Implementation of a Disaster Triage Assessment Instrument to Facilitate Evacuation of Hospitalized Perinatal Patients: A Quality Improvement Project

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Abstract

Disaster preparedness involves the anticipation of an event and integration of appropriate protocols that will likely mitigate the impact of a disaster. An evacuation triage tool for perinatal inpatients, a vulnerable population, that has been designed and integrated into an urban multi-hospital teaching consortium, has not been evaluated for validity and reliability outside of this context. Multiple studies have focused on triaging inpatients for admission to care, only the OB-TRAIN highlights triaging for evacuation in the perinatal inpatient setting. Inter-rater agreement of the OB-TRAIN instrument was assessed during a quality improvement project at a rural community hospital's labor-delivery-recovery-postpartum 7-bed unit with an overall 73% accordance over an 84-day evaluation. Three cycles implementing the plan-do-study-act framework of quality improvement measured the internal consistency by Cronbach's alpha with a result of 0.73. Forecasting of future transport needs could be assessed relying on data from the 84-day project: 16% no hospital census, 32% car discharge, 37% low acuity, 7% moderate acuity, 6% high acuity, and <1% shelter in place. During a disaster, having access to a tool to assess resource needs rapidly, and with reliability between raters, is essential for patient safety when decision making in a crisis management situation.

Key words: Triage, perinatal, quality improvement, vulnerable populations, disaster, community hospitals, patient safety

Problem

> A disaster is a sudden, calamitous event that seriously disrupts the functioning of a community or society and causes human, material, and economic or environmental losses that exceed the community's or society's ability to cope using its own resources. Though often caused by nature, disasters can have human origins. (International Federation of Red Cross and Red Crescent Societies, 2008, p. 1)

Humanitarian emergencies are caused by naturally occurring events (floods, wildfires, earthquakes), outbreaks (Ebola viral disease), pandemics (influenza, SARS-CoV-2), or human-made activities (war and displaced populations). In a position statement on climate change, the World Association for Disaster and Emergency Medicine (2017) recognized that there is increased frequency and severity of disasters worldwide. The risk of exposure to climate change, natural hazards, epidemics, and terrorism with serious health consequences is escalating. Disasters can reveal ongoing vulnerabilities and inadequate levels of global, community, and organizational preparedness. Climate change is viewed as a catalyst of public health crises and a threat of increased risk of direct and indirect health issues such as exacerbation of chronic disease states (asthma, heart disease), premature birth, water and food security issues, mental health, and vector-borne diseases (American College of Nurse-Midwives [ACNM], 2017; Center for Disease Control and Prevention [CDC], 2014; Oregon Health Authority [OHA], 2013; Watts et al., 2018). The impacts of climate change, population concentrations in mega-cities, rural life with limited access to healthcare, global travel, social and economic disparities, racial inequity, food deserts, and limits to clean water affect vulnerable populations disproportionally (Veenema, 2019). Governments, corporations, healthcare systems, and providers must focus on disaster preparation for all citizens.

Post-disaster, approximately 30% of the affected female population are categorized as women of reproductive age (Taghizadeh et al., 2017). Women of reproductive age (WRA) are

considered vulnerable and an increased at-risk population in times of natural and human-made disaster with compounded poor health outcomes related to pregnancy, labor and birth, newborn outcomes and care, contraception, infectious disease, sexual violence, and psychological stress (CDC, 2018; World Health Organization [WHO], 2017). The special needs of women are not addressed in many disaster planning publications. Explicit attention to planning for the specific needs of WRA is necessary in preparation for potential, indeed inevitable, disasters. Without appropriate focus on development of disaster cycle planning phase processes, susceptibility for WRA to poor health outcomes after a disaster will likely increase.

During admission for hospital care, women of reproductive age likely will be affected adversely when a disaster ensues. The perinatal unit is comprised of a diversity of WRA patients and acuity levels at any one moment in time. Women may be in early or active labor, immobile from a regional anesthetic, in the immediate postpartum with a dependent newborn, or in recovery from a surgical birth or gynecologic procedure—all occasions of increased vulnerability. While pregnancy and birth are natural life events, pregnancy is a complex state of health. “During a disaster, all the normal physical needs of pregnant women are present, but healthcare and birthing environments are altered, creating increased challenges for delivery of safe obstetrical health care” (Capitulo & Prepas, 2019, pp. 246-247). When evacuation from a healthcare facility is necessary, most current emergency operations evacuation plans are generalized to cover all citizens and all hospital specialties. Special attention is allocated to elders, children, and other-abled persons. It is necessary to plan for the response phase by considering important differences based on sex and physical and psychological response to disasters. Every hospital should include in its disaster preparation a perinatal-specific emergency

triage plan to facilitate improved outcomes for the susceptible WRA population in the disaster recovery phase.

In the United States (US) and globally, midwives are identified as skilled professionals who provide care for a complete range of primary women's health care services, including pregnancy, birth, postpartum, and reproductive health (ACNM, 2012a; International Confederation of Midwives [ICM], 2014a; WHO, 2016). Midwives in the US work in a variety of health contexts, including "diverse settings such as ambulatory care clinics, private offices, community and public health systems, homes, hospitals, and birth centers" (ACNM, 2012b, p. 1). A midwife offers "the independent provision of primary care, gynecologic and family planning services, preconception care, care during pregnancy, childbirth and the postpartum period, (and) care of the normal newborn during the first 28 days of life" (ACNM, 2012b, p. 1). A certified nurse-midwife provides expert care for women across the spectrum of acuity: from low resource settings and minimal intervention, to high levels of intervention, with inclusion of medical consultation, collaborative management, or referral, as necessary.

The Disaster Management Cycle of emergency planning includes a concurrent progression of mitigation, preparedness, response, and recovery. See Figure 1 (Azimi et al., 2019). All communities are in at least one phase of the disaster management cycle at any time. As primary providers of health care to WRA, midwives are likely to engage as first responders and receivers during the immediate response phase of an emergency. A systematic review of the role and scope of midwives in humanitarian crises concluded that midwives are active primarily in the response and recovery phases of disasters, with gaps of involvement noted in midwife participation in mitigation and planning for emergency preparedness (Beek et al., 2019).

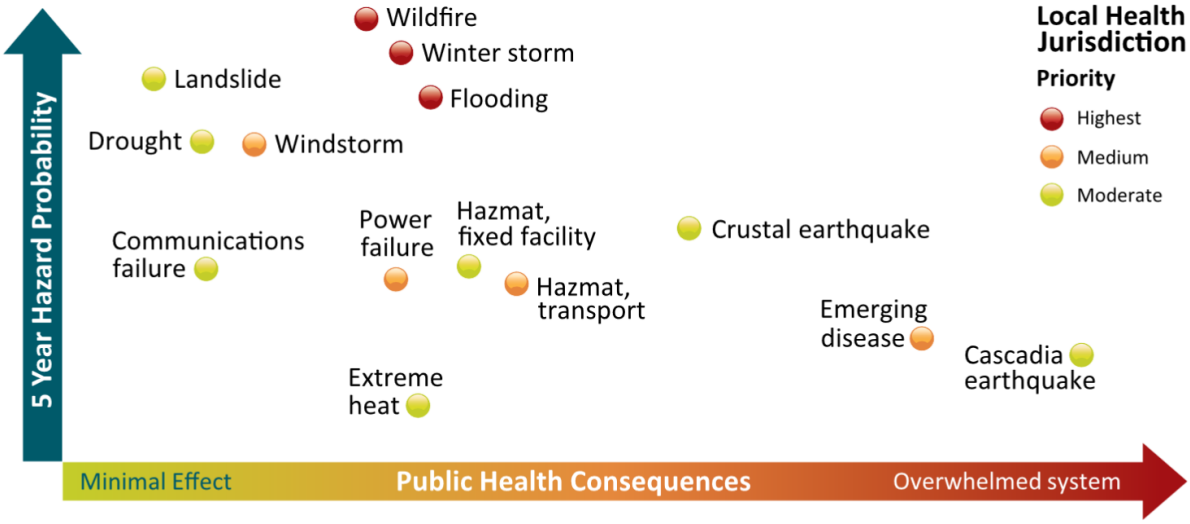
Figure 1

Disaster Management Cycle, adapted from FEMA (Azimi et al., 2019)

Disasters are inevitable but difficult to predict. The SARS-CoV-2 pandemic of 2019-2020 (commonly known as the COVID-19 pandemic) is an example of an expected event, and one that many countries and healthcare systems were ill-prepared for, including the perinatal care community. In 2018 there were 124 federally declared major disasters and emergencies in the United States, with three major wildfires, defined as disasters, declared in Oregon alone (Federal Emergency Management Agency [FEMA], 2019). Oregon (the author's home state) is a geographically diverse state with a coastal border, a volcanic mountain range, dense forests, high desert lands, and seasonal weather extremes. As such, Oregon is in potential danger of experiencing wildfires, ice and winter storms, scorching heat, floods, landslides, catastrophic earthquakes, tsunamis, and volcanic hazards (Oregon Office of Emergency Management, n.d.). See Figure 2 (OHA, 2013). The addition of pandemic to the health security of the state is necessary since the outbreak of SARS-CoV-2. In Oregon, more than 300 certified nurse-midwives (CNM) practice full-scope care of WRA. In 2017, 21.5% of all births in Oregon were attended by a CNM (ACNM Oregon Affiliate, 2015; OHA, 2017).

Figure 2

Public Health Hazard Vulnerability Assessment. Oregon Health Authority (2013)



Women, noted as one of the most vulnerable populations in a disaster, are often marginalized and suffer discrimination post-disaster (ActionAid, 2006). Special population disaster preparedness is not fully realized on a national or local level. Operationalizing specifics of preparedness are not defined. Gender-based inequities are noted in allocation of supplies and resources in preparation and recovery phases of a disaster. Women are not recognized as a priority for gender-based aid and services, often which are not available: obstetric/gynecologic care, gynecologic triage, mental health resources, and medications, supplies and services that are women-specific. If services are available, that which is provided is often less robust than for the general adult population, and often an afterthought (Richter, 2011). Lessons learned from 9/11 and a case study review of Hurricane Katrina emphasized the leadership role of nurses as critical to disaster preparedness (Klein & Nagel, 2007). Nurses and midwives, as agents of change, can transform the nature of disaster planning by advocating for WRA.

Newborn infants who are patients in neonatal intensive care units (NICU) are a high-risk population. Triage by Resource Allocation In Neonates (TRAIN), a quality improvement triage tool designed to be implemented in a disaster, was developed for the Stanford NICU by Cohen et al. (2010). A recent improvement study utilizing a staff simulation drill of the TRAIN tool at Lucile Packard Children's Hospital at Stanford University successfully tested and implemented the TRAIN instrument for the larger pediatric population and expanded beyond its proven usefulness, previously limited to neonatal evacuation (Lin et al., 2018). The OB-TRAIN (Obstetric-Triage by Resource Allocation for INpatient) instrument, also published by Stanford, is a modification of the neonatal TRAIN and implemented at the university's hospital facilities (Daniels et al., 2014).

The OB-TRAIN instrument comprises six parameters to be evaluated specific to the perinatal patient. Utilization of this communication tool, at the bedside or by electronic health record (EHR), assists with determining the ideal level of care recommended for the woman and fetus/newborn during transfer and the appropriate receiving location (e.g., home, birth center, basic care, specialty care, subspecialty care, or regional perinatal health care centers). The risk assessment is based on acuity and available resources when evacuation is necessary. OB-TRAIN has been implemented at Stanford University hospitals via the EHR and carried out in educational practice training simulations. Successful real-time application of the OB-TRAIN at Sutter Santa Rosa Regional Hospital during the Kincade Fire in 2019 was described during a facilitated webinar (Wojciehowski, December 6, 2019). The triage instrument allows for understanding vulnerabilities in the hospital's emergency operations plan as well as to plan and prepare for future emergencies (Lin et al., 2018).

A nursing doctoral quality improvement project translates acquired knowledge into practice while contributing to meaningful enhancement of nursing practice and patient outcomes (Doctor of Nursing Practice, 2020). This paper describes a quality improvement project which focuses on the issue of current local hospital policy for WRA and gaps in perinatal-specific planning for resource allocation in preparation for a disaster when evacuation is required, and on the inclusion of nurse-midwives in leadership planning positions. The OB-TRAIN has not been evaluated outside of an urban setting, and Asante Ashland Community Hospital, as a rural healthcare site, offers an opportunity to evaluate a disaster planning tool, prior to an actual emergency, with the intention of improving patient experience and to explore provider and staff advocacy.

The significance of disaster preparedness in hospitals is not debated and is, in fact, mandated by the Centers for Medicare and Medicaid Services (CMS) through implementation of requirements by facilities focused on preparedness actions in order to receive funding (CMS, 2016). By implementing this triage tool, which facilitates timely assessment of patients and appropriate utilization of resources, the labor and birth health care team benefits from execution of proposed guidelines for rapid triage decision making while providing equitable care. The intention in implementation is the improvement of perinatal population outcomes since the triage tool emphasizes safe, timely, and effective care. These care elements are foundational components of the Institute for Healthcare Improvement's (IHI) *Triple Aim*, an approach to optimizing healthcare improvement in the US (IHI, 2020).

Rationale

Change in a healthcare system is the result of recognizing the need to alter established ways of providing care or necessity of advancement of systems policies. Systems change

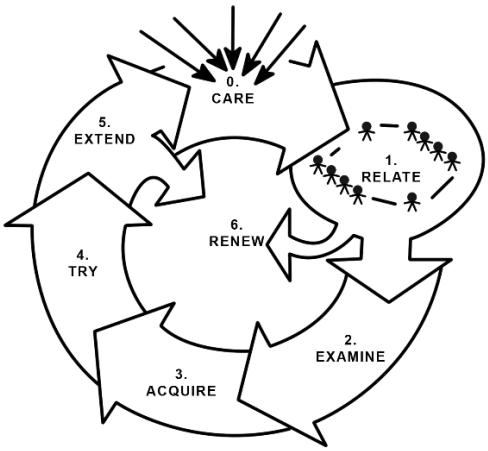
requires a “drastic shift in locus of control, accountability, expectations, performance, and measurement” (Malloch & Porter-O’Grady, 2006, p. 21). Change theories provide a framework for nurse leaders to demonstrate commitment and to manage resources effectively, as well as to guide change processes to assist with managing resistance, feelings of loss and lack of control over the impact of change and, ultimately, acceptance (Handricks-Jackson & Hawkes, 2017).

