Evolution of TeleRehabilitation for Rural Veterans

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Then, Now, Next

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Point of View

- PMRS Chief
  - Leader of the mTBI team
- Director of clinical telerehabilitation programs
  - Low ADL Monitoring Program (LAMP)
  - Rural Veterans Tele Rehabilitation Initiative (RVTRI
- Associate Director of CINDRR
- RRD Investigator
  - Virtual Environments for Therapeutic Solutions

Telehealth assumptions:

- Care that involves distant talking heads usually can be performed successfully by televideo
- With adequate IT infrastructure, talking head care can be exported from the medical center to the community clinic.
- These interactions often require a health care facilitator and occasionally specialized equipment.

How is Rehabilitation Different?

- Rehabilitation often requires
  - Active participation
  - Physical Exercise
  - Home Practice

Text-based systems (c., 2002)

- Office of Telehealth Service
  - Care Coordination/Home Telehealth (CCHT) Programs
  - *Disease Management Protocols* on commercial home messaging devices.
    - Standardized but not personalized.

Text Based TeleRehabilitation:

Low ADL Monitoring Program (LAMP)

- 2002 VISN-8 Community Care Coordination Service (CCCS) 2 year clinical demonstration project
  - 2004: NF/SG VHS funded PM&RS Telerehabilitation Care Coordination Home Telehealth program
- Based on work of William Mann, et al.
  - Functional decline in elders may be attenuated through the provision of assistive technology and adaptive equipment (W.C. Mann *et al*., 1995; W.C. Mann *et al*., 2001; W.C. Mann *et al*., 1999)

Purpose and practice

- To preserve home independence for frail elders
- Home Assessment,and equipment provision.
- Daily remote monitoring of health and functional status via home massing device or computer, phone or tablet
- Encourage self-management of chronic illnesses
- Referrals for additional VA and community services
- Continuous care coordination and support

Bathroom Modifications

Exterior Modifications

Tech Options

Home Messaging Device Interface

- VA Provided
- Low –Tech (POTS)
- Closed Disease Management Protocols with branching tree logic questions – no variability
- One way prescribed communication

Web-enabled Interface (Computer, tablet, phone)

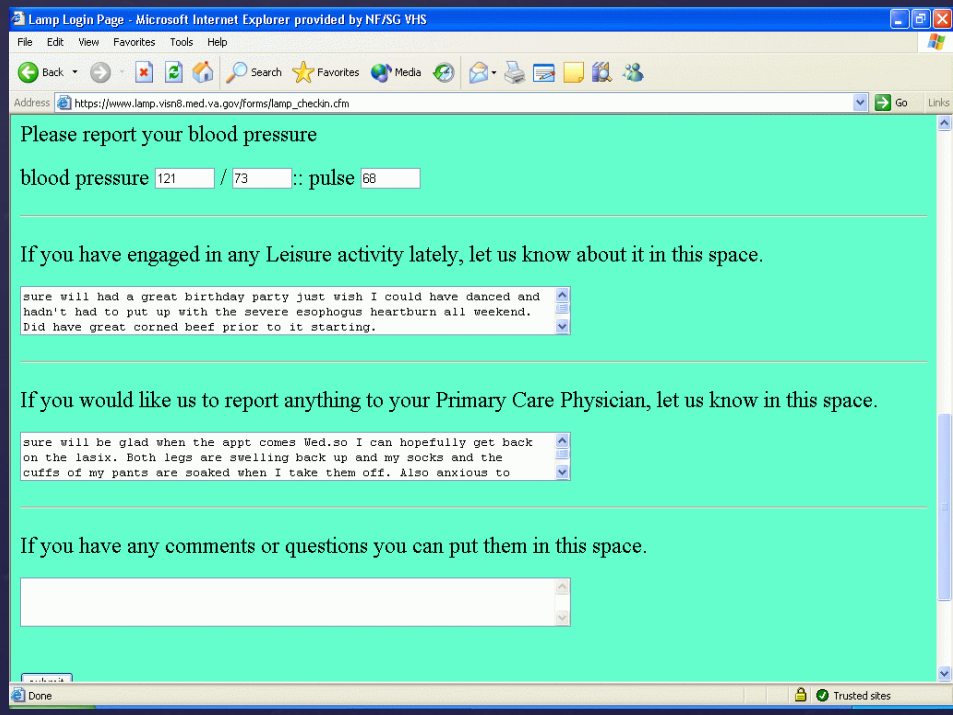
- VA and Veteran provided
- Higher tech (internet connection)
- Veterans log in through secure URL
- Flexible DMP with two way text communication

