



**Article title:** The relationship between

creativity and mental

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systematic review: I would like to express my deepest appreciation to Dr Athina Manoli, my first supervisor, for her dedication and friendly supervision. I would also like to express my gratitude to Dr Georgina Hosang, my final supervisor.

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# The relationship between creativity and mental illness: a systematic review

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## Abstract:

The association between creativity and mental disorders has been a subject of long-standing debate. And it is one of the most controversial issues in the field of creativity and psychopathology research. Despite the fact that engaging in creative activities has a wide range of benefits for mental health the concept of creativity/ mental illness has been widespread. On the one hand, a large body of anecdotal and empirical supports this association (e.g. Simonton, 2010; Andreasen, 2008; Johnson et al., 2012). On the other hand, some scholars argued that the creativity/ psychopathology connection is a traditional legend, and the empirical research in this area has many shortcomings, especially in terms of methodology (e.g. Sawyer, 2012; Schlesinger, 2009). This study conducted a systematic review to investigate the link between creativity and mental illness. Various electronic databases were used to find selected studies: including, Google Scholar, PubMed (Medline), Science Direct, and PMC (NCBI). Also, British Library, Core, and EThOS were applied to search for grey literature. In this paper, 24 studies have been reviewed that they are involved 6,525,664 participations. 21 reviewed studies provided some indications to support a positive link between creativity and psychopathology. 1 study proposed a negative link, and two studies suggested that there is no relationship. Altogether, the results displayed that there is a significant positive correlation between creativity and sub-clinical mental disorders. According to this study, not only creativity was introduced as a by-product of certain sub-clinical mental disorders (e.g., bipolar disorder, schizotypy) but it also identified as a treatment for some severe mental disorders (e.g., depression and addiction).

## *1. Introduction:*

### *1.1. Concept of creativity:*

One of the significant origins of contradictory results among different studies on creativity/mental illness connection is the issue of *definition* due to the fact that there is a wide range of definitions for creativity. Generally, creativity is determined as a capacity of generating original and adaptive ideas or products which can be useful in some way to people (Barron, 1969). In general, creativity can be divided into two categories: high level creativity (eminent creativity) and personal creativity (everyday creativity). In the eminent creativity, creative products and ideas have an advantage for humanity and they could improve survival odds and change the environment for the better (Richard, 1990). However in the everyday creativity, creative outcomes in technology, art, music, science, literature, and medicine would reduce suffering and improve the quality of daily living at a more personal level. Generally speaking, the standard conception of creativity usually characterized as both novelty and task- appropriateness (Amabile, 1996; Barron, 1955; Kaufman et al., 2014). Some conceptions considered a third factor for the definition of creativity such as surprising (Simonton, 2013), or high quality (Sternberg et al., 2003). Beyond the problem of definitions, a wide range of measures were introduced for creativity assessment in different studies from divergent thinking to remote associations to consensual assessment (Kaufman et al., 2012).

Furthermore, numerous dimensions arguably have been operated from these measurements like fluency, flexibility, originality, novelty, functionality, aesthetics, unusual responses, and remoteness of associations (Kaufman, 2014). Scholars suggest that diverse cognitive process needed for both definition and assessment of creativity in different disciplines. For example, the artistic creativity and scientific creativity probably associated with different kind of psychiatric disorders (Greenberg, 2004).

### ***1.2. Mental illness conception:***

Mental illness is a dialectical subject in the various fields of psychology and psychiatry (e.g., Caplan, 1996). Just as creativity manifests itself in a wide range of activities such as art, science, writing, music, mental illness can also mean bipolar disorder, schizophrenia, and so many others or combination of abundant other diagnoses. Hereupon, mental illness is remarkably a wide term and the source of nonconformity within creativity investigations. According to the latest Diagnostic and Statistical Manual of Mental Disorders, the proposed definition for mental illness is “a behavior or psychological syndrome or pattern that occurs in an individual”. Also, National Alliance on Mental illness suggests that mental illness often specifies as a condition that modifies thinking, behavior, feeling and mood of a person. Furthermore, the definition of World Health Organization (WHO) for mental disorders embraces a wide range of problems, with diverse symptoms. WHO defines mental disorders through some combinations of unusual thoughts, behavior, and emotions. Some examples of mental disorders that have been suggested in connection with creativity include: schizophrenia (a mental health condition where you may see, hear or believe things

that are not real) , depression (constant feeling of sadness and losing interest), bipolar disorders (alternating periods of elation and depression), autism (having trouble in social skills, speech and nonverbal communication, and performing repetitive behavior), schizotypy ( having an eccentric personality) attention-deficit/ hyperactivity disorder (a combination of ongoing problems including, difficulty sustaining attention, hyperactivity and impulsive behavior), anxiety disorders (significant feeling of fear), and many more. But the most frequent studies in this field in related to bipolar disorders and schizophrenia (Kaufman et al, 2014).

The creativity/ mental illness association is one of the most contentious issues in this field. Despite the fact that involving in creative activities has a wide range of benefits for mental health and it is also used as a treatment for specific forms of mental illness; the concept of creativity/ mental illness has been also common throughout history. On the one hand, there are a wide range of cases which reinforces the idea that mental illness stimulates creativity (e.g.Simonton, 2010; Andreasen, 2008; Johnson et al., 2012). On the other hand, some scholars argued that the creativity/ psychopathology connection is a legendary story, and the empirical research in this area has many shortcomings, especially in terms of methodology (e.g. Sawyer, 2012; Schlesinger, 2009).

### ***1.3. Background:***

The debates and studies around creativity- mental illness connection have a deep root in the culture of western societies including three eras: namely, Ancient Greek Antiquity, the Italian Renaissance, and the Age of Enlightenment. Most of those old findings are based

on biographical and anecdotal approach; however few of them focused on clinical assessment. The Romantic literatures provide the single strongest impetus to founding medical verdict on this subject. Not only they suggested a dialectical relationship between madness and creativity but they also redefined madness as a pitiable and supreme condition simultaneously.

The modern development of this hypothesis (the link between creativity and psychopathology) in terms of both clinical and non-clinical perspective started in the last three decades. Whereas the use of historical source in terms of eminent figures biography is continuing in this field, clinical studies which based on psychometric and psychiatric approaches started in the 1980s.

The first western society which reflected on mental condition of eminent creative people was the ancient Greek. As they devaluated physical labor, so some professionals who create with their hands such as painters, sculptors were not considered as creative individuals. However they only just focused on those individuals who were determined to cerebral expression (e.g., poets and seers).

Aristotle was the first one who contends that there is a profound link between melancholic type and tremendous creative abilities according to the Hippocrates' humoral theory. But as Aristotle (1984) argues, this connection does not mean that all melancholic people have a mental illness. In short, atrabilious individuals are unstable due to the fact that black bile is variable then as a result all atrabilious persons have significant gifts from natural reasons and not owing to illness (Aristotle, 1984). Aristotle suggests that melancholia attribution can clearly describe a type of individual that is called the homo melancholicus. Melancholic individuals could be either a sane distinguish person or a person with mental illness. It



depends on the special combination of their fluid substances (Wittkower and Wittkower, 1963).

In the Italian Renaissance era, people have a lot of respect for a wide range of creative efforts. Unlike the ancient Greeks who not only did not count manually created endeavors as creativity but they also disdained physical labors, the Romans valued painting and sculpture as worthy as philosophy and poetry. So, they redefine the concept of creativity and they introduce a new term for eminent creative individuals that was *genio*.

However, the main meaning of creativity was an imitation of acclaimed masters and of nature (Becker, 2001). Furthermore, it based on the standard of humanistic traditions and pertained to the *imitation-ideal*, so it is obviously different from the recent concept of genius that emphasizes on two significant features: including, originality and distinguishing. Albeit there rarely were some attacks on the reflection of *imitation-ideal*. *As an example*, some Renaissance pundits such as Leonardo and Vasari suggest that *genio* should not only be imitation but it is also novelty (Lange-Eichbaum, 1930).

There is an overlap between the ancient Greeks and the Romans regarding the attribution of *genio* to melancholia and *pazzia*, and madness. Also, similar to the Greeks there was a significant different between individuals who convicted to insanity and the sane melancholic individuals. Florentine Ficino was the one who played a key role in popularizing Aristotle's idea of melancholy. Therefore, he merely considered the melancholic temperament as creative stimulus. Accordingly, when artists and scholars were assessed on the subject of *pazzia*, the assessments were commonly not purposed to convey the concept of madness. Indeed, the purpose of the assessment of eminent people in terms

of piazza was evaluating the qualities of melancholic temperament: namely, sensitivity, solitariness, moodiness, and eccentricity (Becker, 2001).

However, in the 16<sup>th</sup> century, the hypothesis of creativity-melancholy became a subject of criticism. Those critiques typically reflected on the statement of some artists such as Ginovan Battista Armenini who was an Italian Renaissance art historian and painter in the sixteen century. In this way, he argues there is a misconception among ordinary people and event educated that all creative and distinctive artists must have symptoms of eccentricity and melancholy (Wiittkower, and Wittkower, 1963).

In the 17<sup>th</sup> century, as a result of these critical views, a new notion was formed. According to this new idea, artists should be considered as scholars and social and intellectual elite. Most of all, this new concept was observed in the behavior of 17<sup>th</sup> century artists. As wittkower (1973) suggests, none of the seventeen-century great artists and masters were characterized as melancholic since the Renaissance concept of melancholicus was replaced by the new one. For example, Bernini, Rubens, Rembrandt, and Velasques were ever described as melancholic until again melancholy counted as emotional, psychic and mental catharsis (Wittkower, 1973).

