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Pitout JDD, Church DL, Gregson DB, Chow BL, McCracken M, Mulvey M, Laupland KB (2007). Molecular epidemiology of CTXM-producing Escherichia coli in the Calgary Health Region: emergence of CTX-M-15-producing isolates. Antimicrob. Agents Chemother. 51: 1281-1286.

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Review

The dilemma of diagnosis in bipolar patients with psychiatric disability in the Caribbean setting

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Although there has been a surge in research relating to psychiatric disorders, diagnosing bipolar disorder still proves to be an immense feat. This dilemma can seriously impact on the quality of life of bipolar patients with psychiatric disability. These case studies sought to highlight several factors which may fuel this diagnostic uncertainty. Two in-patients at the Eric Williams Medical Sciences Complex were evaluated. In the first case, the patient admitted for approximately one month, was diagnosed with a co-morbid personality disorder. Although he met the Diagnostic and Statistical Manual (DSM IV) of mental disorders criteria for bipolar II disorder, further evaluation led to the axis II diagnosis with resulting prognostic implications. In the second case, the patient was admitted for six days and his presentation could have been accounted for by several psychiatric disorders. Understandably therefore, the art of diagnosing is complex and numerous factors such as co morbidity, socio-cultural variations, current DSM IV guidelines, cannabis use and genetics play a major role. Analysis of the DSM IV guidelines and identifying how it can be adapted for a Caribbean setting is necessary. It is also recommended that further exploration of links, if any, between bipolar disorders and personality disorders be done, thus enhancing diagnosis and eventually allowing more complete management of patients with psychiatric disability.

Key words: Bipolar disorder, psychiatric disability, Caribbean, diagnostic and statistical manual of mental disorders (DSM IV).

INTRODUCTION

Bipolar disorder is a common psychiatric condition. In fact, it was touted as one of the ten leading causes of disability worldwide in 1990 measured in years-lived with a disability (BMJ, 2002). However, diagnosis of this disorder has proven to be quite challenging for a number of reasons such as co-morbidity, unique socio-cultural factors inherent to this part of the world and arguably, the current DSM IV classification. Drug use and genetics also have a part to play in this dilemma of diagnosis. The following reports seek to address how these factors interact to complicate the diagnosis of bipolar disorder.

This complex interplay of confounding factors becomes more pertinent when taking into consideration the far reaching implications of psychiatric disorders. One such implication is psychiatric disability which can be defined according to Boston University Centre for Psychiatric Rehabilitation (2010) as "that state when mental illness significantly interferes with the performance of major life activities, such as learning, working and communicating, among others." This concept of psychiatric disability is noteworthy in the Caribbean setting. In fact, in the year 1990, psychiatric and neurological disorders accounted for 8.8% of the disability-adjusted life years in Latin America and the Caribbean, with a marginal increase to 21% in 2004 (Rodriguez, 2010). Comparatively, neuro-psychiatric disorders are the second cause of disability-adjusted life years (DALYs) in Europe and account for 19% (World Health Organization, 2004). In the United States, neuro-psychiatric disorders accounted for 28.47%.

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The following cases were selected primarily for comparative purposes since there are key differences between the two cases such as ethnicity, socio-cultural background, premorbid condition and influence of drugs. It highlights therefore the multifactorial nature of diagnosis in an individual patient and how these entities impact the ultimate management. This dilemma of diagnosis is not a new entity by any means. The following case reports are significant as they demonstrate the complexity of diagnosis. Furthermore, they underscore that each patient is unique and in many ways, the rigid application of the DSM IV criteria has not encompassed their presenting complaints in entirety and subsequently, has denied these patients of appropriate management for their holistic problem.

One article (Gangdev, 2007) echoed that of other publications in which it was felt, most of the recent research in mood disorders stemmed from 'redefining and often rigidly applying the DSM criteria." Basing diagnoses on research and opinions was seen as a hindrance to accurate diagnosing which could be corrected with "new phenomenological understanding." Additionally, for future research to be meaningful, it was felt that differences in biological depression resulting from psychosocial factors should be examined.

Trinidad and Tobago and by extension the Caribbean has a unique setting whereby a milieu of socio-cultural factors often complicate the diagnosis of a disorder. While illegal drugs such as marijuana are not specific to this country, they can play a part in the diagnostic dilemma. Cannabis use and its relation to psychiatric disorders are seen as an area of 'nosological uncertainty.' Konings and Maharajh (2006) presented various case studies showcasing clinical presentations among adolescents using cannabis. Their findings suggest that mood disorders are common among cannabis users in Trinidad and Tobago and that mode and local preparation of the drug could account for the different findings in developed countries.

The discrepancies in diagnosis have risen with respect to other disorders such as schizophrenia whereby the relationship between religion and mental illness has been questioned (Maharajh, 2010). This same study by Maharajh (2010) further corroborates the idea of psychiatric disability when the "approach of dealing with diseases and not their context or causation appeared to be a denial of patients' belief and inability to speak in the language of the people." The difficulty of diagnosis stemming from cultural idiosyncrasies is also a Caribbean phenomenon. A term 'Caribbeing Psychiatry' (Maharajh, 2010) has been used to seemingly promote Caribbean identity bereft of European and North American standards. Furthermore, the study describes the DSM IV and ICD-10 as 'picture fitting and menu driven' and therefore inadequate for the varied presentations arising from a Caribbean population.

New inroads into the genetic aetiology of psychiatric disorders can cause some confusion and perhaps loss of faith in the current psychiatric classifications. In a recent study by Craddock et al. (2006) examining genes for schizophrenia and bipolar disorder, it is noted that there is now a specific relation between genotype and psychopathology and evidence of genes conferring susceptibility to an illness with mixed features of schizophrenia and mania. Additionally, the study recommended the need for "alternative approaches to classification and conceptualization for psychiatric research."

The concept of co-morbidity presenting a formidable challenge to diagnosis has been considered on the international scene. The British Journal of Psychiatry (2010) (Goldberg, 2010) highlighted that problems with both DSM and ICD classifications include the high rates of co-morbidity. This is further substantiated by an assessment of literature (Rama Krishnan, 2005) where it was found that the majority of patients with bipolar I and II possess at least one co-morbid psychiatric or medical disorder. Lifetime psychiatric co-morbidity in bipolar I ranges from 50 to 70%. Of significance, there was reference to a study whereby axis II co-morbid personality disorders occurred in 28.8% of 52 remitted DSM-III-R bipolar patients. It was concluded that patients with bipolar disorder should be monitored for the development of co-morbid psychiatric and medical conditions. This should form the basis for 'greater diagnostic vigilance and more thorough diagnostic assessment' leading to treatment tailored specifically for the particular patient.

A study by Garno et al. (2005) using 100 bipolar I patients, using structured clinical interviews for DSM IV Axis I and cluster B Axis II disorders, illustrated that 30% of subjects met DSM IV criteria for Cluster B personality disorder. Thus the conclusion generated was that Cluster B personality disorders are prevalent co-morbid conditions in a substantial number of individuals, independently contributing to an increased lifetime suicide risk.

It should be noted that the additional diagnosis of Cluster C personality disorder is not unrealistic. Another evaluation by George et al. (2003) showed the prevalence of axis II disorders in 52 bipolar patients who were clinically remitted. The results showed that co diagnosis occurred in 28.8% or patients with Cluster B and Cluster C personality disorders more common than Cluster A. This study highlighted the need for further examination of this occurrence in bipolar spectrum patients to further 'clarify the linkage' between these disorders. Obtaining an accurate diagnosis is even more important for patients with psychiatric disability. This is highlighted in the study by Colom et al. (2004) who examined the efficacy of psychoeducation as an additional form of treatment in bipolar I patients with a co existing personality disorder, as opposed to those with bipolar disorder alone. Results showed that those in the psychoeducation group had a 'higher time-to-relapse' and a significantly lower mean number of total, manic and depressive relapses.

The purpose therefore of these reports is to illustrate the

very real problem currently encountered in diagnosing bipolar patients especially in the Caribbean setting and to hopefully, encourage creation of solutions for this dilemma. Better patient management can result if this perennial predicament in psychiatric diagnosis, with specific reference to bipolar disorder, can be resolved.

CASE STUDY 1

Background

Mr. C. J. is a thirty nine year old male of East Indian descent from Maracas, St. Joseph, presented to Adult Priority Care Facility, Eric Williams Medical Sciences Complex in May, 2010. He is single, has no children and is currently employed as a Labourer. He is of the Christian faith; more specifically Pentecostal but was previously a Hindu ten years ago. He is right handed.

Current problem

Mr. C. J was subsequently admitted to the medical ward due to ingestion of two 'mouthfuls' of bleach with water. This was preceded three days before by ingestion of bleach and water (to make about a ¼ cup). Before that, a quantity of bleach, approximately a teaspoon, mixed with a quarter cup of mouth wash was taken two days before, preceded by 'sleeping pills' (unknown quantity), the night before. At time of the interview (June 2010), the patient was still suicidal. He planned to do this by going deep in the forest once discharged from the hospital, drinking bleach and jumping off a precipice. He indicated that he would leave a suicidal note. With respect to the most recent suicidal attempt, patient stated that he was not planning to do this. He wanted to terminate his life because he did not want to live any more; claiming that 'people blame you for things that you never did.' He started feeling depressed and he recounted crying. He went to a private doctor in Curepe, Trinidad who gave him approximately (20 to 30) sleeping pills (unknown name) and referred him to the St. Joseph Psychiatric Clinic. This was the source of 'sleeping pills' which he used. The other substances (the bleach and mouthwash) were household items.

Patient indicated he was not drunk at the time and was not using any alcohol or drugs before the incident. He was feeling very sad at the time. He was alone when it occurred as he had been renting by himself for 3 years now. He did not try to contact anyone but Mr. M* (a pastor at his Church) who would normally visit him sometimes, saw him a few days before admission and suggested that he should go to the hospital. This was because the patient was visibly upset and in some discomfort after ingestion of those substances. There was no indication on the part of the patient that he was relieved to have survived the attempt. Patient attempted to kill himself two times previously.

Four weeks ago, patient recounted only sleeping during the day. His typical day at the time consisted of getting up at 6 am to eat breakfast then returning to sleep until 8 pm, after which he would watch television/movies until 2 am, then return to sleep until 6 am the following morning. This is in contrast to his usual sleeping pattern whereby he would sleep from 11 pm to 5:30 am. He felt as though he had lost weight (unsure of the quantity) but he definitely lost his appetite. He felt 'depressed', lost interest in women and in sports. Additionally, he did not feel like going out at all. He felt somewhat guilty or in some way responsible for what took place at work. He noted decreased energy, decreased concentration and felt that he could no longer feel happy. He said he felt like this four times before for varying reasons. Patient felt hopeless and indicated that he did not like to feel lonely. Also of significance, the patient did not experience increase in self esteem/feeling of importance, an excessive focus on achieving things or increased talking. He felt his thoughts racing only when he was feeling to kill himself. He did notice that he was easily distracted. He was not irritated easily.

Past psychiatric history

Patient said that for nine years now he noted times when he would feel extremely happy and energetic (especially around Christmas time) and then other times when he would be sad. During these periods of 'extreme happiness,' he felt 'invincible' and had more positive ideas, was more focussed on his work' and slept well. The patient was never hospitalised during these times and he was still able to work.

Medications

(Currently) Depakote 500 mg po am; 1 g po nocte, Paxil 40 mg po od, Diazepam 10 mg po nocte. Previously on Prozac (unknown dose).

Social history

He stopped drinking alcohol 9 years ago. Previously, he drank 6 beers once a week. Screening with 'CAGE' questionnaire did not suggest any alcoholic tendency, non smoker and no history of marijuana/cocaine use. He previously lived at home with his mother until 7 or 8 years ago when he was forced to leave because he changed his religion to Christianity. He moved to his Aunt and Uncle's house (maternal aunt). However, she died and his uncle verbally abused him. He sought aid at his younger brother's home. He stayed for three months and then left because he overheard negative comments about him while his brother and sister in law were conversing. He returned to his uncle's home for some time and then moved out 3 years ago. He went to rent by himself and this is where he currently resides. The pastor at his Church considers him a son, according to the patient, and is helping him pay his rent

Family history

He is one of 9 children; 7 boys and 2 girls ranging from 56 (oldest brother) to 30 years (youngest brother). He does not have a good relationship with one of his brothers (45 years) and one of his sisters (48 years) because firstly, he had changed his religion for which they did not approve and secondly, because he did not accept his family's request to get married.

Pre/perinatal history

He believes his father started to drink when he was born. He was told by his mother that he was a 'blue baby' because he could not breathe at the time of birth.

Mental state examination

Young, clean, tidy patient who was appropriately attired for a hospital setting. Mild psychomotor retardation was observed. Patient was quite co-operative. Speech was of normal volume, at times spontaneous flow but at other times a marked rapid flow of sentences. His mood was one of sadness and he seemed unsure of himself. His affect was congruent with mood but also constricted to some extent. In terms of thought form, there was a spontaneous

flow of ideas with an overproduction of ideas at times. Answers were relevant, logical and goal directed. Circumstantiality was evident at times. Regarding thought content, on evenings, obsessive rumination about killing himself was present. Perceptual disturbances were mini-mal. Hypnagogic auditory hallucinations were present in the past. Patient's cognition was good. His memory proved good with the exception of recall which was poor (1 out of 3 objects remembered). He has intellectual insight in that he is not sure what exactly is occurring but is aware something is not right. He believes he can be treated. Future plans are morbid; he wants to die.

Differential diagnoses

The differential diagnosis includes: bipolar II disorder (most recent episode depressed), mood disorder (secondary to general medical condition) or substance induced mood disorder. The axis II diagnosis which was made was dependent personality disorder.

Investigations performed were complete blood count (CBC) and blood film (to ascertain if there is perhaps an anaemia for example, macrocytic anaemia due to vitamin B12 deficiency), erythrocyte sedimentation rate (ESR)/C reactive protein (CR-P) (in case of underlying inflammation/infection), urinalysis, urine drug screen/toxicology, HbA1c, blood pressure testing, thyroid function tests, liver function tests and renal function tests. Imaging studies proposed include computer tomography (CT) scan of brain/MRI of brain (given his neurological history) and Chest X-Ray (given history of bronchitis).

The patient was managed with performance of investigations as outlined previously. He would then be reassessed to ascertain if there are any problems (for example, thyroid or CNS abnormalities) after acquisition of results of the blood investigations and imaging. Pharmacotherapy consisted of sodium valproate (mood stabilizer) 500 mg po am; 1 g po nocte, Fluoxetine (antidepressant) 20 mg po od (if fluoxetine is not available, paroxetine may be used as in this case: 40 mg po od) and diazepam 10 mg po nocte.

Ideally, psychotherapy in the form of cognitive behavioural therapy would be offered but this is not available as a public hospital service. The patient was discharged on the 21st of June, 2010. Suicidal ideations by now were 'more circumscribed' or narrowed and patient was referred to psychiatric outpatient clinic the subsequent week for further evaluation.

CASE STUDY 2

Background

Mr. A. B. is a 31 year old male prison's officer of African descent from Malabar, who was referred from Arima health facility on January 2nd, 2011. He is of Pentecostal faith and currently married.

Current problem

On arrival at the hospital, the patient was mute and crying. He also did not eat for the past 2 days. He experienced occasional aggression and immobility. The patient was previously well until 2 days ago. He attended church service with his family where he began to cry. After this, he refused to talk or eat. He lapsed into a crying mood occasionally during this period. He presented to Arima Health facility with an asthmatic attack and was subsequently referred for his strange behaviour. He was brought to the hospital by his wife who described his symptoms. She did not know the cause of his strange behaviour. The patient began to speak the day after admission. The patient described his feeling of depression as being associated with excessive guilt and stresses at work and home. He felt guilty about having multiple extra-marital sexual relationships. He also felt guilty about going to parties and using marijuana without his wife having knowledge of these acts. He was uncertain about wife's fidelity but not paranoid. He was unable to fall asleep and maintain sleep prior to hospitalisation. He lost approximately 5 to 6 pounds over the past month. He somewhat experienced a loss of interest in his day to day activities. His energy levels and concentration were normal. The patient did not ex-perience anhedonia but he had psychomotor agitation. He also has suicidal thoughts from time to time. Mr A. B. did not have any plans to commit suicide or knowledge of a method to achieve this. He thought it may be easier to die than to deal with his life. He had no previous attempts of suicide.

Past psychiatric history

Mr A. B. has a history of hypomanic episodes in the past. The patient experienced visual and auditory hallucinations on a few occasions which only occurred when he smoked marijuana. Mr A. B. had one previous hospitalisation at St. Ann's Psychiatric Hospital in 1999. The patient claimed to have been diagnosed with Temporal Lobe Epilepsy. The patient has a history of drug abuse, hypomanic episodes and mood disturbances.

Social history

Alcohol, approximately once per month. He has about 5 drinks (usually beers). He used marijuana and cigarettes from the age of 13; 10 cigarettes per day. He stopped for approximately 9 years and restarted using the drugs 1 year ago. Currently, he smokes 20 cigarettes per day and 3 joints of marijuna per week on average but states that he has not used marijuana for the past 2 weeks. He lives with his two children ages 5 (female) and 3 (male) and his wife (aged 29). He has no family history of psychiatric illnesses or sub-stance abuse. The patient has no knowledge about his prenatal, natal and postnatal history.

Mental state examination

Well dressed and groomed patient. His mood was described as depressed but 'getting better.' His effect was neutral generally although he seemed depressed when speaking about certain topics. Speech was soft yet audible and there was reduced spontaneous speech. It was rational and logical with no loosening of associations, tangentiality or obsessions. In terms of cognition, patient was oriented in time, person and place and had good memory, attention, concentration and general knowledge. He displayed good judgement and abstract thinking and has intellectual insight.

Differential diagnoses

These include: bipolar 1 disorder, bipolar 2 disorder, major depressive disorder, conversion disorder, substance induced psychosis, substance abuse, schizophrenia and underlying borderline personality disorder. Investigations were as follows: complete blood count, renal function tests, liver function tests, thyroid function tests and ELISA test for HIV status. An electro-encephalogram and a CT scan (head) were also listed in the patient's management. Patient was admitted to the ward. His treatment consisted of haldol, cogentin, risperidone and valium.

DISCUSSION

Based on the patient's history in Case Study 1, the suicidal risk based on the patient's risk factors and using the 'Sad Persons Screening Tool For Suicide Risk; Hamilton 1987,' was high. Risk factors included male gender, depression, previous attempts, lack of social support, no spouse, co existing illnesses (bronchitis) and feelings of hopelessness. Moreover, at the time of the interview, the patient was still expressing suicidal ideations and had obsessive ruminations of suicide. This was clearly an indication for hospitalisation. The patient satisfied the DSMIV-TR criteria (>5 out of 9 criteria) for a major depressive disorder (Sadock and Sadock, 2005). The definitive diagnosis was given, however, based on the past history of hypomanic episodes. The patient had no accompanying psychotic features, was never hospitalized during these episodes and social and occupational functioning were not impaired during these episodes. Since subsequent laboratory tests and imaging were unremarkable, the disorder could not be attributed to a general medical condition or to substance abuse.