Remote Monitoring Technology

- Health Buddy
  - Messaging and monitoring device

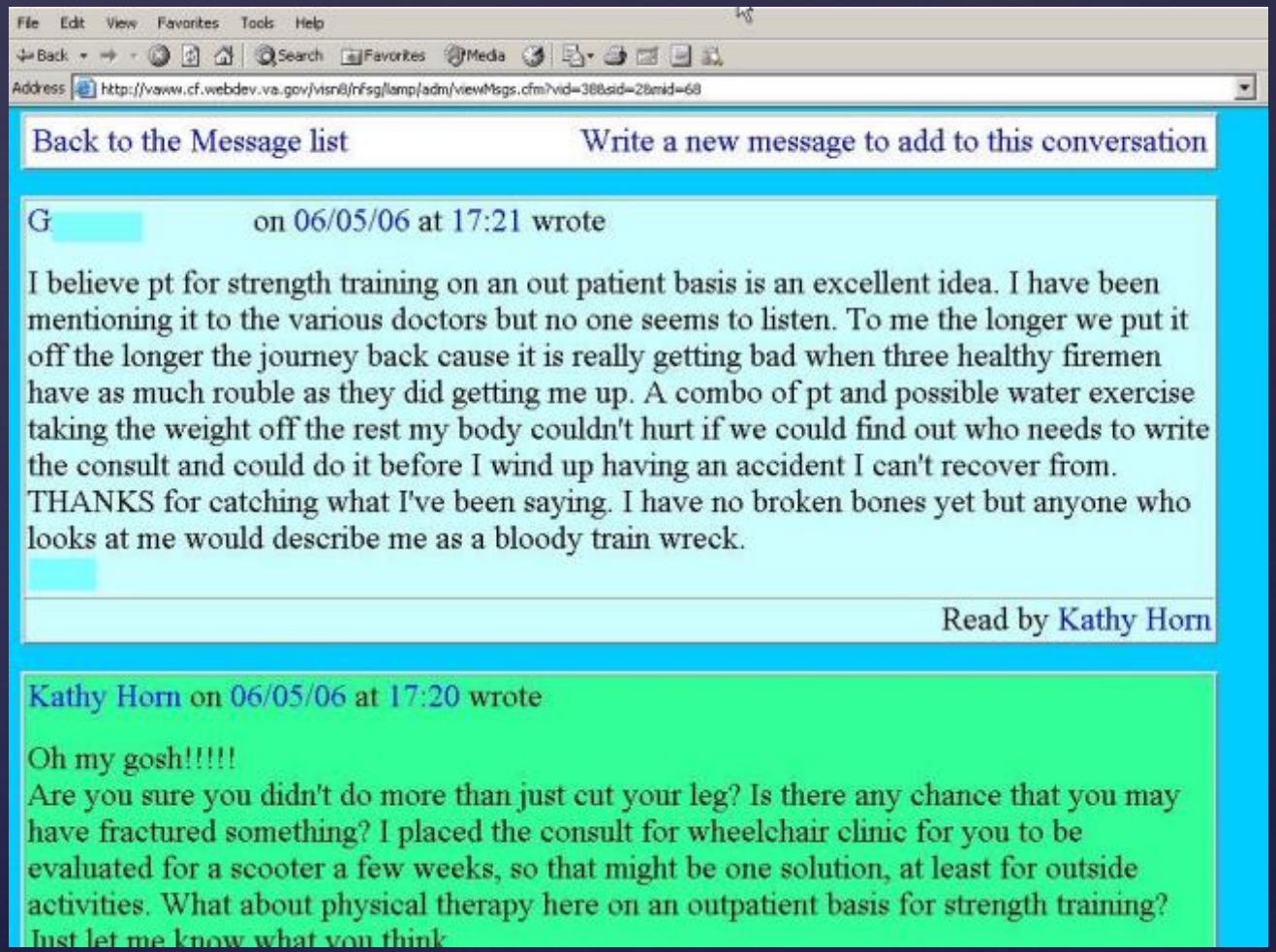
Remote Monitoring Technology

- Computers with internet capability
  - Secure custom disease management protocol completed and submitted by veteran and/or caregiver



Remote Monitoring Technology

- Computers with internet capability (cont.)
  - Secure two-way asynchronous free text messaging



35 y.o. Woman, S/P MVA

- Frontal skull fx
- Subdural hematomas
- 11 days in coma
- Left optic nerve damage
- Separation of left shoulder
- Deficits in executive function, memory, judgment, impulse control

LAMP Interventions

- Functional and home assessment
  - Rolling laundry cart, filing system, labeled bins
- Cognitive Cues
  - Palm Pilot
  - Daily Dialogue
- Care Coordination

Telerehab

How has your mood been since you last checked in?

good

yes | no : Are you having More Pain than Usual or any New Pain?

if yes, How would you rate your pain on a scale of 1-10, 10 being the worst pain imaginable? none

yes | no : Are you taking all of your prescribed medications?

If you did not take a prescribed medication(s) let us know why.

yes | no : Did you keep all of your Palm Pilot appointments since you last checked in?

If you missed some appointments, let us know why?

Customizable DMP (Daily Dialogue)

yes | no : Did you program your Palm Pilot for the upcoming day?

If you have had any problems following your daily child care routine please tell us about them.

What type of fun activities did you do with your children today?

