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TexMed 2017 Clinical Abstract

Please complete all of the following sections and include supporting charts and graphs in this document. Submit a total of two documents - this document and the Biographical Data and Disclosure Form to posters@texmed.org by midnight March 17, 2017.

Procedure and Selection Criteria

- Submissions not directly related to quality improvement or research may be accepted and should follow the standardized format outlined below. Content should enhance knowledge in the field of clinical care and be relevant to a given patient population.

PROJECT NAME: Virtual simulation improves a novice's ability to localize renal tumors in 3D physical models – a multi-institutional prospective randomized controlled study

Institution or Practice Name: Baylor College of Medicine

Setting of Care: Inpatient, surgery

Primary Author: Young Min Moon

Secondary Author: Rai, Arun

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Yadav, Naveen
Link, Richard

Is the Primary Author, Secondary Author or Member of Project Team a TMA member (required)?
☒ Yes ☐ No
Please provide name(s) and their role in the project:
TMA Member Name:
Young Min Moon – participated in experimental design and data collection

TexMed Poster Session Specialty Subject Area: Please check if these apply.
☐ **Enhanced Perioperative Recovery**
☐ **Disaster Medicine and Emergency Preparedness**

Clinical

Background (15 points max): *Describe the purpose for sharing the content. What caused this subject matter to be approached? Why is this content important to share? What is the potential impact if this content is not shared?*

Robotic-assisted laparoscopic partial nephrectomy requires excellent visuospatial understanding of tumor location and orientation. We sought to improve trainee ability to identify tumor location using a patient-specific 3-Dimensional reconstruction in the dV-Trainer simulation environment.

Intended Stakeholders (15 points max): *Identify those individuals, organizations, or interest groups that could be potentially impacted by this information or benefit by obtaining this information.*

Translating standard imaging into a reliable 3D mental model for optimal surgical outcome is challenging, especially for trainees. The research on whether robotic virtual simulator improves identification of tumor location in 3D space is useful for any institutions with surgical trainees in determining if robotic virtual simulator should be a part of surgical training.

Description of Accomplished Work (25 points max): *Provide an overview of the work that was accomplished, including any specific methods, tools or techniques. Also, include any milestones or key accomplishments. Note charts, graphs and tables here and send as addendum with abstract form.*

Medical students were recruited from Baylor College of Medicine and McGovern Medical School (Houston, TX). We generated 3-Dimensional reconstructions of 3 previous partial nephrectomy cases using a novel edge-detection algorithm. Reconstructions were ported into the dV-Trainer. Tumor location was altered digitally to generate 9 models for each case, 1 with the correct tumor location and 8 with sham locations and 3-Dimensionally printed. Subjects were randomized 1:1 into the dV-Trainer (intervention) and No-dV-Trainer (control) groups. Each subject completed the following steps: (1) visualization of computed-tomographic images, (2) visualization of the reconstructed kidney and tumor in the dV-Trainer (intervention group only), (3) selection of the correct tumor location on the 3-Dimensionally printed models (primary outcome). Normalized distances from the correct tumor location were compared between groups.

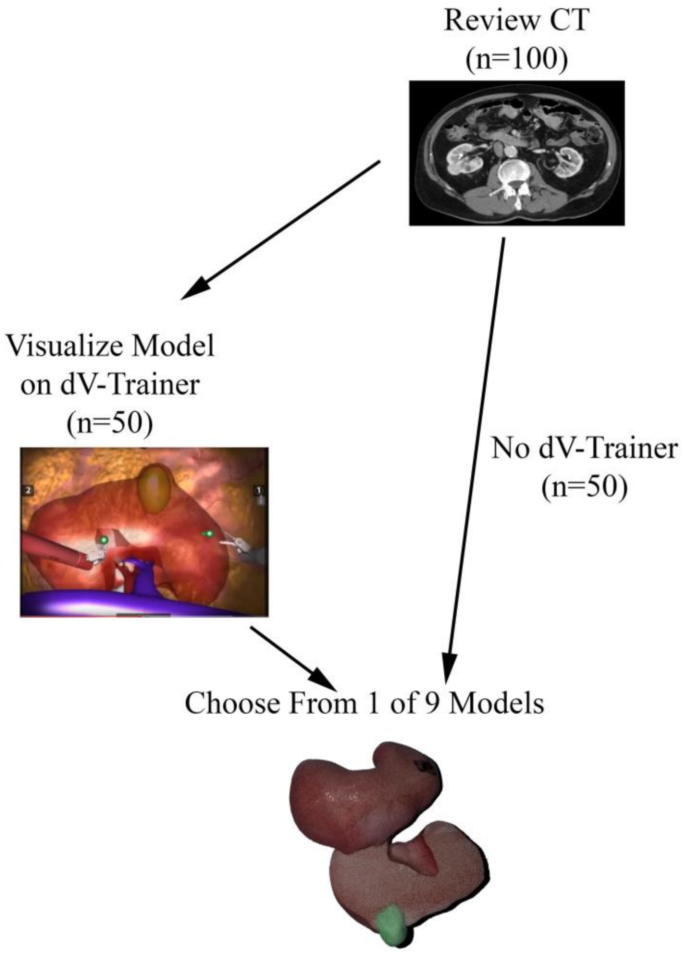
100 subjects participated in the study (n=50 each arm). dV-Trainer use improved tumor localization (Tumor Localization Score: 0.24 vs. 0.38, $p<0.001$). However, subjects in the No-dV-Trainer group more accurately assigned R.E.N.A.L. Nephrometry score (Components correct: 56% vs. 63%, $p=0.02$). Univariate analysis only identified that dV-Trainer use was associated with improved tumor localization ($p<0.001$).