In terms of the suicidal attempt, based on the absence of a plan, choice of substances and method of execution of the suicidal attempt and given the precipitating factor, there is an indication of some underlying unresolved personal and interpersonal issues. The additional diagnosis of Dependant personality disorder (Cluster C) was confirmed after further evaluation of the patient. Based on the DSM-IV Criteria for Dependent personality disorder (Sadock and Sadock, 2005), the patient satisfied 5 of the criteria. He needed others to take responsibility for major areas of his life (attributing his present status to the treatment he received from his family). He did not confront his uncle who verbally abused him and accused him yet he continued to live there for some time (difficulty expressing disagreement with others because of fear of loss of support). He is uncomfortable when alone and does not like to 'feel lonely.' He was never fully independent although working and had to be housed by varying members of his family. Now, the pastor, Mr. M, who visits him, assists with his rent.

In the second case study, the patient's impulsive behaviour as demonstrated by his indiscriminate sexual practices and substance abuse and his presentation of affective instability led to the possibility of an underlying borderline personality disorder. He was mildly suspicious of his wife's infidelity and this may be an example of projection, whereby he directs his unacceptable feelings and thoughts about his own actions onto his wife and uses this to cope with his guilt about his infidelity. However, these aspects account for only three of the criteria (Sadock and Sadock, 2005) (namely unstable and intense interpersonal relationships alternating between extremes of idealization and devaluation, affective instability due to a marked reactivity of mood and impulsivity in at least two areas which are potentially self

damaging) needed for diagnosis. Five or more are needed for diagnosis.

The above examples highlight how co-morbid disorders can complicate a diagnosis. This corroborates studies done by Colom et al. (2004), Rampersad (2007) and Newton-Howes and Johnson (2006), linking personality disorders with bipolar disorders. However, it is recommended that comorbid personality disorders should not be diagnosed in patients who are not yet in remission (Colom et al., 2004). This differs from the assessment done in the case studies whereby the patients were still in-patients at the hospital when evaluated. Also, comorbid personality disorders will need a longer time for evaluation of the patient and is not often apparent from the first interview. This may in part be due to many overlapping symptoms.

Additionally, in one study (Garno et al., 2005), lifetime substance abuse and previous suicide attempts were also used as diagnostic indications for Cluster B personality disorders. However, no evaluation by way of questioning was done to rule out other personality disorders in that study. Authors also stated that distinguishing between bipolar disorder and Cluster B personality disorders still proves to be 'a source of unresolved clinical controversy.' Of significance, the patient in the first case study was evaluated as having a Cluster C personality disorder (Dependent Personality Disorder). This provides further validation that Cluster B and C personality disorders are more prevalent in persons with bipolar disorder. This underscores the reality that diagnosing patients with psychiatric disorders, primarily in the case of dual diagnoses, can become quite complex.

Another interesting point to note was that a differential diagnosis for the patient in Case Study 2 was Conversion disorder. This disorder is characterized by involuntary alteration or limitation of voluntary motor and sensory functioning that result from voluntary psychological conflict or need (Sadock and Sadock, 2005). The patient presented with mutism and immobility along with a psychological stressor (extreme guilt about infidelity). However, this was ruled out since he had a more apt axis I diagnosis (Bipolar II). This shows the reality of mixed or atypical presentations which exacerbates the dilemma of diagnosing bipolar patients.

These patients presented in the case studies were affected by varying socio-cultural factors that are uniquely Caribbean in nature. In the first case study, the patient's psychosocial stressors stemmed from conflict with his family. This was as a result of his change of religion and his non compliance with the status quo of marriage in an Indo-Caribbean family to a girl of whom the family approves (Rampersad, 2007). Additionally, unresolved separation issues are present and this can be linked to the patient's separation from his mother to whom he was once very close. Coupled with his pre and perinatal history creates an individual with a presentation that

cannot be wholly accounted for by a single diagnosis.

In the second case study, the patient grew up in a home with an absent father figure. This may have affected the patient psychologically from a young age. Sharpe (1996) noted the following: "A study conducted with students from the University of the West Indies suggested that Caribbean men have poor emotional relationships with their children. As a result, young boys may view family patterns such as matriarchal households, male absenteeism, and extramarital relationships as norms and continue them as adults" (JRank, 2011). In the Caribbean, it is common to find matriarchal households. The 'Caribbeing psychiatry' concept (Maharajh, 2010) is thus a fitting description for what is needed to aid diagnosis in bipolar patients especially in a Caribbean setting.

Furthermore, it is evident that the current classification systems are not adequate for the varying psychiatric presentations and thus further add to the confusion in diagnosis. Some studies (Gangdev, 2007; Maharajh, 2010; Goldberg, 2010) have shown that emerging differences in bipolar presentations and also co-morbidity challenge the usefulness of the DSM IV in making accurate diagnoses.

Although in the first patient (case study 1) there were no substance abuse issues, this was not the case for the patient in case study 2 who was a cannabis user from the age of thirteen with intermittent breaks from the drug. This can make the diagnosis of bipolar disorder more complex. As noted in a previous study (Konings and Maharajh, 2006), the current DSM IV does not acknowledge mood disorders as an effect of cannabis use. However, finding from this study suggested otherwise. Therefore, it is clear that a major flaw in diagnosis can result in a patient who is a cannabis user if there is strict adherence to the DSM IV.

While it is not possible to examine the patient's DNA, it should be noted that advances in genetics (Craddock et al., 2006) are showing that genes for two major psychiatric diagnoses-bipolar disorder and schizophrenia are stealthily undermining the power of discrimination on the part of the psychiatrist. This complicates diagnosis and can account for many atypical presentations of psychiatric disease. This has important implications in Mr. C. J and Mr. A. B's prognosis. With appropriate treatment, prognosis can be favourable but according to a meta-analysis (Newton-Howes and Johnson, 2006), combined depression and personality disorder is associated with a poorer outcome than depression alone. Thus, given the co-existence of bipolar disorder with his personality disorder, perceived 'loss' of a relationship (in the form of a colleague or spouse) and the lack of free access to psychotherapy (cognitive behavioural/insight oriented) at the hospital, it is likely that only partial recovery may be possible. It is crucial therefore that patients are thoroughly assessed and accurately diagnosed since this impacts on the ultimate management of the patient and can contribute to or worsen psychiatric disability.

Conclusion

It is therefore clear that diagnosis of bipolar disorder is made increasingly difficult due to a number of factors, primarily co-morbidity, socio-cultural variations, inadequacy of current DSM IV guidelines for changing phenolmenology, cannabis use and genetics. It is evident that there is need for more services available in hospital setting such as psychotherapy to more effectively and holistically manage psychiatric patients, especially those with dual diagnoses who may benefit from a better prognosis. Moreover, a closer inspection of any links between personality disorders and bipolar disorders and evaluation of the most effective time for diagnosing co-morbid conditions would aid the diagnostic process significantly. A closer inspection and modification of the DSM to incorporate some of these factors is needed if this dilemma of diagnosis is to be resolved. In the final analysis, it is evident that these factors can have a profound impact on prognosis and ultimately psychiatric disability.

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Full Length Research Paper

Psychosocial profile of students from public schools of the city of Tubarão, Santa Catarina, Brazil with positive indicators for attention deficit hyperactivity disorder (ADHD)

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The objective of this study was to verify the prevalence of positive indicators for attention deficit hyperactivity disorder (ADHD) in children of public schools throughout the urban perimeter of Tubarão, Santa Catarina (SC). The study population composed of students enrolled in the first grades of 10 schools from the city of Tubarão. First, the teachers filled a standard questionnaire defined by Diagnostic and Statistical Manual of Mental Disorders-Fourth Edition (DSM-IV). Next, the caretakers of children that were screened positive were invited for the application of a psychosocial questionnaire. Later, consultations with specialists were made in order to confirm the disorder. Of the 908 students assessed, 8.59% had a positive screening for ADHD, with a boy:girl ratio of 2,1:1. The predominance of ADHD symptoms of inattention was most prevalent (4.29%). The definitive diagnosis of ADHD was identified in 50% of the cases. The application of the DSM-IV questionnaire results in a screening of possible ADHD cases. However, to confirm the diagnosis, it is necessary that a consultation should be done with a specialist, since only 50% of the cases were confirmed.

Key words: Attention deficit, hyperactivity, impulsivity, students, prevalence.

INTRODUCTION

The attention deficit hyperactivity disorder (ADHD) is one of the most common neuropsychiatric disorders of childhood and is responsible for several types of social damage, especially learning disabilities (Possa et al., 2005). The first references in literature about this disorder refer to the mid-nineteenth century, and since then, its nomenclature has been undergoing continuous changes (Rohde and Halpern, 2004). In 1940, it received the designation of "minimal brain damage" (Rohde and Halpern, 2004), it was classified as "hyperkinetic reaction of childhood" (Diagnostic and Statistical Manual of Mental Disorders, DSM-II Second Edition, 1968) (American Psychiatric Association, 1968), and it was named "hyperactivity disorder with attention deficit" (DSM-III, Third Edition, 1980) (American Psychiatric Association, 1980). But the DSM-III-R (Third Edition Revised) framed the disorder as "hyperkinetic disorder" (American Psychiatric Association, 1987), and currently the most widely used classification systems in psychiatry are the International Statistical Classification of Diseases and Related Health Problems (ICD-10) (Organização Mundial da Saúde, 1993) and the DSM-IV (Fourth Edition) which classify the disease as hyperkinetic disorder and ADHD, respectively (American Psychiatric Association, 1994). These two classifications have more similarities than

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differences in their diagnostic guidelines, although they use different names (Rohde and Halpern, 2004).

ADHD is characterized by a persistent pattern of inattention and/or hyperactivity and impulsivity, represented by a deficit in the motor system, a low perception and a cognition disorder, affecting the learning of children with adequate intellectual potential, and resulting in functional impairment (Rohde and Halpern, 2004; Vasconcelos et al., 2003; Amaral and Guerreiro, 2001; Guardiola et al., 2000). Children with ADHD have difficulty in sustaining attention due to agitation and restlessness, which mostly represent hyperactivity and impulsivity (Graeff and Vaz, 2006), more frequent and intense when compared with other children of similar age and also of the same intellectual level (Poeta and Rosa Neto, 2006). This reflects significant impairment in social functions that include difficult relationships with family and friends, academic (low school performance) or professional, causing negative effects on self-esteem of children and adolescents, as well as the abuse of drugs and criminal behavior that may persist into adulthood (Poeta and Rosa Neto, 2007; Mello and Rosa Neto, 2005).

According to the DSM-IV, symptoms must be present in at least two situations, such as home and school, to meet the diagnostic criteria for ADHD (Kaplan et al., 1990). Symptoms usually begin before the age of seven (Poeta and Rosa Neto, 2007), although most are only diagnosed at later stage (Poeta and Rosa Neto, 2004). In many cases, the disorder is only recognized when the child enters school, because this is the period in which the difficulties of attention and restlessness are more frequently detected by teachers, when comparing with children of similar age (Poeta and Rosa Neto, 2007).

Children with ADHD are agitated, show emotional instability and are explosive and irritable (Kaplan et al., 1990). They do not focus on one activity at a time, they have difficulties in academic organization, failing to follow instructions and often require extra attention from their teachers. Besides the difficulty in maintaining a friendly relationship with other colleagues and, at home, they often cannot complete the tasks requested by parents (Kaplan et al., 1990; Poeta and Rosa Neto, 2004). Unnecessary body movements, impulsivity, anticipation of the answers, difficulty waiting one event, as well as school failure and motor disorders of balance, sense of time and space are symptoms that accompany the disorder (Poeta and Rosa Neto, 2004).

The prevalence of ADHD varies around 5% and may vary depending on the methodology used in the study and also on the population investigated (Poeta and Rosa Neto, 2007). In Brazil, studies have shown a prevalence of ADHD which varies from 3.5 to 18% among school children (Poeta and Rosa Neto, 2007). The disorder is most common in boys, predominantly hyperactivity symptoms, while in girls, the prevailing symptom is inattention (Antony and Ribeiro, 2004).

Despite being a frequent disorder in children, is being increasingly diagnosed in adolescents and adults, reflecting that the pathology is not restricted only to childhood (Freire and Pondé, 2005).

Approximately 30 to 70% of the children maintain the symptoms in adulthood, and it is estimated that between 0.3 to 3% of the adult population is affected by ADHD (Silva et al., 2006). Often, ADHD is associated with other psychiatric disorders, especially mood disorders, anxiety disorders and other disruptive disorders of behavior, such as conduct disorders, which generally indicates a more serious problem with bad prognosis (Possa et al., 2005; Cataldo et al., 2003; Rohde et al., 2000).

Despite the large number of previous studies, the precise causes of ADHD are not fully understood (Cataldo et al., 2003). The main factors implicated in the etiology are of genetic, biological and psychosocial nature (Rohde and Halpern, 2004). Epidemiological studies do not only demonstrate a significant familiar recurrence, but also a very high heritability for this disorder (Roman et al., 2002). It is believed that ADHD occurs by multiple genes of small effect that, together, confer vulnerability to the disorder (Rohde and Halpern, 2004). Changes in transporter genes (DAT1) and dopamine receptor (DRD4) are involved in susceptibility to ADHD, although negative results are also reported, suggesting that the disorder is due to a condition of multifactorial origin, both genetic and non-genetic (Rohde and Halpern, 2004; Pereira et al., 2005).

Psychosocial factors that interfere with adaptive functioning and emotional health of children, such as family disagreements, presence of mental disorders in parents, low social class, a very numerous family, criminality of parents and paternal psychopathology, may have an important role in the emergence and maintenance of the disease (Rohde and Halpern, 2004). The relationship of ADHD with complications in pregnancy and childbirth has also been reported (Poeta and Rosa Neto, 2006). Maternal exposure to smoking and alcohol during pregnancy and depression may also be predisposing factors for the disorder (Poeta and Rosa Neto, 2006).

The diagnosis of ADHD is mainly clinical and is based on clear criteria, defined from the classification systems DSM-IV and ICD-10 (Graeff and Vaz, 2006). Children with this disorder are easily recognized in clinics, schools or at home, although there are no laboratory tests, imaging or profiles on neuropsychological tests that are pathognomonic of the disorder (Fontana et al., 2007; Amaral, 2000).

ADHD is thus a major problem given the implications, ranging from difficulties in school development to psychological and social problems in the life of the child, adolescent or adult (Poeta and Rosa Neto, 2004).

Considering the importance of the subject, this work had the purpose of conducting an epidemiological study of ADHD in children of public schools from the urban

Table 1. Distribution of the study population divided by grade and distribution of the sample divided between male and female subjects.

School	Total	2nd grade	3rd grade	4th grade	ADHD	Male	Female
A	116	41	40	35	5 (4.5%)	4	1
B	178	48	66	64	17 (9.5%)	12	5
C	66	21	20	25	7 (10.6%)	5	2
D	58	16	24	18	7 (12.1%)	3	4
E	52	16	20	16	12 (23.1%)	9	3
F	23	9	7	7	4 (17.4%)	2	2
G	111	38	39	34	2 (1.8%)	2	0
H	65	21	21	23	11 (16.9)	6	5
I	117	40	49	28	5 (4.3%)	2	3
J	122	44	51	27	8 (6.6%)	8	0
Total	908	294	337	277	78 (8.59%)	53	25

perimeter of Tubarão, a city located in the State of Santa Catarina (SC), Brazil. The benefits of this research, in relation to the children involved, included early identification of difficulties in learning, greater possibility of intervention in students with positive indicators for the problem and guidance for parents and teachers about the disorder to further improve their teaching methods. The early recognition of ADHD and proper management of this condition can redirect the educational and psychosocial development of most of these children.

METHODOLOGY

The study was cross-sectional descriptive. The sample consisted of students enrolled in basic education from second to fourth grades of public schools in Tubarão (SC), located within the city limits, for a total of 908 students.

The study was approved by the ethics and research committee at the University of Southern Santa Catarina.

First stage of the study

In the first screening, 10 schools from the urban perimeter were selected from the list of public schools, which was provided by the city office. Meetings were held with teachers and principals in order to define the voluntary participation in the survey and to sign an informed consent. The teachers were given a protocol with behavioral characteristics consistent with ADHD, according to DSM-IV, and selected students who might experience the disorder, for tracking purposes. Through interviews based on the script, an evaluation process that all respondents answered the same questions was established, with the same practical examples. This caution was predetermined to ensure that interviews were not different, as to increase the reliability in their results. But despite the care to ensure a possible diagnosis, this study took into account the subjectivity of the criteria, and therefore deemed it necessary to make an interview with a relative caretaker. The questionnaire contained 18 questions of the criterion A of DSM-IV and the students who had at least six of the nine criteria for inattention, or six of the nine criteria for hyperactivity/impulsivity, were referred to the next step.

Second stage of the study

The caretakers of the students who were screened as positive for symptoms of ADHD received written invitation to attend the school to participate in the interview and the application of the psychosocial questionnaire from Poeta and Rosa Neto (2006). Those who did not attend the initial date received further invitations. During the interview, questions about pregnancy, childbirth, psychomotor development in early life, socioeconomic conditions and child behavior were addressed. At the end of the interview, the family received clarifications about the disorder, and so did the teachers and school directors.

Third stage of the study

The pre-selected students were invited to attend the breast clinic of Universidade do Sul de Santa Catarina (UNISUL), accompanied by a responsible adult, for evaluation by a specialist and for refinement of data and definitive diagnosis of ADHD.

The collected data were digitized and analyzed using the software Epidata version 3.1 and Epi Info version 6.04.

RESULTS

From the questionnaires completed by teachers, 78 (8.59%) possible cases of ADHD were identified. Table 1 shows the distribution of cases according to the grades, schools and gender. The analysis revealed that school E had the highest number of possible ADHD patients, with 23.1% of cases, whereas school G had the lowest rate, 1.8% (Table 1).

The age range of children identified with ADHD by teachers ranged between 7 and 14 years. The average age was 9.18 years with standard deviation of 1.6 years. Regarding the shift that the students screened as positive for ADHD were enrolled, 69 (88.5%) studied during the afternoon, while 9 (11.5%) studied during the morning. The sample was constituted predominantly by male individuals, at a ratio of 2.1:1 (67.9% boys and 32.1% of females) (Table 1).

Table 2. Frequency of ADHD subtypes found in the first screening, where n is the number of subjects.

ADHD subtype	n	Frequency (%)
Inattentive	39	50.0
Combined	31	39.70
Hiperactivity/Impulsivity	8	10.30
Total	78	100

The subtype of ADHD with predominance of inattention was recognized in 50% of the cases reported by teachers, the combined subtype in 39.7% and lastly, the subtype with predominance of hyperactivity/impulsivity in 10.3% of the children (Table 2).

The psychosocial questionnaire (second part of the study) was conducted with the person responsible for the child in an interview that had been previously scheduled and held at the school. Only 56 of the people responsible for the children attended, with 47 (83.9%) interviews conducted with the child's mother, 4 (7.1%) interviews with the paternal or maternal grandparents, 3(5.4%) interviews with the child's father, 1 (1.8%) interview with the child' elder brother of 18 years of age and 1 (1.8%) interview with another type of responsible.

On the gestation of the child, it was observed that 42 (75.0%) were normal pregnancies, whereas 14 (25.0%) were considered high-risk pregnancies. In high-risk pregnancies were included conditions such as risk of miscarriage, preeclampsia, eclampsia, bleeding in the third quarter and emotional shocks (either by fighting or violence) caused to the mother during pregnancy.

During pregnancy, 41 (73.2%) mothers were taking medication, 7 (12.5%) were smokers, 2 (3.6%) were users of illicit drugs, 1 (1.8%) was alcoholic and 5 (8.9%) used some continued use of medication.

Regarding the time of pregnancy, 2 (3.6%) were less than 32 weeks, 8 (14.3%) were greater than 32 and less than 37 weeks, 41 (73.2%) were considered term pregnancies (between 37 and 42 weeks) and 5 (8.9%) exceeded 42 weeks.

