Using the Virtual Patient to Improve the Primary Care of Traumatized Refugees

Richard Mollica [1,2,3]*, MD; James Lavelle LICSW[2,3]; Uno Fors[4], PhD; Solvig Ekblad[5], PhD; Brianna Wadler[2,3]

[1]Harvard Medical School, [2]Harvard Program in Refugee Trauma, [3]Massachusetts General Hospital, [4]Stockholm University, [5]Karolinska Institutet

Abstract

Background: Refugees who have experienced traumatic life experiences have entered into the United States' primary health care system. Primary care providers (PCPs) have limited training in their diagnoses and treatment. Assessing and caring for the health and mental health of refugees in a culturally effective way in a time limited health care environment is challenging. We conducted a study on the role of the Virtual Patient (VP) as a training instrument for improving the diagnoses and treatment of refugee patients.

Methods: This was a descriptive and quantitative study of PCPs at a local neighborhood health care center in Massachusetts. A sample of PCPs initially reviewed an alpha Virtual Patient refugee prototype. An improved β-VP prototype was offered in training. The PCPs performance on pre- and post-diagnosis and treatment planning was assessed after studying the β-VP. 10 PCPs studied the alpha VP prototype; an additional 14 PCPs studied the β-VP prototype (N=24). The Karolinska Institutet Virtual Patient Learning Experience Questionnaire (KI-VP-LEQ) assessed feasibility, and motivation to use the VP. A Trauma-BPPS (Trauma -Bio-Psycho-Social- Spiritual scale) scale measured the PCP's perception of the patient's trauma history, and medical, psycho-social and spiritual domains. Pre- and post-VP training using refugee paper clinical cases was performed. Concluding telephone interviews were conducted. Analysis included qualitative methods and significance testing.

Results: PCPs were receptive and motivated to use the VP in training. Prior to VP training, respondents scored highly on medical diagnosis and treatment planning (Medical domain); followed by the psychological domain. Respondents scored lower on the social domain and lowest on the trauma and spiritual domains. All five domain scores significantly improved for those PCPs who devoted ≥90 minutes studying the VP. Telephone interviews conducted after training revealed PCPs felt they did not have enough time and/or clinical training to properly diagnose or treat refugee patients in the primary health care setting.

Conclusions: The PCPs in this pilot study demonstrated the ability to improve their treatment plan for traumatized refugee patients in the medical and psychological domains after VP training. Devotion of time with the VP training instrument was significantly associated with improvement in all domains.

Keywords: GLOBAL HEALTH, IMMIGRANT HEALTH, PRIMARY CARE, PSYCHOLOGY, TRAUMA-INFORMED CARE

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Introduction

Since 1975, the U.S. has resettled approximately 3 million refugees (1). In 2010. the U.S. Census Bureau (2) estimated 40 million people were foreign born, making up 13% of the total U.S. population. Refugees come to the U.S. to escape poverty, mass violence and/or political oppression, human rights violations, and war. As they enter the American health

***Corresponding author:** Richard F. Mollica, MD, MAR; Harvard Medical School, Harvard Program in Refugee Trauma, Massachusetts General Hospital. 22 Putnam Avenue, Cambridge MA, 02139 Phone: (617) 876-7879 Fax: (617) 876-2360; Email: rmollica@partners.org

care system, many refugees will experience disparities within their health care, primarily due to their lower socio-economic status (3), cultural medical world views (4-6), limited English proficiency (7-13), and low levels of health literacy (14-19).

The Institute of Medicine defines primary health care (PHC) as "integrated and accessible care by clinicians who are responsible for addressing a majority of personal health need through a sustained partnership with patients and practicing in a family and community context."(20). Primary health care, for example, serves as the initial point of contact for patients with health related trauma problems, depression, and PTSD; this reality applies for the refugee patient (21). PHC is therefore considered an ideal health care environment for addressing the health and mental health needs of refugees who are traumatized. Yet, the usual care by primary care practitioners (PCPs) may be less than optimal for this patient population with studies indicating the recognition of trauma-related distress as less than 40% (22), diagnosis of PTSD as low as 2% (22), and depression less than 50% (23). In primary health care veteran clinics where PTSD and depression should be routinely diagnosed, less than 50% of diagnosable patients were identified (24). Under diagnosis and treatment for historically disadvantaged ethnic groups (e.g. African Americans), those with language barriers (e.g. Hispanics), and special highly traumatized populations (e.g. resettled refugees) may be especially high (25-28). For example, Davis and colleagues (29) revealed that low-income African Americans in urban primary health care clinics were at a high risk for trauma, with PTSD rates of 22%; but only 13.3% of the latter received trauma focused treatment interventions. In a large-scale study in Ireland of women seeking care in general practice (30), about 40% had experienced domestic violence, only 5% of all women reported that their general practitioner had asked them about a partner threatening them. Of those who had experienced one or more violent episodes, 12% reported their doctor had asked them about abuse. These findings are consistent with findings in the U.S. and England.

