The Virtual Patient for Improving Quality of Care in Primary Healthcare

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1. Structured Abstract

Purpose: To date, few studies have assessed the impact of the virtual patient (VP) as a learning tool in primary health care in diagnosing and treating marginalized patients (e.g. refugees).
Scope: This pilot grant allowed the authors to develop and test the impact of a VP on the clinical approach of PCPs at a community health center serving refugee patients.
Methods: This project was implemented in two stages.
Stage 1: The α prototype was provided to N=10 PCPs at a Community Health Center. Their reactions to the α prototype VP were used to prepare the β-VP prototype.
Stage 2: The β-VP prototype was submitted to the original N=10 PCP participants and N=14 new PCP participants as a learning experience. Before viewing the β prototype the PCPs evaluated a paper clinical case for diagnosis and treatment. After completing this, all PCPs received the β-VP prototype to review at their convenience. After completing VP training, participants received a second paper case. The Trauma-BPSS Scale was created to score the paper case responses on the trauma story and the four domains of the bio-psycho-social-spiritual approach. Afterwards, telephone interviews were conducted.
Results: After using the β-VP prototype, PCP assessments improved on the psychological and social domains. The medical domain was the highest pre and post VP training. The trauma, social, and spiritual domains scored initially low, with the trauma and spiritual domains remaining low. The VP demonstrated significant impact on PCP learning in psychological and social domains. The study investigators are exploring the role of "lack of time" as a barrier.

Key Words: virtual learning; primary care; refugees;

2. Purpose

There have been few studies trying to assess the learning outcomes when using Virtual Patient systems to train practicing clinicians. Therefore, this study was undertaken to try to assess whether the introduction of virtual patients (VPs) for training clinicians in primary care settings could lead to improved understanding and management of the complex issues regarding traumatized refugees.

The formulated hypotheses were:

1. There will be improvement in the clinical case notes scores between Case 1 and Case 2 after the β VP training. Proposed mechanism: the VP learning environment.

2. Sub-hypothesis: Compared with Medical domain as gold standard, case scores will show an improvement in the Trauma, Psychological, Social and Spiritual/Religious domains.

3. The following factors will positively impact scores:

a. older doctors with more experience are better at the 5 domains than the younger doctors

b. profession - people who are not MDs will see a greater impact

c. total time spent on the VP - people who spent more time using the VP will see greater impact

3. Scope

Background

Harvard Program in Refugee Trauma (HPRT) and the Karolinska Institutet (KI) in this project acknowledge the major barriers that currently exist in our health care settings for identifying and treating culturally diverse and traumatized patients with co-morbid health and mental health problems. The health care reform, while providing care to millions of uninsured patients, will increase the number of patients who face the problems of health disparities. HPRT and KI believe that the development of the VP Learning Environment targeted at the health and medical care of these patient groups can make a significant impact over time as a major Health Information Technology (HIT) innovation.

1. Trauma as a health and mental health risk factor

Primary Health Care (PHC) is at the earliest stage of recognizing trauma as an important risk factor for mental health and medical disorders. Patients' traumatic experiences increase the need for as well as exacerbate their difficulties accessing health care for health and mental health services. Exposure to traumatic life events has been demonstrated to be highly correlated with smoking mortality, an increase in alcohol abuse, drug use, and direct physical health problems (i.e. bruising, broken bones, head and organ damage) and long term physical illnesses. It has been well established that cumulative trauma is associated with the psychiatric diagnosis of posttraumatic stress disorder (PTSD) and depression in a dose-effect relationship, i.e. increasing levels of trauma lead to higher rates and severity of PTSD and depression. Over the past 25 years major community studies have demonstrated the high rates of PTSD, depression and physical disability in highly traumatized refugee populations. A recent RAND Corporation study of the Cambodian community in Long Beach, California, revealed prevalence rates of 62% for PTSD and 51% for depression 30 years after the Pol Pot genocide in Cambodia. A large scale community study in the United States of mainstream American patients demonstrated the positive relationship between trauma events, PTSD ($\geq$ 6 months), and physical illness. This study used the data from the National Comorbidity Survey – Replication (NCS-R) to examine the relationship between number of life time traumas, PTSD and 15 self-reported chronic medical conditions. The NCS-R findings reveal that:

1. There is a graded relationship between trauma exposure, PTSD, and the majority of major medical conditions.

2. The relationship between PTSD and chronic medical conditions was explained by the number of lifetime traumas experienced.