In the 18<sup>th</sup> century, the word **genius** came into being to introduce and describe people with significant creative abilities (Lande-Eichbaum, 1927). The Enlightenment **genius** characterize individuals who have an innate power to create very novel and original products by their extra ordinary and imaginative capacity of creation , so it is clearly distinguished from Renaissance **genio** (Becker,2001). Also, Gerard (1774) suggests another definition for **genius** that introduced it as faculty of invention. As he argued, genius is

qualified for either novel detection in science or genuine work in art. In addition, he contends that authentic genius is merely conceivable when four powers: including, imagination, sense, judgment, and memory combine and interact together.

In the dominant Enlightenment's concept of genius, all components potentially have rooted in the creative imagination (Becker, 2001). However, creative imagination directly constitutes judgment with sense, memory, taste, and sensibility as a counterbalance for the rest of components (Becker, 2001). In this way, judgment prevents exaggeration and vagary, and then makes madness as an impossible fact. As Gerard (1774) argued, a spotless judgment is rarely conferred by nature, "even on her most favored sons", however an extremely significant degree of it at all times pertain to a genius (Gerard, 1774; Becker, 2001). Then it was suggested that with a true judgment, it was unseemly that true genius surrendered to either insanity or other variety of it such as inspired and clinical (Becker, 2001).

In the 19<sup>th</sup> century, under the influence of the Romantic Movement, the concept of genius has been profoundly changed. This transformation happened for many reasons. One of those causes is that the Romantics' principles were settled on a more enigmatic perspective of universe and it even changed the meaning of universe and science. Also, this mysterious view supplemented the prevailing Enlightenment's concepts of genius.

The new concept emphasized on the uncontrolled advantage of capacity of imagination in conjunction with other elements such as enthusiasm, divine inspiration, spontaneity, childish naiveté, and the dashing pursuit of knowledge, beauty, and verity (Kaufman, 2014). This alteration of notion of genius was gradually changed the genius understanding

from logical to romantic concept which led to improving the shaky position of Romantic poets and men of letters. As a consequence, the application of the term of genius was changed to elect individuals in the late 18<sup>th</sup> century. And the innate creativity was considered as the main criterion to evaluate a man. So, the degree of respect and the hierarchy of individuals were determined according to their creative abilities (Kaufman, 2014).

Romantics believed that a particular type of madness could characterize individuals as unique, distinguished or even divinely selected (Becker, 2014). Therefore, in the Romantic era the connection between extraordinary creative abilities and madness reestablished and the classic conception of genius which based on divine mania and inspiration was revived (Becker, 2014). Also in this period of time, there is a critically important fact in this case that the ancient Greeks idea of mania has been conveyed into the Romantics' concept of *Weltschmerz* (an old pain), suffering or a condition of innate sadness. According to the Romantic idea of *Weltschmerz* individuals were identified as authentic genius.

The Romantics realized that the redefinition of the conception of genius was demanded in order to supplement it and also to remove the passive role of traditional authority. In addition, it necessitated in a way that veritably prevented victimization process by one's own imagination (Becker, 2001). Due to before the Romantic period, it was totally embraced that the imagination power could lead to a dangerous and shaky state in the lives of men. So before the 18<sup>th</sup> centuries, the human imagination was simultaneously recognized as a source of pride and fear.

The Romantic reformulation of genius emphasized on automatic and unreasonable imagination. These two emphases, paved the way to the attribution of mania from the past,

while it was assuredly done with intellectual independence in the present (Becker, 2001). So, the connection between genius and madness was established through removing the balance of intellectual faculties which were generally seen in the close relationship with sanity (Becker, 2001).

In the contemporary era, the bulk of research on the link between creativity and mental illness significantly focused on schizophrenia and bipolar disorders (Kayaga, 2015). There is a significant paradox in the case of schizophrenia. Despite the fact that schizophrenia has deleterious effects on both mental and physical health of people, it exists. Schizophrenia is a worldwide chronic mental disorder with a strong genetic basis (Kayaga, 2012), while it is contradictory with the adaptations and natural selection. Due to schizophrenia is link to the reduction of fertility rate and early mortality which both lead to negative selection. Therefore, according to Darwin's theory, schizophrenia should be gradually extinct. This contradiction has been explained through evolutionary advantages and schizophrenia by-products such as creativity. In terms of advantages, it was suggested that schizophrenia may increase creativity in schizophrenics and their kin (Kayaga, 2011).

#### ***1.4. Empirical research on the creativity / mental disorder connection***

During the contemporary era a considerable number of empirical studies have been conducted on the creativity/ mental disorder connection (e.g., Juda, 1949; Jamison, 1989; Kaya, 2015; Andeasen, 1987). According to Juda's research on 294 German-speaking scientists, artists and their families, a significant of luminaries and their kin were normal (not insane) (Juda, 1949; Carson, 2011).while on the other hand , she reports that

luminaries and their relatives demonstrated a much more incidence of psychosis than the mean of healthy controls (Juda, 1949). Moreover, Berkeley's Institute (an Institute for Personality Assessment and research) suggested that creative architects and writers are more likely to suffer from schizophrenia and paranoia (Barron, 1955)., Another empirical study indicates that males who have psychotic relatives were three times more likely to work in creative fields than those with no psychotic relatives (karlsson, 1970).

However, Jamison (2000) suggests that there are more empirical evidence for a connection between creativity and bipolar disorders relative to schizophrenia (Kaya, 2014). In the same way, Andearsen et al. (1974) tested both people with schizophrenia and bipolar disorders. And she discovered that patient with history of mania indicated more extraordinary talent in writing in compared with schizophrenic patients. Also, after examining 30 highly creative writers, Andeasen (1987) reported that none of those writers was schizophrenic; whilst most of them (80 %) had affective disorders. Furthermore, Dykes et al. (1976) found similar outcome. They suggest that widening attention which usually happens in patient with schizophrenia let to a detrimental effect on creative functions.

Recently, more research concerns the link between creativity and positive schizotypy, and they arguably reported a connection between them (Kayaga, 2014). A wide range of studies have found a strong connection between creativity and subsyndromal psychotic symptoms such as schizotypy and psychoticism (Kayaga, 2014). For example, Folley et al. (2005) examined divergent thinking abilities in three groups including, schizotypal individuals, schizophrenics, and healthy controls. Schizotypal group demonstrated more divergent thinking abilities compared to the other two groups (Folley et al., 2005). Indeed, they found that enhanced divergent thinking performance was connected with activation of the right prefrontal cortex.

Furthermore, Nettle and Clegg (2006) suggested that accomplishment creative abilities in positive schizotypal adults correlated with enhanced mating success. In the other study, Miller et al. (2007) found that there were significant associations between verbal and drawing creativity and positive schizotypy. Eventually, these studies concluded that the enhancement in creative functions was related to the connection between positive schizotypy and Big Five personality trait of openness to experience (Kayaga, 2012).

In order to reduce risk of bias that cause by debility effects of mental disorders, some research has focused on relatives of individuals with mental disorders (e.g., Kayaga, 2015). Accordingly, Kayaga (2011) suggests that the relatives of patient with bipolar disorders and schizophrenia more likely to be creative rather than the patients. As relatives of patients have a common trait but with milder symptoms (Kayaga, 2011). Karlsson (1970) was the first one who examined relatives of patients with schizophrenia. Karlsson suggests that relatives of schizophrenics much more likely to have extraordinary creative abilities, and it turned out that a quarter of them affiliated with bipolar disorder. Also, in the other study, 8007 relatives of psychotic patients were examined and the results demonstrated that they were overrepresented as eminent writers (Karlsson, 1970). Furthermore, Kaufmann (2000) suggested that the children of schizophrenic mothers were remarkably more creative than controls.

### ***Genetic variation associated with creativity/ mental illness connection:***

It could be argue that if there is a connection between creativity and mental illness, we would expect to identify genetic similarities between them. Indeed, some research indicated

such overlaps (e.g., Keri, 2009; Reuter et al., 2006). Keri (2009) detect that a variant in NRG1 (the promoter region of the neuroregulin 1) has been associated with both creative achievements in academics and an increased risk of psychosis. Furthermore, Reuter et al suggested that there is a link between specific types of creativity and a variant in DRD2 which is related to dopamine D2 receptors.

Crespi et al (2016) found the genetic variants that are related to an increased risk for schizophrenia predicted to higher imagination scores. As it was mentioned before, imagination is one of the main components of creative abilities.

Generally, according to a large body of genome- wide studies, it was suggested that there is a genetic association between certain forms of creativity and particular types of psychopathology (Carson, 2011). Therefore, it could be argue that multiplex risk factors for bipolar disorder and schizophrenia are related to the several measurement of creativity such as a creative profession, a membership in an artistic society, or high creative achievement scores (Carson, 2011).

### ***1.5. Rationale, Research question, objective:***

Research on the probable connection between creativity and mental disorders is indispensable to achieve a comprehensive perception of patients' needs and experiences. Despite the many studies that exist in this area, there is no a comprehensive systematic review on this field. And most of these studies merely analyzed one small piece of the puzzle. The aim of this study was to conduct a comprehensive investigation on the link between creativity and mental disorders. So, the specific question of this study is:



Q- Is there a link between creativity and mental disorders?

Also, according to research question, the hypothesis of this paper is:

H- There is a link between creativity and mental disorders.

## ***2. Methods:***

### ***2.1. The type of study:***

The present review was based on a systematic review. Due to the systematic review is an authentic approach to address the particular research question and also provides a competent procedure to gather, evaluate and critique research studies in an organized way through a set of specific criteria. In addition, it contributes to draw far more rigor conclusions that spontaneously pave the way for generalization of the results of research to a wide range of population. Another reason why for choosing systematic review was its power to reduce the risk of biased that predicts to better decisions. Also, the systematic review is quite suitable because related studies to the research question are entirely extensive.

### ***2.2. Data synthesis:***

In the present study, Narrative Synthesis (NS) was used for summarizing, describing, and juxtaposition of findings from contextual view. The narrative synthesis is one of the systematic review approaches; and it provides an objective, complete and critical analysis

on the current knowledge of the topic. It is also establishes a thorough theatrical framework. Furthermore, it contributes to find schemas and trends in the findings.

