

Physical comorbidity in children with neurodevelopmental disorders

Mohammad Tariqul Alam, Md. Faruq Alam, Ahsan Aziz Sarkar, Rubina Hossain, Surajit Kumar Talukder, Md. Abdullah Al Mamun, A. D. M. Rifat Chowdhury, Mekhala Sarkar, Helal Uddin Ahmed, Mohammad Hasibur Rahman, Fatima Zohra, Farjana Akhter

Abstract

Background: Frequent comorbidity among patients with neurodevelopmental disorders impair management process. Premature mortality and disability could be reduced if there were a greater focus on comorbidity. Holistic and cost-effective services to the persons with neurodevelopmental disorders is of utmost importance.

Objectives: The objective of the study was to find out the prevalence and types of comorbidity among individuals diagnosed with neurodevelopmental disorders.

Methods: A hospital based cross-sectional study was conducted among 346 children between 10 to 18 years with neurodevelopmental disorders (NDDs) in the Child Guidance Clinic of National Institute of Mental Health, Dhaka during the period of September 2017 to June 2018. Diagnosis of neurodevelopmental disorders were done by the research psychiatrists following DSM-5 criteria. Physical comorbidities were diagnosed from history, physical examination, relevant investigations and consultation with the consultant of the respective discipline. A research psychiatrist, a statistician, medicine specialists and other specialists as required, were recruited accordingly. Coordination meetings with involvement of all were held before data collection. MS Excel 2003 and SPSS version 18 were used for data analysis.

Results: Overall 346 children were approached for interview and among them 311 respondents completed full data collection procedure. Among the respondents, 61.7% were boys and 38.3% girls. Intellectual disability was the most common type of NDDs followed by ADHD and ASD. Among children with neurodevelopmental disorders (NDDs), 32.2% had physical comorbidity. Epilepsy (14.2%) was the most common comorbid physical disorder, followed by diabetes mellitus (2.6%) and cerebral palsy. Other physical comorbidity among patients with NDDs were infectious and parasitic diseases, diseases of the thyroid gland, hypertension, obesity, diseases of the respiratory tract, diseases of the urinary tract, diseases of the skin, diseases of ear, nose and throat.

Conclusions: Treatment of coexisting physical illnesses is required for proper management of patients with neurodevelopmental disorders. Approach of integrative medicine involving pediatrics and related disciplines needs to be taken for managing such children.

Declaration of interest: Financing authority- Non-Communicable Disease Control (NCD) wing of Directorate General of Health Services, Ministry of Health & Family Welfare, Government of People's Republic of Bangladesh; study was conducted by National Institute of Mental Health, Dhaka, Bangladesh.

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Keywords: Physical comorbidity; neurodevelopmental disorders

Introduction

When two disorders or illnesses occur in the same person, simultaneously or sequentially, they are described as comorbid. Comorbidity also implies interactions between the illnesses that affect the course and prognosis of both. People with severe mental illness (SMI) have excess mortality, being two or three times higher than that in the general population.^{1,2} This mortality gap, which translates to a 13-30 year of shortened life expectancy in SMI patients^{1,2} has widened in recent decades, even in countries where the quality of the health care system is general-

ly acknowledged to be good.^{3,4} This excess mortality is likely to be related to comorbid physical illness.

Neurodevelopmental disorders (NDDs) are severe form of mental disorders in children. Individuals with NDDs are also prone to many different physical health problems. While these physical diseases are prevalent in general child population, their impact on individuals with NDDs is likely to be greater. Children with NDDs are usually chronically ill and coexisting physical disorders are also usually chronic in nature. Chronic nature of more than one disorder existing in children, make them more

