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A study of post-traumatic stress disorder and depression in poly-trauma patients

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A STUDY OF POST-TRAUMATIC STRESS DISORDER AND DEPRESSION
IN POLY-TRAUMA PATIENTS

by

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A STUDY OF POST-TRAUMATIC STRESS DISORDER AND DEPRESSION IN POLY-TRAUMA PATIENTS

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ABSTRACT

Introduction: A paucity of research has been performed to understand the prevalence and predictors of post-traumatic stress disorder and depression in patients who have experienced multiple blunt forced traumas. These two disorders are very debilitating for the patients who are affected, thus it is important to understand who may be at greatest risk and what factors predict poor outcomes in order to design interventions aimed at decreasing the negative psychological consequence of traumatic injury.

Aims and Hypotheses: Our goals are to examine if there is a relationship between gender and the prevalence of depression, if an open fracture leads to an increased prevalence of depression, and if there is a link between a patient’s length of stay in the hospital and depression. In regards to PTSD we wanted to
investigate if there was a significant relationship between gender and PTSD, and if there was a strong relationship between a patient’s past trauma and an increased risk of developing PTSD after subsequent trauma. We believed that women would have a higher prevalence of depression and PTSD. We also expected that patients with open fractures, and patients with longer stays in the hospital, would all have a higher prevalence of depression. We also hypothesized that patients with past traumas would have a higher prevalence of PTSD.

**Methods:** We enrolled 38 patients based on the inclusion/exclusion criteria that they were 18 years and older, involved in a traumatic accident resulting in a polytrauma injury, and had a long bone fracture. The patients were assessed using the Center for Epidemiological Studies Depression Scale (CES-D), an Event Scale-Civilian questionnaire (ESC), and a Vrana & Lauterbach Purdue Post-Traumatic Stress Disorder scale (PPTSD-R). An Analysis of Variance (ANOVA) and chi-square analyses were performed to test our hypotheses.

**Results:** No significant relationship between gender and depression was observed for the CESD total score, $F(1,25)=0.05, p=0.83$ or when we used the clinical cutoff for the CESD, $\chi^2=2.241, p=0.33$. There was no significant relationship between an open fracture and depression, $F(1,24)=0.068, p=0.81$ and
no significant correlation between length of hospital stay and depression, $r=0.13$, $p=0.18$. We also found no significant relationship between gender and PTSD, $F(1,26)=2.07$, $p=0.16$. There was no relationship between past trauma and higher prevalence of PTSD, $F(1,23)=0.35$, $p=0.56$, but there was a correlation between past trauma related distress and current PTSD symptoms, $r=0.45$, $p=0.04$

**Conclusion:** The lack of a significant relationship between gender and depression or gender and PTSD was much different than the prevalence of both disorders in the general U.S. adult population where women have a higher rate of both depression and PTSD compared to men. We also found that unlike previous research, open fractures did not have a significant relationship with depression, suggesting that the type of injury does not have an effect on the risk one has of developing depression at least early after the traumatic injury. The lack of significance between the length of stay and depression suggests that short stays in the hospital are not a strong influence on the patient’s mental health.

While there was also no significant relationship between a history of past trauma and PTSD, we did find that there was a relationship between past trauma related distress and PTSD, which suggests that solely experiencing a trauma is not as important in predicting PTSD as was the distressfulness of the trauma. These conclusions suggest at the least, that further study of depression and PTSD is
needed to help further understand how patients are affected by these disorders following multiple traumas.
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**ABBREVIATIONS**

<table>
<thead>
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<tr>
<td>ANOVA</td>
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<td>CES-D</td>
<td>Center for Epidemiological Studies Depression Scale</td>
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<td>CRH</td>
<td>Corticotropin-releasing hormone</td>
</tr>
<tr>
<td>DSM-V</td>
<td>Diagnostic and Statistical Manual of Mental Disorders</td>
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<td>ESC</td>
<td>Event Scale Civilian Survey</td>
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<tr>
<td>MDD</td>
<td>Major Depressive Disorder</td>
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<td>MVA</td>
<td>Motor Vehicle Accident</td>
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<td>PPTSD-R</td>
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<td>SPSS</td>
<td>Statistical Product and Service Solutions</td>
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<td>TBI</td>
<td>Traumatic brain injury</td>
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INTRODUCTION

Post-Traumatic Stress Disorder (PTSD) has long been associated with soldiers returning from war, but more recently has been observed in the civilian population. While these are two different populations in terms of the type of exposure to trauma, they both still develop PTSD. In conflict, PTSD will develop when a soldier is not only exposed to combat, but also when they are prisoners of war, or are injured. A soldier’s, prewar vulnerability to psychiatric disorders has been shown to be a predictor of PTSD [1]. In the civilian population PTSD develops in people who experience non-combat related traumas, such as sexual abuse as a child, an abusive adult relationship, a motor vehicle accident (MVA), etc. [2]. Another psychiatric disorder that is more common than PTSD is depression, also known as Major Depressive Disorder (MDD). This disorder can be caused by many things, such as stress. MDD has recently gained widespread attention as the national attitude towards MDD is shifting from ignorance towards the disease and thus stigmatization of people who have developed MDD, to understanding and wanting to help and treat people who are afflicted. The current study will be useful in furthering the understanding of PTSD and MDD in civilians who have experienced a physical trauma such as MVA or falls.
The findings of the study will help in the development of interventions so that health care professionals can better treat patients suffering from these disorders.