Training of primary care practitioners in the identification and treatment of health and mental health disorders of refugees and immigrants has become a priority. Primary care practitioners are exposed to highly traumatized patients with mental health disorders from culturally diverse populations (e.g. refugees) (31). Highly traumatized refugees and torture survivors are most commonly seen in primary health care settings (32). The Harvard Program in Refugee Trauma (HPRT) has cared for over 10,000 refugees, many whom have been tortured, over the past 35 years within primary health care. HPRT partnered with the Karolinska Institutet (KI) and Stockholm University (SU) in Sweden to introduce a new learning instrument into primary health care in order to train PCPs in culturally effective diagnosis and treatment of refugee patients; The Virtual Patient (VP). KI and SU have been developing interactive VP systems for more than 25 years. VPs are interactive computer stimulations of medical cases used in health care education. A VP is a virtual representation of a patient encounter for training and assessment, capable of interactive and user-governed illness history, interview, physical examination, laboratory tests, treatment plan and feedback from VP and a Virtual Expert (VE) (32-41). VPs can emulate a problem-based learning environment in a culturally sensitive manner to assist medical practitioners in an interactive and comprehensive learning environment. VPs can be used in primary health care (PHC) settings as a major Healthcare Information Technology (HIT) advancement in improving PHC decision-making and care for this highly vulnerable patient population.

While the use of the VP has been proven to be effective in the training of surgeons (42) and medical students (38-39), little is known of the effectiveness of VP in training PCPs. This will be the initial effort to develop the

VP for PCP education and another first use of the VP in primary health care training for the care of refugee patients. Our study hypotheses were that the:

1. VP learning experience can improve the practitioner's assessment and planned management of highly traumatized refugee patients
2. VP learning experience can enhance an integrated holistic approach to care that includes increased recognition of the trauma narrative of the patient (i.e. trauma story) and the utilization of the medical-psycho-social-spiritual-clinical management domains.
3. The current VP instrument and learning approach is readily accessible and feasible for use in a neighborhood health center.

Methods

Study Design and Setting: This pilot study, one of the first of its kind, addressed the impact of the VP instrument and training on the clinical assessment skills of PCPs working in a federally funded community health center. The Chiefs of Medicine and Behavioral Health approved the study. During their weekly meeting, PCPs were presented the VP training experience. An initial 10 PCPs (cohort 1) volunteered and experienced the alpha prototype of the previously developed VP. Their reaction and recommendations on VP usability was incorporated into enhancing the VP alpha prototype to create the beta prototype. These results had previously been presented (33). All PCPs were fully employed and in good standing within the health center. The institutional review board at the Massachusetts General Hospital approved the study of moving forward with the beta prototype.

We then recruited an additional 14 PCPs (cohort 2) along with the original 10 (total N=24) to participate in the study. The PCPs were trained by the authors (RFM, JL,SE) on the use of the beta VP prototype. They were given the expectation that they would clinically assess an initial paper case of a fictionalized refugee patient at the health center before utilizing the VP program. They were expected to use the RTSim VP system approximately 3 times over a 4 week period for 90 minutes, then proceed to assess a second post VP refugee paper case. After completing the two paper case assessments (one prior to using the VP program and one succeeding the VP program), the PCPs received a semi-structured interview by telephone BW (Brianna Wadler) to assess improvements and discuss recommendations regarding usability. The HPRT-KI team met weekly by video-conferencing to plan and implement the study.

The VP Instrument: The VP system used in this study was the Refugee Trauma Simulation System (42) (RTSim), which portrays a traumatized female refugee from Bosnia-Herzegovina (Figure 1).

RT sim allows six types of interaction with the VP:

- Chief complaint
- Physical examination
- Lab/Imaging tests
- History of the present illness
- Social and medical history
- Psychiatric screening instruments; included the Harvard Trauma Questionnaire (HTQ) and the Hopkins symptom checklist (45)

After "examining" the Virtual Patient, the PCP then indicates their assessment, diagnosis and treatment plan. Users received direct feedback from the VP and Virtual Advisors (i.e. an expert in the field) regarding the actions they had taken during the VP encounter. The latter included their detailed feedback on their diagnoses and treatment plan. Finally, a summary presentation on the importance of the five clinical domains (i.e. trauma history, medical-psycho-social-spiritual domains) in this clinical encounter is presented by video to the user.