resistant to treatment. They inadequately respond to treatment and are often referred to as high-cost-utilizers, inadequate responders and treatment refractory. Children with NDDs are usually neglected by the society most of the time and this is likely to be more when he or she is burdened with additional comorbid physical disorders. Therefore, this growing problem of medical comorbidity in people with NDDs need an urgent attention in Bangladesh. Bangladesh is an emerging country in all socioeconomic contexts. Health should not stay backward in this glorious journey. To develop effective and sustainable health care delivery model, child mental and physical illnesses must be focused together with utmost priority. Any management option is incomplete without addressing the comorbidity. Premature mortality and disability could be reduced if there was a greater focus on comorbidity. Till time, little attention has been given to the issue of comorbidity among patients with NDDs. To achieve sustainable development goals (SDGs) aimed by the government, good health and well-being of children should be ensured. So, to provide effective, holistic and cost-effective services to the persons with NDDs it is necessary to determine the prevalence and types of physical comorbidity in them. To the best of knowledge, this is the first study of its kind in Bangladesh to assess the comorbid physical illness among children with NDDs.

Methods

National Institute of Mental Health (NIMH), Dhaka carried out the hospital-based survey in collaboration with Non-Communicable Disease Control (NCDC) wing of Directorate General of Health Services (DGHS) under Ministry of Health & Family Welfare (MOH&FW) of the Government of the People’s Republic of Bangladesh. This cross-sectional study was conducted in the Child Guidance Clinic (CGC) of NIMH, Dhaka from September 2017 to June 2018. During the study period, children between 10 to 18 years of age attending CGC of NIMH, Dhaka were included in the study. Overall, 346 children with NDDs were approached conveniently during the study period to find out physical comorbidity among them. NDDs were diagnosed by research psychiatrists following DSM-5 criteria of diagnoses⁵ under the supervision of a child psychiatrist. Guardians of the children refusing to participate were excluded from the study. Brief sociodemographic and clinical information were collected using a pretested questionnaire developed for the purpose. The questionnaire was developed following information from other related studies, literature review, library works and experience of the authors. BMI chart, height and weight machine, BP measurement instrument and other supporting instruments were made available.

Recruitment, coordination meetings and piloting

Research psychiatrists, pediatricians, medicine specialists and other specialists as required were recruited after interviewing them. A statistician was also recruited for the study. Two coordination meetings were organized at NIMH involving all research personnel. Before starting data collection, piloting of the study was done in CGC of NIMH. Samples for piloting were out of the

original study samples. After recommended modification, master protocol was developed.

Data collection techniques and procedure in the field

During the study period, children with NDDs were selected conveniently and recruited. In the first stage, diagnosis of NDDs were done following DSM-5 criteria⁵ of diagnosis by research psychiatrists in consultation with a child psychiatrist. Before confirmation of diagnosis, informed written consent of the guardians of the selected children were taken. Then the research psychiatrists collected brief sociodemographic and clinical information of the diagnosed cases. In the second stage, thorough physical examination of the patients was done by the research psychiatrists to look for possible comorbid physical illnesses. Routine physical investigations (CBC, RBS, Urine RE, S. Bilirubin, S. Creatinine and ECG) were done for all patients. Special investigations were conducted for diagnoses of comorbid disorders. Finally, cases were referred to respective medical consultants for confirmation of diagnoses of physical illnesses as required. Investigators supervised the activities during data collection.

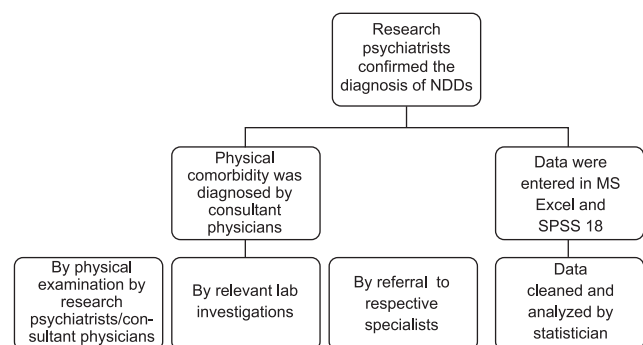
Data processing and statistical analysis

Data were checked for consistencies as well as for completeness. Data collected from each respondent was checked to ensure the completeness of its contents. Data were entered and encoded into the data entry program MS Excel 2003. Then data were transferred to SPSS version 18 for analysis. Categorical data were expressed as frequencies and percentages and appropriate statistical tests were done. Statistical analysis was done by the statistician employed for the purpose. Computer, secretarial and administrative facilities were available at NIMH.