New evidence increasingly reveals the health impact of depression. That severe depression alone (e.g. suicide) is lethal is well recognized. Only recently has it been realized that depression is just as lethal through its effects on chronic diseases. Those with depression are 2 to 4 times more likely to develop hypertension (three-fold risk), myocardial infarction (4-6 fold increase in mortality), diabetes (15% prevalence), and stroke (25% prevalence). These new research findings show the risk of chronic medical diseases secondary to trauma in refugee and mainstream populations and communities. Traumatic life events are directly linked to physical health and indirectly mediated through depression and PTSD to physical health. Mental health and physical illness are directly related to major lifestyle factors such as diet, smoking, obesity, lack of exercise, and alcohol/substance abuse that can be directly improved in the PHC setting and through community-based interventions. The proposed VP HIT innovation will train PCPs on how to accurately identify trauma as a major medical and mental health risk factor in a culturally sensitive way.

2. Barriers to Health Care

Many traumatized patients in PHC face numerous barriers related to their socioeconomic status (SES), cultural medical worldviews, limited English proficiency, and low levels of health literacy. In order to identify and treat patients, the PCP must be aware of these barriers and how to overcome them. The VP as a HIT innovation is a clinical response to the following gaps in the primary health care system.

A. Socioeconomic Differences

Immigrants in the U.S. are more likely to have lower SES compared to native citizens. Individuals with lower socioeconomic status are more likely to report poor communication with their physicians compared to those with higher SES. Research has found that physicians' information giving was positively influenced by patient's communication style, such as question asking and expressiveness. Patients' levels of verbal expressiveness were strongly related to their levels of education. After controlling for the patient's communication style, evidence suggested that physicians gave more information to particular types of patients: more educated patients received more health information than their less educated counterparts. Providers spent a larger proportion of their time in the physical examination of patients with lower education and less time assessing health knowledge and answering patients' questions.

B. Cultural Differences

Providers and patients from different cultural backgrounds may have different explanations of health and illness. For example, the Western paradigm of the separation of mind and body characteristic of Western biomedicine may be difficult for some patients from different cultures to understand. They may also seek different treatments according to their own interpretation of symptoms and origin of disease. In addition, the doctor-patient relationship differs across cultures, which may cause misinterpretation and miscommunication of symptoms and concerns. For example, Asian Americans are more likely to use Eastern herbal or traditional folk medicine, or other Asian complementary and alternative medicine (CAM). These herbs may interact with prescription medications and lead to life-threatening complications. In a national study of 3,258 Chinese and Vietnamese American patients seen at 11 community health clinics, two-thirds reported that they used CAM while also receiving Western medical care. Yet only 7% reported

that their doctors discussed CAM use with them. Patients whose doctors discussed the use of CAM with them were more satisfied compared to those whose doctors failed to understand or discuss their CAM use.

C. Limited English-language Proficiency

In the United States, 47 million people speak languages other than English at home, and over 21 million people speak English poorly or not at all. Limited English proficient (LEP) individuals often have problems accessing medical care; they experience more medical errors, and receive more medical tests compared to those who speak English well. Language barriers result in less health information given to patients, worse provider-patient communication, and longer hospital stays. Having access to trained, professional interpreters during healthcare visits can alleviate some, but not all, of the health disparities associated with language barriers. Because of the cultural stigma surrounding mental health issues, many immigrant and refugee groups may be particularly reluctant to discuss their mental health needs in the presence of an interpreter. Thus, patients whose native language is not English may encounter obstacles with health literacy.

D. Levels of Health Literacy

Health literacy is defined as the "degree to which individuals can obtain, process, and understand the basic health information and services they need to make appropriate health decisions." Low health literacy patients have more problems with medication adherence, are more likely to take medications incorrectly, and have worse health outcomes. Immigrants, older individuals, and those who are racial/ethnic minorities are more likely to have lower health literacy compared to whites. The processes by which health literacy affect health outcomes are still under intense study. However, poor doctor-patient communication may be a fundamental factor. Poor communication impacts all components of the healthcare encounter, from taking an accurate medical history to explanations of diagnoses and treatments. Physicians often use medical jargon that patients do not understand. Furthermore, time pressures created by the 15-minute general medical visit may result in doctors providing information quickly, with little time to answer patients' questions. This problem can be exacerbated since patients with lower health literacy tend not to ask questions. Previous research has shown that patients with low health literacy are often ashamed to ask for help from providers, even though they do not understand instructions on how to take medications.