Which of the following household tasks have you completed since you last checked in? (check if yes)

- Laundry
- Grocery list
- Clean the house
- Make a meal

Have you completed any other household tasks since you last checked in?

yes | no : Have you felt productive since you last checked in?

If you would like us to report anything to your Primary Care Physician, let us know in this space.

If you would like us to report anything to your Mental Health Provider, please let us know in this space.

If you have any comments, questions or other needs please let us know about them in this space.

submit

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Outcomes

Table 3. Comparison of Healthcare Expenditures for LAMP (*n* = 115) and MCG (*n* = 115) One-year Pre-enrollment and One-Year Post-enrollment

LAMP	TOTAL SUM	BDOC	CLINIC	ER	NHCU
Pre-enroll days/visits	$2,767,712.90	$1,494,483 1,449	$1,162,211 4,561	$23,842 116	$87,177 214
Post-enroll days/visits	$2,812,250.50	$690,215 623	$2,053,015 8,728	$24,257 108	$44,763 98
Difference in costs pre-post Difference in days/visits pre-post	+$44,537.60	-$804,268 -826	+$890,814 +4,167	+$415 -8	-$42,414 -116
MCG	**TOTAL SUM**	**BDOC**	**CLINIC**	**ER**	**NHCU**
Pre-enroll days/visits	$2,055,283.60	$1,231,656 1,443	$642,052 3,088	$16,908 76	$164,668 404
Post-enroll days/visits	$1,578,459.30	$553,924 699	$862,510 2,931	$12,826 72	$149,198 400
Difference in costs pre-post Difference in days/visits pre-post	-$476,824.30	-$677,732 -744	+$220,458 -157	-$4,082 -4	-$15,470 -4