The seven-stage process of Havelock’s theory of change (Figure 3) provided a framework for the quality improvement implementation to create a process for change, organize workflow, and implement an innovative method for increased perinatal safety. Havelock’s theory of change encompasses the following steps, which guided the change process:

- Attention to need for change
- Build a relationship
- Diagnose a problem
- Acquire resources
- Choose a solution
- Gain acceptance, and
- Stabilize and self-renew (Lane, 1992).

Figure 3

Havelock's Theory of Change (Havelock & Zlotolow. 1995)



Havelock's Theory is a circular framework where the opportunity for reevaluation of acceptance of system change is present. The author initiated the QI project within a familiar environment and an established team relationship. This was a period of contemplation while seeking subject matter to engage in a change project. Diagnosis of the problem (the gap in policy for vertical evacuation and transport of perinatal patients) had been expressed by several registered nurses (RN) at Asante Ashland during the 2018 Camp Fire in Paradise, California: "What if a wildfire were to threaten Ashland?" At that time, the process for emergency evacuation of the perinatal unit of Asante Ashland Community Hospital (AACH) was reviewed by staff and noted to be general and open to interpretation. A problem was diagnosed.

Support from administration, review of literature, creation of a mind map, development of an Ishikawa diagram, and networking with local stakeholders were resources which were developed. The Plan-Do-Study-Act (PDSA) cycle—a scientific method for testing a change—was utilized in the real world LDRP setting (IHI, 2019). Reiteration of PDSA cycles, with practical application of OB-TRAIN, provided a solution and a structured method to investigate

new change ideas for improvement in the chosen microsystem of a rural community hospital. Nurses and CNMs participated in the PDSA cycles, with varying levels of expressed acceptance, adaptation, and resistance. Maintenance and acceptance (stabilization and self-renewal) of the integration of OB-TRAIN on a system level was interrupted prior to the start of PDSA cycle 4 by necessary and rapid changes in daily workflow related to the SAR-CoV-2 pandemic of 2020.

Havelock's Theory was utilized on a micro-level during each PDSA cycle by offering insight, via the theory's framework, into understanding the process of change with each group of recorders. Modification through feedback was incorporated into the subsequent reiteration.

Context

The community of focus was the Asante Ashland Community Hospital which is a 49-bed inpatient hospital, inclusive of a 7-bed LDRP (labor-delivery-recovery-postpartum) perinatal unit. No newborn nursery is present on site. The hospital would be designated a Level I (basic care) facility, with the capability of providing management for low- to moderate-risk maternal care (American College of Obstetricians & Gynecologists [ACOG], 2019). The community is defined as an urban cluster with perinatal clients living as distant as two to three hours in rural regions. The hospital is recognized as rural due to having 50 or fewer beds and less than 30 miles from another acute care facility (Oregon Association of Hospitals and Health Systems, 2020). Asante Ashland is one hospital in a three-hospital consortium with the nearest sister affiliate located twenty minutes distant.

The LDRP staff consists of three family practice medical doctors with obstetric privileges, one obstetrician-gynecologist, four certified nurse-midwives, 18 registered nurses, four doulas, and one front desk specialist-certified nursing assistant. Five anesthesiologists provision the unit with regional anesthesia as needed for relief of pain during labor or cesarean

birth. The LDRP staff provide primary care during late third trimester antepartum evaluation, inclusive of labor, birth, recovery, and gynecologic surgical recovery. The CNMs deliver comprehensive antenatal care at an outlying clinic site, labor management, postpartum care, and newborn care for 50% of the approximately 225 births which occur yearly at AACH.

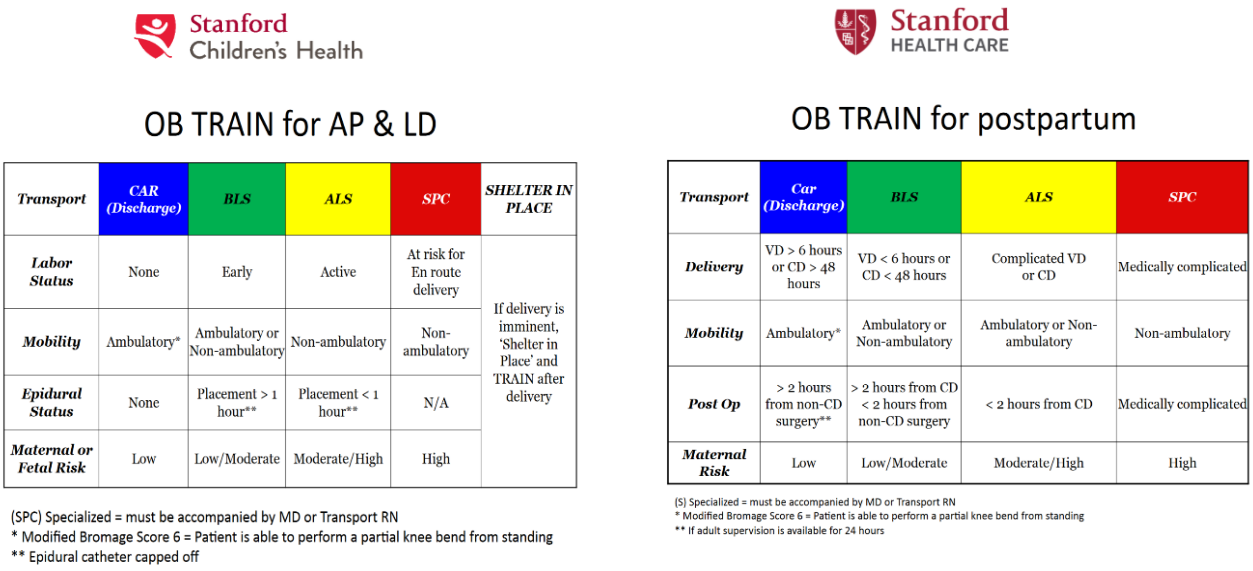
The potential primary emergency hazards for Southern Oregon and, specifically, Ashland are currently severe weather, floods, earthquakes, poor air quality, emerging infectious diseases, and wildland-urban interface fire. The town of Ashland is built on the side of a valley and home structures extend up the hillside into the watershed, a landscape of thick forest and the major wildland-urban interface. Hosler Dam, a potential source for flooding if it were to fail, is located 2.8 miles upstream from downtown. The community hospital is located uphill within a residential area near the two-lane primary road access to town. Approach and exit to the town are limited. A single main interstate bypasses the town, a smaller two-lane Main Street runs north-south, and a steep, winding cut-through offers access to the rural east Siskiyou Mountains. With consideration of the limited access to AACH, implementation of a triage assessment tool specific to the perinatal inpatients would improve rapid assessment and timely decision-making for transport.

The Asante Internal Disaster Policy (document 400-PE-EMGPREP-0011 [2019] of the hospital system of Southern Oregon), provides a systematic means of orderly and efficient actions during periods of internal disaster with obstetric patients moved by gurney or walked to safety with assistance. While perinatal evacuation is addressed, the Asante guidelines are general without detail related to the labor status, mobility, epidural status, maternal or fetal risk, post-operative status, or delivery condition of the inpatient perinatal population. These items are specifically addressed in OB-TRAIN to evaluate for individual resource and transport needs for

evacuation (See Figure 4). The OB-TRAIN acts as an effective communication tool within a system and to determine patient need to guide evacuation decision making due to the diversity of inpatient acuity to the appropriate level transfer facility. When birth is imminent, recommendation for shelter in place adjusts for necessity or presence of skilled medical personnel prior to evacuation, with reevaluation after delivery.

Figure 4

OB-TRAIN. Daniels et al., (2014)



Note: BLS: basic life support; ALS: advanced life support; SPC: specialized care

Level I maternal care includes stabilization of the maternal-fetal or mother-newborn dyad, facilitation of transport to a higher-level hospital, and "a reliable, accurate, and comprehensive communication system between participating hospitals, and hospital personnel, and transport teams" (ACOG, 2019, p. e44). For the quality improvement project, introduction of the OB-TRAIN instrument was the process intervention for evaluation of improved disaster care. A small, dedicated staff was valuable to optimize the translation of the QI. The likely urgency of an impending disaster (i.e., a wildfire) was thought to increase buy-in by the stakeholders.

Implementation of the OB-TRAIN instrument will improve assessment and communication, and appropriate evacuation in future disasters, and facilitate increased collaboration between staff (obstetricians, midwives, registered nurses, incident command supervisors, and local emergency medical systems). While adoption of a disaster planning resource at a single Asante hospital site, AACH, is likely to be an improvement, spread of the resource to all three affiliates would strengthen the system-wide Internal Disaster Policy and sustain the change.

Brief History

The modern history of disaster preparedness and nursing begins with Florence Nightingale and her bedside care and quality improvement efforts on personal hygiene during the Crimean War. Nursing in the United States did not involve direct contact with disasters, aside from wars, until the influenza pandemic of 1918. Later in the century—SARS and AIDS in 1990s to early 2000s; and hurricanes Katrina (2005), Harvey (2017), and Florence (2018)—this involvement increased. The current SARS-CoV-2 pandemic has brought nursing excellence and leadership to the forefront and has had a transformative impact on individual work units, systems policy, and the health of the nation.

After-action reports completed after Hurricane Katrina show major gaps in health care providers' level of disaster training proficiency (Hsu et al., 2006; Subbarao, et al., 2008). In response, a prioritization of disaster preparedness education for nurses in the 21st century and a subsequent call to action of a consensus-based framework for emergency preparedness and disaster-response education and training emerged (International Council of Nurses [ICN] & WHO, 2009; Subbarao et al., 2008; Veenema et al., 2016). Recommendations for nursing

advancement in disaster policy leadership, education, and practice have been developed (Veenema et al., 2016).

The American Medical Association Center for Public Health Preparedness and Disaster Response working group delineated the initial cross-cutting competency set for all disciplines of health care (Subbarao et al., 2008). Because nurses are counted as the largest health care workforce, ICN and the WHO recognized the vital need for nurses to continue to develop specific skills in disaster preparedness by publishing the *ICN Disaster Nursing Competencies* in 2009. Rooted in the work of Subbarao et al. (2008), an emergency preparedness and disaster response core competency set for perinatal nurses was further defined by Jorgensen et al. (2010), to address gaps in preparedness education and the unique needs of WRA.

Daniels et al. (2014) of Stanford University developed an obstetric-specific disaster toolkit that focuses on rapid triaging of antepartum, postpartum, and post-gynecologic surgical patients in preparation for evacuation transport; birth in low-resource settings (shelter in place); and interprofessional collaboration between perinatal providers and collaborative specialties. Titled OB-TRAIN, Obstetric Triage by Resource Allocation for INpatient, the triage transport checklist and toolkit were created to facilitate resource management and timely safe care during an internal or external disaster.

Engaging women in childbirth education classes about the importance of disaster preparedness and family home preparedness for all women of childbearing age has been emphasized in the literature (DeWald & Fountain, 2006; Giarratano et al., 2010; Keeney, 2004; Williams, 2004). Pregnancy-focused disaster preparation recommendations are posted on national and state websites to encourage family readiness (American Public Health Association, n.d.; CDC, 2019; Hawai'i Pacific Health, 2018; March of Dimes, 2019). Likely there will be

limitations in a community's ability to care for all persons susceptible to dangerous conditions caused by a disaster. Promoting advance preparation for women during the childbearing years is a priority. Self-care and health education of women and families has been of paramount importance in the SARS-CoV-2 pandemic.

A study by Paton et al. (2008) revealed that post-disaster "normalization bias" can occur. Post-disaster survival with perceived successful coping and minimal long-term impact, contrary to expectations, may lead to subsequent decreased preparedness. Diminished vigilance is, at the time of this writing, being enacted even while the SARS-CoV-2 pandemic continues unabated. Without previous personal involvement in a disaster there is diminished expectation of risk and limited engagement in being prepared. Urgency becomes muted. Midwives can serve as a resource and as advocates in emphasizing the importance of preventing and minimizing risks, while maximizing survival by preparing for the possibility of a disaster/emergency during pregnancy and post-birth.

During a disaster there will be expected insufficient resources (e.g., personal protective equipment, health care providers) and altered standards of care that may cause ethical quandaries and, for providers, "tough moral choices" (Johnstone & Turale, 2014, p. 68). Health care providers are apt to experience the challenge of personal ethical dilemma while providing perinatal care in unfamiliar low-resource settings. Provision of care, while not under constraints of an emergency, is typically concentrated on the individual, while in a disaster, care is focused on the community and available supplies with a "for the greater good" mindset. Facilities may experience a surge of patients, either transferred from other facilities or arrival by personal vehicle, that is overwhelming to the number of staff; loss of power with lack of access to EHRs and critical medical information; personal risk of harm or exposure to biological weapons or

infectious diseases; separation of families with an urgency for reunification and disrupted communication or transportation systems; trauma during pregnancy which may require increased resource use (cesarean birth); effects of infectious diseases that may compromise a fetus; increased numbers of preterm labors and birth; and, health care providers unfamiliar with perinatal considerations (ACOG, 2019).

Point of View

Health care facilities and state and national health systems are required to have Emergency Operation Plans (EOP) in place. Emergency Operations Plans "describe who will do what, as well as when, with what resources, and by what authority" (FEMA, 1996, foreword). FEMA is an office of the Department of Homeland Security, established to protect and serve the American people before and during domestic disasters. The document *Developing and Maintaining Emergency Operations Plans,* (FEMA, 2010) delineates that "unaccompanied minors, individuals with disabilities, others with access and functional needs, and individuals with limited English proficiency" (p. 3-1), and even pets and livestock (p. 4-22), are to have their needs specifically addressed in EOPs. The special needs of pregnancy, WRA, and infants are not defined. The State of Oregon Emergency Management Plan (2017) also does not address pregnant women as a vulnerable population, further emphasizing the gap in preparedness on a national and state government level for the needs of WRA.

Well-trained professionals are necessary to provide sexual and reproductive health care that ensures quality evidence-based treatment even in the most challenging disaster environments (ICM, 2017). Certified nurse-midwives are nurses with advanced degrees who live and work in their community. As such, they can contribute to local disaster planning and activate as first responders and receivers when the need arises. Over 6,000 CNMs are employed in the United

States, with greater than 300 working in Oregon (ACNM, 2013). Midwives are typically not included in planning processes and operations vital to an effective emergency response (ICM, 2014b). As proven by multiple Oregon wildfires in 2018 and the Camp Fire in Paradise, California, with its associated extensive loss of life just two hours from the Oregon-California border, planning for future disasters in Oregon (wildfire, pandemic, or other) is imperative. It is essential that specialists in reproductive health are involved in developing and carrying out disaster care planning for pregnant and postpartum women and infants. Certified nurse-midwives can provide that critical leadership perspective within an interprofessional disaster planning team.