**Objectives:**

The purpose of this study is to observe the prevalence of PTSD and depression, the potential predictors of PTSD and depression, and consequences of these symptoms on the recovery after a multiple blunt force trauma. We expect to observe:

- The rates of depression and PTSD in this population to be higher than the national average
- The female polytrauma patients develop depression at a higher rate than the male patients, similar to that of the general population
- The patients with open fractures to have a greater prevalence of depression as compared to the patients who have only closed fractures
- Those patients who have a longer length of stay in the hospital will have depression at a higher rate than those patients with a shorter length of stay. With regards to PTSD, we expect patients who are
still traumatized by a past trauma to develop PTSD at higher rate than those patients who were not traumatized by a past trauma at the time of their most recent accident.

**Depression**

Clinical depression is defined as

“a mood disorder in which feelings of sadness, loss, anger, or frustration interfere with everyday life for weeks or longer [3].”

Depression is associated with low levels of serotonin and reduced levels of dopamine, which is connected to the bodies reward system [4]. The cause of this deficiency is not completely known. The DSM-V, Diagnostic and Statistical Manual of Mental Disorders-V, uses the patients’ outward behavior and feelings rather than biomarkers to help the treating physician or psychologist determine a diagnosis of depression. For a diagnosis of a major depressive disorder, the patient must match a certain number of a list of criteria before it can be classified as a depressive disorder [4].

The exact cause of depression is unknown, but it is believed to have beginnings in not only genetics, but also in the environmental stressors, which
suggests that anybody can develop depression no matter the familial history [3].

According to the National Institute of Mental Health, the prevalence of depression in the U.S. is 6.7% [5], and women are 70% more likely to be diagnosed with a depressive disorder than men [6]. There has been research done in determining specific predictors of who will develop depression [7-9]. A higher rate of depression in has been observed in adolescent females compared to adolescent females [8]. The biological difference between males and females in the cortico-limbic-striatal neural system has also been studied and has been shown to be a reason for the higher prevalence of depression in females compared to males [9]. The reason that a difference in depressive symptoms in females and males is expected in polytrauma patients despite both groups experiencing a similarly traumatic event is due to the observation that increased female risk is independent of the type of injury and the injury severity [10].

While females have an increased risk of developing depression, when both males and females do get depression there is no significant difference in the disorders severity [11]. In this population of poly-trauma patients, it is expected that those patients with a prior history of depression or another mental disorder will have a greater chance of having another depressive episode [7]. Gender is a genetic predictor in the strictest sense of the word, but there are other predictors that are
the result of the accident that a patient experiences, such as the kind of fracture(s) that a patient acquires.

It has been shown that a patient with any orthopaedic injury is at risk for depression; the prevalence of depression after the trauma in this population is 45% [12], which is much higher than the national average [4]. Increasing the risk even more is the presence of at least one open fracture, which has been shown to be a significant factor in the patient developing depression [12]. There are few studies that have been conducted in patients who have experienced a physical trauma, with the exception of those who have suffered a traumatic brain injury (TBI); therefore, we aim to add understanding of the prevalence of depression and PTSD in people who have specifically suffered from a multiple blunt force trauma. Depression cannot only affect a person’s state of being, but also can influence their length of stay in the hospital.

Since the cost of medicine has risen to an all-time high, there have been attempts to reduce unnecessary spending. One way to reduce spending that is within the control of health care providers is finding ways to reduce the length of hospital stay. Research by Verbosky, Franco, and Zrull, has shown that patients who exhibit depression during their hospital stay have a longer length of stay by 10 days [13, 14]. Another study has shown that there is an increased psychiatric
morbidity associated with a longer length of stay [15]. A study evaluating cancer patients with a benign disease who were depressed showed an increased length of stay of 82.2 days versus a length of stay of 36 days in benign cancer patients who were not depressed [16]. In that same study there appeared to be no significant difference in length of stay amongst patients with a malignancy. To further give credence to the claim that identifying depression and treating it will reduce the length of stay in the hospital, research has shown that medical-surgical unit patients who were depressed and received anti-depressant medication had a 31.8 days shorter length of stay than depressed patients who did not receive anti-depressant medication [13]. These results will be very beneficial in not only identifying and treating depression early, but it can also indirectly help in reducing the cost of medical expenses.

Another psychiatric disorder that is common in the polytrauma population is PTSD. PTSD is a lot more difficult to diagnose, but if early diagnosis can be accomplished it can help not only help in the treatment of PTSD, but also further reduce medical costs.

Post-Traumatic Stress Disorder
The prevalence of PTSD in the general population is at 6.8% in the adult U.S. population, 3.6% for males, and 9.7% among females [17]. The symptoms of PTSD manifest themselves in three clusters of symptoms: reliving the event, avoidance of thoughts and feelings of the events, and arousal [2, 4]. Reliving the event involves flashbacks, upsetting memories, nightmares, and physical reactions to things or events that remind the patient of the traumatic event. Avoidance involves the patient being emotionally numb, feeling detachment, and presenting with the inability to remember important aspects of the event, a loss of interest in previously enjoyable activities, and a feeling of there being no future. Arousal is when the patient has a hard time concentrating on things ranging from watching TV to eating, being easily startled by normally innate things, hyper-vigilance, and by having a difficult time trying to sleep. Typically the symptoms start within three months of the trauma, but could take longer than 1 year to manifest [18].

