Training and Assessing Communication Skills Using Virtual Human Technology: A Mixed Methods Investigation

Timothy C. Guetterman, PhD
tguetter@umich.edu

MEDICAL SCHOOL
UNIVERSITY OF MICHIGAN

Acknowledgment and Funding

Collaborators

- Michael D. Fetters
- Mas Jimbo
- Pedja Klasnja
- Larry An
- Rich Gonzalez
- Erika Rosenberg, UC Berkley/Consultancy
- Fredrick W. Kron, MCI
- Mark W. Scerbo, Old Dominion University

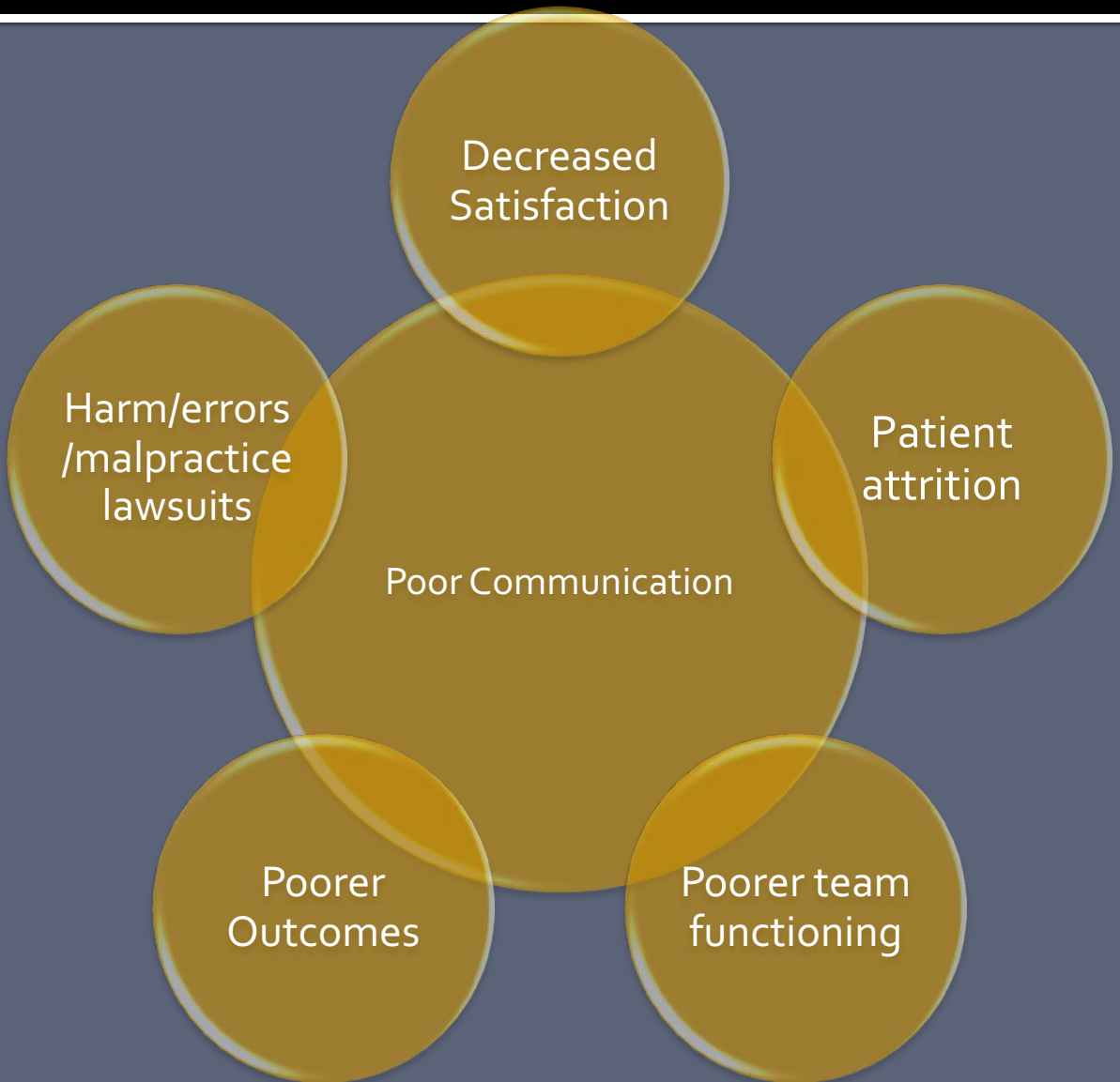
Funding

- 1-K01-LM-012739, NIH/NLM, Guetterman (PI), *Enhancing Verbal and Nonverbal Communication through Virtual Human Technology*

