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eLearning Education

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The influence of globalization in teaching has been huge. On account of distance learning systems and the use of technology in education, in the present day, the modern education system has undergone a natural evolution with respect to teaching methods. Evolution in the field of distance education following the ability to overcome the concerns related to its effectiveness,¹ and quality,² we have been able to deal with important questions, such as personalised education, where the student can set and achieve individual learning goals and be engaged in an open education system.³ Geographical barriers and being able to overcome these issues is a very important factor that has to be taken into account. We can state that this issue has already taken place and could be applicable to multiple contexts.^{2,4}

The advancement of new technologies have altered the reality. In the educational world, these changes have been important and significant. Perhaps one of the most relevant changes has been the mode of delivering knowledge, and technology undoubtedly plays the role of the most relevant catalyst. Because of the changes in the teaching system, students have adapted as well, mainly in the context of use of new technologies. Now, the students are expected not only to study, but to collaborate, socialise, learn and communicate. We can use, as an example, the inclusion of communication tools between teachers and students, like chats, video conferences, electronic whiteboards, email and forums, where, according to Amador,⁵ the role of the student has been changed to become more active and the teacher has become a knowledge facilitator and a leader in the learning path. This change has been brought about without leaving aside the acquisition of required knowledge in this area and being trained for technology and teaching.

The possibility to integrate the Technologies of Information and Communication (TIC) into the education system, firmly implemented nowadays, not only offers a greater probability to facilitate access to knowledge to a large number of people and places, overcoming the barriers due to large distance coverage, but it also ensures that innovation is applied in learning, and therefore in teaching. With a broader range of possibilities, learning has somehow been modified when compared to classroom teaching.

Educational practices and education itself has undergone changes, mainly because the use of TICs offers different possibilities that we did not really find in what we call the traditional education system.⁶

One of the relevant challenges that is important to be taken into account is the search for an interactive, flexible and accesible learning system supporting the the integration of ICTs (to address strictly technical pedagogical aspects). Applications and services, on the basis of ICTs, are designed to facilitate the teaching-learning process. Consequently, in a pedagogical model, in which students become protagonists of the process underlying the basis of a process of permanent significant construction and based on nodal networking of collaborative development. Thus, the innovative changes associated with this new model is not supported in the introduction and application of technology; it goes further, up to the actual integration of technology to constitute a new paradigm. A change, as García Aretio⁷ confirms, does not lie in the use of ICT, but in the conception of the formation by an educator; a key element for the improvement and accessibility to the effective management of knowledge.

To take advantage of the benefits that ICTs offer and to understand its limitations, of-

fers a mean of response to the possible digital gap that exists between the students and the teachers. The integration of technology with education comes with a warning that our students are named “digital natives” that manage easily between technological tools and communicative complexes. In reality: particular ways of thinking, meaning, speaking, pronouncing and socializing is governed by the characteristics of these technological tools through the establishment of different codes of behaviour, which teachers cannot ignore, for the teacher to “get closer” to the students. To introduce with proposals that involve reflective teaching and complying with innovative social actions can mark the beginning of a determined action.⁸

In the present day, the opportunity, to integrate technology and ITC with education, provides a greater possibility to spread knowledge and awareness over a larger audience residing in a large number of places, covering distances. It has also introduced a concept of innovation in learning and certainly in education. The availability of opportunities for learning is large, such that the education system has undergone a considerable modification particularly when compared with on-campus courses. The education system, and so education itself, has undergone a significant change, precisely due to the fact that the use of technology offers various options which could not be found in what is known as traditional education. Change also constitutes the modern education system, and undoubtedly eLearning leads us towards an active learning structure.⁹

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Deprivation or Interest-Type Curiosity and Exploratory Behaviour in Humans: Are they Inherently Cognitive and Implicate Curiosity-Induced Teaching?

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BACKGROUND

The human cognitive architecture appears to be designed to resist uncertainty and doubt. In any new experience that appears to be incongruous to what one is already familiar with, the discrepancy sets into motion the desire to resist and overcome the uncertainty.¹ The incongruity induces a heightened state of arousal in the central nervous system, which sets into motion exploratory behavior aimed at reducing the doubt or the uncertainty. As one looks for the needed information through exploration in order to reduce the tension between the innate feeling of knowing, and the reality of doubt, the heightened arousal begins to reduce. It is in this respect that Berlyne¹ sees arousal, precipitated by deprivation-induced curiosity, as reinforcing in a similar way as food becomes reinforcing for the hungry person. This reduction of doubt, psychologically, becomes a survival value, and hence, essentially it has inner-directedness. The literature on human curiosity distinguishes between two types of human curiosity: a) *perceptual* and b) *epistemic*. The former is typically induced by the senses in a situation of incongruity, such as in a class, and all of a sudden, there is loud noise at the back of the class. All those in the class, would turn to that direction seeking for more information. This curiosity is caused by external stimuli. The latter, *epistemic*, on the other hand, is more cognitive. It is induced by internal stimuli precipitated cognitive dissonance. It is epistemic curiosity that is most significantly connected to human cognition. The connection between epistemic curiosity and human cognition lies in the fact that mental thoughts of ambiguity affect not just the direction of human thought, but also the intensity of the behavior to resolve the incongruity and ambiguity. This is akin to what Piaget would refer to as *disequilibrium*. To be able to adapt to one's environment, the mental disequilibrium would have to be resolved. The disequilibrium between cognition and doubt in people's experience precipitates *feelings of knowing*. This feelings-of-knowing in people's long-term memory stimulates the notion in people to have access to information and hence smaller knowledge gaps. Thus, the smaller the knowledge gaps, the more the intensity of arousal towards exploratory behavior. On the other hand, the higher the perception of knowledge gaps (as in people with little knowledge) the less the intensity of arousal.²

IMPLICATIONS OF THEORY FOR CLASSROOM PRACTICE

The above dispositional tendencies in humans to resolve disequilibrium have been consistently shown in varied empirical studies to enhance learning, especially self-directed learning as well as intellectual attainment.^{3,4} With specific reference to individual differences and epistemic curiosity, the literature outlines two interrelated, but nevertheless, distinct approaches. They are: a) the I-type curiosity (interest-related curiosity) in which the individual seeks information for to increase feelings of pleasure and b) a stimulation to reduce cognitive tension of deprivation (D-type).⁵⁻⁷

Even though these distinctions are made in the literature for theoretical purposes,

findings from empirical studies typically converge.^{8,9} The fundamental point is that whether it is I-type curiosity or D-type, they are both implicated by two variables: a) arousal and b) performance. In classroom interaction, the teacher can explore this inherently cognitive conceptual conflict to make effective use of the Inquiry and Socratic methods of teaching.¹⁰⁻¹² In the former method students are asked questions, whereas in the latter, students are confronted to take a second look at their claims with discrepant information. In these two teaching methods, students' curiosity should be heightened, because students would likely experience some level of uncertainty in their answers. This uncertainty will induce some arousal. It is in this respect that there is always some level of correlation between arousal and human performance. This leads us to consider the relationship between the two, and to examine the Yerkes-Dodson law of 1908.¹³ The Yerkes-Dodson law (1908) simply states that poor performance is the result of low-level of arousal. Similarly, a high-level of performance can equally induce poor performance. However, when arousal is in moderation it precipitates good performance.

The Yerkes-Dodson law (1908) suggests that, even though arousal is typically implicated in setting into motion exploratory behavior in humans to resolve cognitive dissonance or conflict as far as epistemic curiosity is concerned, it is not always the case that arousal induces exploratory behavior, especially, when humans reach a high optimal level of arousal. What is implied here is that, the conditions under which classroom teacher induces curiosity might not necessarily work all the time. Humans have optimal level of arousal. When reached, diminishing returns set in. Thus curiosity-producing strategy be it the interest type (I-type) or the deprivation-type (D-type) becomes effective classroom strategy conditionally: when they stimulate arousal level that is optimal. Beyond that, the intensity of humans' exploratory behavior diminishes.

CONCLUSION

Interest and deprivation-type curiosity in humans are inherently cognitive. Humans as adaptive species in their environment seem to have cognitive architecture designed to resolve cognitive dissonance through physiological-emotional arousal. It is in this instance that curiosity has a value in human survival. The disequilibrium in cognition typically induces human exploratory behavior to look for answers in the midst of uncertainty and doubt. It continues to play a critical role in human inventions and discovery. Additionally, curiosity is positively linked to self-directed learning and human intellectual achievement. It is in this respect that curiosity-induced teaching is recommended for classroom practice, bearing in mind that curiosity-producing techniques work best in classroom situation when they stimulate optimal arousal level.

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Blast-Traumatic Brain Injury (TBI) with Post-traumatic Stress Disorder (PTSD): A Treatable Condition?

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Since 2001, about 2.7 million US service members have been deployed overseas in addition to hundreds of thousands from countries worldwide.¹ During conflicts, troops frequently encounter attacks with high explosives. These have been responsible for at least 60% of combat-related casualties.² Explosive devices include improvised explosive devices (IEDs), landmines, and rocket-propelled grenades.³ “Blast injury” is a term that describes biophysical and pathophysiological events as well as clinical symptoms that occur when individuals are subjected to explosions of any kind.⁴ In a series of post-mortem cases, Shively et al sought to determine if the pathology of the blast-associated traumatic brain injuries presented unique patterns of damage that might differ from those associated with impact-induced, non-blast traumatic brain injuries.¹ They found a “distinctive pattern of scarring that may indicate specific areas of damage from blast exposure consistent with the general principles of blast biophysics that could also account for aspects of the neuropsychiatric clinical sequelae reported” and determined that all cases of chronic blast exposure had an ante-mortem diagnosis of post-traumatic stress disorder.¹ So despite the lack of findings with conventional neuroimaging for mild traumatic brain injury (TBI), military personnel who have reported persistent post-concussive symptoms, such as headache, sleep disturbances, concentration impairment, memory problems, depression and anxiety may have structural damage that goes undetected, yet presents as post-concussion syndrome.⁵ This has led to the use of the term “invisible wounds” for those with TBIs and these symptoms.⁶

The deployments to Iraq and Afghanistan have been associated with an increased risk of mental health problems⁷ which tend to increase in the months after returning from deployment.⁸ Unfortunately, only half of the soldiers with a mental problem reported seeking care within a year,⁹ presumably due to stigma and perceived barriers to mental healthcare.¹⁰ Kim et al also found that only 13-53% of U.S. and Canadian veterans who met the criteria for a mental health problem after deployment received care. An additional problem is that veterans who enter mental health treatment often do not receive adequate care.¹¹ Whatever the reason for the failure of these veterans to receive adequate treatment for mental health disorders, the resulting suicide rate among service members, reported to be as high as 22 suicides per day¹² is being called an “epidemic” by former defense secretary Leon Panetta.

It seems that blast-induced TBI is often associated with post-traumatic stress disorder (PTSD). Estimates of the prevalence of PTSD among returning service members vary widely across wars and eras. However, as many as 500,000 U.S. troops who served in the Iraq and Afghanistan wars over the past 13 years have been diagnosed with PTSD.¹³ Complicating the diagnosis and assessment of PTSD in military veterans are the high rates of psychiatric comorbidity such as major depressive disorder and substance use disorder.¹⁴ Veterans, when they are able to obtain an appointment with a provider, are offered pharmacotherapy as a first-line approach.¹⁵ Other interventions such as cognitive behavioral therapy (CBT) are considered to have the strongest evidence for reducing the symptoms of PTSD in veterans and to be more effective than any other non-drug treatment according to the Institute of Medicine (2007). Guidelines suggest that a combination of pharmacotherapy and psychotherapy may be needed for those with severe PTSD or who have not responded.^{16,17} There is also some evidence to suggest that smoking cannabis (marijuana is associated with reduced PTSD symptoms).¹⁸ Unfor-

unately, there are still some patients with PTSD who do not respond to initial drug treatment and so other pharmacological agents are suggested. These include antipsychotics, antiadrenergic drugs, and anxiolytics that have demonstrated some efficacy in treating PTSD.^{18,19}

Is there a treatment currently available that could provide benefits and relieve the symptoms of PTSD without the extensive side effects often experienced with medications or length of time with CBT? As Shively et al determined blast exposure cases showed damage to brain structures that could possibly explain the persistent clinical symptoms of patients with blast TBI¹ that has been termed an invisible wound.⁶ The wound to the brain caused by blast-TBI requires healing. There is a treatment that has been used for decades to heal chronic wounds of which the blast-TBI can become. Hyperbaric oxygen therapy (HBOT) is defined as the use of 100% oxygen at pressure about 1 atmosphere absolute (1 ATA) or sea level. The application of HBOT increases delivery of oxygen throughout the body by increasing the amount dissolved in plasma, increasing the oxygen saturation in the blood.²⁰ The administration of HBOT for TBI is based on the observation that the hypoxia following the injury plays an important role in the secondary injury to the brain. Without adequate oxygenation, neurons revert to anaerobic metabolism, producing an acidotic state. With continued hypoxia, neurons are unable to maintain metabolic homeostasis. Eventually, the changes become irreversible and cell death is the result.²¹

Investigations into the usefulness of hyperbaric oxygen therapy (HBOT) for TBI and stroke have been ongoing for decades.²⁰ More recently, HBOT has been used to treat neuropsychiatric disorder following traumatic brain injury.²² After HBOT treatment, more than 70%, if the single-photon emission computerized tomography (SPECT) scans showed no abnormalities and these patients were clinically improved. Harch et al recruited 16 military subjects with mild to moderate post-concussion syndrome (PCS) or PCS with PTSD, who received 40 HBOT treatments at 1.5 ATA for 60 min. Brain scans, physical and neurological exams and neuropsychological testing were completed before and within one week after treatment. Significant improvements occurred in symptoms, cognitive testing, quality of life measurements as well as significant improvements in SPECT.⁵ Recent clinical investigation have also examined the effects of HBOT on PTSD symptoms in patients with a history of TBI. These studies did not find a statistically significant difference between the treatment group (2.4 ATA, 100% O₂) and the sham group (1.3 ATA, 21% FiO₂) since both groups demonstrated improvement in PTSD symptoms.^{23,24}

The lack of statistically significant differences between the treatment and sham groups has led some to conclude that HBOT does not work in the treatment of TBI with accompanying symptoms of PTSD. Harch (2013) states that the problem lies in the definition of “sham-controlled” which implies placebo design. The sham treatment set at 1.3 ATA is actually a HBOT treatment. The increased pressure increases plasma oxygen above what it would be at sea level.²⁵ To have a control group would require the removal of increased pressure and hyperoxia. Thus, both doses (hyperbaric oxygen and hyperbaric air) demonstrated net improvements in post-concussion syndrome and PTSD in these studies.

The safety of HBOT at dosages of 1.5 ATA and even higher for wound care (2.4 ATA) has been well established so this is not an issue. As Dr. Harch states “*hyperbaric oxygen therapy in mTBI PCS/PTSD has satisfied one of the cardinal rules of medicine, “First, Do No Harm.”*” Dr. Harch also suggests that after all the research money that has been used seeking effective treatments for TBI and PTSD, perhaps the Coverage with Evidence pathway would allow the Department of Defense (DoD) and Veterans Affairs (VA) to begin treating active military and veteran casualties with hyperbaric therapy so that they can experience improved quality of life (QoL).²⁶

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Case Study

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Virtual Acute Stress Reaction in a Treatment Team Following a Family Meeting of "Potentates": Measures of Prevention

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ABSTRACT

Background: Volumes have been published on "difficult" patients and their representatives; however, there is sparse literature available as to how a "difficult" patient or a provocative family encounter is experienced by a team of members across various disciplines, associated with the treatment. We report a case to present our experience with "potentates", a type of "difficult" client, which could help draw suggestions to allow for prevention in more generalized situations.

Objective: To identify strategies that would help avoid occurrences and minimize the negative impacts possibly associated with the responses of the "potentates" towards the treatment team.

Method: The medical case of a 21-year-old female inpatient with provocative psychopathology was presented, initially evoked as a reaction towards her family followed by a state of intense anger and a tendency of being accusatory towards the treatment team during a family meeting. The patient's response thus led the members of the treatment team to experience signs and symptoms commonly associated with virtual acute stress reaction (ASR).

Results: We analyzed the outcome of the interaction between the patient and the treatment team during the meeting, reviewed the literature relevant to pre-existing research in this domain, and concluded that there could be possible helpful strategies and measures that could be implemented in family meetings to prevent the possibility of virtual ASR. This case report paves the path for further research to ensure the protection of multidisciplinary teams under various clinical settings.

Discussion: A treatment team is potentially vulnerable to physical, verbal, psychodynamic and other commonly implemented modes of attack from patients and their representatives. Appropriate measures need to be implemented with the objective to prevent and minimize the effect of these attacks on the treatment team.

KEY WORDS: Potentates; Projective identification; Acute stress reaction (ASR); Family meeting; Dynamics.

ABBREVIATIONS: DSM IV: Diagnostic and Statistical Manual of Mental Disorders Fourth Edition; PCD: Patient Care Director; ASR: Acute Stress Reaction.

INTRODUCTION

We present a unique aspect amidst the availability of abundant literature on "difficult" patients (referring to the ones with specifically borderline and/or narcissistic pathology) and their representatives. In this article, we discuss a group phenomenon with symptoms similar to that of acute stress disorder experienced by the members of a multidisciplinary treatment team.

The common symptoms of acute stress disorder are associated with numbing; detachment; derealization; depersonalization or dissociative amnesia; continued re-experiencing of

the event *via* thoughts, dreams, and flashbacks; and avoidance of any stimulation that evokes memories of the event (Diagnostic and Statistical Manual of Mental Disorders fourth edition (DSM IV)).¹ This clinical picture is described in the context of dealing with a “difficult patient”, referring to a patient whose behavior seems to challenge the clinician in a negative way, evoking negative countertransference, thereby making it difficult for the physician or the staff to empathize with the patient and/or their even more “difficult” family. The challenges posed while providing therapeutic care to “difficult” patients in different medical settings have been thoroughly studied and well described by various researchers. A particularly useful categorization describes them as either Special, VIP or “potentate” patients. The latter are also referred to as the “want to be celebrity patient.”² However, there have been no evidences of research on the psychological and emotional trauma such cases can have on the multidisciplinary treatment team. Consequently, there is a lack of available information on preventive measures, concrete steps and dynamic strategies to minimize the occurrence as well as the impact on the treatment team. In the present study, we discuss in detail our experience with the difficult patient and propose the general principles of prevention and management for a multidisciplinary team of clinicians.

CASE PRESENTATION

The patient, a 21-year-old female, the only child and a student at an out-of-town college, was admitted to our inpatient unit for the treatment of depression and anxiety showing a voluntary status. The symptoms worsened when the patient was subjected to different social situations, and consequently resulted in a state of passive suicidal ideation. She complained that she was unable to find an antidepressant to effectively address her symptoms. The patient denied a history of suicide attempts or self-injurious behavior. Following her admission to the unit, the psychiatrist interviewed the patient. The patient while sharing her life experiences mentioned that she had a very close relationship with her mother, which according to her speculation kept her from developing healthy interpersonal relationships with her peers.

As the interview progressed, the patient became more agitated and was losing her focus from the conversation, expressing greater frustrations with the passage of time. She reportedly experienced a feeling by virtue of which she could not count on any firm structure. She complained that she did not have access to her inpatient multidisciplinary treatment team members as often as she desired, and they could not give her the answers she sought as quickly as she expected (entitled). The patient continued to meet with the team in the mornings and with her mother and the social worker in the afternoon. Initially it seemed as though overall the patient and her mother were content with the treatment as there were no visible signs of dissatisfaction and anger which developed rather suddenly with time.

Three days following hospitalization, the patient’s father called the unit chief angrily demanding a family meeting. The unit chief met with the team: the psychiatrist, social worker,

and the patient care director (PCD) who was the senior nurse supervising the operations of the unit. The complaints made by the family members of the patient varied from the lack of unit structure, lack of answers to questions based on prognosis, and the most significant reason was the “lack of adequate treatment”, which resulted in no improvement in the patient’s condition. Together, the medical faculty called the patient’s father and arranged for a meeting on the same morning, insisting that the mother of the patient also be present. The unit’s multidisciplinary clinical team started the meeting without the PCD. The meeting commenced with a 3-5 minute long narration by the father about the family’s anger and frustration with the treatment. As the unit chief began to respond to the father, the mother interrupted (pointing her finger to his face) demanding the unit chief to “shut up” and listen attentively as she proceeded to accuse the team and the unit for various shortcomings, such as poor management of the unit by PCD and the unit chief, the lack of unit structure, a poor quality of group therapy, inadequate medical/psychiatric attention provided for her daughter by the social workers and the attendants. Both the parents were belligerent and demeaning towards the members present from the team. The rest of the meeting proceeded in an emotionally charged atmosphere. After about 30-45 minutes, the PCD joined the meeting and was similarly reprimanded by the mother. When the patient was called in to join the family meeting, to the team’s astonishment, she picked up where the mother left off. Supported by her mother who looked on in an admiring manner, the patient enumerated the imperfections of the psychiatrist and the unit in a distorted, demeaning, and abusive manner. Finally, when the patient began to talk about the other patients in an unacceptable way, the meeting was ended.

Aware of the impact that the meeting had on each of the team members, a series of 2 processing sessions was conducted by a senior faculty group dynamicist for the members of the treatment team.

The team reassembled to discuss the proceedings of the meeting and the emotions, and dynamics of the behavior and performance of each team member. We decided to organize a session with an experienced group dynamicist. Two (1-hour) weekly sessions were allotted for conducting the family meeting. The group also gave their consent to record our experience as a case report.