The understanding of what PTSD is and how it affects the body comes from its prevalence in the U.S. military. It was first diagnosed in 1980 in discussions involving Vietnam veterans and how the war affected them [1, 19]. A study examined combat exposure, prewar vulnerability, and involvement in harming civilians or prisoners in order to identify which factors influenced
soldiers the most in PTSD onset [1, 20]. It was observed that harm to either civilians or prisoners was a key factor in influencing PTSD onset [1, 21]. While combat experience is a strong influence on a soldier’s risk of developing PTSD, another factor that plays a role is whether or not the soldier had received any kind of head trauma. A study of soldiers returning from Iraq found that there was a strong connection between traumatic brain injury and PTSD [22]. These studies of soldiers and PTSD have helped pave the way in understanding PTSD in the civilian population.

While civilians don’t experience the combat trauma that soldiers do, there are plenty of instances that are traumatic enough to initiate PTSD. These may include a MVA, a fall from a large height, a sexual assault, and anything else that is physically dangerous or life-threatening to oneself or being observed happening to someone else [4]. A study by North and colleagues to observe PTSD in civilians who were survivors of a mass shooting concluded that the PTSD that civilian survivors experienced was not like the PTSD that the Vietnam veterans experienced, in that the civilians were not trained to experience that kind of trauma and had no expectations of getting involved in such a traumatic scenario. This study also concluded that a history of a psychiatric disorder increased the risk of developing PTSD after the shooting [23]. There are some
patients who experience trauma and do not develop PTSD, which can partly be ascribed to a patient’s resilience [24]. This includes a patient having a strong support system, feeling good about one’s actions in the face of a dangerous situation, and the patient having a feeling that they can act and respond effectively despite the feeling of fear [18]. Another factor that appears to increase the risk for developing PTSD is gender, much like for depression.

It has been found that while PTSD and depression are independent of severity and the mechanism of injury, there is an increased risk in females of developing both [25]. Although males have an increased lifetime risk of experiencing a traumatic event, the development of PTSD following a trauma is twice as high in females [26, 27]. Some possible explanations for this are the different coping styles of females and also the “limited socio-economic resources” to which women have access [27]. As a way of discovering why females experience PTSD differently, a study was done of female police officers. It was found that there is a gender difference in civilians, but amongst military and police personnel there is no gender difference with regard to the development of PTSD. This difference could be associated to the peri-traumatic emotionality that the female civilians may experience whereas the female police officers had reduced emotionality at the time of the trauma possibly due to their
choice of career and preparation for a traumatic experience at some point in their training [28]. The gender difference in PTSD has also been linked to females having a greater risk of PTSD occurrence following a sexually violent assault [26, 29]. Women have a much greater probability of developing PTSD following a sexually violent assault compared to men (36% to 6%, respectively) [26]. Aside from the gender difference in the prevalence or incidence of PTSD, there is a difference in how females experience PTSD symptoms. A study by Breslau et al. demonstrated that women are more likely to experience arousal and avoidance symptoms compared to men [30]. This gender difference could also explain the increased risk of reoccurrence of PTSD following a trauma later in life.

Polytrauma patients have just experienced a very traumatic event, whether it is a MVA, a fall from large heights, an ATV rollover, etc. If they have experienced at least one trauma previously in their lives, then it is believed that they are more likely to develop PTSD after each additional accident, such as the incident that brought them to our study. The studies support the fact that prior trauma may influence the development of depression or PTSD subsequent to another trauma. Prior research has shown that past trauma alone is not a predictor of PTSD [31], but prior PTSD that developed after a previous trauma is a good predictor for a person to develop PTSD after subsequent traumas [32, 33].
It has also been observed that multiple traumatic events increase the risk of developing PTSD later in life much more than a single event [33]. There also appears to be a difference in PTSD recurrence depending on what kind of previous trauma a person experiences. As with the gender difference, assaultive violence tends to have a greater influence on a person developing PTSD later in life [26, 33]. Another study was done on the effects of trauma on both bystanders and victims. That study found that there is an equal risk of a person developing PTSD whether they are a bystander or victim [34]. With this understanding of how PTSD can affect and influence a person’s life and how they cope with trauma, it will become easier for physicians to treat patients of this debilitating mental disease.
METHODS

Patient Selection

This study was a prospective study where the patients were questioned at a baseline, their first visit, and at 6, 12, 16, 24, and 48 weeks after their discharge from the hospital. For the purposes of this study, only the baseline assessment was included in the analyses. Inclusion criteria was 1) the patient was 18 years or older 2) they must have had at least one long bone fracture, such as the tibia, fibula, or femur 3) were considered a polytrauma patient, i.e. two or more injuries and 4) their accident occurred no later than eight weeks prior to being interviewed in the clinic. If these criteria were fulfilled then the patients were approached by a research assistant as to whether or not they wanted to participate in the study.

Instruments

The questionnaire consisted of a Medical History Questionnaire, the Center for Epidemiologic Studies Depression Scale (CES-D) (Table 1), an Event Scale Civilian survey (ESC) (Table 2), and a Vrana & Lauterbach Purdue Posttraumatic Stress Disorder Scale (PPTSD-R) (Appendix A).
The ESC survey (Event Scale Civilian) (Table 1) is a 14 item questionnaire that deals with any of the patient’s past involvement in any traumatic events, such as any industrial accidents, car accidents, natural disasters, violent crime, childhood abuse, or spousal abuse. All of the questions ask how often the past event occurred, at what age(s), on a scale of 1 to 7, how severely was the patient injured, how severely their life was threatened, how traumatic the event was at the time it occurred, and how traumatic the event is to the patient right now. Since prior traumas have been known to increase the likelihood of a patient redeveloping PTSD, this questionnaire was very important in determining if the patient has PTSD related to the most recent traumatic event or if it is related to their past.
Table 1:

**Event Scale-Civilian (ESC)**

1. Have you been in or witnessed a serious industrial, farm, or car accident, or a large fire or explosion?  **YES**  **NO**
   a. How many times? Once twice three+
   b. How old were you at that time(s)? 1st 2nd 3rd 
   c. Were you injured?  
      Not at all  |  Severely  
      1 2 3 4 5 6 7  
   d. Did you feel your life was threatened?  
      Not at all  |  Severely  
      1 2 3 4 5 6 7  
   e. How traumatic was this for you at that time?  
      Not at all  |  Severely  
      1 2 3 4 5 6 7  
   f. How traumatic is this for you now?  
      Not at all  |  Severely  
      1 2 3 4 5 6 7  
   g. What was this event? ________________________________

2. Have you been in a natural disaster such as a tornado, hurricane, flood or major earthquake?  **YES**  **NO**
   a. How many times? Once twice three+
   b. How old were you at that time(s)? 1st 2nd 3rd 
   c. Were you injured?  
      Not at all  |  Severely  
      1 2 3 4 5 6 7  
   d. Did you feel your life was threatened?  
      Not at all  |  Severely  
      1 2 3 4 5 6 7  
   e. How traumatic was this for you at that time?  
      Not at all  |  Severely  
      1 2 3 4 5 6 7  
   f. How traumatic is this for you now?  
      Not at all  |  Severely  
      1 2 3 4 5 6 7  
   g. What was this event? ________________________________

3. Have you been a victim of a violent crime such as rape, robbery, or assault?  **YES**  **NO**
   a. How many times? Once twice three+
   b. How old were you at that time(s)? 1st 2nd 3rd 

c. Were you injured?
   Not at all
   1  2  3  4  5  6  7
   Severely

d. Did you feel your life was threatened?
   Not at all
   1  2  3  4  5  6  7
   Severely

e. How traumatic was this for you at that time?
   Not at all
   1  2  3  4  5  6  7
   Severely

f. How traumatic is this for you now?
   Not at all
   1  2  3  4  5  6  7
   Severely

g. What was this event? ________________________________

4. As a child, were you the victim of either physical or sexual abuse?  YES  NO
   a. How old were you when it began? _________
   b. How old were you when it ended? _________

   c. Were you injured?
      Not at all
      1  2  3  4  5  6  7
      Severely

   d. Did you feel your life was threatened?
      Not at all
      1  2  3  4  5  6  7
      Severely

   e. How traumatic was this for you at that time?
      Not at all
      1  2  3  4  5  6  7
      Severely

   f. How traumatic is this for you now?
      Not at all
      1  2  3  4  5  6  7
      Severely

   g. What the assailant male or female? _________

5. As an adult, have you had any unwanted sexual experiences that involved the threat or use of force?  YES  NO
   a. How many times?  Once  twice  three+
      1st   2nd   3rd   __________
   b. How old were you at that time(s)?
      1  2  3  4  5  6  7
   c. Were you injured?
      Not at all
      1  2  3  4  5  6  7
      Severely

   d. Did you feel your life was threatened?
      Not at all
      1  2  3  4  5  6  7
      Severely

   e. How traumatic was this for you at that time?
      Not at all
      1  2  3  4  5  6  7
      Severely
1 2 3 4 5 6 7  

f. How traumatic is this for you now?  
Not at all  | Severe  
1 2 3 4 5 6 7  

g. Was the assailant male or female? ___________  

6. As an adult, have you ever been in a relationship in which you were abused either physically or otherwise? **YES**  **NO**  
   a. How many times?  Once  twice  three+  
   b. How old were you at that time(s)?  1st 2nd 3rd  
   c. Were you injured?  
      Not at all  | Severe  
      1 2 3 4 5 6 7  
   d. Did you feel your life was threatened?  
      Not at all  | Severe  
      1 2 3 4 5 6 7  
   e. How traumatic was this for you at that time?  
      Not at all  | Severe  
      1 2 3 4 5 6 7  
   f. How traumatic is this for you now?  
      Not at all  | Severe  
      1 2 3 4 5 6 7  

7. Have you witnessed someone who was mutilated, seriously injured, or violently killed?  
   **YES**  **NO**  
   a. How many times?  Once  twice  three+  
   b. How old were you at that time(s)?  1st 2nd 3rd  
   c. Were you injured?  
      Not at all  | Severe  
      1 2 3 4 5 6 7  
   d. Did you feel your life was threatened?  
      Not at all  | Severe  
      1 2 3 4 5 6 7  
   e. How traumatic was this for you at that time?  
      Not at all  | Severe  
      1 2 3 4 5 6 7  
   f. How traumatic is this for you now?  
      Not at all  | Severe  
      1 2 3 4 5 6 7  

8. Have you been in serious danger of losing your life or of being seriously injured?  
   **YES**  **NO**  
   a. How many times?  Once  twice  three+  
   b. How old were you at that time(s)?  1st 2nd 3rd  
   c. Were you injured?
d. Did you feel your life was threatened? 
Not at all  
1 2 3 4 5 6 7

e. How traumatic was this for you at that time? 
Not at all  
1 2 3 4 5 6 7

f. How traumatic is this for you now? 
Not at all  
1 2 3 4 5 6 7

g. What was this event? ________________________________

9. Have you received news of the mutilation, serious injury, or violent or unexpected death of someone close to you?  
   Yes  NO
   a. How many times?  
      Once  twice  three+
   b. How old were you at that time(s)?  
      1st 2nd 3rd
   c. Were you injured?  
      Not at all  
      1 2 3 4 5 6 7
   d. Did you feel your life was threatened?  
      Not at all  
      1 2 3 4 5 6 7
   e. How traumatic was this for you at that time?  
      Not at all  
      1 2 3 4 5 6 7
   f. How traumatic is this for you now?  
      Not at all  
      1 2 3 4 5 6 7