Outcomes: *PCP IT proficiency, clinical worldview, and current motivation to use the VP in training*

An instrument developed at Karolinska Institutet (KI) was employed in this study to assess the PCPs' attitudes and values related

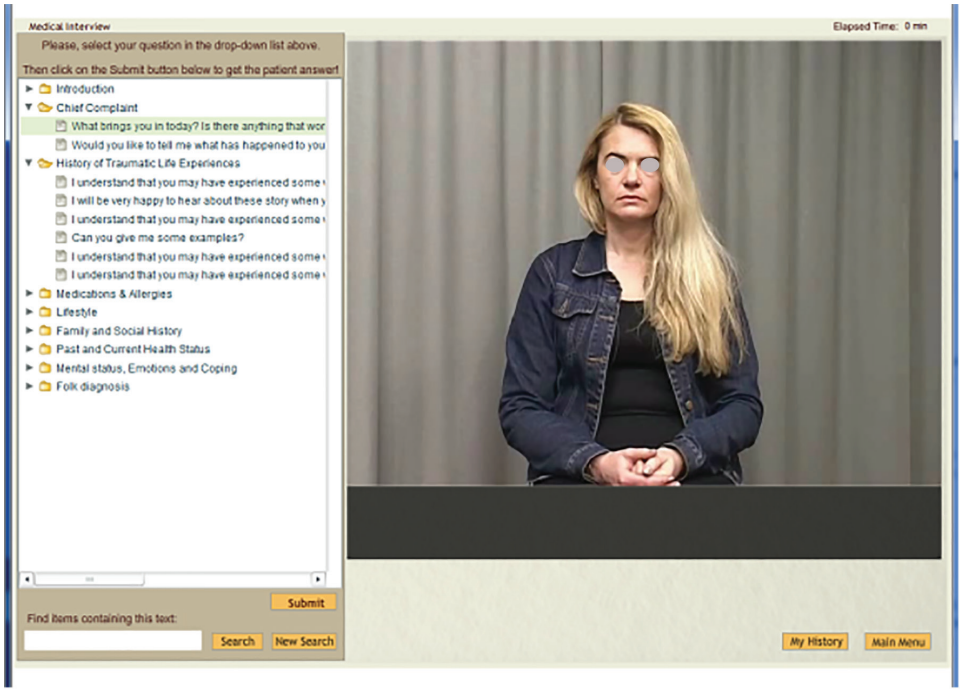

Figure 1. Screenshot of the RT-Sim System presenting the history-taking interview module
The user of the VP can freely choose the actions he/she wants to directly receive on-screen from the patient as if participating in a real clinical encounter.

to the use of the VP (35-38, 43), i.e. the *Karolinska Institutet Virtual Patient Learning Experience Questionnaire (KI-VP-LEQ)*. The KI-VP-LEQ includes 10 items divided into two parts; part 1: (a) data collected during the medical examination (chief complaint, history of present illness, physical exam, mental status, laboratory tests, and traditional healing exam) and (b) root causes of the disease (biological, psychological, social, economic and spiritual). The post-test KI-VP-LEQ assessed the PCPs motivation to use the VP before the simulation exercise on a 4-point Likert scale (1=highly disagree, 4=highly agree) with 17 questions (e.g. "I am motivated to use VP as it helps to improve interdisciplinary communications,", "I believe that VP will help me to provide better care to my traumatized patients from any cultural background").

Pre- and Post-VP clinical case assessment: Two comparable clinical cases were prepared for pre- and post-VP clinical case assessment. The initial clinical case extensively revealed the clinical problems of a refugee patient from the Middle East (44). The second clinical case presented a refugee patient from Cambodia (these clinical cases are available upon request) (45). A specialized scale, the Trauma-BPSS scale, was created based on the Domain Management Model developed and validated by the work of Siebens (46). This model advanced the clinical contribution of Engels on the organization of patient clinical problems into medical (bio), psychological (psycho), social (social), and spiritual etiologies and consequences (47). Mollica and Crosby revealed the critical role of assessing the trauma narrative of the patient in primary health care titled by Mollica in his work *The Trauma Story"* (48, 49).

Each of the Trauma medical-psycho-social domains had 5 elements related to the clinical care of the patient (N=5) the spiritual domain had 2 elements (N=2). The pre- and post-PCP evaluations were independently assessed by the authors, discussed during the bi-weekly skype meeting between HPRT and KI, and summarized into a total score for each domain.

Phone Interview: A semi-structured interview guide was developed by the authors assessing

the strengths and weaknesses of their VP experience and recommended actions for improving the VP training. Phone interviews with all PCPs (N=24) were conducted by a single author (BW) using a semi-structured interview telephone guide. Mean interview time was 15 minutes.

Data Analysis: Responses on the survey instruments were quantified using SPSS 22.0. Analyses of data was descriptive due to the small number of PCPs (N=24). The analysis from the pre and post data included item-by-item measures and mean values for assessing the average ratings on the Likert scale questions. Face validity of the questionnaire had been analyzed prior and had satisfactory psychometric properties (39). The paper case note scores were independently analyzed on each of the five items, including Trauma, Medical, Psychological, and Social domains and two items on Spiritual domain, by all authors. During a weekly video conference the authors presented their results; an average score was compiled for each participant on the five domains.

