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Innovation per DiEM (Design in Emergency Medicine): A Longitudinal Medical School Design Co-Curriculum Led by Emergency Medicine Mentors for Real Emergency Department Issues

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**Table 1.** Curriculum overview.

Foundations EKG Curriculum Schedule		
Session	Challenge EKG #	EKG Core Content Review
1	Core 1	How to Read an EKG (NSR)
2	Core 2	Approach to Ischemia
3	EKG 1	Anterior STEMI
4	EKG 2	Posterior STEMI
5	EKG 3	Inferior STEMI, RV STEMI
6	EKG 4	LBBB/Pacer (Sgarbossa)
7	EKG 5	STEMI Mimics (Hyperkalemia, Pericarditis)
8	EKG 6	STEMI Mimics (Isolated aVR, Benign Early Repolarization)
9	Core 3	Approach to Syncope
10	EKG 7	WPW
11	EKG 8	Brugada
12	EKG 9	Long QT
13	EKG 10	PE/RV Strain/RVH
14	EKG 11	LVH/HOCM
15	Core 4	Approach to Bradyarrhythmias
16	EKG 12	2nd Degree Type II, 3rd Degree AV Block
17	Core 5	Approach to Tachyarrhythmia (Sinus Tach)
18	EKG 13	Atrial Fibrillation/Flutter with RVR
19	EKG 14	SVT
20	EKG 15	VT/VF
21	EKG 16	RBBB/LBBB
22	EKG 17	TCA Overdose
23	EKG 18	Digoxin Toxicity
24	EKG 19	Pacemaker Malfunction
25	EKG 20	Cerebral T Waves

Foundations EKG I course (previously “EKG Fundamentals”) is available as part of the Emergency Medicine Foundations curriculum. Open access to curriculum challenge and answer documents is available on the course website:  
[www.emergencymedicinefoundations.com](http://www.emergencymedicinefoundations.com)

**Table 2.** Survey data.

Learners		
Survey Item (1- Strongly Disagree, 3- Neutral, 5- Strongly Agree)	Agree or Strongly Agree	Mean
The EKG challenges are appropriate for my level of learning.	85% (46/54)	4.20
The EKG challenges are helpful for learning fundamental knowledge.	80% (43/54)	4.09
I like using the standard interpretation format for EKG challenges.	78% (42/54)	4.00
The Foundations EKG curriculum helped me interpret EKGs on shift.	70% (38/54)	3.96
Steve Smith’s Blog is beneficial for understanding key concepts for EKG challenges.	72% (39/54)	4.09
I am highly satisfied with EKG Fundamentals.	80% (43/54)	4.09
I would recommend the EKG Fundamentals curriculum to other learners.	78% (42/54)	4.07
[I am interested in] participating in an Advanced EKG curriculum targeted towards PGY2-3 learners.	80% (152/190)	4.05
Leaders		
I am highly satisfied with EKG Fundamentals.	100% (5/5)	4.80
I would recommend the EKG Fundamentals curriculum to other learners.	100% (5/5)	4.80
[Our program is interested in] participating in an Advanced EKG curriculum targeted towards PGY2-3 learners.	89% (16/18)	4.33

## 7 Innovation per DiEM (Design in Emergency Medicine): A Longitudinal Medical School Design Co-Curriculum Led by Emergency Medicine Mentors for Real Emergency Department Issues

Zhang X, Pugliese R, Hayden G, Rudner J, Rodriguez C, Lee H, Papanagnou D, Ku B, Tykocinski M, /Thomas Jefferson University, Philadelphia, Pennsylvania

**Background:** Innovations that revolutionize healthcare are typically derived from non-traditional research and collaboration from seemingly disparate disciplines. The use of design principles in tackling complex health issues is gaining significant traction. If the inclusion of design in healthcare is to become a new standard, medical education, too, must evolve to prepare future clinicians on design thinking methods.

**Educational Objectives:** 1) To introduce both medical students and EM faculty to design thinking methods; 2) To apply design thinking to address common clinical and workflow challenges that are intrinsic to the ED; 3) To create a ‘design in medicine’ curriculum that exposes clinicians to real-world design experience that can be adopted at other institutions.

**Curricular Design:** Twenty first-year medical students from the Sidney Kimmel Medical College were enrolled in eight 3-hour experiential design sessions in 2017. Student teams were matched with EM physician-mentors, acting as stakeholders and content experts in their respective academic interest (i.e. education, clinical operations, ultrasound). Didactic content includes: 1) empathy building; 2) idea generation; 3) prototyping; 4) testing; 5) the user experience; 6) service design; 7) idea presentation; and 8) business canvas planning. Teams were tasked with applying design thinking methods to specific ED problems (i.e. patient-physician identification, managing patient expectation, point-of-care ultrasound). Each team project was evaluated using the Kirkpatrick Model through self-evaluation, group presentations, essays, and project deliverables (Table 1).