Regarding the type of delivery, 33 (58.9%) children were born by normal deliveries and 23 (54.3%) were born by cesarean section. Three mothers (5.4%) had some type of complication during delivery. Of the cases interviewed, 3 children (5.4%) had one of the perinatal complications. The age of mothers at delivery was less than 20 years in 15 cases (26.8%), from 20 to 29 years in 26 cases (46.4%), 30 to 39 in 11 cases (19.6%) and 40 years or more in 4 cases (7.1%).

With respect to children's weight at birth, 8 (14.3%) weighed less than 2,500 g, 21 (37.5%) weighed between 2,500 to 2,999 g, 24 (42.9%) weighed between 3,000 and 3,999 g and 3 (5.4%) weighed more than 4,000 g at birth. Regarding breastfeeding 15 (26.8%) children were not breastfed, 15 (26.8%) were breastfed until three months

old, 8 (14.3%) were breastfed for more than three and less than six months, 6 (10.7%) were nursed for a period exceeding six months and less than 12 months, while another 12 (21.4%) were breastfed beyond one year of life. The introduction of foods of more solid consistency occurred before three months of living in 4(7.1%) of the students, between three and six months of life in 19 students (33.9%), between six and twelve months in 29 students (51.8%), and after a year old in 4 students (7.1%).

The psychomotor development of the students in the first years of life took place as follows: first words were spoken before nine months of age for 11 (19.6%) children, 21 (37.5%) from nine to 12 months, 21 (37.5%) from 12 to 18 months and 3 (5.4%) only after 18 months of life; as for the march, the first steps were noticed before the age of ten months in 7 (12.5 %) children, 39 (69.6%) from 10 to 15 months, 9 (16.1%) from 16 to 21 months and only in 1 (1.8%) when the first steps were seen after 21 months of life.

The monthly family income was divided by numbers of minimum wages. In 14 (25.0%) family income was below the poverty level, in 40 (71.4%) monthly income was between 1 and 5 minimum salaries, in 1 (1.8%) monthly income was between 5 and 10 and also in 1 (1.8%) of the cases the family had a monthly income above 10 minimum wages (minimum wage at the time of the research was R$ 465.00). Also, 85% of fathers and 57.2% of mothers contributed to the family income at the time of the interview (Table 3).

Regarding the level of parental education, it was observed that 39.3% had completed between the first and fourth grade of elementary school, 25% had completed between the fifth and eighth grade, 28% had completed at least one grade of high school and 1.8% had completed college (Table 3). 30.4% of mothers had completed at least one grade between the first and fourth grade of elementary school, 42.9% had completed between the fifth and eighth grade, 16.1% had completed at least one grade of high school and 5.3% had completed college (Table 3).

At home, 39 (69.6%) children had agitated, anxious and nervous behavior, while 17 (30.4%) children were quiet; 4(7.1%) children did not have a good relationship with their parents and were aggressive; 52 (92.9%) were loving children, educated and respected their parents; finally, 41 (73.2%) conformed well to the tasks requested by their relatives and 15 (26.8%) did not have this behavior.

Of the 78 children pre-selected at the beginning of the study, 32 (41%) attended the breast clinic of UNISUL to perform the third stage of the study: evaluation by a specialist. Of these, 16 cases were diagnosed with ADHD by medical consultation, which represents 50% of the sample. Major diagnoses were: conduct disorder, mental retardation, learning disabilities, social risk and family management problems.

Table 3. Level of schooling and parental profession, where n is the number of subjects.

Variable	n	Frequency (%)
Father schooling		
1 to 4° series	22	39.3
5 to 8° series	14	25
School	16	28.6
Advanced course	1	1.8
Unknown	3	5.3
Total	56	100
Mother schooling		
1 to 4° series	17	30.4
5 to 8° series	24	42.9
School	9	16.1
Advanced course	3	5.3
Unknown	3	5.3
Total	56	100
Father profession		
General service	44	78.6
Professional liberal	3	5.3
Retired	1	1.8
Unknown	8	14.3
Total	56	100
Mother profession		
Housewife	21	37.5
General service	31	55.4
Professional liberal	1	1.8
Unknown	3	5.3
Total	56	100

DISCUSSION

The diagnostic criteria of DSM-IV are without doubt the most used means for diagnosis of ADHD. We identified 78 (8.59%) possible cases of ADHD among the population of 908 students from municipal schools. As the sample came from students identified by teachers, this may have underestimated or overestimated the prevalence of symptoms.

The percentage of possible cases of ADHD found in this study was similar to many other studies (Possa et al., 2005; American Psychiatric Association, 1994; Poeta and Rosa Neto, 2007; Freire and Pondé, 2005; Souza et al., 2001), although, the prevalence of ADHD reported in the literature varies in a very wide range. The age range of children identified with ADHD by teachers varied greatly, with children aged seven to fourteen years of age, and the predominant age being eight years old; the grades also varied, with children enrolled from second to fourth grade of elementary school.

The age of the population studied can exert important influence on the prevalence of ADHD. According to Scahill and Schwab-Stone (2000), the most common age of diagnosis occurs at seven and/or eight years, with increasing decline of the prevalence after this age. This information corroborated with the study, where prevalence was higher in students with eight years of age.

Predominance of positive indicators was observed for ADHD in males, with a ratio of 2.1:1, in agreement with literature data (Szatmary et al., 1989). The study of Szatmari et al. (1989), which examined a population of 2,687 individuals, aged 4 to 16 years in Canada, found a prevalence of 9.0 to 3.3% of boys and girls, a ratio of about 2.7:1.

The subtype of ADHD with a predominance of inattention was recognized in 50% of cases reported by teachers, the combined subtype in 39.7% and finally the subtype with a predominance of hyperactivity/impulsivity in 10.3% of the students, which is consistent with the study of Freira and Pondé (2005). However, other studies show that the combined type is most common in school children and the hyperactive type is the rarest of the three, as evidenced in the sample of Montiel-Nava et al. (2002) using the Conners scale with students aged 6 to 12 years in Venezuela. The prevalence was 5.7% for the combined subtype, 1.4% for the inattentive subtype and only 0.35% for the hyperactive subtype.

According to Rohde et al. (1998), the prevalence of ADHD varies widely depending on the type of sample, instruments and diagnostic criteria used and also the source of information obtained from parents and teachers in the process of diagnosis. However, there seems no reason to think of a difference in the prevalence of ADHD according to geographical distribution, since there is no information relevant to that topic in the literature (Freire and Pondé, 2005).

In analyzing the psychosocial questionnaire, it appears that there are several prenatal, perinatal and postnatal factors that may be associated with manifestations of attention deficit disorder and hyperactivity. According to Barkley (2002), mothers who have any complications during pregnancy or childbirth, are more likely to give birth to children with ADHD. Problems during pregnancy may interfere with normal development of the fetus and cause ADHD (Barkley, 2002). However, it should be noted that children who had a normal development during intrauterine life, without risk or complication may also have hyperactivity or learning difficulties during childhood or even adulthood (Poeta and Rosa Neto, 2006).

Montiel-Nava et al. (2002) showed that 82.5% of mothers of children with ADHD in their study showed no perinatal complications, corroborating the findings of this study, in which majority of mothers who were interviewed did not present any complication during pregnancy or childbirth.

Pineda et al. (2003) in a sample of 200 children identified the most common risk factors during pregnancy of the mother: risk of miscarriage (20%), hemorrhage at the

the third quarter of pregnancy (18%), hospitalization during the first months (17.2%). Such pathologies were also identified in this population, with 25.0% of the sample considered to be high-risk pregnancies.

Of mothers who had used any drug or continued use of medication during pregnancy, smoking was prevalent, reaching 26.8% of pregnant women. Cigarette smoking appears to contribute to the emergence of ADHD in children of smoking mothers, as the literature sources cite the maternal smoking and alcohol consumption as prenatal risk factors (Shapiro, 2002).

Vaginal delivery was predominant in the sample, which resembles the study of Poeta and Rosa Neto (2006), with values of 64.5%. Magalhães et al. (2003) suggest that a significant proportion of premature infants (19.4%) had indicators for attention deficit hyperactivity disorder and other psychiatric comorbidities during school age, such as conduct disorders. This study also found associations of preterm birth and indicators for ADHD similar to those of the authors.

With regard to psychomotor development, most of the students spoke the first words in the average expected age, which ranges from 9 to 12 months of age. However, in a significant proportion (42.9%), the pronunciation of the first words took place after the expected age. This data corroborates the research of Gupta and Ahmed (2003), in which a speech delay was detected in 48.6% of the identified group of ADHD. As for the ability to match, most of the students identified with ADHD took the first steps in the age range expected (10 to 15 months). Studies cite the slow development of motor coordination as one of the early symptoms of ADHD (Poeta and Rosa Neto, 2007).

Szatmary et al. (1989) found an association of significant psychosocial variables with ADHD, such as low income, crowded living conditions and family dysfunction. The present study identified a relationship between low socioeconomic status to behavior problems and learning disabilities in children, since in most identified cases the monthly rent was between one and five minimum wages, with a higher prevalence in poor families. The same could be seen in the population of Newcorn et al. (1994), which assessed children from a lacking public school, identifying a prevalence of 26%, contributing to that certain psychosocial factors, such as low income, are associated with the diagnosis of ADHD.

It is also worth mentioning other psychosocial factors related to ADHD: the education level and occupation of parents, family abandonment by the father or mother, household crowding and history of psychiatric illness of parents (Szatmary et al., 1989; Barkley, 2002). Some of these data were confirmed in this investigation. However, Barkley (2002) believes that these factors cause only a slight increase in risk for the disorder and by itself does not trigger ADHD.

Anxiety, restlessness and nervousness of the children were other common symptoms reported by the family during interviews. The study of Poeta and Rosa Neto (2002) goes in the same direction, since children with ADHD are more prone to anxiety disorder when compared with other children without the disorder.

Other comorbidities related to ADHD were also mentioned, although less common: the conduct disorder, disorder of coordination, anxiety and depression. Their presence is relevant in people with ADHD, recommending the need for closer monitoring (Poeta and Rosa Neto, 2002).

After the child has passed by the medical examination and evaluation by a specialist, it was observed that the number of children confirmed with ADHD was inferior to that previously established with the questionnaire, as 50% of cases were confirmed; however, it is important to note that from the first group, only 41% of children attended for assessment with the specialist, which, therefore, may have underestimated or overestimated the actual value of the confirmations.

Wobraich et al. (1998) demonstrated the risk of using only the questionnaire of symptoms of ADHD in a study of 4,323 students, aged 5 to 12 years, in which the isolated assessment of symptoms by questionnaires completed by teachers, found a prevalence of 16.1% of ADHD. With the inclusion of other diagnostic criteria of DSM-IV, the prevalence fell to 6.8%, showing that satisfaction just for the symptoms is insufficient for the diagnosis of ADHD. So, in summary, information collected through the symptoms should be supplemented with a complete and careful clinical history, which includes an evaluation of functional consequences of children's behavior (Wobraich et al., 1998).

The study by Rohde et al. (1998) reported extremely low values, as 0.5%. Baumgaertel et al. (1995), in a study of school children in Germany, found prevalence values of 17.8%. Another example of high prevalence is the study by Fontana et al. (2007), who found values of 13.0% in a research conducted in four public schools in the state of Rio de Janeiro.

Conclusion

Males were more affected than females and the most prevalent subtype was the predominant inattentive. The psychosocial evaluation obtained results similar to other studies found in literature and the identified differences may be due to the instruments used and, especially, according to the source of information obtained through the process of diagnostic evaluations by parents and teachers. The study also showed that after specialized medical evaluation, the prevalence of children effectively diagnosed with ADHD was reduced, since the application of the DSM-IV questionnaire results in a screening of possible ADHD cases. However, to confirm the diagnosis, a consultation with a specialist is necessary, since only 50% of the cases were confirmed.

The benefits of this research, in relation to the children involved, included the early identification of learning

disabilities, the greater possibility of intervention in students with positive indicators for the problem and guidance for parents and teachers about the disorder to further improve their teaching methods. The early recognition of ADHD and proper management of this condition can redirect the educational and psychosocial development of most of these children.

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Full Length Research Paper

Awareness and attitude of health care workers in a teaching hospital in southwestern Nigeria towards nosocomial infections

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Despite advances in health care system, Nosocomial infections (NIs) still remain a preventable disease threatening public health. This study assessed awareness and attitude of health care workers in LAUTECH teaching Hospital Osogbo towards Nosocomial infections. Descriptive cross sectional study among hospital workers using multistage sampling method was used. Research instruments were semi structured self administered and pre-tested questionnaires, and data analyzed using the SPSS software. Eighty three (91.2%), 77 (84.6%) and 59 (64.8%) of the health workers were aware of patients, hospital staff and hospital environment, respectively as causes of nosocomial infections. Thirty one (34.1%) were aware of presence of their hospital policy on control of nosocomial infections, while 36(39.6%) were aware of presence of infection control committee in the hospital. Twelve (13.2%) has ever notified nosocomial infection. Preventive practices towards nosocomial infections were favourable for hand washing, and unfavourable for self reporting to the staff clinic when sick. There is no significant association between ever reported or willingness to report nosocomial infections and awareness of hospital policy or presence of infection control committee in the hospital (P > 0.05). There is a need to raise awareness on nosocomial infections among health care workers as well as preventive measures against these infections.

Key words: Nosocomial infection (NIs), infection control committee, health care workers (HCWs).

INTRODUCTION

Nosocomial infections (NIs) are a significant and serious public health problem throughout the world (Alvarado, 2000). These are infections occurring in a patient in a hospital or other health care facility in whom the infection was not present or incubating at the time of admission. This includes infections acquired in the hospital but appearing after discharge, and also occupational infections among staff of the facility (WHO, 2002).

Several studies have however reported a prevalence of Nosocomial infections between 5 and 10% (Somwang et al., 2007; Olawale et al., 2011; Pittet et al., 2008; Hopmans et al., 2007). These infections pose serious threat to hospital admissions and those who work or dwell around hospital premises and often increase costs of health care both for patients and the health services. Despite advances in the health care system, the threat to public health due to NIs still remains. NI also caused the suffering of about 1.4 million people across the world at any given time (Allegranzi et al., 2007). NIs are estimated to cause or contribute to nearly 80,000 deaths annually in the United States (Rosner, 2000). They are also regarded as a substantial factor in 3% or 15,000 deaths per year in Britain (Comptroller and Auditor General, 2000).

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Many Nosocomial infections are caused by pathogens transmitted from one patient to another, by way of health care workers who do not routinely observe simple hospital hygiene measures like handwashing, and also between patients. Susceptibility to these infections has been associated with use of invasive devices, extremes of age, immune status and infection control practices (Amita et al., 2003). Most nosocomial infections are thought to be transmitted by the hands of health care workers. It has long been known that hand hygiene among health care workers plays a central role in preventing the trans-mission of infectious agents. Handwashing has been reported as one of the most effective way of preventing the spread of infectious diseases (Anderson et al., 2008). It is thus important to assess knowledge and attitude of these health care workers towards NIs prevention and control.

In a Nepalese study on Nosocomial infection among HCWs, only 16, 14, and 0.3% of the respondents achieved maximum scores for knowledge, attitude, and practice items, respectively (Paudyal, 2008). Poor know-ledge of definition of NI amidst good attitude and poor compliance with simple procedures such as handwashing and use of gloves has also been reported among HCWs (Raka et al., 2006; Flores and Pevalin, 2006; Khaled et al., 2008). It is interesting to note that approximately one-third of hospital-acquired infections may be preventable (Comptroller and Auditor General, 2000), and that their rates can be reduced by up to one-third if healthcare workers comply with guidelines issued by their hospitals and notable regulating bodies such as the Centers for Disease Control (Pittet et al., 2000). However, com-pliance rarely exceeds 50% (Bischoff et al., 2000; Maury et al., 2000; Moongtu et al., 2000), and this will have a bearing effect on disease prevalence.

With reports of low compliance, cases of multi-drug resistance infections and poor awareness of NIs, a study on knowledge, attitude and practice of nosocomial infec-tions is long overdue. This is so in an environment like ours in which personal and organizational attitudes towards interventions such as hand washing, cost con-tainment and logistical barriers may be described as still existing at low pace. The objective of this study was to assess the awareness and attitude of tertiary level health care workers towards nosocomial infections in Osogbo, Southwestern Nigeria.

MATERIALS AND METHODS

This descriptive cross sectional study was carried out among health care workers in selected Teaching Hospital in Osun state in Southwestern Nigeria. The state has two teaching hospitals, and both admit patients and employ various cadres of health workers relevant to their settings. Both LAUTECH and Obafemi Awolowo University Teaching Hospital have NI control committee, hospital policy on control of NIs as well as adequate protective and other facilities required for effective control of NIs for the use of their staff. LAUTECH Teaching Hospital has about 300 beds and 400 workers, Obafemi Awolowo Teaching hospital have about 480 beds and 650

members of staff. Administrative and non clinical related staff and health workers who have spent less than a year working in the hospital environment were excluded from this study. Clinically related staff eligible for this study should have spent at least 2 years in the employment of the hospital, a period enough to have familiarized one with hospital policies and systems.

Using a prevalence figure of 5.9% in the calculation of sample size for population less than 10,000 using Leslie Fischer's formular (Olawale et al., 2011; Olawuyi, 1996), a sample size of 85 was calculated. The sample size was approximately brought up to 100. Multistage sampling method was used in selecting respondents into this study. In the first stage, one teaching hospital (LAUTECH Teaching Hospital) was chosen by simple random sampling employing simple balloting. In stage two, a list of clinically related categories of health workers in the hospital were obtained from the hospital administrative unit, and three (nurses, ward orderlies and doctors) were chosen by simple random sampling. Questionnaires were proportionately allocated according to the ratio of the total number of health care workers on the group list. In stage three, a systematic sampling of one in three health workers in each group were selected until number of allocated questionnaires were ex-hausted. These health workers were located where they were in the hospital and subjected to the research instruments. A total of 91 health care workers returned completely filled questionnaires, giving a response rate of 91.0%.

A pre-coded semi structured self administered questionnaires was administered on sampled health care workers. Questionnaires for ward orderlies were interviewer administered for better and direct understanding of the contents of the questionnaires. Questionnaires were pre-tested among ten health care workers in a nearby general hospital in neighboring Oyo state. Validation of questionnaires was conveniently done by 2 of the lead researchers during pre test. During pretest and data collection proper, 2 research assistants were trained for the administration of the questionnaires on the professional HCWs while 2 additional assistants were used in the translation and back-translation of the Yoruba language version of the questionnaires for ward orderlies who may prefer local language for better understanding. Data were validated by data cleaning, double entry, manual and random checks and location of outliers' data. About six visits to each of the facilities were made over a period of one month including weekend in order to meet the health workers on rotational duty.

Study variables include socio-demographic data of respondents, their awareness of NIs as well as attitude and practice of HAIs and preventive measures. The index used to assess awareness was how they knew about NIs based on the questions asked. Practices were explained under discussions as favourable, less favourable and un-favourable based on grading of the practice responses to the questions asked. Ethical issues were settled at the levels of the ministry of health, the health workers as well as the management and ethical review committee of LAUTECH Teaching Hospital, Osogbo. Data was analyzed using the SPSS software version 13.0 after sorting out the questionnaires. Consistency of data entered were done by double entry and random checking. Data was presented in forms of frequency tables. Association between categorical variable were done using chi-square test at a level of significance of $P < 0.05$.

