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APSF Awards 2022 Grant Recipients

by Yan Xiao, PhD

The APSF grant program supports and advances anesthesia patient safety culture, knowledge, and learning, a part of the APSF mission. The program has played an essential role in establishing and enhancing careers of many in conducting safety research and education. Since 1987, the ASPF has supported 130 anesthesia professionals with more than \$13.5 million in funding.

The 2020–21 APSF investigator-initiated grant program received 28 letters of intent. The Scientific Evaluation Committee scored and discussed these letters, with the assistance of external statistical reviewers. The top four scoring letters were invited to submit full proposals for final review and were discussed via a hybrid meeting on October 9, 2020. Three proposals were recommended for funding to the APSF Executive Committee and Board of Directors, and all three received unanimous support. This year's recipients were Vesela Kovacheva, MD, PhD, from Harvard Medical School, Stephen Choi, MD, FRCPC, MSc, from the University of Toronto, and Paloma Toledo, MD, MPH, from Northwestern University. The principal investigators of this year's APSF grant provided the following descriptions of their proposed work.



Vesela Kovacheva, MD, PhD

Assistant Professor of Anesthesia, Harvard Medical School

Vesela Kovacheva's project is entitled **"Development of Novel Machine Learning Tool to Predict Risk for Severe Maternal Morbidity and Optimize Anesthesiology Resources."**

Background: The United States is the only developed country in which the rates of severe maternal morbidity have been steadily increas-

ing over the past decade—this is an important patient safety priority. Every year in the United States, more than 50,000 women experience severe maternal morbidity, and 700 women die from pregnancy-related conditions.¹ Severe maternal morbidity is highly preventable and considered a "near miss," since without timely treatment or resources it may lead to maternal death.² There are significant racial disparities in outcomes, and Black women are up to four times more likely to suffer severe maternal morbidity compared to White women.³ The risk-adjusted severe maternal morbidity rates can vary up to six times among hospitals, suggesting a large contribution of the quality of care to observed racial disparities in pregnancy-related outcomes.³ Up to 46% of Black and 33% of White maternal deaths could be prevented by improving the quality of hospital care.⁴ However, there is currently no universally utilized or validated severe maternal morbidity prediction tool in clinical obstetric practice. Machine learning tools to combine various clinical risk factors have recently become available. In addition, novel approaches, like explainable artificial intelligence are being developed to aid performance evaluation, un-biasing, and transparency of the decision-making process.

Aims: In line with the APSF goals to improve patient safety, we propose to leverage our rich patient database and computational tools to improve maternal outcomes during delivery. We will design machine learning models using approaches like regression, decision tree models, and neural networks. We will select the best performing model in all racial groups and determine the optimal conditions when anesthesiology resources should be mobilized. We will prospectively evaluate the model accuracy and determine blood product crossmatch, utilization, and staffing escalation. Our long-term goal is to develop a high-fidelity, personalized, and fair algorithm to predict the risk of severe maternal morbidity in pregnant women and support the anesthesiology provider in preparing for and managing the highest risk patients.

Implications: United States has one of the most advanced health care systems in the world, yet maternal morbidity and mortality are significantly higher than in similarly developed countries. There are significant practice variations across different states and hospital systems. Encouraging evidence-based stratification of high-risk pregnant patients is one of the two most important objectives launched by the Department of Health and Human Services to achieve the goal of 50% reduction in maternal mortality over the next 5 years.⁵ Our proposed novel tool will aid identification of

parturients at risk for adverse outcomes with the long-term goal of increasing maternal safety during delivery.

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Stephen Choi MD, FRCPC, MSc

Associate Professor, Department of Anesthesia, Sunnybrook Health Sciences Centre, University of Toronto

Dr. Choi's project is entitled **"Redesigning the surgical pathway: optimizing PReOperative assessMent in anesthesia clinic for adult surgical patients (PROMoTE)."**

Background: Globally, over 300 million surgeries are performed yearly. Risk stratification and monitoring for cardiorespiratory complications are well established to allow

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early identification and management. Unfortunately, perioperative neurocognitive disorders (PND), which include postoperative delirium (POD) and postoperative neurocognitive disorders (P-NCD) are frequently missed. Approximately 25% of patients suffer from POD and experience excess morbidity and mortality.¹ POD increases health care costs by approximately \$32.9 billion (\$44,291 per patient) annually in the United States.

