

Effect of Genetic Testing for Mental Disorders on Married Couple and Their Reproductive Decisions

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Abstract-- *The study aimed to explore the awareness on the genetic susceptibility to psychiatric disorders and investigated their attitudes toward seeking help from genetic testing for psychiatric disorders before marriage and making reproductive decisions. In this study, there were 200 respondents consisted of 15.5% of men and 84.5% of women from Jeddah, Saudi Arabia who identified as being married or engaged. Most respondents were aged between 22 years old and 39 years old and all had different educational backgrounds. A questionnaire was developed based on previous literatures to measure the respondents' attitude toward genetic testing for mental disorders. The questionnaire contained 13 questions that assessed respondents' knowledge about mental illnesses and genetics, interest in genetic testing for mental disorders and attitudes towards the test regarded marital and reproductive decisions. The data was analyzed with SPSS program. The result showed the attitudes toward genetic testing for mental disorders among individuals from Jeddah, Saudi Arabia.*

Keywords-- *Genetics; genetic testing; mental disorders; reproductive decision; marital choices.*

I. INTRODUCTION

Mental disorders are among most common and contributes to health conditions in global [1]. An individual suffering mental disorders may have relatively high positive mental health and absence of psychopathology is necessary or sufficient to make sure a productive life [2]. Men and women diagnosed with serious mental disorders live on average of 20 years and 15 years less than general population [3]. Mental disorders included depressive disorders, anxiety disorders, bipolar disorder, schizophrenia and eating disorder [4].

Family, adoption and twin studies show that many psychiatric disorders such as, Schizophrenia, Bipolar disorder (BD), Attention-deficit/Hyperactivity disorder (ADHD), Major Depressive disorder (MDD) and Autism Spectrum disorder (ASD) have some genetic component. According to the largest genome-wide study funded by the National Institute of Health, those five major mental disorders are found to be traceable to the same inherited genetic variation. These overlapping variations account for 17-28% of mental illness risk.

Moreover, the heritability estimation for major psychiatric disorders suggests that Schizophrenia has a heritability estimate of (70%-85%), bipolar disorder (60%-85%), ADHD (60%-90%), OCD (60%-70%), panic disorder (40%-50%), major depression (40%) and autism spectrum disorder has the highest estimation of approximately 90% chance of heritability [5]. An approximately prevalence ranges from 6 to 14 per 1000 children and higher rate in boys than girls [6].

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However, the etiology of psychiatric disorders is a complex integration between genetics and environmental factors. Although possible susceptibility genes for psychiatric disorders are identified, environmental factors are highly crucial for the development of any disorder.

Nevertheless, the discovery of potential genetic susceptibility for psychiatric disorders improves the understanding of the disorder, provide a comprehensive diagnosis, advances in treatment plans, interventions and more importantly, helps to assess individuals who are at great risk of acquiring these disorders with the help of genetic testing and counseling [7,12].

The genetic testing and counseling process, if in the future were to become available, will enhance the overall patient care by, providing the necessary information about the complexities of genetic mental disorders and their recurrences, clear misconceptions, decrease the stigma, assess couples in making choices about reproductive decisions and offer support for individuals who are affected or are at a high risk of suffering from psychiatric disorders and their families and friends. Mental disorders are exceedingly difficult to treat, and often those treatments are accompanied by severe side effects, which has been a persistent problem in the field of psychiatry over the decades. One barrier to success in battling mental illnesses is the fact that we have relatively little information on the causes and progress of these disorders.

In an online survey, 68 individuals suffering from schizophrenia and 145 of their relatives had selected to measure their interest in genetic counseling. The study found that 72% of people who were suffering from schizophrenia and 74% of their relatives were generally in favor of genetic counseling and thought that it would be beneficial. In addition, 45% of the individuals and 41% of their relatives reported that their family planning decisions were influenced by the presence of schizophrenia in their family and only 6% reported that they had undergone genetic counseling [8].

Furthermore, in a qualitative study involving nine United States military veterans with serious mental illnesses, the respondents were asked to describe their knowledge, attitudes, and beliefs about psychiatric genetics, genetic testing and counseling. 67% reported no prior knowledge about genetic counseling and only 33% had general knowledge about some genetic concepts. The majority of the respondents 67% of the respondents indicated interest in taking genetic tests if available, 56% reported that such tests would improve their lives and 33% said that it would not change their views [9]. Similarly, the study had surveyed 270 individuals who are suffering from Schizophrenia, or a relative of someone, or a loved one with a mental illness. The results indicated that the majority displayed inaccurate knowledge about genetic influences in mental illnesses, and 85% had positive regards towards predictive psychiatric genetic testing [10,11].