DISCUSSION

Inpatient clinical teams conducting meetings with families or visitors are generally always vulnerable to the full spectrum of attack: violent, physical, verbal, psychological or reputational (*via* subsequent letters to the social media or administrators). We have presented a case where all the members of the team experienced only one form of this attack and yet the team found inadequate information on ways to understand and prevent a related incident from taking place in the future. Thus, the goal of this report is to review and present the various measures that could be possibly adopted to prevent avoid the inpatient clinical

team from experiencing such vulnerabilities.

Clearly, the attack on the team in the discussed case was not physical and could rather be addressed as a verbal attack directly addressing the various team members. Furthermore, the attack was effective considering the fact that it took place in a family meeting that allowed group dynamics to play a role in it. Thus, to derive the maximum information from this case, a best effort (albeit speculative) analysis of the process was sought and obtained from Dr. Howard Kibel. Apart from being an expert group dynamicist,^{3,4} he is a consultant with the hospital and is knowledgeable of the various personalities and overlapping systems of the hospital.

Genesis of Psychodynamic Ammunition

All the team members were intensely affected by the verbal attack of the mother, and the mother-daughter/patient dyad directed towards the clinical follow-up later in the meeting. The group discussions that were held with Dr. Kibel helped us understand the mechanisms that possibly led to a similar situation.

The point worth noting here is that the patient narrates a history of her close relationship with the mother, which suggests that their relationship was symbiotic. If that is so, it may serve to explain why the mother was calm and even ingratiating when she met the social worker alone, in the absence of any other family members. Ironically, while we made an effort to avoid “splitting” by insisting on having the mother present in the meeting, we actually invited more trouble. Indeed, the mother’s behavior turned belligerent in the family setting. While we had our guard up for the overt anger of the father, we unwittingly lowered our guard for the covert anger of the mother.

Though speculative, this incident suggests that the setting of the family meeting mirrored the patient’s behavior exhibited in the unit. The power was in the hands of the patient to control the dynamics of the family through her symbiotic association with her mother, and perhaps with her father as well. Projective Identification may have been implemented by the family, which in turn might have induced untoward feelings in the team. This family projected hatred towards the team instilling in them a sense of anger and guilt for the people they wanted to help. Such ambivalence was the cause leading to an essence of conflict.

Projection may be considered in different forms. What the patient and the family projected to the team were internal images and related effects which they found as intolerable. Our experience, in a perverse manner, may be dubbed fortunate, in that it exemplifies a classic projective identification. The experience serves as a model to define the purposes of our discussion. In the psychoanalytical and the analytically-oriented group psychotherapy literature, the term, “difficult patient”, often refers to a patient with narcissistic and/or borderline pathology. This we suspect is true of the patient and the mother. Their posture

in the meeting strongly resembled the “potentates” described by Groves et al¹, in this particular case meaning that the family portrayed themselves as wealthy and connected with influential people who were in charge of the hospital, which caused profound psychological impact on the team. We suspect that the complaints by the family concerning the lack of leadership and structure of the inpatient unit was a metaphor for the patient’s lack of order/coherence within herself, better addressed as identity confusion, which is precisely what the team experienced.

We discovered that there has been inadequate literature and thereby information available discussing the various effects that the presence of “potentates” exerted on the treatment team. Consequently, there exists insufficient literature as well as preventative measures and strategies, which could be implemented by teams, who might find themselves in difficult family meetings. Hence, in this study, we have focused on the extent and the duration of psychological trauma experienced by the treatment team. While the patient and the family were not particularly famous, important or physically menacing, the behavior of the mother and father evoked shared emotions among the clinicians in the treatment unit. Some of the members experienced specific emotions uniquely, while some emotions were felt commonly, but in varying degrees at different time points in the episode. These include: shock, anger, fear, shame, frustration, confusion, anxiety, hatred and guilt.

Acute Stress Reaction shown by the Team

Days after the family meeting, the team talked about the recurrent and intrusive distressing recollections of the event, including images, thoughts, and perceptions. There was a sense of helplessness among the members having been subjected to this situation of intense emotional abuse as this. Each time one stepped into a family meeting we could not help but wonder if we would be subjected to the same situation, or have to relive through such distressing events all over again. For the subsequent patients who were perceived as potentially difficult patients, the team went extra lengths and put in immense efforts to avoid any occurrence of such possibly disastrous family meetings. Days after the family meeting, the team members experienced great difficulty with sleep, irritability and at times outbursts of anger.

The rush of emotions and thoughts that one undergoes in these traumatic situations are relentless. One needs to learn to first recognize the automatic defenses to be able to deal with a similar situation such as when the patient suggests “I will not be treated that way; I do not deserve this.” If one is vulnerable towards getting angry or hurt, it can be considered as an easy “trap” “set” by the difficult people.

How can we protect ourselves from verbal abuse and insult in advance? Often, during the time of attack, it is hard to stay rational and remember to think: “don’t engage in this struggle with an unproductive consumption of time and energy”. We have to remember who we are dealing with, then remember

to ask ourselves: “Is it worth engaging in this struggle?” How quickly is the session going to turn into a power struggle? “Are we ‘really’ going to change the person’s opinion, or are we setting ourselves up for more criticism. Worst would be: “are we becoming ‘a difficult person?’” It is obvious that some of us asked these same questions in our minds during and even days after the meeting.

And then lastly, the additional layer of difficulty is on account of the pressure that is exerted from the administrative point of view (real or imagined). With respect to the context of the meeting, when one is dealing with a presumed VIP patient or family, fantasies about the possible reaction of the administration always come into play. Members of the treatment team inevitably feel that they are under scrutiny and subject to criticism. This adds to the feeling of helplessness and vulnerability. This realization can evoke a sense of mastery among the patient and their respective family before going into the session.

Preventive Measures

We aim to start a dialogue about the ways the multidisciplinary clinicians might prepare for “attacks” in various forms during group settings such as the family meeting. Once again, the availability of related literature is limited and outdated and needs to be adopted with respect to present day conditions.

CONCRETE MEASURES

Physical Safety

Violence and physical attacks are possible incidents which can occur in any meeting. Some healthcare facilities do not screen the visitors for the possession of metal ware and weapons. All efforts should be made to clearly convey to the visitors, the facility’s rules concerning the possession of weapons and firearms. Intoxication in visitors also needs to be addressed. Finally, in terms of physical safety, one must assume that some visitors may violate these restrictions or, may use their own bodies to attack the team members in the meeting, for which the room must be fitted with an alarm to security as a minimum requirement. A concrete measure to be implemented would thus be the installation of a Crisis Alarm Security Button. This measure was further renewed during the processing sessions during which it was considered that the setting for Family meetings should support facilities to encounter physical threats and enable the access to security.^{5,6}

Setting the Agenda and a tentative flow of discussion: Early Preventions

For every meeting there needs to be sufficient pre-planning so that the clinicians will be prepared with strategies that both address and manage the needs of the patient and the family in accordance with the clinical recommendations. The team needs to interact with the family members about their expectations and goals prior to the meeting. A scheme of 2 major categories may

be considered: a) Is the underlying impetus for the meeting to “vent” frustration? or, b) Is it to discuss concrete complaints and issues such as medications, aftercare plans, and come up with solutions? Often it would be a combination of both but a preponderance of one. Next, the clinical team must meet first to discuss the family profile and analyze the expected dynamics. Then, the family and the clinical goals of the meeting will be set and a decision will be taken determining “What will success look like”. That would assure the team members of achieving clearer goal and outcome.

The agenda is then developed with: 1) The approximate amount of time to be spent on each topic; 2) Establishment of Group Norms; 3) Roles for the session will need to be specific: a) choose the facilitator who will specifically deal with process issues, arguments, agreements, and redirect the targeted group back to their goals and agenda; b) assign someone to take notes and write agreements/plans on flip chart if appropriate; c) decide who will take the lead regarding being engaged in discussing about each part of the case. Also, the team needs to agree on how the decisions will be made among the clinical staff of the meeting: Unit chief alone, consensus, or deferring to discuss within the team without the family.

“Interventions” and Exit Strategies

It is imperative to agree to the implementation of “preventive measures” as listed above instead of having to use “interventions” when the group has already become contentious. It is more difficult to bring the group back to follow the appropriate group norms when out of control. This demands the application of the right skills and practice in the right situation but can bridge the gap between a productive meeting and a poor outcome. A strong facilitator can be your best ally in these situations. The clinical staff must decide ahead of time when and how to stop the meeting, particularly if the family and/or patient becomes abusive. The use of a “time out” or a break for 5 minutes to allow a cooling off period and a chance for the clinicians to discuss a strategy which could also be helpful. If the family continues to be disruptive, the assigned decision maker can end the meeting and reschedule it to another time. However, a situation as this has a greater potential to cause family agitation thus demanding careful attention. This is why it is always better to set up as many precautionary measures as possible so that there is a better chance that the family’s agitation does not escalate.

The team became defensive rather than, be able to take a step back and be conscious of their own emotions and perceptions when dealing with a difficult family meeting. A popular tactic implemented by defensive people is to get others to try to defend or explain their perspective of the situation, and in doing so, actively try to make you unable to accurately assess a difficult incident. The team should not have showed any major reactions and should have been more organized; and a strategy should have been drafted in order to avoid the possibility of any unwanted defensive situations by implementing a corrective action plan to address the inadequacy in the structure of the clini-

cal setting and the organization of its intake and treatment, etc. The local attitudes of the staff members and habits should have been taken into account to some extent in explaining the cause of the situation; knowing that perhaps individual team members are more open to suggestions made in private than at the moment, in front of a group. The team should agree with respect to their views on which languages and behaviors should be deemed unacceptable. A pre-established protocol would have been more helpful in avoiding an immediate reaction from the team, it would have helped keep the focus off the treatment team's defensive reaction and the team would have had an organized structured game plan for specific tactics and strategies to move forward.

Administration Alliance

When there is any indication for potential "fallout" from a meeting, the team is best served by pre-empting any calls or letters to supervisors and administrators by informing the appropriate office, such as patient services, in advance regarding the predicted case.

Ethical conflicts are unavoidable in today's healthcare settings; many a times the administration is so far removed from the clinical setting that they are unaware of the challenges that the clinical staff face on a daily basis. The patient may be discharged too early and not receive appropriate care, secondary to the team who would avoid resorting to any daily conflicts with the patient's family. It is important to deal with these ethical conflicts together as a whole, administration and the clinicians, in order to improve patient care and also avoid employee burnout and job turnover.

The hospital is located in one of the wealthiest communities in the country, which also comes with an air of entitlement and narcissism. The members of the community show an attitude which indicates that they are more deserving than others characterized with limited empathy, which poses additional challenges for the team taking care of them.

(PSYCHO) DYNAMIC STRATEGIES

Psychodynamic Formulation

As the adage goes, forewarned is forearmed. The treatment team is best prepared for a family meeting if they have a good understanding of the patient dynamics and can anticipate the family behavior as per the available information. In the discussed case, the father's demanding behavior on the telephone suggested that the parents could possibly get absorbed into the patient's psychopathology. Experience demonstrates that the intellectual exercise of diagnosis and anticipation results in a clinical distance from enmeshment in the family. Intellectualization is a potent defensive mechanism.

A borderline patient who projects her hatred towards the staff by complaining about the way the unit functions may

well do the same to the family concerned. Sometimes this takes the form of blaming the family and provoking an intra-familial fight. But sometimes, as in the case here, the patient induces the family to act-out her rage and *vice-versa*.

This understanding necessitates the importance of a comprehensive diagnosis of the patient, not just a DSM diagnosis, but a basic psychodynamic formulation as well. Knowing that in the present day of short lengths of stay, diagnostic depth cannot be readily attained. However, speculation on possible family/group dynamics can be useful and can give the clinician an edge over the situation when dealing with patients and their family members.

Awareness of Psychodynamic Mechanisms

Being aware of the psychodynamic mechanisms is the first step towards defining preventive strategies.

Some of these factors that require attention include projection and projective identification. There are various other categories of mechanisms, patients and combinations of both common to the group therapy literature that will be important to keep in mind such as: "the monopolist", "the HRC" (help rejecting complainer), "the SRM (self-righteous moralist), the "doctor's assistant", or the "silent" patient, just to name a few. Each type has a general prescription for its management.⁷

The need to even be aware that a similar situation has developed and a proper direction is needed is the key especially towards the earliest signs of discomfort, confusion or distress. Several metaphors ("take a step back" or "rise up to the balcony for the proper perspective") come to mind in this respect, but the most compelling one is that of the disoriented diver frantically struggling to get to the surface to no avail, often deepening trouble and mounting panic. The only solution is to consciously be still and observe the direction of the surfacing bubbles for proper reorientation. Likewise, the clinical team members need to understand a situation before any further deterioration has taken place to reassess the dynamics and mechanisms at play. This strategy is indispensable to the team not only to regain control over the meeting and steer it towards a productive end, but also to avoid being a part of the unfolding drama.

Finally, an argument may easily arise that the team would have done the best if they had not played in to the hands of the family by not convening a family meeting at all. This would have avoided a venue and group setting wherein the psychopathologies were most clearly observed. Indeed, the main goal of the paper is to give the reader a perspective of this experience to consider any "upstream" decision as a future direction should they have a similar case.

CONCLUSION

There is a wide range of potential experiences that a clinical team is exposed to when convening a family meeting. Powerful

emotions may be evoked in both the family as well as the clinical team. Awareness of this is critical in managing the structure and flow of the meeting as well as the potential effects on the patient, the family and the clinical team. Forewarned is forearmed. But awareness alone may not be enough to prevent an experience akin to acute stress-like symptoms shown by the clinical team. Processing sessions after such traumatic family meetings with “potentates” could be a productive learning experience. But most important is a comprehensive checklist of preventive measures that span the full spectrum from concrete to psychodynamic potential sources of “attack”. We see this paper as an initial effort for today’s inpatient community to develop a manual or guidelines on holding inpatient family meetings. Such a manual is needed by clinicians across multiple disciplines to serve their patients better. There are almost no existing empirical evidences of the value of family meetings in an inpatient setting. Most empirical evidences are centered on the pediatric and geriatric population, in medical settings concerning the ICU, palliative care and oncology.

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Brief Research Report

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How Social Status Influences “Affect Language” in Tweets

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ABSTRACT

Background: We studied the “affect language” (emotional content) in over 2000 Tweets of 50 famous celebrities across a one-month period.

Method: The 140-character language bursts were analyzed with the Linguistic Inquiry and Word Count (LIWC), which provided percentage of language used to represent various emotional states.

Results: Lower-status celebrities (i.e., those with fewer followers) used more positive emotion in their Tweets compared to higher-status celebrities, although negative emotional content did not vary by celebrity status. There was no statistically significant difference between sexes on emotional content.

Conclusion: Our results suggest that social status may be more important to public use of affect language than sex of the celebrity.

KEY WORDS: Affect; Language use; Twitter; LIWC; Celebrity status.

INTRODUCTION

“I’m so overwhelmed by all this birthday love!!!! Thank you so much! It means the world to me!” Tweet from Khloe Kardashian to sister Kim, May 29, 2017.

A simple sentiment expressed from one celebrity sibling to another on Twitter speaks volumes about not only the sender’s emotional state, but also the likely sex, social standing, and age of that person. Indeed, language is a reliable indicator of several social markers of its users, including status, sex, and personality.^{1,2}

Different methods may be used to map the content of language to characteristics of users. Several studies by Schwartz, Kern, Park, Eichstaedt, and colleagues³⁻⁵ have employed an open vocabulary method that involves characterization of language into several natural, spontaneous categories. This method has been productive in identifying how language used in social media predicts a user’s personality and emotional state.^{3,5} In contrast, a closed approach begins with pre-set dictionaries into which words are categorized. The most notable closed approach is Pennebaker’s⁶ Linguistic Inquiry and Word Count (LIWC), which classifies word use into different parts and different types of speech using a dictionary of 6000 words. The LIWC has been used to examine language in a broad range of contexts (e.g., natural speech, plays, poems, diaries, social media, song lyrics, political speeches, and news conferences) and has been shown to reliably identify aspects of personality, current emotional state, education, sex, focus on relationships, level of cognitive sophistication, and age of speakers and writers.

Both methods of language analysis have been successful in identifying language user personality,⁷ health,⁸ psychological states,⁹ as well as the aforementioned user demographics. Additionally, each approach has been used to tap emotional content of speech and writing and to map that content onto qualities of the speaker. Not surprisingly, when people are sad their language may connote more negative emotional content, whereas they may use more positive

emotional words when they are happy.¹⁰ On the other hand, simple emotional experience does not necessarily lead to a corresponding linguistic affect.^{9,11,12} Thus, actual emotional states are not the only cause of affect-laden language, which can instead be a function of speaker characteristics and purpose of language use.

Affective words are used differently depending on context^{9,13} and according to sex,^{1,13} age,^{4,14} political affiliation,¹⁵ and personality.¹⁶ For example, language conveying positive affect (particularly with positive feelings; such as “I’m happy” or “that’s nice”) is more common in women,^{4,17,18} and increases with age¹⁴; (although Kern et al⁴ for a discussion of the importance of emotional intensity to this trend). For example, a gamut of emotions is seen in the language of Democrats compared to Republicans,¹⁵ and positive emotion is found more often in the language of extraverted,⁵ conscientious, and agreeable people,^{3,4,16} but it is unlikely to be used by those with high achievement motivations.¹⁶

Negative emotional language also clearly reflects user characteristics. For example, either lots of negative emotion or an absence of any appropriate emotion in language are signs of poor psychological health.¹² Moody, over-reactive, and self-indulgent people (e.g., those high in neuroticism) use negative emotional words,^{14,19} but negative language is less likely among persons who are high in conscientiousness.⁷ In many contexts, particularly those surrounding anxiety-provoking situations, women express more negative emotion.¹³ People who are unpredictable more commonly use words of anger to express themselves,¹⁹ as domes,¹⁸ although anger in linguistic expression is tolerated only among those of higher status.²⁰

Social status differences (such as those due to rank, hierarchy, or importance) are also important to language use, particularly pronoun use.^{21,22} Less, however, is known about how status as opposed to other social and demographic markers influences affect language. While Kacewicz et al’s²² study of status focused on pronoun use, those researchers also reported no statistically significant overall effect sizes for affect collapsing across five studies in a meta-analysis. Specifically, neither the high nor low status persons in their studies were consistently more likely than the other to use positive nor negative emotion,²² regardless of whether status differences were inherent in the relationship of the persons interacting or assigned through experimental manipulations. On a study-by-study basis, however, some status-linked differences were seen, perhaps because status is concomitantly linked with sex in many social interactions. Thus, the consideration of the singular and joint influences of status and sex on use of emotional language may be important to understanding how affect is expressed in social situations.

One good place to look at natural expressions of language is on social media,^{4,7} because so much daily communication takes place in social media platforms including Facebook, Snapchat, Instagram, and Twitter. Indeed, the Pew Research Center²³ reported that most adult Americans use some forms of

social media *each* day. Twitter, a social media site that is open-access (i.e., every Tweet ever sent still exists and can be obtained, regardless of whether you are on Twitter) is one such site. Over 100 million people use Twitter daily, sending over 500 million Tweets.²⁴ Twitter forces users to be spare and succinct in their expression allowing only 140-characters per Tweet. Therefore, our study examined how short linguistic posts on Twitter showed emotional-laden language differences between sexes and social statuses of public persons. Our variables of interest were both positive and negative emotion as a function of speaker background. Specifically, we predicted that women and celebrities with a lower social status on Twitter would show more affect-laden language in their Twitter posts when compared to men celebrities and those with more followers.

METHOD

Sample

A total of 2128 Tweets from a 30-day window in the summer of 2015 were taken from the active (having tweeted within 30 days, at least once), verified Twitter accounts of 50 actors ($n=25$ each men and women) who were most popular in 2015 on www.ranker.com. All sample targets used Twitter in English. Because people sometimes impersonate celebrities on social media, we verified the Twitter account by either checking the blue circle on the account to look for a white checkmark (which means that the Twitter corporation verified to whom it belonged), or we went to the target person’s website and located the Twitter account link. Following Beach et al,²¹ we operationalized social status by the number of followers (number of people who receive one person’s Tweets) taking a median split of our sample ($Mdn=1,063,500$ followers, $SD=3,610,545$). We used a median split rather than dividing the sample into thirds to avoid potentially discrepant and significantly small within cell sample sizes that could severely diminish power. Separate *t*-tests confirmed that the median split yielded two groups differing in the number of followers, $t(48)=4.63$, $p<0.001$, but that there were no differences in number of followers according to actor sex, $t(48)=1.76$, $p>0.05$.

Measures

Each Tweet was placed verbatim into a word document and analyzed with the LIWC software, employing the standard dictionaries installed with the program. The two measures of interest were percentage of positive emotional words (such as nice, happy) and negative emotional words (e.g., ugly, angry, worried). The LIWC approach was used because we were not comparing word use in Tweets to actual measures of personality of the persons writing the Tweets; that comparison would be more productive using an open-vocabulary approach of language analysis.

RESULTS

To determine the differences in affect among the Tweets, we computed a 2 (Sex)×2 (Social Status) between-subjects MANOVA with percentages of positive and negative emotional words

comprising the dependent variables. The analysis showed a statistically significant multivariate effect of social status, $F(2, 2123)=12.94, p<0.001$, Wilks' $\lambda=0.988, \eta_p^2=0.012$ (observed power=0.99), but neither a statistically significant main effect of sex, $F(2, 2123)<1$, nor an interaction, $F(2, 2123)=1.66, p>0.05$. Separate univariate tests, with a Bonferroni correction, indicated that celebrities of lower social status ($M=7.12, SD=10.86$) included more positive emotion in their Tweets than did those with higher social status ($M=4.34, SD=7.45$), $F(1, 2124)=25.67, p<0.01, \eta_p^2=0.012$ (observed power=0.99). Means and standard deviations from the analysis of positive emotion are seen in Table 1. Overall, there was no statistically significant correlation between the percentage of positive and negative emotional words, $r=-0.036, p>0.05$.