### ***2.3. Selection criteria:***

As seen in the Table1, inclusion exclusion criteria were specified in PEOS framework, in four categories including, population, exposure, outcome and study.

Table1. Details of inclusion and exclusion criteria

	Inclusion criteria	exclusion criteria
<b>P</b>	- adults and their relatives and offspring - All genders - All ethnicities	
<b>E</b>	- All types of mental illness	
<b>O</b>	- All types of creativity	
<b>S</b>	- Quantitative studies - English literatures -Publication date between 2000 to 2020	-Qualitative studies - Non English literature -Publication date before 2000

### ***2.4. Search strategy:***

In this paper, several electronic databases were used to find targeted information: including, Google Scholar, PubMed (Medline), Science Direct, PMC (NCBI). Also, British Library, Core, and EThOS were applied to search for grey literature. And the search terms for the current review were as follows: (Creativity) AND (mental illness); (Creativity) AND (psychopathology). Also, merely two filters were applied: including, only English literature and year of publication from 2000. Owing to older studies has been criticized for their

methodological problems such as lack of control groups, and retrospective design (Kayaga, 2015). However, recent research (especially after 2000) applied a far more appropriate methodology in compare with older studies.

Moreover, creativity and mental illness definitions and measurements have been updated over these two decades. So, in this review, studies from 2000 have only been reviewed.

### ***2.5. Data extraction:***

The search terms were entered into data bases to run a search. The search Results were filtered in four steps. In the first stage, irrelevant results were eliminated through title review. In the next stage, duplicated results were omitted from relevant papers. In the third stage, the abstracts of remaining papers were read to understand whether they meet inclusion and exclusion criteria. So, papers which did not meet inclusion/ exclusion criteria were removed. In the fourth stage, the whole text of remaining papers were read foe assessing eligibility and some of them were deleted because of insufficient information and unqualified sample. Finally, identified papers from grey literature were added. Then remaining papers were perused to extract main findings and data.

### ***2.6. Quality assessment:***

The aim of quality assessment of systematic review is to understand strength and weakness of evidence and consider them during the synthesis process. In other words, the reason why for conducting quality assessment in systematic review is to examine the confidence of

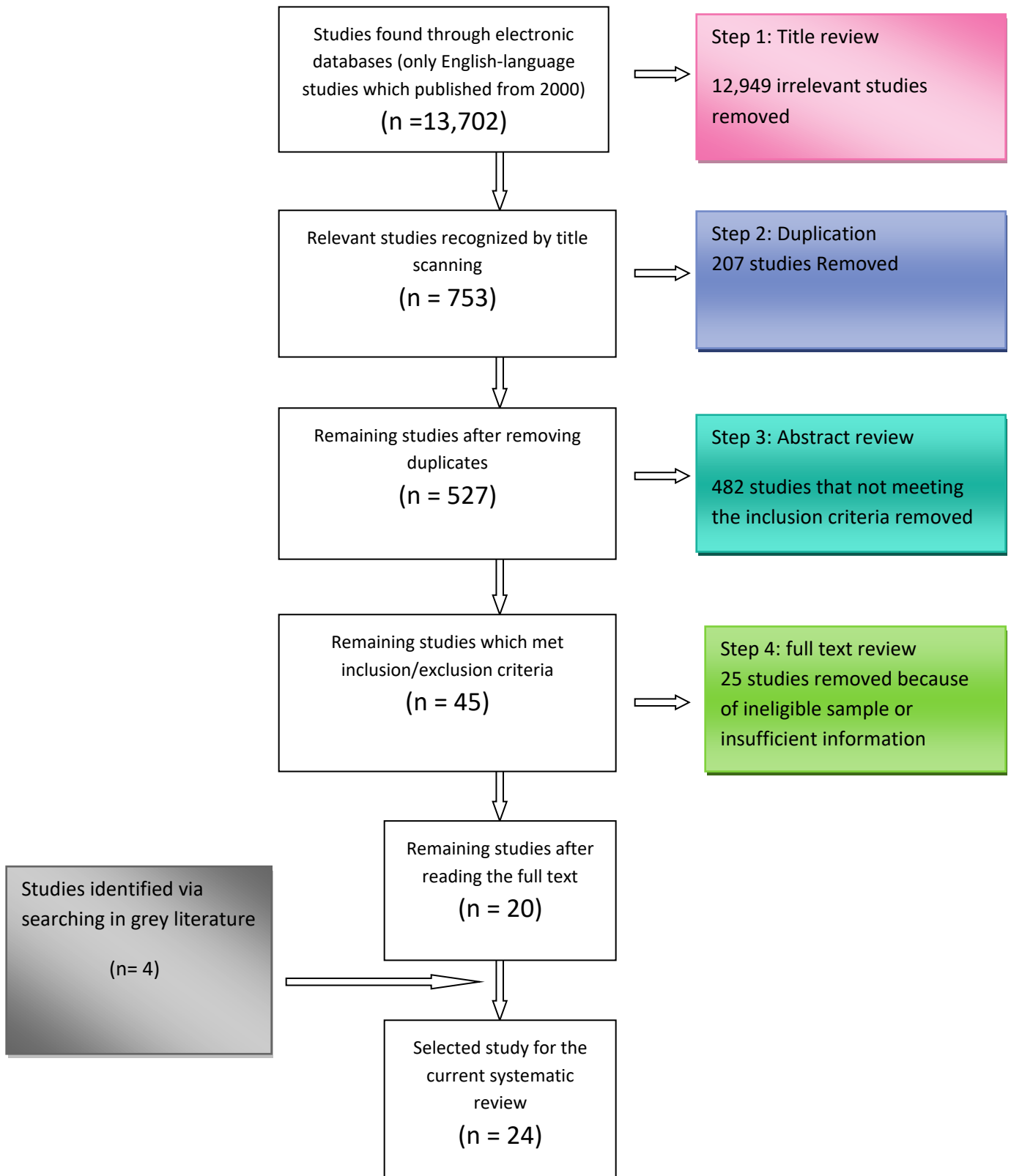
findings of reviewed papers. In the current review, as seen in the appendix, quality assessments of different studies were implemented according to their study design. To assess quality of the case control and cohort studies, the Critical Appraisal Skills Program (CASP) checklists were used (see Appendix1 and Appendix2). The Public Health Resource Unit (2006) suggested that CASP can contribute to establish an evidence based approach in health and social care and make sense of evidence (the American Medical Association). In the case of cross-sectional designs the Newcastle – Ottawa quality assessment tool (which was adapted for prevalence studies) was used (see Appendix3). And NHLBI checklist (which was established for quality assessment of Correlational studies) was applied to assess the quality of regression studies (Appendix4). All of these quality assessment tools are easy to use and they provide very detailed view of risk of bias.

### 3. Results:

Altogether, 13702 results were found from mentioned electronic databases (as it was mentioned in the search strategy, two filters were implemented before starting the research: firstly, only English literatures, secondly, publication date between 2000 and 2020). Finally, 24 studies (see Figure 2) were selected to use in current systematic review after going through the other four filtering steps (namely, title review, duplication, abstract review, and full text review) as well as adding studies that found from grey literature (see Figure1).

### 3.1. Study selection:

Figure1. Flow diagram demonstrating the study selection process



### 3.2. Study characteristics and results of individual studies:

Table2. The summary of the study characteristics

Authors & year	Aims & object of study	Study design	Sample	Procedure & materials	Measures of creativity	Measures of mental illness	Key finding
P. J. Silvia and N. A. Kimbrel, 2010	The aim of this study was to Assess the relationship between various facets of creativity: including, divergent thinking, creative self-concepts, every day creative behaviors, and creative accomplishments and dimensional symptoms of anxiety and depression	Cohort study	189 of psychology students at the university of North Carolina ( 150 woman, 39 men)	Participations divided to different groups, and they expected to do some creativity tasks and response to a questionnaire.	Divergent Thinking, Creative Self-Concepts, everyday creativity, and Creative achievement	Mood Disorder Symptoms	The results displayed that measurements of anxiety, social anxiety and depression predicted slight variance in creativity.
E. Wendler & E. Schubert, 2019	The purpose of this Investigation was to find a link among three variables, creative absorption (CA), OCD, and synaesthesia (SYN)	Cohort study	210 of university student (134 females, 76 males)	Through an online survey participations filled series questionnaires on the three concerned variables.	creative absorption (CA)	OCD and SYN symptoms	The results indicated OCD and synaesthesia were each significantly correlated with creative absorption. It has been suggested that both OCD and SYN contributed to CA, but SYN had dominant contribution.
J. Parnas et al., 2019	The aim of this study was to Examine successful university academics and their first- and second- degree relatives in 5 subgroups: including, children, nephews/nieces, siblings, parents, and grandparents for diagnosed mental disorder and compare them with controls.	Both matched cohort and case-control studies	588,532 university academics and their first- and second-degree relatives	The first- and second- relatives of academics were identified via the Danish Civil Registration System.	Academic-scientific professions	Psychiatric symptoms	The results demonstrated that the relatives of university scientists were significantly more likely suffer from schizophrenia or bipolar disorder. In the case of academics, the link between creativity and mental disorders has not revealed by clinical mental disorders.