The previous literature indicates that the majority of people expressed positive attitudes towards genetic testing and counseling for psychiatric disorders and if these tests were to become available and might in high demand. The study aimed to explore the awareness on the genetic susceptibility to psychiatric disorders and investigated their attitudes toward seek help from genetic testing for psychiatric disorders before marriage and making reproductive decisions.

II. METHODOLOGY

In this study, there were 200 respondents consisted of 15.5% of men and 84.5 of women from Jeddah, Saudi Arabia who identified as being married or engaged. Most respondents were aged between 22 years old and 39 years old and all had different educational backgrounds.

A questionnaire was developed based on previous literatures to measure the respondents' attitude toward genetic testing for mental disorders. The questionnaire contained 13 questions that assessed respondents' knowledge about mental illnesses and genetics, interest in genetic testing for mental disorders and attitudes towards the test regarded marital and reproductive decisions.

Items measured knowledge about mental illnesses and genetics included questions such as "Do you think the following mental illnesses have genetic factors or not?". The respondents were giving a set of mental illnesses (Schizophrenia, Bipolar, ADHD, Autism and Depression) and were asked to choose between "Has genetic factors", "Does not have genetic factors" and "I do not know" based on their knowledge. Other questions were presented as statements such as, "Do you think you can inherit such diseases from your parents?" and "Do you think a person diagnosed with one of the mentioned mental illnesses could live a normal life with effective treatment?" with the possibility of answering "Yes", "No" or "I do not know".

Meanwhile, items measured interest in genetic testing for mental disorders contained 9 statements, presented in a Likert scale from (4) "strongly agree" to (1) "strongly disagree". For example, "Everybody should have access to genetic testing for mental disorders if they want to.", "I would feel guilty concerning my child's mental disease if I knew it was primarily genetic determined" and "I would feel more prepared for fighting the disorder, knowing of the presence of risk genes". Additional questions included statements such as, "I would personally take a genetic test for mental disorder" and "I would have my own child tested" with the possible answers of, "Yes, only if effective treatments and interventions were available", "Yes, regardless of available effective treatments and interventions" and "No, I would not take such test". Items measuring attitudes towards premarital and prenatal testing were included, the respondents were asked to choose if such tests should be made "mandatory" or "optional". Other questions proposed hypothetical scenarios to measure their marital and reproductive decisions based on the test, for example, "If your potential spouse is suffering from or has a genetic predisposition to a severe mental illness would you, (a) Marry him/her or (b) Not marry him/her" and "If you or your spouse have a 25% risk chance of genetic transmission to a severe mental disorder would you, (a) Have children or (b) Not have children". The same question was also asked with a different percentage "75%". Additional items measured the respondents' attitudes towards abortion such as, "If your unborn child has a 25% risk factor for a severe mental disorder would you, (a) Have an abortion or (b) Not have an abortion". The same question was also asked with a different percentage "75%".

The questionnaire was translated to Arabic and both the English and the Arabic versions were distributed in social media platforms (WhatsApp, Path and Email). Respondents had the option to choose their preferred language. The Arabic questionnaire yielded 160 responses, while the English generated 40 responses. The total of combined responses was 200. The responses were collected electronically, coded and analyzed using SPSS, by applying descriptive statistics, T-test, one-way ANOVA and Chi- Square test.

III.RESULT AND DISCUSSION

Result

Table 1 showed frequencies of females and males scores on knowledge about genetic predisposition to mental illnesses. Frequencies of schizophrenia indicate that 54% of the respondents thought schizophrenia had genetic factors, 24% of respondents thought schizophrenia had no genetic factors and 22% of respondents did not know on schizophrenia. For bipolar disorder, 42.5% of respondents thought bipolar disorder had genetic factors and 20% of respondents thought bipolar disorder had no genetic factors and 37.5% of respondents did not on bipolar disorder. ADHD frequencies showed 47.5% of the respondents thought ADHD had genetic factors and 32.5% of respondents thought ADHD had no genetic factors and 20% of respondents did not know on ADHD. Autism frequencies showed that 55% of the respondents thought autism had genetic factors and 28.5% of respondents thought autism had no genetic factors and 16.5% of respondents did not know on autism. For depression, 41.5% of the respondents thought depression had genetic factors, 41% respondents thought depression had no genetic factors and 17.5% of respondents did not know on depression.