3. The Role of Primary Health Care

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 needs through a sustained partnership with patients and practicing in a family and community context." PHC is therefore considered an ideal health care environment for addressing the health and mental health needs of traumatized persons from culturally-diverse communities. Primary health care, for example, serves as the initial point of contact for patients with health related trauma problems, depression, and PTSD. Yet, the usual care by primary care practitioners (PCPs) may be less than optimal with studies indicating the recognition of trauma-related distress as less than 40%, diagnosis of PTSD as low as 2%, and depression less than 50%. In primary health care veteran clinics where PTSD and depression should be routinely diagnosed, less than 50% of diagnosable patients were identified. Under diagnosis and under 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. For example, Davis et al (2008) have recently 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. The identification and treatment of trauma-related health and mental health disorders in low income culturally diverse communities in primary health care must be developed and evaluated. PCPs may not be aware of the new findings relating traumatic life experiences such as refugee trauma, domestic violence, and history of child abuse to the patient's medical problems. Even if the doctor knows of the importance of trauma in the patient's health, they may be lacking the skill necessary to have that discussion with their patients, let alone diagnose and treat in a culturally appropriate manner. The VP is an ideal learning environment for PCPs to learn the content and practice the skills associated with identifying and treating traumatized patients from culturally-diverse backgrounds. Despite the inherent and current limitations of primary care, such as its fast pace and time constraints, it remains the ideal place for diagnosis and treatment of health and mental health problems in the immigrant and refugee population as their first point of access. For mental health problems, primary health care can be less stigmatizing than special mental health clinics and, despite the many barriers, can meet the immigrants' entire spectrum of mental health and medical needs.

4. HIT Innovations in Primary Health Care

HPRT and KI believe that the VP as an HIT innovation can be introduced successfully into PHC to create PCPs who have improved clinical assessment and treatment management skills in the care of the traumatized patient from culturally diverse backgrounds.

The VP HIT innovation introduced into PHC cannot ameliorate all barriers to health care experienced by traumatized patients. But it can be used as an effective tool in a PHC setting for building clinical capacity for the culture and evidence-based identification and treatment of these disadvantaged populations. Consistent with the intentions of this R-21, the VP is a major HIT innovation that can improve health care decision-making through the holistic integrated use of clinical knowledge collection and treatment management. The VP can be integrated into the PHC electronic network to provide readily accessible asynchronous learning to all PCP providers over time.

HPRT and KI invested 100,000 US dollars between 2007-2010 in a preliminary version of a VP called the VP α prototype based upon HPRT's extensive clinical experience with Bosnian refugees resettled in the United States and in Bosnia Herzegovina.

This case, called Mrs. K (available upon request), has been extensively used in HPRT's state-wide trainings of PCPs in the Commonwealth of Massachusetts (n=25 trainings, 200 PCPs) over 6 years. This case along with HPRT and KI's clinical consultation formed the basis of the new VP β prototype. The actual computer based version of the VP α prototype was developed at KI using Adobe Flash. Back-end XML-based data are processed in real time via a PhP server. Specific case content (e.g. VP Mrs. K's case) is managed via external XML files where patient data complies with standardized and structured guidelines for case management. These guidelines are fully compliant in the β version with the recently approved ANSI/MEDBIQ VP.10.1-2010 MedBiquitous Virtual Patient standard (see http://www.medbiq.org/std_specs/standards/index.html). In the VP system, the user can freely interact with the virtual patient and take illness history, perform physical exams, order and interpret lab and imaging tests as well as suggest a proper diagnosis and treatment plan. The user also receives a detailed feedback regarding actions taken, their appropriateness, and the quality of handling the case directly after the session.

The VP α prototype version interacts with the user in the following areas of medical care: (1) medical interview including chief complaint, history of the present illness, and social history; (2)

physical examination (including mental status examination); (3) screening instruments, including the Harvard Trauma Questionnaire (HTQ) and the Hopkins Symptom Check List (HSCL-25); (4) laboratory test and imaging studies; (5) additional data; (6) preliminary assessment (i.e. treatment plan).

5. Improving the PCP Treatment Plan, Problem, and "To-Do" List

PCPs may feel overwhelmed in providing medical care to traumatized patients with LEP and multiple medical, psychiatric, and social problems. The PCPs in a short amount of time have to diagnose and manage their patients; they often focus on a single medical complaint and set up a fairly narrow treatment management plan and "to-do" list.

The "to-do" list common in PHC practice is based upon the PCPs patient problem list. In Behavioral Health (BH) care, the latter is called a treatment plan. Unfortunately, the PCP often considers the BH treatment plan as too long, complicated and an overload. For the PCP, the focus is largely on making a diagnosis and deciding on a treatment to resolve the problem. In complex patients with multiple problems and poor communication skills, the PCP approach is often inadequate. H. C. Siebens has responded to these limitations by creating a systematic approach to organizing the PHC use of clinical information called the Domain Management Model (DMM). The DMM provides a standard approach and language to the entire clinical care process consistent with the principles of evidence and culture-based medicine. The DMM is a practical application of the biopsychosocial approach first described by Engel and primarily used by BH clinicians. As Siebens describes her model:

"In [this] conceptual model, progressively complex levels of information contribute to the health, or ill health, of individual patients: organ level function, whole-person-level function, and the social world around a patient. The DMM translates Engel's model into the care of any patient, of any age, with any disease or disability. The two organizing constructs include 1) the domain classification of a patient's problems and 2) time. The domains organize patient problems into four categories to facilitate logical prioritization of issues. Patients' clinical problems can have biological, psychological, or environmental (social) etiologies and consequences"

The DMM is consistent with HPRT's 11-point training of PCPs and can be modified to include the PCP's full appreciation of the patient's "*Trauma Story*". New computer-based clinical information systems have already been field-tested to integrate all available medical knowledge and lab tests to provide the PCP with a more comprehensive treatment plan.