DISCUSSION

Our results demonstrated that social status, as determined by Twitter followers, was the key factor in determining how much positive emotion was seen in the language of celebrity Twitter users. Lower-status (i.e., less “followed”) celebrities used more positive emotion in their Tweets, regardless of sex. Surprisingly given previous research findings,^{1,13} women did not use more positive emotion than men. Negative emotion in Tweets was not different according to sex and social status.

Status may be more important than sex among this target sample,²¹ particularly because the ages of persons in this sample is large compared to many language studies. While not all language studies focus on only college-aged language users^{14,16} many LIWC studies focused on college-aged students, who may show more sex-linked language differences. More likely, however, is that the medium—140 characters—is the key determinant in content. Perhaps lower-status celebrities sought to portray themselves as agreeable, extraverted, and open, qualities associated with positive emotion in language,^{3,5,25} keeping their Tweets “light”. Lower-status celebrities may have wished for positive attention, making short but upbeat points, regardless of how they were truly feeling—indeed, positive emotion in public writing does not always correspond to actual positive affect.⁹ Higher-status celebrities with many followers may have Tweeted about pet causes, or felt freer to be less upbeat than

lower-status celebrities because they have so many followers.

While lower-status celebrities showed more positive emotion, they did not correspondingly show less *negative* emotion. While celebrities may be characterized as self-involved and neurotic (and, thus, more likely to use negative emotion in their language),^{16,19} there was very little negative content at all in the sample Tweets. While not directly comparable to those reported in other studies using different target groups, the emotional content of these Tweets is nonetheless strikingly different from baseline percentages reported in large samples,^{9,10} particularly that of Newman et al,¹³ which included 500,000 text files. In most samples, negative emotion is less likely than positive emotion; and while that was true of our sample as well (5.72% positive; 1.15% negative), over 5% of language being positive (and only around 1% negative) is atypical. Thus, these Twitter users may not have wished to be perceived as volatile and withdrawn and neurotic, which are traits of people who use negative emotion in their social media language.²⁶ Moreover, negative emotion is domain-specific (mostly about work/school⁹) and context driven,²² suggesting that only an intense focus about a very specific topic will reveal negative emotion in short Tweets.

Our results provide insight on the use of emotional language in Tweets, but only for a relatively uncommon sample. Because we determined social status to be a function of number of followers (ranging from 25,000 to over two million), and the average number of followers people have on Twitter in 2017 was 707, and fewer than 1% of Twitter users have over 10,000 followers,²⁷ our sample of celebrities provides a view that may not be representative of emotional language in short language bursts of people who are not in the public eye. Our sample also included mostly American celebrities who did not vary greatly in race and ethnicity. Additionally, we did not examine the time of day of the Tweets, as people tend to become more “moody” and less happy as the day progresses.²⁸ Finally, our sample was gleaned in a short window of time before the United States presidential election race was in full swing, and it is thus likely that the sample neither represents celebrities from other cultures nor the more-recent social media climate in the US brought about by sharp political divides along partisan lines.

Table 1: Means and Standard Deviations for Positive Emotion in Tweets as a Function of Sex and Social Status.

Sex			
Men		Women	
Low (n=141)	High (n=884)	Low (n=914)	High (n=189)
7.99 (13.75)	4.18 (7.53)	6.98 (10.35)	5.10 (7.00)

Note: Numbers reflect percentage of language in Tweets that included words of positive emotion.

CONCLUSION

In conclusion, this examination of emotionally-linked language in famous Twitter users suggests that impression management may be more important than other determinants of linguistic behavior. Specifically, happier, positive short statements were common among those who had fewer followers and thus less “status” on Twitter, and that being spare with words obviated sex differences that are typically seen in language use. Of course, longer verbalizations (in any form, including those on social media outlets that afford lengthier postings) may reveal different patterns, but our findings indicate that when confined to say something relatively succinct, those with lower status will employ positivity to get attention.

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CONFLICTS OF INTEREST

The authors have no disclosure or competing interests and this research was unfunded.

CONSENT

There is no consent required for research with public documents, and research used public-domain material (Twitter), which does not require Institutional Review Board (IRB) approval.

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Brief Research Report

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The Effect of Mobile Telephone Electromagnetic Field on Human Brain Bioelectric Activity and Information Processing Speed

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ABSTRACT

Aim: This study aimed to examine the effect of a mobile telephone electromagnetic field (MP-EMF) on human brain bioelectric activity, at the T3 location, and information processing speed. Human brain bioelectric activity was assessed by calculating power spectral density (PSD) values from electroencephalogram (EEG) recordings, and information processing speed was assessed by the Paced Auditory Serial Addition Test (PASAT). Eighty-four people (ages 18-25) participated in this study.

Materials and Methods: Each subject had two consecutive 15 minute single-channel EEGs (baseline and treatment) taken with either a T3/T5 or T3/CZ monopolar montage configuration. The treatment EEGs consisted of either exposure to an MP-EMF or a placebo telephone with no electromagnetic field. The mobile telephone or placebo telephone was held by the test subjects and against their left ear for the duration of the 15 minute treatment EEG. Subjects were blind to the possibility of exposure to a placebo telephone. The PASAT is subject to practice effect, so a Solomon four-group design was implemented. Half of the groups received a pre-test and post-test, while the other half only received a post-test.

Results: A three-way mixed analysis of variance (ANOVA) was used to analyze the PSD values, and a meta-analytic approach was used to analyze the PASAT scores. Neither set of data, PSD measurements or PASAT scores, produced statistically significant results.

Conclusion: These results indicate that 15 minutes of exposure to an MP-EMF does not produce a statistically significant effect on human brain bioelectric activity at the T3 location. While the PASAT scores also indicate no effect on cognitive functions from MP-EMF exposure, many confounding factors, like the sensitivity and the time of the administration of the PASAT and duration of MP-EMF exposure, may have influenced the statistics. Further research controlling for these factors is suggested.

KEY WORDS: Electromagnetic field; Paced Auditory Serial Addition Test; Information processing speed; Mobile telephones; Electroencephalogram (EEG); Mobile telephone electromagnetic field (MP-EMF); Solomon-four group design.

ABBREVIATIONS: MPs: Mobile telephones; MP-EMF: Mobile Telephone Electromagnetic field; EEG: Electroencephalogram; EMF: Electromagnetic field; PASAT: Paced Auditory Serial Addition Test; PSD: Power Spectral Density.

INTRODUCTION

Mobile telephones (MPs) have become a primary avenue for communication in our current society. They operate as two-way radios and transmit data and calls through the emission and retrieval of radio waves. These radio waves take the form of oscillating electric and magnetic fields, known as an electromagnetic field (EMF). With the understanding of the partial absorption of a mobile telephone electromagnetic field (MP-EMF) by the skull and brain,¹ there has

been a proliferation in concern for one’s health and the potential adverse effects caused by an MP-EMF. Consequently, studies concerning the technology have increased. However, studies are continually emerging with conflicting results as to whether or not an MP-EMF has an effect on human brain bioelectric activity and cognitive functions. In 2007, research from the University of Essex showed that exposure to an EMF for 40 minutes did not produce an adverse effect on an individual’s performance in an order threshold task² and in 2016, researchers from Sir Seewoosagar Ramgoolam (SSR) Medical College, Vacoas-Phoenix, Mauritius and University College of Medical Sciences (UCMS), Delhi, India and Guru Teg Bahadur (GTB) Hospital, Delhi, India revealed that chronic MP usage did not result in a decline in a user’s cognitive function.³ Conversely, studies from Maastricht University, Maastricht, The Netherlands and Deenbandhu Chhotu Ram University of Science and Technology, Haryana, India reported that MP-EMF altered electroencephalogram (EEG) recordings of brain wave activity,^{4,5} while research from the University of Keele, Newcastle, UK has shown that people that have been exposed to MP-EMF had a higher chance of improved immediate verbal working and immediate visuospatial memory capacity and sustained attention.⁶ Such diversity in findings delineates the need for further research to obtain more conclusive data.

This study was designed to investigate the effect of MP-EMF exposure on human brain bioelectric activity at the International 10/20 T3 location, using a single-channel EEG, and information processing speed, assessed by the Paced Auditory Serial Addition Test (PASAT). This study takes a direct approach by focusing solely on the human brain bioelectric activity at the T3 location and the cognitive function of information processing speed. The T3 position is the closest 10/20 position to the MP’s antenna when held against the ear, making it the central position focused on in the study. Each participant received a treatment of either exposure to an MP-EMF or a placebo telephone with no EMF while an EEG recording co-occurred to assess if the treatment affected human brain bioelectric activity. The PASAT was administered to examine information processing speed.^{7,8} It was first introduced in 1974⁹ as a way to evaluate cognitive functions

of concussed individuals and is currently widely used in clinical settings on multiple sclerosis patients. The PASAT is subject to practice effects,¹⁰ so a Solomon four-group design¹¹ was implemented in this research study to account for that.

MATERIALS AND METHODS

Subjects

Eighty-four people ranging in age from 18-24 years old participated in the experiment. There were 61 females (mean age 20.6±1.6 years) and 23 males (mean age 20.7±1.6 years). Participants were randomly allocated to one of the eight different groups, which were differentiated based on treatment, electrode placement, and PASAT setup (Figure 1).

Design

This study was presented to the Oral Roberts University Institutional Review Board (IRB) and approved on January 27, 2017. All test subjects gave their verbal and written informed consent before participation. Additionally, many psychology courses at Oral Roberts University offered comparable extra credit to students who participated.

Electroencephalogram (EEG) Acquisition

Test subjects were placed in a stationary chair approximately two feet from a video screen. Limited accessible equipment allowed for only a single-channel EEG with a monopolar montage design and it was taken of each participant using a BioPac MP36 with shielded leads (BioPac EL258S). Ag-AgCl electrodes were placed using the 10/20 International System. Half of the groups had the active electrode (Vin⁺) at the T3 location and reference electrode (Vin⁻) at the CZ location. The other half of the groups had the Vin⁺ electrode at the T3 location and the Vin⁻ at the T5 location. The ground electrode was placed on the forehead for all conditions. Rubbing alcohol and electrode gel were used to prepare the skin, and conductive paste was used to adhere each electrode to the scalp. A 60 Hz notch filter was used as

Figure 1: Each Group’s Experimental Design.

	Treatment		Electrode placement		PASAT	
	Placebo telephone	Mobile telephone	T3/T5	T3/CZ	Pre- & post-test	Post-test only
Group 1	X		X		X	
Group 2	X		X			X
Group 3		X	X		X	
Group 4		X	X			X
Group 5	X			X	X	
Group 6	X			X		X
Group 7		X		X	X	
Group 8		X		X		X

PASAT: Paced Auditory Serial Addition Test.

well as a 38.6 Hz and a 66.5 Hz low pass IIR filter. Impedance was kept below 20 kohms, which was measured by the BioPac MP36. During the EEG signal acquisition, each subject viewed the same neutral documentary. A 15 minute baseline EEG was collected before treatment exposure. Subsequently, the treatment (MP or placebo telephone exposure) was introduced, and an additional 15 minute EEG was obtained. For the treatment with the MP, the same MP was used for each participant and had a specific absorption rate of 1.18 W/kg to exposed tissue as reported in the manual. It was held by the test subjects and against their left ear for the duration of the 15 minute EEG. The MP was turned on, in talk mode, with the volume turned down. The placebo telephone groups held a counterfeit MP that was modeled to the same weight and specification of an actual MP but emitted no EMF.

A fast fourier transformation (FFT) was performed on each subject's two EEG data sets (baseline and treatment) to determine the power spectral density (PSD). Each 15 minute EEG was conducted at a sampling rate of 2000 Hz and subdivided into epochs of 32,768 samples, the width of each FFT. A Hanning window and Welch's method of 50% overlap was used in the calculations. The absolute PSD for each EEG was established through the integration of the 0.5 Hz-30.0 Hz bandwidth. The 0.5 Hz-30.0 Hz bandwidth was selected for it encompassed delta (0.5-4.0 Hz), theta (4.0-7.5 Hz), alpha (7.5-13.0), slow beta (13.0-20.0), and fast beta (20.0-30.0) brain frequencies, which allowed for the assessment of the overall effect of an MP-EMF on the main human brain wave frequencies.

Cognitive Assessment Procedures

Following the Solomon four-group design, only half of the groups performed the PASAT at two points during the study: before the initial baseline EEG and directly following the treatment EEG. The other half of the groups performed the PASAT only in the latter condition (Figure 2). The PASAT is a test that is administered *via* an audio recording of numbers, one through nine, that are specifically distributed at a constant inter-stimulus interval. The individuals are asked to add the previous number they just heard to the current number they heard and verbally speak out the answer. In this research study, the PASAT that was administered was formatted with 50 numbers and an inter-stimulus interval of 3 seconds. Test subjects had two practice PASATs consisting of four numbers in order to acclimate them to the format of the test before the initial test was conducted.

RESULTS

EEG Results

Absolute PSD measurements for the baseline and treatment EEGs were analyzed using a three-way mixed ANOVA with the two between-subject factors being the treatment (MP *vs.* placebo telephone exposure) and electrode placement (T3/T5 and T3/CZ), and one within-subject factor being time (baseline PSD values and treatment PSD values). This three-way ANOVA was conducted to understand the effect of MP-EMF on human brain bioelectric activity at the T3 location. PSD values were moderately positively skewed. A square root transformation was performed to normalize the data sets. There were 11 outliers, and each was removed from further analysis. Outlying values were assumed to be due to limitations in EEG filtering on accessible software, which was determined by further inspection of each outlying data set. The three-way interaction between treatment, electrode placement, and brain waves was not statistically significant, $F(1, 69)=0.403, p=0.528, \text{partial } \eta^2=0.006$. Additionally, all two-way interactions were not statistically significant (time and treatment, $F(1, 69)=1.738, p=0.192, \text{partial } \eta^2=0.025$, and time and electrode placement, $F(1,69)=1.876, p=0.175, \text{partial } \eta^2=0.026$).

Paced Auditory Serial Addition Test (PASAT) Results

To accurately analyze the PASAT scores with a Solomon four-group design a meta-analytic approach, outlined by Walton Braver and Braver,¹² was utilized. To determine if there was a practice effect, a 2x2 ANOVA was run with the between factors being the treatment (MP *vs.* placebo telephone exposure) and pre-test (pre-test *vs.* no pre-test). Two outliers were found, but these scores were determined as genuinely unusual values and kept for further analysis. There was no significant interaction between treatment and pre-test, $F(1,80)=0.192, p=0.662, \text{partial } \eta^2=0.002$, so to establish if the presence of an MP-EMF had an effect on test scores and to verify that there was no practice effect from the pre-test, a main effect test was run. There was no statistically significant main effect of treatment (MP *vs.* placebo telephone exposure) on post-test scores, $F(1,80)=2.295, p=0.134, \text{partial } \eta^2=0.028$, and there was no statistically significant main effect of pre-test (pre-test *vs.* no pre-test) on post-test scores, $F(1,80)=0.154, p=0.696, \text{partial } \eta^2=0.002$. These results indicate that there was no practice effect caused by the presence of the pre-test. To determine if the presence of an MP-EMF had an

Figure 2: Chronological Illustration of each Test Subject's Experimental Procedures.

		Viewing a neutral documentary		
Groups 1, 3, 5, & 7	N/A	15 minute baseline EEG	15 minute treatment EEG	Post-PASAT
Groups 2, 4, 6, & 8	Pre-PASAT	15 minute baseline EEG	15 minute treatment EEG	Post-PASAT

PASAT: Paced Auditory Serial Addition Test.

effect on post-test scores, an analysis of covariance (ANCOVA) was run on groups 2, 4, 6, and 8's post-test scores with the covariate being the pre-test scores. After adjustment for the pre-test scores, there was no statistically significant difference in post-test scores between MP and placebo telephone conditions, $F(1,39)=0.145$, $p=0.706$, partial $\eta^2=0.004$. Since the ANCOVA resulted in insignificant results, an independent t -test was run on post-test scores in groups with only post-test scores (groups 1, 3, 5, and 7). There was no statistically significant difference in mean post-test scores between MP condition (32.15 ± 11.28) and placebo telephone condition (32.05 ± 9.52). Since both the ANCOVA and t -test results were insignificant, the meta-analysis approach, Stouffer Method,¹³ was taken by combining the results of the ANCOVA and the independent t -test. The results from the meta-analysis were not statistically significant, $Z_{\text{meta}}=-0.29$, $p=0.77$.

DISCUSSION

A single-channel EEG using a monopolar montage setup was used to examine the effect of MP-EMF exposure at the T3 location. The T3/CZ design was implemented to investigate if there were changes in human brain bioelectric activity at the T3 location when in reference to the most central point on the skull, and the T3/T5 design was chosen to determine if 15 minutes of MP-EMF exposure had a localized effect at the T3 location. Results of the 3-way mixed ANOVA revealed that 15 minutes of exposure to an MP-EMF did not have an immediate effect on human brain bioelectric activity at the T3 location. These findings are comparable to the ones of Hietanen, Kovala, and Hämäläinen¹⁴ and Wu, Sajad, and Omar.¹⁵ Both studies indicate that MP-EMF does not have an effect on EEG recordings.

Satisfactory performance on the PASAT has been shown to be associated with the different sections of the brain, including the left pre-frontal lobe,¹⁰ which is why subjects held either an MP or placebo telephone next to their left ear. The results of the meta-analysis indicate that the MP-EMF did not have an effect on information-processing speed. These findings similarly correlate with Papageorgiou's¹⁶ findings that suggest that an MP-EMF does not have a statistically significant effect on working memory. The results also reflect similar results with the research of Besset, Espa, Dauvilliers, Billiard, and Seze.¹⁷ Their data suggest that daily MP use has no statistically significant effect on information processing speed, attention capacity, and memory and executive function.

While it stands to reason that the lack of change in human brain bioelectric activity produce consistent cognitive functioning, it is important to note that in this study the insignificant results from the PASAT scores may have been influenced by possible confounding factors, such as the sensitivity and the timing of the administration of the cognitive test and the duration of the MP-EMF exposure. While the PASAT was primarily selected for its accessibility, a more sensitive test, such as the Go/No-Go task, may be more appropriate for identifying subtleties in cognitive fluctuations. Furthermore, mirroring the general

setup of Edelstyn and Oldershaw's⁶ research, this study administered the cognitive test after MP-EMF exposure was removed. If there are cognitive variations that occur only while MP-EMF is present, this study's structure was not designed to detect them. Additional research that administers a cognitive test while test subjects are in the presence of MP-EMF is advised. Lastly, the research conducted by Edelstyn and Oldershaw⁶ revealed that MP-EMF exposure increased test subjects' cognitive functions after 30 minutes of exposure. This study's MP-EMF exposure only measured 15 minutes in length, adding to the possible factors that may have influenced the insignificant cognitive test results. Supplementary research with an increased MP-EMF exposure length is recommended.

CONCLUSION

The results of the three-way mixed ANOVA for the human brain bioelectric activity measurements and the results of the meta-analysis for PASAT scores indicate that 15 minutes of exposure to an MP-EMF does not produce a significant effect on human brain bioelectric activity at the T3 location or information processing speed. However, possible confounding factors may have influenced the results of the PASAT test. Further research that incorporates a more sensitive cognitive test, increases the length of MP-EMF exposure, and examines test subjects' cognitive functions while being exposed to MP-EMF is suggested to obtain more conclusive results that support the notion that mobile phones are innocuous.

CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

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Psychological Pleasure in Reading and Visual Cognition Under Colour Luminance: A Psycholinguistic Approach

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ABSTRACT

Purpose: To investigate the psychological pleasure of reading and visual cognition under two colour luminance.

Methods: A comparative study of sixty participants with emmetropia and no history of ocular pathology was conducted at Vision Sciences Laboratory, School of Medical Sciences, University of Hyderabad, Hyderabad, TS, India. Standardized Simple Measure of Gobbledygook (SMOG) index based readability passage was used as visual stimulus along with self paced reading task, obtained from the readability psycholinguistic software. This task was performed under white colour (Fluorescent light-400 lux) and orange colour luminance (Tungsten light-400 lux).

Results: Significant results were obtained when the reading rate and speed, observed under white and orange colour luminance [$p < 0.001$, $X^2 = 53.20$], were compared. Comparison of reading errors also showed significant difference [$p < 0.001$, $X^2 = 23.58$], whereas positive correlation ($r = +0.778$) and psychological pleasure among both the groups observed under white luminance were 80% and 20% respectively.

Conclusion: This study emphasized that psychological pleasure under colour luminance played an important role in reading performance and visual cognition.

KEY WORDS: Psycholinguistics; Visual cognition; Psychological pleasure; Reading performance; Visual cognition; Colour luminance.