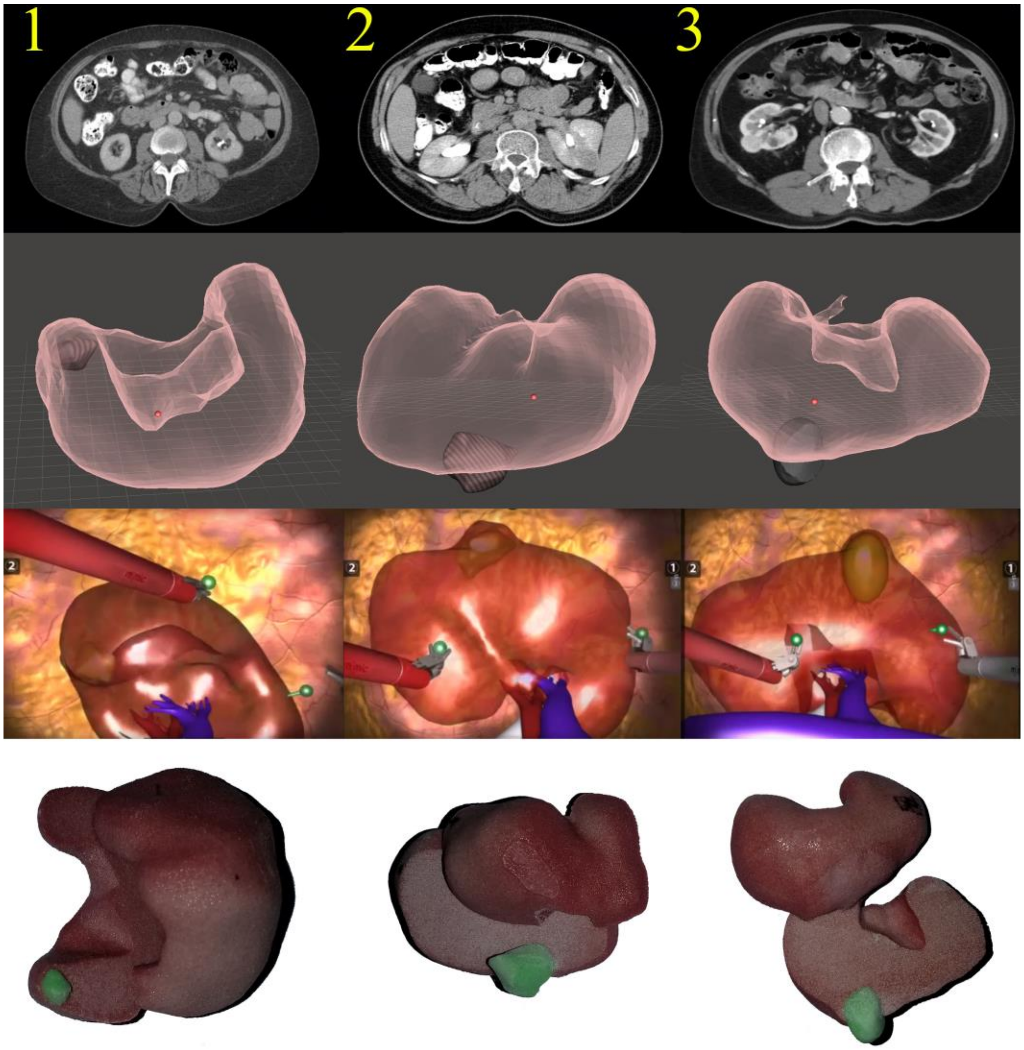
Timeframe and Budget (20 points max): *Provide the start and end dates for the work along with any financial implications that were incurred due to the work accomplished. Note charts, graphs and tables here and send as addendum with abstract form.*

Data was collected starting September 2016, and ending December 2016. Research reported in this publication was supported by the National Institute of General Medical Sciences of the National Institutes of Health under Award Number T32GM088129. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health.