Nurse-midwives are leaders in the field of women's health in the global arena and in the United States, recognized for improving maternal and newborn health outcomes and decreasing maternal death rates, emphasizing respectful care, and advocating for marginalized women (ACNM, 2015). The care of women by midwives is a women-centered approach of shared consent, prioritizing a woman's needs. As advanced-practice registered nurses (APRN), certified nurse-midwives have an expert level of knowledge related to normal perinatal care (as well as variation from the normal), that is realized through complex decision-making skills. As APRNs, certified nurse-midwives, "treat and diagnose illnesses, advise the public on health issues, [and] manage chronic disease" (ANA, n.d., para. 2) and "assume responsibility and accountability for their practice as primary health care providers for women and newborns" (ACNM, 2012a, p. 1).

Literature Review

The scope of the review included topics from an obstetric medical and perinatal nursing perspective that focused on the *prepare* phase of the emergency planning cycle, with *midwifery* as a defining term. The review included the midwifery scope of practice in disasters, tools for

assuring perinatal safety and improving outcomes, plans for adequate and obstetric-specific policies, state and national organization disaster preparation guidelines, emergency preparedness for childbearing women, birth in place, emergency preparedness in low-resource settings, and the ethics of altered standards of care in times of crisis.

The literature review was undertaken utilizing Oregon Health & Science University library resources. The databases searched were CINAHL, PubMed, Ovid, and public-access Google Scholar. Government documents and nongovernmental organizations' websites were also reviewed. Articles and documents were selected for content after utilizing keywords: *pregnancy, midwife/midwives, disaster, disaster cycle, disaster preparedness, disaster relief planning, emergency, obstetrics, birth, birth in place, WRA/Women of Reproductive Age, nursing, newborn, pandemic, earthquake, wildfire, emergency operations plan, climate change, health effects,* and *FEMA*. Most keywords were combinations of pairs. Further articles were hand selected from reference lists of primary articles.

The search was limited to English language articles, with the initial search restricted to the past eight years, then extended farther back an additional ten years. This date change was inclusive of multiple articles regarding maternal care in the wake of a disaster, published in the years following the 9/11 disaster in New York City in 2001 and Hurricane Katrina in Louisiana in 2005. Themes encountered include: the role and scope of practice of midwives in disasters, steps toward a national disaster plan for obstetrics, nurse-midwives' educational preparation for disaster preparedness and response, maternal and newborn outcomes after a disaster, preparation needs of childbearing families, and the ethics of provision of care in low-resource settings.

Available literature does address emergency and disaster preparedness. While rich in recommendations for all-hazards preparedness, a literature search was limited in its return of

articles related to perinatal-specific disaster preparedness for healthcare facilities, families, nurses, and specifically CNMs. Articles accessed focus on a nursing or obstetrical medical perspective and are not particular to midwifery. This insight presented the author (while participating in local interprofessional team disaster planning) with an opportunity for further knowledge development and focus on the assets of midwives and their unique skillset as leaders in primary health care management of women and newborns.

Role and scope of practice of midwives in disasters

Midwives have addressed public health issues since the 1920s when Mary Breckinridge opened the first American midwifery school to care for over a thousand families eking out an existence in impoverished counties in Kentucky. Keeney (2004) writes that midwives "can be a crucial resource to provide expertise relevant to the care of women…in disaster planning" (p. 6). This reinforces the midwifery tradition of improving health of women and their families. In other countries midwives are "at the frontline of offering reproductive health care services in disasters" (Taghizadeh et al., 2017, p. 305). The *Hallmarks of Midwifery* (ACNM, 2012a) characterizes pregnancy and birth as normal physiologic and developmental phases, with midwives' professional responsibilities encompassing care for WRA. Health care providers with advanced levels of professional skills and preparedness, such as midwives, experience greater success at lifesaving and reducing the long-term public health consequences of disasters as compared to a generalist (Toner, 2017).

Disaster planning for an EOP requires knowledge of what specialists are available to respond locally as much as development of adequate policies (Keeney, 2004). Knowledge of and access to midwives working in a community affected by a disaster aligns the safe and expert care of a perinatal professional with the care that women and infants deserve. Diagnostic delays in

treatment of critical health and pregnancy related issues are associated with untoward outcomes for mother and baby. Perinatal issues that may become more complex during an emergency benefit from critical, timely management by experienced perinatal care providers such as midwives. When midwives manage care, problems requiring prompt attention are attended to or referred to obstetricians or emergency medical doctors before the issues become life threatening. "Certified nurse-midwives and CMs (certified midwives) are well suited to providing many of the health care services and types of support that women and infants require during disasters and other humanitarian crises" (Hays & Prepas, 2015, p. 357). Inclusion of midwives, and acknowledgement of their expertise, in all aspects of the disaster cycle can ensure that the potential of midwives is optimized.

Steps toward a national disaster plan for obstetrics

Since Hurricane Katrina in 2005, hospitals nationwide have implemented all-hazards operations planning to define the urgent necessity to respond to a variety of emergencies. Often, considerations for WRA are not addressed in these plans or are given minimal attention (Association of Women's Health, Obstetric & Neonatal Nurses [AWHONN], 2012; White Ribbon Alliance, 2007). The specialized needs of obstetric units—with their unpredictable and varying levels of acuity, laboring women, postoperative patients, and postpartum mothers with newborns—are not recognized by planners of EOPs as requiring additional consideration. "Nowhere else in the hospital is there such a variety of patient acuities so closely housed within the same unit" (Daniels et al., 2014, p. 155). Perinatal societies have called for a consensus of national engagement in disaster preparedness planning (ACOG, 2017; ICM, 2014). The Minimum Initial Service Package (MISP) is a set of life-saving activities that are learned, implemented, and coordinated by trained personnel to employ during a humanitarian crisis and

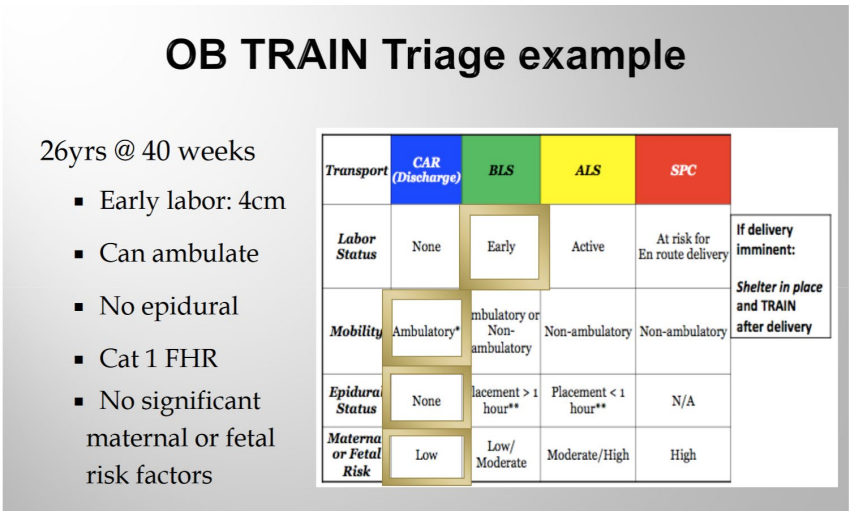
that respond to the reproductive health needs of affected peoples (Inter-Agency Work Group on Reproductive Health in Crises, 2019).

Development and implementation of a predetermined plan specifically for perinatal departments, healthcare facilities, and the local and regional community, facilitates the organization, efficiency, and effectiveness of a rapid response (Keeney, 2004). Clarity of communication and sharing of tools between local response teams as well as regional facilities are fundamental elements of disaster planning. Integration of a perinatal-specific triage plan builds collaboration between health care specialists involved in perinatal care (anesthesiologists, perinatal RNs, obstetricians, and midwives), reducing vulnerability for families and maximizing expert skill sets in decision-making. The greatest need after a disaster is for human resources. Midwives are poised to assist with meeting the need for a highly trained human resource in planning and responding to a disaster.

Developed by perinatal specialists at Stanford University, the OB-TRAIN communication tool has been implemented only in the San Francisco Bay area. The tool facilitates triaging of antepartum, laboring, and postpartum women during a disaster and is inclusive of interprofessional staff preparedness. The OB-TRAIN triage scoring system assists with assigning recommendations for discharge of patients by car, the appropriate level of medical care needed during transport, with ideal transfer of care to a suitable level healthcare system according to the patient's risk (ACOG, 2017; Daniels et al., 2014). An example of the use of the tool is displayed in Figure 5.

Figure 5

OB-TRAIN Triage Example (Daniels et al., n.d., slide 23)



OB-TRAIN has not been executed outside a small geographic region where implementation and spread has occurred via simulation. A single instance of use during a disaster evacuation has been described (e.g., Kincade Fire, 2019). Recommendation for implementation of OB-TRAIN is present in the literature (ACOG, 2017; Maher, 2019). Cycles of implementation in other hospital systems are warranted. A gap in literature exists in evaluation of inter-rater reliability in completion of the tool, and particularly its value in rural community hospital settings.

Nurse-midwives' professional competencies in preparing for a disaster

Adverse perinatal events that increase during and after a disaster include miscarriages, preterm birth, fetal death, intrauterine growth restriction, unplanned pregnancies, and gender-based violence (Eskenazi et al., 2007; Pinkert et al., 2017). Ensuring that health care workers are prepared to respond in a disaster begins with the disaster mitigation and planning phase and knowledge of what role responders can competently manage in a disaster context.

Midwives have expertise in managing "primary, preconception, gynecologic, antepartum, intrapartum, and post-pregnancy care" (ACNM, 2012a, p. 4), as well as newborn care. Breastfeeding is both a life-saving and comforting activity.

A descriptive study by Taghizadeh et al. (2017) evaluated midwives' professional competencies in disasters, especially prevention of maternal mortality, and concluded that specific educational skill areas were necessary to address, primarily, stabilization of a woman with physical trauma, accurate assessment of a need for referral, and stabilization of mothers during referral. Inadequate and irregular education courses may provide deficient information and lack follow-up practice of skills. This inadequacy has led to decreased provider competency in provision of health care services in an emergency (Taghizadeh et al., 2017). Taghizadeh et al. (2018), whose study focused on Iranian midwives' professional competencies, recommend a comprehensive revision of coursework offered in a basic midwifery degree curriculum, as well as extra disaster focused educational programs after completion of degree.

An early disaster competencies framework was developed for nurses by the International Coalition for Mass Casualty Education in 2003 (see Appendix A). The WHO (2007) followed up with a summary of six core disaster competencies for nurses and midwives providing care in emergencies. The WHO and ICN view "midwives as essential in disaster response but considers their lack of disaster training as a major gap…" (ICN & WHO, 2009, p. 13). In 2009, following the publication of the WHO's core competencies, the ICN and WHO together developed the *ICN Framework of Disaster Nursing Competencies.*

Jorgensen et al. (2010) provide a guideline for disaster-based competencies for perinatal and neonatal nurses that defines proficiencies in planning and responding to a public health emergency via education and training objectives. The competencies outline offers a template for

measurable skills objectives in disaster preparedness and response and topics for educational trainings and emphasizes the unique health risks of women, fetuses, and neonates. This framework is valid for midwives to incorporate into their leading and collaborative role in caring for the perinatal population during a disaster. Hays & Prepas (2015) address the topic of limited training of midwives as volunteer health practitioners in humanitarian crises. In their expert opinion on the professionalization of midwives and midwives' place in disaster response, comprehensive resources on personal preparation are delineated. Recently there has been a call to action to establish a nursing specialty designation entitled the American Society for the Advancement of Disaster Nursing (Lavin et al., 2017). The American Nurses Credentialing Center began offering the National Healthcare Disaster Preparedness (NHDP-BC) interprofessional certification in 2017. Inclusion of the expertise and perspective of advance practice nurse-midwives in defining a perinatal framework would help define minimum standards and standard of care for guiding education and training of nurses in caring for WRA during disasters.

Preparation needs of childbearing families

Disaster preparedness in the United States seeks to cultivate a get-ready culture and involves a paradigm shift from reactivity to a management approach, both community-wide and individually. Although general emergency preparedness is a national priority related to the increasing frequency of events, preparing for a disaster may not take personal precedence for most women during pregnancy. Because pregnant women are especially vulnerable to toxins, stress, lack of clean water, infection, and the availability of safe food sources (WHO, 2002), informed preparation can make a significant difference in birth outcomes.

Individual and family development of an evacuation plan is a critical first step in preparing for an emergency. Being prepared with personal evacuation or shelter in place kits,

familiarity with symptoms of labor, and signing up for emergency alerts is recommended by state and federal disaster preparedness agencies (CDC, 2019; Hawai'i Pacific Health, 2018; March of Dimes, 2017). When pregnant, if evacuation is not possible and home confinement may be necessary, childbirth outside of a hospital setting is a possibility. Families are encouraged by ACNM, ACOG, the Women & Infants Service Package consortium, and Stanford's OB-TRAIN recommendations to expand their basic home kit to include specific items in a grab-and-go or birth-in-place response kit necessary for a community birth site (ACNM, 2011; ACOG, 2010; Giarratano et al., 2010; White Ribbon Alliance, 2007; Williams, 2004).

Disaster preparedness education of families should begin during prenatal care and childbirth courses (AWHONN, 2012; Giarratano et al., 2010). Midwives are in a unique position to facilitate preparedness education in their role as a provider throughout the antenatal period. Multiple care visits and comprehensive education regarding "health promotion, disease prevention, and health education, …skillful communication, guidance and counseling" (ACNM, 2012a, p. 2) can be emphasized.

It is critical to plan for the assembly of pre-prepared kits by midwives and families for birth-in-place deliveries anywhere outside a usual environment (home, parking lot, or emergency shelter) and to have the kits available for immediate use (Daniels et al., 2014; White Ribbon Alliance, 2007; Williams, 2004). Midwives who are available and prepared with a portable birth essentials travel kit can provide expert assessment and labor support and management, including postpartum and newborn care, even in a low-resource setting. An example of contents in a grab-and-go backpack is offered in Appendix B. Because many midwives practice in settings of low acuity and limited intervention (and are highly skilled to do so) not only in times of disasters but in a typical day of perinatal care provision, utilization of midwife providers to plan coordination

of care of WRA during a disaster would assist greatly with management of scarce resources. The SARS-CoV-2 pandemic, as an emergency of international concern, has brought community birth to the forefront of birth planning. “During a pandemic, out of hospital birth is essential to minimizing transmission, maintaining health, and efficiently utilizing medical resources” (Chisholm, 2020).