The VP as a major HIT innovation can:

(1) Provide teaching that communicates a standard and more comprehensive approach to the traumatized patient including improved diagnosis, screening and the generating of better problems and "to-do" lists; and ultimately better clinical outcomes;

(2) Serve as a learning tool for both just-in-time and long term learning;

(3) Improve the flow of relevant patient information between VP trained PCPs;

(4) Help PCPs make better decision-making with relevant information including the Trauma Story;

(5) Ultimately lead to improvement in communication between PCP and patient.

4. Methods

This pilot study was designed with two phases, phase 1 and phase 2.

Phase 1. In phase 1 we used the α prototype version of the VP with 10 PCPs. The PCPs participated in three 60-75 minute sessions led by HPRT team leaders. Session 1 provided the

PCPs an introduction to the VP and they were administered the pre-test version of the *KI-VP-LEQ*. In Session 2, all PCPs participated in an actual viewing of the VP α prototype. In Session 2, after the successful viewing of the VP α prototype, all PCPs received the *KI-VP-LEQ* post-test. One month later, after the PCPs had some time to reflect on their experience, they were assembled for Session 3. During this session they were able to reflect on the quality and usefulness of the VP α prototype and make recommendations for improvement in the prototype.

Phase 2. Before presenting the prototype to more participants, the α prototype was revised based on feedback received in Phase 1. The revised prototype was then known as the β prototype. The 10 original PCPs from Phase 1 were recruited to participate in Phase 2, along with an additional 20 new PCPs, also from the same health center. Similar to Phase 1, participants completed measures, used the VP β prototype, then completed measures again, followed by individual phone interviews to gather feedback.
Because of feedback received during Phase 1, during Phase 2 there was only one in-person informational meeting introducing the idea of the VP to the 20 new PCPs. After the informational meeting, participants received Paper Case 1 and the KI-VP-LEQ pre measure via email with instructions to provide a case write-up and answer the survey, sending both back to study staff. Two weeks after we received these documents, we sent the participant a flash drive with the VP β prototype software and instructions about how to use it. Participants were given three weeks to use the software, or longer if needed, and then were sent Paper Case 2 and the KI-VP-LEQ post measure via email. Once participants returned a case write-up and completed post-survey, an individual structured phone interview was scheduled and conducted by study staff.

Paper Cases 1 and 2 were fictional cases created by the investigators as an additional way to measure the impact of the VP β prototype. The investigative team also created a unique scale called the Trauma-BPSS Scale to score the participants' case write-ups in response to the two paper cases. Participants' responses were scored on twenty-two items in five domains: trauma, medical, psychological, social, and spiritual domains. (Available upon request)

Measures:
The study applied three different instruments to measure possible outcomes:
Paper based cases – two descriptions of "typical" refugee trauma cases describing their medical, mental health and other issues, where the PCP then was asked to freely in a written document generate a problem list and a tentative "to do list" or treatment plan. (Available upon request)
Questionnaires – Two different questionnaires were used: a <u>Virtual Patient Learning Experience Questionnaire</u> (questions about the attitude of the user to the VP system as such and the possible advantages of such a system) and HPRT Confidence Questionnaire (Henderson et al 2005) (questions on how confident the user is to manage traumatized refugees). (Both scales available upon request).
Trauma-BPSS Scale – Participants' written responses were scored by investigators on each of 5 domains, each domain containing between 2 and 5 elements. Investigators discussed scores and resolved any differences in discussion. Scores were summed within each domain and also as a grand total (Available upon request).
Phone interview guide – A semi-structured interview guide regarding the user's reflection upon the strengths and weaknesses of their VP experience as well as to recommend improvements of the VP system as such.

5. Results (Principal Findings, Outcomes, Discussion, Conclusions, Significance, Implications).

In total, N=24 primary care practitioners (PCPs) were invited and volunteered to participate in this study. Ten of these had previously tried a preliminary version of the RTSim system (cohort 1) and 14 had not seen it before (cohort 2). In tables below the training demography is shown. The users were general physicians (n=14, 58%), nurse practitioners (n=5, 21%), physician assistants (n=3, 13%), and doctors of osteopathy (n=2, 8%). Before the simulation exercise, the 24 participants reported in general that their information technology (IT) knowledge was intermediate, they had seldom played computer/videogames or medical simulator during the last five years. They agreed that IT was an important support for their learning.

