Term paper on impacts of gene-environment interactions on depression

Science, Genetics

Mental disorders are a common illness in the society. Scholars and medical practitioners have taken time and effort in attempting to understand the causes and treatment methods for these conditions. However, since the biological processes that leads to mental illnesses are quite difficult to understand, several hypotheses have developed to assist studies. Genetics and other environmental factors have been associated with numerous mental disorders. This paper first evaluates the issues of mental disorder such as depression and provides review into the genetics involved. Then the paper reviews studies into twin cases, association and neurodevelopment disorders. The research will then argue the findings and conclude with assertion based on the findings.

Depression may be defined as a collection of several metal disorders that exhibit different characteristics and reflect several mental alteration in emotional processes, cognitive abilities and psychomotor. Each individual exhibits quite different profiles, severity and course on these disorders. Similarly the treatment regiment and response for each of these patients have been differentiated. Genetic epidemiology studies have provided insightful evidence into the fact that mood disorders have variation based on genetic components. Mendel theories of genetics and inheritance provide several assertions regarding health and genetics. There are other suggestions that point at a phenomenon referred to as gene-interaction. Cooper (2001) argues that this phenomenon has a key role in the processes leading several psychological related illnesses. Studies to understand these issues have been employed and have been directed at mental disorders such as depression.

Problem Statement

The genetic component in question is rather complex. However, due to this fact, research has identified that multiple gene of modest effect together with several environmental factors have a significant impact on mental disorders (Rose, Dick, & Viken, 2001).

This paper seeks to understand complex impact of such environmental factors in interaction with genetics on an individual. To gain such an understanding, first the paper will evaluate the complex genetic inheritance scheme associated with mental disorders. Secondly the paper will evaluate environmental factors that have a bearing on the character of depressions. Finally this research will give conclusion on the findings regarding the impact of genetic variation in interaction with environmental factors on depression.

Methodology of Research

On doing this research, several research methods were employed. In understanding several aspects regarding depression and the nature of the disease, numerous secondary sources were studied. These secondary sources include journals from the World Psychiatric Association. The Association is composed of academic institutes and mental clinics that have dedicated their efforts towards psychiatry. Other journals were based mental disorders and explored several contextual issues in concerning interaction between the environment and genetics.

Additionally, several books on genetics and inheritances were reviewed. Most of these books reviewed numerous issues on the subject of genetic and control of brain development. Such brain development based on genetics

was illustrated by Mendel Inheritance Theorems illustrated in several books. Most of the books and articles reviewed were insightful regarding mental disorders and their symptoms. However, concerning the interaction between environmental factors and gene components, the research turned to more journal articles.

In doing this research, a number of key words were used. Some of the key words used include bipolar disorder, gene expression, depressions and gene expression. The research further employed other words such as models, serotonin, environment and interaction.

Analysis and Framework

Understanding the nature in which the interaction of environmental factors and genetic combination has an effect on depression may be analyzed in three basic studies. First it is important to establish the possibility of prevalence of mental disorders based on genetics. Secondly, it is important to review studies that have indicated prevalence of the illness based on twin studies and environmental impacts. Thirdly it is necessary to understand gene-environment interaction due to this association.

Evaluation of Genetics on Mental Disorders

Epidemiology studies on depression have exposed a general risk possibility of about 2% to 19% of any one suffering from the unipolar depression. However, for persons who are first relative of patients, especially first degree family members, then the prevalence changes to between 5% and 25% . In other analysis of families suffering major depression, statistics indicate familiarity in the symptoms of the disease to a very high degree. Multiple

kinds of depression features seem to exist for familial depression cases. Additionally, there exist more evidence in twin and family based research on vulnerability of depression. Lesch (2004), agrees that this vulnerability is found to increase three fold in twins and first relatives. This is particularly the case in major depression cases. However, McNeil, Cantor-Graae, & Weinberger (2000), argue that environmental factors have a significant influence on the manner in which such depression exhibits itself. However, determining the extent to the interaction of such environmental factors and genetics influence depression remains the toll order.