Outline of Talk

- Background - communication training with MPathic-VR
- Mixed Methods Randomized Controlled Trial
- Current research in progress

Communication Implications

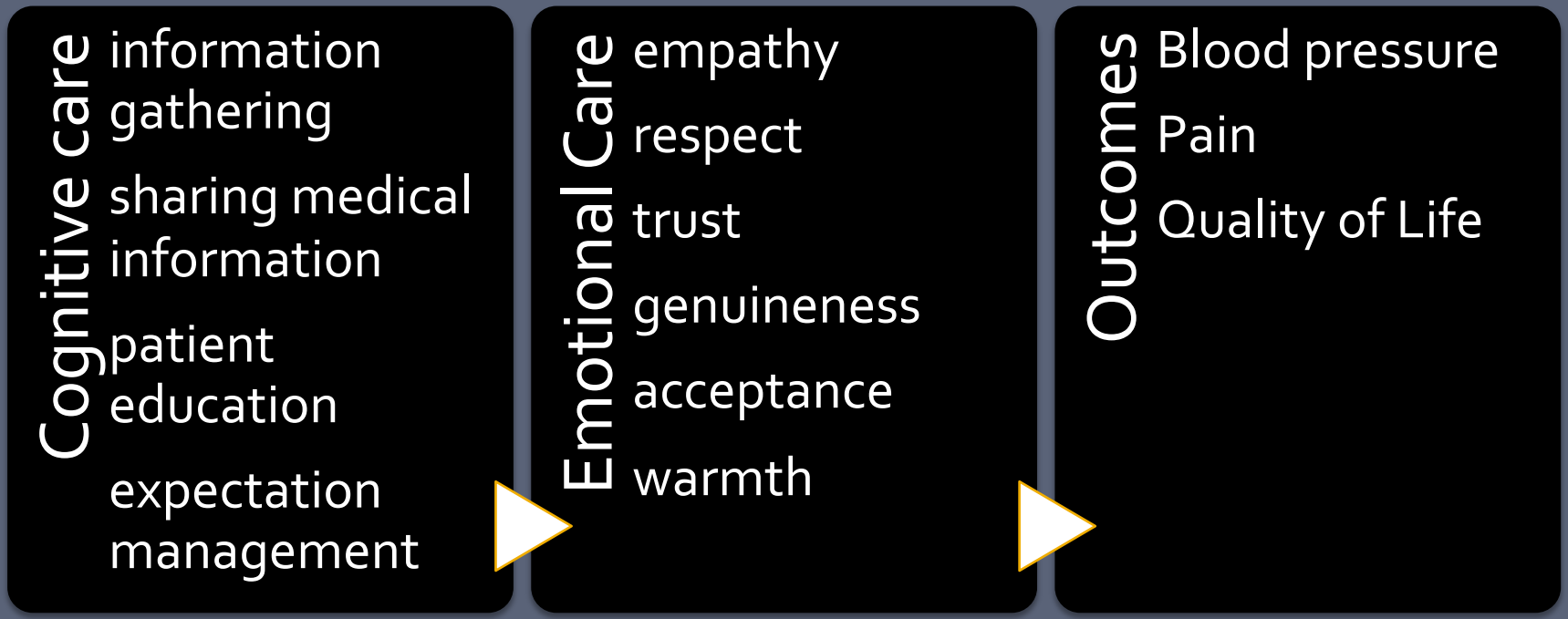


Can the provider-patient relationship influence outcomes?

- Yes

In what ways might the relationship influence patient outcomes?

- Emotional care
- Cognitive care



Communication Training

- Under-addressed in medical training
- Need experiential learning and practice
- Teach techniques
- Standardized patient instructors

Breaking Bad News - SPIKES

- S—SETTING UP THE INTERVIEW
- P—ASSESSING THE PATIENT'S PERCEPTION
- I—OBTAINING THE PATIENT'S INVIT A TION
- K—GIVING KNOWLEDGE AND INFORMATION TO THE PATIENT
- E—ADDRESSING THE PATIENT'S EMOTIONS WITH EMP A THIC RESPONSES
- S—STRATEGY AND SUMMARY

Teaching Empathy Skills

- Reflective listening
- Empathy enhancers
- Avoiding empathy blockers
- Appropriate use of facial expression (i.e., brow raises, smiles)
- Appropriate body language (i.e., nodding, body lean)

Nonverbal Communication

- Mehrabian and Ferris reported only 7% of emotional communication is conveyed verbally; 38% is conveyed by voice tone and inflections, and 55% is transferred by facial expressions

What are virtual humans?

