Does the 5 Factor Personality Model Predict Engagement with, and Response to, Direct-to-Consumer Genetic Testing?

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Statement of Sources

I declare that this report is my own original work and that contributions of others have been duly acknowledged.

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Abstract

Recently, the use of genetic testing to determine an individual's predisposition to psychological disorders has increased. Direct-to-consumer (DTC) genetic testing now enables individuals to order and receive genetic information directly. We explored the effects of personality traits (using the 5-factor model) on attitudes and emotional response towards DTC testing, intentions to seek medical advice, and intentions of behavioural change. A total of 177 participants completed the online survey (males; 26; females; 148, other; 3; between 18 and 68 years of age, M =32.20, SD =14.94). Hypothesis 1 was not supported as openness-to-experience and conscientiousness were not positively associated with attitudes, although extraversion and neuroticism were positively associated. Hypothesis 2 was not supported as neuroticism and conscientiousness were not positively associated with emotional responses. Contrary to hypothesis 3, conscientiousness and agreeableness did not predict intention to seek medical advice, however neuroticism was a significant predictor. Hypothesis 4 was not supported as no personality traits predicted intention to make behavioural changes. This is the first study to investigate this area, and the results suggest that neuroticism and extraversion are significant predictors of individuals' attitudes and response to direct-to-consumer genetic testing for psychological disorders.

Genetic testing enables an individual's predisposition to certain disorders (including psychological conditions) to be determined, through the analysis of genes, proteins and chromosomes (Oh, 2019). The Human Genome Project in 2003 provided a much needed insight into human genes by accurately identifying and gaining an understanding of around 20,500 genes (National Human Genome Research Institute, 2018). The advancement of genetic testing technologies has increased the use of genetic tests in assessment, diagnosis and treatment, as they become more accessible to both health care professionals and consumers (Oh, 2019). With burdened health care systems around the world, genetic testing may help to alleviate the pressure with the ability to identify individuals genetically predisposed for health conditions, allowing earlier interventions to be put into place (Driver, 2020).

There is a large prevalence of individuals living with a psychological disorder in the community; as of 2014 an estimated 12.2 percent of the Australian population experienced a psychological disorder (Harvey et al., 2017). Psychological disorders are conditions with a variety of symptoms that may impact thinking, perceptions, behaviour and mood (Kaur & Sharma, 2019; Lebowitz & Ahn, 2018). There are high personal and societal costs associated with psychological disorders, with the Australian Government spending 10.6 billion dollars on mental health in 2018-2019 and an annual productivity loss estimated at between 10 and 15 billion dollars in Australia (Australian Institute of Health and Welfare, 2021). This indicates that there is a need for measures to be put into place to help with the identification and treatment of psychological disorders.

Recently, there has been an increase in the use of genetic testing to determine an individual's predisposition to psychological disorders (Driver et al., 2020). There is increased evidence of psychological disorders having a genetic component (Driver et al., 2020). Bipolar disorder, for example, refers to a psychological disorder typified by symptoms which affect

mood and are characterised by depression and episodes of hypomania or mania (Barnett & Smoller, 2009). Research has shown the high heritability of bipolar disorder with genetics explaining 60 to 85 percent of the risk of developing the disorder (Smoller & Finn, 2003). Similarly, major depressive disorder has been shown to be heritable, with a heritability rate of 37 percent (Shadrina et al., 2018). This evidence thereby confirms the notion that psychological disorders have a genetic component (Driver et al., 2020).

Genetic testing for psychological disorders could improve treatment options with earlier interventions (Lebowitz & Ahn, 2018; Oh, 2019). Laegsgaard et al. (2010) found that individuals who had received genetic test results for psychological disorders felt more empowered and prepared to cope with the disorder. Furthermore, Freiser et al. (2018) found that individuals made positive changes to their health behaviours after receiving test results, in order to improve health outcomes. This demonstrates that individuals, after receiving genetic test results that indicate a genetic predisposition to psychological disorders, may be more likely to increase preventative behaviours, such as exercise or meditation, to decrease their likelihood of developing a disorder. Results gained from genetic testing may lead to earlier intervention and treatment, as individuals' risk levels are predicted (Driver et al., 2020). These results could motivate positive changes in health behaviours and reduce the burden and cost to the Australian healthcare system (Lebowitz & Ahn, 2018; Oh, 2019).

Research has shown how individuals living with a psychological disorder actively seek meaning to comprehend what they are experiencing (Meiser et al., 2005). Genetic testing could assist not only the individual to understand their family history, but also to satisfy their search to add meaning to their experiences (Laegsgaard et al., 2010). Furthermore, research has shown individuals to be interested in taking a genetic test in the hope of early interventions and prevention (Laegsgaard et al., 2010). Individuals expressed the belief that information gained from genetic testing empowered them and provided them

with an explanation, with the possibility of prevention and treating the disorder (Laegsgaard et al., 2010).

An individual experiencing a psychological disorder may encounter stigma, as the cause of the disorder is often attributed to the individual, which leads to guilt and shame (Laegsgaard et al. 2010). A psychological disorder is often perceived as being a 'behavioural choice' (Easter, 2012). Genetic testing can lead to the use of biogenetic framing of psychological disorders, as with the identification of genes as the main underlying cause, stigma may be reduced, as the responsibility is shifted onto genetics rather than the individual (Kvaale, et al., 2013). Theories of attribution, where individuals determine the causality of events, can explain how stigma can be reduced through biogenetic framing (Laegsgaard et al., 2010). Applying Attribution Theory, biogenetic framing would result in a decrease in stigma as the responsibility is no longer placed upon the individual (Kvaale et al., 2013). Research supports this notion as people living with a psychological condition view favourably their disorder being conceptualised as a medical illness (Laegsgaard et al., 2010).

Direct-to-Consumer Genetic Testing

Direct-to-Consumer Genetic Testing (DTC) involves an individual sending a saliva sample for analysis to companies such as *23andMe*, who analyse the genetic information and then return the results to the consumer. Since the release of the first direct-to-consumer genetic testing kit in 2007 by *23andMe,* there has been an increase in the direct-to-consumer genetic testing market, where genetic testing is easily accessible to consumers as it bypasses the need for a doctor (Driver et al., 2020). In the past individuals wanting a genetic test would first have to seek medical advice, and a health professional such as a general practitioner would order the test. The individual would then receive the results from a general practitioner or be referred to a genetic counsellor to assist in the interpretation of results. This process is

unlike direct-to-consumer genetic testing where individuals order and receive the results straight from the company without a health professional involved.

Previously, the main objective of direct-to-consumer genetic testing was to measure individuals' heredity and predisposition to poor health, however, increasingly psychological disorders have been added (Driver et al., 2020). Direct-to-consumer genetic tests such as *23andMe*, for example, state that they have the ability to measure an individual's predisposition towards specific phobias such as heights or public speaking (23andMe, 2021). As this is starting to branch out into other areas, where normally a health professional would be involved, this has many implications. Often with direct-to-consumer genetic testing, there are no measures in place, such as genetic counselling, to assist with the interpretation of test results. These measures have been shown to be crucial in ensuring a positive outcome (Freiser et al., 2018). Lebowitz and Ahn (2018) found that after receiving information indicating a genetic predisposition to depression, individuals reported decreased confidence in their ability to cope, as opposed to those who had received results indicating that they were not genetically predisposed. Genetic causal attributions could eventuate in prognostic pessimism, where individuals assume that symptoms cannot be alleviated, thereby increasing feelings of hopelessness towards treatment (Lebowitz & Ahn, 2018). After participating in a short intervention, where it was explained that genes are not the sole factor that determines an individual's predisposition to psychological disorders, this negative effect was counteracted (Lebowitz & Ahn, 2018). This highlights the implications that receiving direct-to-consumer test results may have if measures, such as genetic counselling and education programs, are not in place to counteract harmful beliefs that genetic testing results may evoke (Lebowitz & Ahn, 2018).

Traditionally, the relationship between a patient and a health care professional, such as a general practitioner, has been led by the professional, who has control over the medical

information (Jeong, 2018). Recently, this dynamic has begun to change the traditional patient care model, where with services such as direct-to-consumer genetic testing, the patients are given more control to order, access and own the genetic test results (Gammal et al., 2021). This subsequently puts them in a position where they can actively participate in a treatment plan (Gammal et al., 2021). Supporters of direct-to-consumer genetic testing emphasise the autonomy and empowerment given to an individual by the provision of their own genetic information, whereas critics raise a variety of issues including privacy, validity and reliability and individuals' ability to interpret genetic information (Jeong 2018). Furthermore, as direct-to-consumer genetic testing for psychological disorders is a newly emerging option, with limited published research in this area, further research is required (Driver et al., 2020).

The Health Belief Model suggests that the likelihood of behavioural action is based on four core beliefs; perceived threat, expectations, cue to action and self-efficacy (Cook & Wood, 2019). According to this model, whether an individual would use a direct-to-consumer genetic test would depend on whether an individual perceives developing a psychological disorder as a potential threat (Cook & Wood, 2019). The individual would also hold certain expectations surrounding the direct-to-consumer test, such as that the results would be beneficial in reducing the perceived threat and the benefits would outweigh any potential consequences (Cook & Wood, 2019). The individual would need to have high self-efficacy, where they are confident in their ability to conduct and interpret the test and the results (Cook & Wood, 2019).

Personality and Direct-to-Consumer Genetic Testing

Despite the prevalence of psychological disorders and the increasing use of mental health services, there is limited literature regarding the impact of personality on help-seeking (Schomerus et al., 2013). Furthermore, there is no current literature regarding the effects of personality and the use of direct-to-consumer genetic testing. It is possible that personality

traits might influence decisions about direct-to-consumer genetic testing and specifically testing for psychological disorders. As this is a new area of research, literature needs to investigate factors such as the role of personality, as obtaining and understanding this information will allow inferences to be made as to the types of people who use direct-to-consumer genetic tests.

The Five Factor Model is a theory of personality that has major proponents such as Goldberg, McCrae and Costa (McCrae & Costa, 2008). In the early stages of the model the factors were derived from factor analyses of personality adjectives and questionnaire items, with Cattell identifying over 12 related factors (McCrae & Costa, 2008). With further analysis, openness to experience, conscientiousness, extraversion, agreeableness and neuroticism were shown to be replicable and thus formed the Five Factor model (McCrae & Costa, 2008). Each of these factors are dimensions, with an individual varying continuously between two extreme points (McCrae & Costa, 2008). The factors are thought to be partly due to genetics and are mostly stable over time (Jang et al., 1998; Soldz & Vaillant, 1999). Certain personality traits may be associated with how individuals respond to receiving direct-to-consumer genetic test results that indicate a genetic predisposition to psychological disorders.

Evidence from broader literature investigating the association between personality and seeking psychological help can be used to inform expectations specific to direct-to-consumer genetic testing for psychological disorders. A positive correlation was found between conscientiousness and seeking psychological help, where people high in conscientiousness were more likely to utilise mental health treatment services (Hopwood et al., 2008; Miller et al., 2006; Schomerus et al., 2013). Schomerus et al. (2013) corroborated this notion where individuals high in conscientiousness were more likely to seek treatment for depression than those low in conscientiousness. As individuals high in conscientiousness

are often careful and more likely to seek out and adhere to medical advice and treatment, these individuals may be more inclined to use direct-to-consumer genetic testing to gain a more accurate picture of their health (Miller et al., 2006).

A positive correlation exists between openness to experience and seeking psychological treatment, where Park et al. (2017) found that individuals high in openness to experience are more likely to utilise mental health treatment services. Individuals high in openness to experience may be more inclined to use direct-to-consumer genetic testing due to their decreased avoidance to problems and increased active coping style (Park et al., 2017).

Extraversion was found to be negatively correlated to seeking treatment for psychological disorders where individuals high in extraversion were less likely to utilise mental health treatment services (Park et al., 2017). Individuals high in extraversion are often outgoing, gregarious and socially active, and therefore may be less likely to utilise direct-to-consumer genetic testing as they may be more likely to seek appropriate support from their strong social network, if necessary (Miller et al., 2006).

