric%20planning%20train%20toolkit%20x.pdf

Assistant Secretary for Preparedness and Response (ASPR) Technical Resources, Assistance Center, and Information Exchange (TRACIE).

Topic Collection: Pediatric/Children. 2020, February 26. https://asprtracie.hhs.gov/technical-resources/31/pediatric-children

Topic Collection: Hospital Surge Capacity and Immediate Bed Availability. 2020, March 29. https://asprtracie.hhs.gov/technical-resources/58/Hospital-Surge-Capacity-and-Immediate-Bed-Availability/58#Pediatric

New York State Department of Health. Ventilator Allocation Guidelines. 2015, November. https://www.health.ny.gov/regulations/task_force/reports_publications/docs/ventilator_guidelines.pdf

Swiss Medical Weekly. Good Rules for ICU Admission Allow a Fair Allocation of Resources, Even in a Pandemic. 2020, March 24. https://smw.ch/article/doi/smw.2020.20230

Connecticut Children's. COVID-19 Clinical Pathway. 2020, June 25. https://www.connecticutchildrens.org/clinical-pathways/covid-19/

University of North Carolina at Chapel Hill School of Medicine Pediatrics. COVID-19 Clinical Resources. 2020, June 5. https://www.med.unc.edu/pediatrics/covid-19-clinical-resources/

Arizona Department of Health Services. COVID-19 Addendum: Allocation of Scarce Resources in Acute Care Facilities Recommended for Approval by Sate Disaster Medical Advisory Committee (SDMAC) – 6/12/2020. 2020, June 12. https://azdhs.gov/documents/preparedness/epidemiology-disease-control/infectious-disease-epidemiology/novel-coronavirus/sdmac/covid-19-addendum.pdf

Advisory Board. You may not have enough ventilators for the Covid-19 surge. Here are 4 ways to get ready. 2020, April 9. https://www.advisory.com/daily-briefing/2020/04/09/ventilators

ARTICLES

Note: References are sorted by year (newest to oldest)

1. Bressan S, Buonsenso D, Farrugia R, et al. Preparedness and response to Pediatric CoVID-19 in European Emergency Departments: a survey of the REPEM and PERUKI networks. Annals of Emergency Medicine. 2020;15:15.

ABSTRACT: Study objective: We aimed to describe the variability and identify gaps in preparedness and response to the COVID-19 pandemic in European EDs caring for children.

Methods: A cross-sectional point prevalence survey, was developed and disseminated through the pediatric emergency medicine research networks for Europe (REPEM) and the United Kingdom and Ireland (PERUKI). We aimed to include ten EDs for countries with > 20 million inhabitants and five EDs for less populated countries, unless the number of eligible EDs was below five. ED directors or their delegates completed the survey between March 20th and 21st to report practice at that time. We used descriptive statistics to analyse data.

Results: Overall 102 centers from 18 countries (86% response rate) completed the survey: 34% did not have an ED contingency plan for pandemics and 36% had never had simulations for such events. Wide variation on PPE items was shown for recommended PPE use at pre-triage and for patient assessment, with 62% of centers experiencing shortage in one or more PPE items, most frequently FFP2/N95 masks. Only 17% of EDs had negative pressure isolation rooms. COVID-19 positive ED staff was reported in 25% of centers.

Conclusion: We found variation and identified gaps in preparedness and response to the COVID-19 epidemic across European referral EDs for children. A lack in early availability of a documented contingency plan, provision of simulation training, appropriate use of PPE, and appropriate isolation facilities emerged as gaps that should be optimized to improve preparedness and inform responses to future pandemics.

2. Calvo C, Lopez-Hortelano MG, Vicente JCC, et al. Recommendations on the clinical management of the COVID-19 infection by the <<new coronavirus>> SARS-CoV2. Spanish Paediatric Association working group. Anales de pediatria. 2020;25:25.

ABSTRACT: On 31 December 2019, the Wuhan Municipal Committee of Health and Healthcare (Hubei Province, China) reported that there were 27 cases of pneumonia of unknown origin with symptoms starting on the 8 December. There were 7 serious cases with common exposure in market with shellfish, fish, and live animals, in the city of Wuhan. On 7 January 2020, the Chinese authorities identified that the agent causing the outbreak was a new type of virus of the Coronaviridae family, temporarily called <<new coronavirus>>, 2019-nCoV. On January 30th, 2020, the World Health Organisation (WHO) declared the outbreak an International Emergency. On 11 February 2020 the WHO assigned it the name of SARS-CoV2 and COVID-19 (SARS-CoV2 and COVID-19). The Ministry of Health summoned the Specialties Societies to prepare a clinical protocol for the management of COVID-19. The Spanish Paediatric Association appointed a Working Group of the Societies of Paediatric Infectious Diseases and Paediatric Intensive Care to prepare the present recommendations with the evidence available at the time of preparing them.

3. Carlotti A, Carvalho WB, Johnston C, et al. COVID-19 Diagnostic and Management Protocol for Pediatric Patients. Clinics (Sao Paulo, Brazil). 2020;75:e1894.

ABSTRACT: This review aims to verify the main epidemiologic, clinical, laboratory-related, and therapeutic aspects of coronavirus disease 2019 (COVID-19) in critically ill pediatric patients. An extensive review of the medical literature on COVID-19 was performed, mainly focusing on the critical care of pediatric patients, considering expert opinions and recent reports related to this new disease. Experts from a large Brazilian public university analyzed all recently published material to produce a report aiming to standardize the care of critically ill children and adolescents. The report emphasizes on the clinical presentations of the disease and ventilatory support in pediatric patients with COVID-19. It establishes a flowchart to guide health practitioners on triaging critical cases. COVID-19 is essentially an unknown clinical condition for the majority of pediatric intensive care professionals. Guidelines developed by experts can help all practitioners standardize their attitudes and improve the treatment of COVID-19.

4. Haward MF, Moore GP, Lantos J, et al. Paediatric ethical issues during the COVID-19 pandemic are not just about ventilator triage. Acta Paediatr. 2020;04:04.

5. Killien EY, Mills B, Errett NA, et al. Prediction of Pediatric Critical Care Resource Utilization for Disaster Triage. Pediatr Crit Care Med. 2020. DOI: 10.1097/pcc.0000000000002425

ABSTRACT: OBJECTIVES: Pediatric protocols to guide allocation of limited resources during a disaster lack data to validate their use. The 2011 Pediatric Emergency Mass Critical Care Task Force recommended that expected duration of critical care be incorporated into resource allocation algorithms. We aimed to determine whether currently available pediatric illness severity

scores can predict duration of critical care resource use. DESIGN: Retrospective cohort study. SETTING: Seattle Children's Hospital. PATIENTS: PICU patients admitted 2016-2018 for greater than or equal to 12 hours (n = 3,206). INTERVENTIONS: None. MEASUREMENTS AND MAIN RESULTS: We developed logistic and linear regression models in two-thirds of the cohort to predict need for and duration of PICU resources based on Pediatric Risk of Mortality-III, Pediatric Index of Mortality-3, and serial Pediatric Logistic Organ Dysfunction-2 scores. We tested the predictive accuracy of the models with the highest area under the receiver operating characteristic curve (need for each resource) and R (duration of use) in a validation cohort of the remaining one of three of the sample and among patients admitted during one-third of the sample and among patients admitted during surges of respiratory illness. Pediatric Logistic Organ Dysfunction score calculated 12 hours postadmission had higher predictive accuracy than either Pediatric Risk of Mortality or Pediatric Index of Mortality scores. Models incorporating 12-hour Pediatric Logistic Organ Dysfunction score, age, Pediatric Overall Performance Category, Pediatric Cerebral Performance Category, chronic mechanical ventilation, and postoperative status had an area under the receiver operating characteristic curve = 0.8831 for need for any PICU resource (positive predictive value 80.2%, negative predictive value 85.9%) and area under the receiver operating characteristic curve = 0.9157 for mechanical ventilation (positive predictive value 85.7%, negative predictive value 89.2%) within 7 days of admission. Models accurately predicted greater than or equal to 24 hours of any resource use for 78.9% of patients and greater than or equal to 24 hours of ventilation for 83.1%. Model fit and accuracy improved for prediction of resource use within 3 days of admission, and was lower for noninvasive positive pressure ventilation, vasoactive infusions, continuous renal replacement therapy, extracorporeal membrane oxygenation, and length of stay. CONCLUSIONS: A model incorporating 12-hour Pediatric Logistic Organ Dysfunction score performed well in estimating how long patients may require PICU resources, especially mechanical ventilation. A pediatric disaster triage algorithm that includes both likelihood for survival and for requiring critical care resources could minimize subjectivity in resource allocation decision-making.
URL: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7199765/
DOI: 10.1097/pcc.0000000000002425

6. Laventhal NT, Graham RJ, Rasmussen SA, et al. Ethical decision-making for children with neuromuscular disorders in the COVID-19 crisis. Neurology. 2020;01:01.
ABSTRACT: The sudden appearance and proliferation of COVID-19 has forced societies and governmental authorities across the world to confront the possibility of resource constraints when critical care facilities are overwhelmed by the sheer numbers of grievously ill patients. As governments and health care systems develop and update policies and guidelines regarding the allocation of resources, patients and families affected by chronic disabilities, including many neuromuscular disorders that affect children and young adults, have become alarmed at the possibility that they may be determined to have less favorable prognoses due to their underlying diagnoses and thus be assigned to lower priority groups. It is important for health care workers, policymakers, and government officials to be aware that the long term prognoses for children and young adults with neuromuscular disorders are often more promising than previously believed, due to a better understanding of the natural history of these diseases, benefits of multidisciplinary supportive care, and novel molecular therapies that can dramatically improve the disease course. Although the realities of a global pandemic have the potential to require a shift from our usual, highly individualistic standards of care to crisis standards of care, shifting priorities should nonetheless be informed by good facts. Resource allocation guidelines with the potential to affect children and young adults with neuromuscular disorders should take into account the known trajectory of acute respiratory illness in this population, and rely primarily on contemporary long-term outcome data.

7. Li W, Zhou Q, Tang Y, et al. Protocol for the development of a rapid advice guideline for prevention, management and care of children with 2019 novel coronavirus infection. Annals of Palliative Medicine. 2020;24:24.

8. Maves RC, Downar J, Dichter JR, et al. Triage of Scarce Critical Care Resources in COVID-19 An Implementation Guide for Regional Allocation: An Expert Panel Report of the Task Force for Mass Critical Care and the American College of Chest Physicians. Chest. 2020;158(1):212-25.
ABSTRACT: Public health emergencies have the potential to place enormous strain on health systems. The current pandemic of the novel 2019 coronavirus disease has required hospitals in numerous countries to expand their surge capacity to meet the needs of patients with critical illness. When even surge capacity is exceeded, however, principles of critical care triage may be needed as a means to allocate scarce resources, such as mechanical ventilators or key medications. The goal of a triage system is to direct limited resources towards patients most likely to benefit from them. Implementing a triage system requires careful coordination between clinicians, health systems, local and regional governments, and the public, with a goal of transparency to maintain trust. We discuss the principles of tertiary triage and methods for implementing such a system, emphasizing that

these systems should serve only as a last resort. Even under triage, we must uphold our obligation to care for all patients as best possible under difficult circumstances. Copyright © 2020

9. Molloy EJ. The Doctor's Dilemma: lessons from GB Shaw in a modern pandemic COVID-19. Pediatric Research. 2020;28:28.
ABSTRACT: In the current COVID 19 pandemic, the only treatments are supportive as no definitive pharmacological intervention is available. The heterogeneity of the immune response in different patient groups is clear with less severe illness in children. Understanding these disparities is particularly important as severely affected patients with COVID19 cannot always be predicted before they experience a cytokine storm and multiorgan dysfunction. Over 100 years ago, the concept of individualised immunotherapy was introduced by Sir Almroth Wright and immortalised in GB Shaw's play The Doctor's Dilemma. Shaw's play The Doctor's Dilemma explores the issues of private medical practice, equality of health care delivery, rationing of scarce resources (intensive care) and high-risk therapies. The play also describes the dilemma of rationing of resources and selecting the correct patient for new experimental therapies. Immunological theories of the time are now reflected in current understanding of inflammatory responses in sepsis and immunomodulation during the COVID19 pandemic.