- Intelligent virtual agent
- Simulate human behavior and appearance using computer technology
- Design with the capability to present humanlike behavior for **interaction**

Why Virtual Humans

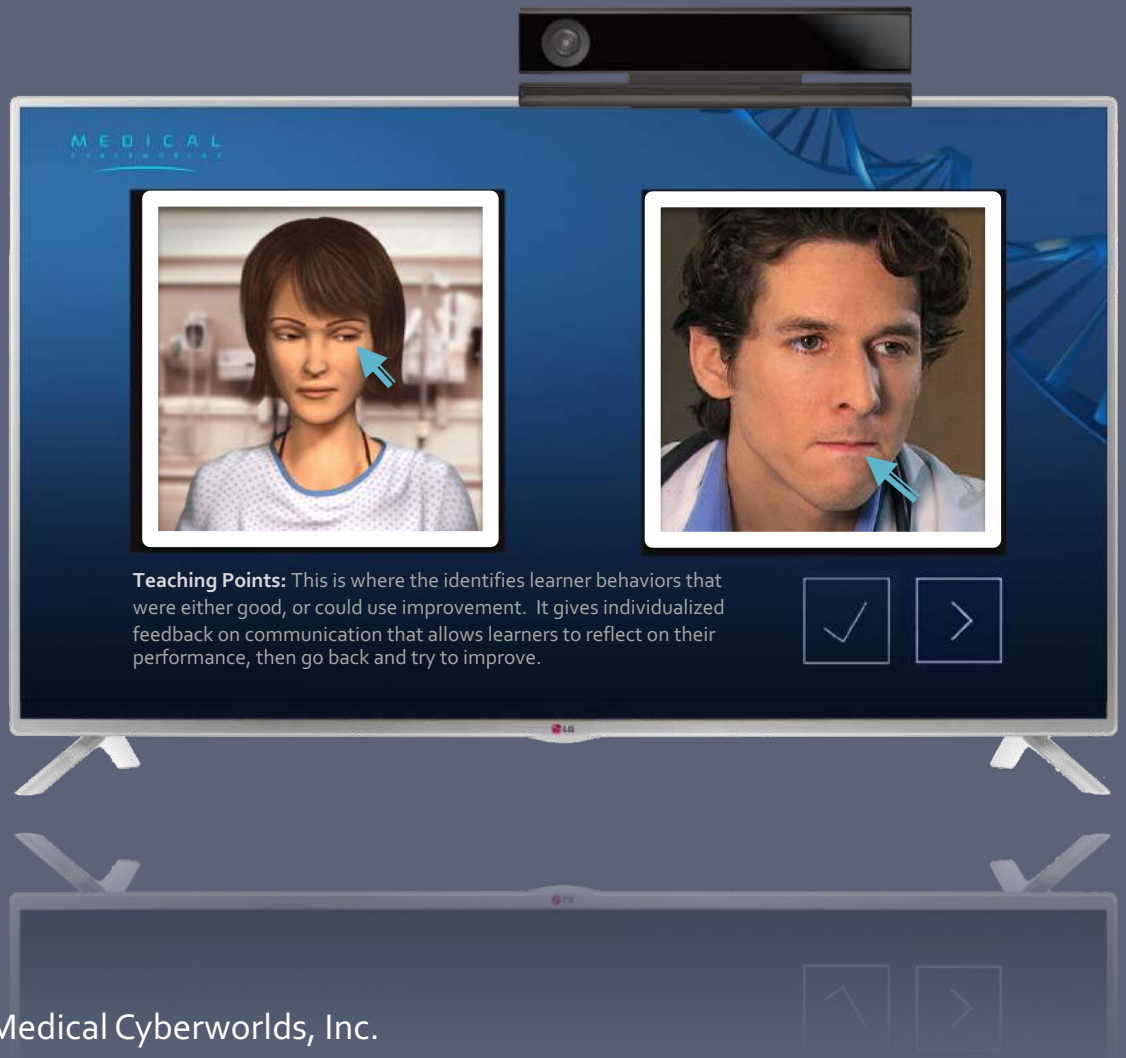
- Cost savings
- Reliability
- Interactive
- Enhanced motivation to learn

Modeling Professional Attitudes and Teaching Humanistic Communication in VR (MPathic-VR)

- Goal: Understand how new media can be used to develop a breaking bad news prototype featuring a one-on-one interaction with a virtual human patient

NIH 3R03LM010052-0151, Kron FW, Fetters MD (Co-Pis)

Technology to Provide Communication Training: MPathic-VR



Used with Permission of Medical Cyberworlds, Inc.