RESULTS

Ninety one respondents returned completely filled questionnaires giving a response rate of 91.0%. Table 1 shows that 39 (42.9%) of respondents were in the age group 20 to 39 years, 20 (22.0%) were doctors while 52 (57.1%) were nurses and 32 (35.2%) of respondents have spent 1 to 5 years in practice. Table 2 shows that

Table 1. Personal data of respondents.

Personal data of respondents	Frequency	Percentage
Age range in years		
20-39	39	42.9
40-59	50	54.9
60 and above	2	2.2
Sex		
Male	21	23.1
Female	70	76.9
Occupation		
Doctors	20	22.0
Nurses	52	57.1
Ward orderlies	19	20.9
No. of years put in practice		
1-5 years	32	35.2
Above 5 years	59	64.8

Table 2. Awareness and attitude to hospital acquired infections.

Variables (n = 91)	Frequency	Percentage
Respondents have spent more than 5 years in hospital practice	8	8.8
Aware of patients as possible causes of HAI	83	91.2
Aware of hospital staffs as possible causes of HAI	77	84.6
Aware of hospital environment as possible causes of HAI	59	64.8
Aware of common examples of HAIs	53	58.2
Aware of common predisposing factors	38	41.8
Aware of possible consequences of HAIs	53	58.2
Aware of auto infection as route of transmission	17	18.7
Aware of cross infection as route of transmission	64	70.3
Aware of hospital staff/equipments as route of transmission	63	69.2
Aware of hospital policy on HAIs	31	34.1
Aware of presence of infection control committee in the hospital	36	39.6
Have ever witnessed HAIs of recent	56	61.5
Ready to notify in the event of an HAI	85	93.4
Respondents has ever notified a case of HAI	12	13.2
Ready to always report himself to staff clinic when sick	52	57.1
Ready to always wear protective gears on duty	82	90.1
Ready to always wash hands before and after procedures	89	97.8

83 (91.2%) of health workers were aware of patients as a possible cause of NIs, while 77 (84.6%) and 59 (64.8%) of respondents were aware of hospital staffs and hospital environment, respectively as causes of NIs. About 53 (58.2%) of respondents knew common examples of infections categorized as being nosocomial. About 38 (41.8%) were aware of common predisposing factors to NIs while

53 (58.2%) were aware of possible consequences of NIs. Thirty one (34.1%) were aware of presence of hospital policy on NI while 36 (39.6%) were aware of presence of infection control committee in their hospital. About 12 (13.2%) has ever notified NIs while 85 (93.4%) were ready to notify in the event of cases of NIs.

About 89 (97.8%) of the HCWs were ready to always

Table 3. Pattern of practice of nosocomial infections preventive measures.

Variable	N (%)			
	All the time	**Sometimes**	**Occasionally**	**Never**
Respondents said they report self to the staff clinic when sick	13 (14.3)	13 (14.3)	48 (52.7)	17 (18.7)
Respondents said they wear overalls or coats, gloves, face masks etc	40 (44.0)	28 (30.8)	14 (15.4)	9 (9.9)
Respondents said they wash their hands before and after examining patients	73 (80.2)	11 (12.1)	5 (5.5)	2 (2.2)
Respondents said they wash their hands before and after handling specimens	82 (90.1)	7 (7.7)	2 (2.2)	-

wash hands before and after procedures. Fifty two (57.1%) of respondents were ready to report themselves to staff clinic when sick, 82 (90.1%) were ready to always wear protective gears as required on duty while, 89 (97.8%) were ready to always wash their hands before and after procedures. Table 3 shows that preventive practices towards nosocomial infections were favourable for hand washing, less favourable for wearing gloves, and un-favourable for self reporting to the staff clinic when sick. There is no significant association between ever reported NIs or willingness to report and awareness of hospital policy on NIs, aware-ness of presence of infection control committee in the hospital or number of years put in practice (P > 0.05).

DISCUSSION

In this study, majority of HCWs were aware of common causes of NIs, half of them were aware of its conse-quences and about one third were aware of predisposing factors to HAIs. This awareness is higher when compared to a similar study in which only 16.8% of respondents knew the complete definition of nosocomial infection and sixty-nine percent of health care workers knew that contact is the most common mode of transmission (Raka et al., 2006). The higher

awareness rate obtained in this study could be as a result of inclusion of nosocomial infections as a topic taught in the medical curriculum in Nigeria, and it usually feature as part of sensitization seminars and continuous medical education for hospital workers. This poses a great prospect for control of nosocomial infections in Nigeria.

The fact that about one third of respondents were aware of presence of hospital policy and presence of infection control committee in their hospital suggested that health workers had a poor knowledge of the notification of Nis and the legal backing for the notification process. This could be responsible for a low rate of notification of NIs to the relevant authority observed in this study. The poor practice of reporting despite good attitude towards notification of NIs however suggested that serial or routine on-the job sensitization seminars to the health workers could lead to a better practice of reporting of NIs. This suggestion is supported by another study in which education sessions for health workers was found to improve knowledge and attitude scores of health workers towards nosocomial infections (Suchitra and Lakshmi, 2007).

In this study, reported preventive practices of HCWs towards NIs were favourable for hand washing, and fair for wearing protective materials like gloves. This supports a similar study in which majority of health care workers reported hand

washing after using gloves (84%) (Raka, 2006). This study however disagreed with another in which routine handwashing before and after glove use was reported by fewer than half of the HCWs studied (Askarian, 2005). In yet another study, health care workers reported a good overall knowledge and positive attitude towards glove use (Flores and Pevalin, 2006). Many factors could have been responsible for low use in these comparative studies. This include availability of gloves, cost of gloves if clients are to buy, availability of hand washing facilities, and attitude of the health care workers towards these simple procedures. All these amenities were available in LAUTECH Teaching Hospital and may influence the prevalence of these infections.

Most of the HCWs in this study were ready to always wash their hands before and after procedures. This observation was better when compared with a study in which attitude to compliance of HCWs with the recommended hand washing practices remains low (Vincent et al., 1995). In order to reduce the incidence of nosoco-mial infections, good attitude and compliance with preventive interventions are mandatory (Suchitra and Lakshmi, 2007). In many settings, hand washing may be seen as a trivial issue that is not routinely taken serious, most especially in non surgical and non invasive sessions. To this effect, sensitization seminars for all categories of health

Care staff will go a long way in reducing prevalence of the different types of NIs within our hospital settings. Regular monitoring and mentoring of health workers, most especially by concerned authority would ensure routine universal precautions and regular hand washing practices. In addition, infection control committees in hospitals should live up to the task of making the provision of hospital NI prevention policy available and accessible to health care workers and take active part in creating awareness.

Conclusion

Majority of health care workers are aware of causes and transmission of NIs, but with a bad attitude towards reporting of Nis. Improved awareness through routine sensitization seminars for health care workers and monitoring of compliance could lead to a reduction in prevalence of nosocomial infections in our health care settings.

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Full Length Research Paper

Human immunodeficiency virus (HIV) seroprevalence and pregnancy outcome among obstetric population in Abakaliki, Southeast Nigeria

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Human immunodeficiency virus (HIV) infection has become a pandemic worldwide especially among the obstetric population where prevention of mother to child transmission (PMTCT) of the infection is still a major challenge. The objective of this study is to determine the prevalence of HIV seropositivity and pregnancy outcome among obstetric patients in Abakaliki, Southeast Nigeria. A retrospective review of all deliveries at the Federal Medical Centre (FMC), Abakaliki, Ebonyi State over a period of three years (January 2006 to December 2008) was done. The records of all HIV positive patients who delivered in the hospital were retrieved for detailed analysis. One thousand eight hundred and sixty six (1866) deliveries were conducted during the period. Of these, 94 patients were HIV positive giving a seroprevalence rate of 5.04%. Seventy percent were between 25 and 30 years. Majority (90%) had some form of education while 10% were illiterates. Most diagnoses (93.3%) were made in pregnancy, 73.3% received antiretroviral therapy and 86.7% delivered vaginally. Thirty percent of the babies were exclusively breastfed. Maternal mortality ratio was 3,300 per 100,000 births, while perinatal mortality was 67 per 1,000 for this group of patients. It is concluded that the seroprevalence rate is high with associated adverse maternal and perinatal outcome. Routine screening by the general populace is advocated, as most diagnoses were made during antenatal care. There is also need to educate our women on safe delivery and breastfeeding options.

Key words: Human immunodeficiency virus (HIV) seroprevalence, maternal outcome, perinatal outcome, Abakaliki, Southeast Nigeria.

INTRODUCTION

Since the first reported case of Acquired Immune Deficiency Syndrome (AIDS) in 1981, the Human Immunodeficiency Virus Infection (HIV)/AIDS has become a global pandemic (Johnson, 1992). In Nigeria, as is the case in most sub-Saharan African countries, available data suggest a rising incidence, as the national seroprevalence rate has increased from 1.8% in 1991 to 4.4% in 2005 (Federal Ministry of Health (FMoH), 2007). In 2007, it rose to 5.4% although it dropped slightly to 4.6% in 2009 (FMoH, 2009). The more significant mode of transmission in sub-Sahara Africa is heterosexual (Misiri et al., 2004). The other mode of transmission is the vertical or mother to child transmission (MTCT) which

may occur during pregnancy, labour/delivery and during breastfeeding (Moore et al., 2002).

The risk of mother to child transmission of HIV infection in pregnancy is still high in developing countries including Nigeria, were there are still deficient standards for care. In developing countries, there are still poor antenatal care, late diagnosis, lack of antiretroviral therapy, marked increase in viral load, poor or haphazard interventions for the prevention of mother to child transmission (PMTCT) of HIV. Without interventions, the risk of perinatal transmission in Sub-Sahara Africa ranges from 25 to 45%, and about three quarters of these occurs around the time of delivery (Segurado and Paiva, 2007; Mock et al., 1999; Bassey et al., 2007). Adverse pregnancy outcomes that may occur in patients with HIV infection include high maternal and perinatal mortality, low birth weight, prematurity, spontaneous miscarriages, puerperal sepsis

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Table 1. Sociodemographic characteristics of patients.

Variable	N	%
Age (years)		
≤15	-	-
16-20	8	13.3
21-24	8	13.3
25-29	22	36.7
30-34	20	33.3
≥35	2	3.3
Occupation		
Civil servant	12	20
Trader	10	16.7
Student	10	16.7
House wife	8	13.3
Farmer	4	6.7
Police officer	4	6.7
Not indicated	12	20
Education status		
Illiteracy	6	10
Primary	18	30
Secondary	22	36.7
Tertiary	14	23.3
Post graduate	-	-
Parity		
Primigravidae	20	33.3
1-4	34	56.7
≥5	6	10

Table 2. Interventions in pregnancy.

Variable	N	%
GA (weeks) at diagnosis of HIV infection		
Before pregnancy	4	6.70
≤13	-	-
14-26	14	23.30
27-35	28	46.70
≥36	14	23.30
Patients on antiretroviral therapy		
Yes	44	73.30
No	16	26.70
Mode of delivery		
Spontaneous vaginal delivery	52	86.7
Caesarean section	8	13.3
Infant feeding options		
Exclusive breastfeeding	18	30
Artificial formula	24	40
Not indicated	18	30

GA: Gestation age

Southeast Geopolitical Zone of Nigeria. It also serves as a referral centre for both government and private health care facilities within and outside the state. Most women register voluntarily for antenatal care in the centre, a process that is carried out weekly. The hospital is located in the Abakaliki Metropolis, the capital of Ebonyi State of Nigeria. The inhabitants of Abakaliki are mainly the Igbos and other migrant workers. Ebonyi State is one of five states in the Southeast geopolitical zone of Nigeria created in 1996 from the old Abakaliki division of Enugu State and old division of former Abia state. It has 13 local governments Areas. Ebonyi state with an estimated population of about 4.3 million, lies between 7° 3' N Longitude 5° 4' E with a land mass approximated at 5,932 square kilometers. The state has boundaries in the North with Benue State, East with Cross River, South with Abia state and West with Enugu State. About 75% of the populations dwell in the rural areas with farming as their major occupation.

and neonatal sepsis (Mock et al., 1999; Bassey et al., 2007). These adverse outcomes occur more often where there are no interventions.

At the Federal Medical Centre, Abakaliki, no work has been done, to the best of our knowledge, to assess specific interventions for HIV positive pregnant women, and particularly their pregnancy outcomes. This study will attempt to address these issues.

MATERIALS AND METHODS

This was a retrospective descriptive study carried out at the Federal Medical Centre, Abakaliki, Southeast Nigeria from 1st January, 2006 to 31st December, 2008. Case notes of all patients that delivered during the period and were HIV seropositive were retrieved for detailed analysis. Information sought included their sociodemographic characteristics, parity, booking status, time of commencement of antiretroviral therapy, mode of delivery and infant feeding options, events in labour and maternal/perinatal outcome. The results obtained were analyzed using frequency tables and simple percentages. The Federal Medical Centre, Abakaliki is a tertiary health care facility situated on the

RESULTS

There was a total of 1866 deliveries during the study period of which 94 patients were HIV positive giving a HIV seroprevalence of 5.04%. However only 60 case notes were suitable for analysis. 54 (90%) of the cases registered for antenatal care (booked) while 6 (10%) did not register (unbooked).

Table 1 shows the sociodemographic characteristics of HIV positive patients. HIV seropositivity was common among patients aged between 25 to 29 years representing 36.7%. Majority were civil servants, traders, students and housewives accounting for 66.7%. Ten percent of the patients did not have formal education while 23.3% had tertiary education. Forty patients (66.7%) were multiparae.

Table 2 shows some interventions during pregnancy.

Table 3. Events in labour.

Variable	N	%
Interval between rupture of membrane and delivery (h)		
>4	6	11.50
<4	46	88.50
Administration of nevirapine prophylaxis		
Mother		
Yes	42	70
No	18	30
Baby		
Yes	46	76.70
No	14	23.30

Total N= 52

The diagnosis of HIV infection was made in 4 (6.7%) patients before pregnancy, while many of the diagnosis (46.7%) were made between 27 to 35 weeks gestation. Forty-four (73.3%) patients were on antiretroviral therapy. Fifty-two (86.7%) patients had spontaneous vaginal delivery while 8 (13.3%) had caesarean section. The common indication for caesarean section was to prevent vertical transmission of HIV infection. Twenty-four (40%) of the babies were fed with artificial formula while 18 (30%) were exclusively breastfed. Eighteen (30%) patients did not indicate their infant feeding option.

Table 3 shows events in labour. Fetal membranes rupture- to- delivery interval was more than 4 h in 6 (11.5%) patients and less than 4 h in 46 (88.5%) patients. Forty-two (70%) patients received a single dose of 200 mg nevirapine while 46 (76.7%) babies had a single dose of 2 mg/kg nevirapine within 72 h of birth. There were 2 maternal deaths due to post-partum haemorrhage and pre-eclampsia resulting in case fatality rate of 3.3% or maternal mortality ratio of 3,300 per 100,000 births for these group of women. There were also 4 perinatal deaths giving a case fatality rate of 6.7% or perinatal mortality ratio of 67 per 1000.

DISCUSSION

The HIV/AIDS pandemic is the most serious health crisis in the world today (Mock et al., 1999). The prevalence rate of 5.04% among pregnant women in this study is higher than the National prevalence rate of 4.6% (FMoH, 2009) and also higher than those reported from other centres in Nigeria (Bassey et al., 2007; Fawole et al., 2002; Ojukwu and Ibekwe, 2005; Ikechebelu and Udigwe, 2006). It is also much higher than those reported from the developed countries (Guay and Miiro, 1990; Lehtovirta et al., 2005). However, the prevalence is lower than that reported from the Eastern and Southern parts of Africa (Hasnain, 2004; Guay and Miiro, 1990). This prevalence rate may not be a true representation, as many of the women in our environment do not book for antenatal care; they prefer to deliver in church and homes of traditional birth attendants. The most recent National HIV sentinel survey showed that the HIV sero-prevalence rate in the state is 2.8 (PMTCT, Nigeria, 2007), a lower figure when compared to the prevalence in this study. The referral nature of the hospital may account for this.

Majority of the patients were multiparous and between the age ranges of 25 to 34 years which also form the bulk of the reproductive age group of average Nigerian women (Ojukwu and Ibekwe, 2005). HIV infection cuts across educational barriers, as ninety percent of the patients in this study had some form of formal education. Some studies have revealed that African women of child bearing age are particularly vulnerable to HIV infection as a result of their lifestyle, and this led to an increase in the number of paediatric HIV infections resulting from MTCT (Akani et al., 2005).

The diagnosis of HIV was made in the antenatal clinic (ANC) in majority of the patients. Routine HIV screening after counseling with the right to opt out during ANC may have contributed to this finding, especially in developing country like Nigeria where ANC setting is a major source of healthcare for women of child bearing age. It is suggested that routine screening outside pregnancy should be encouraged to help prepare them well for pregnancy or even help them take decisions about their future reproductive carriers.

Majority of the patients had antiretroviral therapy while their babies had single dose nevirapine within 72 h of delivery. This may probably be due to free antiretroviral drug in the hospital. Several clinical trials have documented the efficacy of antiretroviral drugs in reducing perinatal transmission of HIV (Connor et al., 1994; Wiltor et al., 1999; Guay et al., 1999). Currently, the Nigerian

National guidelines on PMTCT recommends highly active antiretroviral therapy (HAART) as standard of care for treatment of maternal HIV infection and prevention of mother to child transmission of HIV. All HIV positive pregnancy women receive prophylactic ART irrespective of CD4 count, viral load or clinical stage of the disease. All HIV exposed infants must receive daily nevirapine for 6 weeks irrespective of infant practice. It is sad that 16 (26.7%) patients did not receive antiretroviral therapy. This may probably be due to ignorance and stigmatization that are prevalent in our environment. Poor documentation in the case notes of patients could also be a contributory factor. Some Nigerian studies have shown that poor record keeping is still rife in some of our hospital (Ameh and Shehu, 2002). Fear of ostracization and stigmatization by health staff may contribute to the HIV patient declining to declare their status and/or delivering in homes of traditional birth attendance or church. Most patients (86.7%) delivered vaginally. This is not surprising as there is serious aversion to caesarean section in this part of Nigeria.

It was noted that 24 (40%) patients chose artificial formula as infant feeding option despite the high cost especially in our environment. Several studies reveal that only a minor percentage of women breastfeed exclusively (Egbuonu et al., 2004) as shown in this study where 30% chose to breastfeed exclusively.

This study has shown that the prevalence of HIV infection among women who deliver in our centre is high and the antenatal clinic is the most important setting for diagnosis of HIV and the commencement of PMTCT intervention strategies. Encouraging our women to avail themselves of early registration for antenatal care, regular clinic attendance and compliance to antiretroviral drugs, and hospital delivery with strict compliance to safe delivery options are areas that need emphasis.

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Full Length Research Paper

Epidemiological survey of gastrointestinal parasites of pigs in Ibadan, Southwest Nigeria

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A cross-sectional study was undertaken to determine the prevalence and intensity of gastrointestinal parasites in pigs from the Teaching and Research Farm of the University of Ibadan, Ibadan, Oyo State, Nigeria. Faecal samples were collected randomly from 271 pigs between April and October 2010, processed by modified Kato-katz technique and then examined for the presence of helminth ova and protozoan oocysts and cysts. Out of the 271 faecal samples examined, 97 (35.8%) were infected with one or more parasite species. Five types of parasites were identified, including *Trichuris suis, Ascaris suum,* human hookworm, *Stephanurus dentatus* and *Isospora suis. T. suis* was the most prevalent parasite. The prevalence of intestinal parasites was significantly higher in male pigs than in females (P<0.05). Single infection was more common with a prevalence of 80.4%. The results of this study provide baseline information about the parasitic fauna in intensively managed pigs in Ibadan, Oyo State, Nigeria.