The follow-up phone interview had primarily qualitative data. The qualitative data were analyzed according to inductive content analysis based on Graneheim & Lundman's model (50). Focus for this manuscript was on the time PCPs spent studying the Virtual Patient as well as their interpretations of the usability and efficacy of the program.

Results

Prior to the VP training exercise, the 24 participants reported that their IT knowledge was intermediate on a five point Likert scale (1=none; 5=expert); they had seldom played computer/video games or used medical simulators during the last five years. All agreed that with the growing market of telemedicine, IT was an important support for their learning

Characteristics of Study Sample by Cohort: In Table 1, the characteristics of Cohort 1 and 2 are presented. Cohort 1 reported higher numbers of years on average practicing medicine in primary care (PCP yrs) than cohort 2, (t= 2.39, df=15, p<.031). The mean age of cohort 1 participants (45.8 years) was higher than the mean age of cohort 2 participants (39.4 years), but this difference was not statistically significant (Table 1).

Overview of Clinical Worldview: Table 2 illustrates the self-reported dimensions of clinical care, pre-test and post-test on the KI-VP-LEQ questionnaire. There were few significant differences between pre- and post-test results except participants as a whole (n=24) put more emphasis (1= no emphasis; 5= full emphasis) on trauma as a root cause in the post survey (t=-3.391, df=23, p<.003, Table 2). Self-report on 16 motivation questions (1=highly disagree to 4=highly agree) to use the VP as a training method after the simulation exercise was compared both prior to the exercise, and

Table 1. Characteristics of the Study Sample by Cohort 1 and 2 Demographics

Demographics	Cohort 1 (n=10)	Cohort 2 (n=14)	Total (n=24)	P value
Age, mean (SD)	45.8 (7.86)	39.4 (10.44)	42.1 (9.80)	ns
Sex (male)%	5 (50%)	3 (21.4)	8 (66.7)	ns
Education				ns
MD(%)	7 (50)	7(50)	14 (58.3)	
DO(%)	0	2(100)	2 (8.3)	
NP(%)	2 (50)	2(50)	4 (16.7)	
PA, PA-C(%)	0	3(100)	3 (12.5)	
Number of years practicing medicine in primary care				t=2.39, df=15
PCP yrs (SD)	12.14 (6.88)	6.14 (4.71)	8.65 (6.34)	P<0.031*

Table 2. Changes in mean scores of Self-reported domains of clinical care (between pre- and posttest) (1=no emphasis; 5=full emphasis)

Data		Mean	SD	CI	T	Df	P value
Chief complaint	**Pretest**	4.50	0.722	-0.51, 0.26	-0.681	23	0.503
	Posttest	4.63	0.495				
History of Present illness	**Pretest**	4.83	0.381	-0.19, 0.27,	0.371	23	0.714
	Posttest	4.79	0.415				
Physical exam	**Pretest**	4.25	0.897	-0.32, 0.53	0.510	23	0.615
	Posttest	4.15	0.827				
Mental status exam	**Pretest**	3.73	0.872	-0.69, 0.23	-1.036	23	0.311
	Posttest	3.96	0.999				
Laboratory tests	**Pretest**	4.04	0.751	-0.48, 0.40	-0.196	23	0.846
	Posttest	4.08	0.830				
Traditional Healing exam	**Pretest**	2.41	1.141	-0.90, 0.54	-0.526	21	0.605
	Posttest	2.59	1.260				
Root causes							
Biological	**Pretest**	4.33	0.637	-0.33, 0.25	-0.296	23	0.770
	Posttest	4.38	0.770				
Psychological	**Pretest**	4.33	0.637	-0.61, 0.03	-1.904	23	0.070
	Posttest	4.63	0.495				
Social	**Pretest**	4.04	0.859	-0.51, 0.26	-0.681	23	0.503
	Posttest	4.17	0.816				
Spiritual	**Pretest**	2.96	1.122	-1.03, 0.19	-1.415	23	0.170
	Posttest	3.38	1.013				
Trauma	**Pretest**	3.92	0.881	-0.81, -0.20	-3.391	23	0.003
	Posttest	4.42	0.776				

Overview of Clinical Worldview (All, N=24)