1) Bendixen RM, Horn K, Levy CE: Using telerehabilitation to support elders with chronic illnesses in their homes. Topics in Geriatric Rehabilitation 2007;23:47-51
2) Bendixen RM, Levy CE, Lutz BJ, Horn KR, Chronister K, Mann WC. A telerehabilitation model for victims of polytrauma. Rehabilitation Nursing 2008;33: 215-220
3) Bendixen RM, Levy CE, Olive ES, Kobb RF, Mann WC. Cost Effectiveness of a telerehabilitation program to support chronically ill and disabled elders in their homes. Telemedicine and e-health 2009: 15:31-38

Rural Veterans TeleRehabilitation Initiative (RVTRI)

To enable access, to high quality rehabilitation to rural veterans via telehealth.

- Rural Veterans TeleRehabilitation Initiative: VA ORH: 9.09-10.10
- Rural Veterans TeleRehabilitation Initiative II: VA ORH 10.10-9.11
- XO8-FY12Q1-POOO58. The Rural Veterans Telerehabilitation Initiative Phase III VA ORH :10.11-9.13
- X08-FY12Q1-S5-P00058. Rural Veteran's TeleRehabilitation Initiative Expansion, Proliferation and Dissemination Project.VA ORH
- Rural Veteran's TeleRehabilitation Initiative Expansion, Proliferation and Dissemination Project : Respiration, Eating and Swallowing Program (RVTRI-RESP) 2014, 2015
- Rural Veterans TeleRehabilitation Initiative: Creative Arts Therapy Project. VA Office of Rural health N08-FY14Q3-S0-P01219 2014,2015
- Rural Veterans Supported Employment Initiative (Lisa Ottomanelli, Directo;, Levyco-Director)2014,2015
- Breast Cancer Rehabilitation Initiative, VISN 8 Transformational Innovation Grant

Effects of physical therapy delivery via home video telerehabilitation on functional and health-related quality of life outcomes

- Retrospective pre-post design, n = 26
- Average length of participation was 99.2 +/– 43.3 d
- 15.2 +/– 6.0 therapeutic sessions

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JRRD, Volume 52, Number 3, 2015, Pages 361-70

Patient Characteristics

Table 1.
Patient characteristics ($N = 26$).

Characteristics	Percent
Sex: Male	92.3
Age	
≤64 yr	69.2
>64 yr	30.8
Patients by Home ZIP Codes	
Rural Patients	57.7
Nonrural Patients	42.3
Major Medical Diagnosis	
Musculoskeletal	80.8
Multiple Sclerosis	15.4
Stroke	3.8
Types of Physical Therapy Provided	
General Strengthening Program	26.9
Lumbar Stabilization Program	38.5
Scapular Stabilization	34.6

Results: Satisfaction

Patient satisfaction. Number of respondents for satisfaction survey was 25 for all items except item number 12, which had 24 respondents.

Satisfaction Item and Response Category	Level of Satisfaction, *n* (%)				
	1	2	3	4	5
1. Length of time for 1st appointment*	0 (0.0)	0 (0.0)	11 (44.0)	14 (56.0)	N/A
2. Waiting minutes to see telehealth provider†	23 (92.0)	1 (4.0)	1 (4.0)	0 (0.0)	0 (0.0)
3. Time spent with your specialist*	0 (0.0)	0 (0.0)	3 (12.0)	22 (88.0)	N/A
4. Your providers' personal manner‡	0 (0.0)	0 (0.0)	1 (4.0)	2 (8.0)	22 (88.0)
6. Your privacy was respected*	0 (0.0)	0 (0.0)	3 (12.0)	22 (88.0)	N/A
7. Come back to this clinic for additional care§	0 (0.0)	0 (0.0)	0 (0.0)	3 (12.0)	22 (88.0)
8. Equipment operation was explained*	0 (0.0)	1 (4.0)	3 (12.0)	21 (84.0)	N/A
9. Satisfied with video quality*	0 (0.0)	2 (8.0)	8 (32.0)	15 (60.0)	N/A
10. Satisfied with audio quality*	0 (0.0)	2 (8.0)	6 (24.0)	17 (68.0)	N/A
11. Understanding your specialist*	0 (0.0)	1 (4.0)	4 (16.0)	20 (80.0)	N/A
12. Overall telehealth experience*	0 (0.0)	1 (4.17)	6 (25.0)	17 (70.8)	N/A
13. Future use of telehealth again for medical care¶	25 (100.0)	0 (0.0)	N/A	N/A	N/A

*1 = not, 2 = somewhat, 3 = satisfied, 4 = very satisfied.