M-Pathic VR Experience

- The learner
  - wears headphones with microphone,
  - clicks on MPathic Icon,
  - selects gender for voice recognition profile
- For each scenario, the learner
  - chooses from three choices that are spoken into the microphone
  - options include bad, better, best with different point values for each

M-Pathic VR Experience

- Robin presents with unstoppable nose bleed
- Her labs demonstrate she has a severe form of leukemia
- Player discloses to Robin she has cancer.

She flares with disbelief and anger……

Communication skills

- Breaking bad news and intercultural communication

- Provider-provider tension

Screenshots with Permission of Medical Cyberworlds, Inc.

Computer-Based Module Control

Standardized communication for health professionals

Target audience:
MDs, RNs, PAs, Medical students

Prepared by:
Jennifer Hall with Rebecca Hill and Jeff Young, University of Virginia (UVA) Hospital Safety;
Jennifer Stojan, University of Michigan;
Revised for MPATHIC VR II by Daniel Becker UVA

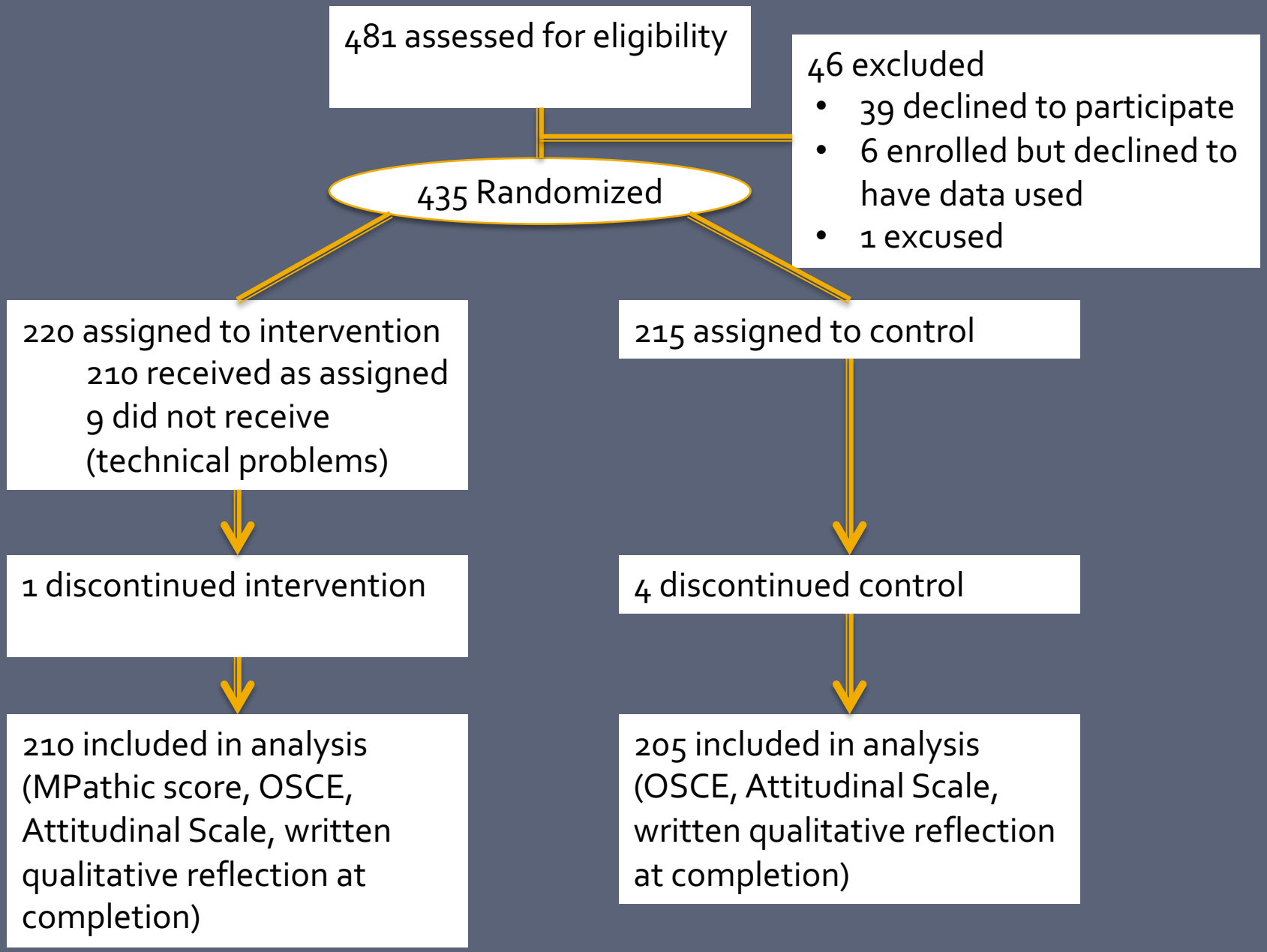
Situation
A concise statement of the problem
Background
Pertinent and brief information related to the situation (context)
Assessment
Analysis and consideration of options for managing the situation (what you think)
Recommendations
Action requested (what you want)