10. Nicoletti A, Talarico V, Sabetta L, et al. Screening of COVID-19 in children admitted to the hospital for acute problems: preliminary data. Acta Biomed Ateneo Parmense. 2020;91(2):75-9.
ABSTRACT: BACKGROUND: The new Coronavirus identified in Whuan at the end of 2019 (SARS-CoV-2) belongs to the Beta Coronavirus genus and is responsible for the new Coronavirus 2019 pandemia (COVID-19). Infected children may be asymptomatic or present fever, dry cough, fatigue or gastrointestinal symptoms. The CDC recommends that clinicians should decide to test patients based on the presence of signs and symptoms compatible with COVID-19.
MATERIAL AND METHODS: 42 children (the majority < 5 years of age) were referred, to our Pediatric Department, as possible cases of COVID-19 infection. Blood analysis, chest X-ray, and naso-oropharyngeal swab specimens for viral identification of COVID-19 were requested.
RESULTS: None of the screened children resulted positive for COVID-19 infection. At first presentation, the most frequent signs and symptoms were: fever (71.4%), fatigue (35.7%) and cough (30.9%). An high C-reactive protein value and abnormalities of chest X-ray (bronchial wall thickening) were detected in 26.2% and 19% of patients, respectively. Almost half of patients (45.2%) required hospitalization in our Pediatric Unit and one patient in Intensive Care Unit.
CONCLUSIONS: Testing people who meet the COVID-19 suspected case definition criteria is essential for clinical management and outbreak control. Children of all ages can get COVID-19, although they appear to be affected less frequently than adults, as reported in our preliminary survey. Further studies are needed to confirm our observations.

11. Parikh SR, Avansino JR, Dick AA, et al. Collaborative Multidisciplinary Incident Command at Seattle Children's Hospital for Rapid Preparatory Pediatric Surgery Countermeasures to the COVID-19 Pandemic. Journal of the American College of Surgeons. 2020;11:11.
ABSTRACT: Washington was the first US state to have a patient test positive for COVID-19. Before this, our children's hospital proactively implemented an incident command structure that allowed for collaborative creation of safety measures, policies, and procedures for patients, families, staff, and providers. Although the treatment and protective standards are continuously evolving, this commentary shares our thoughts on how an institution, and specifically, surgical services, may develop collaborative process improvement to accommodate for rapid and ongoing change. Specific changes outlined include early establishment of incident command; personal protective equipment conservation; workforce safety; surgical and ambulatory patient triage; and optimization of trainee education. Please note that the contents of this manuscript are shared in the interest of providing collaborative information and are under continuous development as our regional situation changes. We recognize the limitations of this commentary and do not suggest that our approaches represent validated best practices.

12. Piscitello GM, Kapania EM, Miller WD, et al. Variation in ventilator allocation guidelines by us state during the coronavirus disease 2019 pandemic: A systematic review. JAMA Network Open. 2020;3 (6) (no pagination)(e2012606).
ABSTRACT: Importance: During the coronavirus disease 2019 pandemic, there may be too few ventilators to meet medical demands. It is unknown how many US states have ventilator allocation guidelines and how these state guidelines compare with one another. Objective(s): To evaluate the number of publicly available US state guidelines for ventilator allocation and the variation in state recommendations for how ventilator allocation decisions should occur and to assess whether unique criteria exist for pediatric patients. Evidence Review: This systematic review evaluated publicly available guidelines about ventilator allocation for all states in the US and in the District of Columbia using department of health websites for each state and internet searches. Documents with any discussion of a process to triage mechanical ventilatory support during a public health

emergency were screened for inclusion. Articles were excluded if they did not include specific ventilator allocation recommendations, were in draft status, did not include their state department of health, or were not the most up-to-date guideline. All documents were individually assessed and reassessed by 2 independent reviewers from March 30 to April 2 and May 8 to 10, 2020. Finding(s): As of May 10, 2020, 26 states had publicly available ventilator guidelines, and 14 states had pediatric guidelines. Use of the Sequential Organ Failure Assessment score in the initial rank of adult patients was recommended in 15 state guidelines (58%), and assessment of limited life expectancy from underlying conditions or comorbidities was included in 6 state guidelines (23%). Priority was recommended for specific groups in the initial evaluation of patients in 6 states (23%) (ie, Illinois, Maryland, Massachusetts, Michigan, Pennsylvania, and Utah). Many states recommended exclusion criteria in adult (11 of 26 states [42%]) and pediatric (10 of 14 states [71%]) ventilator allocation. Withdrawal of mechanical ventilation from a patient to give to another if a shortage occurs was discussed in 22 of 26 adult guidelines (85%) and 9 of 14 pediatric guidelines (64%). Conclusions and Relevance: These findings suggest that although allocation guidelines for mechanical ventilatory support are essential in a public health emergency, only 26 US states provided public guidance on how this allocation should occur. Guidelines among states, including adjacent states, varied significantly and could cause inequity in the allocation of mechanical ventilatory support during a public health emergency, such as the coronavirus disease 2019 pandemic.
URL: https://jamanetwork.com/journals/jamanetworkopen/articlepdf/2767360/piscitello_2020_oi_200482.pdf

13. Prekker ME, Brunsvold ME, Bohman JK, et al. Regional Planning for Extracorporeal Membrane Oxygenation Allocation During Coronavirus Disease 2019. Chest. 2020;25:25.
ABSTRACT: Health systems confronting the coronavirus disease 2019 (COVID-19) pandemic must plan for surges in ICU demand and equitably distribute resources to maximize benefit for critically ill patients and the public during periods of resource scarcity. For example, morbidity and mortality could be mitigated by a proactive regional plan for the triage of mechanical ventilators. Extracorporeal membrane oxygenation (ECMO), a resource-intensive and potentially life-saving modality in severe respiratory failure, has generally not been included in proactive disaster preparedness until recently. This paper explores underlying assumptions and triage principles that could guide the integration of ECMO resources into existing disaster planning. Drawing from a collaborative framework developed by one US metropolitan area with multiple adult and pediatric extracorporeal life support centers, this paper aims to inform decision-making around ECMO use during a pandemic such as COVID-19. It also addresses the ethical and practical aspects of not continuing to offer ECMO during a disaster.

14. Ravikumar N, Nallasamy K, Bansal A, et al. Novel Coronavirus 2019 (2019-nCoV) Infection: Part I - Preparedness and Management in the Pediatric Intensive Care Unit in Resource-limited Settings. Indian Pediatrics. 2020;57(4):324-34.
ABSTRACT: First reported in China, the 2019 novel coronavirus has been spreading across the globe. Till 26 March, 2020, 416,686 cases have been diagnosed and 18,589 have died the world over. The coronavirus disease mainly starts with a respiratory illness and about 5-16% require intensive care management for acute respiratory distress syndrome (ARDS) and multi-organ dysfunction. Children account for about 1-2% of the total cases, and 6% of these fall under severe or critical category requiring pediatric intensive care unit (PICU) care. Diagnosis involves a combination of clinical and epidemiological features with laboratory confirmation. Preparedness strategies for managing this pandemic are the need of the hour, and involve setting up cohort ICUs with isolation rooms. Re-allocation of resources in managing this crisis involves careful planning, halting elective surgeries and training of healthcare workers. Strict adherence to infection control like personal protective equipment and disinfection is the key to contain the disease transmission. Although many therapies have been tried in various regions, there is a lack of strong evidence to recommend anti-virals or immunomodulatory drugs.

15. Romney D, Fox H, Carlson S, et al. Allocation of Scarce Resources in a Pandemic: A Systematic Review of US State Crisis Standards of Care Documents. Disaster med. 2020:1-7.
ABSTRACT: The aim of this systematic review was to locate and analyze United States state crisis standards of care (CSC) documents to determine their prevalence and quality. Following PRISMA guidelines, Google search for "allocation of scarce resources" and "crisis standards of care (CSC)" for each state. We analyzed the plans based on the 2009 Institute of Medicine (IOM) report, which provided guidance for establishing CSC for use in disaster situations, as well as the 2014 CHEST consensus statement's 11 core topic areas. The search yielded 42 state documents, and we excluded 11 that were not CSC plans. Of the 31 included plans, 13 plans were written for an "all hazards" approach, while 18 were pandemic influenza specific. Eighteen had strong ethical grounding. Twenty-one plans had integrated and ongoing community and provider engagement, education, and communication. Twenty-two had assurances regarding legal authority and environment. Sixteen plans had clear indicators, triggers, and lines of responsibility. Finally, 28 had evidence-based clinical processes and operations. Five plans contained all 5

IOM elements: Arizona, Colorado, Minnesota, Nevada, and Vermont. Colorado and Minnesota have all hazards documents and processes for both adult and pediatric populations and could be considered exemplars for other states.

16. White DB, Lo B. A Framework for Rationing Ventilators and Critical Care Beds during the COVID-19 Pandemic. JAMA - Journal of the American Medical Association. 2020;323(18):1773-4.

17. Wolfe ID, Garrett JR, Carter BS, et al. Children's Hospital ICU Resource Allocation in an Adult Pandemic. Pediatrics. 2020;21.

18. Zhang J, Zhang L, Yin Y, et al. Best practice for infection prevention in pediatric respiratory clinics during the COVID-19 epidemic. World Journal of Pediatrics. 2020;25:25.
ABSTRACT: During the COVID-19 epidemic, it is important for ensuring infection prevention and control in the pediatric respiratory clinics. Herein, we introduced the practice of infection prevention and control in pediatric respiratory clinics in China. Triage measures for patients who visit respiratory clinics, quality control for pediatric respiratory clinics and other preventive measures for related examinations and treatment have been introduced in this review article.