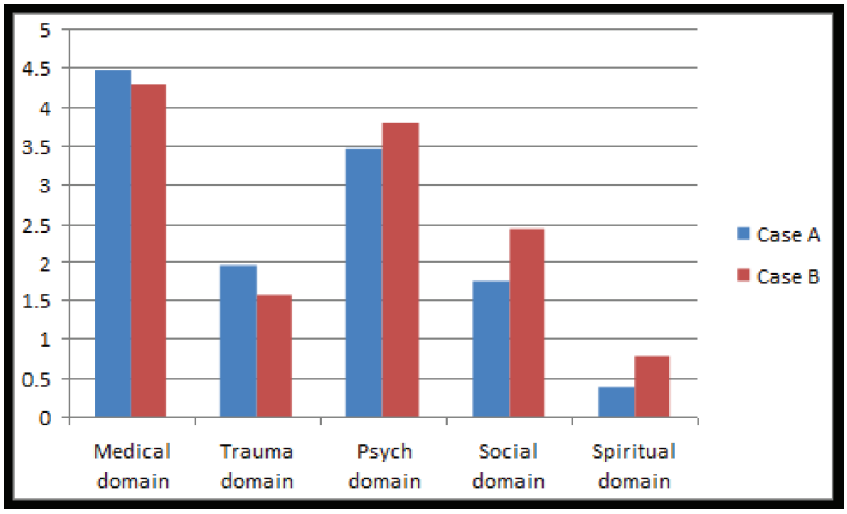

Figure 2. Pre and Post VP training changes on the five domains (N=24).

post. Participants reported being significantly more motivated to use the VP in the post-survey ($P<0.046$). There were no other significant changes between the pre and post tests among the motivation questions. The PCPs rated the use of the VPs for training and management at the highest level pre and post test.

Pre- and post-results on the KI-VP-LEQ are summarized in Figure 2. The five point medical domain scored very high, followed by the psychological and social domains. The trauma narrative domain scored low, and the 2-pint spiritual domain scored the least.

Trauma – BPSS – Domain Analysis: Pre- and post-results on the KI-VP-LEQ are summarized in Figure 2. The five-point medical domain

scored very high, followed by the psychological and social domains. The trauma narrative domain scored low, and the 2-pint spiritual domain scored the least (Figure 2).

In Table 3, pre- and post-scores for the five domains are shown. The medical domain had the highest scores on both pre- and post-scores. The pre-training trauma domain score was low and did not increase in the post test. Low results for the spiritual domain significantly increased between Paper Case A and B score notes, respectively (t=-2.846, df=23, P<0.009) and "Acknowledges spiritual/religious problems and/or strengths" (t=-2.598, df=23, P<0.0.016). The psychological domain showed slightly higher scores, second to the medical domain, but with only a small difference between the pre- and post-tests. The social domain had significant changes in the scores between the pre- and post tests on "Acknowledges social problems/distress and major disruptions" (t= -2.005, P<0.057) and "Plans for addressing social problems" (t=-3.122, df=23, P<0.005, Table 3).

Table 3. Changes in means on pre- and post score data for the five dimensions, (variables codes 0 or 1) (N=24)

Five domains	Data	Mean	SD	CI	T	Df	P value
I. Trauma Domains							
1. Traumatic life history & life experiences	Paper A Paper B	0.58 0.46	0.504 0.509	-0.16, 0.41	0.901	23	0.377
2. Trauma story linked to current symptoms and diagnoses	Paper A Paper B	0.30 0.46	0.495 0.509	-0.33, 0.16	-0.700	23	0.491
3. List the most important trauma events	Paper A Paper B	0.42 0.29	0.504 0.464	-0.16, 0.41	0.901	23	0.377
4. Trauma treatment	Paper A Paper B	0.42 0.29	0.504 0.464	-0.16, 0.41	0.901	23	0.377
5. Patient education on impact of trauma on life	Paper A Paper B	0.17 0.08	0.381 0.282	-0.1, 0.30	0.811	23	0.426
Trauma story summary	Paper A Paper B	1.96 1.58	1.805 1.742	-0.61, 1.36	0.786	23	0.440
II Medical Domain							
1. Link medical problems to chief complains	Paper A Paper B	0.83 0.83	0.381 0.381	-0.22, 0.22	0.000	23	1.000
2. Use labs	Paper A Paper B	0.96 0.96	0.204 0.204	-0.1, 0.13	0.000	23	1.000
3. List the most important medical diagnoses	Paper A Paper B	0.92 0.96	0.282 0.204	-0.1, 0.05	-1.000	23	0.328
4. Treatment of medical problems	Paper A Paper B	1.00 1.00	0.000 0.000	-	-	-	-
5. Patient education	Paper A Paper B	0.75 0.54	0.442 0.509	-0.0, 0.49	1.551	23	0.135
Medical summary	Paper A Paper B	4.46 4.29	0.833 0.806	-0.16, 0.49	1.072	23	0.295
III. Psychological Domain							
1. Acknowledges psychological/emotional distress of patient	Paper A Paper B	0.92 0.96	0.282 0.204	-0.19, 0.11	-0.569	23	0.575