Completed Study: Gender Demographics by Cohort		
Cohort 1	**Cohort 2**	**Combined Cohorts**
Men: 5	Men: 3	Total Men: 8 (33%)
Women: 5	Women: 11	Total Women: 16 (67%)
Total: 10 (42%)	Total: 14 (58%)	Grand Total: 24

Dropped Out: Gender Demographics by Cohort		
Cohort 1	**Cohort 2**	**Combined Cohorts**
Men: 0	Men: 3	Total Men: 3
Women: 0	Women: 4	Total Women: 4
Total: 0	Total: 7	Grand Total: 7

Completed Study: Training Demographics – By Cohort			
Training/Degree	**Cohort 1**	**Cohort 2**	**Combined Cohorts**
Doctor of Medicine (MD)	7	7	14 (58%)
Doctor of Osteopathy (DO)	0	2	2 (8%)
Nurse Practitioner (NP, NP-C, DNP, ANP-BC, FNP-BC)	3	2	5 (21%)
Physician Assistant (PA, PA-C)	0	3	3 (13%)
Totals	10	14	24 (Grand Total)

AHRQ Priority Populations
The priority population of women was well represented in the participants of this study, at 67% of the sample. Participants' race/ethnicity and socioeconomic status data were not collected as part of this study. All participants worked primarily with AHRQ Priority Populations: inner-city, low income, ethnic and racial minorities, women, elderly, and those with special health care needs, including those who have disabilities or need chronic care.

Data analysis

The answers in the questionnaires were quantified using SPSS 22.0. Analyses of this data were descriptive due to small numbers (N=24). The analysis from the pre and post data included item-by-item measures and mean values for measuring the average rating of the Likert scale questions. Face validity of the KI-VP-LEQ had been analyzed before (Pantziaras et al 2012). The follow-up phone interview had both quantitative and qualitative data lasting between 3 -24 minutes (mean: 15 minutes (SD:5.29).

Characteristics of Study Sample by Cohort

In Table 1, the characteristics of the study sample Cohort 1 and 2, respectively and total is presented. The only significant difference between cohort 1 and cohort 2 was that cohort 1 reported higher numbers of years practicing medicine in primary care than cohort 2, on average [t = 2.39 (df = 15) p< .031]. Mean age of cohort 1 participants (45.8 years) was higher than mean age of cohort 2 participants (39.4 years), but this difference was not statistically significant.

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)	Sign
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 MD(%) DO(%) NP(%) PA, PA-C(%)	 7(50) 0 2(50) 0	 7(50) 2(100) 2(50) 3(100)	 14(58,3) 2(8,3) 4(16,7) 3(12,5)	ns
Ltime(SD)	16,0(4,52)	13,73(5,79)	14,72(5,29)	ns
PCPyrs (SD)	12,14(6,88)	6,14(4,71)	8,65 (6,34)	t=2,39, df=15 p<.031[*]
C1mins (SD)	48,33(21,07)	49,29(25,20)	48,91(23,17)	
C2mins (SD)	43,75(29,94)	48,04 (21,29)	46,25(24,73)	
Usumins (SD)	23,22(14,56)	24,23 (11,52)	23,82(12,52)	
MrsKmin (SD)	95,25 (40,93)	90,00(54,73)	92,19(48,53)	
MrsKNNum(SD)	2,25(0,83)	2,72(1,28)	2,52(1,12)	
Lessmore(SD)	1,45(0,69)	1,71(0,61)	1,604 (0,64)	

Overview of clinical worldview

Table 2 shows the self-reported dimensions of clinical care, pre-test and post-test on the questionnaires. For the pre- and post-survey question, "Please indicate level of emphasis [1 to 5 full emphasis] you place on Trauma as a Root Cause in clinical care" (Pre, Section B, question 2e; Post, Section A, question 2e): There was a statistically significant relationship between pre and post responses to this question within each cohort and within the sample as a whole. Participants in the both Cohorts put more emphasis on trauma as a root cause in the post survey. This was more pronounced in cohort 2 and in the sample as a whole. [Exact sign p<.003 whole sample; p<.040 cohorts]. There were minor differences regarding increased importance of psychological root causes after the simulation exercise.