INTRODUCTION

In human beings, cognition involves a variety of mental processes such as perception, attention, memory, reading and thinking that are highly interrelated to each other. One of the most fundamental cognitive processes is reading, which is commonly associated with the storage and perception of the presented visual information. The intriguing aspect of psycholinguistic research is the implemented techniques to enhance reading performance and perception of visual information. Thus, the question arises if colour luminance could possibly result in improved reading performance or psychological pleasure? Reading comprehension involves language-specific processes, as well as domain general cognitive abilities, wherein a variation in any of these abilities potentially, underlies individual differences in comprehensive abilities.¹ A study by Jackson et al¹ proved that fast readers demonstrate better performance in reading and tasks like verbal, quantitative reasoning, short-term auditory memory, and speech comprehension; matching task has long-term memory to capture more information from each reading fixation.² Chen et al, in his study emphasized that text colour had a more pleasing effect to read than black colour text in a white background. Reading performance also proved to be better with coloured text letters than black and white combinations of visual display units and computer screens; variable spacing between the jump lengths of letters also play an important

role in reading comprehension.³ Green et al validated that poor colour combinations for background displays did not attract the readers' ability to read with pleasure and caused visual discomfort, especially with the warm colours.⁴ However, clinically, colour discrimination also varies under different luminance sources as was discussed in a study conducted by Ram et al who explained that colour discrimination with ishihara colour vision plates were influenced by tungsten illumination. White fluorescent light has been associated with a better colour discrimination and a pleasant feeling.⁵ Korbin et al in a study proved that visual cognition associated with computer-based tasks increases relative to printed material; however, the working memory and cognitive demand is the same in both groups but verbal protocol analysis impacted constructive behavioral process compared to paper and pencil test strategies.⁶ Geske et al illustrated in his study that effects of the process of reading on a computer screen at the textual level, and comprehension and information processing, involved decoding of visual information and flicker frequency on the screen which affected the processing of brain activity. However, it did not affect reading printed material.⁷ Allington et al reported that reading without a prior idea or theme on the subject disrupted attention in undertaking tasks.⁸

However, many vision science researchers explained the function and physiology of eyes during reading and the influence of technology on visual cognition.⁹ Many researchers have proposed variables in earlier studies that contribute to the retrieval operations in linguistics and reading.

One of the most important variables is colour and luminance, which will be discussed in the present paper and it will be attempted to elucidate how psychological pleasure is influenced by the colour luminance during reading.

MATERIAL AND METHODS

Participants

Sixty participants belonging to the age group between 19-21 years (male=29 and female=31) participated in the study as has been recorded in Table 1. All the participants were students of University of Hyderabad, Hyderabad, TS, India who were native english speakers and bilinguals with fluent in reading and writing english comprehension. The present study was undertaken by complying with the norms of the Declaration of Helsinki and Institutional Ethics Committee (IEC) approval from the School of Medical Sciences, University of Hyderabad, Hyderabad, TS, India, having received the verbal and written consents from the participants. No monetary award was given to the participants for participating in the study. All the participants were naive to the experiment.

Visual Stimulus

English comprehension reading passage showed an equal readability score based on SMOG index formulae in the psycholinguistic readability text calculator.¹⁰ This passage used as a near

Gender	Age (Mean±SD)	N%	Range (years)
Male	19.76±1.13	29 (48%)	19-21
Female	19.80±0.80	31 (52%)	19-21

Figure 1: Visual Stimulus Presented to the Participants as Reading Comprehension Passage.

A river begins at a source or more often several sources follow a path called a course and ends at a mouth or mouths. The water in a river is usually confined to a channel, made up of a stream bed between banks. In larger rivers, there is often also a wider flood plain shaped by floodwaters overtopping the channel. Floodplains may be very wide about the size of the river channel. This distinction between river channel and floodplain can be blurred, especially in urban areas where the floodplain of a river channel can become greatly. A river is a naturally flowing watercourse, usually fresh water flowing towards the side by ocean, sea, lake or another river. In some cases, a river flows into the ground and becomes dry at the end of its course without reaching another body of water. Small rivers can be referred to using names such as the stream, creek, brook, rivulet, and rill. There are no official definitions for the generic term river as applied to geographic features, although in some countries or communities a stream is defined by its size. Many names for small rivers are specific to geographic location few examples are "run" in some parts of the United States, "burn" in Scotland and north-east England, and "beck" in northern England. Sometimes a river is defined as being larger than a creek, but not always the language is vague. Rivers are part of the hydrological cycle. Water collects in a river from precipitation through a drainage basin from surface runoff and other sources such as groundwater. Rivers can be classified as either alluvial, bedrock, or some mix of the two. Alluvial rivers have channels and floodplains that are self-formed in unconsolidated or weakly consolidated as the importance of Rivers in India.

Readability Consensus
Based on Smog Readability Calculator, we have scored your text:
Grade Level: 12-13
Reader's age: 15-17 years old (college level entry)

visual stimulus consisted of fourteen lines of English sentences written in Times New Roman style of 12-point size with bold letters and these passages were printed against a non-glossy white background sheet in black, to avoid reflections. Visual stimulus content shows a different composition of words, but the readability score of every passage is and these passages were randomly presented to the participants to read under two different colour luminance sources. However, repeatability of passage has not been done. Every participant was presented with an equal readability score passage with different words. The reading was done loudly by the participants in the closed room. The size of reading stimulus chart was 21×29.7 cm (Figure 1).

Experimental Apparatus

A digital Photometer-HS1010 was used for calculating the intensity of light. Two luminance sources—warm white colour (CFL-15 watt, 3000-Kelvin colour temperature) and warm orangish colour (Tungsten-100 watt, 3000-Kelvin temperature) was used. However, the intensity of 400-lux was constant from the two lighting sources. The luminous efficiency of these lighting sources measured the effectiveness of luminance and composition of warm light with constant 400 lux intensity for specific reading tasks. The standards were followed according to the International Commission on Illumination (CIE) to provide a psychophysical analog of radiance. Kadio KD-2004 stopwatch was used to record the reading time and reading pad of 5×5 feet was adjusted to hold the reading material.

Experimental Procedure

The experiment began with the instructions regarding what the participants needed to do, participants were seated under overhead illumination of 1-meter from lighting source to reading pad and the viewing distance from the participant’s eye to visual stimulus was 40 cm (self paced reading task). After deciding on the seating arrangement, a reading passage with the above visual stimulus presented to read fewer than two colour luminance sources (white and warm orangish). The reading task was loud and audible to the experimenter in the closed room. However, the repeatability of the passage for the other participants was avoided and also the reading by the participants was checked by the experimenter to note down the errors and also record the cor-

responding reading time using a stop watch. After the completion of this reading task, all the participants were given a psychological questionnaire to give their feedback on the pleasure of reading under two colour luminance sources.

Data Acquisition and Analysis

The collected experimental data was maintained in a Microsoft excel sheet version-2007. All the variables used for evaluating the reading performance in the manuscript was analyzed using a Graphad prism-7 version statistical software. Before running the analysis, data was checked for normality distribution with the Shapiro-Wilk test followed by a Chi-square test and after measuring the Pearson correlation between the two groups for the reading variables. However, the psychological questionnaire was validated using the Cronbach’s alpha test and Matlab version-2015A and Grapher version-12 was also used as a computational software for the plotting the reading time peaks and the other graphs in the manuscript.

RESULTS

All the dependant variables were analyzed and it was noted that an evident trend in the significant result was observed when the reading rate and the reading speed was compared among white and orange colour luminance [$p < 0.001$, $X^2 = 53.20$] as has been reported in Table 2, Figures 2 and 3. Reading errors were also compared and it was found that significant difference [$p < 0.001$, $X^2 = 23.58$] existed between white and orange colour luminance with positive correlation ($r = +0.778$) as is evident in Table 3, Figure 4. However, Reading symptoms were maximum in orange (86%) followed by (46%) white luminance with significant trend [$p < 0.001$, $X^2 = 52.23$] and psychological pleasure among both the groups for White luminance (80%) and (20%) as has been reported in Figure 7. The reading times peak represented a high in warm orangish colour 210 sec and low in white colour luminance 171 sec as can be observed in Figures 5 and 6.

DISCUSSION

In the current study, an attempt has been made to explore the psychological pleasure of reading and visual cognition under two colour luminance sources (white and warm orangish). How-

Table 2: Chi-square Test Showing the Comparison between Two Groups for Reading Performance.

Luminance (400 lux)	Variables	Mean±SD	Chi square test analysis		
			df	X ²	p value
White colour (CFL)	Reading rate (CWPM)	146±14.73	2	23.52	<0.0001
	Reading speed (seconds)	137±19.45			
Orange colour (Tungsten)	Reading rate (CWPM)	104±13.53			
	Reading speed (seconds)	177±21.75			

* $p < 0.005$ is considered as significant.

Table 3: Pearson Correlation Coefficient and Chi-Square Test Showing the Association between Reading Rate and Colour Luminance N=60.

Luminance (400 lux)	Variables	Meant±SD	Chi square test analysis			
			Correlation <i>r</i>	<i>df</i>	<i>X</i> ²	<i>p</i> value
White colour (CFL)	Reading errors	3.3±1.74	+0.778	2	53.2	<0.0001
Orange colour (Tungsten)	Reading errors	6.23±2.94				

**p*<0.005 is considered as significant

Figure 2: Scattered Q Plot Showing the Distribution of Reading Speed and Reading Rate (CWPM) in White Colour Luminance (Flouroscent-400 lux) N=30.

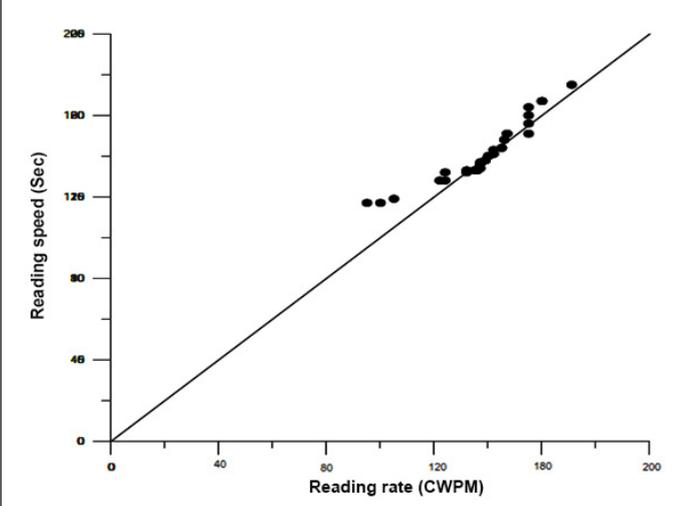


Figure 3: Scattered Q Plot Showing the Distribution of Reading Speed and Reading Rate (CWPM) in Orange Colour Luminance (Tungsten-400 lux) N=30.

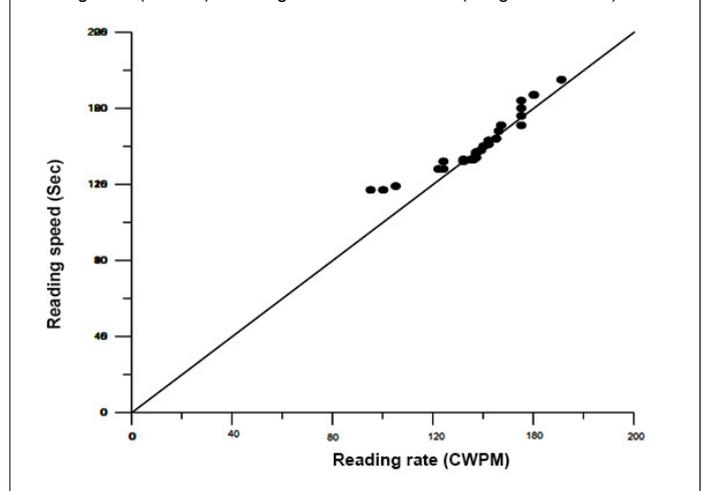


Figure 4: Spike Raster Plot Showing the Reading Speed (Sec) in White Colour Luminance (Flouroscent-400 lux) and Colour Temperature=3050 Kelvin.

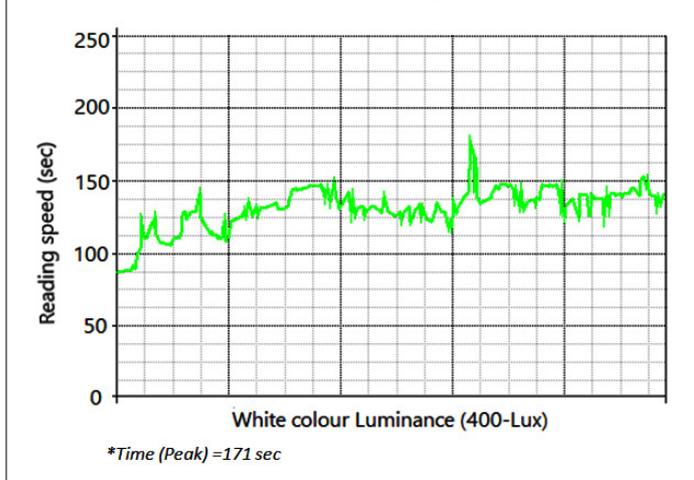


Figure 5: Spike Raster Plot Showing the Reading Speed (Sec) in Orange Colour Luminance (Tungsten-400 lux) and Colour temperature=3000 Kelvin.

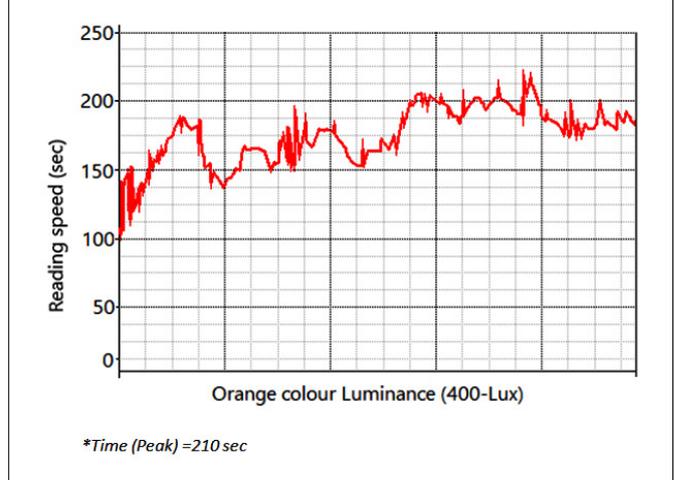


Figure 6: Box and Whisker Plot Showing the Reading Errors Association between White and Orange Colour Luminance (400 lux), N=60.

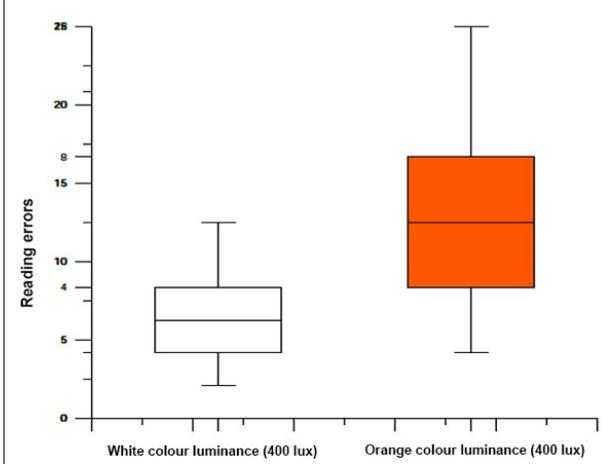
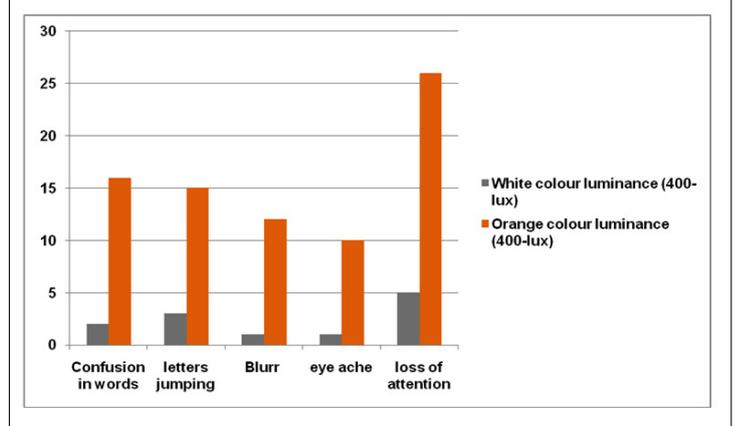


Figure 7: Bar Graph Showing the Symptoms Experienced by Participants after Experiment in Two Groups, N=60 (Sample Size).



ever, the results were consistent and supported by the observations of the existing studies. In the present study, it was found that colour luminance played a role in identifying the reading of the comprehension and visual cognition was slow under (warm orangish) lighting similar to the findings of Schlesewsky et al¹¹. Studies have shown that luminance is the variable influencing the contrast during process of reading. However, visual cognition and psychological pleasure experienced by the participants was good under white colour luminance than warm orange colour luminance. Thus, it was also noted that white colour luminance increased the cognitive visual tasks similar to the observations of the study by Baron et al¹². Supported with our findings, it was found that insufficient illumination and colour of luminance also influenced the behavior and cognitive tasks. Reading errors were found more in the participants who read under orange colour luminance than white colour luminance, similarly reading speed was good in white colour luminance but not under orange colour luminance. The equal readability score passage for both the English native speakers showed a difference in reading under two colour luminance's. The illumination colour could be accountable for this discrepancy in the observation.

Moreover, these findings supported by Kim et al¹³ found that Korean words and visual features were affected due to logographic and syllables property. But in this study, visual cognition and reading text was observed to influence reading under colour luminance.

However, reading symptoms and visual comfort was good under white colour luminance followed by psychological pleasure for a printed material. Our findings also showed that printed material influenced the reading of comprehension and visual cognition under colour luminance concomitant with the findings of Botello et al.¹⁴ Existing studies showed that background colour on computer screens also influenced the text and the reading of the comprehension in relation to the printed material in which it showed minimal effects. Moreover in this paper, the focus was on the visual cognition, reading and psychological

pleasure variables like eye movements and assessment of the blink rate for further understanding of psycholinguistics to undertake future research.

CONCLUSION

The present study showed that psychological pleasure under colour luminance played a role in influencing reading performance and visual cognition. Participants were psychologically more pleasant and visual cognition and reading was better under a white colour luminance source relative to orange colour luminance. It was also suggested that white colour luminance resulted in better satisfaction for near visual task reading. This study also explained that the reading speed was better in white colour luminance with a low reading error rate in comparison to warm orangish colour luminance.

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CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

Note: This Manuscript was extracted from Male Shiva Ram (11IMMO14) I. M.Sc (Optometry and Vision Science) dissertation title: Influence of illumination on reading.

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Perspective Article

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Which is Necessary for Cognition, “Free Will” or “Free Will Illusion”?

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SOFT SCIENCES

Over a long period of time, the issue concerning free will (FW) has been a much debated topic. In general, being fully aware of ourselves, we are convinced that our conscious will can freely control a “voluntary” action. However, natural events that cannot be predicted, such as earthquakes, cyclones, etc., frustrate our self-esteem and affects the process of thinking in men. To address this concern, by comparing the action decision-making of voluntary actions owing to our inability to escape such “supernatural” events, Searle¹ was of the opinion that: “*The persistence of the problem of traditional free will in philosophy seems to me something of a scandal*”; nevertheless, many have studied this issue and many papers have been written focusing on this area; however, it appears that limited progress in related research has been made.

Among the inexplicable events occurring all the time in our daily lives, there are particular events that occur at random, known as the aleatory events. Throwing a dice is identified as an aleatory event in which a number is selected at random; the same occurs when determining the gender of an unborn child due to the random exchange of genetic material. Both the events discussed cannot be predicted in advance; these events are also known as “Markovian” since their occurrence is independent of the preceding results. Talking about these processes can be upsetting having realized that we do not have control over these events. In case of a dice with 6 faces, the degree of probability by which we can predict a number is very low (about 16%). A deterministic prediction is associated with an approximation close to 1, but, to do so, we should be able to widen our perspective and observe the innumerable causes that converge to determine a Markovian event; so that we may consider aleatory events as truly free, unconditioned events. The perception of FW in the minds of people is far from being related to this concept.

In the wide landscape of different religions and cultures moving from the West to the far East, one can find many modalities by which FW is defined; at least, two of these categories that stand at the mental antipodes have been defined: 1) the first one typically belongs to the monotheistic religions — Christianity, Judaism and Islam; 2) the second one corresponds to Taoism.

1) The social hierarchy decided by God which positions mankind as a subordinate to Him but dominant with respect to the universe, is a view common to the first category religions. This form of privilege offered to the mankind over the physical world is justified by the presumption of possessing a soul-inhabited self. Since the religious dialectic can grasp the theories of metaphysics by managing philosophical and psychological argumentations better than empirical science, belief in the soul and spiritual dimension of humans are naturally sustained and inflated. In principle, the idea of FW that pervades this context is a true FW, i.e., a FW that allows mankind to claim the sense of agency and to take the responsibility for any action-decision-making, but this decision can exert only a conditional freedom since, ultimately, the action outcomes are judged *ex post facto* by the laws imposed by a superior entity of infinite wisdom. Thus, having the perception of a soul-inhabited self is a prerequisite for a sense of guilt when the action decision-making surpasses the ethical constraints posed by the transcen-

dental rules. According to Freud² people's belief in God is like a form of illusion; in reality resting on the basis that the idea of God acts as a shortcut to the fulfilment of human wishes. In this regard is his well-known affirmation: "...we call a belief an illusion when a wish-fulfilment is a prominent factor in its motivation, and in doing so we disregard its relations to reality, just as the illusion itself sets no store by verification...". The more he was critical about religion, the less clearly he encountered the question of FW. The goal of Freud's psychoanalysis was to bring repressed thoughts and feelings to consciousness; this is where FW seemed to be a necessary tool to place an individual at the centre of his own life, a perspective in disagreement with the deterministic view against religions. Freud's hypothesis on FW remained ambiguous; after his death, two completely opposite interpretations for the goals of therapy were proposed: a) it allowed for the patient to develop a stronger ego; b) it led the subject to acknowledge his or her inability to satisfy the most basic desires. In the first case, FW functions as a real instrument in the subject's hands, while, in the second case, FW is a mind confusing form of illusion.

