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Review Article

Executive Functions and Public Health: A Narrative Review

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Abstract

Executive functions (EFs) skills are necessary for regulating the thoughts, emotions, and actions which are associated with many aspects of daily functioning. Executive dysfunction (EDFs) is present in a wide range of mental disorders. New study indicates that EFs may predict health behavior and make it easier to engage in a variety of healthy activities. In this narrative review, EFs and public health are briefly discussed. In general, 133 articles met the inclusion criteria (published 2018-2023) which were reviewed. EFs affect the mental and physical health. Besides individual problems, people with mental problems have heavy costs to society. Mental health cannot be considered separately from general health. Consequently, preventive and therapeutic approaches to mental health should be considered not only at the level of the whole society, but also at the global level.

Keywords: Executive functions; Executive dysfunctions; Public health; Mental health

Introduction

Executive functions (EFs) skills are necessary for top-down regulation of thoughts, feelings, and actions which are associated with many aspects of daily functioning (1). EFs comprise related, but separable, cognitive abilities (2). Currently, consensus is lacking as to the precise components of EF since it is a multi-faceted construct (3). Its most accepted model includes three components: inhibitory control (IC), working memory (WM), and cognitive flexibility (CF) (4). Childhood is a relevant period for developing EFs (5). EFs emerge during childhood and continue to develop into early adulthood (6). Numerous studies found the relations among EFs, diverse skills and outcomes (1). Executive dysfunction (EDFs) is present in a wide range of mental disorders (7). Indeed, EDFs were posited as a transdiagnostic cognitive deficit linked to psychopathology broadly (2), and are linked to a range of clinical outcomes (1). Based on the WHO report, one out of every ten people worldwide and almost 20% of children and adolescents suffer from a mental disorder. In recent years, suicides resulting from mental disorders have been the world's second most common cause of death (8).

Negative outcomes among people without mental health impose heavy costs on public health services. WHO considers the consequences of mental health problems as a high public health priority which included it in the Comprehensive Mental Health Action Plan (9). Furthermore, physical health problems are associated with EDFs, and early assessment, diagnosis, and treatment are important in reducing the long-term effects of these diseases(10). Therefore, EFs play a role in mental and physical health and given their importance, a study of EFs is essential (11).

In this narrative review, we summarized the relevance of brain executive functions to general health. In addition, the findings have shown that executive function defects affect the health and well-being of society. Therefore, we aimed to find the relationship between executive functions and public health and seek to show the importance of its preventive and therapeutic approaches.

EFs and Public Health

Mental health literature usually uses the term daily life as the activities that people perform daily to achieve a specific goal and as part of their daily routines. In 2019, the National Institute of Mental Health (NIMH) introduced a new label called Severe Mental Illness (SMI) for chronic psychiatric disorders. A mental, behavioral, or emotional condition that causes considerable functional impairment and seriously restricts or interferes with one or more important life activities is what the institute characterized as SMI. The Diagnostic and Statistical Manual of Mental Illnesses (DSM) states that individuals with psychiatric disorders exhibit impairment in a variety of everyday tasks (12). SMI, including schizophrenia (SC), bipolar disorder (BD), and major depressive disorder (MDD) are associated with EDFs (13). Particularly, the prevalence of MDD is high globally (14) it is the second leading cause of disability worldwide and one of the most prevalent and expensive in mental health care (15). MDD is becoming more prevalent among the elderly worldwide. Considering the importance of mental health and the quality of life of the elderly, it is important to identify the factors related to it (16). The prevalence of borderline personality disorder (BPD) is high. In the psychiatric centers, they make up about 9%-22% of outpatients and 20%-25% of inpatient admissions (17).

This disorder has a very high cost to society, which is estimated to be more than twice the costs associated with depression (17). EDFs are associated with a wide variety of psychiatric disorders (Table 1) (18).

Table 1: Mental or psychiatric disorders related to EDFs

Disorders	***References***
Alzheimer's disease (AD)	(21), (22), (23), (24), (25)
Parkinson disease (PD)	(26), (27), (28), (29), (30), (31)
Depression	(32), (33),(34),(35),(36), (37), (18)
Schizophrenia spectrum disorders (SP)	(38), (39), (40), (41)
Conduct disorder	(42), (18)
Anxiety	(18), (43), (44), (45)
Oppositional defiant disorder (ODD)	(18), (46)
Obsessive compulsive disorder (OCD)	(47), (48), (49), (50)

For instance, EDFs are associated with a variety of disabilities or disorders, including negative mood, depressive symptoms, anxiety symptoms, low self-esteem, interpersonal problems, higher anhedonia, and internalizing symptoms (19). Based on the statistics in the United States (USA), psychiatric disorders are the main cause of disability in this country and are one of the costliest treatments. EFs is one of the most common cognitive domains in psychopathology (19). Another point worth noting is EDFs are associated with the neurodevelopmental disorders (Table 2) (20).