Ethical consideration

Ethical clearance was taken from Bangladesh Medical Research Council (BMRC). Permission also was taken from the authority of NIMH, Dhaka. Research objectives and procedure of the study were explained to every study individual if possible and their guardians before start of the interview. Informed written consent from guardians were obtained before interview. Bengali version of consent form was read out and then signed by their parents or guardians of the children. Interviews were conducted at times and locations suitable to the study individuals and privacy was maintained during assessment.

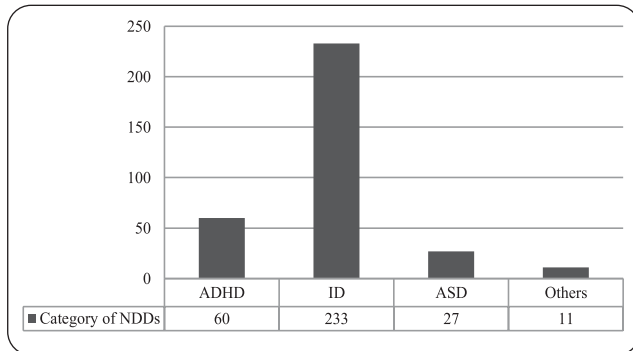
Figure 1: Stepwise approach to respondents



Results

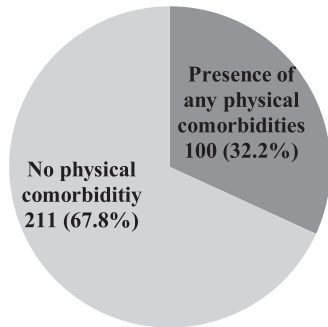
Overall, 346 children were approached for interview and among them 311 respondents completed full data collection procedure. Non-response was mainly due to refusal of the guardians of the children to give interview and dropping out sometimes. Among 311 respondents with NDDs, 192 (61.7%) were boys and 119 (38.3%) girls. Intellectual disability (n=233) was the commonest type of NDDs followed by ADHD (n=60) and ASD (n=27) (Figure 2).

Figure 2: Types of Neurodevelopmental disorders (N=311)



* Multiple responses are there as two or more NDDs existed in the same respondent.

Figure 3: Physical comorbidity among patients with neurodevelopmental disorders (N=311)



Presence of physical comorbidity varied depending on sex of the respondents. Physical comorbidity was more among girls (35.3%) than it was in boys (30.2%) (Table 1).

Table 1: Distribution of children with physical comorbidity depending on sex (n=100)

Characteristic	Total physical comorbidities in both sexes N (%)	Boy n (%)	Girl n (%)
Age in year 10- 18	100(32.2)	58(30.2)	42(35.3)

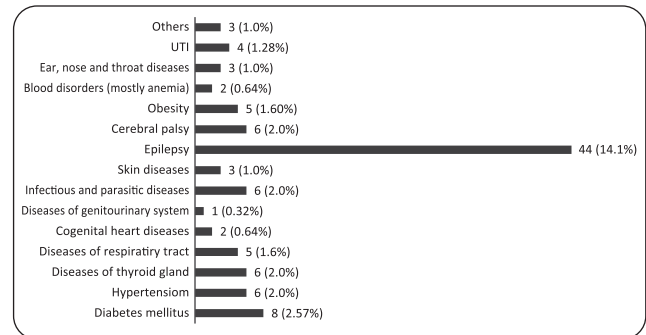
Overall, 26.6% children with NDDs had one comorbid disorder, 4.8% had two comorbid disorders and 0.6% had three or more comorbid disorders (Table 2).