2) Just as the orthodox Hindu Daršana (Advaita Vedanta, Shamyka, Yoga, etc.) and heterodox philosophies (Buddhism and Japanese Zen, etc.), Taoism primarily explores the human mind and its attributes.³⁻⁷ Though the final message conveyed is more radical: the mind is somehow an imperfect tool lying about or hiding the true nature of reality that is non-dual in nature, thus the definition of the self, negatively implies a dual mind-soul perspective. The realization of the non-dual self must be postponed following the enlightenment phase. Noticeably, a detailed study on epistemology presents the sages with the right to unveil the limits of the mind. The self-awareness of the individual's inconsistency and futility, on one side, and the impossibility to experience the divine (or vital principle), if any, through the chattering of the mind, on the other, urge the followers to put aside a sense of ego and deny seeking the truth using their minds. In contrast to many of the Daršanas cited above, Taoism is an atheistic philosophy which interprets our daily life experiences as a global net of synchronous series of events. The global interconnection between the events occurring simultaneously gives a sense of "timelessness" both to bad and good events. The synchronicity denies the classic deterministic cause-effect dependence between the actions of the past, present and the future; therefore, leading to the belief that life is a stream of tri-dimensional frames against which we cannot do anything, except becoming aware about it and, in principle, learning it upon deeper introspection. Tao is a philosophy much closely related to the concepts of modern physics than any other religion or philosophy.^{8,9} As a matter of fact, Taoism considers FW as a tool of no purpose and to this aim, one of the most important precepts of Taoism is to meditate in genuine non-action (*Wu-Wei*) in order to attain the right attitude to be able to avoid desires, i.e., to reach a state of happiness⁵ in clear contrast to the philosophy of Buddhism. In the Taoist concept of life, FW is a synonym for desires, falling into the trap of becoming a prey of time. A constant battle between time and our mind implies that some form of duality continues to control our life. A clear synthesis of the statements enunciated above

can also be found in the book of the ancient Taoist Shu Ching¹⁰:

*«The human mind is dangerous;
its selfish tendencies lead to error and crime
and its affinity with Tao is small»*

At the highest spiritual level, a disciple refusing an attempt to showcase the true nature of divinity, may paradoxically assess a relationship with him (whatever he is), based on the knowledge of wisdom or gnosis. In contrary to the belief of Freud, Jung was positively attracted by the psychological role that religions (in particular of Far East) may play in human life.¹¹ His psychological, philosophical and sociological interests towards the philosophies of the Far East led him to establish a deep connection with Chinese Taoism. His central idea of the unconscious was fundamentally influenced by Taoism, especially on the individual self that emerges from the a causal coincidence of events (later renamed with the notion of "synchronicity"). In this regard, he collaborated with Richard Wilhelm on the translation and the preface of the divinatory book "*I King: or book of changes*".¹² Through a new investigation of the unconscious, he formulated a complex concept of the self that stands on an existing parallelism between the inner and the outer realms of experience. The temporal coincidence between the theories of modern physics and the discovery of Eastern metaphysics played a significant role in the evolution of Jung's thinking process from psychoanalysis to analytical psychology.

In conclusion, we may infer that the ego-sense and FW are psychological by-products of the mind that claims a territory of intervention. In the early lessons of Yoga, in one of the Daršanas cited above, the beginners are posed with the question "who are we? To find an answer, they try to become aware of nature and the extension of their bodies providing an opportunity to explore their existence both from inside and the outside. By means of this practice, the judgement is momentarily suspended; in particular they cannot vividly relate to the world inside or with the outside environment. The beginners' perception of the individual self thus, tends to vanish.

In our opinion theistic religions facilitate the opposite, i.e., they reinforce personal identity and by-products of the mind such as a sense of ego and FW. On the basis of the historical, political, cultural and social environment, all religions tend to strongly support the dichotomy between the brain and mind riding the wave of dissent within the scientific community, so that we fear that the cultural prejudices in this context will bias any positivistic theory of mind even though supported with strong experimental validations. In contrast to this pessimistic view, although illuminating, controversial books by Robert Wright explain this perspective in much detail.¹³ Wright shows that, though starting from an erroneous primordial view on God, the evolution of our ideas leaves room for a transcendental perspective of divinity.

Cognitive sciences have raised the question of Self, FW and the sense of agency, in different contexts. Dennett's

cognitive theory presents the analogy of self with “a centre of narrative gravity”.¹⁴⁻¹⁷ Self is not a physical entity, but a purely abstract object, a sort of folk-physics that is soberly known as phenomenology. *Dennett* observed that “the insistence that consciousness must turn out to be something inexplicable, irreducible, transcendental sometimes rises to a fever pitch.” For many, *Dennett*’s representation of mind has no self, no central witness and only an abstract for “centre of narrative gravity,” which appears to be a convenient fictional perception to avoid metaphysical or religious issues concerning decision-making. For *Dennett*, it is not a case of the emperor having no clothes, but rather that the clothes having no emperor.

Taken together, in *Dennett*’s view, the soul has been eliminated, which is a view that is in odds with the general way of thinking about the relationship between science and religion. A clear conclusion to be drawn here is that the soul is not visible through the brain’s eyes. If *Dennett* denies the self, then two important questions need to be asked: first, do we need a central agent in charge with the direct responsibility of decision-making, and second, is the agent really or only apparently free when exhibiting a purposeful action? Imagining and evaluating are considered as pre-mental states that correspond to the states of brain responsiveness that is already present when affected by events that trigger actions or intentions. This indicates a goal-directed process, which stands on antecedent determinants. This consideration can be elucidated with the example of the car and its engine. The engine will always be prompted to burn fuel and transform the fuel into motion. However, it is unclear as to who steers the car. Thus, the question of whether ego is a virtual driver of our mind becomes an issue that is far more interesting than that relative to the existence of FW. First, FW is a useless tool when deciding an intentional action that has already been predetermined and conditioned by antecedent determinants; and second, the existence of FW is fictitious if we consider that FW is a product of ego, which is, in itself a virtual driver. By chance, are we entering the duality of the new electronic era?

So what are the thoughts of people on FW? Are they in agreement with *Dennett*? According to a series of psychophysical tests reviewed by *Nichols*,¹⁹ several causes contribute to our senses of agency and responsibility in decision-making as well as the prediction of an action. As an example, if one perceives through feedback sensory signals that any body movement is carried out as predicted by one’s decision, then any form of related movement is considered as a voluntary action. According to another example, the same feeling of agency can be perceived if there is a time interval between an external cue and the action, as if an individual requires a proposed period of time necessary for thinking of a voluntary response to the cue. Interestingly, one does feel that one’s own actions are free, not necessarily those carried out by others. Moreover, if we analyse how the existence of FW is perceived by the population of different ages, the question becomes even more complex. To this regard, *Nichols*’ review reports that people might statistically shift from “determinism” to “indeterminism” and from “compatibilism” to “incompatibilism”, with different nuances.

However, on the basis of the experiments on the way people think about “I”, cognitive scientists as *Dennett*¹⁸, infer that the idea of possessing FW is incompatible with “determinism”. People widely accept the fact that internal and external cues contribute to the sense of agency and strongly support the opinion of the self-being a free agent. The idea of being a deterministic machine does not lie in the belief of the people of being free agents; so that, inputs or programs of a computer or even a psychological mechanism cannot substitute for the mind in drawing conjectures, elaborating on thoughts and taking relevant decisions. This people’s way of thinking is referred to as the subjective “1st-person or perspective”(1st-PP), a well-rooted belief that cannot be undermined by any scientific or objective “3rd-person perspective” (3rd-PP) demonstration that the “sense of agency” is just like any other psychological mechanism that can be impaired by various neurological and psychiatric disorders.²⁰ To this regard, *Nichols*’ review¹⁹ reports an interesting experiment that demonstrates that if a concrete case of a man killing his family, is presented to the subjects’ test, they tend to attribute full agency and responsibility to that man, even if affected by neurological disorders.

Incidentally, the possibility that people might consciously embrace a combination of the views of determinism and incompatibilism, would entail considerable risks of social and ethical nature, since no one could be considered morally responsible for his actions.

HARD SCIENCES

In biophysics, “integrate-and-fire” is the most widely accepted mechanism of neuronal computation of information processing.²⁰ According to *Rolls and Deco*²¹, this mechanism can explain how action decision-making may assume alternative directions in a probabilistic way. On considering that a random spiking assembly of neurons might resonate among a Poisson distribution of firing states; each state might be attractive for only one decision, i.e., the only one that fits at best in the attractor basin at that moment. In summary, if one knows which attractor basin is functioning during the stimulus arrival, one can predict in advance the kind of decision the mind will make. To this, the take-home-message of *Rolls and Deco* is that “*the system has so many degrees of freedom that it operates effectively as a non-deterministic system (philosophers may wish to argue about different senses of the term deterministic, but it is being used here in a precise and quantitative way, which has been defined within the framework of stochastic neuro-dynamics)*.”²²

According to our knowledge, the way *Rolls and Deco* interpret the dynamics of their simulated systems, enter in conflict with thermodynamics and, in particular, with entropy implications. One of the most common way of measuring the energy involved in entropy loss is to calculate the number of states of equivalent energy through which a system can resonate, i.e., the interchangeable states that exhibit the same probability (see as an example the resonating formula of benzene that has the same energetic content); therefore, when different attractors induce

the same behavior they must exhibit the same energy content; conversely, when different attractors exhibit different strengths, the system behaviours will also be different. Moreover, the attractor with the longer life span will be also the one with the higher probability to intercept the arriving stimulus. Hence, the idea that system behaviours may vary from trial to trial, based on statistical fluctuations of the attractor within the states of the same energetic probability, is thermodynamically incorrect.

A similar argument was faced in a preceding paper,²³ while discussing the paradox of the so-called “Buridan’s ass”. This paradox was used to support the thesis that, if the mind of a hungry ass is strictly “deterministic” or “mechanistic”, the ass will be unable to decide between the two perfectly identical sacks of hay, thus starving to death. This question could be answered by saying that the hard-deterministic brain does not exist; actually, the ass would not starve since a voluntary action is the outcome of the cooperation between probabilistic and deterministic activities that would help the ass overcome any obstacle in the best way possible. For the sake of simplicity, we may envisage the timeline of the ass’s behavior as separated in two sequential steps:

- 1) by the means of a probabilistic trial-and-error behaviour, the ass will find the first sack, recognize it and learn how to eat it;
- 2) since the efforts spent by the ass in the first step are finally rewarded, it will deterministically engrave in short-term memory the experienced paradigm, a paradigm that will be very easily replicated in front of the second sack.

The two-step sequence describes a typical learning-through-experience process of a probabilistic-deterministic brain; it is not by chance that the sequence reminds of the sequence of events predicted by Bayes’ theory of information processing.²⁴ *Rolls and Deco*, tried to describe about half of the first sequence, i.e., action decision-making, on the basis of the probabilistic mechanism but entirely ignored the deterministic events underlying the cognitive processes. Moreover, *Rolls and Deco* do not consider at all why everybody inwardly manifests the idea of possessing FW; according to these authors, the so-called “freedom of choosing” mechanism is an impersonal mechanism attributed to a probabilistic oscillation between the states of an unconscious mind. If we ask people (including me) their opinion about what *Rolls and Deco* would mean by the above inference (i.e., the subjective 1st-person perspective in comparison with the objective 3rd-person perspective) probably they will reply saying: “nonsense! My FW means another thing! In fact, when my mind consciously decides what to do, it activates an inner speech that silently forewarns the actions that I will make, in a compulsory sequence” (see the role of inner speech in cognition elsewhere).²³⁻²⁶

As far as it concerns the fundamental roles of reward and FW in voluntary actions, *Schultz*²⁷ stresses on the theory that human intelligence depends on rewards while, facing the FW question, he claims that there exists no knowledge of its origin.

If we assume as *Kant* said, that God is the only depository of true FW,²⁸ the question for us is unsolvable. However, he tries to approach the question by observing that the unconscious mind presents alternative intentions in the conscious field, so that conscious FW can freely choose or veto one of these intentions. Some authors have proposed FW as the mechanism of being able to make choices²⁹; *Schultz* accepts the mechanistic definition of FW but he restricts the area of choices only to imaginable or available options. Among a long list of constraints posed by *Schultz*, rewards have the highest priority since they are a survival signal; different constraints may span from a deterministic world that nullify any form of FW (i.e., the actions are pre-determined in advance) to an unrestrained aleatory composition of stimuli that release any capricious choice of conscious FW. According to him, the truth lies in between, but this idea is absolutely risky for world survival. Hence, according to him, we can only choose between anything imaginable that can be enumerated in a list of restrictions e.g., education, personal experience, social pressure, emotions, etc. However, we firmly disagree with him in this regard; can we imagine the risk that democracy might encounter if someone decides on a list of options which everyone is expected to conform to?

Apart from this personal comment, *Schultz*’s FW is a conditional FW and people personally know what this means. However, the main difference is that people initially build up their own list of wishes (affordable or not) and then, by means of personal experience, they skip over those that are unattainable; paradoxically, this might be another incentive for reinforcing the idea of possessing FW.

It is quite obvious even to a non-professional that a decision is thought elaborated in response to the outer or inner stimuli to satisfy desires and ensure general well-being; in other words, it is a reaction to put ourselves again in equilibrium with the environment (“homeostasis” is the technical term widely used in chemistry, biology and psychology, etc.). Most probably, the inference that the idea of possessing FW is ontologically linked with the growth of our psyche might be generally accepted; but the existence of FW is still a much debated topic. Therefore, the question arises as to whether we can assess a benchmark on the issue that hard-sciences has not yet dealt with?

Since the pioneering work of *Katz*³⁰ on *quantal* release of the neurotransmitter vesicles in the neuromuscular junction, we have learnt that each molecular and cellular component of the nervous system, generates aleatory responses to a stimulus.^{22,31} On the basis of this evidence, how can we rely on the information processing of our mind²³? In his famous book, *Katz* proposed that by integrating in space and time a sufficiently large number of active vesicles, the end plate potential may reach the threshold for a statistically reliable response. Generally speaking, the relationship between a stimulus and the appropriate response exhibits a causal and non-casual dependence, with a probabilistic-deterministic mechanism; this modality is functional in all highly-organized, biological and physical-chemical

systems.³² This evidence leads to the important inference that a neuron or a neuronal assembly exhibits a rational/deterministic modality only if it is appropriately stimulated from the outside. A first logical consequence is that the mind when totally isolated from its environment cannot work (even dreams are evoked by some sensations that are picked up from the paradoxical correlations of the memory archives). However, an even more relevant consequence is that the conscious mind cannot take any decision nor execute an action “on its own”, i.e., in the absence of any input. In other words, a logic and finalistic action is causally dependent on the nature of the outer stimuli. This inference is in contrast with the idea that the mind can elaborate on its own decisions autonomously and, ultimately against FW (see the discussion of Bignetti³² on the “free won’t” of Libet³³).

Is it possible that TBM might conciliate all the scientific positions?

How can we then acknowledge people’s belief in FW even though we know it is clearly an illusion? The apparently “nonsensical approach” might be resolved if we assume that, due to a psychological evolution of the abilities of the mind, the illusion of possessing FW plays a fundamental role in fostering cognitive processes. This hypothesis which is a compromise between the need of believing in FW of the 1st-person perspective and the evidence of FW nothingness of the 3rd-person scientific perspective, is enunciated in “The Bignetti Model” (TBM). Elaborated many years ago^{26,34-39} but formalized point by point only from 2014 onwards,^{23,32,40} TBM describes the sequence of events underlying the so-called “voluntary action” and the associated cognitive processes, in 5 compulsory steps:

1. The so-called “voluntary” action is decided and performed by the agent’s unconscious mind (UM) by the means of probabilistic responses to the inner and outer stimuli.
2. After a slight delay, the agent becomes aware of the ongoing actions through feedback signals (somatosensory, etc.) that are conveyed to the brain as a consequence of its performance. Thus, the agent’s conscious mind (CM) always lags behind unconscious activity.
3. Owing to this delay, the CM cannot understand the unconscious work that precedes awareness; thus, the CM erroneously believes it has freely decided the action. Though objectively false, this belief is subjectively perceived as true (FW illusion). It is so persistent and deep-rooted in the mind that the CM is unwilling to abandon it.
4. The FW illusion satisfies a psychological need to secure the arousal of the sense of agency (SoA) and of responsibility (SoR) of the action. Both SoA and SoR inevitably lead the CM to self-attribute reward or blame depending on the performance of actions and its outcome.
5. Both reward and blame are motivational incentives that foster learning and memory in the CM; the updating of knowledge will

provide new information and the skill required for further action (restart from point 1).

To conclude, one might fear that the agent conscious but without FW, would not have the sense of morality; so important implications of TBM in ethics might be raised. Obviously an individual who is dangerous for himself and for the community must be accordingly dealt with. However, FW illusion is the basis for cognition, so the solution to the moral question stands on how moral values can be imprinted by the familial and the social environment. Therefore, the acceptance of TBM in principle would result in a much heavier implication on the rehabilitating methods in jails.^{23,32}

In TBM, every system, be it a neuron or a network of neurons or even the brain *in-toto*, can be considered as a “sparingly opened system” from a thermodynamic point of view since it can communicate with its environment. According to TBM, both sensory inputs from outside and “pieces of thought” coming from a nearby area, trigger an adequate response according to a paradigm that is picked up from memory archives, among those utilized in similar or identical experiences. To this regard, if our memory archives are like a “*tabula rasa*”, a trial-and-error mechanism will be activated to restore the homeostasis between the system considered and its environment (purely probabilistic mechanism); conversely, if we have repeatedly experienced the same stimuli many times in our life, the correct paradigm for an adequate response is already available in the memory, so that an automatic, instinctive response will be put in action (purely deterministic mechanism).²³ When this model was tested by means of a classic press/no-press psychophysical task, a learning curve could be observed in response to trials with the same stimuli rehearsal, in which the probability of success hyperbolically rose from 0% up to 100%. Moreover, the learning process could be impaired by introducing distractors along the task which changed the nature of the paradigm.⁴⁰ In accordance with TBM, these results show a probabilistic-deterministic cognitive process. In this process, the behavioural paradigm is progressively updated and contextually uploaded to memory archives for future actions, thus explaining the observed inter-trial priming effect. This *ex-post* updating was envisaged as the “updating factor” in Bayes’ equation applied to cognition.^{23,41} Then, according to TBM, the role of memory archives in information retrieval and upload carried out with UM and CM, respectively, seems to be fundamental in cognition. Obviously, in agreement with Schultz,²⁷ blame or reward remain as the determinants in fostering a learning process; in fact, paradigms that are satisfied best by expectations are rated by a reward and thus, memorized.

The main question that should be addressed now is: “*Who is conferring blame or a reward and who is to be blamed or rewarded?*” According to TBM, every time an individual is hit by an outer stimulation, it is submersed by a psychological truth, perceived as the presence and absence of desires, of imagination, of an identity engendered by the inescapable will of illusion which is the root of existence. This illusion is fundamental since it projects on the explicit frame of the brain the idea

of being a true individual “I” with the responsibility of acting “in my name”. However, the Gestaltic arousal of possessing a Self is not sufficient to self-attribute the senses of agency and responsibility; in other words, the illusion of having a Self not necessarily implies the possession of FW; rather, it works the other way around, i.e., the illusion of FW (e.g., the illusion of controlling our daily lives) implies the false idea of an individual self independent of outer conditioning (i.e., a thermodynamically closed system capable of autonomous voluntary actions). To this regard, TBM proposes that this illusion is a pillar of human cognition. In fact, by means of this illusion, CM self-attributes the senses of agency and responsibility by which means one’s own actions are legitimized and might be ranked as a blame or a reward. This step is necessary to foster a learning-through-experience process. Actually, the “driver of the car” is non-existent; however with this trick, the mind deludes itself as if it were.

CONCLUSION

On the basis of soft-sciences we may infer that this illusion is psychologically connatural with the human mind (1st-person perspective). All of us can recognize ourselves in a popular definition of FW that recites “*FW is an art for a particular sort of capacity for the rational agent to choose a course of action from among various alternatives*”.⁴² Actually, the term “...rational...” might not have a clear meaning for all, but the verb “...choose...” is surely comprehensible and extremely attractive to our Psyche. According to soft-sciences, the idea of possessing FW is connatural with a subjective experience of conscious will^{1,18,19,32,43-46}; then, the possibility that our Self might choose a voluntary action sounds appealing to TBM’s CM, the “explicit” part of the mind.⁴⁷ This would imply that we may differentiate ourselves from a robot or a mechanical device.

Whereas, from hard-sciences, we may infer that FW must be an illusion (3rd-person perspective). On the other hand, we have evidences from hard-sciences that Free-will is not compatible with the intrinsic activity of neurons and neuronal networks as well, since these are not self-sufficient thinking systems in the absence of an environmental input that might cause an adequate and efficient response. As we inferred from hard-sciences, the theory about the continuity of mind claims that brain in the absence of an environment is nothing but a noisy electronic circuit. To this regard, Spivey⁴⁸ has published a systematic overview of how perception, cognition, and action are partially overlapping segments of one continuous mental flow.