19. Zhang N, Deng Y, Li W, et al. Analysis and suggestions for the preview and triage screening of children with suspected COVID-19 outside the epidemic area of Hubei Province. Translational Pediatrics. 2020;9(2):126-32.
ABSTRACT: Background: Since December 2019, a number of patients infected with COVID-19 (SARS-CoV-2) have been identified in Wuhan, Hubei, China. As the epidemic has spread, similar cases have also been found in other parts of mainland China and abroad. The main reason for this spread is the highly contagious nature of the virus and the fact that children can also become infected during its incubation period. This has made the virus a substantial challenge for the outpatient triage staff of children's hospitals outside the epidemic area of the Hubei Province. It is very important for the preview and triage personnel to accurately grasp the epidemiology of the virus and identify children's symptoms in the fever clinic.
Methods: We performed an analysis of our early preview and triage of suspected COVID-19 in 36 children presenting at fever clinics. Two specialists either excluded suspected cases or referred cases to the isolation ward for new nucleic acid testing.
Results: All 14 children who were transferred to the isolation ward had a fever, and 71.43% of them had a cough. Their nucleic acid testing results were negative. The suspected cases and excluded suspected cases had similar epidemiology history as well as complete blood count results. With reference to the diagnostic criteria in existing pediatric guidelines, we have further improved the triage screening questionnaire for children with fever in our hospital.
Conclusions: According to the situation in our city and hospital, an evaluation questionnaire that is suitable for use with children in our hospital has been formulated to achieve the goals of early detection, isolation, diagnosis, and treatment. We provided an important basis for the next step in developing accurate preview and triage screening standards and appropriate guidelines for pediatric patients.

20. Goto T, Camargo CA, Faridi MK, et al. Machine Learning–Based Prediction of Clinical Outcomes for Children During Emergency Department Triage. JAMA Network Open. 2019;2(1):e186937-e. DOI: 10.1001/jamanetworkopen.2018.6937
ABSTRACT: Key Points: Question: Do machine learning approaches improve the ability to predict clinical outcomes and disposition of children at emergency department triage? Findings: In this prognostic study of a nationally representative sample of 52 037 emergency department visits by children, machine learning–based triage models had better discrimination ability for clinical outcomes and disposition compared with the conventional triage approaches, with a higher sensitivity for the critical care outcome and higher specificity for the hospitalization outcome. Meaning: Machine learning may improve the prediction ability of triage approaches and could be used to reduce undertriage of critically ill children and to improve resource allocation in emergency departments. This prognostic study uses data from the National Hospital Ambulatory Medical Care Survey to test the ability of 4 machine learning approaches to predict clinical outcomes of children presenting to emergency department triage. Importance: While machine learning approaches may enhance prediction ability, little is known about their utility in emergency department (ED) triage. Objectives: To examine the performance of machine learning approaches to predict clinical outcomes and disposition in children in the ED and to compare their performance with conventional triage approaches. Design, Setting, and Participants: Prognostic study of ED data from the National Hospital Ambulatory Medical Care Survey from January 1, 2007, through December 31, 2015. A nationally representative sample of 52 037 children aged 18 years or younger who presented to the ED were included. Data analysis was performed in August 2018. Main Outcomes and Measures: The outcomes were critical care (admission to an intensive care unit and/or in-hospital death) and hospitalization (direct hospital admission or transfer). In the training set (70% random sample), using routinely available triage data as predictors (eg, demographic characteristics and vital signs), we derived 4 machine learning–based models: lasso regression, random forest, gradient-boosted decision tree, and deep neural network. In the test set (the remaining 30% of the

sample), we measured the models' prediction performance by computing C statistics, prospective prediction results, and decision curves. These machine learning models were built for each outcome and compared with the reference model using the conventional triage classification information. Results: Of 52 037 eligible ED visits by children (median [interquartile range] age, 6 [2-14] years; 24 929 [48.0%] female), 163 (0.3%) had the critical care outcome and 2352 (4.5%) had the hospitalization outcome. For the critical care prediction, all machine learning approaches had higher discriminative ability compared with the reference model, although the difference was not statistically significant (eg, C statistics of 0.85 [95% CI, 0.78-0.92] for the deep neural network vs 0.78 [95% CI, 0.71-0.85] for the reference; P =.16), and lower number of undertriaged critically ill children in the conventional triage levels 3 to 5 (urgent to nonurgent). For the hospitalization prediction, all machine learning approaches had significantly higher discrimination ability (eg, C statistic, 0.80 [95% CI, 0.78-0.81] for the deep neural network vs 0.73 [95% CI, 0.71-0.75] for the reference; P <.001) and fewer overtriaged children who did not require inpatient management in the conventional triage levels 1 to 3 (immediate to urgent). The decision curve analysis demonstrated a greater net benefit of machine learning models over ranges of clinical thresholds. Conclusions and Relevance: Machine learning–based triage had better discrimination ability to predict clinical outcomes and disposition, with reduction in undertriaging critically ill children and overtriaging children who are less ill.
DOI: https://doi.org/10.1001/jamanetworkopen.2018.6937

21. Savulescu J, Cameron J. An Objective Approach to Decisions to Withdraw or Withhold Life-sustaining Medical Treatment. Journal of Law & Medicine. 2019;27(1):192-210.
ABSTRACT: Courts in England and Wales, Australia, and New Zealand have insisted the question of when it is acceptable to withdraw or withhold life-sustaining medical treatment from a child must be considered on a case-by-case basis. Over the last 40 years a number of cases have considered whether treatment is objectively in the child's best interests. This article seeks to identify whether there are factors identified and weighed in a consistent manner across cases. Thirty cases involving decisions about the provision of life-sustaining medical treatment to children three years old or younger were identified. Judges regularly refer to the need to weigh benefits and burdens and these factors were identified and assigned scores. Eight key factors were identified, and a scoring range was assigned to each. The factors focus on the condition and position of the child and the burdens of invasive medical treatment. The review demonstrates there are factors consistently identified and despite criticisms of the indeterminacy of the best interests test, there may be a broadly consistent approach to decision-making. Cognitive capacity and unavoidably imminent death appear to be the two most influential factors in determining whether life-sustaining treatment should be provided.

22. Conners GP, Doyle SJ, Fowler MA, Jr., et al. System Stresses in 2 Pediatric Emergency Departments and 2 Pediatric Urgent Care Centers During the 2014 Enterovirus-D68 Outbreak. Pediatric Emergency Care. 2018;34(4):250-2.
ABSTRACT: OBJECTIVE: To describe the association of an unprecedented large-scale Enterovirus-D68 outbreak in 2014 with changes in patient volume and acuity and system stress in 2 pediatric emergency departments and 2 pediatric urgent care centers of a single children's hospital.
METHODS: We compared measures of patient volume, acuity, and system stress during the 2014 Enterovirus-D68 outbreak and the corresponding dates of the previous year.
RESULTS: Both settings experienced large census increases during the Enterovirus-D68 outbreak; patient census increased significantly more in the pediatric urgent care setting (20.3%) than in the pediatric emergency departments (14.3%). Both settings had significant increases in patient acuity. The proportion of pediatric emergency department patients requiring hospital admission increased; the proportion of patients who left the pediatric urgent care setting without being seen also increased. Although there was no emergency department inpatient boarding during the 2013 comparison period, 4.4% of admitted patients required emergency department boarding during the 2014 outbreak. There was no significant change in the mean length of stay or the probability that patient admission was to the pediatric intensive care unit.
CONCLUSIONS: Both the pediatric emergency departments and the pediatric urgent care centers experienced increased patient volumes and acuity and significant system stress in association with the 2014 Enterovirus-D68 outbreak. These data will inform those planning resource allocation for future large-scale viral outbreaks.

23. Fitzgerald F, Wing K, Naveed A, et al. Development of a Pediatric Ebola Predictive Score, Sierra Leone1. Emerging Infectious Diseases. 2018;24(2):311-9. DOI: 10.3201/eid2402.171018
ABSTRACT: We compared children who were positive for Ebola virus disease (EVD) with those who were negative to derive a pediatric EVD predictor (PEP) score. We collected data on all children <13 years of age admitted to 11 Ebola holding units in Sierra Leone during August 2014-March 2015 and performed multivariable logistic regression. Among 1,054 children, 309 (29%) were EVD positive and 697 (66%) EVD negative, with 48 (5%) missing. Contact history, conjunctivitis, and age were the strongest positive predictors for EVD. The PEP score had an area under receiver operating characteristics curve of 0.80. A PEP

score of 7/10 was 92% specific and 44% sensitive; 3/10 was 30% specific, 94% sensitive. The PEP score could correctly classify 79%-90% of children and could be used to facilitate triage into risk categories, depending on the sensitivity or specificity required.
DOI: 10.3201/eid2402.171018

24. Hamele M, Neumayer K, Sweney J, et al. Always ready, always prepared-preparing for the next pandemic. Translational Pediatrics. 2018;7(4):344-55.
ABSTRACT: A future global pandemic is likely to occur and planning for the care of critically ill children is less robust than that for adults. This review covers the current state of federal and regional resources for pediatric care in pandemics, a strategy for pandemic preparation in pediatric intensive care units and regions focusing on stuff, space, staff and systems, considerations in developing surge capacity and triage protocols, special circumstances such as highly infectious and highly lethal pandemics, and a discussion of ethics in the setting of pediatric critical care in a pandemic.

25. Hyatt A, Carlin K, Stone K. Predicting Pediatric Emergency Severity Index Level Based on Emergency Department Pre-Arrival Information. Journal of Pediatric Nursing. 2018;41:34-7. DOI: 10.1016/j.pedn.2017.12.005
ABSTRACT: Purpose This study examines the use of phone referral information to predict Emergency Severity Index triage levels as a proxy to anticipate emergency department nursing resource allocation in a pediatric hospital. It also assesses the relationship between these pre-arrival triage levels and hospital admission. Design and Methods Emergency nurses with specialized training used standardized phone referral information to assign triage levels to 481 patients before their arrival. Upon patient arrival, independent triage levels were assigned. The two levels were then compared and patient disposition was collected. Descriptive statistics and Cohen's kappa were used to assess agreement between the two emergency severity index levels. Results Moderate agreement was found between the pre-arrival and arrival triage levels. The majority of patients (71.3%) with a pre-arrival triage level of 1 or 2 (the most acute levels) were admitted to the hospital. These patients were also more likely to be admitted to the intensive care unit than were patients with a pre-arrival triage level ≥ 3. Conclusions and Practice Implications The ability to predict triage levels for incoming patients could give the emergency department charge nurse the ability to plan ahead so that appropriate nursing staffing is available upon arrival. The knowledge that patients assigned a pre-arrival triage level of 1 or 2 are more likely to be admitted gives the emergency department the ability to plan for bed placement and inpatient nursing resources earlier, potentially resulting in decreased emergency department length of stay. More study on these potential benefits is needed.
DOI: 10.1016/j.pedn.2017.12.005

26. Lin A, Taylor K, Cohen RS. Triage by Resource Allocation for INpatients: A Novel Disaster Triage Tool for Hospitalized Pediatric Patients. Disaster med. 2018;12(6):692-6.
ABSTRACT: OBJECTIVE: To develop a disaster triage tool for the evacuation of hospitalized neonatal and pediatric populations.
METHODS: We expanded an existing neonatal disaster triage tool for the evacuation of a children's hospital. We assessed inpatients using bedside visual assessments and chart review to categorize patients transport level based on local emergency medical services protocols and expert opinion. The tool was refined by using multiple Plan Do Study Act cycles. Primary outcome was the number of each level of transport required for hospital evacuation. Secondary outcome was improved efficiency of obtaining information about specific transport needs for evacuation.
RESULTS: We evaluated 1382 patients both visually and through electronic chart review over 10 random days. Accordance between visual assessment and electronic chart review reached 96.3%. During a 2 hour statewide disaster drill, no hospital units completed self-assessed transport needs for their patients; a single nurse used Triage by Resource Allocation in INpatients to determine transportation needs in less than 1 hour. (Disaster Med Public Health Preparedness. 2018;12:692-696).