10. Have you ever had any other very traumatic event like these?  
   a. How many times?  
      Once  twice  three+
   b. How old were you at that time(s)?  
      1st 2nd 3rd
   c. Were you injured?  
      Not at all  
      1 2 3 4 5 6 7
   d. Did you feel your life was threatened?  
      Not at all  
      1 2 3 4 5 6 7
   e. How traumatic was this for you at that time?  
      Not at all  
      1 2 3 4 5 6 7
   f. How traumatic is this for you now?  
      Not at all  
      1 2 3 4 5 6 7
g. What was this event? ________________________________

11. Have you had any experiences like these that you feel you can’t tell about?
   a. How many times? Once twice three+
   b. How old were you at that time(s)? 1st 2nd 3rd
   c. Were you injured?
      Not at all 1 2 3 4 5 6 7
      Severely
   d. Did you feel your life was threatened?
      Not at all 1 2 3 4 5 6 7
      Severely
   e. How traumatic was this for you at that time?
      Not at all 1 2 3 4 5 6 7
      Severely
   f. How traumatic is this for you now?
      Not at all 1 2 3 4 5 6 7
      Severely

12. If you answered “Yes” to one or more of the questions above, which was the MOST traumatic thing to have happened to you? Fill in the number of the question: ____________________________

13. Did you answer “Yes” to more than one question above while thinking about the same event? YES NO
   a. If yes, which items refer to the same event? _________________

14. If you answered “No” to all questions, describe briefly the most traumatic thing to happen to you. ____________________________
   a. How many times? Once twice three+
   b. How old were you at that time(s)? 1st 2nd 3rd
   c. Were you injured?
      Not at all 1 2 3 4 5 6 7
      Severely
   d. Did you feel your life was threatened?
      Not at all 1 2 3 4 5 6 7
      Severely
   e. How traumatic was this for you at that time?
      Not at all 1 2 3 4 5 6 7
      Severely
   f. How traumatic is this for you now?
      Not at all 1 2 3 4 5 6 7
      Severely
The CES-D (Center for Epidemiologic Studies Depression Scale) (Table 2) was another tool used to determine if the patient was depressed. It consisted of 20 statements regarding any depressive symptoms the patient may have had in the last 7 days. The patient had 4 options to choose with each response given an associated score. They could respond Rarely or none of the time, worth 0 points, Some or a little of the time, worth 1 point, Occasionally or a Moderate amount of the time, worth 2 points, or Most or all of the time, worth 3 points. A total score greater than or equal to 16 was considered clinically depressed. The CESD was our primary tool to diagnose the patients with depression. This survey had a Cronbach’s $\alpha=0.93$, a sensitivity of 0.93 and specificity of 0.62 [35].
Table 2:

<table>
<thead>
<tr>
<th>Center for Epidemiological Studies Depression Scale (CES-D)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Rarely or none of the time (less than 1 day)</strong></td>
</tr>
<tr>
<td>------------------------------------------------------------</td>
</tr>
<tr>
<td>1. I was bothered by things that usually do not bother me.</td>
</tr>
<tr>
<td>2. I did not feel like eating; my appetite was poor.</td>
</tr>
<tr>
<td>3. I felt that I could not shake off the blues, even with help from my family or friends</td>
</tr>
<tr>
<td>4. I felt that I was just as good as other people.</td>
</tr>
<tr>
<td>5. I had trouble keeping my mind on what I was doing</td>
</tr>
<tr>
<td>6. I was depressed</td>
</tr>
<tr>
<td>7. I felt that everything I did was an effort</td>
</tr>
<tr>
<td>8. I felt hopeful about the future</td>
</tr>
<tr>
<td>9. I thought my life had been a failure</td>
</tr>
<tr>
<td>10. I felt fearful</td>
</tr>
<tr>
<td>11. My sleep was restless</td>
</tr>
</tbody>
</table>
The PPTSD-R (Purdue Posttraumatic Stress Disorder scale) (Table 3) was used to determine if the patient had developed PTSD in relation to a traumatic life event. It is a 34 item questionnaire with each question having a 5 item response scale; A=not at all; B=C=sometimes; D=E=often. The questions deal with any bad dreams, paranoia, fear, terrifying memories in regards to the event, etc., that the patient may have experienced in the past month. The PPTSD-R has an internal consistency of 0.91 [36].

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>12. I was happy</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13. I talked less than usual</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14. I felt lonely</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15. People were unfriendly</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16. I enjoyed life</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17. I had crying spells</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18. I felt sad</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19. I felt that people disliked me</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20. I could not get going</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 3:

Vrana and Lauterbach Purdue Post-Traumatic Stress Disorder Scale (PPTSD-R)

These questions ask about your reactions to the event listed at the bottom of the previous page. Please answer each question for how often each reaction occurred during the previous month. Fill in the appropriate circle on your computer answer sheet for each question.