Key words: Prevalence, gastrointestinal parasites, *Ascaris suum*, pig, *Trichuris suis*, Ibadan.

INTRODUCTION

In swine industry, the sustainable development of this sector is faced with a number of constraints, prominent among which is the disease is caused by intestinal parasites. Gastrointestinal parasites are responsible for substantial loss of productivity in swine and other livestock industry. They constitute a major impediment to efficient and profitable livestock production (Boes et al., 2000; Joachim et al., 2001). Gastrointestinal parasitism in swine affects swine's performance in terms of efficient feed conversion, poor growth rate, reduced weight gain and the condemnation of affected organs after slaughter (Nsoso et al., 2000).

In Nigeria, livestock production sector is vital not only because of its economical benefits but because over 80% of the population are involved in one way or the other in Agriculture (Otuma and Udenwa, 2009). Several studies on gastrointestinal parasites affecting pigs have been undertaken in Nigeria and other parts of the world. In a study investigated among 450 pigs for helminth infections

from Jos Plateau, Nigeria, Fabiyi (1979) reported a total of 15 species of helminths which include *Hyostrongylus rubidus, Ascarops strongylina, Physocephalus sexalatus, Ascaris suum, Globocephallus urosubulatus, Strongyloides ransomi, Trichuris suis, Oesophagostomum quadrispinulatum, Oesophagosto-mum dentatum, Metastrongylus salini, Stephanurus dentatus, Cysticercus cellulosae, Cysticercus tenuicollis, hydatid* cyst of *Echinococcus granulosus* and *Spirometra erinacei.* In a study conducted among 383 pigs for parasitic infection in Eastern Centre Province, Burkina Faso, Tamboura et al. (2006) reported that 91% of the pigs were infected with one or more parasites and *Ascaris suum* was the most prevalent parasite (pre-valence of 40%). Parasites of pigs and their potential to infect humans have recently become major issues among the public because of reported outbreaks of water-borne parasitic diseases such as *Giardia lamblia* and *Cryptosporidium* spp. (Olso and Guselle, 2000).

Although studies have been conducted on the intestinal helminth of pigs in some parts of Nigeria, however there is little information regarding the parasitic fauna of pigs in Ibadan. Hence, this study was undertaken to provide epidemiological data on the prevalence and intensity of

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Table 1. Prevalence (%), intensity (I) and range (R) of gastrointestinal parasite eggs in the faeces of 271 pigs in Ibadan.

Parasite	Number infected	(%)	I (Mean ± S.E.)	Range
Trichuris suis	33	12.2	12.03 ± 3.25	0 - 680
Ascaris suum	30	11.1	5.31 ±1.10	0 - 140
Human hookworm	16	5.9	1.92 ± 0.51	0 - 60
Stephanurus dentatus	3	1.1	0.22 ± 0.13	0 - 20
Isospora suis	17	6.3	-	-

gastrointestinal parasites of pigs in the Teaching and Research Farm of the University of Ibadan, Ibadan.

MATERIALS AND METHODS

Study area

Ibadan is the largest indigenous city in tropical Africa and lies within longitude 007°2′ and 007°40′E and latitude 03°35′ and 4°10′N. Ibadan is 128km Northeast of Lagos and 345 km Southwest of Abuja, the Federal Capital (Udo, 1994). The population of Ibadan is estimated to be about 3.8 million according to 2006 estimates. The study area has been described in full details earlier (Sowemimo, 2007). The University of Ibadan Teaching and Research farm is located in the Faculty of Agriculture. The swine unit consists of breeding, farrowing, finishing and experimental pens. The unit is stocked with different breeds of pigs comprising of pure Duroc, strains of large white, Hampshire and local breeds. The total number of pigs in the swine unit at the time of sampling which took place between April and October 2010 was 483 pigs. The parent stocks were sourced from reputable pig commercial farms operating an intensive production system and International Institute for Tropical Agriculture (IITA) in Ibadan.

Faecal samples collection

Faecal samples were randomly collected from the rectum of 271 pigs using a long forceps into a clean 30 ml sterile bottles labeled with the approximate age of pig, sex and location of collection. The faecal sampling took place between April and October 2010. The faecal samples collected were then transported to the Parasitology Laboratory of the Department of Zoology, Obafemi Awolowo University, Ile-Ife, where they were preserved with 10% formalin before processing.

Laboratory procedure

The preserved faecal samples were later processed for egg concentration using modified Kato-Katz technique as described by Forrester and Scott (1990) and later examined under light microscope at X100 magnification for the presence of helminth ova and protozoan cysts/oocysts. The parasite eggs were identified based on structural and morphometric criteria (Soulsby, 1982). The number of eggs was multiplied by 20 to convert the values obtained to eggs per gram (epg) of faeces.

Statistical analysis

SPSS version 16.0 (SPSS Inc. Chicago Illinois, USA) was used for statistical analysis. The differences in prevalence (calculated by dividing the number of infected pigs with the total number of pigs in that category and expressed as a percentage) of parasite infections between age group and sex were tested by chi-squared (χ^2) tests. A Mann-Whitney U test (non-parametric test) was used to test the difference in intensity (number of eggs in one gram of faeces) between sexes.

RESULTS

General infection patterns

Out of the 271 pigs examined for intestinal parasitic infections, 97 were infected with one or more parasite species, giving an overall prevalence of 35.8%. Five types of gastrointestinal parasites were identified, comprising four nematodes and one protozoan. These included *T. suis* having a prevalence of 12.2%, followed by *A. suum* with a prevalence of 11.1%, while human hookworm had a prevalence of 5.9%. Others are *S. dentatus* with the lowest prevalence of 1.1% and *I. suis* the only protozoan with a prevalence of 6.3%. The overall mean intensities (epg) for the various parasite species were 12.03 ± 3.25 for *T. suis*, 5.31 ± 1.10 for *A. suum*, 1.92 ± 0.51 for hookworm and 0.22 ± 0.13 for *S. dentatus* (Table 1). The prevalence of gastrointestinal parasites in pigs age 0 - 6 months was slightly higher than in other age groups, although there was no significant difference (P>0.05). Moreover, the prevalence of intestinal parasites was significantly higher in male pigs (45.0%) than in females (30.4%) ($\chi^2 = 5.845$, df = 1 P<0.05) (Table 2).

Prevalence and intensity of intestinal parasites in relation to age of pig

As can be seen in Table 3, the prevalence of infection was slightly higher in pigs older than 12 months (adult pigs) than in pigs less than 6 months old and those of age 7 - 12 months (young pigs) with regard to infection with *T. suis* and hookworm. However, the prevalence of *Ascaris* infection decreased from 12.6% in pigs less than 6 months old to 7.1% in pigs older than 12 months. *S. dentatus* infection was recorded only in young pigs (less than 6 months), while the only protozoan observed (*I. suis* infection) occurred in pigs less than 12 months old.

Table 2. Prevalence (%) of gastrointestinal parasites of pigs in relation to age and sex.

Variable	Number examined	Number infected	(%)
Age (months)			
0 - 6	183	68	37.2
7 – 12	74	24	32.4
> 12	14	5	35.7
Sex			
Male	100	45	45.0
Female	171	52	30.4
Total	271	97	35.8

$\chi^2 = 5.845$; df = 1, P < 0.05.

Table 3. Prevalence (%) and intensity (I) of gastrointestinal parasites in relation to age of pig.

Parasite	0 – 6 months		7 – 12 months		>12 months	
	%	I (Mean ± SE)	%	I (Mean ± SE)	%	I (Mean ± SE)
Trichuris suis	12.6	10.49 ± 2.67	10.8	17.03 ± 9.91	14.3	5.71 ± 3.88
Ascaris suum	12.6	5.14 ± 1.22	8.1	5.94 ± 2.46	7.1	4.29 ± 3.09
Human hookworm	6.0	1.53 ± 0.55	5.4	2.70 ± 1.18	7.1	2.86 ± 2.86
Stephanurus dentatus	1.6	0.33 ± 0.19	-	-	-	-
Isospora suis	6.6	-	6.8	-	-	-

Pigs aged 7 - 12 months were slightly more infected with *T. suis* than other age groups, while the intensities of infection (epg values) were similar and comparable in all age groups with regard to *A. suum* infection. Similar trend was also observed in the pattern of intensity with regard to hookworm infection where epg values were similar.

Prevalence and intensity of intestinal parasites in relation to sex of pig

The prevalence of *A. suum* infection was significantly higher in male pigs (18.0%) than in females (7.0%) (χ^2 = 7.731, df = 1; P <0.05). Although, the prevalences and intensities of infection with regards to *T. suis* and hookworm were higher in male pigs than in females, there were no significant differences. There was no infection in males pigs with regard to *S. dentatus.* The intensity of *Ascaris* infection was significantly higher in males than in female pigs (U = 7708, df = 1, P<0.05) (Table 4).

Mixed infections

Out of 97(35.8%) pigs infected with one or more parasite species, 78 (80.4%) pigs had single infection with either *A. suum* or *T. suis* or hookworm or *S. dentatus* or *I. suis*. 17 (17.5%) had double infection comprising *Ascaris* and *Trichuris, Trichuris and Isospora,* hookworm and *Isospora, Ascaris* and hookworm, *Ascaris* and *Isospora,*

while 2 (2.1%) had triple infection comprising of *Ascaris, hookworm* and *Trichuris* (Table 5).

DISCUSSION

This study revealed that the overall prevalence of gastrointestinal parasites recorded among 271 pigs from the Teaching and Research Farm in Ibadan was 38.8%. The prevalence was significantly lower than 100% reported from Umuahia, Abia State, Nigeria (Nwoha and Ekwurike, 2011) and 91% from Burkina Faso (Tamboura et al., 2006). The lower prevalence of intestinal parasites recorded in this study could be as a result of effective management practices in the farm, such as daily cleaning and disinfectants of pens, giving high quality commercial feed and the use of effective antihelminthic drugs at the right time. Results from previous studies have shown that the prevalence of gastrointestinal parasites in intensive pig farm is usually considerably lower (Liu and Lu, 2002). In this study five types of intestinal parasites were identified as compared to 15 species of helminths reported from 450 pigs in Jos, Plateau, Nigeria (Fabiyi, 1979). Out of the seven nematode species listed as helminths of veterinary importance by Nansen and Roepstorff (1999), three were observed in this study and they include *A. suum, T. suis* and *S. dentatus.*

This study also revealed that *T. suis* was the most prevalent parasite followed by *A. suum.* This is in contrast with the findings of past studies where *A. suum* was

Table 4. Prevalence (%) and intensity (I) of gastrointestinal parasites in relation to sex of pig.

Parasites	Male		Female		Both Sexes	
	%	I (Mean ±SE)	%	I (Mean ± SE)	%	I (Mean ± SE)
Trichuris suis	13.0	13.80 ± 4.51	11.7	10.99 ± 4.43	12.2	12.03 ± 3.25
Ascaris suum	18.0	7.80 ± 1.99	7.0	3.86 ± 1.29	11.1	5.31 ± 1.10
Human hookworm	8.0	2.00 ± 0.78	4.7	1.87 ± 0.67	5.9	1.92 ± 0.51
Stephanurus dentatus	-	-	1.8	0.35 ± 0.20	1.1	0.22 ± 0.13
Isospora suis	5.0	-	7.0	-	6.3	-

Table 5. Occurrence of multiple infections of intestinal parasites in 271 pigs in Ibadan.

Parasite	Frequency	(%)
Ascaris only	19	19.6
Hookworm only	8	8.2
Stephanurus dentatus only	2	2.1
Trichuris suis only	22	22.7
Isospora suis only	27	27.8
Ascaris + Trichuris	4	4.1
Trichuris + Isospora	4	4.1
Hookworm + *Isospora*	5	5.2
Ascaris + Isospora	2	2.1
Stephanurus + Isospora	1	1.0
Ascaris + hookworm	1	1.0
Ascaris + hookworm + *Trichuris*	2	2.1

reported as the most prevalent parasite in scavenging pigs (Kumar et al., 2002; Ngowi et al., 2004; Tamboura et al., 2006) and also in semi-intensively managed pigs (Nsoso et al., 2000). The moderately high prevalence of *T. suis* (12.2%) could be due to the ability of the eggs to survive for long in the environment (Roepstorff and Murrell, 1997; Pittman et al., 2010). However, the prevalence of 11.1% recorded for *A. suum* in this study was lower than 12.7% reported from Eastern Ghana (Tiwari et al., 2009), 54.6% from Bostwana (Nsoso et al., 2000) but higher than 5.2% from China (Weng et al., 2005). The prevalence of *A. suum* recorded in this study was not extremely high; however infection could have arisen probably as a result of ineffective anthelminthics administered at the source farm prior to transportation to the Teaching and Research farm, which can con-sequently lead to the contamination of the farm. Hence, there is the need to create the awareness as to the possible health risk following human infection with this parasite. It has been reported that *A. suum* is among the causes of visceral larva migrans in humans (Sakakibara et al., 2002). In addition, human cases with liver and lung lesions as well as cases and epidemics of eosinophilia pneumonia have been reported and *A. suum* specific antibodies were positive in all the cases (Arimura et al., 2001; Kakihara et al., 2004).

Previous studies by Esrony et al. (1997), Nsoso et al.

(2000) and Kumar et al. (2002) observed the effect of sex and age of pigs on the prevalence of helminth parasites. Their findings are in agreement with the results of this study, indicating that parasites have a wide occurrence spectrum. In this study, the prevalence of intestinal para-sites was significantly higher among male pigs than in fe-males, which is in contrast with the findings of Tamboura et al. (2006) where female pigs have higher prevalence than the males. Furthermore, human hookworm (which could either be *Necator americanus* or *Ancylostoma duodenale* as their eggs are indistin-guishable) is another parasite identified in this study having a prevalence of 5.9%. A higher prevalence (33%) was reported for hook-worm (*Necator* sp.) in a recent study investigated among 300 intensively managed pigs from Umuahia, Abia State, Nigeria (Nwoha and Ekwurike, 2011). Previous study has shown that there is the possibility of pigs acting as transport host for human parasites (Steenhard et al., 2000). The presence of hookworm in the pigs poses health risk for humans especially farm workers.

S. dentatus is a kidney worm of pig and one of the intestinal parasites of pigs identified in this study, having the lowest prevalence of 1.1%. Infection of pigs with this parasite may occur either by ingestion of infective larvae, by skin penetration or by ingestion of infected earth-worms (Soulsby, 1965). *I. suis* is the only protozoan observed in this study with a prevalence of 6.3% lower

than 26.4% reported from Ontario, Canada (Aliaga-Leyton et al., 2011) and 27.8% from Poland (Karamon et al., 2007). *T. suis* infection is commonly found among piglets (young pigs) as reported by previous investigators and most common cause of diarrhoea in young pigs.

In conclusion, the result of this study has revealed that pig faeces could be an important source for some parasites capable of infecting humans. In a community setting where pigs are reared and pig meat is consumed by a large part of the population, they could be involved in zoonotic helminthosis and a further investigation should study the possible impact of parasitic infections of pigs on public health in Nigeria.

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Full Length Research Paper

Trends in body mass index values of Brazilian enlisted men, 1980 to 2005

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This study was to investigate the temporal evolution of body mass index (BMI) in young enlisted men of 18 years in Brazil between 1980 and 2005, to identify specific points of greatest variance in time series and compare specific points in time, and the temporal evolution of BMI with socioeconomic changes in Brazil. The present study explores a temporal series of twenty-six national surveys of Brazilian men enlisted between 1980 and 2005. Heteroscedasticity in BMI time series was tested using Engle's Lagrange-multiplier (LM) test, and analyses were performed using the autoregressive conditional heteroscedasticity (ARCH) model. As possible explanations for these increases in mean BMI, changes in economic indicators were considered. Particularly in 1985 to 1986 and 1994 to 1995, there was a sharp and significant increase in BMI. These two points occurred after two major economic policy changes that increased the purchasing power of the population related to economics factors such as: reducing the level of social inequality, increased family income, poverty reduction, inflation control, and increased consumption of foods. The present study showed a sharp increase of obesity in the population of young men in Brazil on two occasions during this series (years 1985 to 1986 and 1994 to 19955), when a possible reduction in caloric expenditure and increased food consumption population were observed.

Key words: Temporal trends, body mass index, obesity, Brazil.

INTRODUCTION

Trends of increasing overweight and obesity are now well documented in both developed countries for example, United States (Komlos and Brabec, 2010; Burkhauser et al., 2009), France (de Saint Pol, 2009), Japan (Yoshiike et al., 2002) and developing countries for example, Brazil (Wang et al., 2002) and Mexico (Rivera et al., 2004) but few studies have used time series with more frequent data collection points on weight change, which would allow testing, whether specific points in time are associated with more substantial increases in the rates of overweight and obesity.

Economic development, modernization, and urbanization have been associated to obesity (Staudigel, 2011;

Peracchi and Arcaleni, 2011). Economic factors such as greater purchasing power of poor families (Lignani et al., 2011), low food prices (Christian and Rashad, 2009; Rashad, 2006), technological modernization (Lakdawalla and Philipson, 2009), increased family income (Fowler et al., 2005) are associated with dietary patterns of populations, particularly in developing countries, resulting in increased obesity (Mendez and Popkin, 2004; Ulijaszek and Koziel, 2007).

Recent data from the Brazilian Institute of Geography and Statistics (IBGE, 2010) reported that overweight has been increasing steadily in adults since the mid-1970s and it is currently found in approximately half of all Brazilians. Data from enlisted men have been used to describe the prevalence of overweight in Israel (Gross et al., 2009) and the United States (Hsu et al., 2007). These data are usually collected annually therefore they are a

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good resource for testing temporal changes, mainly when measured by professionals.

The objectives of this study are: (1) To evaluate the temporal change in BMI of enlisted men in Brazil from 1980 to 2005; (2) to test for specific points in time that display greater variance and; (3) to further compare specific points in time in the BMI temporal evolution with economic changes in Brazil.

METHODOLOGY

Study population

The present study explores a temporal series of twenty-six national surveys of Brazilian men who enlisted between 1980 and 2005. Each survey comprises a 35 to 40% of all Brazilian men aged 18 years at the time of examination. The article 143 in the Constitution of the Federative Republic of Brazil (1998) provides that a one year military service is compulsory. Women and clergymen are exempted from compulsory military service. Weight and height were measured to the nearest 0.1 kg and 0.5 cm, respectively using a scale with incorporated stadiometer (Filizola®). All measurements were performed by previously trained examiners. Participants were weighed and measured wearing light clothing and no shoes.

Body mass index data analysis

The Brazilian candidates for compulsory military service are representative of the male population in general thus allowing one to assess the increase in the prevalence of obesity during the period of analysis and identify periods of change. Prevalence of overweight and obese men was calculated with 95% confidence intervals, and the BMI values were plotted to make a descriptive analysis of the time series. This analysis showed that the variance of the error term was not equal over time that is, heteroscedasticity. The cutoff points of the World Health Organization (WHO, 2007) were used to classify overweight (BMI ≥ 25 kg/m^2 and < 30 kg/m^2) and obese (BMI ≥ 30 kg/m^2) men.