Table 2: Neurodevelopmental disorders related to EDFs

Disorders	*References*
Intellectual Disabilities (ID)	(51), (52)
Developmental Language Disorders (DLDs)	(53), (54)
ADHD	(55), (56), (57), (18), (58)
ASD	(59), (60), (61), (62), (63), (64)
Specifc Learning Disorder (SLD)	(65), (66), (67), (68)
Developmental Coordination Disorder (DCD)	(62), (69), (70), (71), (72), (73)

The research findings support the view that the proper functioning of EFs is not only due to mental health (74) but also due to physical health (75) . Various physical problems and diseases are associated with EFs (Table 3). High-risk activities that endanger people's health, such as hazardous sexual conduct, substance use disorders (SUD), and antisocial characteristics or behaviors, should be regarded as an additional EDF. In 2015, the Centers for Disease Control and Prevention (CDC) linked these behaviors to risks associated with infection and unwanted pregnancy (76). SUD is very common in the USA which was shown to correlate with domains of EFs (77). Besides, heart disease (78, 79), stroke (80), diabetes (81), and suicide (82, 84) are due to EFs. CDC identified these diseases as the leading causes of death in the USA in 2016 (84).

Table 3: Physical diseases related to EDFs

Diseases	*References*
Cancer	(91), (92), (93), (94), (95), (96), (97)
obesity	(98), (99), (100), (101), (102), (103)
blood pressure / hypertension	(85), (104), (105), (106), (10), (107)
rheumatoid arthritis	(108), (109), (110), (111), (112)
Cerebrovascular risk	(113), (114), (115), (116)
neurofibromatosis	(117), (118), (119), (120), (121)
amyotrophic lateral sclerosis	(122), (123), (124), (125)
Acromegaly	(126), (127), (128)
Russell syndrome	(90), (129)

Another point worth noting is, physical health problems such as blood pressure are associated with lower EFs and these physical health problems have significant effects on public health (85). Along with the rise in childhood obesity, blood pressure in children has become more common. The results demonstrate a relationship between childhood hypertension and diminished cognitive abilities in both middle age and youth (23). According to research, EDFs are associated with dysfunctional eating-related behaviors (86). The WHO reported in 2016 that more than 340 million children were overweight (74). Obesity affects physical health and is one of the major health problems. Therefore, these days, researchers have paid more attention to the association between obesity or weight problems and EFs (74).
Furthermore, because of the importance of these problems, eating disorders are defined in DSM-5 and they are an important public health problem (87). As mentioned, EFs are recognized as an essential factor in engaging in healthy behaviors and

avoiding unhealthy behaviors. EFs are associated with acute and chronic stress, pain, poor sleep, or suppressed emotions (88). Likewise, EDFs are likely to be associated with other unhealthy behaviors like drinking alcohol, cigarette smoking, and eating high-fat foods (89). A systematic review examined the relationship between EFs and health behaviors associated with leading causes of death in the United States. Their findings showed that executive function is related to health behaviors and can predict them (84). EDF is present in many acquired and genetic disorders which has significant consequences on the daily functioning of patients and even their families. On the other hand, EFs play an important role in the development of public health. Therefore, it is essential to evaluate and understand EFs (90).

Discussion

Maintaining cognitive health and preventing the consequences due to its dysfunction is significantly needed in research, clinical and public health (85). Cognitive functions lead to the promotion of mental health and reduction of disorders, such as depression and anxiety, thus helping to promote public health (130). A significant amount of research has been conducted in various areas related to mental health to provide evidence of mental health benefits. However, many public health professionals still ignore it. It is crucial to think of it as a primary objective in public health (126). Accordingly, mental health issues throughout adolescence are a strong indicator of later-life mental health disorders. Besides, the parents with psychological problems, unhealthy family environment and the lack of social support are associated with behavioral problems. Regarding high prevalence of mental and behavioral problems is one of the most important global health challenges. Therefore, early diagnosis, promotion of mental health and prevention of mental disorders is one priority of public health (131). On the other hand, Individuals with EDFs have negative physical health outcomes, for example, obesity, cardiovascular disease, diabetes, etc., and are at greater risk of premature mortality (100). Moreover, research has shown the relationship between EDFs and physical diseases and problems in childhood. Therefore, early interventions in the field of public health are useful in controlling and reducing its consequences (101).

EFs affect the mental, and physical health which can be one of the health and welfare factors of society. EFs are affected by various factors, and people with EDFs, mental, and physical health problems do not perform well in the family, academic, occupational, and social environments. As a result, they raise public health expenses as well as economic and social concerns. Public health, mental, and physical health are inextricably linked. Managers and authorities from all sectors must include mental, and physical health into public health initiatives in order to support the development of their communities. Because the mental, and physical health problems have a negative effect not only on the individual, but also on the whole of society. Instead of the individual-centered approaches, researchers and professionals should consider preventive, and therapeutic approaches to mental, and physical health at the level of the whole society, and even at the global level, and by combining laws and policies effective on mental, and physical health, seek how to create public health programs in different environments, and situations.

Conclusion

Preventive strategies, and public health are suggested to reduce the incidence or negative effects due to it. Another point worth noting is, more research is needed to better understand the relationship between EFs and public health, as well as EDFs and their consequences. Therefore, it is suggested to conduct more studies on the clinical application of EFs, and public health.

Journalism Ethics considerations

Ethical issues (Including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc.) have been completely observed by the authors.

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Conflict of interest

The authors report no conflicts of interest.

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