TBM proposal seems to conciliate the two positions above: on the one hand, the mind adopts a psychological trick based on FW illusion, in order to activate a learning-through-experience circuit; on the other hand, it manages this circuit by means of a well-known biophysical computational mechanism, e.g., integrate-and-fire.

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Research

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Volunteers Motives in Relation to their Task Preference in Health Service Delivery: A Case of West Kenya

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ABSTRACT

Background: According to the World Health Organization (WHO), human resources is the key ingredient to the effective functioning of health systems. The growing human resource crisis in low-income countries has re-energized the debate concerning the role of community health volunteers in health service delivery. Researchers have studied task-shifting among community volunteers focusing on its impact on health outcomes. This study focused on how task preference could be related to volunteer motives in an African setting.

Methods: We carried out a cross-sectional survey with the aim to investigate the relationship between motives and task preference among health volunteers compared with non-volunteers matched by gender, residence, and education in Western Kenya. The eight motives that were taken into account in the present study were obtained from existing literature, and tasks were derived from the common health activities undertaken by volunteers in Kenya. We recorded the preference of 1062 respondents for each of the tasks on a 1-5 Likert scale. The task preference among volunteers on the basis of motives and the status of the volunteers were compared.

Results: Long-term health tasks such as mother and child healthcare, home visiting and curative care were significantly more associated with altruistic than with material gain motives ($p=0.00$). Short-term tasks such as helping in disease outbreaks, and participation in immunization campaigns were associated with both altruistic and material gain motives. The self-seeking motives tend to be associated only with short-term tasks.

Conclusion: The preference for long-term health tasks was associated with non self-seeking motives; while short-term tasks were associated with both non self-seeking and self-seeking motives. It was concluded that the assessment of the motives of the volunteers was critical in assigning tasks to volunteers.

KEY WORDS: Motives; Tasks; Preference; Community health volunteers.

ABBREVIATIONS: CHV: Community Health Volunteers; CHW: Community Health Workers; VAF: Volunteer Assessment Framework; LMIC: Low and Middle Income Country.

INTRODUCTION

Task shifting refers to the rational redistribution of tasks from health professionals to community health workers in order to improve access to care and optimize the use of limited human resources. Since 2006, global attention has been drawn towards human resources for health crisis, which is worse in lower income countries.¹ This crisis has re-energized the focus on the use of community health workers in service delivery, through task shifting. Task shifting has gained in prominence and urgency to meet the demands concerning the health systems.²⁻⁵

The primary healthcare strategy adopted by the World Health Organization (WHO) at Alma-Ata⁶ promoted the initiation and rapid expansion of community health volunteer (CHVs) programs in low and middle income country (LMIC) settings in the 1970s.⁷ However, researchers questioned the effectiveness and cost of such programs in the following decade, particularly due to high attrition rates that tend to push up the cost of training. Thus, although volunteer-

ing constitutes an essential aspect of primary healthcare, being able to identify and allocate health tasks preferred by volunteers would improve the efficiency of such programs.

Existing studies demonstrate that CHVs play a critical role in providing household services, substituting for health professionals participating in a range of tasks,^{1,8-10} in the quest towards universal health coverage and sustainable development goals.^{4,11-16} CHVs help increase access to, and facilitate the use of healthcare services during medical cases as tuberculosis, immunization and family planning programs, particularly in populations with limited access to healthcare facilities.¹⁷ In complying with the expectations and having received sufficient investment and support, community health workers (CHWs) show great potential towards strengthening the current situation of health systems.¹⁸ Yet such task shifting to volunteers should be carefully done to ensure that the secured livelihoods of the volunteers themselves are not compromised in the process. Kaseje and Sempebwa¹⁹ argued that CHV programs fail because of unrealistic expectations, irrational allocation of tasks, poor planning and an underestimation of the effort and input required to work with CHVs. Assignment of tasks may not always be in the interest of volunteers, thus, arising the need to gain an understanding of the tasks they prefer. This is necessary for a meaningful and sustainable task shifting to volunteers.

Despite its importance, surprisingly, little research has examined as to how volunteer motives relate to their task preferences in the African setting. Studies provide clues that volunteers' experiences are likely to be an important determinant for sustained involvement in volunteering, but there is inadequate information to explain the factors that shape these experiences. Only a handful of studies have examined sustained participation, which is typically measured in terms of the number of hours that volunteers are willing to work and for what period of time. Snyder et al²⁰ suggested that there may be variations in tasks suitable for different volunteers. Specifically, how task preference relates to volunteer motives in African settings have not been investigated. While many studies have demonstrated the effectiveness of CHVs^{4,14,18} and led to the understanding that it is a more cost-effective approach to implement their participation to complement for the available formal services towards saving lives than the formal healthcare system working without their involvement.²¹ The aim of this study was to investigate the relationship between volunteer motives and their task preference. The specific objective was to determine the relationship between volunteer motives and their task preference in an African setting.

METHODOLOGY

The study adopted a cross-sectional design comparing task preference among long serving volunteers and non-volunteers as well as examining relationship with volunteer motives. Five hundred and thirty-one CHVs in Nyakach, Rarieda and Butere Sub-Counties, West Kenya who had served for five years or more, were included in the study. For each CHV participating in the study, their nearest next door neighbor of the same sex,

education and age group, was included resulting in a sample population 1062 respondents. The eight motives (altruistic, materialistic, development of understanding, career development, esteem, social and spiritual) were introduced from phase 1 of the study²² while the tasks were derived from the common health activities undertaken by volunteers in Kenya. Data collection was performed using self-administered questionnaires to be filled by the participants under the supervision of the researcher and research assistants. The preference of the respondents for each of the tasks was recorded on a 1-5 Likert scale. Comparative analysis was undertaken for assessing the task preference among volunteers on the basis of motives and volunteer status.

The questionnaire was based on a volunteer assessment framework with eight motive constructs developed by Ochieng B.M and her colleagues.²² The respondents were gathered at one center in each of the sub-counties for them to fill out the questionnaires. The tool presented the participants with descriptions of 13 common Kenyan health volunteer tasks and asked them to rank the tasks in the order of their preference for performing them, indicating the "most preferred choice" and "least preferred choice." Their level of preference in performing each of the tasks was then measured on a 1-5 Likert scale.

Data Analysis

The data was analyzed using Scientific Package for Social Sciences (SPSS[®] version 16) computer package to describe the outcome variables for each of the study groups. The comparative analysis was performed for cases and controls, where the comparison was centered on the association between motives and task preference. Bi-variate descriptive analysis was undertaken to compare the relationship of motives for volunteering to task preference between the cases and the controls.

The comparative pooled analysis method was used to compare the association of motives with tasks preferred among volunteers. A Poisson regression model was used to assess the effect of volunteer motives on task preference. The Poisson regression model was used because the outcome of interest was considered as count data and the data was analyzed on a population level. The study also used mean scores to compare between volunteers and non-volunteers by the use of pooling of "means".

RESULTS

Socio-Demographic Characteristics

The targeted respondents filled the questionnaires yielding a 100% response rate. The majority of the respondents were female 648 (59%), equally distributed between the volunteers and non-volunteers. A majority of the respondents were aged between 36 to 50 years. Almost all the respondents had a good level of education with almost 540 (50.8%) having completed primary education and 510 (48.2%) having finished secondary level of education. The respondents were evenly distributed geographically as has been reported in Table 1.

Table 1: Distribution of Sample Population by Age, Sex, Education and Residence.

	Nyakach		Rarieda		Butere		Total
	Volunteer	Control	Volunteer	Control	Volunteer	Control	
Age	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	N (%)
20-35	49 (27.7)	49 (27.7)	32 (18.1)	32 (18.1)	42 (23.7)	42 (23.7)	246 (23.2)
36-50	121 (68.4)	121 (68.4)	125 (70.6)	125 (70.6)	107 (60.5)	107 (60.5)	706 (66.5)
>50	7 (0.4)	7 (0.4)	20 (11.3)	20 (11.3)	28 (15.8)	28 (15.8)	110 (10.4)
Total	177 (96.5)	177 (96.5)	177 (100)	177 (100)	177 (100)	177 (100)	1062 (100)
Sex	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	N (%)
Male	86 (44.1)	86 (44.1)	70 (39.5)	70 (39.5)	69 (39)	69 (39)	450 (41)
Female	109 (55.9)	109 (55.9)	107 (60.5)	107 (60.5)	108 (61)	108 (61)	648 (59)
Total	195 (100)	195 (100)	177 (100)	177 (100)	177 (100)	177 (100)	1098 (100)
Educ.	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	N (%)
None		7 (0.4)			3 (.2)	2 (.1)	12 (0.01)
Prim.	104 (58.8)	100 (56.5)	72 (40.7)	76 (42.9)	92 (52)	96 (52)	540 (50.8)
Sec.	73 (41.2)	70 (39.5)	105 (59.3)	101 (57.1)	82 (46.3)	79 (44.6)	510 (48.2)
Total	177 (100)	177 (96.4)	177 (100)	177 (100)	177 (98.5)	177 (96.7)	1062 (100)

Although, a majority of the non-volunteers showed a limited experience in the volunteers' service, a third (31.5%) of them had a volunteering experience of over 1-5 years. Two thirds of the volunteer population had prior experience of over five years with a large proportion, nearly 40%, having more than ten years of experience (Table 2).

Association of Task Preference to Long Serving Volunteers

Comparing the mean scores of task preference by volunteers and non-volunteers, the findings showed that the level of preference for tasks described was statistically significantly higher among volunteers than non-volunteers ($p=0.00$) except for emergencies and community surveys, where the difference was minimal (Figure 1). The results identified two categories of tasks: first, the long-term tasks that were strongly preferred by the long serving health volunteers than non-volunteers. These were typical health tasks such as maternal child health, tuberculosis/human immunodeficiency virus (TB/HIV) defaulter tracing, identification and referral of people with chronic cough and provision of curative services (Figure 1).

The second category included long-term tasks such as community household surveys, and attending community dialogue meetings, and short-term emergency tasks that were preferred equally by all the participants, both volunteers and non-volunteers. The proportion of respondents preferring the short-term tasks was not statistically significantly higher among volunteers than non-volunteers (Figure 1). The tasks that were

either short-term or of an emergency nature, required an urgent response for relatively short periods such as campaigns, spraying of houses with insecticides to protect them from malaria, disaster and emergency response to floods, famine and disease outbreaks. These were tasks that demanded urgent participation of the volunteers and non-volunteers. Though preferred slightly more by volunteers, non-volunteers expressed substantial preference as well (Figure 1).

Association of Task Preference to Volunteer Motive Constructs

Comparing mean scores of task preference by core motive constructs, altruistic and self-seeking, the findings of the study showed that the level of preference of tasks described was statistically significantly higher among participants with altruistic than those with material gain motives except for emergency tasks, where the difference was minimal (Figure 1). We tested the association of tasks with core motives using the Chi-square test. The long-term health tasks such as maternal child health, TB/HIV defaulter tracing, identification and referral of people with chronic cough (Table 3) were strongly preferred more by people with altruistic than self-seeking motives. Non-health long-term tasks such as community household surveys and attending community dialogue meetings, were almost similar to short-term emergency tasks in that they were preferred equally by all the study participants, (volunteers and non-volunteers) irrespective of their motives (Table 3). The tasks that were either short-term or of an emergency nature, demanded response for relatively shorter periods such as in campaigns, spraying of

Table 2: Length of Voluntary Service by Volunteer Status.

Length of service	Volunteers	Non-Volunteers	Totals
<1 year	0 (0%)	354 (67%)	354 (33%)
1-5 years	201 (38%)	164 (31.5%)	365 (34%)
6 to 10 years	122 (23%)	6 (1%)	128 (24%)
>10 years	208 (39%)	7 (1%)	215 (20%)
Total	531 (100%)	531 (100%)	1062 (100%)

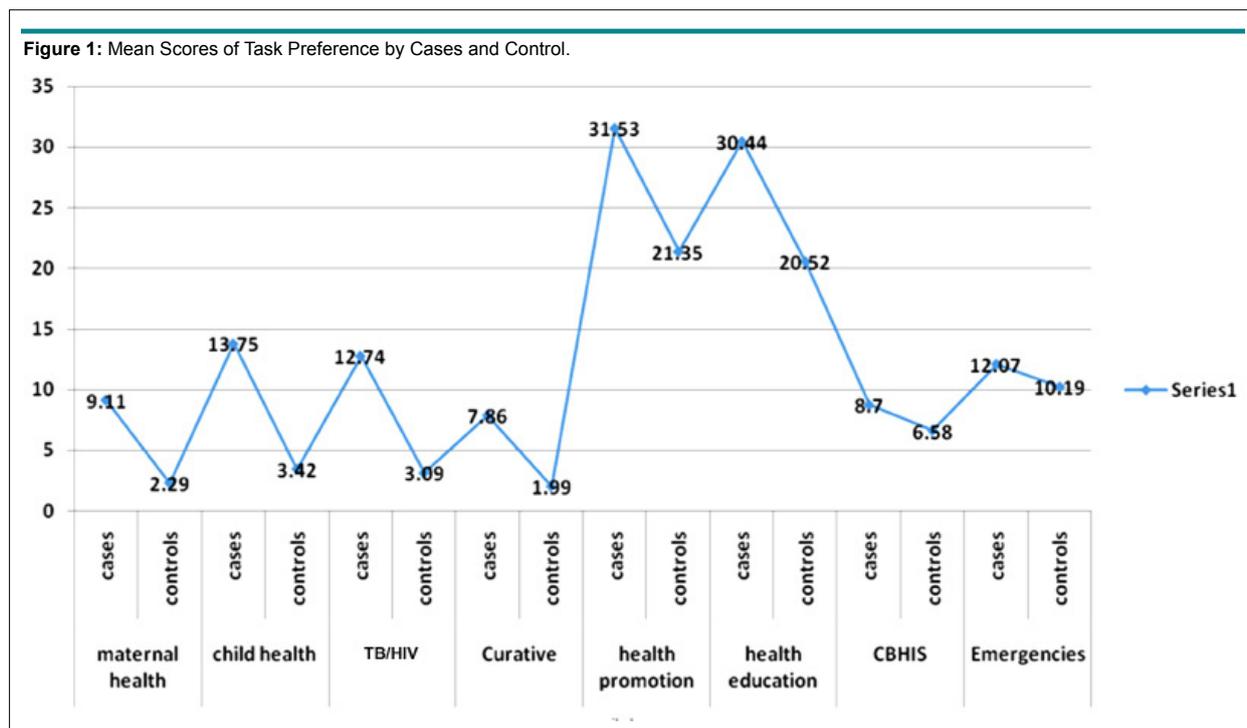


Table 3: Association of Volunteer Tasks with Core Motive Constructs.

Volunteer Tasks	Altruistic Motive		Material gain Motive	
	B (co-efficient determinant)	p Value	B (co-efficient determinant)	p value
Maternal Health	0.061	0.00	-0.033	0.07
Child Health	0.087	0.00	-0.048	0.08
Curative Care	0.044	0.00	0.007	0.73
TB/HIV care	0.063	0.00	-0.045	0.13
Home visits for HE	0.123	0.00	0.000	0.99
Family Planning	0.016	0.13	0.012	0.39
Care of OVCs	0.017	0.01	0.000	0.98
Meetings/Dialogues	0.013	0.00	-0.004	0.53
Campaigns	0.011	0.92	-0.013	0.11
Disaster activities	0.025	0.00	-5.320	0.99
Out Breaks	0.017	0.02	0.021	0.12
Emergencies	0.056	0.01	0.02	0.37

houses with insecticides to protect them from malaria, disaster and emergency response to floods, and disease outbreaks, though preferred slightly more by people with altruistic motives, those with self-seeking motives showed substantial preference as well (Table 3).

Findings of the study showed that most of the tasks such as maternal health, child health, curative care, home visits for health education, TB/HIV defaulter tracing, taking care of orphans and vulnerable children, holding dialogue meetings with community members, helping in disasters, emergencies and outbreaks were significantly associated with altruistic values more than material gain motives ($p=0.00$). The only tasks that were not significantly associated with altruistic than mate-

rial gain motives were family planning and immunization campaigns ($p=0.92$) (Table 3). Emergency tasks were preferred by all motives categories. Tasks did not demonstrate a clear pattern of relationship with the additional motive constructs beyond altruistic and material gain.

The non-core motive constructs did not demonstrate consistent association with task preference; however, we note that, spirituality demonstrated a relationship with the largest number of tasks: home-visits for health education, disasters and emergencies (Table 4).

Development of understanding demonstrated a relationship only with campaigns; career enhancement, only with

the care of orphans and vulnerable children, and the social constructs (esteem enhancement and social adjustment) demonstrated a weak relationship with meetings and dialogues (Table 4). Altruistic motive constructs were associated with the largest number of tasks, followed by esteem enhancement motive. Curative care task was associated with the largest number of motives followed by emergency tasks (Table 3). The less preferred tasks were family planning and community-based health information system.

DISCUSSION

This paper presents an assessment framework that can be used to identify CHVs according to their task preference, for use in recruitment and deployment of volunteers and thus improve the cost-efficiency of the programs. The task preferences associated with volunteer motives were identified. The results seemed to suggest that task preference was most consistently associated with the two core volunteer motives (altruistic value and material gain) described by Ochieng and colleagues.²² The results indicated that altruistic motive was the reason behind volunteering with over 80% of the volunteers preferring 11 out of the 12 tasks (Table 4). The rest of the motives related inconsistently with task preference. Thus, the study identified the same core motives and how they could be applied for the classification of tasks to help categorize and deploy CHVs for efficient task shifting. Using the existing framework, individuals could be matched to the tasks they were likely to find most rewarding and thus help promote retention among the CHVs.

Individuals with altruistic motives preferred all tasks whether long-term or short-term. Whereas, individuals with material gain motives tended to prefer short-term emergency tasks. It is important that they are identified at recruitment so that they are not assigned and trained for long-term health tasks since they are likely to drop out. Task preference for all the 13 health tasks examined was higher among the known long serving volunteers than non-volunteers.

Finkelstein in 2008 reported a positive correlation between time spent in volunteering and motives.²³ This observa-

tion is consistent with the finding in this study that all long-term health tasks requiring considerable investment of time were preferred significantly more by known volunteers than non-volunteers. Penner and Finkelstein²⁴ also found that altruistic motives predicted the amount of time individuals spent in volunteering. These findings provided a basis for linking the motives to task categories. According to functional analysis,²⁵⁻²⁸ people volunteer in order to satisfy one or more needs or motives that relate to task categories.

The tool developed by Ochieng and colleagues²² provides a method for describing the CHVs tasks and ranking them in the order of their preference. The functional approach underlies the importance of matching volunteer motivations to the benefits that volunteerism provides. Clary et al²⁶ found that undergraduate students with matching benefits were more satisfied with their volunteering experience and had greater intentions to continue volunteering. Hence, the importance of considering task preference in task allocation was elucidated. Furthermore, when given a choice, individuals preferred tasks with benefits that matched their personally relevant motives. Houle et al²⁹ found that individuals chose volunteer tasks that they perceived would satisfy the motives that were most important to them.

Thus, individuals who satisfied altruistic tests were the best suited for recruitment and training as CHVs. They could be deployed for implementation of intervention programs to reduce child mortality, such as neonatal care and promotion of exclusive breastfeeding³⁰ recognition and treatment with antibiotics of sick newborns,⁷ as curative care was among the tasks preferred in this study. Delivery of interventions in the home by CHWs was viewed as a critical aspect³¹ and visiting homes was identified among the preferred tasks in this study. Maternal care was strongly preferred by long serving volunteers. Syed and colleagues found that CHVs were effective in tracking pregnant women through the postnatal period and in raising awareness about appropriate maternal and newborn care practices.³² This, in turn, required greater investment towards programs for CHV selection and training.

Researchers assert that a favorable evaluation of an ex-

Table 4: Association of Volunteer Tasks with Additional Volunteer Motives.

Volunteer tasks	Development of understanding		Career Development.		Esteem		Social		Spiritual	
	B (co-efficient determinant)	p value	B (co-efficient determinant)	p value	B (co-efficient determinant)	p value	B (co-efficient determinant)	p value	B (co-efficient determinant)	p value
Maternal health	0.000	0.95	0.008	0.77	-0.020	0.43	-0.023	0.32	0.015	0.57
Child health	-0.004	0.97	0.017	0.66	-0.041	0.26	-0.034	0.32	0.016	0.68
Curative care	0.018	0.33	-0.030	0.33	-0.040	0.17	0.018	0.50	0.023	0.46
TB/HIV care	0.035	0.17	-0.006	0.89	-0.046	0.24	-0.038	0.29	0.45	0.27
Home visits for HE	0.041	0.35	0.028	0.70	-0.080	0.23	0.035	0.57	0.161	0.02
Family planning	0.002	0.89	0.003	0.88	-0.029	0.12	0.032	0.06	0.013	0.50
Care of OVCs	0.011	0.17	-0.030	0.02	0.013	0.30	0.008	0.48	0.009	0.51
Meetings/dialogues	0.004	0.43	0.014	0.11	-0.015	0.06	0.014	0.06	0.011	0.20
Campaigns	0.023	0.00	-0.004	0.73	-0.011	0.32	0.016	0.13	0.001	0.93
Disaster activities	0.001	0.09	-0.012	0.45	0.003	0.84	-0.008	0.54	0.050	0.00
Out breaks	0.005	0.54	-0.013	0.34	0.008	0.54	0.000	0.98	0.021	0.12
Emergencies	0.015	0.55	-0.029	0.49	-0.014	0.71	-0.014	0.70	0.117	0.00

perience is a robust and reliable predictor of repeated engagement in that experience.³³ This study added the dimension of identification and use of motives to predetermine their task preferences and therefore the need for training. This would improve the efficiency of the program by targeting training in content and length according to the realistic expectations of workers according to the categories defined in this paper. In this way long serving volunteers could be identified at recruitment for training, targeting preferred tasks.