Maternal and newborn outcomes after a disaster

The health and well-being of all individuals may be threatened in a disaster. The average female-to-male death ratio is 3:1 in natural disaster areas (Pinkert et al., 2017). Women of reproductive age are disproportionally affected by higher rates of health complications, including “premature births, low-birth-weight infants, and infant deaths” (White Ribbon Alliance, 2007, p. 4) as well as psychologic stress, post-traumatic stress disorder, and depression (ACOG, 2010). Midwives, and midwives in collaboration with obstetric specialists, are well suited to providing care and support services that women and infants require when they experience exposure to physical and psychological harms associated with disasters.

The major cause of maternal mortality in a disaster located in a developing country is hemorrhage (80% of mortalities). Midwives possess the skills necessary to mitigate hemorrhage (Taghizadeh et al., 2017). Midwives can evaluate health needs, consult within an interprofessional team, refer when appropriate, and coordinate available resources to meet basic needs of the population to reduce poor outcomes.

Literature on the known effects of disasters on newborn outcomes is limited and show mixed reports (Callaghan et al., 2007; Harville et al., 2010). Type of disaster and depth of maternal exposure influence infant outcomes. Significant direct exposure causes increased rates of restricted fetal growth and delays in infant neurodevelopment, with potential influences on other outcomes (Harville et al., 2010; Simcock et al., 2018). Exposures to contaminants could

occur at an early stage of a pregnancy, affecting fetal development. The current novel coronavirus has unknown effects on fetal well-being, with no definitive evidence of maternal-fetal congenital transmission, although every day increased information about COVID-19 is published in grey literature (Society for Maternal-Fetal Medicine, 2020).

Women are at higher risk of not breastfeeding their infants during a disaster, while use of breastmilk substitutes increases risk of illness related to contamination by unsanitary water sources and lack of electricity for cleaning equipment (White Ribbon Alliance, 2007). "Inadequate access to safe food, exposure to environmental toxins, … interruption of health care, crowded conditions in shelters, and disruption of public health and clinical care infrastructure…" (Callaghan et al., 2007, p. 307) pose a threat to newborns, infants and mothers. Breastfeeding is recommended as the best infant feeding option during a disaster situation to provide adequate nutrition and antibodies to protect from respiratory infections, diarrhea, and other illnesses (Academy of Breastfeeding Medicine, 2020; CDC, 2020; WHO, 2020).

Ethics of provision of care in low-resource settings

Themes related to limited resources and availability of appropriately skilled personnel were common in the literature. Damage to infrastructure, loss of energy sources, access to life-saving medications, and inadequate numbers of skilled human resources are all items that may impact perinatal outcomes. Potential lack of equipment and the inability to obtain essential supplies after a disaster (such as medications that may be lifesaving during pregnancy, birth, and postpartum) must be planned for (Pinkert et al., 2017). Basic hospital needs (intravenous fluids, beds) as well as advanced supplies (medications) may be in decreased quantities during or after a disaster or undeliverable. Loss of power, which will force limitations on care options, will cause natural, unmedicated birth to be an outcome, not a choice. Prioritization of need, a finite amount of resources and rationing of supplies, and restriction of care will push personal and community

ethical dilemmas to the fore (Beigi, 2007). Rights of individuals may need to be compromised for benefit of the larger community. Ethical issues specific to pregnancy, and which are beyond the scope of this paper, include: the concern for women's interests and rights being overridden by the perceived rights of the fetus; use of medications or vaccines that are categorized as having adverse fetal affects or have been untested during pregnancy; delivery of care safely to healthy women in a center that may be treating infectious people; equity of care of women of color; and, altering triage of women dependent on trimester of pregnancy (Farrell & Beigi, 2009).

Providers skilled in obstetric care for the increased numbers of patients are likely to be limited during disasters, which may lead to inadequate antenatal and intrapartum care availability. International disaster relief agencies that managed obstetric cases during the Haiti earthquake (2010) and the earthquake and tsunami in Japan (2011) found that post-disaster conditions transformed routine perinatal concerns into complex issues due to very limited resources (Pinkert et al., 2013). Midwives are essential members of the obstetric team and incorporate consultation, collaboration, or referral to obstetrician/gynecologists when assessment reveals a condition beyond the midwife's scope of practice.

Application of the philosophy of childbirth as a normal physiologic event—a hallmark of midwifery—assists with the mother's coping and relief of discomfort if a medicated birth is not possible (White Ribbon Alliance, 2007). Initiation of breastfeeding (and avoidance of breastmilk substitutes) due to lack of potable water, storage, or cleaning resources is recognized as best-practice for newborn well-being. A core competency for midwives' scope of practice is management of breastfeeding (ACNM, 2012a). Infants and mothers were separated for up to ten days during the Hurricane Katrina disaster. Basic infant care supplies were not available. Births took place in ambulances and at the New Orleans Airport (Shaver & Oleck, 2006). Separation of

mother and newborn or transfer of peri- and postnatal patients to sites that are unable to provide appropriate care is ethically unacceptable (Daniels et al., 2014).

Ethics related to midwifery care during disasters may include changes in usual practices due to resource availability or prevention of infectious spread. Alteration of values of care related to privacy, equitable care, and shared decision-making is an issue that can impact the provision of the best possible medical care in challenging circumstances (American Nurses Association, 2008).

Specific Aims

This quality improvement project was conducted to determine whether implementation of a triage instrument, the OB-TRAIN, would address the lack of a perinatal-specific Emergency Operations Plan: Internal Disaster Policy of a rural hospital. The existing plan outlines a general obstetric guideline for disaster evacuation of inpatients. The OB-TRAIN instrument was designed to facilitate timely, safe, and equitable assessment of hospital perinatal patients' disaster evacuation transport-needs. The original implementation was in the context of an urban multi-facility institution and this quality improvement project is a pilot fit-test for relevance in the setting of a rural community hospital.

Between October 2019 and March 2020, perinatal RNs and providers at an Oregon community hospital labor-delivery-recovery-postpartum unit piloted a perinatal-specific disaster evacuation instrument, the OB-TRAIN. The goal was to determine the reliability of the instrument in a community hospital setting and to reach at least a 70% inter-rater agreement of matched patient evaluations. In a rural community with limited resources and a high likelihood of a natural disaster, a secondary aim over a 93-day period was assessment of average inpatient

acuities and transport level of care recommendations as determined by color-coded designations of the OB-TRAIN.

Methods

Context. The setting of the implementation project was Asante Ashland Community Hospital (AACH) a designated rural healthcare institution providing essential health services, including perinatal care, to a small community in southern Oregon. The town of Ashland is defined as an urban cluster. The hospital is recognized as rural due to having 50 or fewer beds, with its location less than 30 miles from another acute care facility (Oregon Association of Hospitals and Health Systems, 2020). Perinatal clients live as distant as two to three hours in outlying areas. Asante Ashland is one hospital in a three-hospital network with the nearest affiliate located twenty minutes distant. If the ACOG et al. (2019) recommendation on levels of maternity care were instituted nationally, AACH would be designated a Level I (basic care) facility, with the capability of providing management for low- to moderate-risk maternal care. The facility has 49 inpatient beds, inclusive of a 7-bed LDRP (labor-delivery-recovery-postpartum) perinatal unit. Rooming-in of the newborn with its mother is practiced, with no newborn nursery suite on site.

The LDRP staff consists of three family practice medical doctors with obstetric privileges (FP-OBs), one obstetrician-gynecologist, four certified nurse-midwives, 18 registered nurses, four doulas, and one front desk specialist-certified nursing assistant. Five anesthesiologists provision the unit with regional anesthesia as needed for relief of pain during labor or anesthesia during cesarean birth. Other stakeholders in the QI project were the vice-president of nursing at AACH and the emergency operations planner for the Asante affiliates. The LDRP nursing staff provide direct patient care during late third trimester antepartum evaluations, inclusive of labor,

birth, recovery, and gynecologic surgical recovery. The CNMs deliver comprehensive antenatal and postpartum care at an outlying clinic site, and labor management and newborn care at AACH, for 50% of the approximately 220 births which occur yearly at AACH.

The Asante Midwifery Services program was founded in the summer of 2016 as an adjunct perinatal care service line to the private FP-OBs. The midwifery team is an independent practice owned by Asante Physician Partners who maintain an interprofessional consult relationship with the FP-OBs and obstetrician-gynecologist medical director. The total number of hospital births for 2019 was 204. The CNM practice managed approximately 125 labors in 2019 with a primary cesarean rate of 16%, a 30% epidural rate, and a 99% breastfeeding initiation rate. The average length of stay (LOS) after a vaginal birth is 1.8 days, while the average LOS post-cesarean is 3.5 days.

Daily staffing of RNs on the LDRP unit requires a minimum of two obstetric-trained nurses. Many nurses have completed an advanced perinatal certification. Diversion of patients to an affiliate hospital prior to hospital admission occurs several times in a year due to inadequate availability of staff. Asante Ashland is a clinical training site for bachelor prepared student nurses to complete their senior integration. No new graduate nurses are currently employed on the LDRP.

The hospital has a strong nursing leadership culture. Quality initiatives are regularly implemented, and the plan-do-study-act (PDSA) rapid improvement cycle is familiar to staff. Multiple LDRP workflow changes had been initiated in the fall of 2019 with staff orientation and time-invested training requirements. The midwives are not typically engaged in the planning phase but are encouraged to provide feedback during the study phase.

The current emergency evacuation plan of the Asante affiliate addresses the general transport mode in directing staff on how to exit the unit: ambulation, wheelchair, or gurney. The evacuation plan does not specifically indicate resource needs dependent on risk factors, stage of labor, presence of regional anesthesia, or post-operative status.

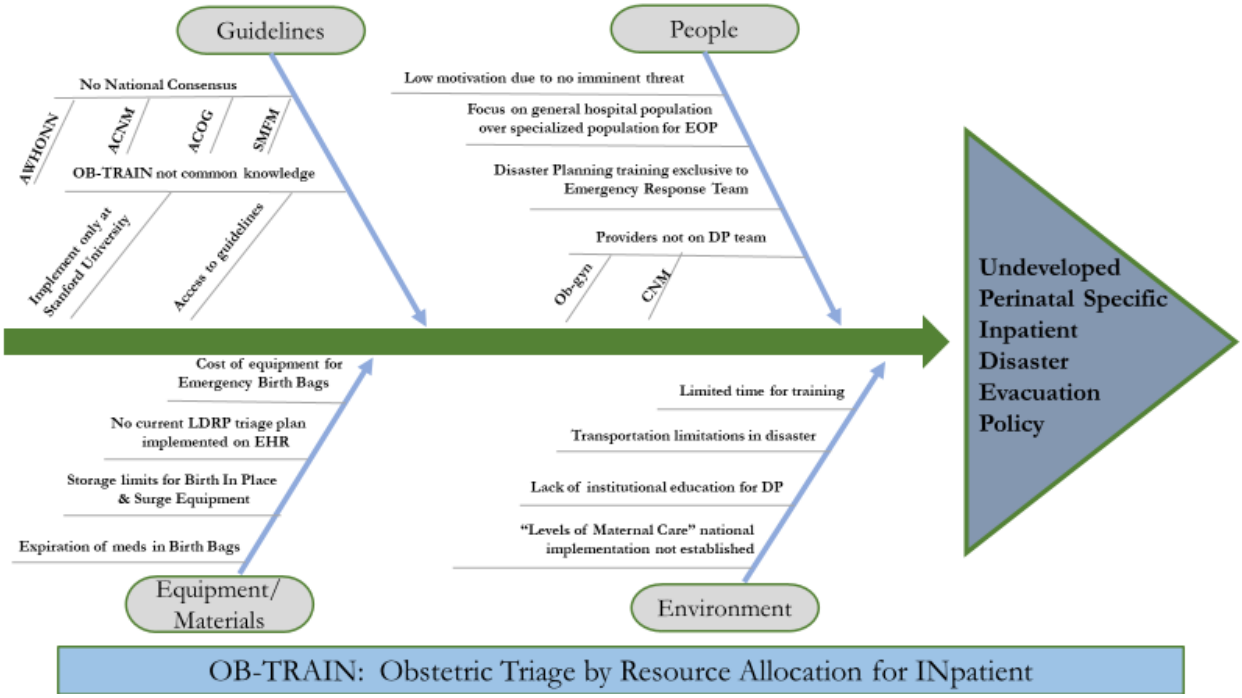
Interventions. The OB-TRAIN is an instrument that is available in the public domain, published by Stanford University (Stanford Medicine, 2020). OB-TRAIN principles of judgment are based on risk assessment. The instrument defines a common language to drive rapid decision making related to mode of transport and recommended medical support persons expertise during an evacuation or surge of patients. The categories are specific to the unique presentations of perinatal patients. Multiple key drivers influenced the decision in choosing the OB-TRAIN as an improvement project: no national consensus for perinatal disaster evacuation triage exists, the threat of an imminent disaster in Oregon increases yearly, the current Asante obstetric evacuation plan is general in its evacuation guidelines, and the Emergency Operations Plan does not acknowledge the dynamic nature, distinct needs, and rapidly changing acuities present in the perinatal population.

Root cause analysis assists in identifying contributing factors to a problem or a system flaw. Use of the root cause analysis tool, the Ishikawa or fishbone diagram, focuses on identifying issues while evaluating a system and the system's effect on behavior (IHI, 2020). An Ishikawa diagram was created after informal discussions with Asante staff and prior to the two-week trial period, regarding the problem of perinatal evacuation and defining causes and relationships. In the following Figure 6 the Ishikawa diagram is depicted. Identifying causes by organizing in standard category themes were defined and discussion of relationship to the effect

were addressed. Insight into a system's processes is valuable in identifying areas to focus on to address the problem or perceived flaw.

Figure 6

Ishikawa Diagram for Disaster Evacuation Policy



The OB-TRAIN has been recommended by perinatal societies and several authors as a useful tool to facilitate and prioritize perinatal transport based in a common terminology (Abir & Daniels, 2019; ACOG, 2019; Daniels et al., 2014; Mayer, 2019; Mielke & Prepas, 2019). No other perinatal disaster tools are available in the literature. This tool was chosen to evaluate as the improvement project in a rural hospital lacking a specific perinatal plan for evacuation. The proposed tool for implementation was designed in an urban, academic health center and its use in a community hospital setting was unknown.