Findings regarding the relationship between agreeableness and seeking psychological treatment are mixed, where both positive and negative correlations have been found (Miller et al., 2006; Park et al., 2017). It could be predicted that individuals high in agreeableness tend to put the needs of others before their own, making them less likely to be proactive about their own health and less likely to use direct-to-consumer genetic testing (Park et al., 2017).

A positive correlation exists between individuals high in neuroticism and seeking psychological help, with individuals high in neuroticism being more likely to utilise mental health treatment services (Park et al., 2017). Those high in neuroticism experience more severe depressive symptoms, often have less problem-solving skills and are less confident in coping with negative emotions, leading to greater professional help seeking (Park et al.,

2017). Individuals high in neuroticism may be less likely to use direct-to-consumer genetic testing as they may be less confident in independently accessing information and seek the reassurance of a professional (Park et al., 2017).

Good health behaviour requires a long-term focus and discipline for achieving goals which is a characteristic of conscientiousness (Booth-Kewley & Vickers, 1994). It has been found that individuals high in conscientiousness have a high adherence to positive health behaviours (Bogg & Roberts, 2004). They may therefore be more likely to seek medical advice and make behavioural changes after receiving direct-to-consumer genetic test results that indicate a genetic predisposition, in order to maximise health outcomes (Bogg & Roberts, 2004). Furthermore, as individuals high in conscientiousness are generally health conscious they may report more negative emotional responses if they receive a direct-to-consumer genetic test result that indicates a genetic predisposition for psychological disorders (Bogg & Roberts, 2004).

Research has demonstrated that high levels of agreeableness is related to consciously being in control of health behaviours (Rivis et al., 2009). Individuals with high levels of agreeableness are social in nature and score higher on measures of assertiveness and self-control (Rivis et al., 2009). Individuals with high levels of agreeableness may therefore be more likely to seek medical advice after receiving direct-to-consumer genetic test results that indicate a genetic predisposition for psychological disorders and make changes to their health behaviours.

Individuals with high levels of openness to experience have greater stress resilience, are often reflective and evaluative about their experiences (McCrae & Costa, 1997; Williams et al., 2009). If these individuals therefore received direct-to-consumer genetic test results that indicated a genetic predisposition for psychological disorders they may be more likely to make behavioural changes to optimize their health. Despite the current study only measuring

an individual's intention of changing their health behaviours following a direct-to-consumer genetic test, current research has demonstrated that individuals who identified a desire to make changes after receiving test results did so regardless of whether the test result was positive or negative (Oliveri et al., 2021).

Research has found individuals with high levels of neuroticism to demonstrate increased emotional reactivity in negative situations (Komarraju et al., 2011; Larsen & Ketelaar, 1991; Widiger & Oltmanns, 2017). These results can be generalised, where individuals with high levels of neuroticism may report more negative emotional responses after receiving direct-to-consumer genetic test results that indicate a genetic predisposition for psychological disorders due to their heightened emotional reactivity (Komarraju et al., 2011; Larsen & Ketelaar, 1991; Widiger & Oltmanns, 2017).

The Present Study

As this is a new area of research, where no literature has investigated whether personality predicts engagement with, and response to direct-to-consumer genetic testing for psychological disorders, it is imperative that research is conducted into this area. Previous literature has demonstrated the association between personality and seeking psychological help, however it is unclear as to how these findings translate to the area of direct-to-consumer genetic testing for psychological disorders. Furthermore, genetic literacy plays a key role in how individuals understand and use the information gained from the results of a genetic test (Chapman et al., 2019). Individuals with poor health literacy may have difficulty understanding genetic test results which could have negative repercussions (Driver et al., 2020). Individuals with high scores in health anxiety may view DTC genetic testing as more favourable as it may serve as another avenue for gaining extra health information. Furthermore, individuals who are trusting of their GP may be more inclined to seek medical advice following a direct-to-consumer genetic test. Genetic literacy, health anxiety and

trustworthiness of GP will therefore be measured in order to control for possible effects. The present research aims to determine the effects of personality traits on attitudes towards direct-to-consumer genetic testing, individuals' emotional response to testing, the intention to seek medical advice following a direct-to-consumer genetic test, and the intention of behavioural change following a direct-to-consumer genetic test.

Thus, the following hypotheses are proposed:

Hypothesis 1: Openness to experience and conscientiousness (as measured by the IPIP Big-Five Factor Markers) will be positively associated with attitudes toward DTC testing for psychological disorders. Conversely, we predict a negative association, whereby individuals high in extraversion will have more negative attitudes toward DTC testing for psychological disorders.

Hypothesis 2: Neuroticism and conscientiousness (as measured by the IPIP Big-Five Factor Markers) will be positively associated with negative emotional responses to receiving DTC test results that indicate genetic predisposition for psychological disorders.

Hypothesis 3: Conscientiousness, agreeableness and neuroticism (as measured by the IPIP Big-Five Factor Markers) will be positively associated with intention to seek medical advice after receiving DTC test results that indicate genetic predisposition for psychological disorders.

Hypothesis 4: Conscientiousness, openness to experience and agreeableness (as measured by the IPIP Big-Five Factor Markers) will be positively associated with intention to make behavioural changes after receiving DTC test results that indicate genetic predisposition for psychological disorders.

Method

Design

This study was approved by the Tasmanian Health and Medical Human Research Ethics Committee (reference number: 24766, Appendix A). This study employed a cross-sectional between-subjects correlational survey design. The predictor variables were the five personality traits (openness to experience, conscientiousness, extraversion, agreeableness and neuroticism, as measured by the IPIP Big-Five Factor Markers) and were used to determine the effect on the four outcome variables; attitudes towards DTC testing, emotional response to testing, intention to seek medical advice, and intention of behavioural change (as measured by Attitudes and Beliefs regarding Direct to Consumer Testing).

Participants

A priori power analysis was conducted using G*Power calculations. It was revealed that a minimum of 138 participants were needed to detect a moderate effect size ($f^2 = .15$) with 95 % probability.

A total of 177 participants (males: 26, females; 148, other; 3) were included in the present study, with ages ranging from 18 to 68 (M= 32.22, SD=14.94). The cultural background of participants was Caucasian (83.60 %), Asian (2.80 %), Indigenous Australian (1.10 %) and other (5.10 %) The only exclusion criteria included was participants under the age of 18. A total of 6.8 % of participants had previously taken a genetic test and 4.5 % had previously taken a direct-to-consumer genetic test. 79.70 % of participants indicated they have a regular GP whom they see regularly.

Materials

Demographic Scale: This 7-item scale was used to measure participants' age, gender and cultural background (Appendix B). Participants were also asked whether they had previously taken a genetic or direct-to-consumer genetic test, and whether they have a

medical practitioner that they see regularly and to rate the trustworthiness of their medical professional.

IPIP Big-Five Factor Markers (Goldberg, 2001): This 50 item-scale was used to measure participants' personality traits of neuroticism, extraversion, openness, agreeableness and conscientiousness (Appendix C). Participants were asked to indicate how each statement is true for them on a 5-point Likert Scale (1= very inaccurate to 5= very accurate) with statements included such as, 'I have frequent mood swings'. Higher scores indicated the participant being high in that personality trait. The IPIP scale has been demonstrated to be a valid and reliable measure of personality, with the lowest Cronbach's alpha being a = 0.69 for agreeableness and the highest being 0.85 for extraversion (Gow et al., 2005).

Attitudes and Beliefs regarding Direct-to-Consumer Testing: To assess their attitudes regarding direct-to-consumer genetic testing, participants completed a scale assessing attitudes towards DTC testing (10 items), emotional response to receiving DTC results (4 items) and actions in response to DTC testing (7 items) (Appendix D). This scale comprised of 19 items where participants rated their agreement on a 5 point-Likert scale (1=strongly disagree to 5=strongly agree). A preamble describing the nature of DTC was provided to ensure all participant had a baseline understanding of what DTC entails.

The Short Health Anxiety Inventory (SHAI) (Salkovskis et al., 2002): This 18 item questionnaire was used to assess health anxiety (Appendix E). Respondents were asked to select the statements which best describes their feelings about their health (e.g. "I occasionally worry about my health."). This measure was used to control for differences in general attitudes towards health, and has been found to be a valid and reliable measure in the general population (Salkovskis et al., 2002).

The International Genetic Literacy and Attitudes Survey (iGLAS) (Chapman et al., 2017): We used the first section of this scale, comprising of 11 items, where participants were

asked to rate their beliefs, on a scale from 0-100, regarding the importance of genetic differences in explaining individual differences in certain traits such as the heritability of weight (Appendix F). This was used to measure individuals' beliefs regarding genetic predeterminism. The iGLAS has been shown to be an effective tool to evaluate genetic knowledge and perceptions of genetics (Chapman et al., 2017).

Procedure

Participants from the University of Tasmania (UTAS) were either recruited through advertisements displayed throughout the UTAS Sandy Bay campus (Appendix G) or online through UTAS's research participation program referred to as SONA. Members of the general public were recruited through the sharing of advertisements on social media platforms such as Facebook and Twitter (See Appendix H). At the completion of the survey, participants had the option to be nominated to go into the draw to receive one of two $50 Coles/Myer vouchers, as a compensation for their time or if they were psychology students they could obtain 30 minutes of research participation credit.

The participants accessed the survey through Lime Survey via an electronic link provided in the recruitment advertisements. Participants first read an information sheet outlining the purpose, potential outcomes and method for the present study (Appendix I) and were then asked if they consented to the study (agree/disagree) (Appendix J). If participants did not give consent, they were directed to a page thanking them for their time before leaving the survey. If participants did give consent, they were asked to complete the survey measures described above, which took approximately 20-25 minutes to complete.

Analysis

This study used a hierarchical multiple regression analysis. Four analyses were conducted to explore the effects of personality traits on attitudes towards DTC testing, emotional response to testing, intention to seek medical advice, and intention of behavioural

change. For all analyses, age and gender were included in step one to control for age/gender effects. Genetic predeterminism (iGLAS score), health anxiety and trustworthiness of GP were included in step 2 to control for beliefs of genetic predeterminism, health anxiety and trustworthiness of GP. The 5 IPIP subscales (neuroticism, extraversion, conscientiousness, openness and agreeableness) were included in step three to assess the research questions (Table 1).

Table 1

Order of Predictor Variable Entry for Hierarchical Multiple Regressions

Step	Predictor Variable
1	Age
	Gender
2	Trustworthiness of GP
	SHAI
	Genetic Predeterminism Beliefs
3	Attitudes
	Emotional Response
	Seek Medical Advice
	Behavioural Change
	Openness to Experience
	Conscientiousness
	Extraversion
	Agreeableness
	Neuroticism

Results

Data Screening

Prior to analysis we tested that the regression analysis assumptions were met. The Durbin-Watson tests indicated independence of errors for all variables; attitudes, emotional response, intention to seek medical advice and intention of behavioural change (d =2.14, d =1.94, d =1.99, d =2.13, respectively). All of the Variance Inflation Factors (VIFs) were below ten (highest VIF = 1.35) and all tests of tolerance were greater than .2, (lowest tolerance = 0.739) therefore multicollinearity was not considered to be an issue (Field, 2017). Shapiro-Wilk tests of normality were non-significant for attitudes and responses. Despite significant Shapiro-Wilk tests for the variables; intention to seek medical advice and intentions of behavioural change, regression analyses are robust to breaches of normality, therefore we decided to still use regression for analyses.

Upon inspection of the evenly distributed scatterplots and normal distributions of residuals on histograms the assumptions of linearity and homoscedasticity were met. Analyses that were conducted to identify any potential outliers found seven outliers overall, however as multiple regression techniques are considered to be robust against breaches of normality they were retained for the final analyses (Field, 2017).

Descriptive Statistics

Descriptive statistics for all measures are presented in Table 2.