Table 2: Number of comorbidities among children with NDDs (N=311)

Characteristic	No comorbidity		Single comorbidity		Two comorbidities		Three or more comorbidities	
	N	%	N	%	N	%	N	%
Age in year 10- 18	211	68	83	26.6	15	4.8	2	0.6

Epilepsy (14.2%) was the commonest physical comorbidity, followed by diabetes mellitus (2.6%) and cerebral palsy (2.0%). Infectious and parasitic diseases, diseases of the thyroid gland and hypertension, each was equal in proportion (2.0%). Obesity and diseases of the respiratory tract, each was 1.6%. Urinary tract infection was present in 1.4% of the cases. Diseases of the skin and diseases of ear, nose and throat were equal and each was 1.0% (Figure 3).

Figure 3: Types of physical comorbidity among children with NDDs (N=311)



* Multiple responses as one respondent sometimes had more than one comorbidity

Discussion

Mind and body are inseparable and both are important components of health. This bidirectional relationship leads to a great deal of overlap between physical and mental disorders.⁶ Psychiatrists tend to diagnose only mental illness and give very little attention to comorbid physical illnesses in children with mental illness. It was observed that physical examination was performed in 13% of psychiatric inpatients and 8% of outpatients.⁷ Existence of comorbid physical illnesses among psychiatric patients is not uncommon. As such, the main goal of this study was to have a better understanding of the prevalence of medical comorbidity among children with NDDs.

Ultimately, data from 311 cases of NDDs were analyzed. Intellectual disability (n=233) was the most common type of NDDs in this survey followed by ADHD (n=60) and ASD (n=27). Boys with NDDs were more (n=192) than girls (n=119). National Mental Health Survey of Bangladesh, 2018-2019 also revealed higher rate of NDDs among boys (6.4%) than girls (3.9%).⁸ Gender difference in this study may be explained by the dominance of boys in getting mental health services on priority especially in hospital set up in Bangladesh. Girls may have been ignored of the services that is usually provided to boys. Total 32.2% of individuals with NDDs had physical comorbidities. Numerous studies worldwide have reported disproportionate medical comorbidity and premature death among people with serious mental illness.⁹ The lifetime prevalence of any physical disorder among patients with severe mental illness has been reported to be 46.4%, while the life time prevalence of 2 and 3 physical disorders were found to be 27.7% and 17.3%, respectively.¹⁰ In a study in India, it was reported that 31% of the patients in outpatient department of psychiatric hospitals were having coexisting physical illnesses and the main system involved was cardiovascular (33.3%) in which hypertension was

the most common diagnosis followed by endocrine (27%), where diabetes mellitus and hypothyroidism were the most common diagnoses.¹¹ A survey on physical comorbidity in persons with severe mental illness in Bangladesh conducted in 2018, found 42% of the patients were suffering from physical comorbidities.¹² Physical comorbidity among children with NDDs were not much studied. Existence of one comorbidity among children with NDDs was found 26.6% in this survey and two comorbidities in 4.8% and three or more comorbidity in 0.6% cases. Epilepsy, cerebral palsy, obesity, diabetes mellitus and thyroid disorders were the main physical comorbidities in children with NDDs. This study demonstrated epilepsy (14.2%) as the commonest comorbid disorder among patients with NDDs which may be explained by the commonality of causes between NDDs and epilepsy. Intellectual disability was the most common type of NDDs in this study and intellectual disability is also etiologically associated with epilepsy. Prevalence of epilepsy (2.2%) and prevalence of intellectual disability (3.8%) were also found relatively high in Bangladesh.¹³ Poor perinatal care is likely to be the main reason of coexistence of cerebral palsy and epilepsy with intellectual disability in the country. Neonatal hypothyroidism is an important cause of intellectual disability and prevalence of hypothyroidism was found 2% in this study. Juvenile onset diabetes mellitus (DM) and diabetes caused by use of atypical antipsychotic drugs may explain the cause of increased diabetes among the same patients.