This QI project utilized the Plan Do Study Act (PDSA) cycle to test a small change to determine whether the implementation of the tool was an improvement over the current plan

(IHI, 2019). The timeline for the project was to be conducted over a four-month period, with data collection and analysis from October 2019 through February 2020. Implementation of the project was facilitated by access to the free Stanford Disaster Planning Toolkit (2020) (https://obgyn.stanford.edu/divisions/mfm/disaster-planning.html). Use of the two variations of the OB-TRAIN, antepartum/intrapartum and postpartum, captured all potential LDRP inpatients (See Figure 4). The OB-TRAIN assessment table for antepartum/intrapartum contains evaluations for labor status, maternal mobility, epidural status, and maternal or fetal risk at a single point in time. The postpartum tool has the assessor consider delivery status by hours post-birth and complications, maternal mobility, time since surgery (cesarean or gynecologic post-operative status), and maternal risk. Postpartum and gynecologic patients were evaluated with the postpartum OB-TRAIN which includes a time post-surgical, medically complicated, and mobility evaluation. Color coding on the horizontal row of the table indicates recommended level of trained personnel for the evacuee: blue signifies car discharge and "no" acuity; the green (basic life support [BLS]) is "low" acuity, with at minimum the presence of an emergency medical technician (EMT); yellow (advanced life support [ALS]) advises for a paramedic for "medium" risk; red (specialized care [SPC]) for "high" risk. The final column recommends shelter in place until safety is ensured or progression to a lower acuity (indicated in purple for this paper).

A Google form web version was created in lieu of paper completion of the OB-TRAIN (See Appendix C). The online version was developed due to lack of space for storage of a paper version of the instrument on the unit, cost of color printing, limited area for a locked box of completed forms, immediate access to responses, and automated data entry in Excel. The paper form was not offered as an alternate method of completion to the web version during the project.

A two-week, pre-cycle baseline data collection trial utilizing the created Google form was conducted by the author for piloting the tool to evaluate for ease of access during patient assessment, appropriate phrasing of inquiries, functionality of Google forms, and end point data collection clarity and usability. The baseline data collection was completed on the same Google form that the participants utilized during the three cycles. Revisions to the form were completed during this initial trial period to create a final form that was deemed usable for the project.

Presentations of the project proposal to the Asante vice president of nursing, the emergency operations planner, the Obstetrics Specialty group, and the LDRP staff was the first formal step in engagement of stakeholders. Evaluation of individuals' knowledge base regarding OB-TRAIN and of disaster resources at Asante and transport recommendations was completed with a convenience sample pre-test. Assessing baseline knowledge of the perinatal staff regarding current emergency preparedness and evacuation planning on the LDRP provided an opportunity to measure change resulting from implementation of the improvement project. See Appendix D for the results. All providers and nurses were invited to participate.

The OB-TRAIN Google format of the instrument was sent as a live link to participant staff's personal work email. The form was completed by required checking of boxes in a sequence. One-on-one training of participants on completion of OB-TRAIN values on the Google form was provided prior to each cycle. Time for each individual training was approximately 15 to 20 minutes. Training of a group of respondents was not chosen for the number of respondents was one or two per shift and flexibility for meeting with respondent during a lull in bedside care. The form was completed by the respondent after shift change report and/or a review of the electronic health record. All inpatients were initially assessed at 0800 and 2000. An individual patient assessment was completed on a single form and submitted prior to

entering an assessment on a subsequent patient. Forms were completed only once per 12-hour shift by each participant regardless of changes in patient acuity or a new admission. Each participant received a text message reminder to complete the form at the start of their scheduled shift.

Daily assessment of responses noted on the OB-TRAIN instrument were collated for each of the iterative 28-day implementation cycles. The primary aim of the QI was an evaluation of the inter-rater agreement of matched patients between participants who recommended evacuation transport level of care via completion of the OB-TRAIN instrument as well as the reliability of the instrument to measure what it was intended to measure (internal consistency). The value of assessing reliability in utilization of the OB-TRAIN is to minimize subjectivity when rapidly gathering information independently and determining transport needs during a disaster. Also, of consequence is an improved ability to communicate appropriate recommendations in a time of crisis and resource limitations. The OB-TRAIN instrument does not recognize poverty, race, ethnicity, religion, or sexual orientation, forcing structural equity into requests for resources. Comparison of inter-rater accordance was evaluated by frequencies of matched observations and calculation through the percentage of agreement between assessors which was a proxy for reliability of the items measured through Cronbach's alpha scoring.

The secondary aim was to determine the mean of each mode of transport and level of care recommended for an evacuation in a 28-day cycle (e.g. discharge by car, basic, advanced, specialized, or shelter in place). Forecasting needs for transport could be determined from surmising that the 84-day evaluation (plus baseline data) was representative of any three-month period acuity levels at AACH. Identification of Asante Ashland's perinatal transport level needs over a quarter of the year provides valuable knowledge to the disaster planning team to project

for necessary resource needs (medical supplies, transport mode, and personnel), and improvement of coordination of evacuations between institutions. Disaster preparation is valuable for a healthcare system to invest in (both financially and program development) and essential to establish prior to an emergency event. Preparedness has been shown to reduce the impact of a disaster, establish a common communication strategy, improve collaboration, and decrease long-term health consequences (FEMA, 2016).

PDSA cycle I:

Plan: Cycle I included two nurses, one day shift and one night shift nurse, and one CNM. The CNM in cycle I was the author of the project. The decision to participate and act as a control was related to personal knowledge of the instrument from literature review and attendance at Stanford University's quarterly disaster planning webinar sessions, and acquaintance with the acuities of the patients evaluated.

Do: The first cycle was 28 consecutive days in length with twice-daily capture of instrument completion. The CNM completed the tool twice daily at 0800 and 2000 each day to provide a matched patient evaluation with the once daily evaluations of each nurse. Patients were assessed by chart review, bedside report assessments, or both.

Study: Data analysis was conducted by use of Excel data sheets and graphs summarizing completion of tool frequency. The inter-rater agreement on transport mode response was recorded and calculated. Acuity and transport level categorization for the 28-day cycle was measured and later calculated in mean percentages. A total of 68 evaluations were submitted. Feedback from the Google form free text and informal one-on-one semi-structured interviews were incorporated into the subsequent cycle's Plan component.

Act: Integration of feedback from the RNs and CNM to improve use of OB-TRAIN for iterative cycles was discussed. To encourage continued stakeholder engagement data collected was posted at the nurses' station whiteboard, which was also accessible by the CNMs and medical staff.

Components of PDSA cycle I were continued in cycles II and III with the following modifications, noted in Table 1. A change in time for data submission was integrated into cycle II, and another time change in cycle III. The Checklist for Well Baby Discharge was an addition for cycle III as requested by the nurses in cycle II. The discharge checklist was retrieved from open access on the website of Stanford Medicine (2020) and can be viewed in Appendix E. Changes to this checklist were made to fit context of the project at AACH: removal of Stanford pediatric phone numbers, modification of pediatric provider designation from MD to FP-OB and CNM, and weight cut-off of 2.5 kilograms for car seat tolerance screening.

Table 1

PDSA Cycles I, II, & III Components

	Baseline 10/25/19-1/06/19	**PDSA I** 11/6/19-12/04/19	**PDSA II** 12/26/19-1/23/20	**PDSA III** 2/19/20-3/17/20
Number of Participants	1	3	4	6
Number of RNs	0	2	3	5
Number of CNMs	1	1	1	1
Number of MDs	0	0	0	0
First-time Participants	1	2	4	6
Time of Data Entry: AM	0800	0800	0900-1000	1000
Time of Data Entry: PM	2000	2000	2100-2200	2200
Total Number of Data Points Entered	12	68	57	53
Total Shifts of No Admissions	11	8	7	9
Evaluation for Discharge of Newborn	No	No	No	Yes
1-on-1 post-interview	NA	Yes	Yes	No

A post-test knowledge base binary answer questionnaire was sent to all providers and nurses, participants, and non-participants in the project, to evaluate change. Ten responses were returned from 32 providers and RNs, a response rate of 31%. A significant increase in knowledge related to current emergency preparedness practices on LDRP (e.g. location of grab and go bag) and recommended evacuation resources as designated by OB-TRAIN occurred in the post-test. Appendix D reviews results.

Study. The Model for Improvement (IHI, 2020b) and specifically the Plan-Do-Study-Act (PDSA) method to implement "small tests of significant change" was utilized for the perinatal evacuation triage quality improvement project. The PDSA method is an iterative, consecutive

implementation cycle which provides a framework for reevaluation, incorporation of acceptable changes, deletion of unacceptable or harmful change, and feedback to inform the subsequent cycle. Grounded in a rationale to execute the project, each cycle includes small-scale testing and continuous data collection (Knudsen et al., 2019). A pre- and post-test knowledge base survey, inter-rater accordance on matched evaluations of patients, and percent of advised mode of transport over a 93-day period (baseline plus cycles I-III) were assessed to inform a recommendation on implementation of OB-TRAIN in the Asante system.

Measures. The clinical outcome of interest was a perinatal specific evacuation plan that addressed the unique and varying needs of women in the ante-, intra-, and postpartum states, while providing safe care, risk reduction, and capacity building. The primary outcome measure was an evaluation of the frequency of inter-rater agreement between all respondents on transport recommendation to matched patients in PDSA I-III. Reliability of the OB-TRAIN assessment tool implies similar evaluation of acuity between RNs or providers with resulting appropriate request for, and conservation of, resources in an emergency and offers an objective instrument that is standardized to improve equity of care, A second measure was the percent occurrence of each recommended mode of transport and associated level of care designation assessed by shift and PDSA cycle I-III over 93 days. Knowledge of projected levels of acuity and associated transport needs would benefit a system's EOP forecast of needed resources.

The process measures that led to the outcome assessments included recorded length of time to complete form, number of accurately completed data collection forms, and evaluation of number of dates a participant was scheduled to work and actually completed a form entry.

Several unintended findings of the QI project related to staff included a lower number of participants than expected in subsequent cycles (with decreased data points available for

evaluation), medical doctors not represented as respondents (which indicates a gap in interprofessional expertise and perspective during iterations of the project), and limited staff available per shift at a rural institution to enter data in a timely manner while providing direct care to a high acuity patient. The outcome of OB-TRAIN is limited to assessment and recommendation for mother while overlooking the newborn as a distinct hospital patient admission that staff are separately accountable for. Conceptualizing mother/baby as one integral unit is commonplace and normally desirable, but during disasters neonates might be triaged and transported separately from their mothers.

Analysis. Pivot table relationships were used to evaluate matched or paired assessments between respondents of the same patient at the same time on the same shift. Inter-rater accordance, the degree of agreement between raters which is expressed as a simple percentage, was utilized in each cycle, and determined for the three-cycle total. The percentage of absolute agreement is calculated by the number of times raters agree on a recommendation, which is then divided by the total number of ratings. Thus, this measure can vary between 0% and 100%. When using percentage of absolute agreement, values from 75% to 90% demonstrate an acceptable level of agreement. Percent of absolute agreement was calculated as the number of subjects evaluated were limited.

Cronbach's alpha measures internal consistency or how well a test or tool measures what it should (reliability) (Goforth, 2015). A higher score, closer to one, expresses if the tool utilized is accurately measuring the variable of interest. The OB-TRAIN has not been evaluated for reliability in review of literature, is based on expert opinion at this time, and does not utilize a standardized risk score (Daniels, private communication, 2019). Evaluating the level of reliability of the tool (as a whole) will help to ascertain whether the instrument is useful in the

context of a rural hospital. A high Cronbach's alpha score may persuade stakeholders and systems to utilize a tool which has a strong correlation for consistent responses between users.

For three 28-day cycles the percent of each designation of transport resource need was averaged. The percentages calculated would serve as a guide to identify LDRP needs to assist the organization in numbers that likely could be discharged from the facility or in resource requests for personnel and transport mode for safe and appropriate care. The instrument does not identify receiving institutions for evacuated patients. The OB-TRAIN assists with an institution recognizing its vulnerabilities to aid with preparedness and capacity building. Knowledge of forecasted resource needs could provide a guideline for disaster planning and preparedness which could expedite the ability to request resources more accurately from outside institutions and agencies. At the same time, inpatients with low resource needs could be identified for potential rapid discharge which could augment surge capacity.

Ethics. The Oregon Health & Science University (2019) defines a human subject as "a living individual about whom an investigator conducting research obtains (1) data through intervention or interaction with the individual or (2) identifiable private information" (para. 1). The quality improvement project did not include human subjects as defined, as all data was collected via the electronic health record with no identifying information attached. Oregon Health & Science University's Institutional Review Board (IRB) determined on November 6, 2019 that the proposed project was QI in nature and not subject to IRB oversight (IRB Identification: STUDY00020689).

Costs. Minimal financial costs were associated with the improvement project. A total of $120 was invested in gift cards for the participants.

Results

Pre- and post-test. The initial steps of the intervention included a pre-test of stakeholder knowledge base related to emergency planning and awareness of OB-TRAIN as a triage instrument. Key findings, prior to implementation of the QI project, included providers' and registered nurses' current, pre-implementation knowledge of the disaster cycle and the OB-TRAIN instrument. Providers, 38% (8), were aware of OB-TRAIN as a decision-making tool, while 23% (13) of nurses and doulas were familiar. The post-test reevaluation consisted of 10 (31%) returned surveys, with 9 respondents (90%) reporting knowledge of OB-TRAIN as a decision-making tool for emergency evacuation. All post-test respondents were nurses.

Trial Period. The two-week trialing of the OB-TRAIN tool via the Google form created for the project evaluated specifically the level of mode of transport. No matched pairs were generated as the author was the only subject entering data with no patient data entry comparisons available. Twenty-three assessments were entered in 13 days. Eleven of 23 evaluations, 48% of the evaluation period, there were no inpatients to assess. Of the twelve evaluations that were completed between 0800-0900 and 2000-2100, all were categorized as postpartum patients. Five of twelve (42%) were evaluated as low risk and able to be discharged by car; seven of twelve (58%) an evaluation of BLS mode of transport was recommended. No patients were assessed to be in a higher acuity category necessitating ALS, SPC, or shelter in place recommendation. Mode of transport noted by time, assessed during the day shift, 0700-1900, was recommendation of four of seven inpatients (57%) be discharged by car, and three of seven (43%) transportation with BLS level of care. On night shift, 1900-0700, five evaluations were completed with one of five (20%) recommended for discharge by car, and 4 of 5 (80%) required BLS transport. Time to completion of form was noted as less than five minutes for each evaluation.

Issues of use by the author included that a “newborn is not recognized or noted where located or status”, and “no place for newborn evaluation (on tool). What if there is a need to transport?”. A query as to “how to define maternal risk?” was documented, and “challenging to document at same time daily” and “difficult to complete at 0800 and 2000. Is there a better time?”. These initial responses could be coded as “infant”, “maternal risk”, and “timing”.