<p>S. Kyaga et al., 2012</p>	<p>The primary aim of this study was investigating the connection between creative professions and psychiatric disorders.</p> <p>The second purpose of this study was separately investigating the association between authors and mental illness.</p> <p>The third objective was attempting to validate a familial link for creative occupations with bipolar disorder and schizophrenia by applying a large dataset.</p>	<p>Nested case-control study</p>	<p>Longitudinal adult Swedish (n = 1,173,763)</p>	<p>Data were collected by surveys, questionnaires and were analyzed through applying conditional logistic regression</p>	<p>Creative occupations, IQ</p>	<p>Psychiatric symptoms: including, schizophrenia, bipolar disorder, anxiety disorder, alcohol abuse, drug abuse, autism, ADHD, anorexia nervosa, and unipolar depression by including schizoaffective disorder in patients and their first, second, and third degree relatives</p>	<p>The results showed that individuals with creative occupations were not generally more likely suffer from mental disorders than controls .but in the case of authors, the risk of psychiatric disorders was significantly high, particularly in terms of schizophrenia, bipolar disorder, unipolar depression, substance abuse, anxiety disorders, and suicide. Also, the link between creative occupations and first -degree relatives of people with some mental disorders: including, schizophrenia, bipolar disorders, anorexia nervosa, and siblings of autistics have been found.</p>
<p>R. A. Chavez-Eakle, M. Del Carmen Lara &amp; C. Cruz-Fuentes, 2006</p>	<p>The main aim of this study was evaluating the association amongst creativity, character, temperament, and psychopathological distress</p>	<p>Comparative cross-sectional study</p>	<p>Group I: 30 individuals with prominent creative scientific or artistic achievements Group II (the control group): 30 individuals without diagnosed psychiatric mental disorders Group III: 30 individuals of psychiatric outpatient</p>	<p>Torrance tests of creative thinking, temperament and character inventory, and symptom check list-90 were applied to contributors. Then collected data from the three groups were compared with each others.</p>	<p>Temperament and Character Inventory (TCI), Divergent thinking, TTCT Figural and Verbal forms, National prizes in art or science, and membership in the National System of Researchers or the National System of Creator in Mexico</p>	<p>The symptom checklist (SCL)-90</p>	<p>The results displayed that people with prominent creative achievements scored low on psychopathology. The significant negative correlation was recognized between creativity and psychopathology (on the all subscales). Also, it was suggested that psychopathology was more associated to personality than to creativity. Furthermore, this research found that the treatment of psychopathology could lead to increase the potential creative abilities.</p>

<i>J.H MacCabe et al., 2018</i>	<i>The aim of the research was to investigate a link between studying a creative field at high school or university and subsequent mental illness.</i>	<i>A case control study</i>	<i>4,454,763 Swedish adult</i>	<i>LISA database has provided demographic information</i>	<i>Tertiary education in an artistic field</i>	<i>Hospital admission with schizophrenia, bipolar disorder, and unipolar depression</i>	<i>Creative art students are more likely suffer from schizophrenia, unipolar depression, and bipolar disorders in their adulthood.</i>
<i>A. Kandaraki et al., 2020</i>	<i>The main aim of this study was exploring the impact of psychopathology on creativity amongst accomplished artists</i>	<i>Cross sectional study</i>	<i>115 living Greek artists</i>	<i>A web-based survey with Self-report questionnaires and open-ended exploratory questionnaires</i>	<i>Artistic professions</i>	<i>Early trauma inventory- self report, and investigators' questionnaire, boundaries questionnaire, and the defense questionnaire</i>	<i>The results demonstrate that artists with mental disorders reported more rates of childhood trauma. Not only they had thinner ego boundaries, but they also employed more immature defense mechanisms. So, they have shown a tendency to creative activities as a need rather than desire and their artistic activity was the only thing that gave meaning to their lives.</i>
<i>S. Gostoli, Veronica Cerini, A. Piolanti &amp; C. Rafanelli, 2017</i>	<i>The objective of this study was to detect the association between creativity, subclinical bipolar disorder symptomatology, and psychological well-being.</i>	<i>Descriptive Correlational study</i>	<i>329 students of different colleges</i>	<i>The procedure was of descriptive, Correlational type. The test of divergent feeling was performed voluntarily. Data were collected in an ethical standard method and the local ethnical committee monitored the procedure.</i>	<i>the creative assessment packet (CAP), the temperament evaluation of Memphis, Paris, Pisa, and San Diego— auto questionnaire (TEMPS-A)</i>	<i>The psychological well-being scale (PWB), subclinical psychopathological symptoms</i>	<i>Significant positive correlations were detected between creativity and bipolar disorders, particularly in the case of hyper mania. And also, poor correlations between creativity and all psychological well-being subscales were recognized, but personal growth and autonomy. The results demonstrated that there is a significant association between creativity and personal growth subscale.</i>



<p>N. Miller, T. Perich, T. Meade, 2019</p>	<p>The purpose of this study was to investigate the association between self-reported creativity and prevalent symptoms of mania and depression.</p>	<p>Cross sectional</p>	<p>397 of individuals with bipolar disorders</p>	<p>The online questionnaire and survey were used and they consisted of demographic and clinical data inquiries</p>	<p>Self reported creativity, The Creativity Domain Questionnaire - Revised</p>	<p>Self-reported symptoms of depression, mania, and hypo mania.</p>	<p>The results showed that there were no significant differences between people with self-reported mania /hypo mania symptoms and people with any self-reported symptoms. In addition, individuals who reported significant symptoms of depression scored far lower in creativity measures than those without symptoms and also individuals with self-reported significant symptoms of mania and hypo mania.</p>
<p>V. Leutgeb et al, 2016</p>	<p>The main purpose of this study was to investigate various facets of psychometrically characterized creativity in female patients with borderline personality disorder (BPD) in compare with healthy females, and also examining differences in their grey matters.</p>	<p>Case control study</p>	<p>20 female patients with personality disorder and 19 healthy woman as controls</p>	<p>Patients with borderline disorder were studied in the psychiatric hospital and also they were compared with control group. After obtaining the consent of participations the magnetic resonance imagining assessment was applied</p>	<p>Torrance tests of creative thinking including Two creativity performance measures were applied: including, the figural-graphic aspect of creativity, and the verbal creativity</p>	<p>Hospital admission with personality disorder</p>	<p>According to verbal and figural- graphic creative task performance and creativity-related personality features, there were no significant differences between the patients with borderline personality disorder and controls. In addition, the experiment of grey matters revealed that the lower level of creativity and the reduction of grey matters in the orbital part of the inferior and middle frontal gyri of patients with BPD were correlated.</p>
<p>C. Chirila, A. Feldman, 2011</p>	<p>The aim of this study was to explore a connection between creativity and psychopathology according to cognitive associations and personality traits that are prevalent amongst creative individuals and mentally disturbed them.</p>	<p>Cross sectional study</p>	<p>43 participations (between 20- 35 years old), belonging to middle and upper class social environment with average and high incomes</p>	<p>A latent inhibition task was performed in a two-phase experiment to confirm the hypothesis. And multifold questionnaires were applied.</p>	<p>Torrance tests of creative thinking (figural and verbal), intelligence tests , and a test for accentuated personalities</p>	<p>DA 307 Questionnaire to assess demonstrativity, hyper-exactness, hyper-perseverance, lack of control hyperthymia, dysthymia, lability, exaltation, emotivity, anxiety, neuroticism, dependence and desirability</p>	<p>The results display that there is a significant association between low scores of latent inhibition and various index of creativity. Also, it was suggested that creativity and clinical scales positively correlated.</p>

<p>A. Preti, F. De Biasi, P. Mitto, 2001</p>	<p>The purpose of this study was to investigating the rate of suicide in eminent artists in 19<sup>th</sup> and 20<sup>th</sup> centuries.</p>	<p>Cross sectional study</p>	<p>4564 eminent artists (including, 2259 poets and writers, 1471 musicians, 834 visual artists such as painters, and sculptures)</p>	<p>Biographical data were collected in terms of the percentage of suicide in eminent artists.</p>	<p>Eminent artistic activities</p>	<p>Collecting data regarding suicidal attempts in eminent artists</p>	<p>The results displayed 63 suicides (1.3 %) in the sample. Musicians group had a lower percentage amongst other groups.</p>
<p>D. I. Simeonova, K. D. Chang, C. Strong, T. A. Ketter, 2005</p>	<p>The aim of this was detecting a link between creativity and bipolar disorders and also exploring the probability of familial and intergeneration transmission of both creativity and bipolar disorders.</p>	<p>Clinical, phenomenological and cohort study</p>	<p>40 bipolar adults, 18 control adult, 20 bipolar offspring with bipolar disorder, 20 bipolar offspring with ADHD, 18 control children N=116</p>	<p>This research compared creativity in different groups: including, parents with bipolar disorder and their offspring with BD and ADHD and healthy controls.</p>	<p>Barron- Welsh Art Scale (BWAS)</p>	<p>The structured clinical interview for DSM- IV Axis I Disorders (SCID) was used for parents, the Family History- Research Diagnostic Criteria was used for first and second degree relatives, and bipolar offspring were assessed by the Affective Disorders Module of the Washington Schedule for Affective Disorders and Schizophrenia for school age Children (WASH- U- KSADS)</p>	<p>The results demonstrate that there is a connection between creativity and bipolar disorder in individuals, and also it was suggested that there is a familial association for bipolar disorder with creativity.</p>