Table 2

Mean Scores and Standard Deviations for All Measures

	Mean	SD
Age	32.22	14.94
Trustworthiness of GP	8.13	1.63
Attitudes	24.06	5.88
Emotional Response	12.23	3.37
Seek Medical Advice	20.05	3.37
Behavioural Change	20.42	2.84
Openness to Experience	39.38	6.017
Conscientiousness	34.80	7.72
Extraversion	32.14	8.28
Agreeableness	39.61	5.78
Neuroticism	28.84	9.08
SHAI	33.99	7.79
iGLAS (Genetic Predeterminism Beliefs)	565.85	178.67

Inferential Statistics

Table 3 provides the bivariate correlations for all measures. Hierarchical multiple regression analyses were conducted for each of the four hypotheses (Table 4, Table 5, Table 6, Table 7).

Table 3

Bivariate Correlations Between All Measures

	Attitudes	Emotional Response	Seek Medical Advice	Behavioural Change	Neuroticism	Extraversion	Openness to Experience	Agreeableness	Conscientiousn-ess	IGLAS	SHAI	Trustworthi-ness of GP	Age
Attitudes	-												
Emotional Response	0.514***	-											
Seek Medical Advice	0.170*	-0.222**	-										
Behavioural Change	0.280***	-0.065	0.621***	-									
Neuroticism	0.170*	0.040	0.123	-0.045	-								
Extraversion	0.122	0.087	0.077	0.141	-0.392***	-							
Openness to Experience	0.013	0.012	0.084	-0.074	-0.067	0.017	-						
Agreeableness	-0.011	-0.105	0.057	0.016	-0.190*	0.155*	0.262***	-					
Conscientiousness	-0.037	-0.086	0.002	0.093	-0.093	0.076	0.030	0.364***	-				
IGLAS	0.030	0.013	0.096	0.023	0.002	0.032	0.043	0.044	0.173*	-			
SHAI	0.007	0.006	-0.118	-0.082	0.039	-0.011	0.045	0.106	0.076	-0.026	-		
Trustworthiness of GP	0.159*	0.070	0.195*	0.069	-0.176*	0.060	0.130	0.057	0.048	-0.112	-0.045	-	
Age	-0.169	-0.178	-0.015	0.112	-0.359	0.200	-0.040	0.075	0.205	0.016	-0.037	0.104	-

Note: * $p < .05$, ** $p < .01$, *** $p < .001$.

To test the hypothesis that openness to experience and conscientiousness will be positively associated with attitudes toward DTC genetic testing for psychological disorders and a negative association, whereby individuals high in extraversion will have more negative attitudes, we conducted a hierarchical multiple regression analysis (Table 4). The overall model was found to be significant, explaining 36.3% of variance in attitudes towards DTC genetic testing**,** $R = 0.363$, $F(10,155) = 2.359$, $p = 0.013$. Furthermore, the addition of personality traits significantly improved the model ($\Delta R^2 = 0.083$, $p = 0.014$) with an additional 8.3% of the variance being explained, $\Delta R^2 = .083$, $\Delta F(5, 155) = 2.978$, $p = 0.014$. Neuroticism and extraversion were found to be significant predictors of attitudes. There was a significant weak positive correlation between neuroticism and attitudes ($r = 0.17$, $p = 0.006$). There was a weak positive correlation between extraversion and attitudes ($r = 0.12$, $p = 0.001$).

Table 4

Full Hierarchical Multiple Regression Showing Relationship of Predictor Variables with Attitudes toward DTC

Model		*B*	*SE*	ß	*t*	*p*	95 % Confidence Interval For *B*	
							Lower	Upper
Step 1	Constant	10.793	6.025		1.791	0.075	-1.109	22.69
	Age	-0.043	0.032	-0.111	-1.353	0.178	-0.107	0.020
	Gender	-0.083	1.158	-0.005	-0.072	0.943	-2.369	2.204
Step 2	Constant	10.793	6.025		1.791	0.075	-1.109	22.69
	Age	-0.043	0.032	-0.111	-1.353	0.178	-0.107	0.020
	Gender	-0.083	1.158	-0.005	-0.072	0.943	-2.369	2.204
	GK	<.001	0.003	0.029	0.384	0.702	-0.004	0.006
	TrustGP	0.754	0.273	0.214	2.757	0.007*	0.214	1.294
	SHAI	0.009	0.056	0.012	0.158	0.874	-0.102	0.119
Step 3	Constant	10.793	6.025		1.791	0.075	-1.109	22.69
	Age	-0.043	0.032	-0.111	-1.353	0.178	-0.107	0.020
	Gender	-0.083	1.158	-0.005	-0.072	0.943	-2.369	2.204
	GK	<.001	0.003	0.029	0.384	0.702	-0.004	0.006
	TrustGP	0.754	0.273	0.214	2.757	0.007*	0.214	1.294
	SHAI	0.009	0.056	0.012	0.158	0.874	-0.102	0.119
	Extraversion	0.187	0.057	0.269	3.299	0.001*	0.075	0.299
	Openness	-0.044	0.075	-0.047	-0.591	0.555	-0.193	0.104
	Conscientiousness	-0.024	0.064	-0.032	-0.374	0.709	-0.149	0.102
	Neuroticism	0.154	0.055	0.244	2.805	0.006*	0.046	0.263
	Agreeableness	<.001	0.085	<.001	0.011	0.991	-0.167	0.169

Note: * $p < .05$, ** $p < .01$, *** $p < .001$.

We conducted a hierarchical multiple regression analysis to test the hypothesis that neuroticism and conscientiousness will be positively associated with negative emotional responses to receiving DTC test results that indicate genetic predisposition for psychological disorders (Table 5). The overall model was found to be non-significant, $F(10, 155) = 1.555$, $p = 0.125$.

Table 5

Full Hierarchical Multiple Regression Showing Relationship of Predictor Variables with Emotional Response following DTC

Model		*B*	*SE*	ß	*t*	*p*	95 % Confidence Interval For *B*	
							Lower	Upper
Step 1	Constant	15.391	3.461		4.447	<.001	8.555	22.227
	Age	-0.032	0.018	-0.144	-1.719	0.088	-0.068	0.005
	Gender	-1.594	0.665	-0.187	-2.398	0.018*	-2.908	-0.281
Step 2	Constant	15.391	3.461		4.447	<.001	8.555	22.227
	Age	-0.032	0.018	-0.144	-1.719	0.088	-0.068	0.005
	Gender	-1.594	0.665	-0.187	-2.398	0.018*	-2.908	-0.281
	GK	<.001	0.001	-0.006	-0.081	0.936	-0.003	0.003
	TrustGP	0.193	0.157	0.097	1.226	0.222	-0.118	0.503
	SHAI	0.011	0.032	0.027	0.351	0.726	-0.052	0.075
Step 3	Constant	15.391	3.461		4.447	<.001	8.555	22.227
	Age	-0.032	0.018	-0.144	-1.719	0.088	-0.068	0.005
	Gender	-1.594	0.665	-0.187	-2.398	0.018*	-2.908	-0.281
	GK	<.001	0.001	-0.006	-0.081	0.936	-0.003	0.003
	TrustGP	0.193	0.157	0.097	1.226	0.222	-0.118	0.503
	SHAI	0.011	0.032	0.027	0.351	0.726	-0.052	0.075
	Extraversion	0.058	0.033	0.149	1.794	0.075	-0.006	0.123
	Openness	-0.014	0.043	-0.027	-0.335	0.738	-0.099	0.070
	Conscientiousness	0.001	0.036	0.003	0.029	0.977	-0.071	0.073
	Neuroticism	0.007	0.032	0.019	0.209	0.835	-0.056	0.069
	Agreeableness	-0.059	0.049	-0.108	-1.216	0.226	-0.156	-0.037

Note: * $p < .05$, ** $p < .01$, *** $p < .001$.

To test the hypothesis that conscientiousness, agreeableness and neuroticism will be positively associated with intention to seek medical advice after receiving DTC test results that indicate genetic predisposition for psychological disorders, we conducted a hierarchical multiple regression analysis (Table 6). The overall model was found to be significant, with 38.4 % of the variance being accounted for, R=0.384, F(10, 155) = 2.678, p = 0.005. The addition of the step 2 variables (iGLAS, SHAI and trustworthiness of GP) significantly improved the step one model, (F(3,160)=3.720, p=0.013, ΔR2=0.063) where trustworthiness of GP was a significant weak positive predictor of seeking medical advice (r= 0.20, p = 0.007). Neuroticism was found to be a significant weak positive predictor of seeking medical advice (r = 0.12, p = 0.010).

Table 6

Full Hierarchical Multiple Regression Showing Relationship of Predictor Variables with Intention to Seek Medical Advice following DTC

Model		*B*	*SE*	ß	*t*	*p*	95 % Confidence Interval For *B*	
							Lower	Upper
Step 1	Constant	7.599	3.496		2.174	0.031	0.694	14.504
	Age	0.003	0.019	0.015	0.186	0.853	-0.033	0.040
	Gender	1.588	0.672	0.178	2.364	0.019*	0.261	2.914
Step 2	Constant	7.599	3.496		2.174	0.031	0.694	14.504
	Age	0.003	0.019	0.015	0.186	0.853	-0.033	0.040
	Gender	1.588	0.672	0.178	2.364	0.019*	0.261	2.914
	GK	0.002	0.001	0.109	1.443	0.151	<.001	0.005
	TrustGP	0.437	0.159	0.212	2.752	0.007*	0.123	0.750
	SHAI	-0.054	0.032	-0.125	-1.669	0.097	-0.118	0.010
Step 3	Constant	7.599	3.496		2.174	0.031	0.694	14.504
	Age	0.003	0.019	0.015	0.186	0.853	-0.033	0.040
	Gender	1.588	0.672	0.178	2.364	0.019*	0.261	2.914
	GK	0.002	0.001	0.109	1.443	0.151	<.001	0.005
	TrustGP	0.437	0.159	0.212	2.752	0.007*	0.123	0.750
	SHAI	-0.054	0.032	-0.125	-1.669	0.097	-0.118	0.010
	Extraversion	0.060	0.033	0.148	1.834	0.069	-0.005	0.125
	Openness	0.038	0.044	0.068	0.864	0.389	-0.048	0.864
	Conscientiousness	-0.020	0.037	-0.045	-0.534	0.594	-0.093	0.053
	Neuroticism	0.084	0.032	0.226	2.616	0.010*	0.020	0.147
	Agreeableness	0.032	0.049	0.056	0.648	0.518	-0.066	0.130

Note: * $p < .05$, ** $p < .01$, *** $p < .001$.

The regression analysis (Table 7) for the last hypothesis (that conscientiousness, openness to experience and agreeableness will be positively associated with intention to make behavioural changes after receiving DTC test results that indicate genetic predisposition for psychological disorders) was not significant, $F(10, 155) = 0.885$, $p = 0.549$.

Table 7

Full Hierarchical Multiple Regression Showing Relationship of Predictor Variables with Intention to Make Behavioural Change following DTC

Model		*B*	*SE*	ß	*t*	*p*	95 % Confidence Interval For *B*	
							Lower	Upper
Step 1	Constant	17.633	3.109		5.672	<.001	11.492	23.775
	Age	0.014	0.017	0.073	0.852	0.396	-0.019	0.047
	Gender	0.540	0.597	0.072	0.903	0.368	-0.640	1.720
Step 2	Constant	17.633	3.109		5.672	<.001	11.492	23.775
	Age	0.014	0.017	0.073	0.852	0.396	-0.019	0.047
	Gender	0.540	0.597	0.072	0.903	0.368	-0.640	1.720
	GK	<.001	0.001	0.009	0.117	0.907	-0.002	0.003
	TrustGP	0.130	0.141	0.059	0.728	0.468	-0.176	0.381
	SHAI	-0.030	0.029	-0.081	-1.022	0.308	-0.087	0.028
Step 3	Constant	17.633	3.109		5.672	<.001	11.492	23.775
	Age	0.014	0.017	0.073	0.852	0.396	-0.019	0.047
	Gender	0.540	0.597	0.072	0.903	0.368	-0.640	1.720
	GK	<.001	0.001	0.009	0.117	0.907	-0.002	0.003
	TrustGP	0.130	0.141	0.059	0.728	0.468	-0.176	0.381
	SHAI	-0.030	0.029	-0.081	-1.022	0.308	-0.087	0.028
	Extraversion	0.049	0.029	0.142	1.670	0.097	-0.009	0.107
	Openness	-0.031	0.039	-0.067	-0.809	0.420	-0.108	0.045
	Conscientiousness	0.028	0.033	0.077	0.868	0.387	-0.036	0.093
	Neuroticism	0.013	0.028	0.042	0.463	0.644	-0.043	0.069
	Agreeableness	-0.008	0.044	-0.016	-0.172	0.864	-0.094	0.079

Note: * $p < .05$, ** $p < .01$, *** $p < .001$.