Home visiting for health education, was among the most critical tasks for volunteers. It was associated with more than five motives. CHVs thus play an important role in helping to achieve the universal health coverage and sustainable development goals reported by many researchers.^{4,11-16} To these would be added emergency and data management tasks, focusing on volunteers with altruistic values. Finkelstein, and his co-workers demonstrated that the fulfillment of motives was a good predictor of volunteer tasks and longevity.^{20,23,35}

One chief characteristic of volunteerism in community health was that it needed to be sustained, long-term. This study demonstrated that it may be possible to classify tasks according to the motives they satisfy. Other workers have reported that when volunteering met the motives for helping, individuals reported greater satisfaction in volunteering.^{25,26,36} This study added to the specific categories relevant to the health volunteers: long-term health, and developmental and short-term tasks required in disasters and emergencies.

If the managers of volunteer programs develop a list of tasks in the implementation of activities at the community level, that satisfy various motives suggested in this paper, they would be able to recruit from a larger pool of individuals, the appropriate volunteers. Volunteer recruits would be better able to find tasks with benefits that match their personal motives resulting in higher satisfaction and commitment to serve their communities. As shown in these studies, people prefer tasks they think will satisfy motives important to them.^{24,35,37}

The view expressed by the findings of Houle, Sagarin, and Kaplan²⁹ found that “people do differentiate tasks based on the volunteer motives they satisfy”. A task can be classified in terms of the motive(s) it does or does not satisfy. The results from this study were based on this idea and offered a classification of tasks. Further, psychological and sociological research suggested that experiences encountered while volunteering were the primary determinants of whether people decided to continue volunteering and hence the tasks that community volunteers preferred to undertake.^{27,38,39}

CONCLUSION

The study concluded that the volunteer assessment framework developed by Ochieng and her colleagues is useful, not only in the identification of volunteers likely to volunteer long-term but also in the assignment of tasks they are likely to prefer and that

would satisfy their motives for volunteering. It is noteworthy that the two constructs, altruistic value and material gain are adequate, both to identify long-term volunteers and to allocate them the most appropriate tasks. This would contribute to sustainability of volunteer initiatives.

The study demonstrated that it is possible to classify tasks according to the motives they satisfy. The results suggest that maternal child health, curative care, household visits lie in one class; community health surveys, and community meetings are within another and emergency tasks are in a third cluster. This will help volunteer recruiters to align them to tasks with benefits that match their personal motives resulting in higher satisfaction and commitment to serve their community for long. The proposed volunteer assessment framework (VAF) can thus be used to align volunteers to tasks, short-term (emergency), and long-term as CHVs.

COMPETING INTERESTS

The authors declare no competing interests.

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Observational Study

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Epistemic Curiosity, Conceptual Ambiguity and Cognitive Conflict: Do these Implicate Students Exploratory Behavior?

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ABSTRACT

Background: Contemporary demands in the labour market continue to be more scientific-technological. Onus is on institutions of higher learning to develop in students' flexibility of thinking, as well as an inquiring and inquisitive mindset, that would stimulate in them the culture for curiosity and scientific research. Consequently, this paper establishes a link of cognitive/educational psychology research to epistemic curiosity and human exploratory behavior in postgraduate students attending educational psychology classes, to assess how epistemic curiosity implicates their inquiry and affects critical thinking for classroom practice.

Method: A total of two hundred (200) random sampling size of students' in a university, located in the middle belt of Ghana, aged between 24-30 years, participated in this study. They were tested to assess the discrepancy between their feel-of-knowing on three variables: general fluid reasoning, memory test recognition and curiosity-trait questionnaire.

Results: Participants with high intensity level to knowledge demonstrated lower knowledge gap, compared to those with low-level of intensity. Similarly, the lower the knowledge gap between curiosity and cognition, the higher the arousal indicating that the 'I know' experienced acute stimulation relative to the 'I don't know' participants. In the experiments performed, scores of the 'I know' group correlated more positively with epistemic curiosity, feelings of knowing and exploratory behavior than the 'I don't know' individuals.

Conclusion: Human cognitive architecture seems to be structured to avoid cognitive ambiguity. Interest and deprivation-type curiosity in humans appears to be the leading predicting factor inducing humans to search for answers to bridge the gap between cognition and cognitive dissonance, triggering exploratory behavior to find answers.

KEY WORDS: Epistemic curiosity; Cognitive dissonance; Exploratory behavior; Feeling-of-knowing

ABBREVEATIONS: FOK: Feelings-of-knowing; LTM: Long-Term Memory; CNS: Central Nervous System.

INTRODUCTION

Epistemic curiosity has to do with the desire to bridge the gap between cognition and cognitive dissonance. On theoretical grounds, the concept is not unrelated to conceptual ambiguity and cognitive conflict as far as the literature on uncertainty and curiosity in human exploratory behavior is concerned. As has been discussed in this paper, the three concepts are used interchangeably to convey the same idea. As a theoretical framework, the concept of epistemic curiosity could be traced back to the works of Berlyne.¹ According to this author,¹ uncertainty is heightened, when humans encounter something diametrically different from what they would expect to encounter in their experiences. This incongruity and dissonance in cognition, consequently precipitates arousal in the central nervous system (CNS).¹⁻⁵ For example, a child in Primary 3 goes to school in the morning, expecting to see his/her Primary 3 teacher. Instead

he/she sees a substitute teacher. The dissonance between what is already encoded in the child's cognitive architecture, especially in the child's Long-Term Memory (LTM), and what he/she sees could induce physiological responses, such as, fast heartbeat, shallow breathing, and increased dilation of the pupil of the eye. It is the cognitive dissonance and conceptual ambiguity that heighten all these responses. This aroused emotional state, precipitated by uncertainty, is what was referred to as *curiosity* by Berlyne¹ a little over five decades ago. This curiosity triggers behaviors that would be typically exploratory, aimed at minimizing the curiosity and uncertainty.

With respect to its characteristics, epistemic curiosity is essentially a complex psycho-cognitive state involving both emotions and motivation, anticipating the learning of something new, to get rid of unpleasant feelings of incongruity and uncertainty in the knowledge gap.⁶ In such a situation, the expected human reaction is to seek for information that would eliminate the uncertainty between discrepancy and the desired information. This leads to what is referred to in the literature as a *feeling-of-knowing*. This *feeling of knowing* implies that at the level of metacognition, the person in doubt, would make a judgment and an evaluation of his/her available knowledge in the LTM to help resolve the impasse.⁷⁻⁹ The stronger the feelings of knowing experiences, the smaller the gap between cognition and cognitive dissonance. For example, in the example cited above in the case of the third grade child, he/she would spend considerable time trying to size up the substitute teacher from head to toe, trying to pay attention to the new teacher's response to his/her other colleagues in the class, or even to ask the substitute teacher simple question such as: 'Sir, do we have social studies today?'. These are psycho-meta/cognitive approaches, by means of which, one collects information through exploration, to reduce one's level of arousal. It is in this respect that according to Berlyne¹, this theory of epistemic curiosity is reinforcing.

Regarding the topic of human exploratory behavior, this researcher is of the view that considerable number of studies have been undertaken in respect of its manipulative forms, especially in the areas of shape inspection and the solution of puzzles in psychological and cognitive literature.^{10,11} More studies are yet to be conducted, specifically, with the aim of acquiring new knowledge through arousal induced by cognitive dissonance. Consequently, the purpose of this short research paper is to respond to this lacuna.

With specific reference to epistemic curiosity, Loewenstein⁴ presented the hypothesis, that when there is a dissonance between cognition and people's experiences, the *feelings-of-knowing* leading people to the realization that they have more access to information (and therefore smaller knowledge gaps) is more likely to arouse a heightened stimulation towards exploratory behavior, than people with perceptions that they have little knowledge, and therefore larger knowledge gaps. With the above hypothesis of Loewenstein⁴ as backdrop, this short research investigated whether or not, students' exploratory behaviors are

aroused more, when they perceive to have more knowledge in the face of dissonance or less aroused, when there is a perceived little knowledge.

Based on the above, this paper investigated the following three research questions:

1. What are the possible relationships between mental thoughts (cognition) and the intensity of behavior (motivation)?
2. In what ways can the feelings-of-knowing (FOK) induce epistemic curiosity?
3. What are the instructional/pedagogical implications that could be derived from conceptual ambiguity and cognitive conflict for effective classroom interaction?

METHODOLOGY

Participants

A total of two hundred (200) random sampling size of postgraduate students in Educational Psychology class in a university located in the middle belt of Ghana participated in this study. Their ages ranged between 24-30 years. Out of this, one hundred and thirty (130) participants were males, and the remaining seventy (70) were females. All the participants held Bachelor's degree in various areas of discipline, such as Mathematics, Science, Social Sciences, the Arts and Language. Thirty (30) of them in addition to the Bachelor's degree, also possessed a second degree. In terms of family background, about 80% of the participants were from Middle class civil service background, while the remaining 20% came from a working class farming background. All of them were not native speakers of English and therefore had English as a second language.

Design and Materials

The participants responded to all three research questions through three research instruments: a) a structured questionnaire and b) a Likert's scale type assessment on multiple choice questions on memory test recognition and c) curiosity trait-questionnaire.

Structured questionnaire on fluid reasoning knowledge: The structured questionnaire was based on the Woodcock Johnson Test Guide¹² to assess the discrepancy between their *feel-of-knowing* of the general knowledge on fluid reasoning on: i) concept formation and ii) analysis synthesis. Questions on concept formation had 50 simple questions and that of analysis synthesis also had 50 simple questions. All questions were scored over one hundred (100), that is, each of the questions had a score value of 1. Each question was to be answered in one simple word. To enhance the *feel-of-knowing* responses, questions were varied along two normative probabilities (p) of valid retrieval and accurate subject matter categorization. Participants were asked to write down the responses they reported to be knowing.

Regarding the participants' meta/cognitive judgments of their knowledge of answers to questions, this was evaluated through the subsequent two mechanisms: a) participants were asked to show their feel-of-knowing by indicating either 'Yes I know the answer' or 'No I don't know the answer' If the answer was yes, they were asked to write the answer'.

Memory test on recognition on Likert's scale: On a Likert's scale, respondents were asked to rate the intensity of their feel-of-knowing for all the 'Yes I know' responses to indicate the level of confidence ranging from 5 to 1, the highest score indicating the highest level of confidence and the lowest score indicating the lowest state of confidence level in a multiple choice questions.

Curiosity-trait questionnaire: Two different instruments were used in this section of the experiment. Ten (10) items questionnaire were posed, using a variant of the Epistemic Curiosity scale of Litman and Spielberger,⁵ and another 15-item questionnaire with a variant of Curiosity- as-a-Feeling-of-Deprivation scale of Litman and Jimerson⁶. On the first instrument, they were asked to rate their pleasures of interest or otherwise in connection with learning (e.g. I like to learn things that are unfamiliar) or unpleasant experience (e.g. I feel uneasy when I am learning something I do not understand). In both, the following were the 4-point scale from 1-5, 1=almost never; 2= At times; 3= Often, 4= Almost always.

Procedure

All materials and questionnaires were administered through group/class testing during a 3-hour Psychology class from 11.30 am to 2.30 pm by the author and two Faculty Research Assistants. Students had already been informed about this experiment and participation was purely voluntary. Students were informed that the purpose was purely academic. The experiment was meant to gauge the feelings, sentiments and general knowledge of postgraduate students specifically on how variables such as epistemic curiosity, conceptual ambiguity and cognitive conflict implicate the intensity of students' exploratory behavior. All detailed explanations were given to the students before each phase of the experiment. For example, it was explained, that the experiment would be conducted in three phases: a) *structured questionnaire on fluid reasoning knowledge*; b) *Memory test on*

recognition on Likert's scale to test the level of confidence of all 'I know states' and c) Curiosity-trait questionnaire. Detailed instructions on each of the three measures were clearly explained to all the participants. All raw scores were computed into mean scores and standard deviations.

RESULTS

The results have been presented in three categories. The first part presents the summary of the descriptive statistics on the types of feelings of knowing (FOK) states on fluid reasoning which were all assessed to find out whether or not FOK intensity level measures as well as their retrieval accuracy varied as predicted. The second part presents the expected hypothesis of the link between FOK, epistemic curiosity state and its implied exploratory behavior. The third section offers some relationship between epistemic curiosity traits and states, FOK and human exploratory behavior.

The first row in Table 1 presents the two variables of the 'I don't know' and the 'I know' states as measured on fluid reasoning, while the first column presents the scores of the FOK states. So Table 1 presents the mean, the standard deviation and the alpha scores for answers that were correctly recalled on the general knowledge for FOK between the 'I don't know' and the 'I know' groups for the total sample of 200. Additionally, it explains the number of responses correctly recalled when participants were reading the questions on fluid reasoning which was gauged to measure whether or not the FOK level measures together with their retrieval accuracy differed as predicted. The mean scores having varied superscripts were scores that significantly varied from each other at $p \leq 0.05$. The low alpha values were suggestive of the FOK intensity and indication that they varied appreciably. Answers that were correctly retrieved when respondents indicated 'I know' *p* (retrieved) were reported in the right corner with the correlation between the level of confidence (intensity) as well as the 'I know' correlations with correctly retrieved answers

The first column of the Table 2 shows the feelings of knowing state between the two variables of 'I know' and 'I don't know', while the second and third columns indicate the correlation scores for recognition and feelings of knowing level. Thus, the Table reports the level of confidence of the FOK

Table 1: Summary of Descriptive Statistics on Confidence Level of Feel-of-Knowing States in Respect of Retrieval Indicators for 'I know' States on Fluid Reasoning (N=200).

	'I don't know'	'I know'
For Intensity		
M'	1.75 ^a	3.67 ^b
SD	0.65	0.28
α	0.51	0.52
<i>p</i> (retrieval) ² =0.73 Point biserial <i>r</i> =0.38		

Table 2: Memory Test on Recognition Index to Rate Intensity (Level of Confidence) for all the 'I know' States (N=150) on Likert's Scale.

FOK State	<i>p</i> (recognition)	Point-biserial <i>r</i> in relation to FOK level of confidence
'I know'	0.76	0.27
'I don't know'	0.49	0.06

states for the 'I know' and the 'I don't know' groups in terms of correlation between recognition and level of confidence. Thus it reports memory test on recognition index to rate intensity (level of confidence) for all the 'I know states' of a random sample of 150 out of the 200 total sample size, which included 100 male students and 50 female students, both groups being postgraduate students. Using the Goodman-Kruskal gamma co-efficient, the FOK states of participants in this test was evaluated to see whether or not, the results were of different retrieval and also where the accurate answers commensurate with each type of the FOK state.

The first row in this Table 3 presents the three variables of epistemic curiosity, feelings of knowing and exploratory behavior that were correlated. The first and subsequent columns show the correlation scores between the 'I know' and the 'I don't know' The Table reports that the correlation between the three measured variables, namely, state of epistemic curiosity, FOK intensity as well as exploratory behavior for each category of FOK conditions. Curiosity state correlated negatively with 'I know state' as shown on the table. Thus, as hypothesized in this short study, when people are innately convinced that they have not succeeded in giving an answer, the intensity in the FOK is heightened and this commensurates with the heightened state of curiosity.

DISCUSSION

This study investigated the connection between perceived knowledge and cognitive dissonance and how the gap between these two variables precipitates epistemic curiosity and its consequent exploratory behavior to resolve the discrepancy. The data in all the tests indicated above, are suggestive, that typically, when people have the mindset that they have access to knowledge, this realization induces a more heightened arousal, relative to people with the belief that they have a much larger knowledge gaps. Central to the desire to bridge this gap is epis-

temic curiosity which is an essentially emotional-motivational state. This complex state is aroused by both the positive and negative feelings which are correlated to both the anticipation of a new learning, as well as not so pleasant feelings of uncertainty. For example, in Table 1, which sought to measure the general comprehension knowledge of these sampled postgraduate psychology class students, to measure their general comprehension knowledge, suggested that those who perceived to have knowledge ('I know'), recalled by far more accurate responses, than those who did not ('I don't know'), as shown in the scores in Table 1: M=3.67 (SD=0.28) compared to M=1.75 (SD=0.61) respectively. Additionally, in terms of correlation scores, the scores of those who perceived to have knowledge ('I know'), correlated with a *p* (retrieval) of 0.73, while the intensity levels were positive correlation of *r*=0.38.

Similarly, in Table 2, results in the recognition accuracy indicators point to the same fact. The answers with the highest number of correct responses at the FOK states were more in the 'I know' state, than it was in the 'I don't know'. This findings seem to corroborate the fact that participants in this study appeared to have been more conscious of their knowledge and because of this they were able to either in part or in full retrieve the correct responses as indicated in *p* (recognition) indicating 0.76 for 'I know' and 0.49 for 'I don't know' as well as *r*=0.27 and *r*=0.06 respectively. The scores in the correlations in Table 3, between the three variables of epistemic curiosity, feelings-of-knowing, and exploratory behavior, by and large are in favor of the 'I know', compared to the 'I don't know'.

As predicted in this study, the findings above, by and large corroborate the thesis of Loewenstein⁴, namely, that when there is a cognitive dissonance or cognitive ambiguity or conflict concerning the probability that the feelings-of-knowing already stored in people's LTM would come to the fore arousing a heightened stimulation towards resolving the conflict. The findings from this study support the following three interrelated

Table 3: Correlation between Epistemic Curiosity, Feelings-of-Knowing and Exploratory Behavior (N=200).

	Epistemic curiosity		(FOK) intensity		Exploratory behavior	
	'I know'	'I don't know'	'I know'	'I don't know'	'I know'	'I don't know'
For Intensity	-0.12	0.24	-0.20	14		
Exploratory behavior	0.28	0.43	-0.21	17		
CFD scale	0.01	0.12	0.00	0.06	0.03	0.08
EC scale	0.01	0.23	0.02	0.06	0.01	0.11

Note: Figures in bold are significant correlations.

theses that: a) there appears to be greater recognition memory when there is a feeling of knowing for all who feel that they have an access to knowledge. This comes out clearly in this study when the scores were more favorable to the 'I know' state in relation to FOK; b) the participants in this study, who indicated 'I know', seemed to have experienced more of a heightened stimulation than those who showed 'I don't know' and c) for all the three study variables, namely, epistemic curiosity, feelings of knowing state and exploratory behavior, the scores of participants in this study who indicated 'I know' correlated more positively with exploratory behavior for all the FOK states. The above fundamental findings confirm other studies such as Jordan, Tiffany & Ryan,¹³ Keller Schneider & Henderosn,¹⁴ as well as Loewstein.⁴

IMPLICATIONS FOR CLASSROOM PRACTICE

These findings have implications for classroom teacher-student interaction. First, with specific reference to individual dispositional tendencies, many studies highlight the critical importance of epistemic curiosity in the students' intellectual achievements. This is especially so in self-directed learning.¹⁵⁻¹⁷ Self-directed learning is not unrelated to the development of curiosity in students, which in turn enhances inquiry and critical thinking¹⁸ especially in teacher education. Thus, epistemic curiosity precipitates inquiry attitude, especially when a teacher is expected to cultivate this attitude, and is constantly questioning whether or not his teaching and classroom interaction with students, and in the school induce in students, such curiosity as inquisitiveness and critical reflection.^{19,20} With specific reference to exploratory behavior, it is theorized that openness to knowledge and epistemic curiosity are the driving forces that trigger the human desire to search for knowledge and therefore assumed to be theoretically connected to inquiry attitude.^{21,22} Hence in terms of teacher education for example, it is related to the teacher's professional development.

CONCLUSION

Interest and deprivation-type curiosity in humans appear to be the leading predictor inducing humans to search for answers to bridge the gap between cognition and cognition dissonance, between cognitive conflict and knowledge, as well as between cognitive ambiguity and information. Human cognitive architecture seems to have been structured to avoid cognitive ambiguity. This is especially so, when one is pretty sure that information/knowledge already encoded into the LTM can be retrieved with ease. When the intensity or the confidence level of such FOK is high, humans are naturally predisposed to a heightened stimulation towards exploratory behavior. The major findings from the study are as follows: a) there appears to be greater recognition memory, when there is a feeling of knowing, for all who feel that they have an access to knowledge. This is evident in this study when the scores were more favorable to the 'I know' state in relation to FOK; b) the participants in this study, who indicated 'I know', appeared to have experienced more of a heightened stim-

ulation and high intensity level than those who showed 'I don't know' and c) for all the three study variables, namely, epistemic curiosity, feelings of knowing state and exploratory behavior, the scores of participants in this study who indicated 'I know' correlated more positively with exploratory behavior for all the FOK states. These findings are consistent with the psychological behavior of humans when faced with interest on hand, and deprivation-type curiosity on the other. Additionally, these findings have implications for classroom teaching especially in the area of enhancing inquiry and critical attitude as well as self-regulation in the students' intellectual development.

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CONFLICTS OF INTEREST

This author declares having no conflict of interest in this study. All students who participated in this study did so voluntarily without any coercion. No funding was obtained for this research.

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Research

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Anxiety and Depression among Pregnant Women in the Gaza Strip

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ABSTRACT

Aim: This study aimed to examine the levels of anxiety and depression among pregnant women attending primary healthcare clinics in Gaza Strip.