†1 = 1–5, 2 = 6–15, 3 = 16–30, 4 = 31–45, 5 ≥ 45 (minutes).

‡1 = poor, 2 = fair, 3 = good, 4 = very good, 5 = excellent.

§1 = no opinion, 2 = strongly disagree, 3 = disagree, 4 = agree, 5 = strongly agree.

¶1 = yes, 2 = no.

N/A = not applicable.

Visits and Travel

Table 2.
Patient visits, travel, and potential cost avoidance.

Visit, Travel, And Potential Cost Avoidance	Mean ± SD
Average Time with RVTRI (d)	99.2 ± 43.3
Average Number of Sessions Received	15.2 ± 6.0
Average Number of Telerehabilitation Sessions Received	11.3 ± 5.9
Average Number of Face-To-Face Sessions Received	3.9 ± 2.6
Average Roundtrip Miles Per Visit Saved*	179.8 ± 182.7
Average Total Number of Miles Saved†	2,774.7 ± 3,197.4
Average Total Driving Hours Saved	46.3 ± 53.3
Average Travel Expense Saved ($)‡	1,151.50 ± 1,326.90

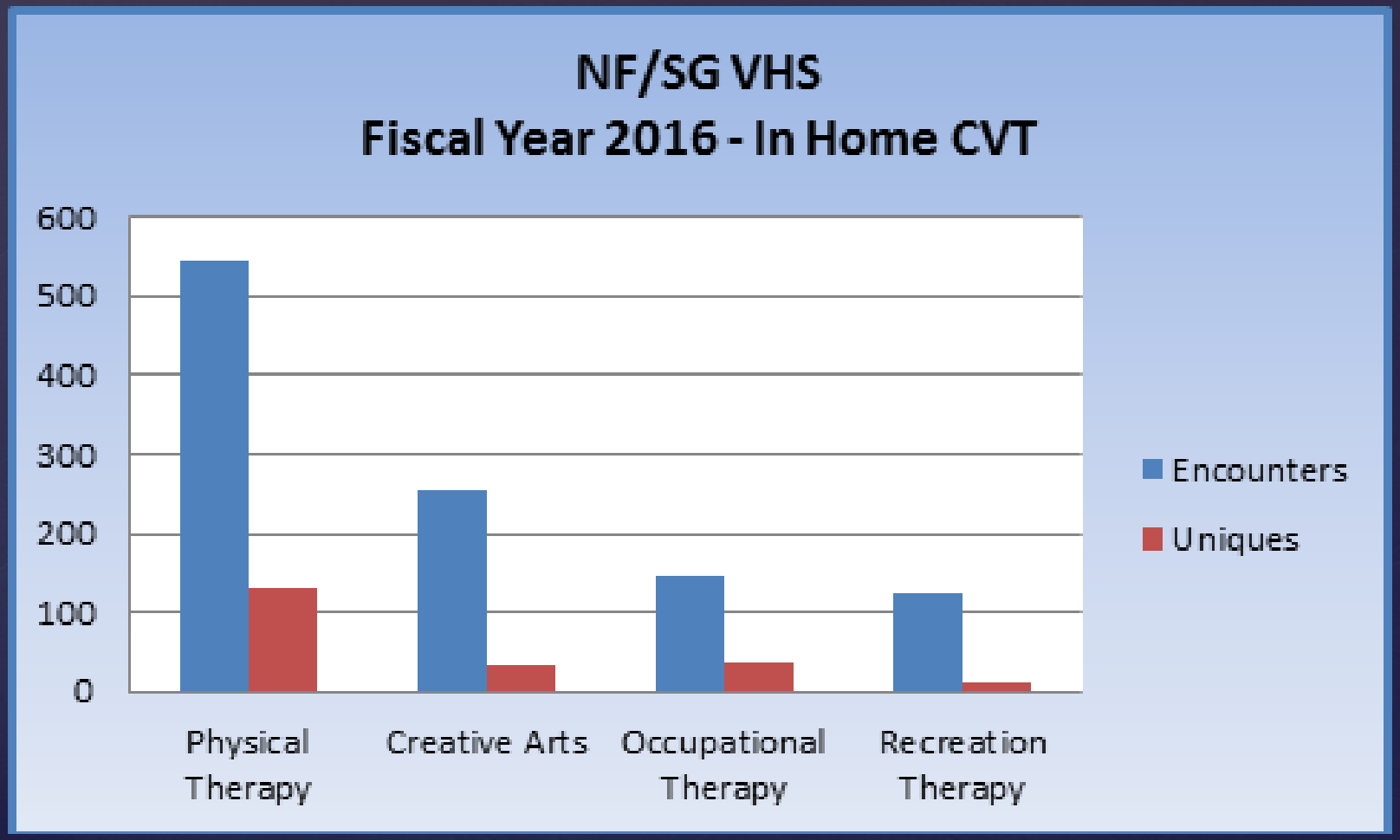
*Roundtrip mileage from patients' home residence to closest local Department of Veterans Affairs (VA) hospital for each visit.
†Roundtrip miles per visit × number of telerehabilitation sessions received through RVTRI program.
‡Total number of miles saved × $0.415 (per mile travel reimbursement rate to eligible Veterans by VA for 2010–2011).
RVTRI = Rural Veterans TeleRehabilitation Initiative, SD = standard deviation.