27. Williams K, Levine AR, Ledgerwood DM, et al. Characteristics and Triage of Children Presenting in Mental Health Crisis to Emergency Departments at Detroit Regional Hospitals. Pediatric Emergency Care. 2018;34(5):317-21.
ABSTRACT: OBJECTIVES: The number of children in the United States utilizing emergency department (ED) services for psychiatric crises is increasing, and psychiatric-related ED visits disproportionately burden hospital resources. Yet, there is limited available information on the epidemiology and outcomes of pediatric mental health emergencies. The present study sought to characterize pediatric mental health-related ED presentations in a large urban center and identify factors predictive of inpatient hospitalization.
METHODS: Data were analyzed from a sample of 225 children (120 female and 105 male children), aged 5 to 18 years, who presented in mental health crisis to Detroit regional EDs over a 27-month period. A trained mental health professional used the Crisis Assessment Tool to assess all children.

RESULTS: Thirty-eight percent of children presented with severe depression symptoms, and 52% were judged to be at acute risk of suicide, most of whom were female. Sixteen percent of the sample presented with severe psychotic features, and 34% were assessed as being at risk of harming others. Following assessment, 86% of the sample was directed to inpatient treatment, and no sex differences were found in treatment disposition. Risk of suicide, poor judgment, symptoms of psychosis, and risk of danger to others were all found to be significant predictors of subsequent inpatient hospitalization.
CONCLUSIONS: Results provide descriptive information regarding child psychiatric emergency presentations in the city of Detroit. The identified factors that help determine triage to inpatient hospitalization suggest areas for possible resource allocation and potential ED-based intervention.

28. Burkle Jr FM. Pediatric Reverse Triage—Uncomfortable but Real Decision Making for Community Preparedness. JAMA Pediatrics. 2017;171(4):1-2. DOI: 10.1001/jamapediatrics.2016.4839
DOI: 10.1001/jamapediatrics.2016.4839

29. Ram-Tiktin E. Ethical Considerations of Triage Following Natural Disasters: The IDF Experience in Haiti as a Case Study. Bioethics. 2017;31(6):467-75.
ABSTRACT: Natural disasters in populated areas may result in massive casualties and extensive destruction of infrastructure. Humanitarian aid delegations may have to cope with the complicated issue of patient prioritization under conditions of severe resource scarcity. A triage model, consisting of five principles, is proposed for the prioritization of patients, and it is argued that rational and reasonable agents would agree upon them. The Israel Defense Force's humanitarian mission to Haiti following the 2010 earthquake serves as a case study for the various considerations taken into account when designing the ethical-clinical policy of field hospitals. The discussion focuses on three applications: the decision to include an intensive care unit, the decision to include obstetrics and neonatal units, and the treatment policy for compound fractures.

30. Gall C, Wetzel R, Kolker A, et al. Pediatric Triage in a Severe Pandemic: Maximizing Survival by Establishing Triage Thresholds. Critical Care Medicine. 2016;44(9):1762-8.
ABSTRACT: OBJECTIVES: To develop and validate an algorithm to guide selection of patients for pediatric critical care admission during a severe pandemic when Crisis Standards of Care are implemented.
DESIGN: Retrospective observational study using secondary data.
PATIENTS: Children admitted to VPS-participating PICUs between 2009-2012.
INTERVENTIONS: A total of 111,174 randomly selected nonelective cases from the Virtual PICU Systems database were used to estimate each patient's probability of death and duration of ventilation employing previously derived predictive equations. Using real and projected statistics for the State of Ohio as an example, triage thresholds were established for casualty volumes ranging from 5,000 to 10,000 for a modeled pandemic with peak duration of 6 weeks and 280 pediatric intensive care beds. The goal was to simultaneously maximize casualty survival and bed occupancy. Discrete Event Simulation was used to determine triage thresholds for probability of death and duration of ventilation as a function of casualty volume and the total number of available beds. Simulation was employed to compare survival between the proposed triage algorithm and a first come first served distribution of scarce resources.
MEASUREMENTS AND MAIN RESULTS: Population survival was greater using the triage thresholds compared with a first come first served strategy. In this model, for five, six, seven, eight, and 10 thousand casualties, the triage algorithm increased the number of lives saved by 284, 386, 547, 746, and 1,089, respectively, compared with first come first served (all $p < 0.001$).
CONCLUSIONS: Use of triage thresholds based on probability of death and duration of mechanical ventilation determined from actual critically ill children's data demonstrated superior population survival during a simulated overwhelming pandemic.

31. King MA, Kissoon N. Triage During Pandemics: Difficult Choices When Business as Usual Is Not an Ethically Defensible Option. Critical Care Medicine. 2016;44(9):1793-5. DOI: 10.1097/CCM.0000000000001796
ABSTRACT: The article deals with the ethical aspects of the triage of pediatric patients during pandemics. It references the study "Pediatric Triage in a Severe Pandemic: Maximizing Survival by Establishing Triage Thresholds," by C. Gall et al. published within the issue. The study is said to have simulated outcomes of critically ill children in a pandemic. According to the authors, the study provides an ethical way of resource allocation in times of crisis.
DOI: 10.1097/CCM.0000000000001796

32. Turner EL, Nielsen KR, Jamal SM, et al. A Review of Pediatric Critical Care in Resource-Limited Settings: A Look at Past, Present, and Future Directions. Frontiers in Pediatrics. 2016;4:5.
ABSTRACT: Fifteen years ago, United Nations world leaders defined millenium development goal 4 (MDG 4): to reduce under-5-year mortality rates by two-thirds by the year 2015. Unfortunately, only 27 of 138 developing countries are expected to

achieve MDG 4. The majority of childhood deaths in these settings result from reversible causes, and developing effective pediatric emergency and critical care services could substantially reduce this mortality. The Ebola outbreak highlighted the fragility of health care systems in resource-limited settings and emphasized the urgent need for a paradigm shift in the global approach to healthcare delivery related to critical illness. This review provides an overview of pediatric critical care in resource-limited settings and outlines strategies to address challenges specific to these areas. Implementation of these tools has the potential to move us toward delivery of an adequate standard of critical care for all children globally, and ultimately decrease global child mortality in resource-limited settings.

33. Kelen GD, Sauer L, Clattenburg E, et al. Pediatric Disposition Classification (Reverse Triage) System to Create Surge Capacity. Disaster med. 2015;9(3):283-90.

ABSTRACT: BACKGROUND: Critically insufficient pediatric hospital capacity may develop during a disaster or surge event. Research is lacking on the creation of pediatric surge capacity. A system of "reverse triage," with early discharge of hospitalized patients, has been developed for adults and shows great potential but is unexplored in pediatrics.
METHODS: We conducted an evidence-based modified-Delphi consensus process with 25 expert panelists to derive a disposition classification system for pediatric inpatients on the basis of risk tolerance for a consequential medical event (CME). For potential validation, critical interventions (CIs) were derived and ranked by using a Likert scale to indicate CME risk should the CI be withdrawn or withheld for early disposition.
RESULTS: Panelists unanimously agreed on a 5-category risk-based disposition classification system. The panelists established upper limit (mean) CME risk for each category as <2% (interquartile range [IQR]: 1-2%); 7% (5-10%), 18% (10-20%), 46% (20-65%), and 72% (50-90%), respectively. Panelists identified 25 CIs with varying degrees of CME likelihood if withdrawn or withheld. Of these, 40% were ranked high risk (Likert scale mean >=7) and 32% were ranked modest risk (<=3).
CONCLUSIONS: The classification system has potential for an ethically acceptable risk-based taxonomy for pediatric inpatient reverse triage, including identification of those deemed safe for early discharge during surge events.

34. Toltzis P, Soto-Campos G, Shelton C, et al. Evidence-Based Pediatric Outcome Predictors to Guide the Allocation of Critical Care Resources in a Mass Casualty Event. Pediatric Critical Care Medicine. 2015;16(7):e207-16.

ABSTRACT: OBJECTIVE: ICU resources may be overwhelmed by a mass casualty event, triggering a conversion to Crisis Standards of Care in which critical care support is diverted away from patients least likely to benefit, with the goal of improving population survival. We aimed to devise a Crisis Standards of Care triage allocation scheme specifically for children.
DESIGN: A triage scheme is proposed in which patients would be divided into those requiring mechanical ventilation at PICU presentation and those not, and then each group would be evaluated for probability of death and for predicted duration of resource consumption, specifically, duration of PICU length of stay and mechanical ventilation. Children will be excluded from PICU admission if their mortality or resource utilization is predicted to exceed predetermined levels ("high risk"), or if they have a low likelihood of requiring ICU support ("low risk"). Children entered into the Virtual PICU Performance Systems database were employed to develop prediction equations to assign children to the exclusion categories using logistic and linear regression. Machine Learning provided an alternative strategy to develop a triage scheme independent from this process.
SETTING: One hundred ten American PICUs
SUBJECTS: : One hundred fifty thousand records from the Virtual PICU database.
INTERVENTIONS: None.
MEASUREMENTS AND MAIN RESULTS: The prediction equations for probability of death had an area under the receiver operating characteristic curve more than 0.87. The prediction equation for belonging to the low-risk category had lower discrimination. R for the prediction equations for PICU length of stay and days of mechanical ventilation ranged from 0.10 to 0.18. Machine learning recommended initially dividing children into those mechanically ventilated versus those not and had strong predictive power for mortality, thus independently verifying the triage sequence and broadly verifying the algorithm.
CONCLUSION: An evidence-based predictive tool for children is presented to guide resource allocation during Crisis Standards of Care, potentially improving population outcomes by selecting patients likely to benefit from short-duration ICU interventions.

35. Johnson EM, Diekema DS, Lewis-Newby M, et al. Pediatric triage and allocation of critical care resources during disaster: Northwest provider opinion. Prehospital & Disaster Medicine. 2014;29(5):455-60.

ABSTRACT: INTRODUCTION: Following Hurricane Katrina and the 2009 H1N1 epidemic, pediatric critical care clinicians recognized the urgent need for a standardized pediatric triage/allocation system. This study collected regional provider opinion on issues of care allocation and pediatric triage in a disaster/pandemic setting.
METHODS: This study was a cross-sectional survey of United States (US) health care providers and public health workers who demonstrated interest in critical care and/or disaster care medicine by attending a Northwest regional pediatric critical care

symposium on disaster preparation, held in 2012 at Seattle Children's Hospital in Seattle, Washington (USA). The survey employed an electronic audience response system and included demographic, ethical, and logistical questions. Differences in opinions between respondents grouped by professions and work locations were evaluated using a chi-square test. RESULTS: One hundred and twelve (97%) of 116 total attendees responded to at least one question; however, four of these responders failed to answer every question. Sixty-two (55%) responders were nurses, 29 (26%) physicians, and 21 (19%) other occupations. Fifty-five (51%) responders worked in pediatric hospitals vs 53 (49%) in other locations. Sixty-three (58%) of 108 successful responses prioritized children predicted to have a good neuro-cognitive outcome. Seventy-one (68%) agreed that no pediatric age group should be prioritized. Twenty-two (43%) of providers working in non-pediatric hospital locations preferred a triage system based on an objective score alone vs 14 (26%) of those in pediatric hospitals (P = .038).