Cycles I-III. Subsequent cycles of PDSA with staff participants were then initiated in an iterative manner. Evaluations of individual patient admissions on the perinatal unit took place over three cycles. Each cycle was comprised of 28 consecutive days. The form was available on the participants’ personal computer via an active link that each rater was invited to access at the initiation of the cycle. An individual patient’s assessment required data entry in each section by the rater and then submission of form prior to evaluation of a subsequent patient. Multiple patients could be evaluated by each rater.

Sixty-eight evaluations by three participants were recorded in PDSA cycle I, 53 evaluations by four participants in PDSA cycle II, and 52 evaluations by six participants occurred in PDSA cycle III. A total of 173 evaluations were completed on 150 individual patients (see Table 2). Twenty-three shifts during the 84-day period of evaluations (28% of project) specified no admissions. Completion of the OB-TRAIN Google form was not possible if no patients were on the unit. A response was submitted to record that the unit did not have admissions. These null data points were removed from the total count of evaluations.

Table 2

Data Entry by Cycle, Status of Admission, and Transport Mode Support

	Total Assessments	AP/IP	PP/ post-surgery	Car Discharge	BLS	ALS	SPC	Shelter in Place
Baseline	12	0	12	5 (42%)	7 (58%)	0	0	0
I	68	12	56	21 (31%)	40 (59%)	3 (4%)	4 (6%)	0
II	53	16	37	23 (43%)	25 (47%)	5 (9%)	0	0
III	52	10	42	24 (46%)	13 (25%)	6 (12%)	8 (15%)	1 (2%)
Total	185	38	147	73 (39%)	85 (46%)	14 (8%)	12 (6%)	1 (1%)
Baseline:								
AM shift	7	0	7	4	3	0	0	0
PM shift	5	0	5	1	4	0	0	0
Cycle I:								
AM shift	34	5	29	13	17	0	4	0
PM shift	34	7	27	8	23	3	0	0
Cycle II:								
AM shift	40	13	27	17	19	4	0	0
PM shift	13	3	10	6	6	1	0	0
Cycle III:								
AM shift	40	8	32	20	10	4	5	1
PM shift	12	2	10	4	3	2	3	0

AP/IP: antepartum/intrapartum; PP: postpartum; BLS: basic life support; ALS: advanced life support; SPC: specialized care; AM: 0700-1900; PM: 1900-0700.

The time to completion of the form was evaluated as a measure of process. Entry of patient evaluation by RNs was completed after shift report, EHR review, and/or bedside assessment of the patient. The CNM provider would complete the instrument, acting as a control, after remote EHR review and/or bedside care. Less than five minutes to complete form was recorded 94% of entries (Table 3). Entry of data by the subjects was encouraged by a text reminder from the author but was voluntary. Completion of OB-TRAIN instrument occurred on average of 67% of RN working shift counts (Table 4). CNM respondents completed data entry on any day that they were scheduled to work or had time to complete the form. The CNM did enter data during the agreed upon time of submission for her cycle.

Table 3

Data Entry: Time to Complete Submission

Time to Complete	Less than 5 minutes	6 to 10 minutes	11 to 15 minutes	16 minutes or more
Baseline	12	0	0	0
Cycle I	58	10	0	0
Cycle II	52	1	0	0
Cycle III	51	1	0	0

Table 4

Shift Count and Data Entry

RN	**Shift Number per Cycle**	**Entry of Assessment on OB-TRAIN**	**Percent Time Data Entry**
RN-A	8	6	75%
RN-B	12	8	67%
RN-C	9	9	100%
RN-D	12	8	67%
RN-E	8	6	75%
RN-F	15	8	53%
RN-G	16	10	63%
RN-H	16	7	44%
RN-I	15	9	60%

Inter-rater reliability was possible to evaluate during cycles I, II, and III as raters would assess identical patients and determine a transport level of care. These matching patients were then evaluated for concordant rating of transport level recommendation. In cycle I, 14 evaluations were concordant for 16 matched patients (88%); cycle II specified nine out of 11 correlations (64%); and in cycle III the raters matched transport mode on seven of 11 matched patients (64%). See Table 5.

Table 5

Inter-rater agreement in PDSA Cycle I, II, III of Quality Improvement Project.

PDSA-I	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Total
RN- A	0	3	0	0	0	3	0	2	0	2	3	0	0	0	0	0	
RN- B	3	0	1	4	3	0	3	0	3	0	0	3	1	1	3	2	
CNM-1	3	3	1	3	3	3	3	3	3	2	3	3	1	1	3	2	
Inter-rater Correlation	1	1	1	0	1	1	1	0	1	1	1	1	1	1	1	1	**14/16**

Inter-rater agreement **=0.875 (88%)**

PDSA-II	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Total
RN- C	2	0	0	0	0	0	2	2	4	2	2	0	0	0	
RN- D	0	0	0	0	0	0	0	0	0	0	0	0	2	2	
RN- E	0	1	2	3	3	3	0	0	0	2	3	1	0	0	
CNM- 2	3	1	2	3	3	2	2	2	4	0	3	1	3	3	
Inter-rater Correlation	0	1	1	1	1	0	1	1	1	1	0	1	0	0	**9/14**

Inter-rater agreement **=0.643 (64%)**

PDSA-III	1	2	3	4	5	6	7	8	9	10	11	Total
RN- F	0	0	0	0	0	0	0	0	0	0	3	
RN- G	3	1	0	0	2	2	5	0	0	3	0	
RN- H	0	0	0	0	0	0	0	0	0	0	3	
RN- I	4	1	1	0	2	0	3	2	0	3	0	
RN- J	0	1	1	5	2	2	0	2	2	3	0	
CNM- 3	0	0	0	4	0	0	0	0	3	0	0	
Inter-rater Correlation	0	1	1	0	1	1	0	1	0	1	1	**7/11**

Inter-rater agreement **=0.636 (64%)**

Note: 0=no data input; 1= Car Discharge; 2= BLS (Basic Life Support); 3= ALS (Advanced Life Support; 4= SPC (Specialized Care); 5= Shelter in Place

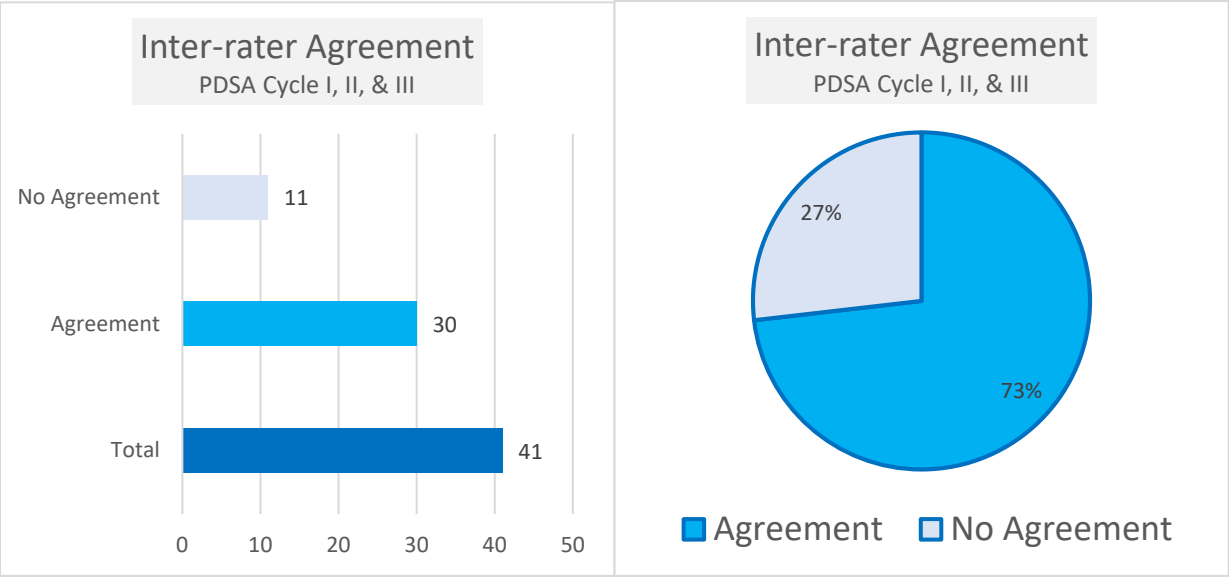
Inter-rater Correlation: 0 = no correlation; 1 = perfect correlation

RN-A-J: Registered Nurse; CNM 1-3: Certified Nurse Midwife

When a patient evaluation was submitted by more than two respondents, all coding was necessary to agree or the data was excluded. Total percent of inter-rater agreement, 73%, is displayed in Figure 7.

Figure 7

Inter-rater agreement: PDSA Cycles I, II, & III.



Asante Ashland, a community hospital with a 7-bed LDRP capacity, is limited in its number of admissions to evaluate. As AACH is designated a Level I basic care facility by hospital level of maternity care definition, admissions are of generally low perinatal acuity (ACOG, 2019). During the baseline and three 28-day cycles (97 days), there were either no patient admissions to quantify on 34 days, or 35% of the improvement project. On 63 days data was submitted. Seventy-three assessments of 185 (39%) were designated as not requiring further medical care and to be released by car discharge. For greater than one-third of all days in a three-month period the hospital incident command would not require any transport vehicles and personnel. Close to 40% of all admissions would be discharged to home due to the low patient

acuity typical of AACH and as assessed in OB-TRAIN stage of labor or postpartum status, risk factors, epidural status, mobility, or time passage since birth

Assessment of transport resource needs by time, day or night shift, reveals the following: 85% of day shift evaluations and 86% of night shift evaluations are recommended low resource transport needs, either car discharge or basic life support. Fourteen percent of remaining inpatient assessments are of greater resource dependence, necessitating advanced life support or direct care by perinatal RN, CNM, or obstetrician. Day shift evaluations make up 65% of all data entries. Postpartum evaluations represented the majority of assessments, 147/185 (79%), while antepartum evaluations represented 38 of 185 (21%) data points. As noted previously, 39% of all inpatients during a 93-day period were recommended to be discharged home. Values are represented in Table 6.

Table 6

Evaluation of Transport Resource Need by Shift

	AM: 0700 - 1900				PM: 1900 - 0700		
		AM Total: 121	Total Entry: 185			PM Total: 64	Total Entry: 185
Car	54	45%	30%		19	30%	10%
BLS	49	40%	26%		36	56%	19%
ALS	8	7%	4%		6	9%	3%
SPC	9	7%	5%		3	5%	2%
SIP	1	0.5%	0.1%		0	0%	0%

Evaluation of the internal consistency of the tool between recorders for the OB-TRAIN, PDSA I-III, for this project was completed by utilization of Cronbach's alpha statistic. The Cronbach's alpha measure reflects the degree to which OB-TRAIN measures what it purports to measure based on the manner that the evaluators interpreted the assessment options. Tabulation of correlating responses and values were entered into an Excel data analysis. The internal consistency was determined to be similar between cycles I and II at 85% and to have diminished

consistency in cycle III at 55%. In cycles I and II the Cronbach's alpha internal consistency score was ≥0.8 between 30 evaluations. This high value is interpreted as a good correlation of reliability of the tool between evaluators. Cycle III had a moderate rating of correlation, ≥0.5with evaluation of 11 matching recommendations. See Table 7.

Table 7

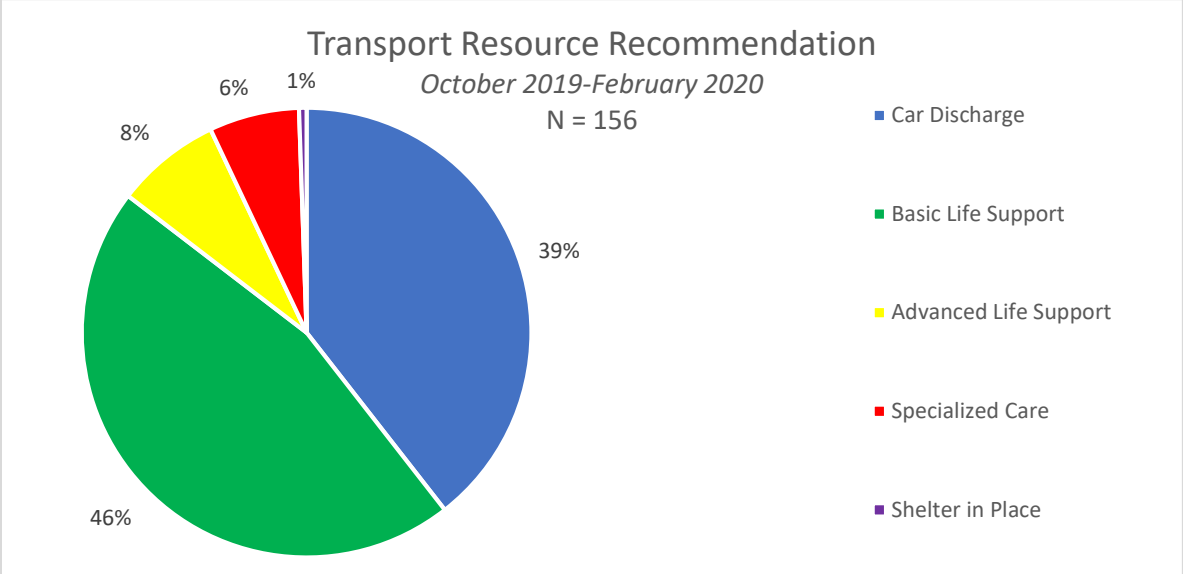
Results from PDSA cycles I, II, & III for OB-TRAIN Inter-rater Reliability

	PDSA I	PDSA II	PDSA III
Number of evaluations	16	14	11
Cronbach's alpha	**0.848263**	**0.850343**	**0.546584**

The secondary outcome of this QI project was to determine the percentage of each level of transport acuity required in one 28-day period (e.g. discharge by car, basic care, advanced care, specialized care, or shelter in place) for an evacuation to an appropriate level of care facility or to home. Cycle entries were counted with the average projected transport level of care determined over a cycle of three, 28-day periods of data analysis or one yearly quarter. Baseline data for transport mode was in addition to the three cycle's data. The number of individual patient evaluations from October 2019 through February 2020 totaled 156, with 185 data entries. Utilizing the OB-TRAIN parameters and coding, 73 (39%) perinatal patients were evaluated to be discharged via private vehicle, 85 (46%) required basic life support or EMT care, 14 (8%) required ALS, 12 (6%) patients necessitate SPC, and 1 (1%) was determined to shelter in place during a disaster is represented in Figure 8.

Figure 8

Transport Mode Recommendation by OB-TRAIN Assessment.