Intended Use (25 points max): *Describe how this information could be used moving forward to impact patient care.*

In this prospective randomized trial, exposure to a patient-specific virtual model improves the novice ability to accurately visualize tumor location when compared to interpreting standard planar CT images alone. This workflow, including our novel reconstruction algorithm, provides a streamlined method for generating patient-specific kidney anatomic simulations which may be valuable for teaching surgical trainees and visualizing complex tumor cases before surgery.


Review CT
(n=100)
Visualize Model
on dV-Trainer
(n=50)
No dV-Trainer
(n=50)
Choose From 1 of 9 Models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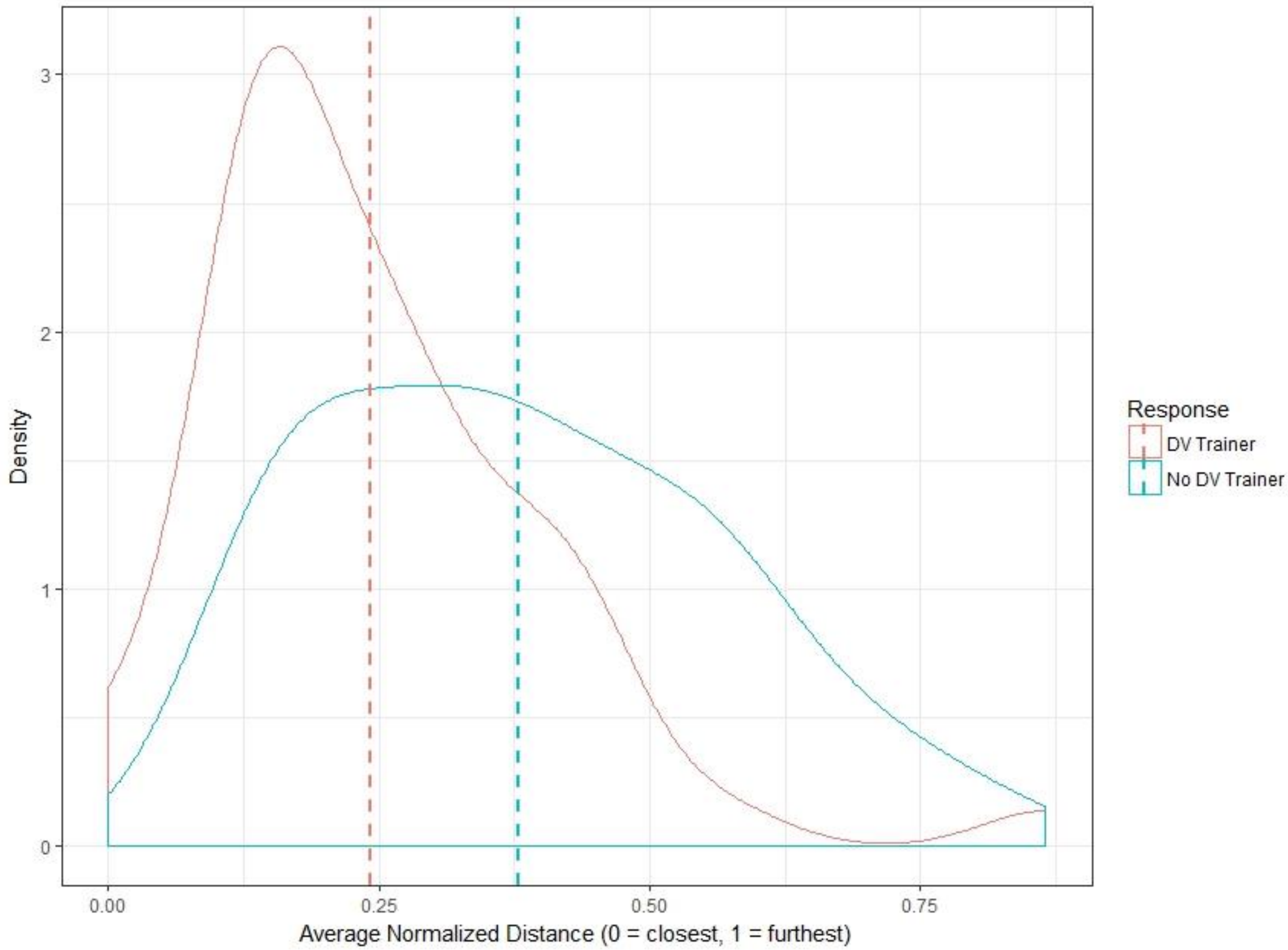