Heteroscedasticity in BMI time series was tested using Engle's Lagrange-multiplier (LM) test, and analyses were performed using the autoregressive conditional heteroscedasticity (ARCH (1)) model (Engle, 1982; Bollerlev et al., 1994) with a level of significance set at $p < 0.05$. For those points in time with higher oscillations of the mean of BMI (1985, 1994 and 2000), dummy variables were included under the assumption that the growth rate of mean BMI was not the same throughout the period.

When heteroscedasticity is present, the regression coefficients for an ordinary least squares regression (OLS) are unbiased, but the variance and confidence intervals estimated by conventional procedures will be too narrow, giving a false sense of precision. In this context, an ARCH model, introduced by Engle (1982), is an appropriate framework for analyzing the data. All analyses were performed using the STATA.

Economic factors

As possible explanations for these increases in mean BMI, changes in economic indicators were considered (Brazilian Institute of Geography and Statistics and Institute of Applied Economic Research). The economics factors which have been analyzed were:

annual inflation rate, food production, poverty (%), soft drinks consumption and average annual real income.

Annual inflation rate

The annual inflation rate was measured by the General Price Index, an index that attempts to reflect the monthly variations in prices (%). The index calculates the price variations of agricultural raw materials and wholesale industrial and final goods and services for consumption. Annual inflation was measured by the average of the 12 months of the year (IPEA, 2010).

Food production

Food production was measured by indicators for aggregated products that represent the sectors that provide supplies directly to livestock or delivering the first industrial processing of goods resulting from activities in the primary sector. The series consists of products and aggregates defined class-based agribusiness industry (year 1989 = 100) (ABIA, 2010).

Poverty

Poverty was measured by the percentage (%) of people in total population with per capita household income below poverty line. The poverty line is twice the extreme poverty line, an estimate of the value of a basic food basket with a minimum of calories needed to adequately sustain life, based on the recommendations of Food and Agriculture Organization and WHO (IPEA, 2009).

Soft drink consumption

The Soft drink consumption was measured by the annual wholesale value of soft drinks and juices in liters per year (l/y) (ABIR, 2009).

Average annual income

The series were calculated from all jobs of employed persons with employment income (IPEA, 2008). The annual income was measured by the average of the 12 months of the year and in national currency: Real (R$). The study was approved by the Research Ethics Committee of Rio de Janeiro State University, Institute of Social Medicine (protocol number 397523).

RESULTS

The study population of 11,090,230 males showed an increase in mean BMI from 21.4 kg/m^2 in 1980 to 22.2 kg/m^2 in 2005. The prevalence of overweight men changed from 4.5% in 1980 to 12.5% in 2005 (2.6 times larger). The prevalence of obesity increased from 0.5% in 1980 to 1.9% in 2005, an increase of almost 300% during the period; although these values are still at low level in international comparison. Table 1 shows increasing variance of mean BMI over time, indicating heteroscedasticity.

The LM test of heteroscedasticity on BMI showed a p-value

Table 1. Mean, standard deviation (SD) and variance of body mass index (BMI) and the prevalence of overweight and obesity (%) and the 95% confidence interval (CI) in Brazilian enlisted men, 1980 to 2005.

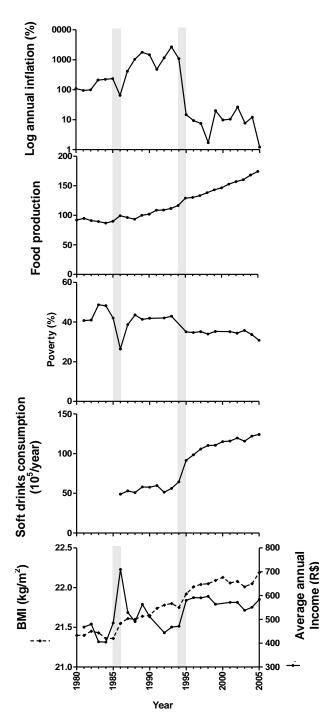| Year	BMI (kg/m^2)			Overweight (%)	95% CI		Obesity (%)	95% CI	
	Mean	SD	Variance						
1980	21.40	2.11	4.45	4.51	4.43	4.57	0.37	0.36	0.42
1981	21.40	2.13	4.55	4.66	4.64	4.76	0.42	0.38	0.43
1982	21.45	2.21	4.87	5.01	4.94	5.06	0.56	0.54	0.62
1983	21.43	2.19	4.81	4.87	4.84	4.96	0.55	0.48	0.58
1984	21.36	2.16	4.67	4.54	4.44	4.56	0.47	0.45	0.52
1985	21.36	2.18	4.74	4.68	4.64	4.76	0.48	0.45	0.52
1986	21.55	2.27	5.15	6.16	6.13	6.27	0.51	0.48	0.52
1987	21.61	2.24	5.02	6.54	6.43	6.57	0.46	0.43	0.52
1988	21.60	2.25	5.06	6.55	6.43	6.57	0.49	0.48	0.52
1989	21.64	2.28	5.20	6.81	6.73	6.87	0.56	0.54	0.60
1990	21.65	2.31	5.33	6.85	6.82	6.98	0.62	0.57	0.63
1991	21.74	2.38	5.64	7.76	7.72	7.88	0.71	0.68	0.73
1992	21.78	2.41	5.80	8.27	8.21	8.39	0.72	0.67	0.73
1993	21.80	2.48	6.15	8.75	8.61	8.79	0.87	0.85	0.93
1994	21.75	2.50	6.24	8.62	8.51	8.69	0.87	0.87	0.93
1995	21.92	2.63	6.93	10.06	10.01	10.19	1.20	1.17	1.23
1996	22.01	2.66	7.09	10.63	10.51	10.69	1.31	1.27	1.33
1997	22.04	2.69	7.23	10.98	10.91	11.09	1.34	1.27	1.36
1998	22.05	2.72	7.38	11.15	10.99	11.20	1.38	1.36	1.44
1999	22.09	2.72	7.39	11.24	11.09	11.30	1.44	1.38	1.46
2000	22.13	2.76	7.60	11.51	11.37	11.63	1.55	1.53	1.61
2001	22.06	2.85	8.14	11.54	11.39	11.61	1.58	1.56	1.64
2002	22.08	2.86	8.18	11.81	11.69	11.91	1.59	1.56	1.64
2003	22.01	2.84	8.07	11.24	11.09	11.31	1.55	1.53	1.61
2004	22.05	2.91	8.45	11.57	11.49	11.71	1.73	1.66	1.74
2005	22.19	2.96	8.78	12.55	12.39	12.61	1.95	1.94	1.98

of 0.0002, rejecting the null hypothesis of no ARCH effects. The ARCH models were fitted including the dummy variables for the years 1985, 1994 and 2000 (the independent variables). Only 1985 and 1994 showed a statistically significant modification of the rate of change ($p < 0.05$). The year 2000 was not statistically significant ($p = 0.54$). Thus, the final model was ARCH (1) with two dummy variables (years 1985 and 1994). Data are shown in Figure 1 and the results of analysis are given in Table 2. From 1980 to 1985, there were no significant changes in mean BMI. From 1985 to 2005, BMI values increased.

In Table 2, the coefficients associated with the years 1985 and 1994 indicate the statistically significant changes. Thus, the constant represents the overall mean of 22.073 kg/m^2 in years 1985 and 1994. The negative value -0.232 kg/m^2 indicates a BMI smaller than mean BMI after 1985. The same apply for 1994 when BMI values after 1994 were 0.437 kg/m^2 greater. The bottom portion of Table 2 is related to the fit of the model. The coefficient L1 = 0.49 indicates that the

variance of the current period error depends on information that is revealed in the preceding period. The years of change in BMI were accompanied by the usual changes in Brazilian´s lifestyle (1985 to 1986 and 1994 to 1995) but by international comparison they are below average (Figure 1).

DISCUSSION

Non-genetic factors appear to have a major role in rapidly increasing rates of obesity (Ogden et al., 2007; Saarloos et al., 2009) but there is less consensus on the specific environmental factors that may contribute to such dramatic shifts (Jeffrey and Utter, 2003). Although young males are not the group with the greatest prevalence of overweight in Brazil, overweight changed from 4.5% in 1980 to 12.5% in 2005, the prevalence in the overall population according to nationwide surveys in Brazil has increased substantially. Overweight and obesity combined

Figure 1. Log annual inflation (%), food production, poverty (%), soft drink consumption (10^5 liters/year, body mass index (kg/m²) and average annual income (R$) in Brazil, 1980 to 2005. The shaded zones illustrate that the periods of economic growth (1985 to 1986 and 1994 to 1995) and are corresponding in time with increased sharp of BMI.

among adults has increased from 18.5 to 50% in the last 30 years indicating that the obesity epidemic is happen

also in Brazil (IBGE, 2010).

The data of enlisted men provides a practical and large convenience sample of the Brazilian young male population and possibly reflects general population trends. We identified turning points in the BMI curve in 1985 and 1994 and also identified changes in the Brazilian economy of possible factors are corresponding in time with increased BMI. Beginning in 1985, a marked change in general consumption was noted with an increasing amount of available calories (Silveira and Almeida, 2008) and also the launching of many new food products (Mendonça and Anjos, 2004). Beginning in 1994, a trend was observed towards increased consumption of fast foods (Mendonça and Anjos, 2004) and soft drinks (ABIR, 2009).

The decline in inflation rate and consequent reduction in food prices, mainly for industrially-produced food products, was observed in both periods and many authors have concluded that low food prices induce people to consume more calories (Mitra, 2001; Cutler et al., 2003; Chou et al., 2004). Glanz et al. (1998) found that cost is one of the most important factors in food-purchasing decisions and that these trends toward increased consumption and reduced industrialized food prices (for example, soft drinks and vegetable oils) have also been observed in the past three decades in other developing countries (Popkin, 1993).

An increase in wages mainly among the poor (Lavinas, 2001; IBGE, 2007) and the reduction of inequality (Hoffman, 2002) were also a result of the 1994 real plan in Brazil, a major economic intervention by the government, which increased food consumption in res-taurants and fast food establishments (Mendonça and Anjos, 2004). Eating outside the home has been associated with obesity in studies conducted in the United States (Guthrie et al., 2002) and Europe (Orfanos et al., 2007) and in Brazil eating outside the home has been associated with obesity among men (Bezerra and Sichieri, 2009).

In the United States, increased rates of obesity have coincided with a large increase in average caloric intake between 1985 and 2000 when more fats were added to homemade foods and many processed foods (Chastenet, 2011) and in Brazil, an increase in processed foods and sodas has been well documented (Levy-Costa et al., 2005). Watching television has also received great attention for its contribution to a sedentary lifestyle (Finkeltein et al., 2005). Time spent on computers, video games and other electronic resources have increased substantially since the 1980's in Brazil. Furthermore, an increase in TV sales was observed in the period 1994 to 1995 (Mendonça and Anjos, 2004).

Conclusion

Finally, the results of this study show that between 1980

Table 2. ARCH model for BMI. Brazilian enlisted men, 1980 to 2005.

Parameter	Coefficient	P > |z|	95% Confidence interval	
BMI (kg/m^2)				
Year 1985	-0.232	0.001	-0.321	-0.144
Year 1994	-0.437	0.001	-0.555	-0.319
constant	22.073	0.001	22.025	22.122
ARCH				
L1	0.497	0.043	0.015	0.979
constant	0.003	0.020	0.000	0.005

and 2005, we identified that two points of rate of change in BMI are corresponding in time with economic changes that altered Brazilians' lifestyles. Much has yet to be investigated on the influence of economic factors on the development of obesity and although time series studies are not considered the best framework for causal analysis, this methodology clearly allows the identification of major changes over time, as shown in our analyses. Because of their public health importance, trends in over-weight and obesity need to be monitored continuously and factors associated with these trends studied, in order to develop sound health-policy strategies to improve health and prevent obesity.

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Full Length Research Paper

The sense of coherence and its relation to health factors among patients with diastrophic dysplasia

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Diastrophic dysplasia is a congenital skeletal condition with features of short and disproportioned statue, short limbs and joint deformities. Despite the patients' frequent use of health care services, information about their psychological health is scarce. The purpose of the cross-sectional study was to get a comprehensive view of the sense of coherence and its relations with physical and mental health factors among patients with diastrophic dysplasia. A total of 68 patients participated in the study representing 59% of the known adult patients with diastrophic dysplasia in Finland. The patients completed the Sense of Coherence questionnaire, the RAND 36-Item Short Form Health Survey, the Finnish version of the Beck Depression Inventory and the Health Assessment Questionnaire. The visual analogue scale was used to estimate the pain intensity. The sense of coherence was highly significantly related to psychological but only marginally related to physiological measures. The sense of coherence was significantly positively associated with mental health ($p < 0.001$). The sense of coherence was significantly negatively associated with pain medication ($p = 0.005$), pain intensity ($p = 0.006$) and depressive symptoms ($p < 0.001$). We conclude that the relations between the sense of coherence and health factors among patients with diastrophic dysplasia resemble those found in samples of other patient groups and healthy individuals. Measuring the sense of coherence of patients with diastrophic dysplasia could help targeting individuals at risk for mental problems like depression. The sense of coherence measure could be useful when planning supportive psychosocial interventions for patients with diastrophic dysplasia.

Key words: Diastrophic dysplasia, sense of coherence, health, depression.

INTRODUCTION

Diastrophic dysplasia (DD) is a congenital skeletal dysplasia of autosomal recessive type caused by a mutation in the sulphate transporter gene SLC26A2 (Hästbacka et al., 1994; Kaitila, 1980). DD occurs in adulthood as disproportionate dwarfism with the clinical features of short and disproportioned statue, short limbs and joint deformities, and with an average height of 130 to 140 cm of the individuals (Hollister and Lachman, 1976; Kaitila et al., 1989; Vaara et al., 1998). Although found in all populations, it is particularly prevalent in Finland, with

an estimated incidence of 1:33.000 (Kaitila et al., 1989).

The mental status has shown to be normal among patients with DD (Hollister and Lachman, 1976; Kaitila et al., 1989; Reinikkala et al., 1982). There are two earlier studies evaluating factors related to the mental health of people with DD. Vaara et al. (1999) evaluated the health-related quality of life (HRQoL) and found that the overall HRQoL of the patients with DD was inferior to that of healthy controls. However, the DD patients showed greater adaptability to deviations in health status than did the controls. The assessment was made using the gene-ric 15-D questionnaire, with a total of 18 patients (aged 17 to 31 years) participating in the study. Recently Krüger et al. (2012) found no significant differences in the mental components of HRQoL in a sample of 68 patients with DD

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with DD when compared with healthy controls. The HRQoL was assessed with the RAND 36-Item Health Survey.

Research supports the view of the sense of coherence (SOC) as a health promoting resource, which seems to strengthen resilience and develops a positive subjective state of health (Eriksson and Lindström, 2006). There seems to be an association between the SOC and quality of life (QoL). The relationship occurs in both clinical samples and groups of healthy individuals. In a systematic review by Eriksson and Lindström (2007), the SOC had an impact on the QoL: the stronger the SOC, the better the QoL. Furthermore, it was stated that longitudinal studies confirm the validity of the SOC in predicting the QoL.

In a study by Drageset et al. (2008), the sense of coherence showed the strongest association with mental health and the weakest with bodily pain. The SOC has shown to be strongly associated with fewer depressive symptoms (Chumbler et al., 2004), resembling the results of the earlier study of Carstens and Spangenberg (1997) in which significant negative correlations were found between depression scores and total scores of the SOC scale as well as all three of its subscales. The SOC might even predict depression and could be useful for identifying persons at high risk for future depression (Sairenchi et al., 2011). Schnyder et al. (1999) state that the SOC is related to psychosocial effects of health problems and could be understood as a mediator between disability and handicap.

In a recent study by Moksnes et al. (2011), the SOC was inversely associated with the states of depression and state anxiety in adolescents. Flensborg-Madsen et al. (2005) conclude in their review including 50 publications that the SOC is only a weak predictor of physical health, but a very powerful predictor of psychological health, including stress and behavioural aspects. These results give support for the implications of salutogenic (an approach focusing on factors supporting human health and well-being, rather than on factors causing disease) factors in emotional health and quality of life (Dilani, 2008; Becker et al., 2010). There are only two studies concerning the mental health of Finnish adult DD patients (Vaara et al., 1999; Krüger et al., 2012). No published paper concerning the SOC among DD patients is available. The aim of this cross-sectional study was to obtain a comprehensive view of the SOC and its relations to the physical and mental health factors in a representative sample of Finnish patients with DD.

MATERIALS AND METHODS

Participants

There exists no official patient register for patients with skeletal dysplasia´s in Finland. Most of the patients have presumably been ascertained at the Helsinki University Central Hospital (HUCH) and the Finnish Association for Short People (FASP). The patients in the study were collected through the databases of HUCH and FASP. A total of 130 adult patients with DD were reached. Nine patients had died and three patients emigrated from Finland. A total of 115 DD patients, over 18 years, were contacted and asked to participate in the study. During spring of 2008, the study questionnaires were sent to 89 participants, either in paper-form or through e-mail. The final patient sample of 68, representing 59% of the known adult DD patients in Finland, gives a response rate of 74%. Socio-demographics and clinical data of the study sample are presented in Table 1.

Measurements

The patients completed the Finnish versions of Antonovsky's Sense of Coherence scale (SOC-13), the Beck Depression Inventory (BDI-I), the RAND 36-Item Health Survey (RAND-36) and the Finnish version of the Health Assessment Questionnaire (Finn-HAQ).

Sense of coherence

The validated Finnish version of SOC-13 questionnaire was used to evaluate the SOC of the patients. The SOC-13 questionnaire comprises three factors: comprehensibility (eleven items), manageability (ten items) and meaningfulness (eight items), according to of Antonovsky's theory of sense of coherence (Antonovsky, 1996; Bengel et al., 1999). The SOC scale seems to be a reliable, valid, and cross-culturally applicable instrument for measuring the management of stressful situations and the capability to maintain health (Eriksson and Lindström, 2005).

Depressive symptoms

BDI-I was used to measure depressive symptoms (Beck et al., 1961). The questionnaire contains 21 items with four (0 to 3) response options. The total score is compared to a key to determine the severity of the depression. In BDI I, the standard cut-offs are as follows: 0 to 9 indicates that the person is not depressed, 10 to 18 indicates mild-moderate depression, 19 to 29 indicates moderate-severe depression and 30 to 36 indicates severe depression. It has proven to be a useful and reliable tool for screening of depression (Beck et al., 1988). The consistency between this version and the revised Beck Depression Inventory is satisfactory (Beck et al., 1984).

Physical and mental health

The Finnish version of RAND-36/SF-36 was used to measure the health of the patients (Aalto et al., 1999). The RAND-36 contains 36 questions, yielding an 8-scale profile of functional health and well-being scores as well as physical and mental health summary measures and a preference-based health utility index (VanderZee et al., 1996). It has proven to be useful in surveys of general and specific populations, comparing the relative burden of diseases, and in differentiating the health benefits produced by a wide range of different treatments (VanderZee et al., 1996). The RAND-36 has not been tested for usefulness, validity or reliability in samples of patients with DD.

Daily activities

The Finnish version of the Health Assessment Questionnaire (Finn-HAQ) was used to assess the difficulty in performing activities of daily living. The HAQ contains 20 questions covering different

Table 1. Socio-demographics and clinical data of the subjects.