Change in status

	Baseline	Discharge	Change Score	*p*-Value*	*r* Score
VR-12 ($n = 23$)	35.8 ± 8.5	39.7 ± 9.8	3.8 ± 7.1	**0.02**	0.42
FIM ($n = 26$)	107.2 ± 23.7	114.7 ± 15.7	7.6 ± 13.6	**<0.001**	0.63
Quick DASH ($n = 19$)	40.0 ± 19.4	36.8 ± 22.3	−3.1 ± 14.4	0.35	−0.22
MoCA ($n = 16$)	23.7 ± 3.8	26.2 ± 4.4	2.5 ± 3.9	**0.01**	0.44
2MWT ($n = 13$)	319.4 ± 182.2	392.9 ± 240.7	73.5 ± 86.7	**0.006**	0.73

*p-Values were results from Wilcoxon signed-rank tests comparing baseline score and follow-up score for each measurement. Bold indicates significance.
2MWT = 2-minute walk test, FIM = Functional Independence Measure, MoCA = Montreal Cognitive Assessment, VR-12 = Veterans RAND 12-Item Health Survey.

RVTRI Uniques & Encounters



Strategies to maximize useful signal in low bandwidth enviroments:

- Vary the paramaeters:
  - Frame Rate
  - Resolution
  - Color
  - Cropping
  - Spatial data extraction Via Kinect