Table 2. Self-reported dimensions of clinical care (pre-test questionnaire and post-test questionnaire) Ranked by the level of emphasis (1= no emphasis; 5= full emphasis)

Items	Pre / Post Cohort 1 (n=10) Median range	Pre / Post Cohort 2 (n=14) Median range	Pre / Post Total (n=29) Median range	Significance Pre/Post total Pre Cohort 1 & 2
A. IT PROFICIENCY				
1. My IT knowledge is	3	3	3	
2. During the last 5 years I have played computer/videogames	2,50	2	2	
3. During the last 5 years I have been training with some kind of medical simulator	2	2	2	
4. I believe that IT is an important support for my learning	4	4	4	
B. OVERVIEW OF CLINICAL WORLDVIEW				
1. Data (1= no emphasis; 5=Full emphasis)				
a) Chief complaint	5 / 5	5 / 4,50	5 /5	
b) History of present illness	5 / 5	5 / 5	5 / 5	
c) Physical exam	5 / 5	4 / 4	4,50 / 4	
d) Mental Status Exam	4 / 3,50	4 / 4	4 / 4	
e) Laboratory Tests	4 / 4	4 / 4	4 / 4	
f) Traditional Healing Exam	2,50 / 2,50	2,50 / 2	2,50 / 2	
2. Root Causes (1= no emphasis; 5=Full emphasis)				
a) Biological	5 / 5	4 / 4	4 / 4,5	
b) Psychological	5 / 5	4 / 5	4 /5	
c) Social (Economic)	5 / 4,50	4 / 4	4 / 4	
d) Spiritual	3 / 3	2,50 / 3,50	3 / 3	
e) Trauma	4,50 / 5	4 / 5	4 / 5	Exact Sign p<.003 Exact sign p<.040
B General opinions and perceptions AFTER the learning experience B1. Did respondent leave a comment? B2. Did respondent leave a comment? B3. Did respondent leave a comment? B4. Did respondent leave a comment?			./ yes N=24 ../ yes N=23 / 4 ../ yes N=23	

Motivation to use VPs for training

Table 3 shows results of self-reports of motivation to use the VP before and after the simulation exercise. For the pre- and post-survey question, "I am motivated to use VP as it leads to better care" [1=highly disagree to 4=highly agree] (Pre, Section C, question 1; Post, Section D, question 1): Participants reported being significantly more motivated in the post-survey, for the sample as a whole. [Exact sign p< .046]. There were no other significant changes between the pre and posttests. Several answers regarding the use of this type of VPs for training and management of traumatized patients were rather high (question 1, 4, 9, 14 and 15). Very few agreed that they could meet more patients per hour (question 5) after training with the VP, or that

this case only was good to handle Bosnian refugees (question 16), which both are interpreted as an positive indication

Table 3. Self-reports of current motivation (pre-test questionnaire and post-test questionnaire) ranked by level of emphasis (1= highly disagree; 4= highly agree)

C. SELF-REPORTS OF CURRENT MOTIVATION TO USE THE VP BEFORE THE SIMULATION EXERCISE (1=highly disagree, 4=highly agree)				
Items	Pre / Post Cohort 1 Median range	Pre / Post Cohort 2 Median range	Pre / Post Total (n=29) Median range	Significance Pre/post total
1. I am motivated to use VP as it leads to better care	3 / 4	3 / 4	3/4	Exact sig p<.046
2. I am motivated to use VP as I will feel more competent	3 /	3 / 3	3/3	
3. I am motivated to use VP as I will have a better relationship with the patient	3 / 3,50	3 / 4	3/3	
4. I am motivated to use VP as it will provide better treatment outcomes	3 /4	3 / 3	3/4	
5. I am motivated to uuse VP as I can meet more patients per hour	2 / 2	1 / 1	1,50/1	
6. I am motivated to use VP as I can have more time with the patient	2 / 2	2 / 1	2/2	
7. I am motivated to use VP as I can use VP to educte my staff	3 /3,50	3 / 3	3/3	
8. I am motivated to use VP as it helps to improve interdisciplinary communication	3 / 3	3 / 3	3/3	
9. I am motivated to use VP as it helps me to udnerstand the mental health problems of my patient	3,50 / 3	3,50 / 4	3,50/4	
10. I am motivated to use VP as it helps me to understand medical problems of my patient	3 / 3	3 / 3	3/3	
11. I am motivated to use VP as it helps me to understand social problems of my patient	3 / 3	3 / 3,50	3/3	
12. I am motivated to use VP as it helps me to understand spiritual problems of my patient	3 / 2,50	3 / 3	3/3	
13. I believe the VP will help me provde better care to all my patients	3 / 3,50	3,50 / 3	3/3	
14. I believe the VP willhelp me provide care to my traumatized patients from any cultural background	4 / 4	4 / 3	4/3,50	
15. I believe the VP will help me provide better care to my traumatized patients whoa re from culturally diverse backgrounds and are low-English speakers	3 / 4	3,50 / 3	3/4	
16. This system is only good for	1 / 1	1 / 1	1/1	

helping me to manage trauamtized refugees from Bosnia				
17. Open question				
POST				
5. Rate how the following dimensions contribute to perceive a virtual case as realistic (1=does not contribute at all; 5= highly contributes) 1) Interactivity b) Authenticity c) Trustworthiness d) Dramaturgy e) Layout/design f) Videotaped patient g) Recorded voice h) X-ray images i) Physical Exam images j) other			/4 /4 /4 /4 /3,25 /4 /4 /4 /4	
6. How do you perceive a virtual patient as compared to a paper case			/5	

Correlations

PCPyrs & Age r = 0.758   p< .000
Number of years practicing medicine in primary care and age in years are positively correlated. Older participants reported more years practicing medicine in primary care.