36. Toltzis P, Gall C, Kanter R, et al. Optimal thresholds for a PICU ventilator allocation algorithm in a pandemic. Critical Care Medicine. 2014;1):A1395-A6.

ABSTRACT: Learning Objectives: A global pandemic may overwhelm ICU capacity, activating crisis standards of care (CSC) in which scarce resources will be diverted from selected patients to ensure maximum population survival. CSC ICU resourceallocation algorithms (ALGs) exist for adults. Our goal was to evaluate a CSC pandemic ALG for children. Method(s): 150,000 records were obtained from the Virtual PICU Systems database, from which prediction equations for probability of death (POD) and duration of ventilation (DOV) were derived (SCCM Congress 2014, Abst 602). We estimated pandemic ICU activity by proportionally assigning peak weekly deaths caused by the 1918 influenza pandemic, using projected numbers in Ohio as an example. PICU capacity was taken as the number of surge beds in Ohio PICUs. Discrete Event Simulation (DES) was used to all the mechanically ventilated patients are treated in the ICU. However, the epidemiological data of the patients who were treated outside the ICU has not been reported. The aim of this study was to clarify the epidemiological data of mechanically ventilated patients who were treated outside the ICU. Method(s): The data source was derived from the Quality Indicator/Improvement Project, which is a voluntary data administration project from more than 300 acute care hospitals in Japan. Data of mechanically ventilated patients treated in or outside the ICU from Apr 2010 to Mar 2012 were analyzed. Data of adult patients who were ventilated for more than 3 days was analyzed. Patients whose diagnosis was related to cancer were excluded. Patients' demographic data and the rate of standard critical care provided were compared. Result(s): In the study period, 17,775 mechanically ventilated patients were treated only outside the ICU (non-ICU group) while 20,516 patients were treated once in the ICU (ICU group) (46.4% vs 53.6%). The average age was higher in non-ICU group patients than ICU group patients (72.8 vs 70.2, p<0.001). The mean ventilation days were longer in non-ICU group patients than in ICU group patients (11.7 vs 9.5, p<0.001). Hospital mortality was higher in non-ICU group patients than in ICU group patients (41.4% vs 38.8%, p<0.001). Standard critical care, such as arterial line placement, enteral nutrition and stress ulcer prevention, were provided significantly less often in non-ICU group. Conclusion(s): We have described the current practices of the mechanically ventilated patients in Japan. Patients treated in the ICU have a better survival with a higher rate of critical care compared to those treated outside the ICU.

37. Winsor S, Bensimon CM, Sibbald R, et al. Identifying prioritization criteria to supplement critical care triage protocols for the allocation of ventilators during a pandemic influenza. Healthc Q. 2014;17(2):44-51. DOI: 10.12927/hcq.2014.23833

ABSTRACT: The purpose of this study was to identify supplementary criteria to provide direction when the Ontario Health Plan for an Influenza Pandemic (OHPIP) critical care triage protocol is rendered insufficient by its inability to discriminate among patients assessed as urgent, and there are insufficient critical care resources available to treat those in that category. To accomplish this task, a Supplementary Criteria Task Force for Critical Care Triage was struck at the University of Toronto Joint Centre for Bioethics. The task force reviewed publically available protocols and policies on pandemic flu planning, identified 13 potential triage criteria and determined a set of eight key ethical, legal and practical considerations against which it assessed each criterion. An online questionnaire was distributed to clinical, policy and community stakeholders across Canada to obtain feedback on the 13 potential triage criteria toward selecting those that best met the eight considerations. The task force concluded that the balance of arguments favoured only two of the 13 criteria it had identified for consideration: first come, first served and random selection. The two criteria were chosen in part based on a need to balance the clearly utilitarian approach employed in the OHPIP with equity considerations. These criteria serve as a defensible "fail safe" mechanism for any triage protocol.

URL: https://www.ncbi.nlm.nih.gov/pubmed/25191808

DOI: 10.12927/hcq.2014.23833

38. Chung S, Fagbuyi D, Lozon MM, et al. Going viral: Adapting to pediatric surge during the H1N1 pandemic. Pediatric Emergency Care. 2013;29(11):1159-65.

ABSTRACT: OBJECTIVES: The objective of this study was to assess hospital and emergency department (ED) pediatric surge strategies utilized during the 2009 H1N1 influenza pandemic as well as compliance with national guidelines. METHOD(S): Electronic survey was sent to a convenience sample of emergency physicians and nurses from US EDs with a pediatric volume of more than 10,000 annually. Survey questions assessed the participant's hospital baseline pandemic and surge preparedness, as well as strategies for ED surge and compliance with Centers for Disease Control and Prevention (CDC) guidelines for health care personal protection, patient testing, and treatment. RESULT(S): The response rate was 54% (53/99). Preexisting pandemic influenza plans were absent in 44% of hospitals; however, 91% developed an influenza plan as a result of the pandemic. Twenty-four percent reported having a preexisting ED pandemic staffing model, and 36% had a preexisting alternate care site plan. Creation and/or modifications of existing plans for ED pandemic staffing (82%) and alternate care site plan (68%) were reported. Seventy-nine percent of institutions initially followed CDC guidelines for personal protection (use of N95 masks), of which 82% later revised their practices. Complete compliance with CDC guidelines was 60% for patient testing and 68% for patient treatment. CONCLUSION(S): Before the H1N1 pandemic, greater than 40% of the hospitals in our study did not have an influenza pandemic preparedness plan. Many had to modify their existing plans during the surge. Not all institutions fully complied with CDC guidelines. Data from this multicenter survey should assist clinical leaders to create more robust surge plans for children.

39. Challen K, Goodacre SW, Wilson R, et al. Evaluation of triage methods used to select patients with suspected pandemic influenza for hospital admission. Emergency Medicine Journal. 2012;29(5):383-8. DOI: 10.1136/emj.2010.104380

ABSTRACT: Objectives Prepandemic projections anticipated huge excess attendances and mortality in an influenza pandemic. A number of tools had been suggested for triaging patients with influenza for inpatient and critical care admission, but none had been validated in these patients. The authors aimed to evaluate three potential triage tools - CURB-65, PMEWS and the Department of d Health community assessment tool (CAT) - in patients in d the first waves of the 2009 H1N1 pandemic. Setting Prospective cohort study in three urban emergency departments (one adult, one paediatric, one mixed) in two cities. Participants All patients presenting to the three emergency departments fulfilling the national definition of suspected pandemic influenza. Outcome measures 30-day follow-up identified patients who had died or had required advanced respiratory, cardiovascular or renal support. Results The pandemic was much less severe than expected. A total of 481 patients (347 children) were recruited, of which only five adults fulfilled the outcome criteria for severe illness. The c-statistics for CURB-65, PMEWS and CAT in adults in terms of discriminating between those admitted and discharged were 0.65 (95% CI 0.54 to 0.76), 0.76 (95% CI 0.66 to 0.86) and 0.62 (95% CI 0.51 to 0.72), respectively. In detecting adverse outcome, sensitivities were 20% (95% CI 4% to 62%), 80% (95% CI 38% to 96%) and 60% (95% CI 23% to 88%), and specificities were 94% (95% CI 88% to 97%), 40% (95% CI 32% to 49%) and 81% (95% CI 73% to 87%) for CURB-65, PMEWS and CAT, respectively. Conclusions Although limited by a paucity of cases, this research shows that current triage methods for suspected pandemic influenza did not reliably discriminate between patients with good and poor outcomes.
DOI: 10.1136/emj.2010.104380

40. Johnson E, Lewis-Newby M, Diekema D, et al. Regional provider opinion on triage of pediatric patients during emergency mass critical care. Critical Care Medicine. 2012;1):221-2.

ABSTRACT: Introduction: Following Hurricane Katrina and the 2009 H1N1 epidemic, pediatric critical care clinicians recognized the urgent need for a standardized pediatric triage system. The 2010 Pediatric Emergency Mass Critical Care (PEMCC) Taskforce could not recommend any current triage model but advised further research towards this goal. Hypothesis: Providers will prefer an objective pediatric triage system for PEMCC as compared to one that includes factors such as subjective evaluation, neuro-cognitive outcome or patient age. Method(s): This cross-sectional survey used an audience response system with US healthcare providers who attended a regional pediatric disaster preparation symposium in 2012 to answer ethical and logistical questions about triage. Differences in opinions between respondents' professions and hospital type were evaluated using a Student's t-test. Result(s): 112 attendees responded (89% response rate); 55% were nurses, 26% physicians and 19% other providers. Work locations included pediatric hospitals (51%) vs. clinics, non-pediatric hospitals or other areas (49%). 59% of respondents agreed that a pediatric triage system should include both objective and subjective components. 59% prioritized children predicted to have a good neurocognitive outcome. 70% agreed that no pediatric age group should be prioritized. When considering the effect of workplace, 63% of non-neutral responding pediatric hospital providers preferred a pediatric triage system combining both a subjective evaluation by a care provider and an objective score compared with 37% from care settings other than a non-pediatric care settings (p= 0.04). Conclusion(s): In this regional survey of providers, the majority of respondents agree that a pediatric triage system should: 1) include both an objective score and a subjective evaluation, 2) prioritize predicted neuro-cognitive outcome but 3) should not include patient age. However, the majority of responders from settings other than pediatric hospitals prefer a triage system that excludes subjective evaluation. Further evaluation of

community and provider opinion in other regions is clearly necessary to further the development of a nationally standardized pediatric triage system.

41. Kanter RK. Pediatric mass critical care in a pandemic. Pediatric Critical Care Medicine. 2012;13(1):e1-4.
ABSTRACT: OBJECTIVES: Previous simulation studies suggest that temporary pediatric mass critical care approaches would accommodate plausible hypothetical sudden-impact public health emergencies. However, the utility of sustained pediatric mass critical care responses in prolonged pandemics has not been evaluated. The objective of this study was to compare the ability of a typical region to serve pediatric intensive care unit needs in hypothetical pandemics, with and without mass critical care responses sufficient to triple usual pediatric intensive care unit capacity. DESIGN, SETTING, PATIENTS, AND INTERVENTIONS: The Monte Carlo simulation method was used to model responses to hypothetical pandemics on the basis of national historical evidence regarding pediatric intensive care unit admission and length of stay in pandemic and nonpandemic circumstances. Assuming all ages are affected equally, federal guidelines call for plans to serve moderate and severe pandemics requiring pediatric intensive care unit care for 457 and 5,277 infants and children per million of the population, respectively.
MEASUREMENTS AND MAIN RESULTS: A moderate pandemic would exceed ordinary surge capacity on 13% of pandemic season days but would always be accommodated by mass critical care approaches. In a severe pandemic, ordinary surge methods would accommodate all the patients on only 32% of pandemic season days and would accommodate 39% of needed patient days. Mass critical care approaches would accommodate all the patients on 82% of the days and would accommodate 64% of all patient days.
CONCLUSION: Mass critical care approaches would be essential to extend care to the majority of infants and children in a severe pandemic. However, some patients needing critical care still could not be accommodated, requiring consideration of rationing.