This relation between the environment and gene on impact expressed in differentiated depression is phenomenon referred as gene-environment correlation. In appreciating these issues, individual genotype exposure on different environmental factors may provide evidence towards such an assertion. However, understanding candidate gene and mental disorders is still a matter contention in past studies. This is due to the fact that there is limited knowledge on the biological process that leads to mental disorders. Lesch (2004) argues that of all the diseases that affect man, it is mental disorders that is least understood by biologists. Researchers have to find less determinate methods and a myriad of hypotheses in order to develop such an analysis.

However, other studies have pointed out some relation between genetics and specific mental disorders. One such study was in the case of Alzheimer’s disease (AD). In this study, it was found that there exists an allelic association between Alzheimer’s disease and an allele of the apolipoprotein E (APOE) gene (Bennett, 2002). In this finding, it was found that an

individual’s risk of contacting AD increases six fold if the individual is found to have one or two copies of the APOE protein in the gene. The said protein is said to be only a susceptibility gene. Cooper, (2001) asserts it is not a causative or necessary agent for the development of AD.

A more elaborate study sought to establish a gene-environment correlation in the case of AD. In this particular study, there was an association between the presence of the gene APOE protein content and in a case of a head injury. Lesch (2004), emphasizes that with the presence of the gene and a history of head injury, the risk of AD was found to increase nearly tenfold. Subsequent studies into the impact of head injuries on AD found that head injuries had a significant impact on biological processes. In this case, head injuries influenced the pathogenesis of AD, largely attributed to an increase beta-amyloid precursor protein (APP). The increase in APP is said to exacerbate the APOE protein increasing susceptibility to AD.

A separate analysis of a case of gene-environment correlation to mental disorders as found in schizophrenia. Malaspina, Goetz, Friedman, et al, (2001) explain that head injuries were found to have a significant relation to schizophrenia. Schizophrenic pedigrees of mental disorders in comparative studies found the schizophrenic pedigrees had a history of head injuries. However, studies into the gene susceptibility due to such a head injuries were rather inconclusive in the case of schizophrenia. Other mental disorders have different gene-environment correlation. Other quantitative studies into family cases and environmental factors have been performed. Such studies looked into twins, adoption and association. Quantitative research on these

matters may provide open ended discussions into the possibility of family and gene factors and its impacts of mental disorders.

Studies into Twin Cases

Twins can be a very good tool in understanding the underlying concepts of gene-environment correlation and impact found in mental disorders. Studies into Monozygotic (MZ) discordant twins can present elaborate indication into the non-inherited character of mental disorders. This is due to the fact that MZ twins have a similar genotype and any variations in character can fully be attributed to environmental factors. Such evaluation can best be done in comparative studies into heritability and genetic variation due to the presence or absence of some environmental risk factors. McNeil, et al, (2000) asserts that the magnitude or orders of depression and other mental disorder may be significantly influenced by a combination of genetic and environmental issues in moderation. Therefore, for such a study to work there must be significant differences in the environments that such discordant twins are exposed for plausible differences and conclusions. Several twin studies have been conducted in attempting to understand these issues. In one of the studies, several Finnish twins identified on population based sampling method were put under such study (Rose, et al, 2001). Several socio-regional variables such as adolescent alcohol were examined. In the study it was found that while alcohol drinking was at a similar rate in rural and urban environments, genetic factors were influenced by the environment. More analysis into such differentiated character on the environment pointed to the fact that other factors such as high percentage

of young adults, higher alcohol sales and immigration rates had greater influence on the character of such twins.

Other studies have been performed on large population-based samples of twins in evaluating impacts of life event on major depression (MD) in women (Rutter & Silberg, 2002). Similar studies were performed to look into the gene-environment correlation with to Generalized Anxiety Disorder (GAD). It was found out that common familial environments and genetic factors were not found to have significant impact on how these disorders manifest. However, different environment occurrences such as stressful life events may have had significant influence on both GAD and MD. In this respect, Rutter & Silberg, (2002) suggest that there is strong likelihood that environmental factors play a vital role on whether females express higher vulnerability to such mental disorders. In a separate study, the same results seem to have been replicated in which stressful life events involving loss may have helped in exacerbating susceptibility.