C1mins & C2mins r = 0.846 p<.000
Time spent on paper case 1 and time spent on paper case 2 are positively correlated. Participants who reported spending more time on paper case 1 also reported spending more time on paper case 2.

C2mins & lessmore r = 0.534 p=.007
Time spent on paper case 2 and the participant's comparison between time spent on the paper case and usual time spent in clinical practice were positively correlated. Participants who reported higher amounts of time spent on paper case 2 also reported that they spent more time on one of the paper cases than they usually do on a clinical intake.

Usumins & lessmore r = -0.614 p=.002
The usual amount of time spent on an intake in clinical practice and the participant's comparison between time spent on the paper case and usual time spent in clinical practice were negatively correlated. Participants who reported usually spending smaller amounts of time on an intake also reported that they spent more time on one paper case in comparison to the usual amount spent on an intake.

MrsKmins & Age r = 0.462 p = .023
The total amount of time spent using the virtual patient software was positively correlated with participants' ages. Older participants also reported spending more time using the virtual patient software.

MrsKmins & MrsKNum r = .505 p= .012

The total amount of time spent using the virtual patient software was positively correlated with the total number of times the participant reported sitting down to use the software. Participants who spent more total time using the software also reported more individual number of sessions using the software.

Ltime & usumins r = 0.548 p= .010

Length of time spent in the phone interview was positively correlated with the usual amount of time a participant reported spending on an intake in clinical practice. Participants who reported longer amounts of time for a usual intake in clinical practice also had longer phone interviews.

Ltime & lessmore r = -0.418 p= .047

Length of time spent in the phone interview was negatively correlated with the participant's comparison between time spent on the paper case and usual time spent in clinical practice. Participants who had shorter phone interviews also reported that they spent more time on one paper case in comparison to the usual amount of time they spent on an intake.

Pre and post data for the 5 dimensions

Despite the short training time used by most clinicians, we did receive statistically significant results in two of the most important domains (Table 4)

In Table 4 pre- and post-data for the 5 dimensions are shown. The medical dimension had the highest scores on both pre- and post-scoring. There were significant improved small changes measured by Cohen's d on total score (d=0.26)), total psychological sum (0.36), total social sum (0.41) and improved average changes on total spiritual sum (d=0.51).

Among the five elements on each dimension (except spirituality), two elements of the Social Domain had the highest improved changes: "plans for addressing social problems" (d=0.92), "acknowledges social problems/distress and major disruptions" (d=0.45) and "patient education" (d=0.43). On the Psychological domain, the element "list the most important psychiatric diagnoses" was significant average improved between pre and post data (d=0.50).

In the spiritual domain, "acknowledges spiritual/religious background of patient" and acknowledges spiritual/religious problems and/or strengths.

Table 4. Effect size – A and B Case (an effect size of 0.20 is assumed to be small, 0.5 to be average and values over 0.80 to be large) N=24

Five Domains	Variables Codes,	A Case Mean(SD)	B Case Mean(SD)	Cohen's d
I. Trauma Domain				
1. Traumatic life history & life experiences (general acknowledgement)	0 or 1	0.58(0,504)	0.46(0.509)	0.24
2. Trauma story linked to current symptoms and diagnoses	0 or 1	0.38(0,495)	0.46(0.509)	0.16
3. List the most important trauma events	0 or 1	0.42(0,504)	0.29(0,464)	0.27