Screenshots with Permission of Medical Cyberworlds, Inc.

Why Use SBAR?

- Consistent communication between caregivers = safe and effective care of patients
- The Joint Commission has added "standardized communication" to the Patient Safety Goals & recommends SBAR as a best practice.
- SBAR provides a framework for communication between members of the health care team concerning a patient's condition.
- SBAR follows a scripted, focused process to identify what information will be communicated between members of the team; essential for developing teamwork & fostering a culture of patient safety.
- Most medical errors can be traced to communication issues.
- Experience & stress level can affect our ability to effectively communicate.

Study Recruitment



Data Sources

- Attitudinal Scale
- Qualitative written reflections and observations
- MPathic-VR game score
- Objective Structured Clinical Examination with Standardized Patient Instructor
- **Video recordings of interaction**
- **Kinect sensor nonverbal data**

Results

QUANTITATIVE

- MPathic score improved pre-post, intercultural and inter-professional scenarios (p<.001)

MPathic Score

- A lower score in MPathic-VR reflects better performance-less optimal choices were penalized with higher values
- Best of the three options scored 0 points; two suboptimal options had higher point values
- Intercultural scenario included 16 exchanges (0 to 29 points)
- Inter-professional scenario had 13 exchanges (0 to 25 points)

Results

QUANTITATIVE

- OSCE Composite Score between groups better for MPathic (p=.01)

OSCE

- SPIs blinded to the trial
- Evaluated each student's performance (intervention and control arms) using a 5-point grading format
- Four domains: openness/defensiveness, collaborative/competitive, nonverbal communication, and presence (awareness of others)
- α = 0.82.

Results

QUANTITATIVE

- Student attitudes scale more positive for MPathic (*p*<.001)

Attitudinal Scale

- 12 items
- 7-point Likert-type
- Four domains: clarity, purpose, utility, and likelihood to recommend the learning experience
- α = .95

Results

QUALITATIVE

- Verbal communication
- Nonverbal communication
- Engagement of training
- Supplemental training
- Immediate feedback

Written Reflection

- "Reflect on how you think this learning experience in advanced communication skills could be improved"
- "Reflect about the three most important things you learned from this interaction."
- "Reflect on how interacting with the system has influenced your understanding about nonverbal communication."

Side-by-side Joint Display of Attitudes with Qualitative Reflections on Experience with Intervention

Domain	Intervention		Control		MM Inference
	MPathic-VR		CBL		
Domain	Attitudinal Item Mean (SD)	Qualitative Reflection Illustrative Quotes	Attitudinal Item Mean (SD)	Qualitative Reflection Illustrative Quotes	Interpretation of mixed methods findings
Verbal Communication	4.11 (1.85)	"How to introduce myself without making assumptions about the cultural background of the patient and the family"	2.77 (1.45)	"This educational module was useful for clarifying the use of SBAR and addressing ways that all members of a health care team can improve patient care through better communication skills"	Intervention arm comments suggest deeper understanding of the content than teaching using memorization and mnemonics as in the control, a difference confirmed by higher attitudinal scores.
Nonverbal Communication	5.13 (1.48)	"Effective communication involves non-verbal facial expression like smiling and head nodding"	2.34 (1.35)	None	Intervention arm comments address the value of learning non-verbal communication, the difference confirmed by attitudinal scores.
Training was engaging	5.43 (1.55)	"Reviewing the video review was a great way to see my facial expressions and it allowed me to improve on these skills the second time around"	3.69 (1.62)	"This experience can be improved by incorporating more active participation. For example, there could have been a scenario in which we would have to select the appropriate hand-off information per SBAR guideline"	Intervention arm comments reflect engagement through the after action review while the control comments suggested the need for interaction, the difference confirmed by higher attitudinal scores.