Discussion

The present study investigated the effects of personality traits on attitudes towards DTC testing, individuals' emotional response to testing, the intention to seek medical advice following a DTC test, and the intention of behavioural change following a DTC test. Support for the hypotheses was mixed. The results for the first hypothesis (that openness to experience and conscientiousness will be positively associated with attitudes toward DTC genetic testing for psychological disorders and a negative association, whereby individuals high in extraversion will have more negative attitudes) was not supported. The overall model was found to significantly predict attitudes towards DTC genetic testing for psychological disorders, where neuroticism and extraversion were found to be significant predictors. Openness to experience and conscientiousness, however, were not found to be significant predictors. This contradicts previous findings where individuals high in conscientiousness and openness to experience were more likely to utilise mental health treatment services (Hopwood et al., 2008; Miller et al., 2006; Park et al., 2017; Schomerus et al., 2013). One explanation for this could be that as individuals high in conscientiousness are often careful and more likely to seek out and adhere to medical advice and treatment, these individuals may be less inclined to use direct-to-consumer genetic testing (Friedman et al., 2014; Miller et al., 2006; Redelmeier et al., 2021). They might not feel the need to seek out DTC genetic testing as they have previously established regular contact with a health professional (Miller et al., 2006). Furthermore, as individuals high in openness to experience often have a decreased avoidance to problems and an increased active coping style, they might not feel the need to access this extra genetic information as they feel they are sufficiently informed regarding their health (Park et al., 2017).

While a significant negative association was not found between attitudes and extraversion as hypothesized, extraversion was found to be a significant weak positive

predictor of attitudes towards DTC. This contradicts previous literature where it has been shown that individuals high in extraversion were less likely to utilise mental health treatment services, instead relying on their strong social support network (Miller et al., 2006; Park et al., 2017). A potential explanation for this finding could be that individuals high in extraversion often seek excitement and enjoy being action-oriented (Weisberg et al., 2011). DTC genetic testing gives the individual the opportunity to take action to order, complete the test and receive the test results, satisfying their excitement seeking and their assertive nature (Redelmeier et al., 2021; Weisberg et al., 2011). Furthermore, DTC genetic testing is individualized, therefore this might relate to individuals high in extraversion enjoying being the centre of attention (Redelmeier et al., 2021).

A significant, weak positive association was also found between neuroticism and attitudes towards DTC genetic testing. Individuals high in neuroticism often experience a heightened state of anxiety, therefore they may feel anxious towards their psychological health and wish to gain a deeper understanding of their health (Komarraju et al., 2011; Widiger & Oltmanns, 2017). Despite having already sought out medical advice, these individuals may not be satisfied with the findings and wish to further explore their symptoms. These individuals may be reluctant to seek medical advice due to feelings of embarrassment and anxiety, instead seeking DTC genetic testing as it gives them the privacy to order their own testing where the results are directly returned to them.

The results for the second hypothesis (that neuroticism and conscientiousness will be positively associated with negative emotional responses to receiving DTC test results that indicate genetic predisposition for psychological disorders) was not supported. This contradicts findings where neuroticism has been associated with heightened emotional reactivity in negative situations (Komarraju et al., 2011; Larsen & Ketelaar, 1991; Widiger & Oltmanns, 2017). Individuals with high levels of neuroticism often respond poorly and

overexaggerate environmental stress and minor frustrations and view them as overwhelming (Redelmeier et al., 2021; Widiger & Oltmanns, 2017). We found no multicollinearity between health anxiety and neuroticism, therefore health anxiety is unlikely to have had an effect on our neuroticism findings. Furthermore, these findings also do not support the idea that as individuals high in conscientiousness are generally more health conscious, they may report more negative emotional responses after receiving DTC genetic test results (Bogg & Roberts, 2004; Redelmeier et al., 2021) Our study found that the majority of participants indicated a mid-range response on emotional response to receiving DTC test results (mean= 12 out of 20) with the majority of participants indicating neither bad nor good responses. As the majority of our participants (95%) have not experienced using a DTC genetic test they may have incorrectly predicted their emotional response, thereby providing a response in the average range. This corroborates previous literature where individuals have been found to have difficulty predicting their emotional responses to negative future events that they have not experienced (Lench et al., 2019; Wilson & Gilbert, 2005).

The results for the third hypothesis (that conscientiousness, agreeableness and neuroticism will be positively associated with intention to seek medical advice after receiving DTC test results that indicate genetic predisposition for psychological disorders) was partially supported. The overall model was found to be significantly associated with seeking medical advice after receiving DTC test results, however conscientiousness and agreeableness were not found to be significant predictors. This contradicts the nature of the traits of conscientiousness and agreeableness which often underpin good health behaviours (Booth-Kewley & Vickers, 1994; Rivis et al., 2009). It is also inconsistent with previous findings where individuals high in conscientiousness and agreeableness are often more proactive and in control of their health behaviours and were found to be more likely to utilise mental health treatment services (Hopwood et al., 2008; Miller et al., 2006; Schomerus et al., 2013). A

potential explanation for this could be that individuals high in agreeableness are generally people pleasing, therefore they may be embarrassed to seek medical advice and disclose that they ordered a genetic test without a health professional involved (Redelmeier et al., 2021; Weisberg et al., 2011). The finding of conscientiousness being a non-significant predictor could be explained that as individuals' high in conscientiousness may already be in control of their health, they may feel confident to interpret the DTC results themselves (Bogg & Roberts, 2004; Booth-Kewley & Vickers, 1994). This also corroborates the findings of Iwasa and Yoshida (2020) who found conscientiousness to be a significant positive predictor of health literacy.

As hypothesized, neuroticism was found to be a significant positive predictor of intention to seek medical advice after receiving DTC results. This corroborates the previous findings of Park et al., (2017) where individuals high in neuroticism were more likely to utilise mental health treatment services. Those high in neuroticism often experience more severe depressive symptoms, often have less problem-solving skills and are less confident in coping with negative emotions, leading to greater professional help seeking (Park et al., 2017; Weisberg et al., 2011). These factors could be used to explain why individuals high in neuroticism may be more inclined to seek medical advice following a direct-to-consumer genetic test, as they may be less confident in their abilities to comprehend the information and seek the reassurance of a professional (Park et al., 2017; Weisberg et al., 2011).

The results for the fourth hypothesis (that conscientiousness, openness to experience and agreeableness will be positively associated with intention to make behavioural changes after receiving DTC test results that indicate genetic predisposition for psychological disorders) was not supported. This is in contradiction to prior research that has found that individuals high in conscientiousness seek out and adhere to additional medical advice in order to maximise their health outcomes (Bogg & Roberts, 2004; Friedman et al., 2014;

Miller et al., 2006; Redelmeier et al., 2021). These findings could indicate that individuals high in conscientiousness may not value DTC genetic testing as highly as other sources of health information and do not see it as a reliable source of information. Future research could investigate whether individuals value certain health information sources more highly than others. Furthermore, these results are inconsistent with previous literature finding that high levels of agreeableness is related to consciously being in control of health behaviours (Rivis et al., 2009). Furthermore, these results are inconsistent with previous literature finding that individuals with higher levels of openness to experience have greater stress resilience and are reflective and evaluative about their experiences (Komarraju et al., 2011; McCrae & Costa, 1997; Williams et al., 2009). Similar to the emotional response results, these findings could be explained by as individuals do not experience what it would be like to receive these results they might not accurately predict their behavioural intentions. Alternatively, another explanation for these results could be that our sample may not have been diverse enough to detect an effect and further research using a larger, more diverse sample may confirm the predicted results.

These findings indicate that overall, personality is somewhat associated with individuals' attitudes towards DTC and their intentions to seek medical advice after receiving DTC test results, where neuroticism and extraversion are the significant predictors.

Strengths and Limitations

This study is the first to explore the area of direct-to-consumer genetic testing for psychological disorders and personality. As such, it has provided a valuable insight into the potential relationship between personality and direct-to-consumer genetic testing, and paves the way for future research. The study used a sufficient sample size to achieve adequate power. A priori power analysis revealed that a sample of 138 participants was required in

order to obtain a moderate effect size. A sufficient sample of 177 participants were included in the final analyses, therefore adequate power was achieved.

There are several limitations to this study. An important limitation is the gender response bias (84% female). Previous literature has found that females score higher on the personality traits of extraversion, agreeableness and neuroticism than men (Weisberg et al., 2011). Therefore, as we have a highly skewed female response rate, we may not have accurately measured the broader personality scores and this may have affected the external validity of these results, thereby impacting generalisability to the broader population.

Although the accessibility associated with online survey designs is a strength, the use of online survey designs can be seen as a limitation (Andrade, 2020). The manner in which the survey is undertaken cannot be controlled, therefore accuracy and diligence is unknown (Andrade, 2020). Furthermore, it has been found that attention and effort diminish throughout online surveys which corroborates the participant drop-out we experienced as our study progressed (Andrade, 2020). Community members might have been more likely to drop out of the study as they did not have as much of an incentive to complete the survey, in comparison to university students who needed to complete the whole survey in order to receive course credit. This could have led to our sample being mainly comprised of university students which is a significant limitation. Self-selection bias may have also played a role in our sample, as individuals who were interested enough to participate in the study may already have a certain level of interest towards genetic testing or have certain demographic characteristics such as educational levels, socio-economic status and confidence in completing university-based research. This limits the generalisability of our findings to the broader population as our sample may have lacked diversity in terms of factors such as education levels, socio-economic status and age range. Furthermore, as the majority of the sample were psychology university students, their attitudes towards DTC genetic testing

might not be representative of the broader population and may be influenced by their increased knowledge of psychological factors such as genetics.

This study may be deemed a thought experiment, in that participants were asked to imagine what their emotional responses and behavioural changes would be if they received a DTC genetic testing result that indicated a genetic predisposition towards a psychological disorder. As the majority of previous literature examining genetic testing has found an incongruence between hypothetical and actual response to testing, participants may not have accurately reported their responses (Roberts & Ostergren, 2013).

Implications and Recommendations for Future Research

The current study has several important implications in regard to DTC genetic testing for psychological disorders. There are also significant implications in regard to medical practice. As this was the first study which has been conducted investigating direct-to-consumer genetic testing for psychological disorders, it is important that this study is replicated. An exact replication of this study will allow further clarification regarding whether personality is associated with individuals' attitudes and response towards DTC genetic testing.

Due to the primary source of recruitment being first year university students, future research should aim to gather a larger, more diverse sample. Furthermore, research has found personality traits to vary across age (Allemand et al., 2008). Older adults have been found to score higher in the traits of agreeableness and conscientiousness than middle and younger aged adults (Allemand et al., 2008). As it has been found that individuals with a low socio-economic status are more likely to experience psychological disorders, such as anxiety and depression, than those with high socio-economic statuses, future research should take this into account (Vittengl, 2017). As our study did not measure socio-economic status, it is recommended that future studies include this measure and ensure that a wide range of

statuses are included to accurately capture the broader community's views towards direct-to-consumer genetic testing. It is therefore evident that future research should gather a broader sample where there is a better distribution of factors such as age and socio-economic status. This would thereby provide a more accurate representation of the general population, thus better representing individuals who use DTC genetic testing. With larger samples, further research could also categorise the personality traits into high and low extremes, allowing for comparisons to be made.