2. Use screening instrument	Paper A Paper B	0.29 0.38	0.464 0.495	-0.36, 0.19	-0.624	23	0.539
3. List the most important psychiatric diagnoses	Paper A Paper B	0.88 1.00	0.338 0.000	-0.27, 0.02	-1.813	23	0.083
4. Multi modal treatment	Paper A Paper B	1.00 1.00	0.000 0.000	-	-	-	-
5. Patient education	Paper A Paper B	0.38 0.46	0.495 0.509	-0.36, 0.19	-0.624	23	0.539
Psychological summary	Paper A Paper B	3.46 3.79	0.932 0.884	-0.79,0.13	-1.498	23	0.148
IV Social Domain							
1. Acknowledges social problem/distress and major disruptions	Paper A Paper B	0.58 0.79	0.504 0.415	-0.42,0.01	-2.005	23	0.057
2. Link social problems to chief complaint	Paper A Paper B	0.33 0.38	0.482 0.495	-0.33, 0.25	-0.296	23	0.770
3. List the most important social problems	Paper A Paper B	0.38 0.46	0.495 0.509	-0.30, 0.13	-0.811	23	0.426
4. Plans for addressing social problems	Paper A Paper B	0.21 0.63	0.415 0.495	-0.69,-0.14	-3.122	23	0.005
5. Patient education	Paper A Paper B	0.04 0.17	0.204 0.381	-0.31, 0.06	-1.366	23	0.185
Social summary	Paper A Paper B	1.75 2.42	1.511 1.767	-1.59, 0.25	.1.498	23	0.148
V. Spiritual Domain							
1. Acknowledges spiritual/ religious background of the patient	Paper A Paper B	0.21 0.33	0.414 0.482	-0.27, 0.02	-1.813	23	0.083
2. Acknowledges spiritual/ religious problems and/or strengths	Paper A Paper B	0.17 0.46	0.381 0.509	-0.52, -0.06	-2.598	23	0.016
Spiritual summary	Paper A Paper B	0.38 0.79	0.711 0.884	-0.72, -0.11	-2.846	23	0.009
Grand Total	Paper A Paper B	11.79 12.96	4.314 4.601	-2.97, 0.64	-1.335	23	0.195

Time Spent on VP Training Analysis: The PCPs were instructed to run the system at least three times, for a 90-minute period, throughout the 4-week study. On average, the 24 participants used the VP 2.5 times (min-max: 1-5 times); for Cohort 1 (N=10) average of 2.25 times (min-max: 1-3.5 times) and for Cohort 2 (N=14) average of 2.7 times (min-max: 1-5 times). The approximate time in total spent using the VP software was 92 minutes (min-max: 20-210 minutes); for Cohort 1, average of 95 minutes _min-max 52,5-180 minutes) and for Cohort 2, average of 90 minutes (min-max: 20-210 minutes). Results were evaluated comparing those PCPs who used the VP for 90 minutes and those who studied the VP for less than 90 minutes (Table 4). Increased scores were seen primarily within the medical domain, followed by psychological, social and trauma domains (spiritual domain had only two items). Table 4 reveals all five domains improved considerably when the PCPs spent more than 90 minutes with the VP. Grand total scores increased, for both Paper Case A and B ($t=-2.109$, $df=22$, $P<0.0.47$, and $t=-2.279$, $df=22$, $P<0.0.33$, respectively).

Table 4. Pre- and post data on how much time in total the participants (n=24) perceived to spend using the Virtual Patient software (0<90 minutes (median); 1≥90 minutes) measured by mean (SD) on the five dimensions regarding Paper Case A and Paper Case B, (variables codes 0 or 1)

Five Domains	<90 min Paper Case A (N=11) Mean (SD)	≥90 min Paper Case A (N=13) Mean (SE)	Sign	<90 min Paper Case B (n=11) Mean(SD)	≥90 min Paper Case B (n=13) Mean(SD)	P value
I. Trauma Domain						
Trauma story summary, min-max	1.27(1.348)	2.54(1.984)	ns	1.00(1.789)	2.08(1.605)	ns
II Medical Domain, max values						
Medical summary, min-max	4.36(0.809)	4.54(0.877)	ns	4.09(0.831)	4.46(0.776)	ns
III. Psychological Domain						
Psychological summary, min-max	3.09(0.831)	3.77(0.927)	ns	3.64(0.809)	3.92(0.954)	ns
IV. Social Domain						
Social summary, min-max	1.36(1.804)	2.08(1.188)	ns	1.55(1.635)	3.15(1.573)	t=-2.452 df=22 p<.023
V. Spiritual Domain						
Spiritual summary, min-max	0.27(0.647)	0.46(0.776)	ns	0.36(0.674)	1.15(0.899)	t=-2.398 df=22 p<.025
Grand total	9.91(3.590)	13.38(4.350)	t=-2.109 df=22 P<0.047	10.82(4.070)	14.77(4.362)	t=-2.279 df=22 P<.033

The Spirituality domain represented the most significant increase for Paper Case B (t=-2,398, df=22, P<0.025).