Statistics-by-themes Joint Display of Communication Skill Scores with Themes of the Experience for the Mpathic-VR intervention group

Theme

Quan data -categorized

	OSCE Advanced Communication Assessment		
Themes	Low (<.55)	Medium (.54 - .98)	High (>.98)
Useful communication skills	N/A	"Effective communication both verbal and non verbal will be essential in getting the best care for patients"	"Useful in making sure I used inclusive language and was sensitive to the feelings of others" "I vs. we…"
Remembering nonverbals	"Smiling and nodding is also important" (6%)	"Body language is super important in establishing relationships with patients and colleagues"(65%)	"Helped teach [illegible] to read facial expressions from people such as when the nurse was upset"
Motivated to learn more	N/A	N/A	"It would be interesting to go through other scenarios, and to see if this actually has a positive effect on my future interactions with patients"
Prefer humans	"hard to engage in non-verbal communication when you know you are just talking at a computer"	"think that training for communication with patients is better done with live patients"	"true response can only come from human to human interaction…program is much stronger at allowing a person to think about their verbal responses"
"Too repetitive"	"I mostly just got annoyed"	"Repeating was boring…I would have asked clarifying questions that weren't listed."	N/A
Doubting nonverbal	"I was really annoyed when I had to redo one module because I didn't smile at a computer image or "raise my eyebrows." In theory, I feel like this exercise would be fine, but not in practice"	"'non-verbal' advice was probably less helpful. It is hard to get fully emotionally engaged with a module the same way one would with a real person"	N/A

What we learned

- Evidence of effectiveness
  - Scores improved
  - Retention of skills a week later
- Interactive learning preferred
- Repeating VH scenario yielded improvement
- VH allows standardized experience

Virtual Humans for Assessment

- MPathic for competency assessment in breaking bad news (BBN)
- Initial construct validity evidence
- Group A
  - MPathic pre → BBN seminar → MPathic post
- Group B
  - BBN Seminar → MPathic post

Construct Validity Evidence

- No evidence of pretest sensitization
- VH detected pre-post seminar differences in communication skills
- Postseminar only comparison not significantly different