Variable	Tertiles of SOC			P-value
	I (<65, N=24) Mean (SD)	II (65-75, N=22) Mean (SD)	III (>75, N=22) Mean (SD)	
Number of females, n (%)	15 (62)	17 (77)	11 (50)	0.18
Age, years, mean (SD)	45 (15)	42 (14)	45 (14)	0.72
Work situation				
Working	10 (42)	10 (45)	7 (32)	
Unemployed	1 (4)	1 (5)	2 (9)	
Studying	1 (4)	2 (9)	1 (5)	0.98
Disability pension	11 (46)	8 (36)	11 (50)	
Retired	1 (1)	1 (5)	1 (5)	
Education				
Basic education only	4 (17)	4 (18)	2 (9)	
Vocational education	14 (58)	10 (45)	10 (45)	
Upper secondary school	1 (4)	1 (5)	1 (5)	0.92
Upper secondary school and vocational education	3 (12)	4 (18)	4 (18)	
Higher education	2 (8)	3 (14)	5 (23)	
Medication				
Any medication used	18 (75)	18 (82)	9 (41)	0.012
Pain	16 (67)	14 (64)	5 (23)	0.005
Anti-depressant	2 (8)	2 (9)	1 (5)	0.99
Sleeping	2 (8)	2 (9)	0 (0)	0.54
Cardiovascular	2 (8)	5 (23)	4 (18)	0.42
Household monthly income (€)				
≤850	11 (46)	9 (41)	8 (36)	
851-1680	10 (42)	5 (23)	8 (36)	0.43
1681-2500	1 (4)	6 (27)	3 (14)	
≥2500	2 (8)	2 (9)	3 (14)	
Surgery	22 (92)	21 (95)	19 (86)	
Arthroplasty	13 (54)	9 (41)	8 (36)	
Back	1 (4)	4 (18)	2 (9)	0.68
Other	8 (33)	8 (36)	9 (41)	
Other illnesses	8 (33)	8 (36)	8 (36)	
Musculoskeletal disease	4 (17)	5 (23)	1 (5)	
Lung disease	4 (17)	1 (5)	3 (14)	
Cardio-vascular disease	2 (8)	1 (5)	0 (0)	0.99
Diabetes mellitus	1 (4)	0 (0)	0 (0)	
Psychiatric disease	2 (8)	0 (0)	1 (5)	
Leisure time physical activity				
≥ 2/week	12 (50)	6 (27)	11 (50)	
~1/week	1 (4)	6 (27)	4 (18)	0.16
<1/week	11 (46)	10 (45)	7 (32)	

Table 1. Contd.

Visual analogue scale, VAS (0-10)				
Pain intensity	5.7 (2.3)	5.0 (2.1)	3.9 (2.3)	0.006*
Global assessment	5.0 (2.4)	4.1 (2.0)	3.1 (2.2)	0.005
Work capacity	6.1 (3.0)	5.5 (3.0)	4.0 (3.1)	0.021
Health assessment scale, HAQ (0-3)	1.53 (0.69)	1.44 (0.59)	1.19 (0.79)	0.13*
Short-form health survey, SF-36				
Physical component summary	29 (9)	31 (9)	35 (11)	0.052*
Mental component summary	50 (11)	59 (7)	64 (5)	<0.001*
Beck depression inventory, BDI	14.0 (10.2)	7.0 (3.9)	3.7 (3.6)	<0.001*
Rehabilitation plan made, n (%)	14 (58)	13 (59)	17 (77)	0.22
Rehabilitation during 12kk, n (%)	12 (57)	15 (68)	17 (77)	0.19
Number of doctor visits, median (IQR)	1 (0.4)	2 (1.5)	0 (0.1)	0.31
Number of physiotherapist, median (IQR)	48 (1.77)	50 (13.52)	45 (10.65)	0.87

*P-value for linearity, SD = standard deviation.

levels of activities of daily living: dressing and grooming, arising, eating, walking, hygiene, reach, grip and activities. The items of the HAQ questionnaire include standard 1 to 4 response options. Raw responses to the HAQ scales are re-coded from 1 to 4 to 0 to 3, 0 representing good and 3 the poorest functional ability (Fries et al., 1982). The Finn-HAQ has not been tested for usefulness, validity or reliability in samples of patients with DD. In a study on Finnish rheumatic patients by Arkela-Kautiainen et al. (2005), it is stated that, although there was incongruity in the psychological scale structure, the Finn-HAQ is an applicable, reliable, and valid instrument for the part of the scale measuring functional ability in Finnish patients with rheumatoid arthritis.

Pain intensity

The patient's overall assessment of pain intensity during daily activities was measured with a paper version of the Visual Analogue Scale (VAS, scale 0 to 100) (Price et al., 1983). The present pain intensity was estimated on the VAS marker line, on the scale from "no pain" to "worst possible pain" (1 to 100). Pain intensity refers to the sensory-discriminative dimension of the pain experience only, excluding cognitive and emotional dimensions (Melzack, 2001). The VAS has been widely used and has shown an acceptable level of reliability (Williamson and Hoggart, 2005).

Statistical analysis

Results are expressed as mean or median values with standard deviation (SD), inter-quartile range (IQR), or counts with percentages. Statistical significance between groups was evaluated by permutation test, analysis of variance (ANOVA), Kruskal-Wallis test, chi-square test, or Fisher-Freeman-Halton test when appropriate. Statistical significance for hypotheses of linearity was evaluated by bootstrap type analysis of variance (ANOVA). The normality of the variables was tested by using the Shapiro-Wilk W test. Internal consistency was estimated by calculating Cronbach's alpha internal consistency with bias corrected bootstrap 95% confidence intervals.

Ethics

The study has acquired research permission from the scientific board at Orton Foundation. The study protocol was approved (dated 27th March, 2008) by The Coordinating Ethics Committee of the Helsinki and Uusimaa Hospital District.

RESULTS

The analyses between study variables indicated that SOC was significantly positively related to psychological health, but marginally related to physiological measures when using SOC-13 tertiles. No association were found between SOC and socio-demographic or economic variables, surgery anamnesis, other illnesses, physical activity, or the use of health services. Results are presented in Table 1. The SOC-13 total score showed a negative association with medication use in general (p = 0.012) and pain medication (p = 0.005). Negative association was found between SOC-13 and pain intensity on VAS (p = 0.006). Significant positive correlation was found between SOC-13 and mental health (p < 0.001) while the relation between SOC-13 and physical health was only marginally positive when using SF-36 (p = 0.052). Results are presented in Table 1. SOC-13 related negatively to depressive symptoms on BDI (p < 0.001). In the lowest SOC-13 tertile, the BDI score indicated mild-moderate depression while no depression was found in the higher SOC-13 tertiles. Results are presented in Table 1. No significant gender differences were found in the SOC-13 total score or subscales. Means and standard deviations of SOC-13 including subscales are presented in Table 2.

Reliability analysis (Cronbach's α) of the SOC-13 scale showed that the internal consistency of the total scale was good. For subscales "comprehensibility" and "meaningfulness", the internal consistencies were acceptable

Table 2. Means and standard deviations of SOC-13 including subscales by gender.

SOC-13 questionnaire	Gender		Total	P-value*
	Female, N=43 Mean (SD)	Male, N=25 Mean (SD)	N=68, Mean (SD)	
SOC-13 total score	67.20 (12.78)	65.11 (11.59)	66.16 (12.34)	0.37
Subscales:				
Comprehensibility	25.98 (5.54)	22.88 (4.95)	24.43 (5.33)	0.38
Manageability	20.59 (4.21)	21.48 (3.44)	21.04 (3.96)	0.23
Meaningfulness	20.63 (4.73)	20.75 (4.76)	20.69 (4.71)	0.91

*P-value for gender difference, SD = standard deviation.

Table 3. Internal consistency of the SOC-13 total score and subscales.

Scale	Cronbach's α	95% CI
SOC-13 total score	0.86	0.79-0.90
Comprehensibility	0.73	0.60-0.82
Manageability	0.53	0.23-0.73
Meaningfulness	0.70	0.53-0.81

while it was poor for the subscale "manageability". Results are presented in Table 3.

DISCUSSION

The results indicated that the SOC of people with DD was significantly related to psychological health-related factors, but marginally related to physiological factors. This resembles the conclusions made by Flensborg-Madsen et al. (2005), according to which the SOC is only a weak predictor of physical health, but a strong predictor of psychological health.

The relation between SOC, pain intensity and depressive symptoms is in line with previous studies (Drageset et al., 2008). The SOC could possibly be understood as a mediator between disability and handicap, as proposed by Schnyder et al. (1999). Depression could be the consequence of the physical condition that is, pain condition and difficulties in physical functioning. Even factors related to the short stature may have a negative impact on the mental health, as stated by Johansen et al. (2007). Anyhow, due to the small sample size in this study, it was not reasonable to test mediator effects.

Only subjects with lowest scores of SOC showed clinical depression while no depression was found among those with higher SOC. This result resembles that of Carstens and Spangenberg (1997) according to which significant negative correlations were found between scores of depression and total scores on the SOC scale, as well as all three of its subscales. In this patient group, the adaptation to the limitations caused by the physical

state might implicate grief reactions due to experiences of loss physical function. Bereavement experiences could predispose to depression as stated in the review by Stroebe et al. (2007).

A complementary interpretation of the relations is provided by the salutogenic view focusing on factors promoting health and well-being (Dilani, 2008; Becker et al., 2010). According to this, perspective, individuals with high SOC could be able to utilize the health promotion and healthcare more efficiently. This, in turn, could even help these individuals to adapt to deviations in health status as stated in the study by Vaara et al. (1999). However, the cross-sectional design of the study does not enable inferences about causal relations between variables; it is impossible to determine whether low SOC lowers mental health or high SOC promotes health.

There are some limitations in our study. The cross-sectional study design enables inferences about relations only. A longitudinal design would reveal information about causal relationships. The small sample size, although understandable due to the small total amount of patients with DD, could be criticized.

Conclusions

The relations between the SOC and health factors among patients with DD resemble those found in samples of other patient groups and healthy individuals. Measuring the SOC of patients with DD could help targeting individuals at risk for mental problems like depression. The SOC measure could also contribute in planning and offering supportive psychosocial interventions. It is worth noticing that there were quite strong connections between SOC and perceived pain and used medication, as well as subjective working capacity. These observations may be useful when planning multi-professional pain management and other rehabilitation programs.

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Full Length Research Paper

Nurses' uniforms: How many bacteria do they carry after one shift?

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This pilot study investigated the pathogens that nurses are potentially bringing into the public and their home when they wear work uniforms outside of the work environment. To achieve this, sterilized uniforms were distributed to 10 nurses at a local hospital in Washington State at the beginning of their shift. Worn uniforms were collected at the end of the shifts and sent to a laboratory for analysis. Four tests were conducted: 1) a heterotrophic growth plate count, 2) methicillin-resistant *Staphylococcus aureus* (MRSA) growth, 3) vancomycin-resistant *Enterococci* (VRE), and 4) identification of the heterotrophic plate counts. Each participant completed a questionnaire and a survey. The results showed that the average bacteria colony growth per square inch was 1,246 and 5,795 for day and night shift, respectively. After 48 h, MRSA positives were present on 4 of the day shift and 3 of the night shift uniforms. Additional bacteria identified include: *Bacillus* sp.*, Micrococcus luteus, Staphylococcus aureus, Staphylococcus epidermidis, and Micrococcus roseus.* The significant presence of bacteria on the uniforms 48 h after the shift ended necessitates further study, discussions and policy consideration regarding wearing health care uniforms outside of the work environment.

Key words: Scrubs, uniforms, infections, nurses, healthcare providers, pathogens.

INTRODUCTION

The spread of pathogens breaching hospital walls and into communities is a major public health concern (Committee to Reduce Infection Deaths, 2008). Other countries such as the United Kingdom, Belgium, Australia, and Canada acknowledge and address this problem by prohibiting the wearing of hospital clothing outside the workplace. These countries also require health service providers to sterilize and provide clean uniforms to healthcare workers (Australian Government: Department of Health and Ageing, 2004; Conseil Superieur D'hygiene, 2005; Jacob, 2007; Nye et al., 2005; Treakle et al., 2009). However, the United States has lagged in fully addressing this issue. To date, studies have yet to investigate the frequency to which hospital uniforms are worn outside of the workplace. Hospitals in the United States do not regulate whether or not health care providers wear their uniforms to and from work. Therefore, their uniforms remain potential vectors for spreading pathogens such as methicillin-resistant *Staphylococcus aureus* (MRSA) (Rao, 2009).

The cost of care for infections due to pathogens such as MRSA is estimated to be over $20 billion annually in the US (Marler, 2009). Taking precautionary measures can decrease the financial and health burdens experienced by those who become infected due to exposure to vector infected hospital uniforms. This pilot study explored the presence and potential transmission of microorganism on uniforms worn during shifts in clinical settings that are subsequently worn in public.

Background of study

Several studies have confirmed the presence of pathogens on nurses' uniforms during their shift (Callaghan,

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1998; Perry et al., 2001; Wiener-Well et al., 2011). These studies found a relationship between the presence of pathogens such as MRSA and vancomycin-resistant Enterococci (VRE) on health care providers' uniforms and the spread of nosocomial infections. However, in these studies the uniforms tested were worn prior to the commencement work in a clinical setting, thus not controlling for outside sources of contamination (Callaghan, 1998; Perry et al., 2001; Wiener-Well et al., 2011). Studies exploring the presence of bacteria on nurses' uniforms have not been conducted to control outside contamination. Hence, this study sought to investigate this aspect by answering the following research questions: If nurses begin work shifts with sterilized uniforms, to what degree, and with what organisms are these uniforms infected during their shifts? Do those bacteria continue to live on the uniforms hours after the shift ends long enough to potentially infect members of the public who may come into contact with the uniform?

The importance of understanding and addressing the risk for increased exposure to pathogens and the potential spreading infections from healthcare workers' uniforms in milieus beyond the walls of the workplace is acknowledged (Committee to Reduce Infection Deaths, 2008; Jacob, 2009; Loveday et al., 2007). It also remains a public health concern (Committee to Reduce Infection Deaths, 2008; Jacob, 2009; Loveday et al., 2007). This pilot study investigated the pathogens that nurses are potentially bringing into the public and into their home when they wear work uniforms outside of the work environment.

METHODOLOGY

Ten nurses working on a medical telemetry unit from a local hospital in Washington State were recruited for this study. Prior to conducting the study, hospital institutional review board (IRB) approval was obtained. All 10 participants worked 12-h shifts. Five of the nurses worked the day shift and the other five worked the night shift. Upon recruitment and receipt of informed consent, the participants provided their scrub top size. Eleven scrub tops were purchased and sterilized, individually packaged and then distributed to each of the 10 nurses at the beginning of their 12-h shift. The eleventh scrub top was also sterilized and was used as a control to ensure that the nurses started their shift with uniforms that were bacteria free. At the end of their shift, each of the nurses placed their worn scrub top in an individual paper bag and returned the bag to the principal investigator. The uniforms were collected from the nurses within a 24-h period. All 11 scrub tops were then sent via express mail to a designated laboratory unaffiliated with the hospital for testing. The laboratory received the uniforms within 48 h. Each of the participants completed a demographic questionnaire and a brief survey about their shift. Questions in the survey included the number of patients cared for, the type of diagnoses, whether the patients were in isolation, and any other factors that the nurse believed might have increased their exposure to a contaminant. Each participant was randomly assigned a number between 1 and 10 to ensure confidentiality.

Upon receipt of the uniforms by the laboratory, a single 3 inch by3 inch portion of each of the eleven uniforms was cut out with

sterilized scissors from the front beltline/pocket area of each scrub. The front beltline/pocket areas and the sleeves (for long sleeves coats) are more likely to be contaminated (Nye et al., 2005). For this study, all the uniforms were short sleeves; thus the focus remained on the front beltline/pocket area of the participants' uniforms. Gloves were changed and the scissors flame sterilized between samples. After removing each sample, the fabric was cut into small pieces and placed in a sterile 100 ml container to which exactly 25 ml of sterile peptone water was added. The cloth in the peptone water was vigorously mixed to extract bacteria. After agitation, three volumes of each sample were placed on separate sterile Petri dishes (1 mL, 100 µL and 20 µL). 12 to 15 mL of tempered heterotrophic growth medium was added to each plate, swirled, and allowed to solidify. 1 mL of the peptone water extracted sample was also added to the top of a prepurchased chromogenic MRSA agar plate (Hardy Diagnostics G249) and 1 mL to a chromogenic VRE agar plate (Hardy Diagnostics G333). Prepared Petri dishes were sealed with parafilm and placed in an incubator at 35°C. After the designated growth interval was completed for each of the plates, the most prevalent bacteria were identified. There were three control measures for this study: 1) the 11th scrub top; 2) the media control of the peptone water; and 3) the HPC Agar Black media. There was no growth observed on any of the three controls, thereby ensuring that there was no contamination prior to sample collection and testing.

Sampling

Table 1 depicts the participants' characteristics. Seven of the participants cared for 4 patients while 3 of the participants cared for 5 patients. All the study participants reported frequently wearing a gown over their uniforms when going in the rooms for hands-on care.

RESULTS

Presence of pathogens

A total of 4 tests were conducted with the scrub tops: 1) a heterotrophic growth plate count, 2) methicillin-resistant *Staphylococcus aureus* (MRSA) growth, 3) vancomycin-resistant enterococci (VRE), and 4) identification of the heterotrophic plate counts. The heterotrophic plate counts reported significant bacteria colony growth for both day and night shift. The average colony growth per square inch was 1,246 for the day shift (minimum 175 and maximum 2,600). The average colony growth per square inch for the night shift was 5,795 (minimum 300 and maximum 24,900). One night shift nurse had a number of 24,900, which influenced the age bacteria for the night shift. Without this one outlier, there were no major differences between the average of the day shift and that of the night shift. MRSA was present on 4 of the day shift and 3 of the night shift scrub tops. However, VRE was not present on any of the scrub tops.

Identification of the heterotrophic plate counts yielded the following: *Bacillus* species, *Micrococcus luteus, Staphylococcus aureus* (MRSA Negative), *Staphylococcus epidermidis, Micrococcus* species and

Table 1. Participants' characteristics.

ID	Shift	Age	Ethnicity	Years as RN (year)	Year on Unit (year)	No. of Patient	Diagnoses	Cover gown
1	Day	31 - 40	Caucasian/White	4 - 7	1 - 3	4	Fecal impaction, gull stones, bronchitis, ankle wound	Yes
2	Day	25 or under	Hispanic	1 - 3	1 - 3	4	Chronic renal failure, chronic obstructive pulmonary disease (COPD), septicemia, UTI, Rhabdo, AMS,	Yes
3	Day	25 or under	Asian/Pacific Islander	<1	<1	5	Nephrolithiasis, COPD, ESBL, Kidney Stones, Aspiration pneumonia, MRSA	Yes
4	Day	26 - 30	Caucasian/White	1 - 3	1 - 3	4	UTI, chest pain, abscess	Yes
5	Day	26 - 30	Caucasian/White	1 - 3	1 - 3	5	AMS, CP, S/P skin graft groin, severe anemia, PNA r/o TB	Yes
6	Night	31 - 40	Asian/Pacific Islander	8 - 15	4 - 7	4	Pneumonia, UTI, Diabetic foot ulcer, Decub. To Coccyx	yes
7	Night	31 - 40	Asian/Pacific Islander	16+	1 - 3	4	Sickle cell anemia crisis, COPD exacerbation, chest pain with hypertension, abscess foot	yes
8	Night	31 - 40	Asian/Pacific Islander	1 - 3	1 - 3	4	Dehydration, right knee infection, r/o MI, CHF	Yes
9	Night	51 - 60	Asian/Pacific Islander	16+	8 - 15	Charge nurse	All	Yes
10	Night	26 - 30	Caucasian-White	1 - 3	<1	4	Bowel obstruction, UTI, cellulitis, hypoglycemia	yes

Micrococcus roseus. Up to 4 bacteria were identified on each of the uniforms. For example, scrub number 5 of the day shift contained *M. luteus (35%), S. aureus* (MRSA negative) (20%) and *S. epidermidis* (25%). Scrub number 2 night shift contained bacillus species (60%), *M. luteus* (15%), *Micrococcus* (10%) and *S. epidermidis* (10%) (Table 2). Other factors that the participants thought might have influenced contamination of the uniforms include: going into the break room, sharing desks, sharing computer mouse and keyboards, touching the gowns with dirty gloves, sharing equipment with co-workers, and using the restrooms. There were no significance differences on the presence of microorganisms between those who reported other places for potential sources of contamination.