<p><i>C. M. Santosa et al, 2006</i></p>	<p><i>The objective of this research was to assess creativity of non- eminent patients in a clinical sample in terms of several mental disorders: including, euthymic bipolar (BP), unipolar major depressive disorder (MDD), and creative discipline controls (CC), and healthy controls (HC).</i></p>	<p><i>Case Control study</i></p>	<p><i>A total of 153 euthymic subjects including, 49 patients with bipolar disorder (BP), 25 patients with major depressive disorder (MDD), 32 creative controls (CC), and 47 healthy controls (HC)</i></p>	<p><i>The research was performed in bipolar disorder clinic. Creativity. Mean scores of creativity measures of different groups were compared across groups.</i></p>	<p><i>The measures were included 6 parameters: including, Barron-Welsh Art Scale (BWAS-Total and two subscales, BWAS-Dislike and BWAS-Like), the Adjective Checklist List Creative Personality Scale (ACL-CPS), and Torrance Tests of Creative Thinking – Figural (TTCT-F) and Verbal (TTCT) versions.</i></p>	<p><i>A psychiatric evaluation including psychiatric history and Structured Clinical Interview for DSM- IV Diagnosis (SCID), semi-structured interview to evaluate individual DSM- IV symptoms, Bech Depression Inventory (BDI)</i></p>	<p><i>The results revealed that patients with BP and CC (but not MDD) similarly increased creativity in terms of the BWAS-Total score in compared with the HC group.</i></p>
<p><i>D. Rawlings, A. Locarnini, 2008</i></p>	<p><i>The purpose of this research was to find evidence for an association between creativity and the tendency to psychiatric disorders.</i></p>	<p><i>Cross sectional study</i></p>	<p><i>31 professional artists : including, musicians and visual artists, and 28 accomplished scientists: including, mathematicians, physical and biological scientists</i></p>	<p><i>Four groups belong to creative occupations were employed to compare in relation to the symptoms of psychiatric disorders</i></p>	<p><i>Producing high standard work in art, music, biological science, physical</i></p>	<p><i>Questionnaire s: namely, the Oxford-Liverpool Inventory of feelings, and Experiences (O-LIFE), the Hypomanic Personality Scale, and the Autism-Spectrum Quotient (AQ), and shortened from of the Kent-Rosanoff Word association Scale were applied to this research to measure minor features of mental disorders and autism</i></p>	<p><i>The results found that there is a strong link between artistic creativity and positive Schizotypy and hypomania. Also, the results provided slightly weaker support for the associations between scientific creativity and specific parts of the autism spectrum.</i></p>

A. Kasirer, N. Mashal, 2014	The aim of this study was to examine verbal creativity in adult with autism spectrum disorder (ASD)	Case control study	17 adults with autism spectrum (14 men and 3 women) disorder, and 17 healthy controls	A multiple choice questionnaire including, novel and conventional metaphoric language task were applied in this study to examine verbal creativity.	creativity test, metaphor comprehension, metaphor generation, executive functions, ambiguous word meaning generation test, phonemic fluency, semantic fluency, and the trail making test.	Autistic symptoms in the line with the Diagnostic and Statistical Manual of Mental Disorder- IV, and the autism-spectrum quotient (AQ) questionnaire	The results indicated that adult with autism spectrum disorder generated more creative metaphors in compare with controls.
I. Carlsson, 2002	The objective of this study was to search anxiety and defense mechanisms in various creative individuals.	Cohort study	24 males undergraduate students who obtained either very high or very low scores in creative function	Firstly 60 participations were tested by CFT and if they scored very high or very low, they were selected to participate in the full research.	The Creative Function Test (CFT) test was used to measure creativity	The MCT was used to assess defense mechanisms and anxiety	The results displayed that high creative groups had more anxiety relatives to low creative group. Also defense mechanisms were positively associated with a fluency measure of the creativity test.
A. Furnham, D. J. Hughes, E. Marshal,	The purpose of this study was to investigate which one personality traits (normal or abnormal) predict to creativity.	Cross sectional study	207 participants (151 females, 56 males)	Questionnaires and surveys were applied.	self- rated creativity and creative achievements that was measured through Biographical Inventory of Creative Behaviors (BICB),	The Obsessive Compulsive Inventory Revised (OCI-R), a shortened 16 item version of the Narcissistic Personality Inventory (NPI- 16)The 60- item NEO-FFI to measure the big five factors of Neuroticism, Extraversion, Openness- to- experience, Agreeableness and Conscientiousness	The results displayed that there were positive correlations amongst creativity and OCD, narcissism, extraversion and openness. The positive relationship of narcissism was significantly linked to self- rated creativity measures, but in the case of OCD, it was related to the biographical inventory of creative behaviors.
T. O'Reilly, R. Dunbar, R. Bentall, 2000	The aim of this research was to find an association between creativity and psychosis disorders according to the retention of psychosis genes in the gene pool	Cross sectional study	100 undergraduate humanities and art students	The data were collected by questionnaires	the Torrance tests of divergent thinking	Multidimensional scales of schizotypal traits, the Oxford-Liverpool Inventory of Feeling, picture construction task.	The results showed that Schizotypy may predict to creative potential but it was not directly connected to divergent thinking.

L. Carpenter, 2018	The main objective of this study was to determine what direct associations exist amongst creative achievements and symptoms of psychoticism and quality of life impairment and psychological inflexibility.	Cross sectional study	152 College students with various levels of creativity and psychological distress, psychological flexibility, and impairment in quality of life. 21 participants excluded because of incorrect and incomplete answers.	The online self-report survey and automatic thoughts questionnaire were applied in this study.	Creative achievements	Automatic thoughts questionnaire, psychological inflexibility, the personality Inventory for DSM- IV (PID-5 –BF), Self-history and family- history of patient with psychiatric disorders	The results revealed that creative abilities can predict to some symptoms of psychiatric disorders. Also the results showed that high creative achievement significantly correlated to some personality disorders dimensions in the DSM-V. Furthermore, it was suggested that creativity may increase the likelihood of experience psychosis symptoms. But it is not obvious whether these symptoms are adequate to diagnose psychiatric disorders.
K. Wood, 2017	The purpose of this study was to investigate a meditational linkage amongst creativity, schizotypy, impulsiveness and behavioral inhibition.	Correlational / regression design	177 students (122 females, 55 males) including, 106 freshman, 33 sophomores, 23 juniors, and 15 were seniors	Participations were employed from the Murray State University online subject pool. Online questionnaire and survey were used in this study.	To assess creativity several measures were applied: namely, self-reported real-world achievement questionnaire, conceptual expansion, constrain of examples, and creative imager.	The schizotypal personality questionnaire was used to measure schizotypy. Furthermore, the Barratt impulsiveness scale assessed impulsiveness.	The results demonstrated that individuals with Schizotypal personality trait were more creative than others according to self-reported real-world achievement questionnaire and also they were more likely to be impulsive. In addition, it was suggested that impulsivity could not be the mediate factor between creativity and schizotypy, because it had not significantly correlated to creativity.

<p><i>N. LeBoutillier, R. Barry, and D. Westley, 2016</i></p>	<p><i>The goal of this study was to determine the role of some well-known psychopathological measures particularly latent hypomania to predict creative abilities.</i></p>	<p><i>Correlational / regression design</i></p>	<p><i>203 participants (102 females, 101 males)</i></p>	<p><i>Questionnaires with two creative cognition tasks were applied in this study. And multivariate regression was used for data analyzing.</i></p>	<p><i>Self measures creativity tests, the creative visualization task,</i></p>	<p><i>The mental health questionnaire, the shortened Oxford-Liverpool Inventory of Feeling and Experiences, the shortened Eysenck personality questionnaire, Hypomania Personality Scale (HPS)</i></p>	<p><i>The results indicated that creativity and schizotypy and latent hypomania were significantly associated. Also it was suggested that some psychopathological measures: namely, introverted anhedonia, excitement, and social vitality were negatively associated with creativity. However, other psychopathological measures: including, impulsive nonconformity and mood volatility positively led to predict creativity.</i></p>
<p><i>V. Kwan, 2016</i></p>	<p><i>This purpose of this study was to organize and replicate former findings which connected psychopathology to creativity.</i></p>	<p><i>Case control study</i></p>	<p><i>165 biographies of eminent professionals including, 85 artists, 21 athletes, and 59 scientists were investigated. Artists and scientists were considered as creative groups. However, athletes group was used as control group.</i></p>	<p><i>Digital papers and eBooks were used to collect data. And the rate of psychopathology in each group were compared with each other.</i></p>	<p><i>Eminent professions</i></p>	<p><i>A three point scale was applied to determine potential symptom in this study. In this way, not present symptoms, probable and potential symptoms were considered respectively, 0, 1 and 2.</i></p>	<p><i>The results indicated that the percentage of psychopathology (87.06 %) was significantly higher in the artists than scientists, and athletes. So, it was suggested that there is a strong association between artistic creativity and psychopathology.</i></p>

<b>S. Kayaga, 2011</b>	<i>The purpose of this study was to test whether the connection between mental illness and creativity is the outcome of genetic elements or environments.</i>	<i>Nested case-control study</i>	<i>351,457 patients with schizophrenia, bipolar disorders, unipolar depression and their siblings in Sweden between 1973 and 2003</i>	<i>Patients with schizophrenia, bipolar disorders, and unipolar depression who received in-patient treatment were compared with their siblings and controls.</i>	<i>Creative occupations</i>	<i>Diagnoses were done according to ICD- 8, ICD- 9, ICD- 10</i>	<i>The results indicated that patients with bipolar disorders and healthy siblings of schizophrenics had a large percentage in overall creative occupations. However, schizophrenics, patients with unipolar depression and their siblings in compared with controls were not overrepresented in creative jobs.</i>
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### 3.3. Participation characteristics:

In this paper, 24 studies have been reviewed that they are involved 6,525,664 participations. Table 3 indicates demographic characteristic of the sample.