<table>
<thead>
<tr>
<th>In the last month, how often…</th>
<th>Not at All</th>
<th>Often</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Were you bothered by memories or thoughts of the event when you didn’t want to think about it?</td>
<td>A B C D E</td>
<td></td>
</tr>
<tr>
<td>2. Have you had upsetting dreams about the event?</td>
<td>A B C D E</td>
<td></td>
</tr>
<tr>
<td>3. Have you suddenly felt as if you were experiencing the event again?</td>
<td>A B C D E</td>
<td></td>
</tr>
<tr>
<td>4. Did you feel very upset when something happened to remind you of the event?</td>
<td>A B C D E</td>
<td></td>
</tr>
<tr>
<td>5. Did you avoid activities or situations that might remind you of the event?</td>
<td>A B C D E</td>
<td></td>
</tr>
<tr>
<td>6. Did you avoid thoughts or feelings about the event?</td>
<td>A B C D E</td>
<td></td>
</tr>
<tr>
<td>7. Did you have difficulty remembering important aspects of the event?</td>
<td>A B C D E</td>
<td></td>
</tr>
<tr>
<td>8. Did you react physically?</td>
<td>A B C D E</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Since the Event…</th>
<th>Not at All</th>
<th>Often</th>
</tr>
</thead>
<tbody>
<tr>
<td>9. Have you lost interest in one or more of your usual activities?</td>
<td>A B C D E</td>
<td></td>
</tr>
<tr>
<td>10. Have you felt unusually distant or cut off from people?</td>
<td>A B C D E</td>
<td></td>
</tr>
<tr>
<td>11. Have you felt emotionally “numb” or unable to respond to things emotionally the way you used to?</td>
<td>A B C D E</td>
<td></td>
</tr>
<tr>
<td>12. Have you been less optimistic about your future?</td>
<td>A B C D E</td>
<td></td>
</tr>
<tr>
<td>13. Have you had more trouble sleeping?</td>
<td>A B C D E</td>
<td></td>
</tr>
<tr>
<td>14. Have you been more irritable or angry?</td>
<td>A B C D E</td>
<td></td>
</tr>
<tr>
<td>15. Have you had more trouble concentrating?</td>
<td>A B C D E</td>
<td></td>
</tr>
<tr>
<td>16. Have you found yourself watchful or on guard, even when there was no reason to be?</td>
<td>A B C D E</td>
<td></td>
</tr>
<tr>
<td>17. Are you more jumpy or easily startled by noises</td>
<td>A B C D E</td>
<td></td>
</tr>
</tbody>
</table>
These questions ask about your reactions to the same event as before. This time, please answer each question for how often each reaction occurred during the time in your life when you were most distressed by the event. Fill in the appropriate circle on your computer sheet for each question.

At the time the event was most distressing to you, how often…

<table>
<thead>
<tr>
<th>Question</th>
<th>Not at All</th>
<th>Often</th>
</tr>
</thead>
<tbody>
<tr>
<td>18. Were you bothered by memories or thoughts of the event when you didn’t want to think about it?</td>
<td>A B C D E</td>
<td></td>
</tr>
<tr>
<td>19. Did you have upsetting dreams about the event?</td>
<td>A B C D E</td>
<td></td>
</tr>
<tr>
<td>20. Did you suddenly feel as if you were experiencing the event again?</td>
<td>A B C D E</td>
<td></td>
</tr>
<tr>
<td>21. Did you feel very upset when something happened to remind you of the event?</td>
<td>A B C D E</td>
<td></td>
</tr>
<tr>
<td>22. Did you avoid activities or situations that might remind you of the event?</td>
<td>A B C D E</td>
<td></td>
</tr>
<tr>
<td>23. Did you avoid thoughts or feelings about the event?</td>
<td>A B C D E</td>
<td></td>
</tr>
<tr>
<td>24. Did you have difficulty remembering important aspects of the event?</td>
<td>A B C D E</td>
<td></td>
</tr>
<tr>
<td>25. Did you react physically to things that reminded you of the event?</td>
<td>A B C D E</td>
<td></td>
</tr>
<tr>
<td>26. Had you lost interest in one or more of your usual activities?</td>
<td>A B C D E</td>
<td></td>
</tr>
<tr>
<td>27. Did you feel unusually distant or cut off from people?</td>
<td>A B C D E</td>
<td></td>
</tr>
<tr>
<td>28. Did you feel emotionally “numb” or unable to respond to things emotionally the way you used to?</td>
<td>A B C D E</td>
<td></td>
</tr>
<tr>
<td>29. Were you less optimistic about your future than before the event?</td>
<td>A B C D E</td>
<td></td>
</tr>
<tr>
<td>30. Did you have more trouble sleeping than before the event?</td>
<td>A B C D E</td>
<td></td>
</tr>
<tr>
<td>31. Were you more irritable or angry than before the event?</td>
<td>A B C D E</td>
<td></td>
</tr>
<tr>
<td>32. Did you have more trouble concentrating than before the event?</td>
<td>A B C D E</td>
<td></td>
</tr>
<tr>
<td>33. Did you find yourself watchful or on guard, even when there was no reason to be?</td>
<td>A B C D E</td>
<td></td>
</tr>
<tr>
<td>34. Were you more jumpy or easily startled by noises than before the event?</td>
<td>A B C D E</td>
<td></td>
</tr>
</tbody>
</table>
Procedure

The study was not commenced until Institutional Review Board approval from the University of Pittsburgh was obtained. The patients were screened by the outpatient research coordinator. The patients were consented about 1) the reasons for doing the study 2) the benefits and risks that were involved in participation in the study 3) what was involved in the study 4) what would happen if they chose to no longer participate in the study with regard to their medical care 5) how they did not have to contribute financially and 6) how they would not be compensated for their involvement. Reasons for this could have been a simple unwillingness to participate in research, time constraints, or an inability to answer the entire questionnaire.