Themes included in the 51 longhand comments of raters addressed: eleven separate statements requesting a newborn form (Newborn TRAIN), prior to addition of the Well Baby Checklist for Discharge in cycle III; eleven comments on clarification of risk as being subjective and difficult to limit choice to one category; and, eight remarks on difficulty of evaluation when remotely entering OB-TRAIN evaluation. Other comments were notes on specific patient medical issues (e.g. induction of labor, use of magnesium sulfate, etc.). The main ideas conveyed by these comments would be coded as “infant”, “risk subjectivity”, “remote access accuracy”, and “interventions”.

Changes that were integrated into subsequent cycles were important but not complicated: increase in number of subjects in each 28-day cycle, change of time of data entry to a period when nurses had completed tasks and were likely documenting in the EHR, with the most significant change being the addition of assessment of the newborn.

Discussion

An unintended finding and a profound gap were the observation by the participants that the newborn was not considered in the basic evaluation of the OB-TRAIN postpartum. Fetal risk is considered as an evaluation element in the antepartum OB-TRAIN. Assessment of the maternal-newborn as a dyad was not possible as the Stanford OB-TRAIN postpartum form focuses solely on maternal recovery and transport resource need recommendations.

At AACH the mother-baby dyad shares a room, the couplet is not separated, and no nursery is available. Level I centers such as AACH provide basic newborn care. The unit is an LDRP (labor-delivery-recovery-postpartum) unit, there is no distinct postpartum unit and staff, and no separate well-newborn instrument. An evaluation checklist specifically for the newborn was addended to cycle III to complete when the maternal and newborn risk factors differed, or the mother was discharged, and the newborn continued as an admitted patient requiring care. At AACH a mother may be discharged while her newborn is maintained as a patient for continued medical care. During the project, a newborn was an inpatient after maternal discharge on 20 admissions. Newborn medical issues included treatment for hyperbilirubinemia, loss of >10% of birth weight, gestational age <37 weeks, and post-vacuum assisted delivery. Standard of care is for the mother to remain at the newborn's bedside as a boarder (no longer admitted as a patient) to continue bonding, breastfeeding, and provide care.

A newborn checklist from the Stanford University Obstetric Disaster Toolkit was completed by respondents on an as-needed basis. The checklist does not evaluate the newborn's resource needs for transport, but rather assesses for completion of required screening tests prior to release, or recommendation of evaluation by pediatric provider. Ideally, the postpartum OB-TRAIN instrument would be improved with an additional row of assessment criteria specifically

focused on the newborn evaluation while acknowledging the mother-baby as a unit during transport.

Previous publications that have discussed TRAIN have utilized paper forms for collection of triage recommendation and to communicate resource needs (Cohen, 2010; Daniels et al., 2014; Lin et al., 2018). Compilation of completed OB-TRAIN instrument documentation for the project by the author was efficient with the utilization of Google forms and Excel data sheets, and data was immediately accessible. While efficient, the participants were required to have access to the tool, enter the data manually and at requested specific times for consistency. Manual entry did impact daily workflow. Respondents requested a data entry time change with each cycle. In cycle I the expected data entry time was 0800 and 2000. As that time was deemed to be too close to shift change and patient care acquisition, in cycle II the data entry was moved to 0900 and 2100. Respondents in cycle II requested another small change, maintaining that 1000 and 2200 there is a natural break in workflow after assumption of care. In cycle III data entry occurred at that time.. Automated integration of the instrument into the EHR was not implemented during this quality improvement. A cost analysis to build a clinical decision support instrument was not completed.

An unexpected benefit of the timing of the project initiation was the topic of disaster imminence and preparedness specifically for the perinatal population and the onset of the SARS-CoV-2 pandemic. OB-TRAIN was not utilized at AACH for assessment of patient resource needs during the pandemic as there was no evacuation, but active discussion took place regarding how the instrument could be useful if necessary, for a surge. Trialing the project in the winter during several holidays was related to significant changes in time off of participants, limiting typical patterns of work regularity. Recent hospital and unit-imposed QI projects were

time-intensive and limited the enthusiasm of the staff to engage in commitment to one month of data entry. The early adopters were engaged in the first cycle and not integrated into subsequent cycles, which may have improved support and appreciation of the project.

Pre- and post-test. The results of the pre- and post-test regarding disaster preparedness tools in place at Asante Ashland, transport recommendations during evacuation, and the OB-TRAIN instrument changed significantly. Pre-test 21 of 32 providers and nurses (65%) participated in the anonymous survey, while post-test 10 of 32 (31%) returned the survey. The pre-test survey was distributed during staff meetings while the post-test was sent out via work email. Question number nine on the survey stated: "Have you heard of implementation of OB-TRAIN (Obstetric Triage by Resource Allocation for Inpatients) for transport decision making during a disaster"? The change in personal awareness of the instrument from 0.3% of responses on the pre-test (prior to QI project) to 0.9% post-test was a 200% percentage increase in change in knowledge. An added question to the post-test stated: "Do you think that integration of the OB-TRAIN into the AACH emergency operations plan would be beneficial?", with 100% of respondents answering 'yes'.

Trial. The results from the trial do reveal a brief glimpse of the regularity of low census (48%) and low transport resource requirements (100% of admissions categorized as blue or green) at AACH. Preparing for future disasters will benefit from projected needs assessment and forecasting of resource allocations as assessed over time.

Cycle I-III. Completion of the form was rapid, only 6% of participants reporting 6-10 minutes was necessary per patient entry, all other submissions were completed in five minutes or less. Report of longer time to completion was greater in the first week of the cycle as there was a learning curve with an unfamiliar form. During remote chart evaluation by CNMs, form entry

time was reported as necessitating six to ten minutes as there was a need to search the EHR for information to complete the values.

Inter-rater agreement was assessed during each cycle, gauging the extent to which the responses of the evaluators were concordant. Ninety percent (37/41) of all matched evaluations were assessments of the same patient by two respondents, with 72% (30/41) concordance. Evaluations that were completed by three or more respondents were assessed by inter-rater percent agreement. In evaluations that did not have total agreement (e.g. only two of three agreed) that assessment was removed. With a larger number of respondents in future studies assessment of data collection with Fleiss kappa would likely result in a more accurate measurement of inter-rater reliability. Nurses at the bedside have intimate knowledge of patients' status received from shift report, direct patient care, and electronic health record data. Application of this knowledge to a few specific data points yielded an overall inter-rater reliability of 73% meeting the QI project goal of > 70% agreement.

The first two cycle iterations Cronbach's alpha value of 0.85 signifies that the tool was reliably measuring the matched transportation resource recommendations as determined by perinatal care experts via use of the instrument. Assessment of the reliability of the OB-TRAIN is helpful in evaluating the tool's consistency to generate similar results when different raters are evaluating the same patient. The result of a lower Cronbach's alpha in cycle III, (0.5), is likely related to the increased number of evaluators (six), and the variance of the total score which included higher acuity evaluations.

Cycles I and II were limited by the number of respondents participating on each shift, hindering completion of OB-TRAIN at the agreed upon time while providing direct patient care, possibly skewing accurate assessment of acuity. A patient with a higher acuity requires one-on-

one care. With limited staff availability on each shift at a rural institution it is likely difficult, if not impossible, to complete a checklist when providing direct patient care to a dynamically changing situation. In preparation for a potential disaster, Asante Ashland and the Asante system could consider implementing daily shift assessment of resource need allocation via manual staff completion of the OB-TRAIN, such as that which occurred in this QI project. Another possibility is the emergency operations planner could integrate activation of OB-TRAIN as a one-time-only tool incorporated in emergency response protocol. A third option is to consider the feasibility and cost of a build into the EHR by embedding the instrument as a clinical decision support tool capturing data with real-time updates.

Subjectivity of the instrument was noted by respondents. Several coding classifications have two options and are present in two columns, increasing time for deliberation of risk. Clarification of risk would simplify the tool, decrease time for decision-making, and increase objectivity of coding.

Interpretation. The TRAIN newborn/pediatric instrument (on which the OB-TRAIN is derived from) has been evaluated for reliability by Lin et al. (2018), demonstrating a 96.3% accordance between visual assessment and TRAIN embedded in the electronic medical chart. According to publications by Stanford's Office of Emergency Management (n.d.) the neonatal TRAIN increases a unit's ability in an emergency to quickly assess and accurately request the appropriate resources from the hospital emergency operations center, streamline communication with a common color-based code, implements a standardized inpatient hospital evacuation triage system with minimal impact to workflow, and increases awareness and disaster preparedness across the institution. The OB-TRAIN instrument uses a color-coded transport level of care system that is visually familiar to most (i.e. green, yellow, red). Communication is critical in a

disaster and if OB-TRAIN were implemented regionally several issues would be addressed: utilization of the same language for acuity and resource needs, indirect communications from LDRP to the hospital incident command would be streamlined, a simple and objective checklist that is completed at point of care (or in future by EHR) during a highly stressful experience, and with addition of a newborn evaluation line item, maintenance of the interconnection of the maternal-infant dyad .

The gathering of statistics over a quarter of the year offers insight on the prediction of LDRP transport needs. Knowledge of potential resource requirements assist with preparedness and offer vital information to the emergency operations planner for average forecasting projections for the LDRP. Evacuation in a disaster situation is likely to be chaotic. Knowledge of essential information of potential resource needs is valuable for anticipatory planning.

Limitations and strengths. Multiple areas that impacted the project during implementation were specific to the context of the site. A limited RN pool, numerous mandatory project roll outs, low patient census, and irregular holiday work scheduling could not be controlled and affected evaluation submissions. A daily text reminder to participants with variable schedules was not sustainable. The OB-TRAIN as implemented is a static tool. Completion at one point in time will not represent a progression in patient status, leading to inaccurate request for transport allocations. Minimal representation of professional specialty staff limits a team-based perspective.

Inclusion of the CNM providers as participants in each cycle was helpful in promoting interprofessional conversation about the value of the urgency of disaster planning and preparedness. The necessity of rapid workflow changes that were required in response to SARS-CoV-2 ensuring safety of patients and health care workers showcased the importance of

institutional disaster preparedness. As the form can be completed rapidly in 5 minutes or less (93% of responses) facilitation of a prompt determination of resource requirements is possible, which is necessary in an emergency. The OB-TRAIN is an equitable instrument as coding does not recognize social-economic status, race, ethnicity, religion, or sexual orientation, forcing structural equity into requests for resources.

Future directions of this project include tool implementation, leadership aspects, provider, and staff engagement, and the context's unique population, limitations, and strengths. Table 8 displays specific issues during the project.

Table 8

Quality Improvement Project: Limitations and Strengths by Issue

	Limitations	Strengths
Tool Implementation	-Subjective element to responses -Risk factors/acuity not guideline based -Incorrect data entry by subjects -Newborn representation lacking -Dynamic inpatient status representation on static tool	-Daily hands-on familiarity with use -Tool available on public domain -Clinical decision tool increasing rapid decision-making
Provider Engagement	-Interprofessional staff not represented as subjects	-Provider verbal engagement/interest -Commitment of involved CNMs
Staff	- Incomplete staff participation -Dynamic status change of inpatient requiring staff at bedside limiting form completion -Small staff size;	-Champions & early adopters -Small staff size & close working relationship -Staff retention during cycle -Intimate knowledge of patient status (1-to-1 care)
Leadership	-EOP non-engagement	-Nursing leader support - Project leader's quarterly attendance at Stanford Disaster Community webinar -FEMA/CERT/MISP training
Setting/Environment	-SARS-CoV-2 emergency planning health care shift of focus away from Cycle IV implementation -Low census volume -Limited daily staff -Seasonal scheduling variation of available staff	-Team-based -PDSA cycle familiarity -SARS-CoV-2 rapid transition to emergency planning implementation

Conclusions. Preparedness involves the anticipation of an event and integration of appropriate protocols that will likely mitigate the impact of a disaster. Designation of appropriate actions at all points of the disaster cycle leads to an increase in capacity and assists with the reduction of vulnerabilities. An evacuation tool for inpatients that has been designed at Stanford

University and is integrated into the urban multi-hospital teaching facilities has not been evaluated for validity and reliability outside of this context. Multiple studies have focused on triaging inpatients for admission to care (e.g. Maternal Fetal Triage Index, Birmingham Symptom Specific Obstetric Triage System, Swiss Emergency Triage Scale, and others), only the OB-TRAIN highlights triaging for evacuation in the inpatient setting (ACOG, 2016; Fakari et al., 2019; Ruhl et al., 2015).

Inter-rater agreement of the OB-TRAIN instrument was assessed during a quality improvement project at a rural community hospital's LDRP with an overall 73% accordance over an 84-day evaluation. Assessment of the reliability of the OB-TRAIN was critical in evaluating the tool's capacity to produce similar results when different raters were evaluating the same patient in a dissimilar context. During a disaster, having access to a tool to assess resource needs rapidly, communicate in common terminology, and with reliability between raters, is essential for patient safety, an obligation of the healthcare system to provide, when decision making in a crisis management situation.

Prior to a disaster occurring, forecasting of potential needs of at-risk populations is a preventative action that can anticipate bolstering of necessary resources and mutual aid contracts. Knowledge of the changing nature of the perinatal patient status, average number of days per quarter of inpatient census, and mean number of transportation care level requirements provides data for the emergency operations planner to extrapolate for expert resource projection.

Newborns are highly vulnerable. They have complete dependence on others for nutrition, warmth, and in some cases, life-saving technology. Improving disaster preparedness for newborns requires the unit care providers to participate in the larger plan for unit-specific and hospital preparedness. Determination of medical personnel needed to assist with newborn

transport and safe transport, identification banding, and avoidance of separation of the maternal-newborn dyad is critical. Assessment and coding of the newborn on the OB-TRAIN instrument is necessary for inclusiveness of all patients on the LDRP unit, maintenance of the dyad, and safe transport with appropriate resources. In a disaster scenario, available resources for newborns may become limited and could be substituted, adapted, or reallocated, while evaluation and recommendation for evacuation resource needs should be included in an evacuation triage instrument.

The QI project at AACH could benefit from incorporating OB-TRAIN into the EHR as a tool of clear communication, meeting a criteria of disaster preparedness. Clinical decision support tools can streamline workflows and take advantage of existing data sets. Incorporation of providers order sets and nurse's flowchart data which typically signifies a change in status, could input data points into the embedded OB-TRIAN. The instrument, which is based on objective evaluation of resource need, is a practical solution in time of a disaster where resources are scarce, sharing of limited resources is ethical, accurate communication of resource need is of the essence, and rapid decision-making saves lives. The focused patient data reports and summaries could be printed on notification of a disaster or daily in preparation for an unexpected event.