42. Kim KM, Cinti S, Gay S, et al. Triage of mechanical ventilation for pediatric patients during a pandemic. Disaster med. 2012;6(2):131-7.
ABSTRACT: OBJECTIVE: The novel H1N1 influenza pandemic renewed the concern that during a severe pandemic illness, critical care and mechanical ventilation resources will be inadequate to meet the needs of patients. Several published protocols address the need to triage patients for access to ventilator resources. However, to our knowledge, none of these has addressed the pediatric populations.
METHODS: We used a systematic review of the pediatric critical care literature to evaluate pediatric critical care prognosis and multisystem organ failure scoring systems. We used multiple search engines, including MEDLINE and EMBASE, using a search for terms and key words including including multiple organ failure, multiple organ dysfunction, PELOD, PRISM III, pediatric risk of mortality score, pediatric logistic organ dysfunction, pediatric index of mortality pediatric multiple organ dysfunction score, "child+multiple organ failure + scoring system." Searches were conducted in the period January 2010-February 2010.
RESULTS: Of the 69 papers reviewed, 22 were used. Five independently derived scoring systems were evaluated for use in a respiratory pandemic ventilator triage protocol. The Pediatric Logistic Organ Dysfunction (PELOD) scoring system was the most appropriate for use in such a triage protocol.
CONCLUSIONS: We present a pediatric-specific ventilator triage protocol using the PELOD scoring system to complement the NY State adult triage protocol. Further evaluation of pediatric scoring systems is imperative to ensure appropriate triage of pediatric patients.

43. Kissoon N. Pediatric mass critical care in a pandemic: yes, it is in the cards. Pediatric Critical Care Medicine. 2012;13(1):106-7.

44. Sweney JS, Poss WB, Grissom CK, et al. Comparison of severity of illness scores to physician clinical judgment for potential use in pediatric critical care triage. Disaster Medicine and Public Health Preparedness. 2012;6(2):126-30.
ABSTRACT: Objective: A pediatric triage tool is needed during times of resource scarcity to optimize critical care utilization. This study compares the modified sequential organ failure assessment score (M-SOFA), the Pediatric Early Warning System (PEWS) score, the Pediatric Risk of Admission Score II (PRISA-II), and physician judgment to predict the need for pediatric intensive care unit (PICU) interventions. Method(s): This retrospective cohort study evaluates three illness severity scores for all non-neonatal pediatric patients transported and admitted to a single center in 2006. The outcome of interest was receipt of a PICU intervention (mechanical ventilation, acute dialysis, depressed consciousness, or persistent hypotension). Predictive ability was assessed using receiver operating curves (ROCs). Result(s): Of 752 patients admitted to the hospital, 287 received a PICU intervention. Median scores for all tools were significantly higher for children receiving an intervention than for those who did not. ROCs showed PEWS had the least discriminatory ability, followed by PRISA-II and pediatric M-SOFA. No value of the

pediatric MSOFA produced both positive and negative predictive values better than clinician judgment. Conclusion(s): No score had a clinically acceptable discriminate ability to predict patients who required a PICU intervention from those who did not. Physician judgment outperformed all three triage scores.

45. Waseem M, McInerney JE, Perales O, et al. Impact of operational staging to improve patient throughput in an inner-city emergency department during the novel H1N1 influenza surge: A descriptive study. Pediatric Emergency Care. 2012;28(1):39-42.

ABSTRACT: BACKGROUND: A level 1 pediatric emergency department (ED) in a public hospital of South Bronx rapidly encountered a significant surge in ED patient census over several days as the novel H1N1 influenza outbreak occurred. Our aim was to identify ill patients with influenza-like illness and evaluate and treat them as expeditiously as possible without failing in our responsibility to treat all patients. We describe the ED response to the outbreak during 2009 H1N1-related visits. OBJECTIVE(S): The objective of this study was to describe and compare pediatric ED visits during the fall 2009 H1N1 to that in the previous year. METHOD(S): The department reorganized patient flow in the ED to maximize the understanding of where to best apportion our resources and to minimize walkout and return visit rates. We developed staging of the flow of patients. This included, but was not limited to, a rapid screening at pretriage stage, early registration before the formal triage, and expanding the service. We compared walkout rates during fall 2009 and fall 2008. Return visits for asthmatic patients within 7 days were also compared. RESULT(S): Over a period of 48 days, 8841 patients visited the pediatric ED. The average number of visits during this outbreak was 184 per day (usual visits per day, 80-110). Overall ED visits increased by 93.6% (95% confidence interval [CI], 78.2%-109.6%; P < 0.001). Fifty-two patients tested positive for H1N1. The walkout rate was 2.9% (95% CI, 1.9%-4.0%) in 2009 compared with the walkout rate of 1.5% (95% CI, 1.0%-2.0%) in 2008. There were no statistically significant differences between walkouts (P = 0.06) and 7-day asthma revisits (P = 0.07) in 2008 and 2009 despite the almost doubling of the ED visits. Admission rates from 2009 did not significantly differ from 2008 (11.2% [990/8841] vs 10.2% [464/4560], P = 0.07). CONCLUSION(S): Staging of a surge volume allows ED administrators to maintain a strong control of a multipatient event to ensure an effective response and appropriate use of limited resources. The implementation of the reorganized measures during the fall 2009 H1N1-related surge in patient's visits resulted in improved patient flow without significant increase in walkout and 7-day asthma revisit rates. Our strategies accommodated the surge of patients in the ED. Copyright © 2012 by Lippincott Williams & Wilkins.

46. Ytzhak A, Sagi R, Bader T, et al. Pediatric ventilation in a disaster: clinical and ethical decision making. Critical Care Medicine. 2012;40(2):603-7.

ABSTRACT: INTRODUCTION: Medical resources may be overwhelmed in a mass disaster situation. Intensive care resources may be limited even further. When the demand for a certain resource, like ventilators, exceeds its availability, caregivers are faced with the task of deciding how to distribute this resource.Ethical dilemmas arise when a practical decision necessitates ranking the importance of several ethical principles. In a disaster area, the greatest good for the greatest number principle and the goal of equal distribution of resources may take priority over the needs of the individual. Nonetheless, regardless of the interventions available, it is a prime goal to keep the patients' comfort and dignity as much as possible.
BACKGROUND: In the mass disaster of the Haiti earthquake of January 2010, The Israeli Defense Forces Medical Corps field hospital was one of the first to respond to the call for help of the Haitian people with surgical and intensive care capabilities. It was the only facility able to ventilate children and neonates in the first week after the earthquake, although this ability was relatively limited. SPECIAL ARTICLE: Five case scenarios that we confronted at the pediatric ward of the field hospital are presented: two children with respiratory compromise due to pulmonary infection, one premature baby with respiratory distress syndrome, an asphyxiated neonate, and a baby with severe sepsis of a probable abdominal origin. In normal circumstances all of them would have been ventilated but with limited resources we raised in each case the question of ventilating or not.To help in the evaluation of each case we used a decision-support tool that was previously developed for ventilator allocation during an influenza pandemic. This tool takes into account several factors, including the illness severity, prognosis, and the expected duration of ventilation.
CONCLUSIONS: Applying ethical priorities to analyze the decision-making problems leads to the understanding that an individualized approach with an ongoing assessment of the patient condition and the availability of resources, rather than a strict predefined decision rule, will give patients a better chance of survival, and will assist in allocating scarce resources.

47. Burkle FM, Williams A, Kissoon N. Pediatric emergency mass critical care: The role of community preparedness in conserving critical care resources. Pediatric Critical Care Medicine. 2011;12(6 SUPPL.):S141-S51.

ABSTRACT: Introduction: Public health emergencies require resources at state, regional, federal, and often international levels; however, community preparedness is the crucial first step in managing these events and mitigating their consequences, particularly for children. Community preparedness can be optimized through system-wide planning that includes integrating

multiple points of contact, such as the community, prehospital care, health facilities, and regional level of care assets.Citizen readiness, call centers, alternate care facilities, emergency medical services, and health emergency operations centers linked to community incident command systems should be considered as important options for delivery of population-based care. Early collaboration between pediatric clinicians and public health authorities is essential to ensure that pediatric needs are addressed in community preparedness for mass critical care events. Method(s): In May 2008, the Task Force for Mass Critical Care published guidance on provision of mass critical care to adults. Acknowledging that the critical care needs of children during disasters were unaddressed by this effort, a 17-member Steering Committee, assembled by the Oak Ridge Institute for Science and Education with guidance from members of the American Academy of Pediatrics, convened in April 2009 to determine priority topic areas for pediatric emergency mass critical care recommendations.Steering Committee members established subcommittees by topic area and performed literature reviews of MEDLINE and Ovid databases. The Steering Committee produced draft outlines and convened October 6-7, 2009, in New York, NY, to review and revise each outline. Eight draft documents were subsequently developed from the revised outlines as well as through searches of MEDLINE updated through March 2010.The Pediatric Emergency Mass Critical Care Task Force, composed of 36 experts from diverse public health, medical, and disaster response fields, convened in Atlanta, GA, on March 29-30, 2010. Feedback on each manuscript was compiled and the Steering Committee revised each document to reflect expert input in addition to the most current medical literature. Task Force Recommendations: The Pediatric Emergency Mass Critical Care Task Force recommends active promotion of programs to ensure an informed citizenry; education of children and families in Centers for Disease Control and Prevention community mitigation strategies; emphasis on community-level preparedness empowering the public to provide self care; use of 9-1-1 telephone triage with pre-established protocols and in coordination with emergency medical services; and advocacy for healthcare coalitions and other creative operational concepts that provide guidance and protocols for care of the pediatric population.

48. Christian MD, Toltzis P, Kanter RK, et al. Treatment and triage recommendations for pediatric emergency mass critical care. Pediatric Critical Care Medicine. 2011;12(6 Suppl):S109-19.

ABSTRACT: INTRODUCTION: This paper will outline the Task Force recommendations regarding treatment during pediatric emergency mass critical care, issues related to the allocation of scarce resources, and current challenges in the development of pediatric triage guidelines.
METHODS: In May 2008, the Task Force for Mass Critical Care published guidance on provision of mass critical care to adults. Acknowledging that the critical care needs of children during disasters were unaddressed by this effort, a 17-member Steering Committee, assembled by the Oak Ridge Institute for Science and Education with guidance from members of the American Academy of Pediatrics, convened in April 2009 to determine priority topic areas for pediatric emergency mass critical care recommendations.Steering Committee members established subcommittees by topic area and performed literature reviews of MEDLINE and Ovid databases. The Steering Committee produced draft outlines through consensus-based study of the literature and convened October 6-7, 2009, in New York, NY, to review and revise each outline. Eight draft documents were subsequently developed from the revised outlines as well as through searches of MEDLINE updated through March 2010. The Pediatric Emergency Mass Critical Care Task Force, composed of 36 experts from diverse public health, medical, and disaster response fields, convened in Atlanta, GA, on March 29-30, 2010. Feedback on each manuscript was compiled and the Steering Committee revised each document to reflect expert input in addition to the most current medical literature.
TASK FORCE RECOMMENDATIONS: Recommendations are divided into three operational sections. The first section provides pediatric emergency mass critical care recommendations for hospitals that normally provide care to pediatric patients. The second section provides recommendations for pediatric emergency mass critical care at hospitals that do not routinely provide care to pediatric patients. The final section provides a discussion of issues related to developing triage algorithms and protocols and the allocation of scarce resources during pediatric emergency mass critical care.

49. Antommaria AH, Sweney J, Poss WB. Critical appraisal of: triaging pediatric critical care resources during a pandemic: ethical and medical considerations. Pediatric Critical Care Medicine. 2010;11(3):396-400.