Importantly, a significant proportion of POD is preventable. Several intraoperative strategies have been trialed with limited success. This includes pharmacotherapeutics, increased regional anesthesia, and anesthetic depth monitoring, each with limited success. Multimodal nonpharmacologic strategies (CHASM from Hospital Elderlife Program [HELP]) are safe and consistently demonstrate large reductions in delirium (OR 0.47).² Despite this, implementation is suboptimal, and POD remains stubbornly high, actually increasing between 2003 and 2019.³

Barriers to delirium friendly care include institutional pressure to reduce length of stay and being unaware of high-risk individuals. Among the biggest risk factors for POD is any degree of pre-existing cognitive impairment (pre-Cl). Pre-Cl is common in the surgical population (29%) and is associated with an increased risk of POD (Odds Ratio=2-3).⁴ Routine assessment for pre-Cl is rare in preoperative clinics. Indeed without systematic objective screening pre-Cl is missed. A recent study of 215 preoperative patients identified only 2 with pre-Cl during routine assessment, yet 121 had pre-Cl when screened with simple cognitive screening.⁵

Individuals at high risk for POD (pre-Cl), a common complication with major negative consequences, are not identified and are not managed with a known, safe, and effective intervention (CHASM from HELP). The perioperative team (anesthesia professionals, surgeons, nurses) are not ignorant of best practices, nonetheless implementation is sub-optimal. Importantly, awareness of high-risk status can positively impact behavior. Evidence comes from the dementia realm where knowledge of impaired cognitive status led to multiple increased interventions from health care workers including additional assessments and referral.

Aims: This project aims to reduce POD incidence and severity. By proactively identifying patients with pre-Cl, a comprehensive program can target these high-risk individuals. The program will engage patients, caregivers, perioperative physicians, and nursing/allied health staff to utilize delirium friendly practices (e.g., minimize benzodiazepines, utilize regional analgesia and anesthetic depth monitoring where possible, minimize opioids, reduce urinary catheter usage, and engage in educational sessions to reinforce CHASM). Additionally flagging high-risk individuals to all team members will promote adherence to POD friendly best practices. This comprehensive approach, from identification to collaborative care, will reduce the incidence of POD in surgical patients. This will be prospectively assessed with a two-phase, observational study (pre/post implementation).

Implications: POD continues to be a problem. It has effects on morbidity, mortality, and quality of life beyond the immediate perioperative period. A large proportion of the population presenting for surgery is elderly and will increase with demographics. Without a concerted effort to address POD, the problem will only get worse. Introducing a comprehensive program in high-risk POD patients that combines multiple aspects of POD friendly care—patient/family engagement, perioperative team awareness and application of best practices—is necessary. However, without identifying high-risk patients before the onset of POD, care that will help patients cannot be initiated. Identification will facilitate awareness and the opportunity to target those most at risk.

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Paloma Toledo, MD, MPH

Assistant Professor, Department of Anesthesiology, Northwestern University

Paloma Toledo's project is entitled “**Iron Deficiency Anemia: Developing and Implementing an Intervention to Treat this Preventable Cause of Maternal Morbidity.**”

Background: Postpartum hemorrhage (PPH) complicates 4–6% of all deliveries in the US and is a leading cause of maternal morbidity and mortality worldwide.¹ Hemorrhage-related morbidity includes blood transfusions, complications from blood transfusions, potential end-organ damage to the patient (e.g., renal injury), and loss of future fertility if a hysterectomy is performed. Poor outcomes from PPH are highly preventable and amenable to safety interventions.² This prevention is possible through patient safety interventions such as clear guidelines, readiness, and effective emergency response. To date, many efforts have been focused on improving the in-hospital management of PPH, but few have focused on identifying and addressing modifiable risk factors prior to delivery. Iron deficiency anemia (IDA) complicates greater than 20% of all pregnancies, and is easily correctable.³ Early identification and treatment of anemia may prevent or mitigate adverse outcomes, such as depression, fatigue, or the need for transfusion should an anemic woman hemorrhage.^{3,4}

Despite the frequency of iron deficiency anemia in the pregnant population, treatment protocols to guide peripartum anemia management are scarce. The American College of Obstetrician and Gynecologists recommends pregnant women be screened for IDA, but there is little guidance regarding the timing of

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From “2022 Grant Recipients,” Preceding Page this screening, and there is even less consensus on how to manage patients diagnosed with IDA (oral vs intravenous iron therapy).⁵ Oral iron therapy, while easy to administer and low-cost, is poorly tolerated due to side effects. Intravenous iron (IV) infusions are effective, and well tolerated, but have not been widely implemented in obstetric practice.

Aims: As anemic women are more likely to be harmed if they hemorrhage, it is important to identify barriers to treatment and create an anemia management algorithm. Using qualitative methodology, we will identify patient and provider awareness of the significance of maternal anemia, awareness of treatment options, and barriers to treatment. We will then convene a multidisciplinary expert panel to design a prenatal anemia management protocol and optimal workflows. We will then implement the anemia management protocol at our

institution and evaluate the proportion of women who have received treatment for their anemia, as well as measure the impact on maternal outcomes.

Implications: While postpartum hemorrhage (PPH) is not preventable, poor outcomes, particularly maternal morbidity and mortality from hemorrhage are highly preventable. Anemia is easily recognized and treated, therefore, an ideal safety intervention to improve patient outcomes. This project will improve patient safety through systems-level improvements in patient outcomes and prevention of clinical deterioration in the event of a hemorrhage. We anticipate that this protocol will be most influential in resource-limited environments, where treatment options for postpartum hemorrhage are scant and the potential for maternal harm is great.

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