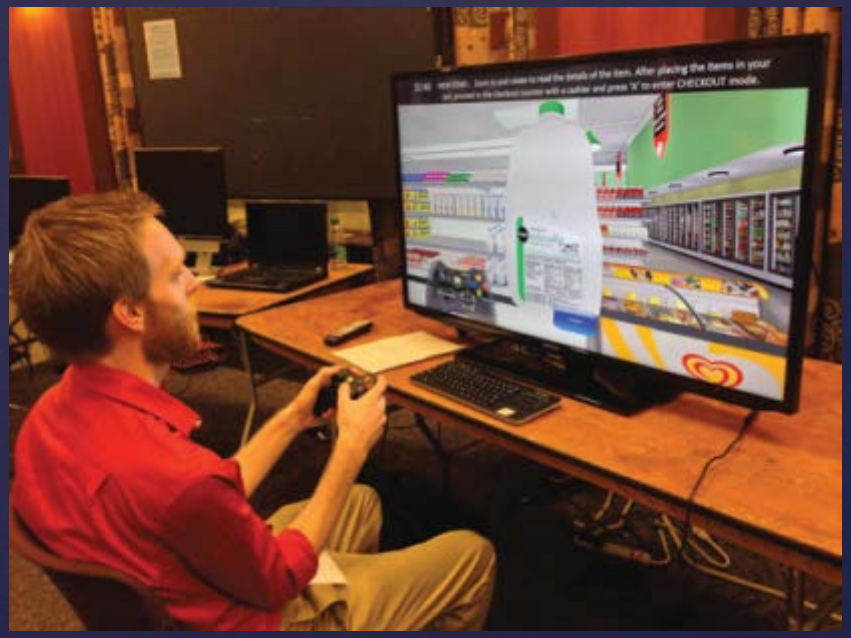
Tan KK, Narayanan AS, Koh GC, Kyaw kk, Hoenig HM
Development of telerehabilitation application with designated consultation categories, JRRD, Volume 51, Number 9, 2014, Pages 1383–1396

Enhanced Therapy: Virtual Reality therapy delivered via Telehealth

Virtual Environments for Therapeutic Solutions (VETS) mTBI/PTSD Phase II. VA RR&D 1I01RX000339-01A3.

Levy CE[1], Lok B[2], Marsiske M[3], Halan S[2], Chen W[2], Lehman L[1], Silverman E[1], Christie J[1], Myers K[1].

[1]VA Center of Innovation on Disability and Rehabilitation Research, [2]Computer and Information Science and Engineering Department, [3]College of Engineering, University of Florida, Department of Clinical and Health Psychology, University of Florida



This work was supported by: 1) CDMRP/DoD Concept Award: Design of Effective therapeutic interventions for Mild TBI/PTSD using interactive Virtual World Environments, 9.15.08-9.14.09; 2) Development of Virtual Humans for PTSD and mTBI: Rehabilitation Outcomes Research Center: 9.1.10-9.1.11

mTBI/PTSD Impairments

- Memory
- Attention
- Irritability

The Therapist Joins the Veteran in V-Mart

- The Veteran and the therapist sign on to a secure, encrypted URL from their own device
- They are connected by live streaming video while in the virtual world, via web-cameras
- The therapist controls multiple aspects of the experience at the outset, and can make adjustments on the fly.

Simple and Complex Cognitive challenges

- Simple:
  - Determine Sodium or calorie Content (read label)
  - Finding a product (visual search)
  - Determining least expensive of two products (direct comparison)
- Complex
  - Compute unit pricing where units are not displayed on the label
  - Determine the most economical low sodium soup where the one with least sodium is not least expensive