Table 1: Knowledge on genetic predisposition to mental illness between genders

Mental illness	Female		Male	
	Frequency	Percentage	Frequency	Percentage
Schizophrenia				
Has genetic factors	95	88.0	13	12.0
Does not have genetic factors	39	81.3	9	18.8
I do not know	35	79.5	9	20.5
Bipolar disorder				
Has genetic factors	76	89.4	9	10.6
Does not have genetic factors	29	70.7	12	29.3
I do not know	64	86.5	10	13.5
ADHD				
Has genetic factors	81	85.3	14	14.7
Does not have genetic factors	52	80.0	13	20.0
I do not know	36	90.0	4	10.0
Autism				
Has genetic factors	94	91.6	16	8.4
Does not have genetic factors	45	7.9	12	21.1
I do not know	30	90.9	3	9.1
Depression				
Has genetic factors	76	89.4	7	10.6

Does not have genetic factors	62	75.6	20	24.4
I do not know	31	88.6	4	11.4

A chi-square test of independence was performed to examine the relation between gender and knowledge as shown in Table 2. The relationship between these variables was significant in Bipolar disorder, $\chi^2 (2, N = 200) = 7.72$, $p = .021$ and Depression $\chi^2 (2, N = 200) = 8.55$, $p = .014$, which indicated that males had less knowledge about genetic predisposition to mental illnesses than females regarded these two mental illnesses.

Table 2: Chi- square test

Variables	Value	df	p-value
Bipolar	7.72	2	0.021
Depression	8.55	2	0.014

Table 3 showed frequencies of knowledge about genetic predisposition to mental illnesses. There were 65% of the respondents thought that mental illnesses can be inherited from their parents, and 81% of respondents thought that people diagnosed with a mental disorder could live a normal life with effective treatments.

Table 3: Knowledge on genetic predisposition to mental illness

Statement	Frequency	Percentage
Do you think you can inherit such diseases from your parents?		
Yes	130	65
No	38	19
I do not know	32	16
Do you think a person diagnosed with one of the mentioned mental illness could live a normal life with effective treatment?		
Yes	162	81
No	26	13
I do not know	12	6

In Table 4, there was a significant difference in item of the access to psychiatric genetic testing would lead to more abortions ($M = 0.185$, $SD = 0.179$). The findings suggests that males disagreed with the statement more than females, $t (198) = 1.032$, $p < 0.036$.

Table 4: Reliability

α	N of items
0.729	9

Table 5 indicated the Cronbach's alpha level of the 9-item scale that was developed for this study. The scale had a high reliability score of ($\alpha = 0.729$). There were 95.5% of the respondents agreed that everybody had the right to know about their hereditary psychological characteristics, 93.5% of the respondents agreed that everyone should have the right to access genetic testing if wishes and 88.5% of respondents thought that genetic testing for mental illnesses is necessary. Moreover, 80.5% of the respondents agreed that spreading knowledge about genetic predisposition to mental illnesses would make it less shameful to have a mental illness. 85.5% of the respondents felt that more prepared to fight mental illness if respondents knew of the presence of a risk gene, and 49% of the respondents feel that not be able to cope emotionally with the results of genetic testing. In addition, 68.5% of the respondents agreed that would feel guilty if their unborn child suffered from a genetic mental disorder and 43% of the respondents agreed that had this test would lead to more abortions. However, 86.5% of the respondents agreed that parents should have the right to know about their unborn child's genetic predisposition to mental illnesses. The results suggested that majority respondents agreed to have access to genetic testing for mental illnesses if it was available.

Table 5: Attitude on access to genetic testing for mental illness

Statement	Frequency	Percentage
Everybody has the right to know about their hereditary psychological characteristics.	191	95.5
Everybody should have access to genetic testing for mental disorders if they want to.	187	93.5
I think genetic testing for mental disorders is necessary.	177	88.5
Spreading the knowledge that mental disorders are partly genetic will make it less shameful to suffer from a mental disease.	161	80.5
I would feel more prepared for fighting the disorder, knowing of the presence of risk genes.	171	85.5
I fear not being able to cope emotionally with the results of a psychiatric genetic test.	98	49
I would feel guilty concerning my child's mental disease if I knew it was primarily genetic determined.	137	68.5
The access to psychiatric genetic testing would lead to more abortions.	86	43
Parents should know their unborn child's disposition for psychiatric diseases.	173	86.5

Table 6 showed that 44% of the respondents would take a genetic test for mental disorders only if effective treatments were available and 40% of the respondents would take it even if there were no effective treatments. Meanwhile, 16% of the respondents did not take the test. 42% of the respondents agreed to test their unborn child if effective treatments were available, 37% of the respondents agreed to have their unborn child tested even without effective treatments and 21% of the respondents thought did not have their unborn child tested.