Gender was found to be a significant predictor of individuals' emotional response to DTC genetic testing and an individual's intention to seek medical advice following DTC testing. This corroborates previous findings of Deng et al. (2016) where females were found to have increased emotional expressivity towards negative emotions in comparison to males. Another explanation for our findings could be that the highly skewed female sample could have had an effect and with a broader distribution of gender, different results may have been found. Future research could specifically investigate gender differences in individual's attitudes toward and intentions following a DTC genetic testing.

As our sample is predominately Caucasian, (83 %) future research should aim to gather a more diverse cultural sample. Research has indicated that certain cultural groups such as Indigenous Australians often hold negative views towards genetic testing as it may reinforce the notion of victim blaming (Kowal et al., 2012). Individuals' cultural background, therefore may influence their attitudes and responses to DTC genetic testing, thereby illustrating the important of gathering a more culturally diverse sample in future research (Fox, 2020; Kowal et al., 2012).

As there is a need for measures to be put into place that help with the identification and treatment of psychological disorders, direct-to-consumer testing could be implemented. If found to be a reliable and valid measure of an individuals' predisposition to psychological

disorders, direct-to-consumer testing could assist healthcare systems around the world, allowing for earlier diagnoses and interventions, potentially reducing healthcare costs. DTC may also encourage those who may not feel comfortable to seek traditional genetic testing to access DTC, by placing them in control. There is the risk that people high in neuroticism will utilise DTC genetic testing and not seek advice which could have negative ramifications such as the misinterpretation of results. Individuals may become anxious when interpreting the results, as they may have difficulty interpreting them, as well as becoming too anxious to seek medical advice after receiving the results. This would have significant implications for all individuals but particularly those high in neuroticism due to their heightened emotional reactivity to negative stimuli (Komarraju et al., 2011; Larsen & Ketelaar, 1991; Widiger & Oltmanns, 2017). Our results, however, suggest that individuals high in neuroticism show an intention to seek medical advice, which is reassuring. Regardless of our findings, policy makers need to ensure that genetic counselling is mandated for all consumers. As generally genetic literacy has been found to be low and as genetic literacy is essential in understanding genetic testing results, genetic counselling could assist in the interpretation of results (Chapman et al., 2019).

Future research could utilise a sample of individuals who have actually used DTC genetic testing to gain a deeper insight into their experiences after receiving the results and whether they would recommend the experience. Previous research has indicated that receiving genetic test results can have negative implications, exacerbating stigma and causing distress, therefore individuals may change their opinions based upon their experience (Lebowitz & Ahn, 2018). As we measured individuals' intentions to make behavioural change, we cannot conclude whether individuals will actually implement these behavioural changes. Previous literature investigating traditional genetic testing has indicated that individuals' intentions are not associated with their actions (Hollands et al., 2016). Future

studies could actually measure the behavioural changes individuals make following a DTC test, thereby building upon the findings of this study. This indicates the need for a survey design utilising a sample of individuals who have experienced DTC genetic testing to gain a more accurate perception of a range of factors such as behavioural changes implemented (Easter, 2012; Kvaale et al., 2013; Meiser et al., 2005).

A potential possibility for further research could involve an investigation into parent's attitudes towards using direct-to-consumer genetic testing for their children's predisposition to psychological disorders. Previous research has found that parents are interested in and hold generally positive attitudes towards testing children's genetic information to determine their predisposition to health conditions, where they view the benefits to outweigh the risks (Lim et al., 2017; Tercyak et al., 2011). There are benefits of testing children's genetic information to determine their predisposition to psychological disorders (Manzini & Vears, 2017). It has been found that early diagnosis of certain psychological disorders such as Attention Deficit Hyperactivity Disorder is critical to enable intervention and treatment (Hamed et al., 2015; Oztekin et al., 2021). As Attention Deficit Hyperactivity Disorder is related to behavioural and learning difficulties, early diagnosis allows strategies to be implemented to improve educational and social outcomes (Hamed et al., 2015; Orban et al., 2018). This testing would have significant ramifications, allowing for earlier diagnoses and interventions and the creation of individualised programs to optimise outcomes for the child (Laegsgaard et al., 2010; Manzini & Vears, 2017). Alternatively, there could be negative ramifications for children tested for genetic information to determine their predisposition to psychological disorders. Studies have suggested that despite the potential benefits of genetic testing, parent-child bonds or the child's self-concept may be harmed by the information gained (Wertz et al., 1994). The research conducted by Garrett et al. (2019) discusses the violation of a child's right to a future free from predictive genetic information. It is, therefore, imperative that

literature investigates factors such as the role of personality to allow inferences to be made as to the types of people who use direct-to-consumer genetic testing. Furthermore, future research could investigate whether parents were interested in genetic testing for their children's predisposition to psychological disorders and whether they would prefer to use DTC or traditional genetic testing.

As stigma is often associated with psychological disorders, DTC genetic testing could actually assist in the reduction of guilt and shame by framing the disorder biogenetically. Often psychological conditions are viewed as a 'behavioural choice', therefore the identification of genes as the main underlying cause may shift the blame from the individual onto genetics (Easter, 2012; Kvaale, et al., 2013; Laegsgaard et al. 2010; Meiser et al., 2005). As there is an established relationship between neuroticism and psychological disorders such as depression and anxiety, the likelihood of an individual receiving DTC test results that indicate a genetic predisposition may be greater for those high in neuroticism (Vittengl, 2017). DTC might provide these individuals with an explanation which could assist to reduce their heightened emotional reactivity (Komarraju et al., 2011; Larsen & Ketelaar, 1991; Widiger & Oltmanns, 2017).

The findings from the current research indicate that overall, personality is somewhat associated with individuals' attitudes towards DTC and their intentions to seek medical advice after receiving DTC test results. More specifically, neuroticism and extraversion significantly predicted these findings, in that high neuroticism seems to be associated with individuals having a more favourable attitude towards direct-to-consumer genetic testing, which does not involve a medical professional. Neuroticism, however, is also associated with seeking medical advice, where individuals show a greater intention to seek medical advice after receiving DTC test results. This is important as these individuals will not just receive and try to interpret the genetic information themselves, they will follow-up with a medical

professional which will assist in the interpretation of the results, similar to genetic counselling in the traditional genetic testing process. As it has been demonstrated that overall, individuals' genetic literacy rates are low, they may experience difficulty interpreting the results, as a predisposition to a psychological disorder does not necessarily mean that they will develop the disorder (Chapman et al., 2019). Thus, having a medical professional involved will provide a more accurate picture for the individual.

Conclusion

The present study adds to the growing body of research into direct-to-consumer genetic testing and provides an insight into a new area of research by examining the association between direct-to-consumer genetic testing for psychological disorders and personality. The results obtained within this research suggest that in the context of direct-to-consumer genetic testing for psychological disorders, neuroticism and extraversion are associated with attitudes, and neuroticism is associated with seeking medical advice, but no traits are significantly related to emotional response and intention to make behavioural change. As individuals high in neuroticism are more likely to develop psychological disorders, this could have important implications for the use of direct-to-consumer genetic testing, as they may be more likely to receive results that indicate a genetic predisposition. Given that individuals high in neuroticism showed an intention to seek medical advice, and as individuals high in neuroticism have a heightened emotional reactivity, it is imperative that measures such as genetic counselling are put in place to assist with the interpretation of results (Komarraju et al., 2011; Larsen & Ketelaar, 1991; Widiger & Oltmanns, 2017). As demand for this service will inevitably increase, these results can assist to inform medical practice and policy making. This study provides avenues for future research to assist our understanding of individuals' engagement with and response to direct-to-consumer genetic testing. If direct-to-consumer genetic testing is found to be a valid and reliable measure of

predisposition to psychological disorders, this will have significant, positive ramifications for society, improving public health outcomes.

References

Andrade, C. (2020). The limitations of online surveys. *Indian Journal of Psychological Medicine, 42*(6), 575-576. https://doi.org/10.1177/0253717620957496

Australian Institute of Health and Welfare. (2021). *Mental health services in Australia.* Australian Government. https://www.aihw.gov.au/reports/mental-health-services/mental-health-services-in-australia/report-contents/expenditure-on-mental-health-related-services

Barnett, J. & Smoller, J. (2009). The genetics of bipolar disorder. *Neuroscience, 164*(1), 331-343. https://doi.org/10.1016/j.neuroscience.2009.03.080

Bogg, T., & Roberts, B. (2004). Conscientiousness and health-related behaviours: a meta-analysis of the leading behavioural contributors to mortality. *Psychological Bulletin, 130*(6), 887-919. https://doi.org/10.1037/0033-2909.130.6.887

Booth-Kewley, S., & Vickers, R. Jr., (1994). Associations between major domains of personality and health behaviour. *Journal of Personality*, *62*(3), 281-98. https://doi.org/10.1111/j.1467-6494.1994.tb00298.x

Chapman, R., Likhanov, M., Selita, F., Zakharov, Smith-Woolley, E., & Kovas, Y. (2017). Genetic literacy and attitudes survey (iGLAS): International population-wide assessment instrument. *The European Proceedings of Social & Behavioural Sciences, 33*(6), 45-66. https://doi.org/10.15405/epsbs.2017.12.6

Cook, E., & Wood, L., (2019). Health Psychology: The Basics, Taylor & Francis Group. ProQuest Ebook Central, http://ebookcentral.proquest.com/lib/utas/detail.action?docID=6407017

Deng, Y., Chang, L., Yang, M., Huo, M., & Zhou, R. (2016). Gender differences in emotional response: Inconsistency between experience and expressivity. *PLoS One*. *11*(6), 1-12. https://doi.org/10.1371/journal.pone.0158666

Driver, M., Kuo, S., & Dick, D. (2020). Genetic feedback for psychiatric conditions: Where are we now and where are we going. *American Journal of Medical Genetics, 183*(7), 423-432. https://doi.org/10.1002/ajmg.b.32815

Easter, M. (2012). Not all my fault: Genetics, stigma, and personal responsibility for women with eating disorders. *Social Science and Medicine, 75*(8), 1408-1416. https://doi.org/10.1016/j.socscimed.2012.05.042

Field, A. (2017). *Discovering statistics using IBM SPSS Statistics* (5th ed.). Sage Publishing.