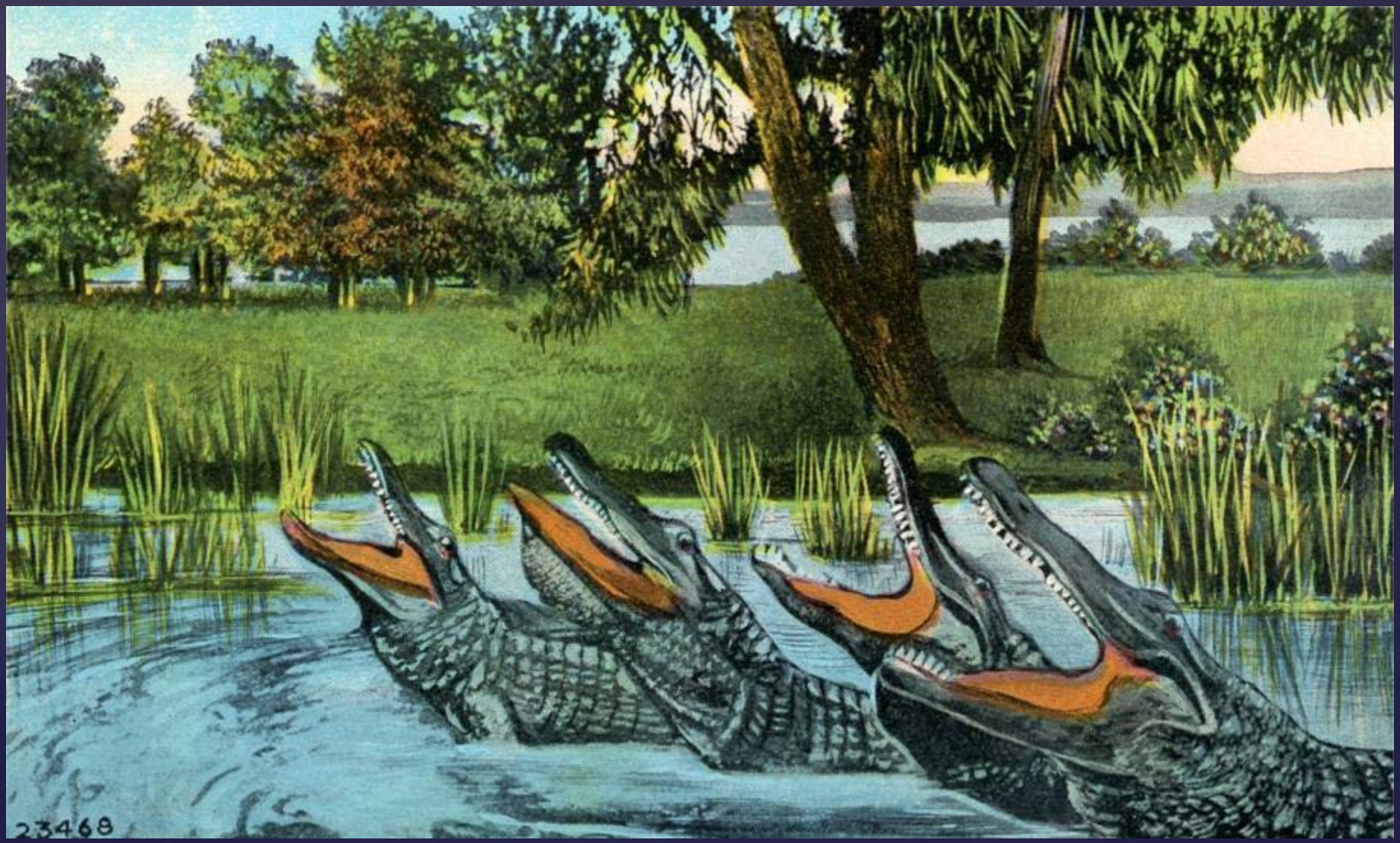
Prolonged Exposure Therapy in V-Mart

- Treatment Components
  - Education
  - Breathing
  - Imaginal Exposure: Revisiting the traumatic memory with the goal of processing and reducing emotional distress (Virtual Viet Nam, Virtual Iraq, Virtual Afghanistan)
  - In Vivo Exposure: Real world practice in approaching safe situations that trigger emotional distress (V-Mart).

On the Horizon: Extending therapy gym to the home

- Beyond activity monitoring
- Connected Instrumented Exercise Equipment

Stuff that wasn't covered

- Apps: Annie Text Messaging
- Apps Concussion Coach, TBI Coach
- Other related projects RVSETI, Breast Cancer Rehabilitation Initiative
- Other VA practices: Home evals, TBI second Level Evals, Seating and Positioning Clinics, Amputee Clinics

Questions?