Table 6: Interest in taking genetic testing for mental illness

Statement	Frequency	Percentage
I would personally take a genetic test for mental disorders		
-Yes, only if effective treatments and interventions were available.	88	44
- Yes, regardless of available effective treatments and interventions.	80	40
No, I would not take such test.	32	16
I would have my own unborn child tested.		
- Yes, only if effective treatments and interventions were available.	84	42
- Yes, regardless of available effective treatments and interventions.	74	37
- No, I would not have my unborn child tested.	42	21

In Table 7, 61% of the respondents felt that pre-marital genetic testing for mental illnesses should be mandatory, and 39% of the respondents felt that it should be optional. 47% of the respondents said that prenatal genetic testing for mental illnesses should be mandatory while 53% of the respondents felt it should be optional.

Table 7: Attitudes toward pre-marital and prenatal genetic testing for mental illness

Statement	Frequency	Percentage
Pre-marital genetic testing for mental disorders should be		
Mandatory	122	61
Optional	78	39
Prenatal genetic testing for mental disorders should be		
Mandatory	94	47
Optional	106	53

Table 8 showed the respondents' attitude toward marital choices. 32.5% of respondents would marry someone who is suffering from or has a genetic predisposition to a severe mental disorder while 67% of the respondents would not marry someone who is suffering from or has a genetic predisposition to a severe mental disorder. The results suggested that most of respondents would not marry a person who is suffering from or has a genetic predisposition to a severe mental illness.

Table 8: Attitudes toward marital choices

Statement	Frequency	Percentage
If your potential spouse is suffering from or has a genetic predisposition to a severe mental illness would you		
-Marry him/her	65	32.5
-Not marry him/her	135	67.5

The results revealed a statistically significant difference between age groups, $F(3,196) = 1.287$, $p\text{-value} = 0.001$ as shown in Table 9. A Tukey post hoc test showed that, a significant difference was shown between the age groups between 22 years old and 29 years old. ($M=1.59$, $SD= 0.4940$) and aged 40 years old and above ($M=1.91$, $SD=0.288$) and $p\text{-value} = 0.001$ in Table 10. There was no statistically significant difference between other age groups. These findings suggest that, the older the person, the more probable they will not marry someone who is suffering from or has a genetic predisposition to a severe mental illness.

Table 9: One-way analysis of variance (ANOVA)

Source	df	SS	MS	F	p-value
Between groups	3	3.615	0.308	1.287	0.001
Within groups	196	40.260	0.239		
Total	199	47.795			

Table 10: Multiple comparisons

Age (I)	Age (J)	Mean (I-J)	Std. Error	p-value
22-29	16-21	0.33	0.098	0.986
	30-39	-0.248	0.082	0.014
	>40	-0.324	0.104	0.011

Table 11 showed the respondents' attitudes toward reproductive choices. The respondents were given four scenarios for genetic testing, with different risk estimates and were asked to imagine if, given the circumstances of the scenario, would they have/not have children, and would they have/not have an abortion. For the first scenario,

“If you or your spouse have a 25% risk of genetic transmission to a severe mental disorder would you, have children or not have children”, there were 22.5% of respondents agreed not to have children. For the second scenario, “If you or your spouse have a 75% risk of genetic transmission to a severe mental disorder would you, have children or not have children” 58.5% of the respondents agreed not to have an abortion when the risk estimate is at 75%. For the third scenario, “If your unborn child has a 25% risk factor for a severe mental disorder would you, have an abortion or not have an abortion” only 20% of the respondents would have an abortion. For the last scenario, “If your unborn child has a 75% risk factor for a severe mental disorder would you, have an abortion or not have an abortion”, 39.5% of the respondents agreed to have an abortion when the risk estimate was at 75%. The results suggested that higher the risk factor the more likely people would avoid having children and would choose to have an abortion. Nevertheless, most of respondents, 60.5% decided against having abortion even with a higher risk factor.

Table 11: Attitudes toward reproductive choices

Risk estimate	Statement	Frequency	Percentage
25%	Not have children	45	22.5
75%	Not have children	117	58.5
25%	Have an abortion	40	20
75%	Have an abortion	79	39.5

Discussion

The respondents were asked to demonstrate their knowledge about the genetic role in five major mental illnesses (Schizophrenia, Bipolar, ADHD, Autism and Depression). The findings found most respondents thought that Schizophrenia, Autism and ADHD disorders had genetic factors (Schizophrenia: 54%, Autism: 55%, ADHD: 47%). For depression, the percentages for those who thought it has genetic factors and for those who do not think genetic factors were similar (had genetic factors: 41.5%, does not have genetic factors; 41%). Furthermore, bipolar disorder had the highest percentage with 37.5% for those who chose “I Do not know”. Moreover, results showed that males had significantly less knowledge than females regarding bipolar disorder ($p = .021$) and Depression ($p = .014$). This result might be due to fact that the study had more female responses (84.5%) than males (15.5%).