Method: The sample consisted of 400 pregnant women attending primary healthcare clinics in the Gaza Strip. They were interviewed using the sociodemographic scale, Hamilton Anxiety Rating Scale (HAM-A), and Beck Depression Inventory (BDI).

Results: The study showed that 33.3% of the pregnant women showed moderate and 18.5% showed severe depression. Women living in refugee camps more often reported clinical cases of depression. 14.3% of these women showed moderate and 8.8% showed severe symptoms of anxiety. Depression and anxiety symptoms were closely associated with each other. The results showed that 6.3% of women experienced co-morbid depression and anxiety.

CLINICAL IMPLICATIONS

There is a need for early diagnosis of mental health problems in pregnant women attending primary health clinics through psychological screening. More programs are necessary to be included within the primary healthcare services to support psychosocially women with mental health problems. Also, the training of staff working in the clinics for early detection of mental health problems in such target group is necessary. Women with severe mental health problems should be subjected to a clear and effective transfer to more specialized psychiatric clinics for treatment.

KEY WORDS: Anxiety; Depression; Pregnant women; Gaza Strip.

ABBREVIATIONS: HAM-A: Hamilton Anxiety Rating Scale; BDI: Beck Depression Inventory; MOH: Ministry of Health; PHC: Primary Health Care; NGOs: non-governmental organizations; PHC: Primary Health Care; UNRWA: United Nations Relief and Work Agency for Palestine Refugees.

INTRODUCTION

Depressive disorders account for almost half of the burden of clinical conditions associated with mental disorders, followed by anxiety disorders, and drug and alcohol use disorders (WHO Department of Health Statistics and Informatics, 2008). Globally, the lifetime prevalence of major depressive disorders was estimated to be between 10% and 15%.¹

Pregnancy has been defined as a period of well-being that has allowed women to feel biologically complete, supported their emotional well-being, caused enjoyment and fulfillment, and at the same time led to a moment of stress and related changes.

It was estimated that the rate of occurrence of depressive disorders in women of the reproductive age was at least twice as that observed in men.² In addition, depression and anxiety

may also have had a negative impact on the developing fetus and may have been associated with premature births and lower birth weights.^{3,4} Moreover, in a study of a sample of 3,472 pregnant women aged 18 years and older in Michigan, USA, the results showed that 20% (n=689) of the women who were screened, scored above the cutoff score of depression, and only 13.8% of those women reported to have received any formal treatment for depression.⁵

Depression during the perinatal period can have devastating consequences, not only for the women experiencing it, but also for the women's children and family.⁶ Stressful situations are considered to be mental disorder triggers, and such disorders are the most common health problems associated with pregnancy and postpartum period anxiety and depression.⁷

The prevalence rates for anxiety disorders varies widely, and it is estimated that women generally showed higher prevalence rates across all anxiety disorder categories, compared with men,⁸ and lifetime and 12-month prevalence rates of anxiety disorders among women was roughly twice the rate observed among men.⁹ Research evidences have shown that there is now a growing realization that many women suffer from either the onset or the exacerbation of existing anxiety disorders during the prenatal period.¹⁰ Moreover, in a study of anxiety in pregnant women it was observed that a significant number of women were affected.¹¹ In a large sample of pregnant women, it was observed that 21% of the women showed clinical symptoms of anxiety and, of these, 64% continued to experience postpartum anxiety.¹²

In a different study, it was observed that the prevalence of prenatal anxiety and associated factors among pregnant women at the Changchun Gynecology and Obstetrics Hospital, Jilin Province, China, from January 2015 to March 2015, was 20.6% (96 of 467).¹³ Other studies examined both depression and anxiety among pregnant women in developing countries, despite the estimates of WHO that depressive disorders would be the second leading cause of the global disease burden by 2020.¹⁴ Furthermore, in a study of pregnant women in an urban community in Pakistan showed that 18% of the women were anxious and/or depressed.¹⁵ Also, in a study in rural Bangladesh, results showed that the rate of anxiety disorder was recorded as 18%.¹⁶ While, in a study conducted in Malaysia, the prevalence of anxiety and depression disorders among prenatal mothers using diagnostic clinical interview were 9.1% and 8.6%, respectively.¹⁷ Similarly, in a study aimed towards evaluating the occurrence of depression and anxiety during the perinatal period in a sample of 660 English-speaking pregnant women in the City of Vancouver, Canada showed that 28.8% of the pregnant women experienced anxiety disorders at some point of time in their lives, and 16.2% underwent mood disorders.¹⁸

Significance of the study

This study attempted to bridge the gap in studies concerning women in the Gaza Strip as it was the first study centered about

pregnant women. This study may pave the path for further research in the same field and highlight the urgent need to establish psychological programs in clinics for the affected women. Also, the present study may contribute towards the knowledge of mental health in Palestine, and help provided guidelines for other researchers to conduct further studies in field.

The aims of this study were 1) to examine the level of anxiety and depression among pregnant women, 2) to investigate the relationship between depression and anxiety among pregnant women, 3) to determine the relationship between anxiety, depression and the sociodemographic variables governing the lives of pregnant women in Gaza strip.

METHODS

Participants

The sample consisted of 400 randomly selected Palestinian pregnant women attending primary health care clinics in the Gaza Strip. The demographic information collected has been reported in the Results section.

Measures

Sociodemographic sheet: Included parameters as age, level of education among the women and their husbands, place of residence, type of housing, family type, number of family members, and monthly income.

Beck Depression Inventory Short form 13 item¹⁹

The 13-item beck depression inventory (BDI) was used to estimate the probable prevalence of depression. The BDI was scored on a four-point scale 0-3, giving a possible range of 0-39. The severity of depression was classified on the basis of the total score; in a normal community sample, a BDI score <4 suggested no or minimal depression, 5 to 7 represented mild to moderate depression, 8 to 15 indicated moderate to severe, and <=16 indicated severe depression. BDI being a universal scale; its validity and reliability has already been tested. This Arabic version of the scale was validated in the Palestinian Society.²⁰ The BDI demonstrated a high internal consistency, with alpha coefficients of 0.86 and 0.80 for psychiatric and non-psychiatric populations respectively.²¹ In this study, the Cronbach's Alpha was 0.89 and split half was 0.77.

Hamilton Anxiety Rating Scale²²

The HAM-A was one of the first rating scales developed to measure the severity of anxiety symptoms, and is still widely used today in both clinical and research settings.²³ The scale consisted of 14 items, each defined by a series of symptoms, and measured both psychic anxiety (mental agitation and psychological distress) and somatic anxiety (physical complaints related to anxiety). Although the HAM-A remains widely used as an outcome

measure in clinical trials, it has been criticized for its poor ability to discriminate between anxiolytic and antidepressant effects under certain situations, and somatic anxiety versus somatic side effects. The instrument has been used but not validated in an Arabic speaking population.²⁴ The items were rated on a five-point scale and summed to provide a score ranging from 0 to 56. A score of 17 or less represented mild anxiety, a score between 18 to 24 represented mild to moderate anxiety, and a score of 25 and above, represented moderate to severe anxiety. The Arabic version of the scaling tool was used in this area and indicated high reliability.²⁰ For this study, Cronbach's Alpha was 0.86 and split half was 0.74.

Study Setting and Procedure

Palestinian health care system in the Gaza Strip: Ministry of Health (MOH) is the main healthcare provider in the governorates; providing Primary Health Care (PHC), secondary and tertiary services for the entire population. It invests in advanced medical services by referring patients to the neighboring countries, and other private and non-governmental organizations (NGOs) healthcare facilities. United Nations Relief and Work Agency for Palestine Refugees (UNRWA) in the Near East provides PHC services to the refugee population, and invests secondary and tertiary care services when needed. The NGOs sector ranges across missionary hospitals, to facilities supported by international organizations, to community health centers. The private for-profit health sector also provides the three levels of care through a wide range of practices.²⁵

Primary health care services in the Gaza Strip for pregnant women: The five main healthcare providers in Palestine includes the Ministry of Health, UNRWA in the Near East, NGOs, Palestinian Military Medical Services (PMMS) and the Private sector. However, it is the primary responsibility of MOH to provide these healthcare services. In the Gaza Strip, there are 163 primary healthcare centers run by four main providers: 54 Government primary healthcare centers, 21 primary health care centers maintained by the UNRWA, 81 primary healthcare centers run by NGOs and 7 primary healthcare centers under the supervision of PMMS.²⁶ MOH is the main healthcare provider in the Gaza Strip; providing PHC, secondary and tertiary healthcare services for the entire population. It maintains advanced medical services by referring patients to the neighboring countries, and other private and NGO-based healthcare facilities. United Nations Relief and Work Agency for Palestine Refugees in the Near East (UNRWA) provides PHC services to the refugee population, and purchases secondary and tertiary care services when needed. The NGO sector ranges across missionary hospitals, to facilities supported by international organizations, to community healthcare centers. The private for-profit health sector also provides the three levels of care through a wide range of practices.²⁶

Pregnant women were randomly selected from both governmental and UNRWA primary healthcare centers in the

Gaza Strip during their visit to the prenatal clinics for a medical follow-up on all the weekdays except Friday. Participants were selected using systematic sampling method and every third woman was included in the study, taking into consideration, that the first one was selected randomly. To ensure equal participation in the study for pregnant women, the researcher collected data towards the beginning of the month (day 1, 2, 3), middle of the month (day 14, 15, 16), and at the end of the month (day 27, 28, 29). An official approval to conduct the study was taken from the Helsinki Committee, UNRWA Health Department, and the Ministry of Health. In addition, an informed written consent from each woman was obtained, which included the statements of women who agreed to participate in the study including the purpose of the study, confidentiality information and some instructions, such as the right to withdraw or refuse to participate in the study. The data was collected while the women were waiting for their medical examination in different clinics in the period from December 2015 to October 2016.

Statistical Analysis

Statistical analysis was carried out using the SPSS program version 20. Continuous variables were presented as means and standard deviations, and categorical variables were expressed as frequencies and percentage. In addition, the independent *t*-test was performed to compare the mean of anxiety and depression and the type of clinics. One-way ANOVA and Turkey significant differences tests were used for data analysis. Pearson correlation test was performed to establish the correlation between anxiety and depression. A *p*-value ≤ 0.05 was considered statistically significant.

RESULTS

Socio Demographic Characteristic for Study Samples

The sample consisted of 400 women attending primary healthcare centers for prenatal care. With respect to age groups, 37.3% of the women were less than 25 years old, 48.5% were between 25 and 35 years old, and 14.3% were aged between 36 years and more. On the basis of educational qualification, 37.3% of those affected finished secondary school and 30.8% finished their university education and more. With regards to clinic type for medical examination, 60% of the participants attended Government clinics (MOH) and 40% attended UNRWA in the Near East clinic. On the basis of monthly income, 77.3% of the sample population had a monthly income less than \$450, 12.0% had an income between \$451-\$600, for 7.0% it was between \$601-\$800, for 3.3% between \$801-\$1050, and only for 0.5% it was more than \$1051.

Depression Symptoms in Pregnant Women

The most common symptoms of depression observed were: making decisions (10.5%), being satisfied out of things as used to (7%), stating that "my appetite is no worse than usual" (7%), while the least commonly observed symptoms were thoughts of

Table 1: Sociodemographic Characteristics of the Study Sample (N=400).

Item	N	%
Age		
Less than 25 years	149	37.3
26 to less than 35 years	194	48.5
more than 36 years	57	14.3
Education of women		
Less than secondary	75	18.9
Secondary	149	37.3
Diploma	52	13
University and above	1124	30.8
Educational qualification for the husband		
Less than secondary	93	23.3
Secondary	141	35.3
Diploma	42	10.5
University and above	104	26
Place of residence		
City	237	59.3
Camp	121	30.3
Village	29	7.3
Other	13	3.3
Clinic type		
Government	240	60
United Nations Relief and Work Agency for Palestine Refugees in the Near East	160	40
Number of children		
Less than 4	146	36.5
5-7	138	34.5
8 and above	116	29
Monthly income		
Less than \$ 450	309	77.3
\$451- \$600	48	12
\$601-\$800	28	7
\$ 801-\$1050	13	3.3
More than \$1051	2	0.5

killing self (2%), working as usual (2%), and failure (1.3%).

Prevalence of Depression

As shown in Table 2, 25% of the women did not report depression, 23.3% showed mild symptoms, 33.3% showed moderate symptoms, and 18.5% had a more severe form of depression. Using the Beck depression scale, mean depression scores ranged between 0 to 34, and the mean depression was 9.29 (SD=6.6).

Depression and Sociodemographic Variables

In order to examine the differences in depression among pregnant women on the basis of sociodemographic variables such as place of care, age, place of residence, number of children, education, and monthly income, independent *t* and One-way ANOVA tests were performed. The study showed that women who at-

tended UNRWA clinics reported higher incidence of depression (Mean=10.60, SD=6.45) than those who attended governmental clinics (mean = 8.43, SD=6.78) ($t(400)=3.21, p<0.001$).

Uneducated women reported a greater incidence of depression relative to the other groups ($F(7,399)=5.40, p=0.001$). Women living in refugee camps were comparatively more depressed than those living in a city or a village ($F(3, 399)=8.14, p=0.001$), women with more than 8 children were more depressed (mean=11.19, SD=6.6) than those with 5-7 children (mean=9.22, SD=6.34), and 4 and less number of children (mean=7.86, SD=6.63) ($F(2, 399)=8.37, p=0.001$). (Provide means and standard deviations).

Prevalence of Anxiety

The Table 3 showed that 77% of the participants showed mild

Table 2: Prevalence of Depression in the Study Sample (N=400).

Depression	N	%
No depression	100	25
Mild depression	93	23.3
Moderate depression	133	33.3

symptoms of the condition, 14.3% had moderate, and 8.8% had a severe form of anxiety. Using the Hamilton anxiety scale, the mean anxiety ranged from 0 to 56, while the mean was recorded as 12.94 (SD=8.71).

Anxiety and Sociodemographic Variables

Post-hoc analysis using the Tukey test showed that women with more than 8 children showed more anxiety symptoms (mean=13.84, SD=8.19) than those with 5-7 children (mean=12.98, SD=9.04) and 4 and less number of children (mean=11.03, SD=8.19) ($F(2, 399)=3.87, p=0.02$).

The study showed that women who attended UNRWA clinics reported greater anxiety (Mean=13.54, SD=8.15) than those who attended governmental clinics (Mean=11.54, SD=8.94) ($t(400)=3.21, p<0.001$). However, there were no significant differences in total anxiety with respect to the age of women, place of residence, education, and family monthly income.

Co-morbidity of Depression Anxiety among Pregnant Women

In order to examine both depression and anxiety, total scores of anxiety were recorded as 25 and above for anxiety), 24 and less for no anxiety, total scores of depression were recorded as <16 in depression and 15 and less for no depression. The results

showed that 6.3% of women had comorbid depression and anxiety (Table 4).

Correlation between Depression and Anxiety

Pearson correlation test was performed to establish the relationship between depression and anxiety. Correlations were reported with the degrees of freedom (which is N-2), total depression and anxiety were strongly correlated ($r(400)=0.49, p<0.01$) (Table 5).

DISCUSSION

Our study aimed to investigate the prevalence rate of depression and anxiety among Palestinian pregnant women attending primary healthcare centers in the Gaza Strip.

The findings of our study showed that one third of the women reported moderate depression and 8.8% reported severe anxiety. This study showed that 6.3% of the affected women experiences comorbid depression and anxiety. The reported findings were less relative to the observations in another study conducted on pregnant women in an urban community in Pakistan which reported that 18% of the women were anxious and/or depressed. Psychological distress was associated with the unemployment of the husband, lower household wealth, having 10 or more years of formal education.¹⁵ Other studies indicated higher

Table 3: Prevalence of Anxiety in the Study Sample (N=400).

Anxiety	N	%
Mild anxiety	308	77
Moderate anxiety	57	14.3
Severe Anxiety	35	8.8

Table 4: Comorbidity of Depression Anxiety among Pregnant Women.

	No	%
No depression of anxiety	316	79.0
Either depression or anxiety	59	14.8
Comorbid depression and anxiety	25	6.3

Table 5: Correlation between Depression and Anxiety.

	Anxiety
Depression	0.49**

* $p<0.05$, ** $p<0.01$, *** $p<0.001$

rates of depression and anxiety in pregnant women in southeastern Michigan (USA).⁵ The rate of anxiety in pregnant women in the present study was less than that found in a cross-sectional study carried out at the Changchun Gynecology and Obstetrics Hospital, Changchun, Jilin Province, China which showed that the prevalence of antenatal anxiety was 20.6% (96 of 467), antenatal anxiety showed a significant relationship with level of education when lower than middle school, expected natural delivery, anemia during pregnancy, pregnancy-induced hypertension syndrome, disharmony in family relationship and satisfaction with life. Our results were inconsistent with the study of Chinese pregnant women recruited in Zhoushan Pregnant Women Cohort, China at the Zhoushan Maternal and Child Care Hospital from 2011 to 2015. The prevalence rates were 35.64, 24.23, and 26.24% for depression and 22.57, 17.41, and 21.04% for anxiety at 1st (T1), 2nd (T2), and 3rd trimester (T3), respectively.²⁷ The results of our study were consistent with the findings of the study of the lifetime diagnosis of anxiety, depression, and current depression in 402 pregnant women in USA. The results showed that the prevalence of lifetime diagnosed anxiety and depression was 13.6% and 11.3%, respectively, whereas 10.6% reported current depression.²⁸ The findings of our study showed that pregnant women reported a high rate of depression which was supported by the findings of other studies that women who live in conditions of social and economic adversity, may be at an increased risk of depression during the perinatal period.^{28,29} Similarly, another study described the prevalence of depression, anxiety, pharmaceutical treatment, and help-seeking behaviors among a multiethnic population of women with recent live births in Hawaii. Seven point three percentage of the pregnant women reported visiting a healthcare worker for a check-up or for treatment of depression or anxiety in the year before their most recent pregnancy, 4.9 % reported having experienced depression 3 months before pregnancy, 5.9% reported to have experienced anxiety in the same period, 9.1% screened positive for postpartum depression, and 6.9% consulted a doctor, nurse, and a healthcare worker seeking medical help for postpartum anxiety.³⁰

Moreover, our results reported a lower rate of depression relative to a cross-sectional study at the Hanover Park Midwife Obstetric Unit (MOU), in Cape Town, South Africa.³¹ Furthermore, the results of our study were consistent with the findings of the study reporting the prevalence of anxiety and depression during pregnancy among in Tuanku Bainun Hospital, Ipoh, Malaysia.¹⁷ Our findings indicated lesser anxiety levels in a study of 660 English-speaking pregnant women in the City of Vancouver, Canada.¹⁸ Other studies indicated higher rates of incidence of depressive episodes.³²

The study observed that there were no reported differences in depression and anxiety due to age; this could be due to the emotional state being impacted by different age groups, but to varying degrees, and all pregnant women were being exposed to physical, hormonal and emotional changes during pregnancy and mostly when the participant's age was less than 35 years The

study showed that there were no differences in the symptoms of anxiety due to age.¹³ Our study showed that there was a correlation between depression and anxiety which was inconsistent with the findings of a similar study conducted which showed no significant relationship between depression and anxiety, and the age of pregnant women.¹³

The study showed that the women who attended UNRWA clinics (mainly refugee women) reported more depression and anxiety than those pregnant women attending governmental clinics (Citizen Women-Ministry of Health). Such findings could be explained understanding that refugee women attending UNRWA were living in refugee camps experiencing a higher rate of unemployment and poverty.¹⁴ Women living in refugee camps reportedly experienced more symptoms of depression than those living in a city or a village while, women with more than 8 children in the family were more affected by depression than those having less number of children. Such findings were inconsistent with the observations made in other related studies which showed that psychological problems were significantly higher in women living in villages than in cities.³³

CONCLUSION

This study presented a strong evidence that pregnant Palestinian women, like other women in different regions, experienced depression and anxiety which must draw the attention of service providers to related problems to help find solutions. This study found that women living in refugee camps, and having more than 8 children were at an increasing risk of developing depression and anxiety.

CLINICAL IMPLICATIONS

The findings of our study highlighted on a higher level of depression in pregnant women to introduce a new screening program for the early diagnosis of mental health problems in women attending primary healthcare centers in the Gaza Strip. We recommend establishing counseling programs for such target groups within the centers providing psychosocial support to women with mental health problems. Also, there is a need for introducing training courses addressing mental health issues for staff working in the centers or for the early detection of mental health problems in such target groups. Women with severe mental health problems should be provided a clear and effective referral system for more specialized psychiatric clinics, for their treatment. Empowering women in the Palestinian society may be a factor contributing towards the prevention of psychological problems.

According to the results and limitations of the present study, the researcher recommends the study of other risk and protective factors among pregnant women. A research evaluating the benefit of counseling in clinics for pregnant women with depression and anxiety would help focus on the outcome of the intervention.

STRENGTHS AND LIMITATIONS OF THE STUDY

A major strength of this study is that it adds to the knowledge of prenatal depression and anxiety in primary healthcare centers in the Gaza Strip. This paper also presents data on multiple psychosocial and sociodemographic factors associated with depression and anxiety in a large sample of pregnant women in the Gaza Strip. These findings may contribute to the emerging literature on the risk factors for pregnant women in Gaza Strip. There are a number of limitations to this study. The study was designed as a primary healthcare-based study; however women affected by more severe psychopathological conditions may have been missed if they were unwilling or unable to attend the clinic. Given that this was a cross-sectional study, we were not able to measure a change in depression and anxiety over the trimesters. The use of self-report measures to collect data such as ownership of assets and income may have yielded data that could not be verified or that was subject to recall bias.

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CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

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