Increased risk of DM in patients with NDDs may be explained by multiple factors including genetics, life style and treatment factors. Atypical antipsychotics, diet and physical inactivity are among the important issues related to DM in these patients. For several decades, respiratory tract diseases such as pneumonia and tuberculosis accounted for majority of deaths in people with SMI who lived in institutions.¹⁴ Respiratory diseases are still more prevalent among people with SMI.¹⁵ About 1.6% of the respondents in this survey had diseases of the respiratory system. Coexistence of respiratory tract, urinary tract and parasitic infections found associated in this survey may be due to poor self care of the patients with NDDs.

Heart diseases and hypertension may be causally related to NDDs. Hypertension is a form of major cardiovascular diseases (CVD) and it was found among 2.0% of children in the current study. The etiology of the excess CVD may be multifactorial and it may include genetic, lifestyle and treatment factors.¹⁶ This group of patients are likely to be obese also and the prevalence of obesity among patients with NDDs was 1.6% in this survey. Obesity is a part of chronic metabolic syndrome which also include hypertension and rate of metabolic syndrome in patients with NDDs are likely to be high.

Studies found strong relationship between comorbidity and higher rates of suicide,^{17,18} suicidal ideations,¹⁹ greater symptom severity,^{20,21} poorer quality of life and social support.¹⁹ Patients diagnosed with multiple disorders also tend to have a poorer prognosis, are less responsive to intervention, and generally exert a greater demand in the health care sector.^{17,18,21} Several studies have attributed medical comorbidities among psychiatric patients for being responsible for the premature death observed in this population.^{22,23} Gaps in information on this issue

of physical comorbidity among children with NDDs still exist around the globe particularly in Bangladesh.

Overlap of medical conditions with psychiatric conditions is a significant challenge for health care professionals and create additional costs in the health care system. A person diagnosed with both diabetes and NDDs will have to be treated for both conditions. If someone live with multiple conditions or disorders, it is important that the doctor is aware of all medications and their interactions. An approach of integrative medical practice may be considered for this group of patients. This approach depends on developing an expertise in evaluation of patients that include a psychological formulation as well as a physical one and a treatment plan that address both sets of problems in an integrated way. Integrative medicine is a model of medical care in which all elements of health care are provided to the patient in a coordinated way that is based on a comprehensive evaluation, a shared diagnostic formulation and a team-based treatment plan which is flexible and communicable to all the caregivers.²⁴ The most important element of integrative medical practice is professionals communicating and collaborating about mutual patients.²⁴

Implications of the study

It is important that a child psychiatrist or psychiatrist should not miss the coexisting physical illness in the patient that may present with NDDs. In the same way, pediatrician or physician needs to be cautious that some physical illness may in fact be the reflection of an underlying mental illness. The occurrence of mental and physical comorbidity in children has public health significance especially in Bangladesh. The national health strategy focuses on child mental health also and intends to develop programs to improve the delivery of mental health services that revolve around community-based care in Bangladesh. Exploring the prevalence of medical comorbidities in people with NDDs and how these are being addressed are necessary to build strategies within the primary health care system to close the care gaps. Result of the survey is intended to be a guide for all health care professionals to working with the group of children suffering from NDDs. Integrated treatment plans that focus on all the treatment needs of the child may be developed based on the survey result.

Recommendations

1. Child psychiatrists or psychiatrists should not miss the physical comorbidity in the patients that may present with a NDD and pediatricians or physicians dealing with physical illness should also be vigilant that physical problems may be a reflection of mental illness or there may be coexistent mental illnesses like NDDs.
2. Perinatal care of mother and neonatal care of baby are essential to reduce intellectual disability and some of NDDs.
3. Appropriate management of comorbidity at the individual and public health level will require a significant reorientation of medical students, medical professionals and reorganization of health services.
4. Health services will have to be adjusted to the fact that most of the people who come to seek help are likely to suffer from more than one illness.

5. Researchers will have to give more attention to the commonalities in the pathogenesis of NDDs and physical disorders and to the development and assessment of strategies for the treatment of co morbid conditions.
6. A psychiatric hospital needs to have other departments especially pediatrics, medicine and its allied subjects with laboratory facilities.

