

team leader effectiveness correlated with patient care ($p < 0.05$) as predicted by team leadership conceptual models. **DISCUSSION/SIGNIFICANCE OF IMPACT:** This work represents a critical step in advancing translational simulation-based research (TSR). While there are several examples of high quality translational research programs, they primarily focus on procedural tasks and do not evaluate highly complex skills such as leadership. Complex skills present significant measurement challenges because individuals and processes are interrelated, with multiple components and emergent nature of tasks and related behaviors. We provide evidence that simulation-based training of a complex skill (team leadership behavior) transfers to a complex clinical setting (emergency department) with highly variable clinical tasks (trauma resuscitations). Our novel team leadership training significantly improved overall leadership performance and partially mediated the positive effect between leadership and patient care. This represents the first rigorous, randomized, controlled trial of a leadership or teamwork-focused training that systematically evaluates the impact on process (leadership) and performance (patient care).

Commercialization/Entrepreneurship/ Regulatory Science

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Innovative 3D Printed Intravaginal Rings: Developing AnelleO PRO, the First Intravaginal Ring for Infertility

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OBJECTIVES/SPECIFIC AIMS: The study aims to develop and test a biocompatible 3D-printed IVRs for the mechanical and release properties of a model drug, β -estradiol, then translate these methods to the target drug, progesterone. The goals include demonstrating decoupling of mechanical and release properties of the rings, release profiles driven by geometry and efficacy in sheep animal models to evaluate device safety. **METHODS/STUDY POPULATION:** A novel 3D-printing platform, continuous liquid interface production (CLIP), pioneered by Carbon, enables the fabrication of complex designs on a timescale that is amenable to manufacturing. The process utilizes computational-aided design (CAD), specifying shape and geometry, which is recreated via a photopolymerization process. IVRs are fabricated with CLIP using a biocompatible resin at a rate of approximately 15 min. per ring. Rings were fabricated and assessed for the release of a model drug, β -estradiol. The process was then translated to the target drug, progesterone. Rings were evaluated for radial compression and in vitro release in simulated vaginal fluid (SVF). **RESULTS/ANTICIPATED RESULTS:** Intravaginal rings (IVRs) were designed and fabricated to be geometrically complex in an effort to control release. Ring geometry and subsequent pore size was achieved through the use of unit cells. Several design parameters were explored including unit cell type, size, and band presence in two resins of differing mechanical properties. Through design, a wide range of radial compressive properties were achieved which spanned values covered by commercially available rings. The release of β -estradiol in SVF was found to span 57 – 115 days and resulted in near or complete release of the total loaded drug. Changing the internal geometric design of the ring was found to have minimal influence on the compression properties,

thus the mechanical and release characteristics of the rings were largely decoupled. **DISCUSSION/SIGNIFICANCE OF IMPACT:** This is a novel approach to the design and fabrication of intravaginal rings for the treatment of infertility. The use of CAD and the decoupling of release from mechanical properties allows for us to move away from the one-size one-dose fits all approach to IVRs.

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The Regulatory Landscape of Products to Treat Opioid Overdose

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OBJECTIVES/SPECIFIC AIMS: Since 1971, Naloxone has been the only FDA approved opioid antagonist indicated for use after opioid overdose. New formulations of Naloxone have been introduced into the market, including an injectable, auto-injector, and nasal spray. However, Naloxone is short-acting and as such often requires multiple doses and may induce severe withdrawal symptoms. This study examines the regulatory framework to understand the evolution of products indicated to treat opioid overdose and the landscape of therapies in development. Furthermore, this study examines how the Food and Drug Administration (FDA) and other government agencies have approached the opioid crisis. **METHODS/STUDY POPULATION:** A PubMed search of “naloxone AND opioid overdose” with the filter “humans” was conducted to understand Naloxone’s regulatory framework. The term “naloxone” was searched on the Drugs@FDA: Approved Drug Products database. Additionally, “nalmefene” was searched on ClinicalTrials.gov. To examine the opioid antagonist market landscape, a PubMed search of “opioid antagonist AND opioid overdose” with the filters “humans” and “clinical trial,” and a ClinicalTrials.gov search of “opioid antagonist and opioid overdose,” were conducted. Government agency reports were reviewed and cataloged. **RESULTS/ANTICIPATED RESULTS:** Preliminary findings suggest a lack of innovation in the development of novel opioid antagonists. Most literature review findings focused on already-marketed Naloxone products, including the original injectable approved in 1971, the 2014 Evzio Auto-Injector, and the 2015 Narcan Nasal Spray (Figure 1). For example, there were 14 results yielded from the FDA approvals database, but none of these results represented a new opioid antagonist molecule. A longer-acting opioid antagonist, Nalmefene injectable, was approved in 1995 but has since been removed from the market due to low sales. Our initial ClinicalTrials.gov search using condition “opioid overdose” and other terms “opioid antagonist”, revealed no new studies being conducted on alternative opioid antagonist treatments for opioid overdose. Findings only focused on the distribution, co-dispensing, intervention, pharmacokinetics/pharmacodynamics (PK/PD) of Naloxone (Figure 2). However, a Google search yielded one new trial with an opioid antagonist by Opiant Pharmaceuticals, almost fifty years after FDA’s approval of Naloxone. A ClinicalTrials.gov search was then performed using the search term “nalmefene” to find whether Opiant Pharmaceuticals’ trial was in the ClinicalTrials.gov database. However, the Opiant trial is phase I, and as such does not require reporting on ClinicalTrials.gov. In 2017, the National Institutes of Health (NIH) launched an initiative for longer-acting opioid antagonist formulations. In 2018, Opiant Pharmaceuticals announced positive phase I results for intranasal Nalmefene. The potential return of Nalmefene in intranasal form