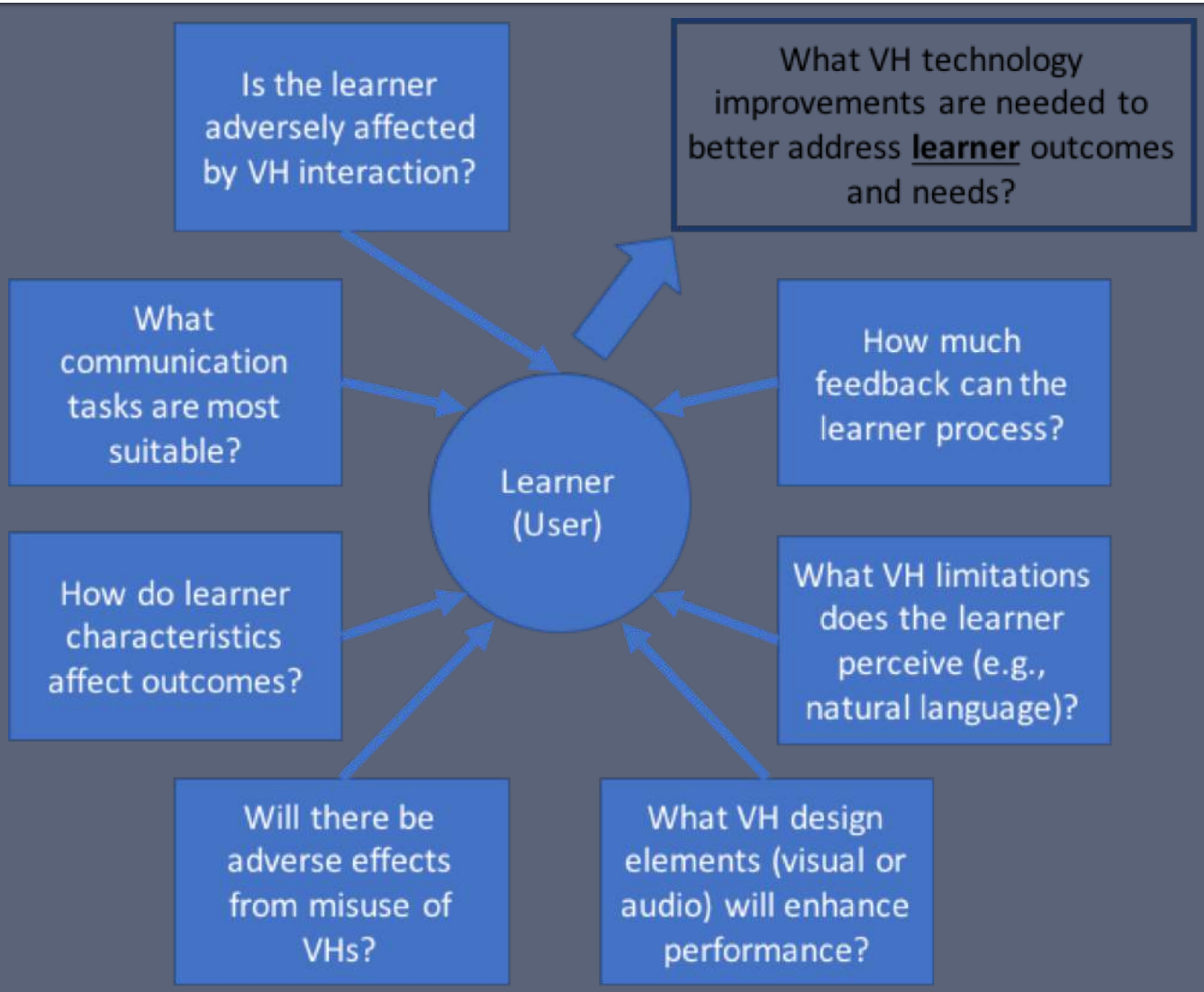
K01 Specific Aims

Aim 1: To better understand the mediating influence of nonverbal communication from a virtual human simulation program on providers' empathic and conflict-resolution skills.

Aim 2: To develop a new conceptual model of nonverbal communication to inform virtual human-based training.

Aim 3: To develop new nonverbal functionality into the MPathic-VR virtual human simulation by creating an automated nonverbal communication behavior assessment for healthcare providers.

Conceptual Model: Human factors in virtual human environments



Conceptual Model of Core Functions of Patient-Clinician Communication. Adapted from Epstein & Street (36)

Aim 1

- To better understand the mediating influence of nonverbal communication from a virtual human simulation program on providers' empathic and conflict-resolution skills.
  - Did the learner follow instructions for nonverbal behavior?
  - If the learner demonstrates nonverbal behavior through the scenario, do the assessments detect it?

Aim 1 Data Sources

- Unanalyzed data from MPathic-VR intervention arm (n=210)
  - Video recording MP4 files for four interactions
  - MPathic-VR scores (continuous data)
  - Warehouse of nonverbal sensor data (binary data) from Microsoft Kinect sensor for four nonverbal behaviors: nodding, shaking head, smiles, proximity
- OSCE performance scores (5-point rating for four domains and a continuous global score)
- Qualitative written reflections from the medical students

Aim 1 Data Analysis

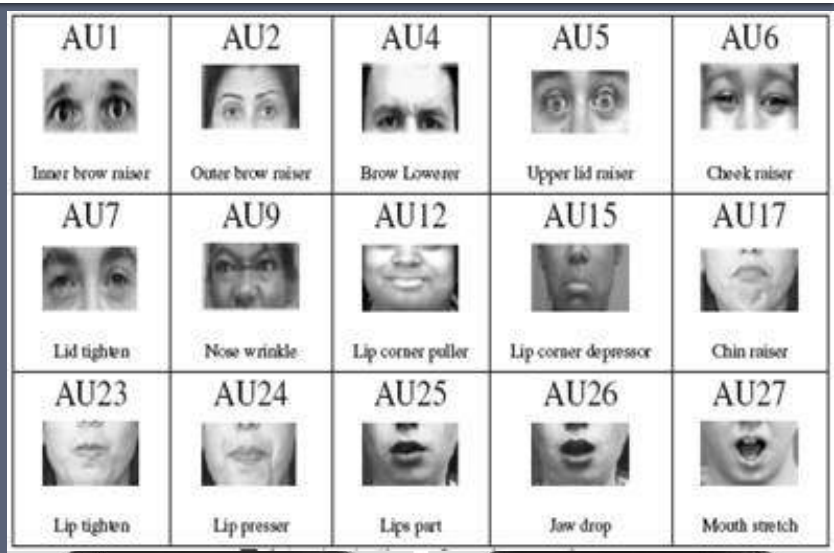
- Code instances of nonverbal behavior displayed by the learner and the virtual human
- Dyadic data analyses to examine the extent to which the learner mirrored the behavior of the virtual humans
- Code the interactions using the FACS and other coding systems
- Test the relationship between the learner nonverbal behavior and assessment scores using SEM
- Merging with qualitative data to understand mechanisms of nonverbal behavior related to OSCE outcomes