**Impact/Effectiveness:** Innovation per DiEM is a unique design curriculum that focuses on EM challenges with active EM clinician mentorship. Both students and faculty mentors report new senses of accomplishment and better understanding of design through the application of novel frameworks (i.e., user/patient experience design, clinical workflow optimization). The authors plan to evaluate each project longitudinally with the long-term goal of achieving level four on the Kirkpatrick Model (i.e., organizational outcomes): 1) improved patient satisfaction; 2) decreased resource utilization; and 3) integration of a design curriculum in medical education.

**Table 1.** Applying Kirkpatrick’s Learning Evaluation to Learners on a Sample Project Challenge: “Assisting Patients with Improved Provider Identification” from “Innovation per DIEM” course. Source: Kirkpatrick Partners. (2009-2016). The Kirkpatrick Model. Retrieved November 17, 2017 from <https://www.kirkpatrickpartners.com/Our-Philosophy/The-Kirkpatrick-Model>

Sample Project Challenge:	Innovation per DIEM			
Measurement of Evaluation	Who is Evaluated?	Evaluation Description	Method/Tools	
<p><b>Empathize:</b> Patients do not recognize their providers in the Emergency Department (ED).</p> <p><b>Problem Definition:</b> How can we keep patients better informed about their providers during their ED stay?</p> <p><b>Ideate:</b> Creating a feasible interface with real-time updates on the patients’ providers during their care including their name, face, and role.</p> <p><b>Iteration and Prototyping:</b> Constructing low-technology prototype (i.e. role-playing a patient-physician scenario with polaroid photographs of providers on the wall) with formative feedback from design course faculty and members.</p> <p><b>Testing:</b> In-situ ED studies on provider recognition based on polaroid photographs of the ED providers with user-interface feedback.</p>	Level 1 – Reaction	Learner	Measuring the degree to which participant reacted to the training.	Daily evaluation Post-event evaluations
	Level 2 – Learning	Learner	Measuring the degree to which participants acquire knowledge, skills and attitude from the training.	Reflective essay of design thinking Survey of self-perceived skills Oral presentation
	Level 3 – Behavior	Learner	Measuring the degree to which learners apply what they learn	Longitudinal post-course survey for utilizing design thinking in clinical environment.
	Level 4 – Results	Learner & Patient	Measuring the effect of the targeted project outcomes on healthcare delivery	Patient satisfaction survey (i.e., Press Ganey) Staff satisfaction survey (i.e., AHRQ Patient Safety Survey) Learner-based reflective surveys for future design projects

represent the space occupied by the corpus cavernosi. Once cured, the penises were removed and the dowels were extracted. The corpus cavernosi were made from balloons with tubing from posterior nasal packing that was inserted and tied shut. These balloons were inserted into the spaces left by the wooden dowels. Priapism was replicated by insufflating “blood” (water/corn starch/red food coloring mixture) from a syringe through the tubing. This is then detumesced via manual needle aspiration after a penile nerve block has been performed.

**Impact/Effectiveness:** Currently, there is a lack of readily available task trainers for male urologic emergency procedures. For the cost of less than \$15 per model, our device provides a surprisingly realistic trainer for these rare procedures. Each model is reusable, as only the “corpus cavernosi” balloons need to be replaced per learner. Additionally, each one can be used for myriad urologic procedures.

## 8 Low-cost Priapism Model for Emergency Medicine Simulation: Detumescence Using Intracavernosal Suction (DICS)

*Fritzges J, Nguyen M, Elliott N, /Lehigh Valley Health Network, Bethlehem, Pennsylvania*

**Background:** Priapism is a relatively uncommon ED complaint. However, it is imperative for an ED physician to know how to rapidly relieve this painful threat to male genitourinary health. Providers must ask personal, and sometimes uncomfortable, questions to their patients to determine the etiology (low-flow vs high flow) and then conduct the proper procedure. Having familiarity with the steps involved and practicing the procedure in a simulated environment aids future providers when they will one day be tasked with treating a priapism without immediate urologic backup.

**Educational Objectives:** To construct a low-cost, realistic model of a human penis that can be used in emergency medicine simulation to teach residents penile nerve blocks, priapism cavernosal aspiration, and other minor procedures (i.e.: zipper entrapment).

**Curricular Design:** Plaster of Paris molds were made using a commercially available phallic model. Flexible silicone was dyed with flesh-colored pigment and poured into the molds. Two wooden dowels were inserted to