After the first interview, the patient was then given another interview the next time that they came to the clinic or if they no longer appeared in clinic, attempts were made to contact the patient via phone so as to complete the interview. The questioning was immediately halted if the patient expressed a desire to either harm themselves or others. If the patient exhibited signs of depression or PTSD during questioning, then they would be contacted by a
psychologist and provided referrals to a psychiatrist or psychologist to treat the
symptoms of PTSD and depression.

Data Analysis

The data was entered and verified in PASW, v21. Descriptive statistics
were performed to provide the characteristics of the sample. The dependent
variables were normally distributed therefore parametric statistics were
performed. Analysis of Variance (ANOVA) and chi-square analyses were
performed to test between group differences for continuous and categorical data
respectively. A p-value less than or equal to 0.05 is considered significant.
RESULTS

A total of 69 patients were approached for this study and 38 (55%) were enrolled from a level 1 trauma center outpatient orthopedic clinic. Of the 38 patients, 26 were male (68.4%) and 12 were female (31.6%); the mean age of the population was 43.4 years (Table 4). The leading mechanism of injury was MVA with 17 (44.7%), a motorcycle or ATV accident 6 (15.8%), a fall 6 (15.8%), pedestrian versus motor vehicle 3 (7.9%), and other accidents 6 (15.8%), which included the one patient enrolled in our study who attempted to commit suicide.

Depression

The number of patients with clinical depression (a score of 16 or greater on the CESD scale), was 12 (44.5%). The number of male participants who are clinically depressed was 7 (25.9%) and the number of female participants was 5 (18.5%) (Table 5). A chi-square test was performed on the clinical CESD cutoff score and gender and no significant differences were found between groups ($\chi^2(2)=2.241$ and $p=0.33$). An ANOVA was also performed to test differences between mean depression scores by gender and no significant difference was observed [$F(1,25)=0.05$ and $p=0.83$]. The number of patients with open fractures
was 14 (36.8%), with closed fractures was 22 (57.9%), and with amputations only 2 (5.3%) (Table 6). There was no significant difference found between patients with depression and whether the fracture was open or closed [$F(1,24)=0.068$ and $p=0.81$]. The mean CESD score of patients with an open fracture was $14.67 \pm 3.13$; whereas the mean CESD score of patients with a closed fracture was $15.69 \pm 2.91$. Additionally, there was no significant correlation between length of stay and depression, with an average length of stay of 14.4 days. The correlation coefficient between length of stay and depression was $r=0.13$ and the $p=0.18$.

**PTSD**

There was no significant difference found between gender and PTSD [$F(1,26)=2.07$ and $p=0.16$]. Thirty of 34 patients (88.2%), 4 were missing, reported that they had experienced a trauma prior to the traumatic injury for which they were evaluated. There was no significant relationship between those who experienced a past trauma and those who currently have PTSD [$F(1,23)=0.35$ and $p=0.56$]. Although there was a significant relationship between past trauma related distress experienced at the time of the interview and of PTSD, $r=0.45$, $p=0.04$. 

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### Table 4. Population Data (N=38)

<table>
<thead>
<tr>
<th>Gender (n, %)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>26 (68.4)</td>
</tr>
<tr>
<td>Female</td>
<td>12 (31.6)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Age (years)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>43.4</td>
</tr>
<tr>
<td>Std. Dev.</td>
<td>15.3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Method of Injury</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>MVA</td>
<td>17 (44.7)</td>
</tr>
<tr>
<td>Fall</td>
<td>6 (15.8)</td>
</tr>
<tr>
<td>Motorcycle/ATV</td>
<td>6 (15.8)</td>
</tr>
<tr>
<td>Pedestrian vs. Car</td>
<td>3 (7.9)</td>
</tr>
<tr>
<td>Other</td>
<td>6 (15.8)</td>
</tr>
</tbody>
</table>

### Table 5. Prevalence of depression based on the CESD clinical cutoff

<table>
<thead>
<tr>
<th></th>
<th>n, (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>7 (25.9)</td>
</tr>
<tr>
<td>Female</td>
<td>5 (18.5)</td>
</tr>
<tr>
<td>Total</td>
<td>12 (44.5)</td>
</tr>
</tbody>
</table>

### Table 6. Fracture type.

<table>
<thead>
<tr>
<th>Fracture</th>
<th>n, (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open</td>
<td>14 (36.8)</td>
</tr>
<tr>
<td>Closed</td>
<td>22 (57.9)</td>
</tr>
<tr>
<td>Amputation</td>
<td>2 (5.3)</td>
</tr>
</tbody>
</table>
DISCUSSION

The goal of this study was to determine the prevalence of depression and PTSD in polytrauma patients and how prior trauma affects the reporting of these symptoms. We also explored the link between depression with regard to length of stay and fracture type. Our hypotheses were that the female patients would have a higher rate of depression and PTSD, which is the case in the general population, with females having a 70% greater chance than males to develop depression [5, 6]. Females are also more likely to develop PTSD than males according to the Department of Veteran Affairs; women at 9.7% prevalence versus 3.6% for men, or more than 2 times as likely [17, 25-27]. Our findings showed that in our sample no significant relationship between gender and depression was observed. This was a very interesting result because it showed that polytrauma patients, whether they be male or female, react similarly to the stressors related to their trauma or that males may have a higher risk of developing depression after this type of injury when compared to combat related situations. Another deviation from the general population was the percent of patients in our population who were depressed. A large portion of the patients enrolled in our study, 45%, with 11 patients missing, were diagnosed as
depressed based on their responses to the CES-D questionnaire. This is counter to the 12 month prevalence in the U.S. adult population, which is 6.7% [5]. However, these results were consistent with previous literature that poly-trauma patients have a prevalence of depression at approximately 45% [12]. As with our study of depression and gender, we found no significant relationship between gender and PTSD. This was contrary to the literature that females are 2 times more likely to develop PTSD than males [17, 25-27]. Several studies have concluded that females responded to trauma differently than males and as a result have higher rates of PTSD. Our results also were similar to the lack of a significant gender difference in Vietnam veterans where males have a lifetime prevalence of 30.9% and females a prevalence of 26.9%, as reported by the Department of Veterans Affairs [17].