Two more questions were asked to measure the respondents’ knowledge, “Do you think you can inherit such diseases from your parents?”, and “Do you think a person diagnosed with one of the mentioned mental illnesses could live a normal life with effective treatment?”. Based on the results, 65% of the respondents answered “Yes” to the first question and 81% of the respondents answered “Yes” to the second one, which indicated greater level of awareness. These findings suggest that the people have adequate knowledge about the genetic predisposition to mental illnesses, that might be due to the small sample size ($N = 200$) and the education level of the respondents.

The reliability score for the developed 9-item scale used in this study was interestingly high ($\alpha = 0.729$). Most of the respondents agreed that everybody has the right to know about their hereditary psychological characteristics, 93.5% of the respondents agreed that everyone should have the right to access genetic testing if wished to and 88.5% of the respondents thought that genetic testing for mental illnesses is necessary. 86.5% of the

respondents agreed that parents should have the right to know about their unborn child's genetic predisposition to mental illnesses.

There were 68.5% of the respondents agreed that would feel guilty if their unborn child suffered from a genetic mental disorder. These findings suggest that, the people want to have access to genetic testing if it were to become available. Moreover, 80.5% of the respondents agreed that spreading knowledge about genetic predisposition to mental illnesses would make it less shameful to have a mental illness. 85.5% of the respondents felt that would be more prepared to fight mental illness if knew of the presence of a risk gene and 49% of the respondents felt that they would not be able to cope emotionally with the results of genetic testing. This result suggested that the process of genetic testing for mental illnesses would decrease social stigma, discrimination and enhance pre-symptomatic diagnosis.

Furthermore, the results showed significant difference between males and females, 43% of the respondents agreed that having this test would lead to more abortions. Interestingly findings showed that, males disagree with the statement significantly more than females ($p = .036$). There were 44% of the respondents would take a genetic test for mental disorders only if effective treatments were available, and 40% of the respondents would take it even if there were no effective treatments and only 16% of the respondents would not take the test. Similarly, 42% of the respondents agreed to test their unborn child if effective treatments were available. 37% of the respondents would have their unborn child tested even without effective treatments and 21% of the respondents thought not have their unborn child tested. The results indicate that most people are interested in undergoing genetic testing for mental illnesses, however, there is a higher support for genetic testing of oneself than of unborn children.

Results for interest in pre-marital and prenatal genetic testing showed that 61% of the respondents thought that pre-marital genetic testing for mental illnesses should be mandatory, and 39% of the respondents felt that it should be optional, and 47% of the respondents said that prenatal genetic testing should be mandatory.

Moreover, this study showed more acceptance for pre-marital genetic testing than prenatal. The results for the third research question, "What are the effects of genetic testing of mental disorders on couple's marital and reproductive decisions?" showed that, 32.5% of the respondents agree to marry someone with a severe mental disorder or carries a gene for it, while 67% of the respondents said would not marry such person. Moreover, the One-Way ANOVA results showed a significant difference between the age groups of 22-29 and 40 and above ($p\text{-value} = .001$). The latter group was not in favor of marrying. These findings indicate that most of the people would not marry someone who suffers from or carries a gene for a severe mental illness, older people (40 and above) are significantly less likely to marry such person than a younger age group (22-29 years old). This finding might be because older people tend to be more experienced and affirmed about their choices.

There also 22.5% of the respondents would avoid having children if the risk estimate was at 25%, interestingly, when changing the risk estimate to 75%, more people favored not having children. Furthermore, scenarios for abortion choices showed weak support in both risk estimates. Although, these scenarios ask about personal intentions, the answers might reflect different approaches to the question. Religious and cultural factors might have had a strong influence on the people's attitudes toward their reproductive choices.

IV. CONCLUSION

In conclusion, the findings showed the attitudes toward genetic testing for mental disorders among individuals from Jeddah, Saudi Arabia. Their attitudes and expressed intentions are relevant to the public debate and future conducting of genetic testing, as well as, to the future planning of genetic counseling for mental disorders services. Furthermore, the attitudes of future providers of genetic testing and counseling should be considered when results from relevant researches are integrated into practice and in the education of future genetic counselors of mental disorders.

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