A review of the literature highlighted the special consideration that perinatal and neonatal populations warrant as vulnerabilities present normally during the perinatal period will likely be exacerbated during disasters. Because natural and manmade disasters can occur at any time, individuals, communities, and governments must be prepared. The current active SARS-CoV-2 pandemic has presented opportunities for significant improvement in health care professionals' capabilities to respond to a disaster in the moment and in planning for a critical analysis of the state of readiness of the global society, nations, regional communities, and local institutions. As

advanced-practice nurse leaders and primary health care providers of women and newborns, midwives are uniquely positioned to provide expert perspective and insight in the leadership and improvement efforts of emergency operations plan specifics related to perinatal care. By including advanced practice nurse-midwives in the critical processes of planning and preparation for a disaster, best-possible outcomes for the vulnerable women of reproductive age population will be supported through appropriate, effective, and uniquely designed perinatal policies.

Targeting of gaps in preparedness, pre-planning, skills and training, and technology integration are resources that can be implemented before a disaster as priorities are identified. It is important to further develop and test models, like the OB-TRAIN, that offer the potential for improvement in patient health outcomes while decreasing mortality. Quality improvement activities are implemented to systematically improve the way that care is delivered to patients. Whether an urban multi-center institution such as Stanford University or a rural community setting like Asante Ashland, testing processes for improvement of care and outcomes is critical. Trialing a tool, in a similar or different context, provides an opportunity to assess fit within an institution, receiving input and feedback, addressing weaknesses and gaps, evaluating costs, and outcomes. Through measurement of reliability and projection of the percent of LDRP unit evacuation transport resource needs, the OB-TRAIN defines level of care required for safe transport and allocation of supplies for a dynamic and vulnerable population. Implementation in a rural environment is extremely valuable as resources are likely limited prior to a disaster. Maximizing constrained resources by policies in planning and staff training will benefit an already vulnerable population with a tool specifically designed for this unique population.

By shifting to process evaluation, a systematic approach, and optimal outcomes, the Model for Improvement and PDSA cycles are an opportunity to evaluate best practice and

implement care practices which satisfy meeting the Triple Aim initiative of improving patient care experience (equity of OB-TRAIN), reduction of cost through conservation of resources (utilization planning), and improving health of populations (decreased mortality) (IHI, 2020). Currently disaster planning for the perinatal population is in its infancy with no best practice processes agreed upon among national societies. Community resilience is increased when there is a disaster preparedness plan in place. Desired outcomes in any disaster are to minimize mortality and maximize safety, continued health, access to resources, and improvement upon rebuilding.

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Appendix A: Disaster-based Competencies for Nurses and Midwives

Author	Year of Publication	Title of Competency	Description
International Nursing Coalition for Mass Casualty Education (INCMCE)	2003	Educational Competencies for Registered Nurses Responding to Mass Casualty Incidents	Consensus-based "basic-level" competencies for entry-level nurses, focused on multidisciplinary response to mass casualty events including CBRNE materials.
World Health Organization	2007	Core Competencies for Nursing and Midwifery in Emergencies	A unified competency model for nurses & midwives derived from knowledge, skills & judgment. Covers five domains.
American Medical Association EWG	2008	Core Competencies for All Health Professions in a Disaster	Competencies across health specialties. Categories of student/ professional/ leader delineated. Identified: 7 core learning domains, 19 core competencies, & 73 specific competencies. Seminal work.
International Council of Nurses & World Health Organization	2009	ICN Framework of Disaster Nursing Competencies	Generalist-nurse focused utilizing the "disaster management continuum" (mitigation/ prepare/ respond/recover) with identification of 10 domains of knowledge, skills & safe functioning. Framework for self-evaluation of individual nurse, gaps in educational programs, development of assessment tools, & further specialized competencies and international resources.
Jorgensen, Mendoza & Henderson	2010	Emergency Preparedness and Disaster Response Core Competency Set for Perinatal and Neonatal Nurses	Consensus-based core competency set providing perinatal nurses a template to guide emergency preparedness and disaster response educational and training activities. Provides for identification and incorporation of measurable objectives. Addresses learning needs of nurses as well as the unique needs of WRA.
Walsh et al.	2012	Core Competencies and Sub competencies for Disaster Medicine and Public Health	Relevant to broad DMPH audience to be utilized as foundation on which to build expertise. Supports all aspects of disaster management cycle. Useful for curricula development.

Notes: CBRNE: Chemical, biological, radiological, nuclear, and explosive; DMPH: Disaster Medicine & Public Health; EWG: Expert working group.

Appendix B: Shelter in Place Contents for Provider Supply Kit

PROVIDER GRAB & GO SUPPLIES

Sterile single gloves	5-10 gloves
Sterile gloves	Size 6.5 x 2; Size 8 x 1
S/M/L non-sterile gloves	One box (50 gloves)
Face masks	4 masks
Exam gel	5-10 packets
BP cuff + stethoscope	x 1 each
Head lamp + extra batteries	
Birth Pack	
• Under buttocks drape	
• Sterile gown	
• Table cover	
• 4x4 Sponges	x 2 packs
L&D Instrument Set	
• Mayo Scissors	
• Mayo Clamp	
• Needle driver	
Sutures	
• Monocryl 2-0	x 1
• Monocryl 3-0	x 1
• Vicryl 3-0	x 1
Cord clamp	x 2
Red biohazard bag	x 4
Peri pad	x 2
Instant cold pack	x 1
Hand Sanitizer	
Chux	1-3
Ambu-bag, self-Inflating (neonatal)	
Neonatal stethoscope	
Bulb syringe	x 1
Baby blanket	x 3
Newborn hat	x 1
Fetal doppler/fetoscope or Pinard	
Space blanket	x 1
Paper (partograph) & Pen	
on Clipboard	x 1

OXYTOCIN 20U IM + NEEDLE/SYRINGE
METHERGINE 0.2MG IM + NEEDLE/SYRINGE
MISOPROSTOL 1000MCG
LIDOCAINE 1% 30ML + NEEDLE/SYRINGE

Appendix C: OB-TRAIN Google Form

Section 1 of 8

OB-TRAIN: PDSA Cycle III

Hello Women:
Please, complete OB-TRAIN tool between 0900-1000 and 2100-2200.
Complete one OB-TRAIN tool for each mother admitted on the AACH Family Birth Center unit. Do not fill out the Well Baby Checklist unless the newborn is admitted for care and the mother is rooming in.
Submit form to document when there are "no patients admitted to LDRP".
Check appropriate box on assessment of mother at time of completion: Labor, Mobility, Epidural, Risk (AP/IP) or Delivery, Mobility, Risk, Post Op (PP).
One check mark required in each row (except Post-op in postpartum if not surgical client).
Well baby checklist to be completed only if mother is discharged, newborn is admitted.
Feedback is welcome when you would like to comment on item not addressed or ideas to share.
No patient identifiers are included. HIPAA compliant.

February 19th through March 17th are the 28 days for data collection!

RN / Provider name: *

Short answer text

Time: *

Time

Date: *

Month, day, year

After section 1 Continue to next section

Section 2 of 8

Admission Status

Description (optional)

There are patients admitted on LDRP: *

- YES
- NO

After section 2 Continue to next section

Section 3 of 8

Room Number & Status

Description (optional)

Room number: *

- 13
- 14
- 15
- 16
- 17
- 18
- 20
- 10
- 11

Is your patient antepartum/intrapartum or postpartum? Is your patient a newborn only (mother discharged)? *

- Antepartum/Intrapartum
- Postpartum
- Newborn

After section 3 Continue to next section

Section 4 of 8

Antepartum/ Intrapartum

Description (optional)

Image title

OB TRAIN for AP & LD

Transport	CAR (Discharge)	BLS	ALS	SPC	SHELTER IN PLACE
Labor Status	None	Early	Active	At risk for En route delivery	If delivery is imminent, 'Shelter in Place' and TRAIN after delivery
Mobility	Ambulatory*	Ambulatory or Non-ambulatory	Non-ambulatory	Non-ambulatory	
Epidural Status	None	Placement > 1 hour**	Placement < 1 hour**	N/A	
Maternal or Fetal Risk	Low	Low/Moderate	Moderate/High	High	

(SPC) Specialized = must be accompanied by MD or Transport RN
* Modified Bromage Score 6 = Patient is able to perform a partial knee bend from standing
** Epidural catheter capped off

AP/IP (Labor & Delivery) *

	Car (Discharge)	BLS	ALS	SPC	Shelter in Place...
Labor Status	☐	☐	☐	☐	☐
Mobility	☐	☐	☐	☐	☐
Epidural Status	☐	☐	☐	☐	☐
Maternal or Fet...	☐	☐	☐	☐	☐

How long did it take for you to complete this form? *

- less than 5 minutes
- 6 - 10 minutes
- 11-15 minutes
- 16 minutes or more

After section 4 Continue to next section

Section 5 of 8

Comments

Additional feedback welcome!

Question

Long answer text

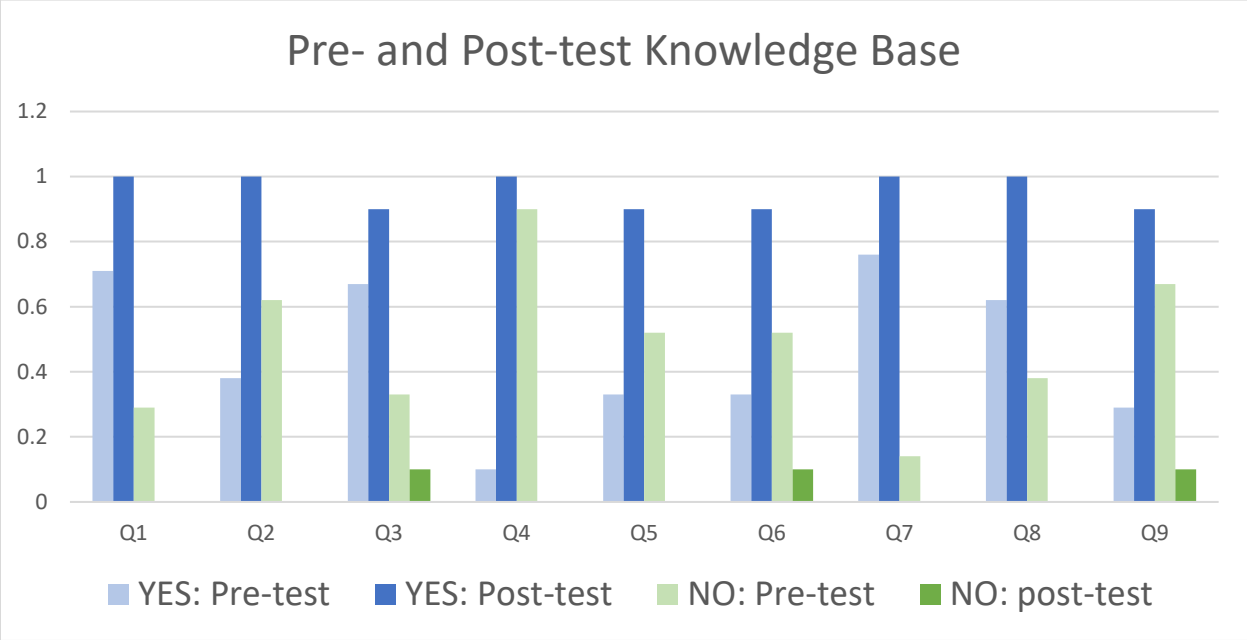
Thank you for your time! Your commitment to this project is invaluable.

Description (optional)

Image title

After section 5 Submit form

Appendix D: Pre- and Post-knowledge Evaluation of Staff



If a disaster were imminent in Ashland that affected AACH…

1. Do you know where the Emergency (Grab & Go) birth kit is located on LDRP? Y N
2. Do you know where the Emergency (Grab & Go) birth kit is located in the ED? Y N
3. Should there be more Emergency birth kits located in the hospital? Y N
4. If evacuation is necessary would all patients in LDRP be transported with the same level of care? Y N
   (If YES, skip to question 7).
5. Would you know what level of transport care is necessary for a woman with a working epidural? Y N
6. Would you know what level of transport care is necessary for a woman if she is experiencing an unmedicated active labor? Y N
7. Can a mother-baby dyad be discharged to home if the disaster requires hospital evacuation? Y N
8. If transport is necessary, do you think that the AACH tagging system for mother-baby would be effective in a disaster to prevent separation? Y N
9. Have you heard of implementation of OB-TRAIN (Obstetric Triage by Resource Allocation for INpatients) for transport decision making during a disaster? Y N

Appendix E: **Checklist for Well Baby Discharge by OB-GYN in a Disaster**

All answers should be **YES**

If any answers are **NO** or **DON'T KNOW**, refer to designated pediatric provider (FP-OB/CNM) for disposition.

	YES	NO	DON'T KNOW
Is Mom going home?			
Baby ≥ 37 weeks gestation?			
Has the baby had a normal pediatric provider exam?			
Is the baby feeding well without any issues?			
Does the baby have normal vital signs? • HR = 100-160 bpm • RR = 30-60 /min • Temp = 36.5-37.5°C			
Is the bilirubin level (either serum or transcutaneous): • ≤ 6.0 at 24 hrs. • or ≤ 9.0 at 36 hrs. • or ≤ 11.0 at 72+ hrs.			
If indicated, baby has blood glucose ≥ 45 x3?			
Car seat available?			

All answers should be **NO**

If any answers are **YES** or **DON'T KNOW**, refer to designated pediatric provider (MD/CNM) for disposition.

	YES	NO	DON'T KNOW
Does that baby have any risk factors for infection?			

• Maternal chorioamnionitis or endometritis, or maternal risk factors for chorio:
  • ROM ≥ 18 hrs.
  • PROM
  • GBS positive (+) with < 4hrs of antibiotics
  • Maternal history of syphilis/genital herpes/Hep B during this pregnancy			

Has the baby lost >10% of its birth weight?			
Is a car seat challenge needed (< 37wga, < 2.5kg)?			
Is CPS involved?			

TURN OVER. COMPLETE BACK.

If **ALL** above answers are in the appropriate column, baby can be discharged after RN ensures below tests are complete:

	COMPLETE?	**NOT DONE**
Have the following screening tests been done? • **Cardiac Screening** (O2 sat) • **Newborn Screen** (should be drawn on ALL patients before discharge, regardless of age)		

In a disaster:

- ALGO can be postponed and hearing screen done as outpatient
- Transcutaneous bilirubin can replace serum level and be tested any time > 12 hours
- Newborn screen can be drawn early:
  - >12 hours, test can be drawn and treated as complete
    - Admission order is for >24h, but this can be re-timed
  - <12 hours, infant should still have blood spot card completed before D/C
    - Will need to be repeated after 12 hours of life, but before 1 year.
  - Regardless, blue carbon copy form should stay with infant