Fox, K. (2020). The Illusion of Inclusion - The "all of as" research program and Indigenous peoples' DNA. *New England Journal of Medicine, 383*(5), 411-413. https://doi.org/10.1056/NEJMp1915987

Freiser, M., Wilson, S., & Vrieze, S. (2018). Behavioural impact of return of genetic test results for complex disease: Systematic review and meta-analysis. *Health Psychology, 37*(12), 1134-1144. http://dx.doi.org/10.1037/hea0000683

Friedman, H., Kern, M., Hampson, S., & Duckworth, A. (2014). A new lifespan approach to conscientiousness and health: Combining the pieces of the causal puzzle. *Developmental Psychology, 50*(5), 1377-1389. https://doi.org/ 10.1037/a0030373

Gammal, R., Smith, M., Wiisanen, K., Cusimano J., Pettit, R., Stephens, J., Walko, C., Hagyeong Yang, R., & Dunnenberger, H. (2021). The pharmacist's responsibility to ensure appropriate use of direct-to-consumer genetic testing. *Journal of the American College of Clinical Pharmacy, 4*(5), 652-658. https://doi.org/10.1002/jac5.1437

Garrett, J., Lantos, J., Biesecker, L., Childerhose, J., Chung, W., Holm, I., Koenig, B., McEwen, J., Wilfond, B., & Brothers, K. (2019). Rethinking the "open future" argument against predictive genetic testing of children. *Genetics in Medicine*, *10*(1), 2190-2198. https://doi.org/10.1038/s41436-019-0483-4

Goldberg, L. R. (2001). *International Personality Item Pool: A scientific collaboratory for the development of advanced measures of personality and other individual differences.* https://ipip.ori.org

Gow, A., Whiteman, M., Pattie, A., & Deary, I. (2005). Goldberg's IPIP Big-Five factor markers: Internal consistency and concurrent validation in Scotland. *Personality and Individual Differences, 39*(2), 317-329. https://doi.org/10.1016/j.paid.2005.01.011

Hamed, A. M., Kauer, A. J., & Stevens, H. E. (2015). Why the diagnosis of attention deficit hyperactivity disorder matters. *Frontiers in Psychiatry, 6*(168), 1-10. https://doi.org/10.3389/fpsyt.2015.00168

Harvey, S., Deady, M., Wang, M., Mykletun, A., Butterworth, P., Christensen. H., & Mitchell, P. (2017). Is the prevalence of mental illness increasing in Australia? Evidence from national health surveys and administrative data, 2001–2014. *The Medical Journal of Australia, 206*(11), 490-493. https://doi.org/10.5694/mja16.00295

Hollands, G., French, D., Griffin, S., Prevost, A., Sutton, S., King, S., & Marteau, T. (2016). The impact of communicating genetic risks of disease on risk-reducing health behaviour: systematic review with meta-analysis. *BMJ*, *352*(1), 1102-1112. https://doi.org/10.1136/bmj.i1102

Hopwood, C., Quigley, B., Grilo, C., Sanislow, C., Mcglashan, T.,Yen, S.,Shea, T., Zanarini, M., Gunderson, J., Skodol, A., Markowitz, J., & Morey, L. (2008). Personality traits and mental health treatment utilization. *Personal Mental Health, 2*(4), 207-217. https://doi.org/10.1002/pmh.51

Iwasa, H., & Yoshida, Y. (2020). Personality and health literacy among community-dwelling older adults living in Japan. *Psychogeriatrics, 20*(6), 824-832. https://doi.org/10.1111/psyg.12600

Jang, K., McCrae, R., Angleitner, A., Riemann, R., & Livesley, W. (1998). Heritability of facet-level traits in a cross-cultural twin sample: support for a hierarchical model of personality. *Journal of Personality and Social Psychology, 74*(6). 1556-1565. https://doi.org/ 10.1037//0022-3514.74.6.1556

Jeong, G. (2018). Estimating the effects of consumer characteristics on the intention to use direct-to-consumer genetic testing. *Health Policy and Technology, 7*(1). 233-238. https://doi.org/10.1016/j.hlpt.2018.06.004

Komarraju, M., & Karau, S. (2011). The big five personality traits, learning styles, and academic achievement. *Personality and Individual Differences. 51*(4), 472-477. https://doi.org/10.1016/j.paid.2011.04.019

Kowal, E., Pearson, G., Peacock, C., Jamieson, S., & Blackwell, J. (2012). Genetic research and Aboriginal and Torres Strait Islander Australians. *Bioethical Inquiry, 9*(1), 419-432. https://doi.org/10.1007/s11673-012-9391-x

Kvaale, E., Gottdiener, W., & Haslam, N. (2013). Biogenetic explanations and stigma: A meta-analytic review of associations among laypeople. *Social Science and Medicine, 96*(1), 95-103. https://doi.org/10.1016/j.socscimed.2013.07.017

Laegsgaard, M., Stamp, A., Hall, E., & Mors, O. (2010). The perceived and predicted implications of psychiatric genetic knowledge among persons with multiple cases of depression in the family. *Acta Psychiatrica Scandinavica, 122*(6), 470-480. https://doi.org/10.1111/j.1600-0447.2010.01555.x

Larsen, R. J., & Ketelaar, T. (1989). Extraversion, neuroticism and susceptibility to positive and negative mood induction procedures. *Personality and Individual Differences, 10*(12), 1221–1228. https://doi.org/10.1016/0191-8869(89)90233-X

Lebowitz, M., & Ahn, W. (2018). Blue genes? Understanding and mitigating negative consequences of personalized information about genetic risk for depression. *Journal of Genetic Counselling, 27*(2), 204-216. https://doi.org/ 10.1007/s10897-017-0140-5

Lench, H., Levine, L., Perez, K., Carpenter, Z., Carlson, S., Bench, S., & Wan, Y. (2019). When and why people misestimate future feelings: Identifying strengths and weaknesses in affective forecasting. *Journal of Personality and Social Psychology, 116*(5), 724-742. https://doi.org/10.1037/pspa0000143

Lim, Q., McGill, B., Quinn, V., Tucker, K., Mizrahi, D., Patenaude, A., Warby, M., Cohn, R., & Wakefield, C. (2017). Parents' attitudes toward genetic testing of children for health conditions: A systematic review. *Clinical Genetics 92*(6), 569-578. https://doi.org/ 10.1111/cge.12989

Manzini, A., & Vears, D. (2018). Predictive Psychiatric Genetic Testing in Minors: An exploration of the non-medical benefits. *Bioethical Inquiry, 15*(1), 111-120. https://doi.org/10.1007/s11673-017-9828-3

McCrae, R., & Costa, P. (1997). Chapter 31- Conceptions and correlates of openness to experience. *Handbook of Personality Psychology* (825-847). Academic Press. https://doi.org/10.1016/B978-012134645-4/50032-9

McCrae, R., & Costa, P., (2008). The five-factor theory of personality. In O. P. John, R. W. Robins, & L. A. Pervin (Eds.), *Handbook of personality: Theory and research* (159–181). The Guilford Press.

Meiser, B., Mitchell, P., McGirr, H., Van Herten, M., & Schofield, P. (2005). Implications of genetic risk information in families with a high density of bipolar disorder: an exploratory study. *Social Science & Medicine, 60*(1), 109-118. https://doi.org/10.1016/j.socscimed.2004.04.016

Miller, J., Pilonis, P., & Mulvey, E. (2006). Treatment utilization and satisfaction: Examining the contributions of axis II psychopathology and the five-factor model of personality. *Journal of Personality Disorders, 20*(4), 369-387. https://doi.org/10.1521/pedi.2006.20.4.369

National Human Genome Research Institute. (2018). *What is the human genome project?* https://www.genome.gov/human-genome-project/What

Oh, B. (2019). Direct-to-consumer genetic testing: advantages and pitfalls. *Genomics & Informatics, 17*(3), 33-35. https://doi.org/0.5808/GI.2019.17.3.e33

Oliveri, S., Masiero, M., Arnaboldi, P., Cutica, I., Fioretti, C., & Pravettoni, G. (2016). Health orientation, knowledge, and attitudes toward genetic testing and personalized genomic services: Preliminary data from an Italian sample. *BioMedical Research International, 6*(1), 1-9. https://doi.org/10.1155/2016/6824581

Orban, S., Rapport, M., Friedman, L., Eckrich, S., & Kofler, M. (2018). Inattentive behaviour in boys with ADHD during classroom instruction: the mediating role of working memory processes. *Journal of Abnormal Child Psychology*, *46*(4), 713-727. https://doi.org/10.1007/s10802-017-0338-x. PMID: 28825170.

Öztekin I., Finlayson M., Graziano P., & Dick A. (2021). Is there any incremental benefit to conducting neuroimaging and neurocognitive assessments in the diagnosis of ADHD in young children? A machine learning investigation, *Developmental Cognitive Neuroscience, 49*(1), 1-12. https://doi.org/10.1016/j.dcn.2021.100966

Park, S., Lee, Y., Jeong, Seong, S., Man Chang, S., Young Lee, J., Hahm, B., & Hong, J. (2017). A cross-sectional study about associations between personality characteristics and mental health service utilization in a Korean national community sample of adults with psychiatric disorders. *BMC Psychiatry, 17*(170), 1-6. https://doi.org/10.1186/s12888-017-1322-2

Redelmeier, D. A., Najeeb, U., & Etchells, E. E. (2021). Understanding patient personality in medical care: Five-Factor Model. *Journal of General Internal Medicine*, *36*(7), 2111–2114. https://doi.org/10.1007/s11606-021-06598-8

Roberts, J. S., & Ostergren, J. (2013). Direct-to-consumer genetic testing and personal genomics services: A review of recent empirical studies. *Current Genetic Medicine Reports*, *1*(3), 182–200. https://doi.org/10.1007/s40142-013-0018-2

Salkovskis, P. M., Rimes, K. A., Warwick, H. M. C., & Clark, D. M. (2002). The Health Anxiety Inventory: Development and validation of scales for the measurement of health anxiety and hypochondriasis. *Psychological Medicine, 32*(5), 843–853. https://doi.org/10.1017/S0033291702005822

Schomerus, G., Schwahn, C., Holzinger, A., Corrigan, P.W., Grabe, H.J., Carta, M.G., Angermeyer, M.C. (2012). Evolution of public attitudes about mental illness: a systematic review and meta-analysis: evolution of public attitudes. *Acta Psychiatrica Scandinavica. 125*(6), 440–452. https://doi.org/10.1111/j.1600-0447.2012.01826.x.

Shadrina, M., Bondarenko, E. A., & Slominsky, P. A. (2018). Genetics factors in major depression disease. *Frontiers in Psychiatry, 9*(334). 1-18. https://doi.org/10.3389/fpsyt.2018.00334

Smoller, J., & Finn C. (2003). Family, twin, and adoption studies of bipolar disorder. *American Journal of Medical Genetics, 123*(1), 48–58. https://doi.org/10.1002/ajmg.c.20013

Soldz, S., & Vaillant, G. E. (1999). The Big Five personality traits and the life course: A 45-year longitudinal study. *Journal of Research in Personality, 33*(2), 208–232. https://doi.org/10.1006/jrpe.1999.2243

Tercyak, K., Alford, S., Emmons, K., Lipkus, I., Wilfond, B., & McBride, C. (2011). Parents' attitudes toward pediatric genetic testing for common disease risk. *Pediatrics, 127*(5), 1288-1295. https://doi.org/10.1542/peds.2010-0938

Vittengl, J. (2017). Who pays the price for high neuroticism? Moderators of longitudinal risks for depression and anxiety. *Psychological Medicine, 47*(10), 1794-1805. https://doi.org/10.1017/S0033291717000253

Weisberg, Y., DeYoung, C., & Hirsh, J. (2011). Gender differences in personality across the ten aspects of the Big Five. *Frontiers in Psychology, 1*(2), 178-179. https://doi.org/10.3389/fpsyg.2011.00178

Widiger, T., & Oltmanns, J. (2017). Neuroticism is a fundamental domain of personality with enormous public health implications. *World Psychiatry, 16*(2), 144-145. https://doi.org/10.1002/wps.20411

Wilson, T., & Gilbert, D. (2005). Affective forecasting: Knowing what to want. *Current Directions in Psychological Science, 14*(3), 131-134. https://doi.org/10.1111/j.0963-7214.2005.00355.x

23andMe. (2021, April, 11). *Fear of heights and genetics.* https://www.23andme.com/topics/traits/fear-of-heights/

Appendix A

Ethics Approval Letter

10/05/2021

10/05/2021

Dear Dr Padgett

Project ID: 24766

Project Title: Does the 5 Factor Personality Model Predict Engagement with, and Response to, Direct to Consumer Genetic Testing?

We are pleased to advise that the above named project submission and associated documentation has been approved by the Tasmania Social Sciences Human Research Ethics Committee.

The decision and authority to commence the associated research may be dependent on factors beyond the remit of the ethics review process. For example, your research may need ethics clearance from other organisations or review by your research governance coordinator or Head of Department. It is your responsibility to find out if the approvals of other bodies or authorities are required. It is recommended that the proposed research should not commence until you have satisfied these requirements.

All committees operating under the Human Research Ethics Committee (Tasmania) Network are registered and required to comply with the National Statement on Ethical Conduct in Human Research 2007 (updated 2018).