DISCUSSION

This pilot study mirrors previous study results on the presence of bacteria on health care providers' uniforms, thus increasing the risk for infection spread (Halliwell and Nayda, 2011; Wilson et al., 2007). The findings of this study are important for many reasons. First, unlike previous research, the provision of sterilized uniforms allowed the researchers to control for potential confounding factors that might have influenced the contamination of the uniforms. Secondly, this study is the first to illustrate the longevity of the vectors found, with live bacteria presence confirmed more than 48 h after the shifts ended. Previous studies have been limited to showing the presence of micro-organisms during and immediately after shifts. This study addresses the growing concern of health care providers' uniforms as potential reservoirs for community infections.

According to this study, differences were found in the average of bacteria on the night shift compared to the day shift. This was because of the count of one night nurse whose count per square inch was 24,900. There were no particular indications on the demographic questionnaire or on the survey that would explain the high number of bacteria present on this participant's uniform. The participant had been an RN for over 10 years

Table 2. Identification of 3 most predominant organisms and presence/absence of MRSA and VRE.

Sample ID	Organism identification	MRSA Presence/absence (Primary isolation)	VRE Presence/absence (Primary isolation)
Day Shift Scrubs-1 (D-1)	*Bacillus* sp. (45%); *Micrococcus luteus* (35%)	Absent	Absent
Day Shift Scrubs-2 (D-2)	*Bacillus* sp. (50%); *Micrococcus luteus* (40%)	Present	Absent
Day Shift Scrubs-3 (D-3)	*Bacillus* sp. (25%); *Micrococcus luteus* (70%)	Present	Absent
Day Shift Scrubs-4 (D-4)	*Micrococcus luteus* (65%); *Staphylococcus aureus* (MRSA negative) (35%)	Present	Absent
Day Shift Scrubs-5 (D-5)	*Micrococcus luteus* (35%); *Staphylococcus aureus* (MRSA negative) (20%); *Staphylococcus epidermidis* (25%)	Present	Absent
Night Shift Scrubs-1 (N-1)	*Bacillus* sp. (75%); *Micrococcus luteus* (10); *Staphylococcus aureus* (MRSA negative) (10%)	Present	Absent
Night Shift Scrubs-2 (N-2)	*Bacillus* sp. (60%); *Micrococcus luteus* (15%) *Micrococcus* sp. (10%); *Staphylococcus epidermidis* (10%)	Present	Absent
Night Shift Scrubs-3 (N-3)	*Bacillus* sp. (35%); *Micrococcus luteus* (25%); *Staphylococcus aureus* (MRSA negative) (25%)	Present	Absent
Night Shift Scrubs-4 (N-4)	*Bacillus* sp. (20%); *Micrococcus luteus* (70%)	Absent	Absent
Night Shift Scrubs-5 (N-5)	*Bacillus* sp. (75%); *Micrococcus roseus* (15%)	Absent	Absent
Control 1 (C1)	No growth observed	N/A	N/A
Media Blank (MB-Peptone)	No growth observed	N/A	N/A
HPC Agar Blank	No growth observed	N/A	N/A

and had been working on the unit for over five years and for that shift cared for participants with the diagnosis of pneumonia, urinary tract infection (UTI), diabetic foot ulcer, and decubitus ulcer. The high number of bacteria on this particular nurse's uniform could have been due to mode of practice such as lack of proper hand hygiene, and laboratory discrepancies.

Study limitations

Several factors might have influenced the study findings. The first limitation relates to the Hawthorne effect. Participation in the study was voluntary; therefore, knowledge of participation might have influenced the participant's behavior while providing care during their shift. We recommend that a future study randomly recruit participants at the end of their shifts. Moreover, all of the 38 patients that were cared for by the study participants were in isolation. Therefore, the nurses had to wear a gown on top of the uniforms provided for the study, thus minimizing the level of exposure. Despite the isolation gowns, these study findings showed substantial presence of

bacteria on the uniforms. Bacterial presence could be an indication of the lack of effectiveness of those isolation gowns as personal protective equipment (PPE) (Lovitt et al., 1992). The presence of bacteria despite the isolation gowns could also be an indication that the nurses were not fully compliant and were not wearing their isolation gowns as necessary over their uniforms during patient care. Such issue of lack of compliance for donning isolation gowns has been addressed in previous studies (Manian and Ponzillo, 2007). Thus, an "observational study" is recommended for further study to observe how

healthcare providers' implement infection control measures while taking care of their patients. Additionally, the laboratory was not able to detect organisms that were anaerobic. Every step of the testing, including incubation took place in the presence of oxygen as they focused on aerobic (isotonic peptone water) organisms. Bacteria that are susceptible to oxygen such as *Clostridium haemolyticum*, would have likely died before reaching the laboratory due to oxygen exposure.

Further studies are needed to compare presence of bacteria across hospital units and other types of health-care workers. Studies also are needed to determine the presence of pathogens in open public spaces (e.g. surface of restaurant tables) where health providers wear their post-shift uniforms. Research is also needed to compare whether differences exist in infection rates of family members of nurses who wear soiled uniforms outside the clinical setting to those who do not. The increasing numbers of bacteria resistant to antibiotics makes a compelling case for limiting public exposure to such pathogens. This study makes clear that such bacteria are present and alive on hospital uniforms that nurses wear both inside and outside the hospital setting, increasing the potential both for nosocomial infections and for wider circulation of potentially dangerous micro-organisms in communities. While creating policy to limit public exposure to hospital-based microorganisms benefit community health, there are economic consequences to consider. We therefore recommend that a cost-benefit analysis be conducted to compare the cost of providing laundered uniforms to the potential cost of community-acquired infections such as MRSA.

Conclusion

The scientific contribution of this study supports and builds on previous research that health care providers' uniforms can be vectors that spread infections not only within hospitals, but also potentially within communities. Therefore, further research and policy that address this topic is imperative to protecting patients, health care providers, and the health of the public.

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Full Length Research Paper

Determination of the pollution loads of Brewery X and the impacts of the pollutant on the Sisai River

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Determining pollution load is not a common practice in most Ghanaian industries. This paper is aimed at providing a comprehensive picture of the environmental impacts on the Sisai River as a result of the pollutant loads from a Brewery X located in the Ashanti Region of Ghana. The effluent flow rate, effluent parameters concentrations and pollutant loads were determined using standard procedures. The effluent from Brewery X had a mean daily flow rate of 1035.85 m^3/day, mean Biochemical oxygen demand (BOD) of 1800.70 mg/l, chemical oxygen demand (COD) of 2844.33 mg/l, TSS of 129.32 mg/l, respectively and p values/rating for all effluent parameters of ($p < 0.0001$***). The presence of the effluent in the Sisai River will lead to oxygen depletion, increase in plant and animal biomass, reduction of the amount of light available for aquatic vegetation, decrease in species diversity and changes in the dominant biota.

Key words: Effluent, environmental impact, pollution load, eutrophication, Sisai River.

INTRODUCTION

Since the early 70s, the Institute of Aquatic Biology in Achimota, Accra, has performed special research projects on pollution problems and monitored chemically, biologically and bacteriologically some rivers (Institute of Aquatic Biology, 1970; 1974). A study by Antwi (1973) also found chemical pollution in some rivers and streams. Untreated wastes from processing factories located in cities are discharged into inland water bodies resulting in stench, discolouration and a greasy oily nature of such water bodies (Mombeshera, 1981). These wastes pose serious threat to associated environment including human health risks (Khan et al., 1997). Industrial effluents contain toxic and hazardous materials from the wastes that settle in rivers as bottom sediments and constitute health hazards to the urban population that depend on the water as source of supply for domestic uses (Akaniwor et al., 2007).

The mining, textile and oil exploration industries readily come to mind when issues concerning polluters are to be discussed. The brewing industry probably does not. There has however, been a shift in this mentality since 1992 when the Colorado-based Coors Brewing Company became the first major brewery in the United States to do a comprehensive, voluntary investigation of its Volatile Organic Compound (VOC) emissions (Volokh, 1997). Irrespective of the location and equipments in a brewery, beer preparation always use up a lot of water and generates large volumes of wastewater.

Micro organisms gradually break down the organic component of wastewater produced during beer production consuming oxygen and subsequently polluting rivers, lakes, streams and deep-water aquifers (www.oasisenviro.co.uk/eutrophication.html). Brewery effluents are high in carbohydrates; nitrogen and cleaning/washing reagents which have been proved to be water pollutants. The introduction of wastewater, high in organic matter and essential nutrients, bring about changes in the microflora. Ekhaise and Anyansi (2005) reported high counts of bacterial population in Ikpoba River in Benin City Nigeria receiving a brewery industrial effluent. Similar results were reported by Kanu et al. (2006) of the effect of brewery discharge into Eziama River, Aba, Nigeria.

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In Ghana, the Environmental Protection Agency (EPA) Act 490 and Environmental Assessment Regulations 1999 (LI, 1652) are some drivers that are suppose to regulate the discharge of emissions from industries by setting standards and ensuring compliance. As to whether Brewery X complies with standards outlined by the EPA is worth investigating.

The study determined the pollution loads from Brewery X and assessed the impacts of the pollutant on the Sisai River.

MATERIALS AND METHODS

An anonymous and non-linked methodology was used.

Study area

Brewery X is situated in the Kumasi Metropolis. It shares boundaries to its south and east with timber processing companies, and shares a boundary to its west with a timber haulage company. It is separated from the Kaase Industrial area, which is to its north, by a street. The climatic data obtained from the Kumasi Airport was sourced to represent conditions at Brewery X. The study area falls within the wet semi-equatorial climatic region of Ghana with two rainfall maxima. Inter Tropical Boundary (ITB) influence the climate conditions of the area. The North-east trade winds are associated with a dry cool wind known as the harmattan, which affects the Ashanti Region of Ghana during the months of November to March. The first major rainy season occurs between May and July while the second is from September to October; attaining a maximum in June. The rainfall in the Brewery X vicinity is often intense and torrential. The resultant runoffs are very intense and accompanied by massive erosion of loose topsoil. The mean monthly rainfall ranges from 16.9 to 207.6 mm (Meteorological Office, Kumasi Airport). The mean monthly relative humidity in the area generally increases from the dry month of January to a maximum in August. The relative humidity value in the area ranges mainly from 70 to 80%, with daily temperature values varying from 24.4 to 28°C (Meteorological Office, Kumasi Airport).

Collection and analysis of water samples

Waste water samples (effluent) were collected into sterilized bottles over a fifteen week period and transported under dark conditions to the Ghana Water Company laboratory, for analysis. Physico-chemical parameters such as biochemical oxygen demand (BOD_5), total suspended solids (TSS), chemical oxygen demand (COD), phosphate, and oil/grease were used to determine the water quality and pollution loads from Brewery X. Standard methods as stated in Eaton et al. (1995) were used for determination suspended solid, BOD, COD and ammonia concentrations as well as temperature and pH. Standard methods as stated in the DR/2000 Spectrophotometer Procedures Manual by HACH Company, USA, were used to determine the concentrations of phosphorus and nitrate.

Measurement of effluent flow and velocity floats trial

The Community Clean Water Institute Volunteer Water Quality Monitoring Program Sampling and Analysis Methods (CCWI, 2011) methodology was used.

Flow Rate = ALC / T

Where, A = average cross-sectional area of the channel (channel width multiplied by average water depth), L = length of the channel, C = a coefficient or correction factor of 0.8 for rocky-bottom Channels, and T = time in seconds for the float to travel the length of L.

Pollution load

The pollution load was obtained by multiplying the mean daily flow by the mean daily effluent concentration and dividing by a thousand

RESULTS

The effluent from Brewery X had a mean daily flow rate of 1035.85 m^3/day. The concentrations for all effluent measured with the exception of nitrate as shown in (Table 1) were significantly higher than the EPA per-missible levels. The COD and nitrate concentrations were the least compliant and the most compliant respectively with EPA permissible limits with the COD concentration exceeding the EPA value by more than 11-fold. The mean effluent concentrations of the main pollution indica-tors, together with the daily flow rate of the effluent, were used in calculating the daily pollution load discharged into the Sisai River from Brewery X (Table 2). Phosphate and COD were the pollutants with the least and most pollutant loads of 3.67 and 2946.30kg/day, respectively discharged into the Sisai River.

DISCUSSION

The effluent from brewery activities is likely to have serious environmental consequences when discharged untreated (Institute of Aquatic Biology, 1970, 1974; Parawira et al., 2005; Al-Rekabi Wisaam et al., 2007; Brewers of Europe, 2002). With a daily pollutant load of 133.88 mg/l for TSS, 1865.26 mg/l (BOD), 2946.30 mg/l (COD), 3.67 mg/l (Phosphate), 40.35 mg/l (Oil/Grease), respectively (Table 2) and (P < 0.0001) for all measured effluent parameters (Table 1), the Sisai River will be depleted of dissolved oxygen and noxious conditions will be created (Parawira et al., 2005; Osibanjo et al., 2011). There will be stimulation of aquatic plant growth and subsequently eutrophication of the Sisai River.

The breakdown of spent yeast, wort, trub and kieselguhr generated by Brewery X will deplete dissolved oxygen needed to sustain aquatic life in the Sisai River (P< 0.0001***) as depicted by (Table 2); consequently there will be suffocation of aquatic life which will result in putrefaction producing foul odour and killing living organisms in the river as confirmed by (Kunze, 2004; Osibanjo et al., 2011).

High concentrations of suspended solids with a mean value of 129.32mg/l, (p < 0.0001) as shown in (Table 1) and pollutant load 133.88kg/day (Table 2) as a result of spent grains, kieselguhr, surplus yeast, trub and label

Table 1. Descriptive statistics of effluent parameters with reference to EPA Permissible Levels.

Parameter	Min.	Max.	Mean	95% CI	EPA standard P value
TSS (mg/l)	67.9	140.90	129.32	119.47-139.04	50 $P < 0.0001$***
BOD (mg/l)	1274.09	2580.37	1800.70	1550.00-2051.43	50 $P < 0.0001$***
COD (mg/l)	1876.22	3849.65	2844.33	2508.36-3180.30	250 $P < 0.0001$***
COND (µS/cm)	1448.87	2945.90	2171.83	1969.29-2374.39	1,500 $P < 0.0001$***
OIL/GREASE (mg/l)	11.20	65.00	38.95	30.70 - 47.17	5 $P < 0.0001$***
Nitrate (mg/l)	0.37	0.92	0.60	0.52 - 0.69	50 $P < 0.0001$***
Phosphate (mg/l)	2.20	4.58	3.54	3.11 - 3.98	2 $P < 0.0001$***

Data presented in means, Min: minimum, Max: maximum, EPA Standard, CI: confidence interval, BOD: biochemical oxygen demand, COD: chemical oxygen demand, COND: conductivity. *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

Table 2. Mean daily flow and pollution loads,

Effluent parameter	Mean daily flow (m^3/day)	Mean effluent conc. (mg/L)	Pollutant load (kg/day)
TSS		129.25	133.88
BOD		1800.70	1865.26
COD	1035.85	2844.33	2946.30
Phosphate		3.54	3.67
Oil/grease		38.95	40.35

Data presented in mean daily flow, mean effluent concentration, pollution load, TSS: total suspended solids, BOD: biochemical oxygen demand, COD: chemical oxygen demand.

pulp in the effluent of Brewery X will cause the colour of the Sisai River to darken thereby reducing the amount of light available for aquatic vegetation, algae and mosses to photosynthesize. Reduced plant matter means less food and habitat for herbivorous organisms such as snails, insects, fries and fingerlings. As photosynthesis slows, less oxygen is released into the water during the daytime and can lead to many plants dying off. As the dead plants decompose, bacteria will use up even more oxygen from the water (Osmond et al., 1995).

The darkening of the Sisai River will make the river warmer than usual due to the fact that darker materials absorb more heat from sunlight as compared to lighter ones. This will lead to a drop in oxygen levels and a rise in hydrogen sulphide concentration which can be toxic to all forms of life in the Sisai River. During the breakdown of the yeast, trub and spent grains which form the bulk of SS in the Sisai River, oxygen will be used up and this will deprive the surrounding water of oxygen. This will give the Sisai River an unpleasant smell and destroy aquatic life (Lenntech, BV).

The presence of phosphate in the Sisai River as a result of chemicals like phosphoric acid used in the clean-in-place (CIP) units by Brewery X will drastically densify vegetation along banks of the Sisai River and subsequently lead to eutrophication (Passant et al., 1993; UNEP, 1996; SEPA, 1991). Plankton and algae will become increasingly abundant and dead plants and animals will accumulate at the bottom layers of the river. If the

water becomes completely de-oxygenated, as a result of the eutrophication, hydrogen sulphide, toxic to all higher forms of life will be formed. In all, heavy eutrophication will lead to a reduction in the number of plant and animal species in the Sisai River.

Fatty organic materials from petroleum are not quickly broken down by bacteria and can cause environmental pollution. When large amounts of oils and greases are discharged to receiving waters, they increase BOD and they may float on the surface and harden, causing aesthetically unpleasant conditions. The daily oil/grease load of 40kg/day from Brewery X into the Sisai River will trap trash, plants, and other materials, causing foul odours, attracting flies and mosquitoes and other disease vectors (http://www.danpatch.ecn.purdue.edu/~epados/septics/w water.htm). The oil/grease will increase BOD of the Sisai River. High BOD will lead to oxygen depletion, which can have severe consequences on fish life in the Sisai River (Osibanjo et al., 2011). If the dissolved oxygen (DO) value falls below the minimum oxygen requirement for particular species of fish in the Sisai River, they will be subjected to stress, which will result in mortality (Chapman and Kimstach, 1992).

Conclusion

The presence of the effluent in the Sisai River will lead to oxygen depletion, increase in plant and animal biomass, reduction of the amount of light available for aquatic

vegetation, decrease in species diversity and changes in the dominant biota in the Sisai River. This will impact negatively on the water quality of communities which depend on the Sisai River as their source of water. Even though BOD is not a pollutant itself, it is a measure of organic pollution of the effluent from Brewery X. All the BOD_5 values obtained were beyond the EPA maximum permissible discharge level of 50mg/l. Brewery X is therefore non compliant for the effluent parameter BOD and can be said to be polluting the Sisai River.
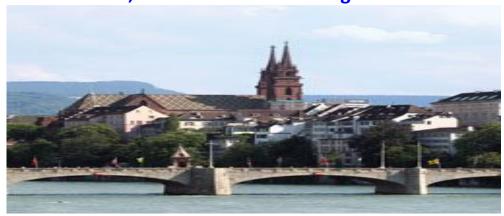
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