We also hypothesized that the patients with open fractures would have an increased prevalence of depression, based on previous literature [12]. The study by Crichlow and colleagues demonstrated that the only injury specific factor that influenced depression was open fractures, with an odds ratio of 4.58. Not only was there no significant relationship between open fractures and depression found in our study, but those patients who were more depressed were found to be the ones with closed fractures. This could be due to the one patient whose
injury was obtained by an attempted suicide, thus a higher depression score, who had a closed fracture. This result is interesting not only because it counters previous literature, but also because an open wound suggests a much more serious injury, thus a more traumatic experience, therefore, the expected results would be a higher rate of depression [37].

While the length of stay could certainly be influenced by the severity of injury that the patient suffers, i.e. an open fracture compared to a closed fracture, there are other reasons for a person to have an extended stay in the hospital. One of them being depression, which we expected would lead to increased length of stay for the patients who were depressed. The literature supported our hypothesis, showing in several instances, studies in which patients that were depressed experienced longer stays [13-16]. Our results showed otherwise, as there was no significant relationship between length of stay and depression. While the correlation was positively trending towards significance, it was still not a significant result. The reasons for the difference between the conclusions of previous literature and our results could be the deceptiveness of depressive symptoms in patients who are in the hospital. Such as sickness behavior (e.g., social withdrawal, lack of energy), which the individual may appear to be depressed, but really it is the body’s healing process [38]. The previous literature
also dealt with patients who had much more severe injuries, thus they all had longer stays, ranging from weeks to months, whereas our patients averaged only 14.4 days in the hospital [13-16]. This could explain why the correlation between length of stay and depression was greater in previous literature. Another reason could be the severity of the injury will equal greater disability and thus a longer length of stay that may have no relationship to the patient’s depression status.

Another aspect of PTSD that we explored was the effect of a patient’s past trauma experience on their development of PTSD after their most recent accident that led to them being enrolled in our study. Thirty of 34 patients (88.2%), with 4 missing, had reported that they had experienced a trauma prior to the traumatic injury for which they were evaluated, but there was no significant relationship between the existence of a past trauma and PTSD. This result runs counter to previous research that previous exposure to trauma increases the risk of PTSD after subsequent traumas [32]. However, we did find a significant relationship between past reported trauma associated distress experienced at the time of the interview and current development of PTSD. While this is certainly a promising result, there is the possibility that the PTSD that the patients were diagnosed with at the time of the interview could be due to the past trauma and not the most recent accident. This relationship between distress from past trauma and
PTSD development was supported by studies of female victims of assaultive violence. The study by Gavranidou and Rosner, showed that women had an increased risk of developing PTSD later in life after they have experienced an assaultive trauma [26]. This was also supported by Floyd et al., which observed that as patient’s gets older, the main reason the prevalence of PTSD increases is due to the increased “subjective distress” associated with past traumatic memories [33]. Therefore, our results suggest that the experience of a trauma is not the sole predictor of PTSD.

Overall, the lack of significant results between several of our hypotheses could be due to the small sample size. We were limited in the sample size from the start due to our recruitment out of the orthopaedic clinic, which is a small portion of the overall trauma patient population. Then the stringent inclusion criteria further reduced our possible sampling pool and the non-responses further decreased our sample size. The lack of a significant relationship between gender and depression and PTSD could have been caused by the limited number of females enrolled in our study. A reason for this could be that males are more likely to be involved in a traumatic event in their lives, due to the risky behavior of males [39]. This higher prevalence of risky behavior means that more males would experience poly-traumatic injuries more often, thus the possible
population that we had to choose from was already biased towards males [40, 41]. Other reasons for the lack of significant results could be the evaluation of only baseline data. The one year period was short and did not allow for us to parse out the high number of patients who are currently registering as having depression and PTSD, but after rehabilitation and further reacquiring of their independence will no longer have depression and PTSD. In observing patients for the influence of past traumas on development of PTSD, a lack of variance, 30 of 34 patients claimed to have experienced a past trauma, could be the cause of the lack of association between past traumas and increased PTSD prevalence.

The future of research in this area is promising. By getting ahead of the patients negative psychological state, the physician can treat not only the primary injury site, but can improve the patient’s psychology and thus improve how the body heals itself. If a patient had PTSD or depression they are likely to not want to or not be motivated to participate in rehabilitation of their injuries. This could lead to increased stays within the hospital and thus further depression or PTSD. By developing interventions to treat depression and PTSD early on in a patient’s hospital admission, physicians can cut down on the cost of treatment by getting the patient in a positive state of mind and motivated to get better following their trauma, thus discharging the patient earlier and shortening
the length of stay in the hospital. Patients should be given a battery of questionnaires much like the ones used for this study, so that depressive and PTSD symptoms can be screened and identified early upon admission. This will allow for a trained psychologist to observe the patient and determine the patient’s mental status. This could increase the quality of life that the patient experiences following discharge. Further study of PTSD and depression can also help in the treatment of soldiers returning from combat. All soldiers who have seen front-line combat should be subjected to PTSD and depression testing so that their re-acclimation into civilian life is much easier.
REFERENCES


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