Table3. Demographic and participation characteristics

Total participation n	Ethnicity						Gender			Mean age	Age Range	SD
	White	Hispanic	Asian	Black	Alaskan Native	Others	Male	Female	others			
S1= 189	69 %	0%	0 %	26 %	0 %	0 %	150 (79 %)	39 (21 %)	0 (0 %)	Not stated	Not stated	Not stated
S2= 210	Not stated						76 (36 %)	134 (64 %)	0 (0 %)	M= 20.8 Years	18-42	SD= 2.48
S3= 588,532	Not stated						51.8 %	48.2 %	0 (0 %)	Not stated		
S4= 1,173,763	Not stated						Not stated	Not stated	Not stated	Not stated		
S5A= 30 S5B= 30 S5C= 30 N= 90	Not stated						Not stated	Not stated	Not stated	Not stated	Older than 18	Not stated
S6= 4,454,763	Not stated						2,275,400 (51.08 %)	2,179,363 (48.92 %)	0(0%)	M= 42.31	20-64	Not stated
S7= 115	Not stated						44 (38.26 %)	68 (61.74 %)	0 (0 %)	M= 44.2	Not stated	SD= 13
S8= 329	Not stated						163 (49.54 %)	166 (50.45 %)	0 (0 %)	M= 23.92	21-45	SD= 2.44
S9= 397	Not stated						52 (13.1%)	344 (86.4 %)	0 (0 %)	M= 38.61	16-67	SD= 11.22
S10A= 20 S10b= 19 N= 39	Not stated						0 (0 %)	20 (100 %)	0 (0 %)	M= 30.9	Not stated	SD= 8.5
	Not stated						0 (0 %)	19 (100 %)	0 (0 %)	M=25.7	Not stated	SD= 8.6
	Not stated						0 (0 %)	39 (100 %)	0 (0 %)	M= 28.3	Not stated	Not stated
S11= 43	Not stated						Not stated	Not stated	Not stated	Not stated	20-35	Not stated
S12= 4564	Not stated						Not stated	Not stated	Not stated	Not stated	Not stated	Not stated
S13A= 40	37 (92 %)	1 (5 %)	2 (5 %)	0 (0 %)	0 (0 %)	0 (0 %)	9 (22.5%)	31 (77.5 %)	0 (0 %)	M= 42.5		SD= 6.5
S13B= 18	13 (72 %)	1 (6 %)	4 (22 %)	0 (0 %)	0 (0%)	0 (0 %)	2 (11.11 %)	16 (88.89 %)	0 (0 %)	M= 45.1		SD= 7.5
S13C= 20	19 (95 %)	0 (0 %)	0 (0 %)	1 (5 %)	0 (0%)	0 (0 %)	15 (75 %)	5 (25 %)	0 (0 %)	M=13.9		SD= 2.8
S13D= 20	14 (70 %)	2 (10 %)	3 (15 %)	1 (5 %)	0 (0 %)	0 (0 %)	13 (65 %)	7 (35 %)	0 (0 %)	M= 12.4		SD= 2.2
S13E= 18	14 (78 %)	1 (6 %)	3 (16 %)	0 (0 %)	0 (0 %)	0 (0 %)	10 (55.55 %)	8 (44.44 %)	0 (0%)	M= 14.4		SD= 2.7
N= 116												

S14A= 47 S14B= 25 S14C= 49 S14D= 32 N= 153	Not stated Not stated Not stated Not stated	38.3 % 32 % 36.7 % 46.9 %	61.7 % 68 % 63.3 % 53.1 %	0(0 %) 0 (0%) 0 (0 %) 0 (0 %)	M= 33.8 M= 33.5 M= 37.5 M= 29.7	Not stated Not stated Not stated Not stated	SD= 14.2 SD= 12.3 SD= 10.8 SD= 3.5
S15A= 20 S15B= 15 S15C= 20 S15D= 15 N= 70	Not stated Not stated Not stated Not stated	5 (25 %) 7 (46.66 %) 11 (55 %) 10 (66.66 %)	15 (75 %) 6 (40 %) 5 (25 %) 5 (33.33 %)	0 (0 %) 2 (13.33) 4 (20 %) 0 (0%)	M= 35.90 M=35.69 M= 50.25 M= 43.20	Not stated Not stated Not stated Not stated	SD= 15.13 SD= 15.57 SD= 16.22 SD= 19.17
S16A= 17 S16B= 17 N= 34	Not stated Not stated	Not stated Not stated	Not stated Not stated	Not stated Not stated	M= 21.06 M= 22.71	Not stated Not stated	SD= 3.44 SD= 2.02
S17A=12 S17B=12 N= 24	Not stated Not stated	Not stated Not stated	Not stated Not stated	Not stated Not stated	M= 23 M= 23	20-27 20-27	Not stated Not stated
S18= 207	Not stated	56 (27.05 %)	151 (72.94 5)	0 (0 %)	M= 20	16-54	Not stated
S19A= 50 S19B= 50 N= 100	Not stated Not stated	28 (56 %) 33 (66 %)	22 (44 %) 17 (34 %)	0 (0 %) 0 (0 %)	M= 22.14 M= 22.96	Not stated Not stated	SD= 2.86 SD= 3.25
S20 = 131	82.2 % 1.6 % 0 % 12.2 % 1.6 % 2.4 %	35 (26.71%)	93 (70.99 %)	3 (2.29 %)	M= 19.24	Not stated	SD= 1.9
S21 = 177	80.79 % 0.56 % 9.03 % 0 % 9.03 %	55 (31.07 %)	122 (68.92 %)	0 (0 %)	M= 20.16	Not stated	SD= 6.34
S22= 203	Not stated	101 (49.75 %)	102 (50.25 %)	0 (0 %)	M= 30.44	16-70	SD= 11.64
S23 = 165	Not stated	143 (86.66 %)	22 (13.34 %)	0 (0%)	Not stated	Not stated	Not stated
S24A= 54,042 S24B= 29,644 S24C= 217,771 N= 301457	Not stated Not stated Not stated	29479 11910 84352	24563 17734 133419	0 0 0	Not stated Not stated Not stated	Not stated Not stated Not stated	Not stated Not stated Not stated

### 3.4. Quality assessment of studies:

This paper conducted a systematic review on quantitative literature only: including, cohort design, cross sectional design, case control design, Correlational / regression design (see Figure2). As seen in the appendix, quality assessments of different studies were implemented according to their study design. To assess quality of the case control and cohort studies, the Critical Appraisal Skills Program (CASP) checklists were used (see Appendix1 and Appendix2). In the case of cross- sectional designs the Newcastle – Ottawa quality assessment tool was used (see Appendix3). And Correlational checklist was applied to assess the quality of regression studies (Appendix4).



In general, the quality of all of the reviewed studies in this paper is found to be good and satisfactory (see appendix). The reasons why the quality of these studies has been described as justified include: addressing a clearly focused issue, the satisfactory sample size, recruiting the sample in proper way, choosing appropriate method for their questions and selecting appropriate statistical tests for the analyzing data. Also, the results of all studies were idea and really good fit ( $CI \geq 95\%$ , or  $P \leq 0.05\%$ ); and whole measurements of the outcomes were clearly measured.

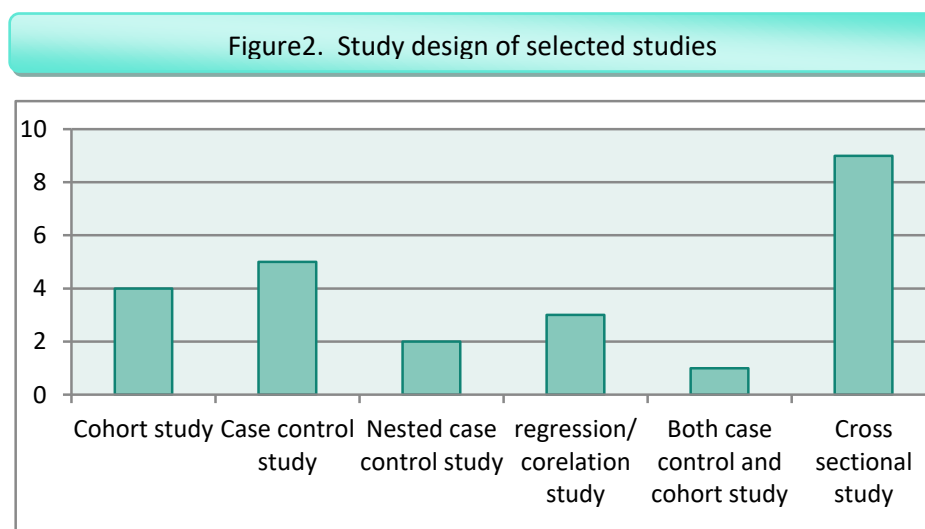
All but one study (MacCabe et al., 2018) have one thing in common regarding confounding factors that they have not taken account of potential confounding factors in their analysis.

### ***3.5. Narrative of studies and results:***

In this paper, 24 studies have been reviewed that they are involved 6,560,935 participations. Despite some conflicting results, a large body of presented literature has confirmed that there is an association between specific forms of creativity and specific type of mental disorders. Among these studies, common shared vulnerability characteristics between creativity and psychopathology were: attenuated latent inhibition, preference for novelty, and hyperconnectivity. Also, the results displayed that individuals with subclinical mental illnesses and relatives of patient with severe mental illness were much more likely to be creative rather than patients with severe clinical mental disorders. In other words, creative individuals who are prone to mental illness have some protective factors (including, cognitive flexibility working memory skills, and high IQ) against severe forms of psychopathology.

One of the major challenges in creativity/ mental illness research is the creativity assessment. Due to there are various ways to measure creativity. Even in some cases a categorical criteria of creativity (for instance artists, writers, and musicians) were used to assess creativity as an alternative for measurements. Nevertheless, among all the reviewed studies, there were five basic and common assessments for creativity: including, everyday creativity (Little C), eminent creativity (Big C), divergent thinking, creative achievements, and creative professions. In most studies, to reduce weakness of assessments and the risk of bias more than one instrument was used to measure the creativity. Taking into account all the reviewed studies in this paper, the mental illnesses most frequently associated with creativity were respectively bipolar disorders (11 studies, 45.8 %), schizophrenia (6 studies, 25 %), schizotypy (5 studies, 20.8 %), and autism (4 studies, 16.6 %).

On the whole, a surprisingly large portion of the studies (87.5 %) were observational, so they were approximately homogenous in terms of their study designs. This systematic review covered 21 observational studies (including, cohort studies, case control and nested case control study, and cross sectional study) and 3 Correlational studies (12.5 %) (Figure2).