Conclusions

Many physical disorders have been identified among patients with NDDs. Side effects of psychotropic medications, perinatal care of mothers, neonatal care of babies and access to appropriate health care remain addressable for patients with NDDs. Efforts are required to convince decision makers, educators, clinicians, and community workers that comorbidity is one of the most urgent challenges to the quality of health care in the twenty first century that must be recognized and dealt with without delay.

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Mohammad Tariqul Alam, Associate Professor, Psychiatry, NIMH, Bangladesh; **Md. Faruq Alam**, Former Director-Cum-Professor, National Institute of Mental Health (NIMH), Bangladesh; **Ahsan Aziz Sarkar**, Assistant Registrar, Psychiatry, NIMH, Dhaka, Bangladesh; **Rubina Hossain**, FCPS Part 2 Trainee, Psychiatry, NIMH, Dhaka, Bangladesh; **Surajit Kumar Talukder** Assistant Professor, Psychiatry, NINS, Dhaka, Bangladesh; **Md. Abdullah Al Mamun**, Registrar, Psychiatry, NIMH, Dhaka, Bangladesh; **A. D. M. Rifat Chowdhury**, Honorary Medical Officer, Psychiatry, NIMH, Dhaka, Bangladesh; **Mekhala Sarkar**, Associate Professor, Psychiatry, NIMH, Bangladesh; **Helal Uddin Ahmed**, Associate Professor, Psychiatry, NIMH, Bangladesh; **Mohammad Hasibur Rahman**, MD Resident, Psychiatry, NIMH, Bangladesh; **Fatima Zohra**, Assistant Professor, Psychiatry, Uttara Adhunik Medical College, Bangladesh; **Farjana Akhter**, Assistant Professor, Radiology & Imaging, NIMH, Dhaka, Bangladesh.

Correspondence: Mohammad Tariqul Alam, Associate Professor, National Institute of Mental Health (NIMH), Dhaka- 1207,

Bangladesh.