ABSTRACT: OBJECTIVE: To identify the ethical norms that should govern the allocation of pediatric critical care resources during a pandemic.
DESIGN: Narrative review.
METHODS: Review the literature on triage and pandemics.
FINDINGS: When care that is functionally equivalent to usual patient care practices can no longer be maintained, resources should be allocated primarily on the basis of medical need and/or benefit. Unequal treatment may be justified to increase the supply of available resources and thereby save more lives. When ethically relevant distinctions can no longer be made between patients, resources should be distributed by chance. Allocation on the basis of quality of life, general contributions to society,

or age are potentially problematic. Existing triage protocols inconsistently articulate the relationship between these ethical norms and their specific recommendations. In addition, they have limited applicability in pediatrics principally because of the lack of a simple validated global scoring system, which predicts mortality and/or resource utilization.
CONCLUSIONS: Although research to develop such scoring systems is ongoing, clinicians will need to rely more heavily on individual diagnoses of acute illnesses with high mortality rates and underlying conditions with short life expectancies and on random allocation methods.

50. Goodacre S, Challen K, Wilson R, et al. Evaluation of triage methods used to select patients with suspected pandemic influenza for hospital admission: cohort study. Health Technology Assessment (Winchester, England). 2010;14(46):173-236.
ABSTRACT: BACKGROUND: Triage methods are necessary in emergency departments to provide clinicians with a reliable method for determining each patient's risk of adverse outcome. Prior to the 2009 H1N1 influenza pandemic the CURB-65 (a risk prediction score for pneumonia, based on confusion, urea level, respiratory rate, blood pressure and age over 65 years) pneumonia score and the Pandemic Modified Early Warning Score (PMEWS) were used to assess adults. In response to the emergence of the pandemic, national guidance produced a new swine flu hospital pathway for use adults and children. However, none of these methods had been widely validated or tested in the setting of pandemic influenza.
OBJECTIVES: To use the initial waves of the 2009 H1N1 pandemic to evaluate existing triage methods in patients presenting with suspected pandemic influenza, and to determine whether an improved triage method could be developed.
METHODS: A prospective cohort study was undertaken of patients with suspected swine flu presenting to four hospitals during the second wave of the 2009 H1N1 pandemic. Staff completed a standardised assessment form that included the CURB-65 score, PMEWS and the swine flu hospital pathway. Patients who died or required respiratory, cardiovascular or renal support during the 30-day follow-up were defined as having a poor outcome. Patients who survived to 30 days without requiring respiratory, cardiovascular or renal support were defined as having a good outcome.
RESULTS: Data were collected and analysed from 481 cases across three hospitals. Most of the cases were children, with 347 out of 481 (72%) aged 16 years or less. There were five poor outcomes: two deaths and three survivors who required respiratory support. The five patients with poor outcomes had CURB-65 scores of zero, one (three cases) and two, and PMEWS scores of one, five, six, seven and eight. The swine flu hospital pathway was positive in three out of five cases. The C-statistic for each method was CURB-65 0.78 [95% confidence interval (CI) 0.58 to 0.99], PMEWS 0.77 (95% CI 0.55 to 0.99) and the swine flu hospital pathway 0.70 (95% CI 0.45 to 0.96). Patients with a higher CURB-65 score were more likely to be admitted ($p < 0.001$): 25 out of 101 (25%) with a score of zero, 11 out of 24 (46%) with a score of one, 7 out of 8 (88%) with a score of two, and the patient with a score of three were admitted. Admitted patients had a higher mean PMEWS score (4.6 vs 2.0, $p < 0.001$). The C-statistics for CURB-65, PMEWS and the swine flu hospital pathway in adults in terms of discriminating between those admitted and discharged were 0.65 (95% CI 0.54 to 0.76), 0.76 (95% CI 0.66 to 0.86) and 0.62 (95% CI 0.51 to 0.72) respectively.
LIMITATIONS: The 2009 H1N1 pandemic was much smaller and less severe than predicted and resulted in a lack of sufficient data.
CONCLUSIONS: Potential concerns were raised about the use of existing triage methods for patients with suspected pandemic influenza, as these methods may fail to discriminate between patients who will have an adverse outcome and those with a benign course. Clinicians in the study did not generally appear to admit or discharge on the basis of these methods, despite their recommended use. Further research is required to evaluate existing triage methods and develop new triage tools for suspected pandemic influenza.

51. Howes D, Tsai E. Ventilator allocation in a pandemic: discussion and a model for rationing restricted resources. 2010.
URL: http://www.webmedcentral.com/article_view/1258

52. Koller D, Nicholas D, Gearing R, et al. Paediatric pandemic planning: children's perspectives and recommendations. Health & Social Care in the Community. 2010;18(4):369-77. DOI: 10.1111/j.1365-2524.2009.00907.x
ABSTRACT: Children, as major stakeholders in paediatric hospitals, have remained absent from discussions on important healthcare issues. One critical area where children's voices have been minimised is in the planning for future pandemics. This paper presents a subset of data from a programme of research which examined various stakeholder experiences of the severe acute respiratory syndrome (SARS) outbreaks of 2003. These data also generated recommendations for future pandemic planning. Specifically, this paper will examine the perspectives and recommendations of children hospitalised during SARS in a large paediatric hospital in Canada. Twenty-one (n = 21) child and adolescent participants were interviewed from a variety of medical areas including cardiac (n = 2), critical care (n = 2), organ transplant (n = 4), respiratory medicine (n = 8) and infectious diseases (patients diagnosed with suspected or probable SARS; n = 5). Data analyses exposed a range of children's

experiences associated with the outbreaks as well as recommendations for future pandemic planning. Key recommendations included specific policies and guidelines concerning psychosocial care, infection control, communication strategies and the management of various resources. This paper is guided by a conceptual framework comprised of theories from child development and literature on children's rights. The authors call for greater youth participation in healthcare decision-making and pandemic planning.
DOI: 10.1111/j.1365-2524.2009.00907.x

53. Nicholas D, Patershuk C, Koller D, et al. Pandemic planning in pediatric care: A website policy review and national survey data. Health Policy. 2010;96(2):134-42.
ABSTRACT: Objectives: This study investigates current policies, key issues, and needs for pandemic planning in pediatrics in Canada. Method(s): Online pandemic plans from national, provincial and territorial government websites were reviewed to identify: plans for children and families, and psychosocial and ethical issues. A survey was administered to gather participants' perspectives on the needs in pediatric planning, as well as important elements of their organizations' and regions' pandemic plans. A thematic analysis was conducted on qualitative survey responses. Result(s): The majority of existing plans did not adequately address the unique needs of pediatric populations, and mainly focused on medical and policy concerns. Several gaps in plans were identified, including the need for psychosocial supports and ethical decision-making frameworks for children and families. Similarly, survey respondents identified parallel gaps, in their organization's or region's plans. Conclusion(s): Although many plans provide guidelines for medical and policy issues in pediatrics, much more work remains in psychosocial and ethical planning. A focus on children and families is needed for pandemic planning in pediatrics to ensure best outcomes for children and families. © 2010 .

54. Hahn R, O'Riordan MA, Lowrie L, et al. Use of pediatric risk of mortality (PRISM) II score as a tool for critical care triage during a pandemic. Critical Care Medicine. 2009;37 (12 SUPPL.):A327.
ABSTRACT: Introduction: ICUs will be overwhelmed in a severe pandemic, requiring triage schemes to direct resources where they will save the maximal number of lives. No such schemes have been devised for children. In adult patients, a persistently high SOFA score, predicting mortality >= 80%, has been suggested as a prompt to reallocate critical care resources (CCR) to other patients. Hypothesis: We hypothesized that persistently elevated PRISM II scores could likewise inform CCR allocation decisions in children. Method(s): A database including patients admitted 2004-2008 to a 20-bed tertiary care PICU was employed. After excluding heart surgery admissions, we measured the association of first-3-day (F3D) PRISM II scores and the following outcomes: mortality, mechanical ventilator (MV) days, Therapeutic Intervention Scoring System (TISS) scores, and PICU length of stay (LOS). The results are descriptive in nature and were not subjected to tests of significance. Result(s): 7798 admissions were analyzed. As a proof-of-concept, we imagined a 2-step triage algorithm, with the first step identifying children with high mortality and the second step identifying high CCR-users among the remaining population. Increasing F3D PRISM scores were associated with incremental mortality, from 10% when F3D PRISM scores were all >= 5 to 90% when F3D PRISM scores were all >= 14. F3D PRISM scores >= 13 were associated with mortality of 75%; if further care were withdrawn from this group, approximating the triage scheme for adults, increasing F3D PRISM scores in the remaining population were associated with an incremental use of CCR. Specifically, as F3D PRISM scores increased from >= 5 to >= 12, MV days increased from median 5 (IQR 0,13) to 12.5 (11,15) and TISS scores increased from 23.5 (13.5,31.5) to 32.3 (22,36). Association between F3D PRISM scores and LOS were less correlative. Conclusion(s): F3D PRISM II scores were useful in informing a hypothetical triage scheme for assigning scarce PICU CCR in the event of a pandemic. These results require validation and await consensus regarding the ethics of selectively allocating CCR to children in an overwhelming crisis.

55. Kanter RK, Cooper A. Mass critical care: pediatric considerations in extending and rationing care in public health emergencies. Disaster med. 2009;3 Suppl 2:S166-71.
ABSTRACT: This article applies developing concepts of mass critical care (MCC) to children. In public health emergencies (PHEs), MCC would improve population outcomes by providing lifesaving interventions while delaying less urgent care. If needs exceed resources despite MCC, then rationing would allocate interventions to those most likely to survive with care. Gaps between estimated needs and actual hospital resources are worse for children than adults. Clear identification of pediatric hospitals would facilitate distribution of children according to PHE needs, but all hospitals must prepare to treat some children. Keeping children with a family member and identifying unaccompanied children complicate PHE regional triage. Pediatric critical care experts would teach and supervise supplemental providers. Adapting nearly equivalent equipment compensates for shortages, but there is no substitute for age-appropriate resuscitation masks, IV/suction catheters, endotracheal/gastric/chest tubes. Limitations will be encountered using adult ventilators for infants. Temporary manual bag valve ventilation and development of shared ventilators may prolong survival until the arrival of ventilator stockpiles. To ration

MCC to children most likely to survive, the Pediatric Index of Mortality 2 score meets the criteria for validated pediatric mortality predictions. Policymakers must define population outcome goals in regard to lives saved versus life-years saved.