In general, the results of the presented studies in this systematic review were almost analogous and considerable numbers of them have continuously confirmed the link between creativity and psychopathology (22 studies, 91.6 %). For the studies as a whole, 21 of the studies (87.5 %) provided significant evidence in favor of the hypothesis that there is a positive relationship between creativity and some specific mental illnesses: including, schizophrenia, bipolar disorders, anorexia nervosa, autism, unipolar depression, anxiety, obsessive compulsive disorder, personality disorders particularly schizotypy and narcissism, adjustment disorder, alcoholism, drug dependency, eating disorder, gambling disorder, kleptomania, OSD, paraphilia, posttraumatic disorder, sleep disorder, somatic disorder, suicide attempt, and synesthesia. However, more than half of these studies (57 %) that confirmed a positive relationship between creativity and mental illnesses focused on bipolar disorders, schizophrenia, and schizotypy.

Furthermore, 14.2 % of these studies in terms of genetic susceptibility suggested that there is a positive relationship between creativity and healthy relatives of patient with some specific psychiatric disorders: including, schizophrenia, bipolar disorders and autism. Also, the link between creative occupations and first -degree relatives of people with some mental disorders: including, schizophrenia, bipolar disorders, anorexia nervosa, and siblings of autistics have been found. So, According to these studies, patient with these specific mental disorders and their kin have more creative capacity.

2 of the reviewed studies (8 %) found no significant indications to support a relationship between creativity and some particular mental disorders: namely, depression, anxiety, and borderline personality disorder. And finally, merely one of the reviewed studies supports a significant negative association between creativity and some mental disorders: including, somatization, OCD, interpersonal sensibility, depression, anxiety, paranoid ideation, and psychoticism. Accordingly, this study claims that eminent creative people scored low on mentioned mental illnesses and also it was suggested that creativity is associated with different types of personality rather than psychopathological problems. However, all things considered, most of the included studies (21 studies, 87.5 %) reached a consensus on the existence a positive connection between creativity and psychopathology.

#### 4. Discussion:

Is there a link between creativity and mental disorders? The goal of this review was to investigate the relationship between creativity and mental disorders. Generally speaking, the combined study results suggested that there is a positive association between creativity and specific types of mental illnesses (: namely, schizophrenia, bipolar disorders, anorexia nervosa, autism, unipolar depression, anxiety, obsessive compulsive disorder, personality disorders particularly schizotypy and narcissism, adjustment disorder, alcoholism, drug dependency, eating disorder, gambling disorder, kleptomania, OSD, paraphilia, posttraumatic disorder, sleep disorder, somatic disorder, suicide attempt, and synesthesia).

In general, individuals with creative occupations were not generally more likely suffer from mental disorders than controls (Kayaga, 2015). But the results provide a significant evidence to support the link between artistic creativity and occupations and schizotypy and

hypomania (Rawlings & Locarnini, 2008). Also, a slightly weaker link was found between scientific creativity and autism spectrum (Rawlings & Locarnini, 2008).

Accordingly, it could be argued that the types of creative activities modify with the severity and types of psychiatric disorders. So, different types of mental illnesses could predict to various forms of creative professions. According to this, it was suggested that that patients with bipolar disorders and healthy siblings of schizophrenics had a great portion in overall creative occupations (Kayaga, 2011). However, schizophrenics, patients with unipolar depression and their siblings in compared with controls were not overrepresented in creative jobs (Kyaga, 2011). The results of a number of studies indicated that the percentage of psychopathology (87.06 %) was significantly higher in the artists than scientists, and athletes (Kwan, 2016). So, it was suggested that there is a strong association between artistic creativity and psychopathology. Furthermore, in the case of poets, and authors the risk of psychiatric disorders was significantly high, particularly in terms of schizophrenia, bipolar disorder, unipolar depression, substance abuse, anxiety disorders, and suicide (Kayaga, 2012). However, In the case of academics, the link between creativity and mental disorders has not revealed by clinical mental disorders (Parnas et al., 2019).

Also, a number of studies convincingly demonstrate that the severity of the mental illness play a key role in creativity/ psychopathology relationship. For more details, the likelihood of being creative in moderate types of psychiatric disorders (especially in the case of schizophrenia) and the relatives of patients with severe forms of mental disorders (particularly in case of schizophrenia, bipolar disorder, and autism) are higher than severe types of mental disorders. In the same way, a number of studies suggested that there is a familial association in some types of mental disorders such as schizophrenia, bipolar

disorder, and autism with creativity. Also, the link between creative occupations and first - degree relatives of people with some mental disorders: including, schizophrenia, bipolar disorders, anorexia nervosa, and siblings of autistics have been confirmed (Kayaga, 2012). In addition, the results demonstrated that the relatives of university scientists were significantly more likely suffer from schizophrenia or bipolar disorder (Parnas et al., 2019). This finding developed the idea of inverted U in creativity/ mental illness connection.

Generally speaking, this paper found four theories and models in existing literature to explicate why and how there is a connection between creativity and psychopathology: including, evolutionary (or Darwinian) model, Eysenck's psychoticism- creativity theory, inverted U- curve model, and the shared vulnerability model. According to Darwinian model, psychoticism doomed to be removed. Due to it is link to the reduction of fertility rate and early mortality which both lead to negative selection. So, it is a contradictory phenomenon with the adaptations and natural selection. Therefore according to Darwin's theory, psychotic trait should be gradually extinct. As we know, it is not the case. Then it could be argued that the creativity/ psychotic trait association might describe the retention of psychosis genes in the gene pool (O' Reilly et al, 2000). The evolutionary hypothesis linking psychosis to creativity suggests that the advantage of psychosis gene will be most carried by individuals who have the genes without being openly madness (O' Reilly et al, 2000). Also, according to evolutionary hypothesis a modest association was found between creative abilities and schizotypy (O' Reilly et al, 2000).

A number of studies in the field of creativity/ psychopathology research have been inspired by Eysenck's psychoticism- creativity theory and his model of creativity (O' Reilly et al, 2000). Eysenck developed this theory with three dimensions: including, psychoticism,

extraversion, and neuroticism. Generally, this theory suggested that individuals who are genetically related to diagnosed psychotics are much more likely to be creative than others. This theory has demonstrated that there is a significant overlap between creativity and psychotic traits. Eysenck (1993) was of the opinion that creative people are at a greater risk of suffering from varied psychopathologies particularly in the case of psychotic trait (O'Reilly et al, 2000).

A wide range of research on people with mild and subclinical types of mental illnesses and relatives of patients with severe forms of mental disorders indicate that they have a high potential for creativity in comparison to individuals with severe psychiatric disorders and healthy control populations. So, according to the results of these studies the idea of an inverted U-curved effect has been developed for clarifying the association between creativity and mental disorders (Richard et al, 1988). Also, the results of the current study show that the association between creativity and psychiatric disorders hits the peak in first-degree relatives of patients with schizophrenia, bipolar disorder, autism and anorexia nervosa in comparison with the patients (Kayaga et al, 2012; Parnas et al, 2019).

Furthermore, the results display that creative individuals not only have several shared cognitive vulnerabilities (including attenuated LI, novelty-seeking, and neural hyperconnectivity) with some specific psychopathology but they have also some protective factors (including, high IQ, working memory skills, and cognitive flexibility) against severe psychiatric disorders (Carson, 2011). According to the shared vulnerability model, risk factors (including, low IQ, working memory deficit, and perseveration) that are usually seen in severe forms of mental disorders would reduce the likelihood of creativity.

Over time, there are a wide range of studies which have been investigated on the relationships between many forms of creativity and many types of psychopathologies. A large body of literature has been focused on bipolar disorders, schizophrenia, and schizotypy, while some mental disorders such as anxiety and depression have been neglected. According to the findings of the current study, it could be concluded that this neglect is presumably reasonable. According to motivational model of creativity, some features of depressive anhedonia, anxiety, and social anxiety such as absence of novelty seeking and appetitive behavior are in conflict with some certain creative traits (: including, approach oriented, appetitive and novelty seeking). However bipolar disorders, schizophrenia, and schizotypy have many features in common with creative traits such as novelty seeking, divergent thinking (thinking out of the box), and originality. So, the small amount of research on this area is not very surprising. Because it could be argued that depression and anxiety might not predict to higher levels of creative abilities. But further research is needed to find a negative relationship between specific forms of creativity and different dimensions of anxiety and depression. In this paper, no indications of confounding were found by ethnicity, age, gender, and education but IQ that is high in creative people. Therefore, more research is needed to show weather the creativity/ psychopathology connection varies according to level of education, gender, age, and race.

#### ***4.1. Conclusion:***

Despite the fact that creativity is a desirable and crucial human trait and it significantly improve the quality of life and the compatibility of humanity; but the review of the studies illustrates that creativity and psychopathology have a positive association with certain types of mental disorders. It could be argued that creative people (particularly in the case of



eminent creative individuals) have a shared cognitive vulnerabilities pattern (including, attenuated latent inhibition, preference for novelty, and hyperconnectivity) which could predicts to the specific forms of psychopathology. Also they have some common protective factors (including, high IQ, working memory skills, and cognitive flexibility) against severe forms of mental. Because some risk factors (including, low IQ, working memory deficits, and perseveration) of severe forms of mental disorders could reduce creativity.

Accordingly, usually people with mild forms of psychopathologies and relatives of patients with severe forms of mental disorders such as schizophrenia, bipolar disorders, and autisms who are prone to moderate types of the mental disorders are more likely to reach the peak of creativity. Because they have the shared vulnerabilities and protective factors at the same time, so the creative capacity could be protected by cognitive strengths against the risk factors of severe forms of psychopathologies. Therefore, it could be suggested that by bolstering protective mechanism can contribute those who suffer from severe psychopathologies. So, according to this finding it could be argued that subclinical forms of mental disorder might predict to creativity, however creative abilities would reduce in the case of severe clinical psychopathologies. On the other hand creativity could treat severe psychiatric disorders through improving cognition strengths. Thus it could be conclude that creativity is both a byproduct of specific subclinical mental disorders, and a cure of severe psychopathologies.