Phone Interview: Feedback from the PCPs on the telephone interview included the following:

- Initially, I did not place enough emphasis on this patient's trauma history. It even came to mind during the interview, but then I failed to follow up and ask the questions that needed to be asked.
- When it comes to working with immigrants and refugees, special attention must be given to trauma story.
- Excellent example of the type of patients we see at the Health Center.
- Helps improve awareness of PTSD in refugee patients.
- A learning experience, heartbreaking story and consequences of war and displacement on the lives of people.
- Importance of being empathetic and patient in trying to elicit health information from patient.
- It is useful in breaking the ice and gives the opportunity to ask difficult questions in a no risk setting.
-It is a good tool for teaching and self-evaluation, helps in the assessment of patients' medical/psychological problems.
- First of all, primary care does not seem to give the necessary time that is required to see patients like Katarina. The virtual patient experience allows for a real world experience in caring for the patient without time constraints.
- In the office, an ongoing challenge is always the time which we have with a patient. Going through just the questions with the virtual patient took over an hour when we usually have 10-15 minutes in the office.

Discussion

Our pilot study confirmed the initial results indicating that using the VP in primary health care is readily accessible and beneficial to PCPs (39). PCPs showed a high motivation to use the VP both at the initiation of this current study and at the study's conclusion. The participants agreed that the use of IT knowledge is necessary to remain relevant in today's world, and the VP was a quintessential example of how advances in technology can greatly improve knowledge and training. These findings confirmed our third hypothesis.

The results of this study in a local community health center revealed that the measurable impact of the VP learning experience on the pre- and post-test of two highly traumatized paper based patient cases was significant. The pre-test paper case introduced an Iraqi refugee woman who presented to the primary health care practitioner with a significant trauma history. This patient had a history of rape in Iraq and suffered past domestic violence from her parents and current husband. She had newly arrived to America, she could not read or write in English and was solely dependent on her abusive husband. She was socially isolated, had active medical problems including diabetes, obesity, dyslipidemia, elevated blood pressure, and active mental health problems (binge eating, symptoms of depression, and PTSD). She was a very religious woman who actively practiced Islam.

After studying the VP the primary health care practitioners were offered a post-test for diagnosis and treatment recommendations. The post-test paper case was a male refugee from Cambodia living in the United States with a significant trauma history that included the experience of mass violence and torture. This Cambodian refugee presented to primary care with emotional distress secondary to serious unrelated back pain. His back pain was of proportion when compared to his radiographic findings. The patient clearly stated his back pain began when he was in a Pol Pot labor camp and was forced to carry heavy sacks of rice for hours on end. This patient suffered from chronic lumbar back pain, degenerative disc disease, hyperlipidemia, heavy ongoing smoking (2 pack a day) and symptoms of PTSD and depression. He was an active Buddhist believer but could not attend temple because of his pain. Socially he was unemployed, he had financial problems, and was so irritable he consistently yelled at his family. His wife and kids avoided him because of this unbearable behavior.

These two case papers were constructed using a conventional standard medical case history model. Although the cases were fictional, they illustrate case scenarios that might be seen in a primary health care setting when exploring the traumatized population. Using our Domain Management Scale that assessed the primary care practitioner's attention to the trauma story and the Medical (Bio)-Psycho-Social-Spiritual domains of medical assessment, the results revealed that at baseline all primary care practitioners scored high on the medical domain and slightly lower on the psychological domain. The PCPs scored lower on attention to the patients' trauma story and social domains. The spiritual domain showed the lowest score. After studying the VP, the PCPs scores remained essentially stable except for increased attention to addressing the patients' social problems and acknowledging the spiritual background of the patient. Further analysis splitting the group into those who spent less time studying the VP (< 90 minutes) versus those who spent considerably more time (≥ 90 minutes) revealed that more time spent with the VP improved all domains including significant changes to the social and spiritual domain and the grand total. Our hypotheses 1 and 2 are thus confirmed with the caveat that the PCP needs to spend sufficient time studying the VP in order to enhance their learning. Our results are consistent with VP studies that reveal that short term trainings can be limited (44); that VP learning results are heightened if an intense follow-up to the

VP learning occurs (43). In another VP study using a similar system, we found that a single session with a VP is not sufficient for long term effects in knowledge building (35, 36, 38). "Lack of Time" with patients' especially non-English speaking refugee patients with complex medical and psychiatric problems was consistently indicated by the PCPs in their telephone interview and during the implementation of the study. Our study results regarding time spent on the VP by the PCPs and improvement in clinical assessment is consistent with these anecdotal complaints universally expressed to us by the PCPs in their telephone interviews. Refugee patients are especially challenging since it is common that they do not speak English, have no or very little familiarity with the US health care system, may speak a non-familiar language or come from a culture unfamiliar to the PCP and their clinic, and have a history of traumatic life experiences and social problems.