56. Kanter RK. Strategies to improve pediatric disaster surge response: potential mortality reduction and tradeoffs. Critical Care Medicine. 2007;35(12):2837-42.
ABSTRACT: OBJECTIVE: To estimate the potential for disaster mortality reduction with two surge response strategies: 1) control distribution of disaster victims to avoid hospital overcrowding near the scene, and 2) expand capacity by altering standards of care to only "essential" interventions.
DESIGN: Quantitative model of hospital mortality.
SETTING: New York City pediatric intensive care unit and non-intensive care unit pediatric hospital capacity and population.
MEASUREMENTS AND MAIN RESULTS: Mortality was calculated for a hypothetical sudden disaster, of unspecified mechanism, assuming 500 children per million population need hospitalization, including 30% severely ill/injured warranting pediatric intensive care unit care, with high (76%) predisaster hospital occupancy. Triage rules accommodated patients at lower levels of care if capacity was exhausted. Specified higher relative mortality risks were assumed with reduced levels of care. In a pessimistic baseline scenario, hospitals near the disaster scene, considered to have 20% of regional capacity, were overcrowded with 80% of the surge patients. Exhausted capacity at overcrowded hospitals near the scene would account for most of the 45 deaths. Unused capacity would remain at remote facilities. If regional surge distribution were controlled to avoid overcrowding near the scene, then mortality would be reduced by 11%. However, limited pediatric intensive care unit capacity would still require triage of many severe patients to non-intensive care unit care. Instead, if altered standards of care quadrupled pediatric intensive care unit and non-intensive care unit capacity, then mortality would fall 24% below baseline. Strategies 1 and 2 in combination would improve mortality 47% below baseline. If standards of care were altered prematurely, preventable deaths would occur. However, additional simulations varying surge size, patient severity, and predisaster occupancy numbers found that mortality tradeoffs would generally favor altering care for individuals to improve population outcomes within the range of federal planning targets (500 new patients/million population).
CONCLUSION: Quantitative simulations suggest that response strategies controlling patient distribution and expanding capacity by altering standards of care may lower mortality rates in large disasters.

57. Christian MD, Hawryluck L, Wax RS, et al. Development of a triage protocol for critical care during an influenza pandemic. Cmaj. 2006;175(11):1377-81.
ABSTRACT: Background: The recent outbreaks of avian influenza (H5N1) have placed a renewed emphasis on preparing for an influenza pandemic in humans. Of particular concern in this planning is the allocation of resources, such as ventilators and antiviral medications, which will likely become scarce during a pandemic. Method(s): We applied a collaborative process using best evidence, expert panels, stakeholder consultations and ethical principles to develop a triage protocol for prioritizing access to critical care resources, including mechanical ventilation, during a pandemic. Result(s): The triage protocol uses the Sequential Organ Failure Assessment score and has 4 main components: inclusion criteria, exclusion criteria, minimum qualifications for survival and a prioritization tool. Interpretation(s): This protocol is intended to provide guidance for making triage decisions during the initial days to weeks of an influenza pandemic if the critical care system becomes overwhelmed. Although we designed this protocol for use during an influenza pandemic, the triage protocol would apply to patients both with and without influenza, since all patients must share a single pool of critical care resources.

SEARCH STRATEGIES

Database: Ovid MEDLINE(R) ALL <1946 to June 29, 2020>
Search Strategy:
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1 exp *pediatrics/ or exp *infant/ or exp *child/ or *adolescent/ or exp *intensive care units, pediatric/ (118867)
2 (child? or children or childhood or p?ediatric* or baby or babies or newborn? or new-born? or neonat* or perinat* or infant? or infantile or infancy or toddler? or preschooler? or pre-schooler* or boy? or girl? or

adolescen* or teen* or youth? or juvenile? or pre-menarch* or pre-adolescen* or pre-teen or pre-pubert* or pre-pubesc* or premenarch* or preadolescen* or preteen or prepubert* or prepubesc*).tw,kf. (2448959)
3 1 or 2 (2460923)
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6 (coronavirus* or coronovirus* or coronavirinae* or CoV or "middle east respiratory syndrome*" or "middle eastern respiratory syndrome*" or MERSCoV or "MERS-CoV" or MERS).ti,ab,kw,kf. (29754)
7 ("2019-nCoV" or 2019nCoV or nCoV2019 or "nCoV-2019" or "COVID-19" or COVID19 or "CORVID-19" or CORVID19 or "WN-CoV" or WNCoV or "HCoV-19" or HCoV19 or "2019 novel*" or Ncov or "n-cov" or "SARS-CoV-2" or "SARSCoV-2" or "SARSCoV2" or "SARS-CoV2" or SARSCov19 or "SARS-Cov19" or "SARSCov-19" or "SARS-Cov-19" or Ncovor or Ncorona* or Ncorono* or NcovWuhan* or NcovHubei* or NcovChina* or NcovChinese* or SARS2 or "SARS-2" or SARScoronavirus2 or "SARS-coronavirus-2" or "SARScoronavirus 2" or "SARS coronavirus2" or SARScoronovirus2 or "SARS-coronovirus-2" or "SARScoronovirus 2" or "SARS coronovirus2").ti,ab,kw,kf. (26813)
8 (respiratory* adj2 (symptom* or disease* or illness* or condition*) adj10 (Wuhan* or Hubei* or China* or Chinese* or Huanan*)).ti,ab,kw,kf. (483)
9 "severe acute respiratory syndrome*".ti,ab,kw,kf. (7601)
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11 (epidemic? or pandemic? or outbreak*).tw,kw,kf. (211905)
12 or/4-11 (270929)
13 triage/ (11599)
14 (triage? or triaging or ((casualt* or patient? or treatment? or care) adj2 (priorit* or sorting or classification? or hierarch* or urgency))).tw,kf. (36204)
15 13 or 14 (40627)
16 exp resource allocation/ (17311)
17 ((resource? adj2 (allocat* or access*)) or scarce resource? or limited resource? or ((medical or health care or healthcare or resource?) adj2 ration*)).tw,kf. (30366)
18 16 or 17 (44268)
19 3 and 12 and (15 or 18) (284)
20 3 and 15 and 18 (150)
21 19 or 20 (422)
22 limit 21 to yr="2000 -Current" (343)
23 from 22 keep 1,14,20,23,26,49,65,68,75,118,123-124,157,165,185,193,232,238,241,244,247,265,270,275,292 (25)
24 4 or 5 or 6 or 7 or 8 or 9 (51352)
25 3 and 24 (3330)
26 25 and protocol*.tw,kf. (70)
27 from 26 keep 11,15 (2)
28 23 or 27 (27)

Database: Embase <1974 to 2020 June 29>
Search Strategy:
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1 Pediatrics/ or exp Infant/ or exp Child/ or Adolescent/ (3375792)
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3 1 or 2 (4232991)

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7 (coronavirus* or coronovirus* or coronavirinae* or CoV).ti,ab,kw. (27500)
8 ("2019-nCoV" or 2019nCoV or nCoV2019 or "nCoV-2019" or "COVID-19" or COVID19 or "CORVID-19" or CORVID19 or "WN-CoV" or WNCoV or "HCoV-19" or HCoV19 or "2019 novel*" or Ncov or "n-cov" or "SARS-CoV-2" or "SARSCoV-2" or "SARSCoV2" or "SARS-CoV2" or SARSCov19 or "SARS-Cov19" or "SARSCov-19" or "SARS-Cov-19" or Ncovor or Ncorona* or Ncorono* or NcovWuhan* or NcovHubei* or NcovChina* or NcovChinese* or SARS2 or "SARS-2" or SARScoronavirus2 or "SARS-coronavirus-2" or "SARScoronavirus 2" or "SARS coronavirus2" or SARScoronovirus2 or "SARS-coronovirus-2" or "SARScoronovirus 2" or "SARS coronovirus2").ti,ab,kw. (24002)
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12 "severe acute respiratory syndrome*".ti,ab,kw. (7573)
13 epidemic/ (105080)
14 (epidemic? or pandemic? or disease outbreak?).tw,kw. (152679)
15 or/4-14 (242156)
16 (triage? or triaging or ((casualt* or patient? or treatment? or care) adj2 (priorit* or sorting or classification? or hierarch* or urgency))).tw,kw. (56350)
17 resource management/ or resource allocation/ (30431)
18 ((resource adj2 (allocat* or access*)) or scarce resource? or ((medical or health care or healthcare or resource) adj2 ration*)).tw,kw. (17227)
19 16 or 17 or 18 (97210)
20 3 and 15 and 19 (346)
21 limit 20 to yr="2000 -Current" (332)
22 2 and 21 (231)
23 from 21 keep 2,6 (2)
24 from 22 keep 2,104,109,122,128,137,147,190 (8)
25 23 or 24 (9)

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CINAHL

S1	(MM "Pediatrics+") OR (MM "Child+") OR (MM "Adolescence+")	51,631
S2	TI (child# or children or childhood or pediatric* or paediatric* or baby or babies or newborn# or new-born# or neonat* or perinat* or infant# or infantile or infancy or toddler# or preschooler# or pre-schooler# or boy# or girl# or adolescen* or teen* or youth# or juvenile# or pre-menarch* or pre-adolescen* or pre-teen or pre-pubert* or pre-pubesc* or premenarch* or preadolescen* or preteen or prepubert* or prepubesc*)	586,533
S3	AB (child# or children or childhood or pediatric* or paediatric* or baby or babies or newborn# or new-born# or neonat* or perinat* or infant# or infantile or infancy or toddler# or preschooler# or pre-schooler# or boy# or girl# or adolescen* or teen* or youth# or juvenile# or pre-menarch*	637,813

	or pre-adolescen* or pre-teen or pre-pubert* or pre-pubesc* or premenarch* or preadolescen* or preteen or prepubert* or prepubesc*)	
S4	S1 OR S2 OR S3	876,860
S5	(MH "Triage")	10,167
S6	(MH "Decision Making, Clinical")	35,409
S7	TI ((triag* or ((casualt* or patient* or treatment* or care) N2 (priorit* or sorting or classification* or hierarch* or urgency)))) OR AB ((triag* or ((casualt* or patient* or treatment* or care) N2 (priorit* or sorting or classification* or hierarch* or urgency))))	22,344
S8	S5 OR S6 OR S7	61,362
S9	(MH "Health Resource Allocation")	10,003
S10	TI (((resource* N2 (allocat* or access*)) or scarce resource* or ((medical or health care or healthcare or resource) N2 ration*))) OR AB (((resource* N2 (allocat* or access*)) or scarce resource* or ((medical or health care or healthcare or resource) N2 ration*)))	10,975
S11	S9 OR S10	19,632
S12	S4 AND S8 AND S11	113
S13	TX ("severe acute respiratory syndrome*")	4,108
S14	TX ("middle east respiratory syndrome*" or "middle eastern respiratory syndrome*" or MERSCoV or "MERS-CoV" or MERS)	8,015
S15	TX ("severe acute respiratory syndrome*" or SARS)	15,507
S16	TX ("SARS-CoV-1" or "SARSCoV-1" or "SARSCoV1" or "SARS-CoV1" or SARSCoV or SARS-CoV or SARS1 or "SARS-1" or SARScoronavirus1 or "SARS-coronavirus-1" or "SARScoronavirus 1" or "SARS coronavirus1" or SARScoronovirus1 or "SARS-coronovirus-1" or "SARScoronovirus 1" or "SARS coronovirus1")	587
S17	TI (epidemic* or pandemic* or outbreak*) OR AB (epidemic* or pandemic* or outbreak*)	50,231
S18	(MH "Disease Outbreaks")	31,791
S19	S13 OR S14 OR S15 OR S16 OR S17 OR S18	82,722
S20	S8 OR S11	80,014
S21	S4 AND S19 AND S20	154
S22	S12 OR S21	256
S23	S12 OR S21	247

Google Scholar

(covid19|"covid 19"|2019ncov|pandemic*) AND (pediatrics|paediatrics) AND triage AND (protocol*|pathway*)

Other search terms used
scarce resource triage pediatrics
covid triage pediatrics
Italy covid triage pediatric(s)