Moreover, given that patient with psychosis have fewer offspring than others. So another explanation for the association was developed according to the "balancing selection" hypothesis. Accordingly, the genetic factors of susceptibility to psychosis also

carry the biological advantages such as high intelligent and creativity. Likewise these productive advantages are present in relatives of patients with psychosis.

#### ***4.2. Limitations and strengths***

The question of the current paper (Is there a link between creativity and mental disorders?) is too big to answer. Therefore, it is not possible to comment clearly on the relationship between all typed of mental disorders and all forms of creativity. Moreover, this review like other research in this field has faced some common challenges: including, measurement errors, high diversity of assessment, and ambiguity of the concept of creativity. The vagueness of the concept of creativity and the diversity of its measurements could pave the way for increasing the risk of bias. A wide range of early works in the field of creativity/ mental illness connection have used outstanding achievement, success, esteem and reputation as a proxy of creativity. But these measures may not meet the basic requirements such as originality for creativity. Some of reviewed studies have applied categorical criteria (e.g. creative occupations) to evaluate creativity instead of measurements which it is problematic and has its own drawbacks and obstacles to assess creativity. The first difficulty is that creative individuals may not hold professions which are differentially creative such as self- employed and also they may even be unemployed. Further problem is most patients with psychosis may not have an opportunity to have creative occupations due the fact that the peak of psychosis begins in the third decade of life (32- 35 years). Thus one of the main limitations in this study is the definition and assessment of creativity.

One of the most important strengths of this study is the minimal selection bias. Given that sample size of this research is very large. And also a number of Swedish population- based

studies were reviewed in this paper in which the selection bias is dramatically minimized owing to full population coverage. Furthermore, to reduce weakness of assessments and the risk of bias, studies were selected to review that used various way of assessing creativity; and most of them applied more than one instrument was used to measure the creativity. Therefore, this review includes a wide range of instruments which are usually used to measure and assess the creativity. Besides, the next strength of this paper is that a large number of mental illnesses and various dimensions of creativity have been investigated.

#### ***4.3. Clinical implications and future direction:***

The results and outcomes of current research can be used in clinical practice. Owing to the association between creativity and mental disorders mostly requires psychological and psychiatric support. This study indicates that creative abilities can be sign of predisposition to mental illness. This may have an implication to raise the level of both service users' awareness and service provision. It is very important that therapists to be aware of the peculiarities of the patients with creative abilities. This awareness can lead to a faster diagnosis of the mental disorders, and this in turn increases the productivity of eminent creative patients through controlling symptoms and strengthening of protective factors related to creativity such as working memory capacity and cognitive flexibility. Accordingly, psychopathological symptoms in the case of creative individuals could be reduced by one of following remedies: including, reinforcing protective factors associated with creativity; or, treating symptoms connected to vulnerability factors;

or increasing entire creativity. Thus, in this case, the chance of treating creative patients will increase by faster diagnosis and relying on cognition protective factors.

A remarkable fact about creative luminaries is they often prefer to tolerate high level of symptomatology instead of using creativity-killing pharmaceuticals. So, they mostly prefer cognitive behavioral therapy (O'connor et al., 2009).

Furthermore, it could be argued that patients with schizophrenia spectrum disorders, mood disorders who have not yet shown their creativity could be treated with one of a variety of art therapies (e.g. music, dance, drama, and creative writing). Owing to the predisposing factors for certain psychopathologies such as schizotypy, bipolar disorders, schizophrenia, and autism may also boost creativity. Increased creative capacities also can contribute to the strengthening of cognition protective factors against risk factors for severe forms of mental disorders.

A significant aim for future research will be to improve our knowledge and understanding on the relationship between creativity and mental illness, with a greater focus on race, gender, and level of education.

Given that despite there are many studies on the relationship the relationship between creativity and mental illness as well as the relationship between creativity and mental health separately; there is almost no research on the relationship amongst creativity and mental illness and mental health. Thus, future research should be done to address the relationship among creativity, mental illnesses, and mental health at the same time. Because this relationship could be expand scope of our knowledge of how shared vulnerabilities factors and environment factors in relation to each other can move to path of creativity instead of leading to mental illness.

## 5. Appendix:

### 5.1. Quality assessments of cohort studies:

Appendix1. The questions of the CASP checklist used for the quality assessment of the Cohort designs

Questions	<i>P.J Silvia., &amp; N. A. Kimberl, 2010</i>	<i>E. Wendler &amp; E. Schubert, 2019</i>	<i>J. Parnas et al., 2019</i>	<i>I .Carlsson, 2002</i>	<i>D.I. Simeonova et al., 2005</i>
	<i>N = 189</i>	<i>N = 210</i>	<i>N = 588,532</i>	<i>N = 24</i>	<i>N = 116</i>
1. Did the study address a clearly focused issue?	Yes	Yes	Yes	Yes	Yes
2. Was the cohort recruited in an acceptable way?	Yes	Yes	Yes	Yes	Yes
3. Was the exposure accurately measure to minimize bias?	Yes	Yes	Yes	Yes	Yes
4. Was the outcome accurately measured to minimize bias?	Yes	Yes	Yes	Yes	Yes
5. (a) Have the author identified all important confounding factors?	No	No	No	No	No
(b) Have they taken account of the confounding factors in the design and /or analysis?	No	No	No	No	No
6. (a) Was the follow up of subjects complete enough?	Can't tell	Can't tell	Yes	Can't tell	Yes
(b) Was the follow up of subjects long enough?	No	No	Yes	No	Yes
7. What are the results of this study?	Strong ( +) association	Strong (+) association	Strong (+) Association	Moderate (+) association	Moderate (+) association
8. How precise are the results?	Good fit ( CFI= .975) .001)	Ideal ( p<	Ideal CI = 95% Yes	Ideal (P= .007) Yes	Ideal ( p< .05) Yes
9. Do you believe the results?	Yes	Yes	Yes	Yes	Yes
10. Can the results be applied to the local population?	Yes	Yes	Yes	Yes	Yes
11. Do the results of this study fit with other available evidence?	Yes	Yes	Can't tell	Can't tell	Can't tell
12. Are the implications of this study for practice?	Can't tell	Can't tell			



### 5.3. Quality assessment of the cross- sectional studies:

#### Appendix3. Overview of the Newcastle- Ottawa quality assessment used for cross- sectional designs

	R. Aurora et al., 2006 N= 90	A. Kandaraki et al., 2020 N= 115	N. Miller, T. Perich, T. Meade, 2019 N= 397	C. Chirila, A. Feldman, 2011 N= 43	A. Preti, F. De Biasi, P. Mitto, 2001 N= 4564	D. Rawlings, A. Locarnini, 2007 N= 59	A. Furnham, D. J. Hughes, E. Marshal, 2012 N= 207	T. O' Reilly, R. Dunbar, R. Bentall, 2000 N= 100	L. Carpenter, 2018 N= 131
<p><b>Selection:</b> 1) representative of the sample: 2) sample size: 3) non-respondents: 4) ascertainment of the exposure (risk factors):</p> <p><b>Comparability:</b> The subjects in different outcome groups Comparable, based on the study design or Analysis. Confounding factors are Controlled.</p> <p><b>Outcome:</b> 1) Assessment of the outcome: 2) Statistical test:</p>	<p>Truly Justified Satisfactory Validated</p> <p>The study controls for the most important factors</p> <p>Record linkage</p> <p>Appropriate</p>	<p>Truly Justified Satisfactory Validated</p> <p>The study controls for the most important factors</p> <p>Self report</p> <p>Appropriate</p>	<p>Truly Justified Satisfactory Validated</p> <p>The study controls for the most important factors</p> <p>Self report</p> <p>Appropriate</p>	<p>Truly Justified Satisfactory Validated</p> <p>The study controls for the most important factors</p> <p>Record linkage</p> <p>Appropriate</p>	<p>Truly Justified Satisfactory Validated</p> <p>The study controls for the most important factors</p> <p>No description</p> <p>Appropriate</p>	<p>Truly Justified Satisfactory Validated</p> <p>The study controls for the most important factors</p> <p>Record linkage</p> <p>Appropriate</p>	<p>Truly Justified Satisfactory Validated</p> <p>The study controls for the most important factors</p> <p>Independent blind assessment</p> <p>Appropriate</p>	<p>Truly Justified Satisfactory Validated</p> <p>The study controls for the most important factors</p> <p>Record linkage</p> <p>Appropriate</p>	<p>Truly Justified Satisfactory Validated</p> <p>The study controls for the most important factors</p> <p>Record linkage</p> <p>Appropriate</p>

#### 5.4. Quality assessment of the Correlational studies:

##### Appendix4. Overview of quality assessment for Correlational studies

Questions	N. LeBoutillier, R. Barry, and D. Westley, 2016	Sara Gostoli, Veronica Cerini, Antonio Piolanti & Chiara Rafanelli, 2017	Karrah Wood, 2017
<b>Design</b>			
1. Was the study prospective?	Yes	Yes	Yes
<b>Sample:</b>			
1. Was probability sampling used?	Yes	Yes	Yes
2. Was sample size justified?	Yes	Yes	Yes
3. Was sample drawn for more than one site?	Yes	Yes	Yes
4. Was anonymity protected?	Yes	Yes	Yes
5. Response rate was more than 60%?	Yes	Yes	Yes
<b>Measurement:</b>			
Yes			
1. Was the outcome measured reliably?	Yes	Yes	Yes
2. Was the outcome measured using a valid instrument?	Yes	Yes	Yes
<b>Influence on the measure of job satisfaction (DV)?</b>			
1. Was the dependence variable measured using a valid instrument?	Yes	Yes	Yes
2. If a scale was used for measuring the dependent variable, was the internal consistency $\geq 70$ ?	Yes	Yes	Yes
3. Was a theoretical framework used for guidance?			
<b>Statistical analysis</b>			
1. If multiple outcomes were studied, are correlation analyzed?	Yes	Yes	Yes
2. Were outliers managed?	Yes	Yes	Yes



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