It is unclear how a PCP can successfully structure a short 15 minute visit with a refugee patient. Scarcity of time is a limiting factor for even mainstream American patients. A 1999 study of 29 family practitioners found that the doctor lets patients speak for only 23 seconds before interrupting them (51). A study by the University of South Carolina found primary care patients were interrupted after 12 seconds, if not by the doctor by a beeper or knock on the door. New doctors in training are spending approximately 8 minutes each day with patients (52), only about 12% of their time. In a study from St. Luke's University Health Network revealed that Emergency Department physicians spend 44% of their time on data entry, 28% in direct patient care, 12% reviewing test results, and 13 % in discussion with colleagues. Under this reality how can a PCP successfully implement a full Medical (Bio)-Psycho-Social-Spiritual assessment, or study a Virtual Patient learning environment that is based upon this model? Our findings indicate that PCPs have little time available for both. This would greatly inhibit their capacity to care for traumatized refugee populations.

We believe that the trauma story greatly contributes to the Domain Management Model (45). PHC is at the earliest stages of recognizing trauma as an important risk factor for mental health and medical disorders. The patient's traumatic experience increases the need for, as well as, exacerbates their difficulties accessing and mental health care services. Exposure to traumatic life events has been demonstrated to be highly correlated with smoking mortality, an increase in alcohol abuse, drug use, diabetes, heart problems, and direct physical health problems (i.e. bruising, broken bones, head and organ damage) and other long term physical illnesses (53). It is well established that cumulative trauma is associated with the psychiatric diagnoses of posttraumatic stress disorder and depression in a dose-effect relationship i.e. increasing levels of trauma lead to higher rates and severity of PTSD and depression (53-57). New evidence increasingly reveals the health impact of depression. It is recognized that severe depression alone is lethal (e.g. suicide). Only recently has it been revealed that depression is just as lethal through its effects on chronic disease (56). Those with depression are two to four times more likely to develop hypertension (three-fold risk), myocardial infarction (4-6 fold increase in mortality), diabetes (15% prevalence), and strong (25% prevalence) (54).

The documented association between trauma, life experiences, and serious medical and mental health disorders makes the PCP assessment of the trauma story/narrative essential in the care of highly traumatized patients, especially refugees. Mollica (48) and Crosby (49) have addressed the centrality of the trauma story in the diagnosis and treatment planning of refugees in primary health care. Our study reveals the low appreciation and use of the refugee's traumatic life history in the pre and post case evaluations. After viewing and studying the VP, PCPs showed some limited overall improvement in their recognition of the clinical importance of the patients' traumatic

life histories. In addition to scarcity of time and lack of financial compensation to the PCPs for spending more time on the life narrative of the patient, other factors may exist: PCPs may feel inadequate or unprepared to witness this narrative (58); refugees may not know how to tell the physician their life history; or the patient may not feel their traumatic life events are medical problems (59). The PCP may also feel fear, upset, impotence, and helplessness if they open-up this "Pandora's Box."

The VP learning environment at face value is an HIT instrument and approach that has the potential of providing a highly stimulating training experience for PCPs. Clearly the PCP need "time" to study the VP as well as apply it in their clinical practice. A dialog with the PCPs after their VP learning experience appears to be essential to maximizing the learning impact.

The importance of PCPs obtaining the trauma history of the refugee patient, as well as all traumatized mainstream patients, is no longer debatable (58). How this major domain can be integrated into medical education and successfully applied in the primary health care setting raises many challenges beyond the scope of this study (60). PCPs can no longer neglect the traumatic life history both past and current especially when patients want their physicians to listen to their trauma story (61).

Limitations: The rather small sample size and limited location of only one community health center used for this study inhibit the generalizability of our conclusions. A further limitation is the lack of discussion with the PCPs after they viewed the VP prototype in order to enhance their learning experience. The sample included a non-random inclusion of PCP participants, which may have introduced selection bias. However, the participants were highly homogenous consisting only of the clinical staff in primary care at one community clinic. The only significant differences in background factors were the number of years practicing medicine. One major factor limiting the study analysis is that other limiting factors such as financial reimbursement and productivity standards for time spent with patients was not explored. Grant funding for this pilot study did not allow for the actual assessment of VP training on patient care over time. Aside from these limitations, this study highlights the importance of the time spent during the training on the improvement in test scores.

This pilot study is the first to be used to educate and train PCPs on the diagnosis and treatment of a traumatized refugee patient in a primary care setting using the virtual patient (VP). The VP is a promising approach for PCP clinical training that was valued and well-received by the PCPs in our study.

Conflict of Interest

The author declares no conflict of interest.

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