Email: sum.tariq@gmail.com

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References

- Harris EC, Barraclough B. Excess mortality of mental disorder. *Br J Psychiatry* 1998; 173: 11-53.
- Laursen TM, Munk-Olsen T, Nordentoft M, Mortensen PB. Increased mortality among patients admitted with major psychiatric disorders: a register-based study comparing mortality in unipolar depressive disorder, bipolar affective disorder, schizoaffective disorder, and schizophrenia. *J Clin Psychiatry* 2007; 68: 899-907.
- Osby U, Correia N, Brandt L, Ekbohm A, Sparén P. Time trends in schizophrenia mortality in Stockholm county, Sweden: cohort study. *BMJ* 2000; 321: 483-4.
- Robson D, Gray R. Serious mental illness and physical health problems: a discussion paper. *Int J Nurs Stud* 2007; 44: 457-66.
- American Psychiatric Association. Diagnostic and Statistical Manual 5 (DSM-5) for diagnosis of mental disorders. American Psychiatric Publishing, Arlington, VA, American Psychiatric Association, 2013.
- Gautam S. Fourth revolution in psychiatry- addressing comorbidity with chronic physical disorders. *Ind J Psychiatry* 2010; 52(3): 213-9.
- Bunce DF. Medical Illness in psychiatric Patients: barriers to diagnosis and treatment. *South Med J*. 1982; 75(8): 941-944.
- National Mental Health Survey of Bangladesh, 2018-2019, National Institute of Mental Health, Dhaka, 2018-2019. Available at: https://www.who.int/docs/default-source/searo/bangladesh/pdf-reports/cat-2/nimh-fact-sheet-5-11-19.pdf?sfvrsn=3e62d4b0_2.
- Zolezzi M, Abdulrhim S, Isleem N, Zahrah F, Eltorki Y. Medical comorbidities in patients with serious mental illness: a retrospective study of mental health patients attending an outpatient clinic in Qatar. *Neuropsychiatr Dis Treat* 2017; 13: 2411-8.
- Kessler RC, Berglund P, Demler O, Jin R, Merikangas KR, Walters EE. Lifetime prevalence and age-of-onset distributions of DSM-IV disorders in the National Comorbidity Survey Replication. *Arch Gen Psychiatry* 2005 6; 62(6): 593-602.
- Vaidyanathan A, Monteiro J, Avinash BL, Bondade S, Sattar FA, Kumar KK. Physical comorbidities in patients visiting the psychiatric outpatient department in a tertiary hospital in India. *Asian J Psychiatr* 2017; 25: 136-7.
- Alam MF, Ahmed HU, Alam MT, Sarkar M, Bhowmik AD, Singha RK, et al. Physical comorbidity in persons with severe mental illness in Bangladesh. *Arch NIMH* 2019; 2(2): 07-18.
- Rabbani MG, Alam MF, Ahmed HU, Sarkar M. Prevalence of mental disorders, mental retardation, epilepsy and substance abuse in children. *Bang J Psychiatry* 2009; 3(1): 11-52.
- Brown S. Excess mortality of schizophrenia. A meta-analysis. *Br J Psychiatry* 1997; 171: 502-8.
- Laursen TM, Munk-Olsen T, Nordentoft M. Increased morbidity among patients admitted with major psychiatric disorders: a register-based study comparing mortality in unipolar depressive disorder, bipolar affective disorder, schizoaffective disorder and schizophrenia. *J Clin Psychiatry* 2007; 68: 899-907.
- De Hert M, Dekker JM, Wood D, Kahl KG, Holt RI, Müller HJ. Cardiovascular disease and diabetes in people with severe mental illness. Position statement from the European Psychiatric Association (EPA), supported by the European Association for the Study of Diabetes (EASD) and the European Society of

Cardiology (ESC). *Eur Psychiatry* 2009; 24: 412-24.

17. Umberto A, Gianluca R, Giuseppe M, Filippo B. Impact of anxiety disorder comorbidity on quality of life in euthymic bipolar disorder patients: differences between bipolar I and II subtypes. *J Affect Disord* 2008; 105(1-3): 297–303.

18. Schoevers RA, Deeg DJ, van Tilburg W, Beekman AT. Depression and generalized anxiety disorder: co-occurrence and longitudinal patterns in elderly patients. *Am J Geriatr Psychiatry* 2005; 13(1): 31-9.

19. Al-Asadi AM, Klein B, Meyer D. Comorbidity structure of psychological disorders in the online e-PASS data as predictors of psychosocial adjustment measures: psychological distress, adequate social support, self-confidence, quality of life, and suicidal ideation. *J Med Internet Res* 2014; 16(10): e248.

20. Kessler RC, Chiu WT, Demler O, Merikangas KR, Walters EE. Prevalence, severity, and comorbidity of 12-month DSM-IV disorders in the National Comorbidity Survey Replication. *Arch Gen Psychiatry* 2005; 62(6): 617-27.

21. Farabaugh A, Fava M, Mischoulon D, Sklarsky K, Petersen T, Alpert J. Relationships between major depressive disorder and comorbid anxiety and personality disorders. *Compr Psychiatry* 2005; 46(4): 266-71.

22. Colton CW, Manderscheid RW. Congruencies in increased mortality rates, years of potential life lost, and causes of death among public mental health clients in eight states. *Prev Chronic Dis* 2006; 3(2): A42.

23. Lawrence D, Hancock KJ, Kisely S. The gap in life expectancy from preventable physical illness in psychiatric patients in Western Australia: retrospective analysis of population-based registers. *BMJ* 2013; 346: f2539.

24. Peek CJ. The National Integration Academy Council. Lexicon for behavioral health and primary care integration: concepts and definitions developed by expert consensus, AHRQ 2013. Available at: <http://integrationacademy.ahrq.gov/sites/default/files/Lexicon.pdf>.