Table 1. *Participant demographics*

		No dV-Trainer	dv-Trainer	P value
No. participants		50	50	
Age		23.5 (1.9)	23.8 (2.5)	0.528
MS Year				0.600
	MS1	24 (48)	20 (40)	
	MS2	19 (38)	21 (42)	
	MS3	5 (10)	4 (8)	
	MS4	2 (4)	5 (10)	
Future Specialty				0.604
	Surgical	26 (52)	29 (58)	
	Non-Surgical	1 (2)	2 (4)	
	Undecided	23 (46)	19 (38)	
dv-Trainer Warm-Up				
	Targeting	929 (231)	922 (222)	0.887
	Pick and Place	651 (220)	727 (265)	0.120
3-Dimensional Aptitude Score (0 to 1; 1 is best)		0.87 (0.18)	0.83 (0.20)	0.225

All data presented as means (st. dev) or # per group (%)

Table 2. *Model Performance*

		No dV-Trainer	dV-Trainer	P value
All Models				
	Distance Score	0.38 (0.35)	0.24 (0.29)	<0.001
	Diameter (R.)	136 (90.7)	117 (78)	0.004
	Endophytic/Exophytic (E.)	80 (53.3)	54 (36)	0.004
	Nearness to Collecting System (N.)	20 (13.3)	20 (13.3)	1.000
	Anterior/Posterior (A.)	130 (86.7)	103 (68.7)	<0.001
	Location Relative to Polar Lines (L.)	71 (47.3)	102 (68)	<0.001
Model 1				
	Distance Score	0.49 (0.32)	0.44 (0.26)	0.431
	Diameter (R.)	47 (94)	46 (92)	1.000
	Endophytic/Exophytic (E.)	23 (46)	9 (18)	0.005
	Nearness to Collecting System (N.)	5 (10)	6 (12)	1.000
	Anterior/Posterior (A.)	45 (90)	32 (64)	0.004
	Location Relative to Polar Lines (L.)	30 (60)	42 (84)	0.014
Model 2				
	Distance Score	0.31 (0.31)	0.17 (0.23)	0.012
	Diameter (R.)	40 (80)	35 (70)	0.356
	Endophytic/Exophytic (E.)	14 (28)	15 (30)	1.000
	Nearness to Collecting System (N.)	8 (16)	6 (12)	0.774
	Anterior/Posterior (A.)	45 (90)	35 (70)	0.023
	Location Relative to Polar Lines (L.)	20 (40)	29 (58)	0.072
Model 3				
	Distance Score	0.34 (0.39)	0.12 (0.28)	0.001
	Diameter (R.)	49 (98)	36 (72)	<0.001
	Endophytic/Exophytic (E.)	43 (86)	30 (60)	0.006
	Nearness to Collecting System (N.)	7 (14)	8 (16)	1.000
	Anterior/Posterior (A.)	40 (80)	36 (72)	0.483
	Location Relative to Polar Lines (L.)	21 (42)	31 (62)	0.045

All data presented as means (st. dev) or # correct (%)

Table 3. *Univariate Analysis of Factors Associated With Correct Tumor Localization*

		β	95% CI	P value
Age		-0.004	-0.020, 0.013	0.657
3D Aptitude Score		0.007	-0.182, 0.195	0.946
dV-Trainer Targeting Score		0.000	0.000, 0,000	0.626
dV-Trainer Pick and Place Score		0.000	0.000, '0.000	0.358
RENAL Nephrometry Score		0.012	-0.110, 0.035	0.323
MS Year (ref: MS1)				
	MS2	-0.019	-0.097, 0.59	0.635
	MS3	0.046	-0.084, 0.177	0.487
	MS4	-0.071	-0.216, 0.074	0.335
Desired Specialty (ref: Non-Surgical)				
	Surgical	0.037	-0.172, 0.247	0.726
	Undecided	0.105	-0.106, 0.316	0.327
dV-Trainer (ref: No dV-Trainer)		0.137	0.070, 0.203	<0.001

Total tumor localization score as the dependent variable