Neurodevelopment Disorder as impacted by gene-environment Interaction

Development of the human body is largely a component of interactions between the genes and the environment. Methodical analysis of the impact of the gene-environment interaction and neurological development disorder may provide important insights into the impact of this interaction on depression. Etiological factors as exhibited by environmental and genetic interaction begin at early stages of development and any disorder in the development is magnified by genetic susceptibility (Tsuang, 2004). Thus the severity of cases varies with the extent to which gene-environment

interaction varies. According to Lesch (2004) these factors depend on the presence or absence of genetic vulnerability and the presence of appropriate environment factors. Two cases of neurodevelopment disorders commonly associated with gene-environment interaction are autism and schizophrenia. While autism genetics factors have seen to play exceedingly important roles in the autistic MZ twins, several evidence points to the direction that severity of each case is directly attributable to the environment. Studies performed on several animal test agents referred to the suggestion that interaction between specific environment factors such as viral infection and genetic susceptibility (for instance in strain of animal test agent), neurodevelopment disorder manifests.

Similarly in schizophrenia, there is no direct evidence that direct family relation to a patient causes the illness, however, as earlier stated, such direct gene inheritance increases the risk of the disease. Schizotaxia is term developed to refer to the condition or the state of susceptibility to schizophrenia . According to Cooper schizotaxia is based on neurodevelopment of the individual and the state is set to be determined by the gene-environment interaction. Early exposure, especially in childhood, to adverse environmental conditions such as obstetric complications affects the neurodevelopment of the individual. The results are abnormalities expressed in social, cognitive and neurobiological deficits at childhood. However, Lesch (2004) argues in good environments and with care, most of the individual should develop and remain stable for most of the lifespan. On the other hand, having such predisposition of affected neurodevelopment may later lead to psychosis or chronic schizophrenia if the individual is exposed to

more unfavorable combination of environmental factors such as substance abuse and other psychosocial circumstances.

Association Studies on Gene-Environment Interaction

It is important to point out there is much debate on issues regarding the emotional state of an individual and the role of gene-environment interaction. Several studies have been performed on the impact on several strains of rodents and their response due to different rearing experiences. These studies help shine some light on issues regarding the emotional discomfort that individual undergo such as maternal separation or loss, social deprivation, abuse and neglect.

Discussion

It is quite clear that studies into gene-environment interaction in an open and decisive field in psychiatry. However, there are basic important results that have come out of these studies. First and foremost, most studies have confirmed that there is significant increase in vulnerability to mental disorder based on genetics. In this sense, reviews into families and twin cases suffering AD and Schizophrenia have ascertained an increase in the susceptibility by about six folds. But a more important finding is that genetics factors only increase the vulnerability but not major etiologic factor.

Having made the above assertion, the next important issue of discussion is the impact of environmental factors that would exacerbate gene vulnerability. These studies have confirmed that cases of schizophrenia and AD is said to increase in persons who have suffered significant head injury in

the past. While there is no concrete evidence of any relation between the gene and such environmental factors, it was found out that the cases of the two conditions increased in individuals with a history of head injury.

Twin studies have also provided important assertions on matter regarding gene-environment interaction. In studies involving women MZ twins, women who had suffered a stressful life event such as marriage breakup or death of a close relative gene susceptible of an individual increased nearly ten folds as compared to the non affected twin. Other studies point to the fact that neurodevelopment disorder based on gene-environment interaction is equally important in future development of mental disorders in adults. However, none of these studies seem to be quite conclusive in most matters. Future studies need to employ the use of advanced technology that we now have. Exact gene mappings and vulnerability to mental disorders is one of the areas that can be clearly identified. For instance, cases of autism have been directed towards purely genetic etiologic factors. In that, several cases of autism have not found any relation to environmental factors. The implication is that in depth analysis into the gene component responsible for autism can be.

Conclusion

Genetics and environmental factors may have a significant impact on the nature of depression experienced by different patient. Evidence has proved that different patients exhibit different characteristic of mental disorders. Such differential character is said to be based on the gene-environment interaction however at a complex relational model. Research into this

complex relation has provided important knowledge on how the environment and the gene can increase susceptibility to mental disorders. In one of the cases, research identifies gene component exacerbated by injuries on the head leading to AD. Other mental disorder such as general anxiety disorder, major depression and schizophrenia increases in susceptibility due to environmental factors. While there is no direct evidence of mental disorders in terms of genes and environmental factors in separation, it appears that a combination of right environmental factors in the presence of gene susceptibility is vital for mental disorders.

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