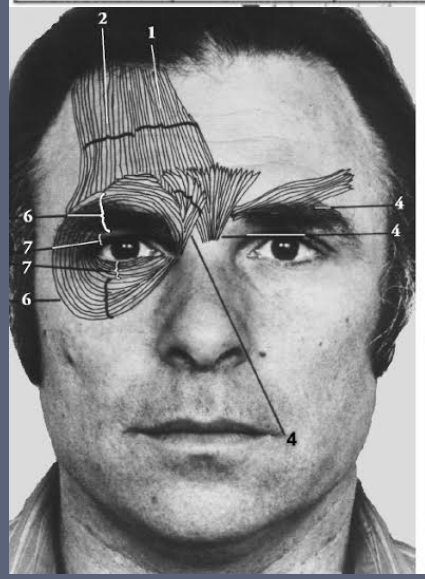
Systematic Review of Nonverbal Communication and Patient Satisfaction

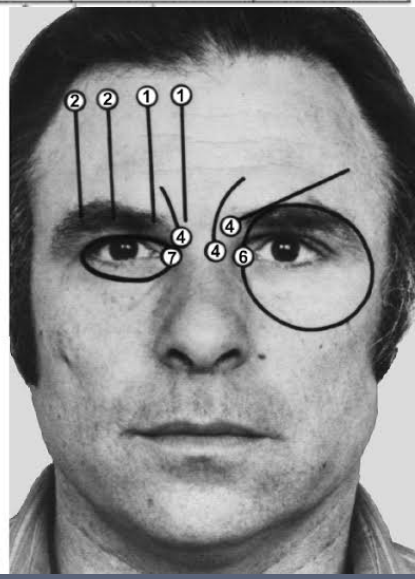
- Correlation between global nonverbal communication (global affect, warmth, negativity, listening) and patient satisfaction
- Less evidence for facial expression, gaze or eye contact, touch, laughter, ratings of voice tone, and body language and gestures
- Problems with research:
  - "Associations between outcomes and facial expressions (which are largely outside of conscious control) [66], are particularly susceptible to mutual influence between clinician and patient"

Facial Action Coding System

- Nonverbal communication
  - Mediator?
  - Automate feedback
  - Nonverbal behavior of providers
  - Reading nonverbal behavior among patients
- Model of nonverbal communication







Aim 2

- **To develop a new conceptual model of nonverbal communication to inform virtual human-based training**
  - Grounded theory study with providers about perspectives combined with Aim 1
  - Corbin and Strauss' constant comparative method([73]), including open and focused coding for the purpose of developing a theory of the process of patient-provider nonverbal communication
  - Model will provide a theoretical basis for the subsequent automated nonverbal communication behavior assessment

Aim 3

- **To develop new nonverbal functionality into the MPathic-VR virtual human simulation by creating an automated nonverbal communication behavior assessment for healthcare providers.**
  - Programming the software to: 1) identify nonverbal actions, and 2) categorize each as helpful or not
  - Building and testing a novel automated nonverbal communication behavior assessment
  - Compare coding with OSCE nonverbal behavior ratings to gather evidence of construct validity
  - Prospective quality control check

Future Directions for VH Research

- More difficult conversations (palliative care)
- Longer term change
- Patient outcomes/satisfaction

Potential Applications

- Training difficult conversations
- Training for counselors
- Focusing on nonverbal cues
- Training patients to talk with providers
- Better understanding two-way communication

Training and Assessing Communication Skills Using Virtual Human Technology: A Mixed Methods Investigation

Timothy C. Guetterman, PhD
tguetter@umich.edu

MEDICAL SCHOOL
UNIVERSITY OF MICHIGAN