Therefore, the Chief Investigator's responsibility is to ensure that:

(1) All investigators are aware of the terms of approval and that the research is conducted in compliance with the HREC approved protocol or project description.

(2) Modifications to the project do not proceed until approval is obtained from the HREC. This includes, but is not limited to, amendments that:

(i) are proposed or undertaken in order to eliminate immediate risks to participants;
(ii) may increase the risks to participants;
(iii) significantly affect the conduct of the research; or
(iv) involve changes to investigator involvement with the project

(3) Safety reporting for Clinical Trials must follow the 2016 NHMRC Guidance: Safety Monitoring and Reporting in Clinical Trials Involving Therapeutic Goods.

(4) The HREC is informed as soon as possible of any new safety information, from other published or unpublished research, that may have an impact on the continued ethical acceptability of the research or that may indicate the need for modification of the project.

(5) All research participants must be provided with the current Participant Information Sheet and Consent Form (if applicable), unless otherwise approved by the Committee.

(6) This study has approval for four years contingent upon annual review. A Progress Report is to be provided each year on the anniversary date of your approval and you will be sent a courtesy reminder closer to this due date. Ethical approval for this project will lapse if a Progress Report is not submitted in the time frame provided.
Generally ethics approval is granted for a maximum of 6 years, which includes the initial approval and up to two 1 year extension requests. However, applications will be reviewed on a case by case basis as to whether additional extensions will be granted. It is up to the discretion of the Tasmania Social Sciences Human Research Ethics Committee whether additional 1 year extensions will be granted or if a new application is to be submitted.

(7) A Final Report and a copy of the published material, either in full or abstract, must be provided for HREC review and approval at the end of the project.
(8) The HREC is advised of any complaints received or ethical issues that arise during the course of the project.

(9) The HREC is advised promptly of the emergence of circumstances where a court, law enforcement agency or regulator seeks to compel the release of findings or results. Researchers must develop a strategy for addressing this and seek advice from the HREC.

In accordance with the National Statement on Ethical Conduct in Human Research, it is the responsibility of institutions/organisations and researchers to be aware of both general and specific legal requirements, wherever relevant. If researchers are uncertain they should seek legal advice to confirm that their proposed research is in compliant with the relevant laws. University of Tasmania researchers may seek legal advice from Legal Services at the University.

Additional Information:

For all Clinical Trials approved by the Tasmania Health and Medical HREC

Please note that all clinical trials are to be registered on a clinical trial registry. In Australia, registration must occur prospectively, that is before enrollment of the first participant. For more information please refer to NHMRC: Clinical Trial registries

Kind regards,

Ethics Executive Officer

UNIVERSITY of TASMANIA

Appendix B

Demographic Questionnaire

Demographic Information Questions

What is your gender? [Male/Female/Other/Prefer not to say]

How old are you? [dropdown option 18-100]

How would you describe your cultural background? [enter text]

Have you had a genetic test previously? [checkbox yes/no]

Have you previously used a direct-to-consumer genetic test? [checkbox yes/no]

Do you have a medical practitioner (e.g. G.P.) that you see regularly? [checkbox yes/no]

On a scale of 1-10, how much do you trust your medical practitioner to give you sound medical advice? [slider 1-10]

Appendix C

Big Five Personality Scale

IPIP50
Personality Inventory
How Accurately Can You Describe Yourself?

Describe yourself as you generally are now, not as you wish to be in the future. Describe yourself as you honestly see yourself, in relation to other people you know of the same sex as you are, and roughly your same age. So that you can describe yourself in an honest manner, your responses will be kept in absolute confidence.
Indicate how true each statement is for you, using the following scale:

1. Very Inaccurate
2. Moderately Inaccurate
3. Neither Accurate Nor Inaccurate
4. Moderately Accurate
5. Very Accurate

Statement
I often feel blue.
I dislike myself.
I am often down in the dumps.
I have frequent mood swings.
I panic easily.
I rarely get irritated.
I seldom feel blue.
I feel comfortable with myself.
I am not easily bothered by things.
I am very pleased with myself.
I feel comfortable around people.
I make friends easily.
I am skilled in handling social situations.
I am the life of the party.
I know how to captivate people.
I have little to say.
I keep in the background.
I would describe my experiences as somewhat dull.
I don't like to draw attention to myself.
I don't talk a lot.
I believe in the importance of art.
I have a vivid imagination.
I tend to vote for liberal political candidates.
I carry the conversation to a higher level.
I enjoy hearing new ideas.
I am not interested in abstract ideas.
I do not like art.
I avoid philosophical discussions.
I do not enjoy going to art museums.
I tend to vote for conservative political candidates.
I have a good word for everyone.
I believe that others have good intentions.

I respect others.
I accept people as they are.
I make people feel at ease.
I have a sharp tongue.
I cut others to pieces.
I suspect hidden motives in others.
I get back at others.
I insult people.
I am always prepared.
I pay attention to details.
I get chores done right away.
I carry out my plans.
I make plans and stick to them.
I waste my time.
I find it difficult to get down to work.
I do just enough work to get by.
I don't see things through.
I shirk my duties.

Appendix D

Attitudes and Beliefs regarding Direct-to-Consumer Testing Scale

Attitudes and Beliefs regarding Direct-to-Consumer Testing

The following questions relate to Direct-to-Consumer genetic testing. Direct-to-Consumer testing is when a member of the public sends a saliva sample directly to a genetic laboratory, who will conduct genetic testing and send test results directly back to the consumer. While this sort of testing has usually been used to identify someone's heredity (e.g. geographic background), it can also include things like whether you have genes known to increase risk of developing physical or psychological conditions (for example, diabetes, phobias). *The questions below relate specifically to your views about using Direct-to-Consumer testing to identify increased genetic risk for psychological disorders* (NOTE: genetic tests do not indicate whether or not someone has a disorder, just whether they have greater risk of developing a disorder due to their genetic make-up).

[All items measured on a 5 point Likert scale where 1 = strongly disagree and 5 = strongly agree]

Attitude to DTC testing

I would consider using Direct-to-Consumer Genetic Testing to see my genetic risk of developing a psychological disorder (e.g. depression, schizophrenia)

I would be interested in Direct-to-Consumer Genetic Testing to see if I had greater genetic risk for poorer mental health

I would be interested in Direct-to-Consumer Genetic Testing to find out about my family history

I believe that anyone should be able to access Direct-To-Consumer Genetic Testing to see if they have greater risk of developing a psychological disorder.
I believe Direct-To-Consumer Genetic Testing would be useful for predicting my risk of developing a psychological disorder
I believe that the results from a Direct-To-Consumer Genetic Test would be accurate for detecting risk of developing a psychological disorder

I believe a health professional such as a doctor should be involved in the Direct-To-Consumer Genetic Testing process

It would be better for results to be sent to a doctor rather than directly to the person

It would be better for results to be sent to a psychologist rather than directly to the person

I am confident I would be able to interpret the results from a Direct-To-Consumer Genetic Test
Response to receiving DTC results

I believe receiving results directly from a Direct-to-Consumer company would make me feel like I am more in control of my mental health, even if it turned out I had genes associated with increased risk of getting a mental health disorder

I believe that receiving results from a Direct-To-Consumer Genetic Test would make me feel anxious about my mental health

I would regret getting a Direct-to-Consumer Genetic test if it turned out I had genes associated with increased risk of getting a mental health disorder

I believe that receiving results from a Direct-To-Consumer Genetic Test would make me feel more optimistic about my future mental health, even if it turned out I had genes associated with increased risk of getting a mental health disorder

Actions in response to DTC testing

If I received a test result that indicated I had genes associated with increased risk of mental health disorders I would contact a health professional to seek further advice

I would be confident in seeking the appropriate medical advice after receiving results from a Direct-To-Consumer Genetic Test

There is no point in getting medical advice if the results from a genetic test show you have greater risk of developing a psychological disorder

If I received test results that showed I had a greater risk of developing a psychological disorder, I would be more likely to see a counsellor or psychologist as soon as I felt like I has experiencing mental health problems (eg starting to feel more anxious or sadder than normal)

I believe that if I received a test result that showed I had genes associated with mental health disorders from Direct-To-Consumer Genetic Testing it would impact my health decisions and behaviours

If I received a test result that showed I had greater risk of developing a disorder, I would make lifestyle changes in order to maximise positive outcomes for my health (such as increasing exercise, which is known to reduce psychological disorder symptoms)

There’s not much point in changing my lifestyle if there is evidence I have a genetic predisposition to developing a psychological disorder

Appendix E

The Short Health Anxiety Inventory

The Short Health Anxiety Inventory (Salkovskis et al., 2002).
HAI (short version)

Each question is this section consists of a group of four statements. Please read each group of statements carefully and then select the one which best describes your feelings, over the past six months. Identify the statement by ringing the letter next to it, i.e. if you think that statement (a) is correct, ring statement (a); it may be that more than one statement applies, in which case, please ring any that are applicable.

1. (a) I do not worry about my health.
   (b) I occasionally worry about my health.
   (c) I spend much of my time worrying about my health.
   (d) I spend most of my time worrying about my health.

2. (a) I notice aches/pains less than most other people (of my age).
   (b) I notice aches/pains as much as most other people (of my age).
   (c) I notice aches/pains more than most other people (of my age).
   (d) I am aware of aches/pains in my body all the time.
3. (a) As a rule I am not aware of bodily sensations or changes.
   (b) Sometimes I am aware of bodily sensations or changes.
   (c) I am often aware of bodily sensations or changes.
   (d) I am constantly aware of bodily sensations or changes.

4. (a) Resisting thoughts of illness is never a problem.
   (b) Most of the time I can resist thoughts of illness.
   (c) I try to resist thoughts of illness but am often unable to do so.
   (d) Thoughts of illness are so strong that I no longer even try to resist them.

5. (a) As a rule I am not afraid that I have a serious illness.
   (b) I am sometimes afraid that I have a serious illness.
   (c) I am often afraid that I have a serious illness.
   (d) I am always afraid that I have a serious illness.

6. (a) I do not have images (mental pictures) of myself being ill.
   (b) I occasionally have images of myself being ill.
   (c) I frequently have images of myself being ill.
   (d) I constantly have images of myself being ill.

7. (a) I do not have any difficulty taking my mind off thoughts about my health.
   (b) I sometimes have difficulty taking my mind off thoughts about my health.
   (c) I often have difficulty in taking my mind off thoughts about my health.
   (d) Nothing can take my mind off thoughts about my health.

8. (a) I am lastingly relieved if my doctor tells me there is nothing wrong.
   (b) I am initially relieved but the worries sometimes return later.
   (c) I am initially relieved but the worries always return later.
   (d) I am not relieved if my doctor tells me there is nothing wrong.

9. (a) If I hear about an illness I never think I have it myself.
(b) If I hear about an illness I sometimes think I have it myself.
(c) If I hear about an illness I often think I have it myself.
(d) If I hear about an illness I always think I have it myself.

10. (a) If I have a bodily sensation or change I rarely wonder what it means.
(b) If I have a bodily sensation or change I often wonder what it means.
(c) If I have a bodily sensation or change I always wonder what it means.
(d) If I have a bodily sensation or change I must know what it means.

11. (a) I usually feel at very low risk for developing a serious illness.
(b) I usually feel at fairly low risk for developing a serious illness.
(c) I usually feel at moderate risk for developing a serious illness.
(d) I usually feel at high risk for developing a serious illness.

12. (a) I never think I have a serious illness.
(b) I sometimes think I have a serious illness.
(c) I often think I have a serious illness.
(d) I usually think that I am seriously ill.

13. (a) If I notice an unexplained bodily sensation I don't find it difficult to think about other things.
(b) If I notice an unexplained bodily sensation I sometimes find it difficult to think about other things.
(c) If I notice an unexplained bodily sensation I often find it difficult to think about other things.
(d) If I notice an unexplained bodily sensation I always find it difficult to think about other things.