	0 or 1			
4. Trauma treatment	0 or 1	0.42(0,504)	0.29(0,464)	0.27
5. Patient education on impact of trauma on life	0 or 1	0.17(0,381)	0.08(0,282)	0.27
Trauma story summary, min-max	0-5	1.96(1,805) 0-5	1.58(1,742) 0-5	0.21
II Medical Domain, max values				
1. Link medical problems to chief complaint, HPI	0 or 1	0.83(0,381)	0.83(0,381)	-
2. Use labs	0 or 1	0.96(0,204)	0.96(0,204)	-
3. List the most important medical diagnoses	0 or 1	0.92(0,282)	0.96(0,204)	-
4. Treatment of medical problems (with side effects of meds)	0 or 1	1.00(0,00)	1.00(0,00)	-
5. Patient education	0 or 1	0.75(0.442)	0.54(0,509)	0.28
Medical summary, min-max	0-5	4.46(0.833) 2-5	4.29(0,806) 2-5	0.21
III. Psychological Domain				
1. Acknowledges psychological/emotional distress of patient	0 or 1	0.92(0,282)	0.96(0,204)	-
2. Use screening instruments	0 or 1	0.29(0,464)	0.38(0,494)	0.19
3. List the most important psychiatric diagnoses	0 or 1	0.88(0,338)	1.00(0,00)	0.50
4. Multi-modal treatment (psychotropic drugs, counseling, etc)	0 or 1	1.00(0,00)	1.00(0,00)	-
5. Patient education	0 or 1	0.38(0,495)	0.46(0,509)	0.16
Psychological summary, min-max	0-5	3.46(0,932) 2-5	3.79(0,884) 2-5	0.36
IV. Social Domain				
1. Acknowledges social problems/distress and major disruptions	0 or 1	0.58(0,505)	0.79(0,415)	0.45
2. Link social problems to chief complaint, HPI, exam, M/Exam, etc	0 or 1	0.33(0,482)	0.38(0,495)	0.10
3. List the most important social problems	0 or 1	0.38(0,495)	0.46(0,509)	0.16
4. Plans for addressing social problems	0 or 1	0.21(0,415)	0.63(0,495)	0.92
5. Patient education	0 or 1	0,04(0,204)	0.17(0,381)	0.43
Social summary, min-max	0-5	1.75(1,511) 0-5	2.42(1,767) 0-5	0.41
V. Spiritual Domain				
1. Acknowledges spiritual/religious background of patient	0 or 1	0.21(0,415)	0,33(0.482)	0.27
2. Acknowledges spiritual/religious problems and/or strengths	0 or 1	0.17(0,381)	0.46(0,509)	0.65
Spiritual summary, min-max	0-2	0.38(0,711) 0-2	0.79(0,884) 0-2	0.51
Grand total	0-22	11.79(4,314) 5-19	12.96(4,601) 7-21	0.26

Table 5 shows how the gold standard medical domain compared with the other three domains (trauma, psychological and social) is less on B Case.

Table 5. Comparison between gold standard medical domain and the other four domains. Effect size – A and B Case (an effect size of 0.20 is assumed to be small, 0.5 to be average and values over 0.80 to be large) N=24

Five Domains	Variables Codes,	A Case Mean(SD)	Cohen's d	B Case Mean(SD)	Cohen's d
I. Golden standard medical domain – trauma domain					
Trauma story summary, min-max, compared with golden standard medical domain	0-5	1.96(1,805) 0-5 4.46(0.833) 2-5	2.32	1.58(1,742) 0-5 4.29(0,806) 2-5	1.99
II. Golden standard medical domain – psychological Domain					
Psychological summary, min-max compared with golden standard medical domain	0-5	3.46(0,932) 2-5 4.46(0.833) 2-5	1.13	3.79(0,884) 2-5 4.29(0,806) 2-5	0.86
III. Golden standard medical domain - Social Domain					
Social summary, min-max compared with golden standard medical domain	0-5	1.75(1,511) 0-5 4.46(0.833) 2-5	2.22	2.42(1,767) 0-5 4.29(0,806) 2-5	1.35

Conclusions

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 primary health care using the virtual patient (VP). The VP was shown to be an effective learning tool. A new scale (called the Trauma-BPSS Scale) was created to evaluate the use of the Trauma Story and the Bio-Psycho-Social-Spiritual domains in assessing a traumatized refugee. This study revealed that PCPs in the study scored low on using the trauma story and the social domain of the patient. Not surprisingly the PCPs scored high on the medical and moderately high on the psychological domains. Also, their acknowledgements of the spiritual dimensions of the patient were also low.

After using the VP β prototype as an educational tool there were some modest improvements in the psychological and social domains. Use of the trauma story and the spiritual domain remained low. The HPRT-KI team is still in the process of analyzing these possible factors (such as limited time studying the VP prototype) as a major factor affecting these outcomes. Overall the VP was demonstrated to be readily accepted by PCPs in a community health center affecting improvement and enhanced use of the psychological and social domains in the initiation of treatment. It is not known (maybe time) why the trauma story of the assigned paper cases revealed limited change in use after viewing the VP prototype. Clearly, as a trauma-informed care approach becomes a priority in primary health care, we will need better understanding of those factors that cause VPs to avoid the trauma story and its implications for diagnosis, treatment including patient education.

The limitations of this pilot study included:

1. Small sample size
2. Location at only one community health center
3. Lack of discussion with the PCPs after they viewed the VP prototype in order to enhance learning experience.

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