14. (a) My family/friends would say I do not worry enough about my health.
(b) My family/friends would say I have a normal attitude to my health.
(c) My family/friends would say I worry too much about my health.
(d) My family/friends would say I am a hypochondriac.

For the following questions, please think about what it might be like if you had a serious illness of a type which particularly concerns you (such as heart disease, cancer, multiple sclerosis and so on). Obviously you cannot know for definite what it would be like; please give your best estimate of what you think might happen, basing your estimate on what you know about yourself and serious illness in general.

15. (a) If I had a serious illness I would still be able to enjoy things in my life quite a lot.
(b) If I had a serious illness I would still be able to enjoy things in my life a little.
(c) If I had a serious illness I would be almost completely unable to enjoy things in my life.
(d) If I had a serious illness I would be completely unable to enjoy life at all.

16. (a) If I developed a serious illness there is a good chance that modern medicine would be able to cure me.
(b) If I developed a serious illness there is a moderate chance that modern medicine would be able to cure me.
(c) If I developed a serious illness there is a very small chance that modern medicine would be able to cure me.

(d) If I developed a serious illness there is no chance that modern medicine would be able to cure me.

17. (a) A serious illness would ruin some aspects of my life.
(b) A serious illness would ruin many aspects of my life.
(c) A serious illness would ruin almost every aspect of my life.
(d) A serious illness would ruin every aspect of my life.

18. (a) If I had a serious illness I would not feel that I had lost my dignity.
(b) If I had a serious illness I would feel that I had lost a little of my dignity.
(c) If I had a serious illness I would feel that I had lost quite a lot of my dignity.
(d) If I had a serious illness I would feel that I had totally lost my dignity.

Appendix F

The International Genetic Literacy and Attitudes Survey

IGLAS Items

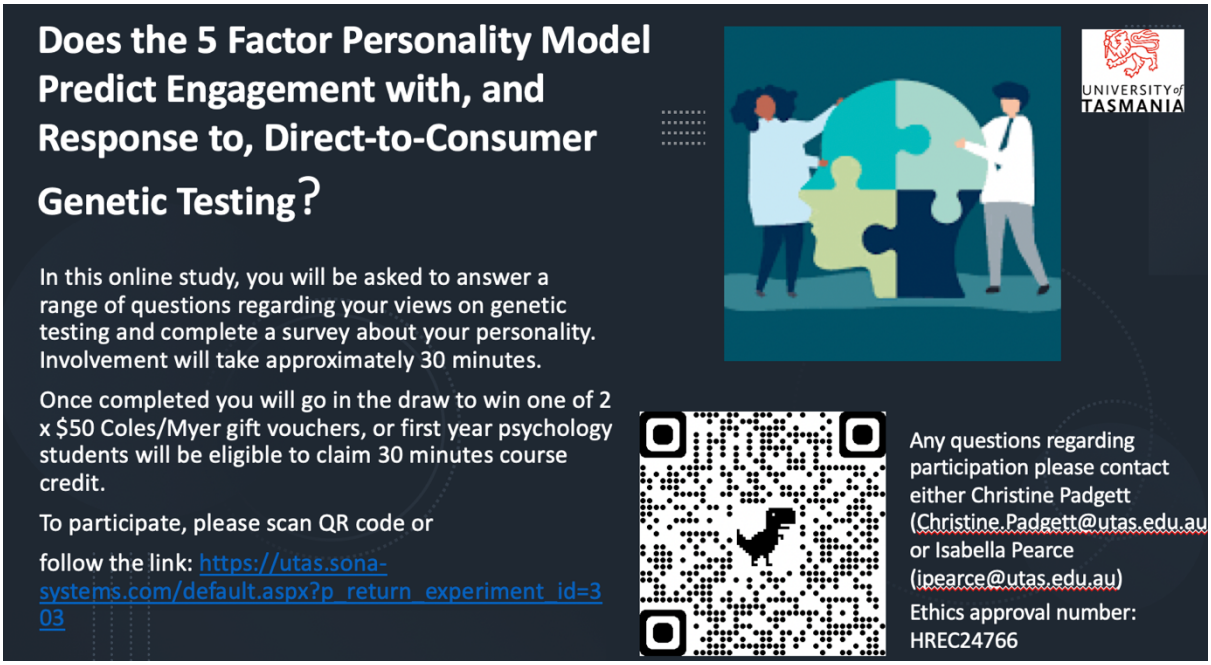
Genetic Knowledge Section 1

On a scale of 0- 100 how important are genetic differences between people in explaining individual differences in the following traits? [slider 0-100]

- Heritability of height
- Heritability of weight
- Heritability of IQ
- Heritability of Eye Colour
- Heritability of clinical depression
- Heritability of motivation
- Heritability of school achievement
- Heritability of sexual orientation
- Heritability of ADHD
- Heritability of Dyslexia
- Heritability of Schizophrenia

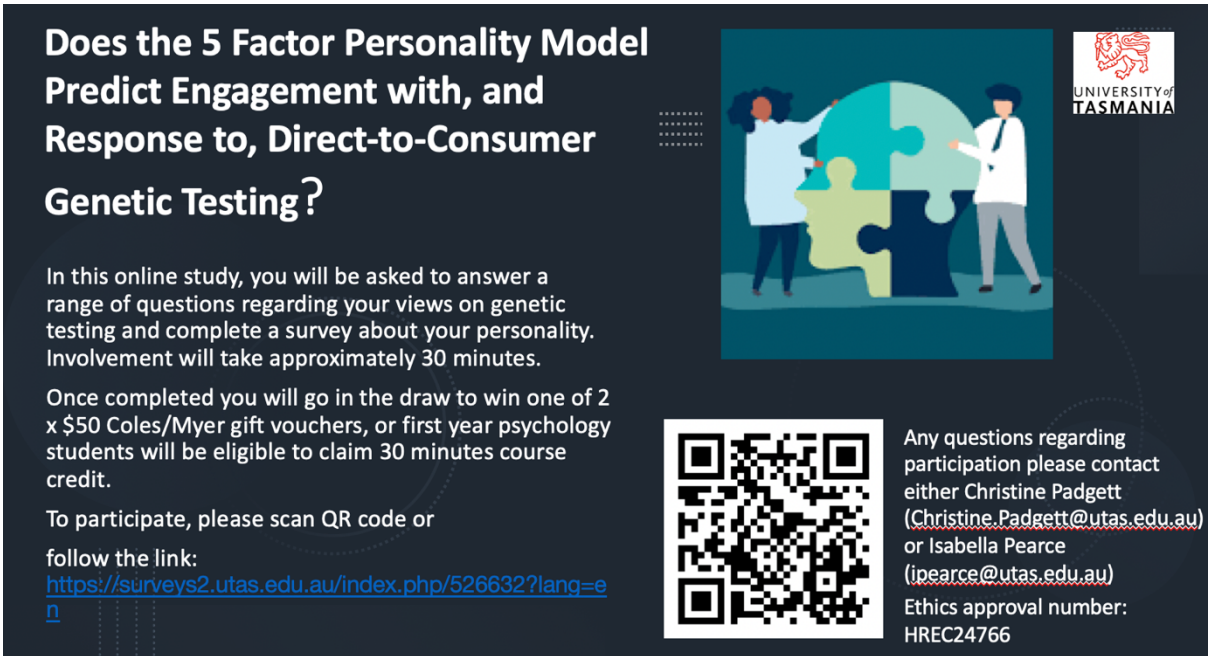
Appendix G

Campus Advertisement Flyers



Appendix H

Social Media Participant Online Recruitment Invitation



Appendix I

Participant Information Sheet

Does the 5 Factor Personality Model Predict Engagement with, and Response to, Direct to Consumer Genetic Testing?

PARTICIPANT INFORMATION SHEET

Research team *Dr Christine Padgett,* School of Psychological Sciences, University of Tasmania

Ms Isabella Pearce, Honours student, School of Psychological Sciences, University of Tasmania

Contact Phone: 6226 5718
Contact Email: Christine.Padgett@utas.edu.au

Invitation
You are invited to participate in a research study examining whether personality traits (e.g. extraversion) influence people's interest in receiving direct-to-consumer genetic testing for psychological conditions. This study is being run by Dr Christine Padgett from the School of Psychological Sciences at the University of Tasmania. Before you decide to participate in this research, please read the information provided, and feel free to ask any questions if necessary.

What is the purpose of this study?
Direct to consumer genetic testing – where people send saliva to a company to undergo genetic testing for things such as family history and health traits – is becoming increasingly popular. We are interested in whether personality traits might influence who is interested in direct to consumer testing for psychological conditions (e.g. fear of heights), and how people might respond to getting test results.

1. **Why have I been invited to participate?**

You are eligible to participate in this study because you're either an undergraduate UTAS student, or a member from the general population over the age of 18. Participation in this study is completely voluntary and there will be no consequence for individuals who do not wish to participate in this study.

2. **What will I be asked to do?**

You will be asked to complete an online survey. The survey includes a range of questions relating to the following:

- Your age, gender, and other general information about yourself
- How you rate your knowledge about genetic testing, and some general knowledge questions about genetics
- A questionnaire measuring personality traits (i.e. extraversion, conscientiousness, emotional stability, openness and agreeableness)
- How you would feel about getting a direct to consumer genetic test.

We expect the survey to take about 20-25 minutes to complete

3. **Are there any possible benefits from participation in this study?**

It is not anticipated that your involvement in this study will result in any direct benefits. However, the data collected from this research will provide further understanding of how people make decisions about using direct to consumer genetic testing.

After completing this study, non-psychology undergraduates and members of the general public will have the opportunity to go into the draw to win a $50 Coles/Myer gift voucher. First year psychology undergraduates from UTAS will be provided with the choice to either enter the gift voucher draw or receive 30 minute research participation course credit via SONA for their involvement in this study.

4. Are there any possible risks from participation in this study?

Other than the inconvenience of completing an online survey, there are no anticipated risks associated with this study. However, should you have any concerns please contact the investigators (see point 10 for contact details).

5. What if I change my mind during or after the study?

You are free to withdraw from the study at any point when you are completing the survey. However, as this survey is anonymous and there will be no identifiable data, we will not be able to retrieve and delete individual responses once the survey is completed.

6. What will happen to the data when this study is over?

All data that is collected from this study will be safely secured and kept confidential. It will be securely saved on a password-protected server in the School of Psychology. In accordance with National Ethics standards, we would like to retain your anonymous (non-identified) data indefinitely to also use in future related research projects. This data would not contain any identifying information about you.

7. How will the results of the study be published?

All data in this study will be anonymous. Data from this study will be discussed and published in an honours thesis, and may be published elsewhere. If you wish to be notified on the results of this study, please feel free to contact us. It

10. What if I have questions about this study?

If you have any queries, concerns or issues with this study, please feel free to contact us:

- Dr Christine Padgett: Email: Christine.Padgett@utas.edu.au or phone 6226 5718

This study has been approved by the Tasmania Health and Medical Human Research Ethics Committee. If you have concerns or complaints about the conduct of this study, you can contact the Executive Officer of the HREC (Tasmania) Network on (03) 6226 6254 or email human.ethics@utas.edu.au The Executive Officer is the person nominate to receive complaints from research participants. You will need to quote HREC project number 24766

8. How can I agree to be involved?

If you do wish to take part within this study, you will be required to select 'agree' on the following online consent form. Selecting 'agree' on the consent form will indicate that you agree to participate in this study, and you will then be directed to the survey.

Thank you for your time

Appendix J

Participant Consent Form

PARTICIPANT CONSENT FORM

Clicking on the “I have read the information sheet and agree to participate in this study” button indicates that:

- You have read and understand the above information
- You voluntarily agree to participate
- You are 18 years of age or older

☐ I have read the information sheet and agree to participate in this study
☐ I do not agree to participate in this study

If you ticked ‘yes’ above please select one of the below options:

I agree that my de-identified study data can be shared and used for future research projects in the same general area of this research

☐ Yes
☐ No