**Emotional and Behavioural responses to Covid-19: Explanations from Three Key Models of Personality**

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**Abstract**

We present a review of research into the association between personality traits and Covid-19 related emotions and behaviours. We considered literature based on three models of personality - the Five-factor model, the HEXACO model, and the Reinforcement Sensitivity Theory. Most studies focus on the Five-factor model, in line with personality research more generally. Key findings are that neuroticism is most associated with poor mental health and extraversion with a reluctance to socially isolate. Conscientiousness predicts compliance with safety guidelines, but also with less prosocial behaviours, particularly stockpiling. Research within the HEXACO framework has largely concurred with these results, especially for emotionality and mental health. The additional Honesty-humility factor is found to be associated with prosocial views and abstention from panic buying. Reinforcement sensitivity theory has indicated the presence of emotional conflict as people wish to stay safe, whilst also maintaining a sense of normality. Behavioural compliance is driven by activation in the fight-fight-freeze (fear) and behavioural inhibition (anxiety) systems. The behavioural activation system is implicated in approach-driven behaviours such as avoiding infection. We also discuss some relevant issues for health communications and post-pandemic support.

**KEYWORDS:** Reinforcement Sensitivity Theory; Big Five; HEXACO; Covid-19; mental health

1. **Introduction**

Of all of the individual difference variables connected to health, personality has been the subject of most research. Broadly speaking, personality traits reflect characteristic patterns of thoughts, feelings, and behaviour (Funder, 2001) and are partly heritable, with genetic factors interacting with enviromental circumstances, including early life experiences (Vukasovic & Bratko, 2015). Although personality traits are malleable to a degree, particularly in the context of major life changes, individual differences remain fairly stable over the adult lifespan (Denissen, Luhmann, Chung, & Bleidorn, 2019).

Taylor (2019) identified personality as a key vulnerability factor in pandemic-related outcomes, particularly traits typified by a susceptibility to stress, anxiety and fear. Negative emotionality and stressful life events are known to be associated with suppressed immunity, thus increasing the likelihood of infection (Cohen et al., 2012; Irwen & Slavich, 2017; Taylor, 2019). Moreover, immune responses to vaccination can be dampened in individuals experiencing distress (Kiecolt-Glaser, 2009). The Covid-19 pandemic and associated social restrictions have resulted in unprecedented levels of stress (Taylor et al., 2019), fear (Ahorsu et al., 2020) and anxiety (Lee, 2020). A review by Brookes et al. (2020) reported a range of additional negative psychological effects, including post-traumatic stress symptoms, confusion, and anger. Stressors include longer quarantine duration, infection fears, frustration, boredom, inadequate essential supplies, inadequate information, and financial loss. If the pandemic is to be effectively managed and the virus eradicated, it is vital to understand individual differences in emotional reactance and compliance with Government safety regulations.

In this article, we examine some of the most recent findings which explain how personality can influence virus-related emotions and behaviours. We focus on research based on three well-established, validated and most widely used models of personality: the Five Factor Model, the HEXACO model, and the Reinforcement Sensitivity Theory.

**2. The Five-Factor Model**

Often referred to as The Big Five, the five-factor model (Costa & McCrae, 2006) is arguably the most widely used model in personality research generally, and Covid-19 research specifically. It comprises five traits: openness to experience (creative, receptive to new ideas/change, independent thought); extraversion (outgoing sociable, confident); agreeableness (trusting, helpful, warm-hearted); conscientiousness (self-controlled, goal-oriented, determined); and neuroticism (tendency to psychological distress, maladaptive coping; Costa & McCrae, 2006). Most studies employ short questionnaires which yield global scores on the five superordinate traits only, as these are quickly administered and generally free to use. The five traits are found to have predictive utility across a wide range of applied settings (Ozer & Benet-Martinez, 2006), with high conscientiousness and low neuroticism presenting the strongest associations with mental and physical health (Bogg & Roberts, 2013; Friedman & Kern 2014; Lahey, 2009; Strickhouser, Zell, & Krizan, 2017; Heilmayr & Friedman, 2020).

 Individuals high in neuroticism may be particularly vulnerable in a pandemic (Taylor, 2019). They often present with above average levels of health anxiety in general (Asmundson, Taylor & Cox, 2001) and this is known to be associated with Covid-specific anxiety (Jungmann & Witthöft, 2020). Neuroticism is associated with generally high levels of emotional reactivity, a perception of the world as threatening, and poor, maladaptive coping with stress (e.g., emotion rather than problem based). Furthermore, individuals high in this trait can become easily bored and lack purpose which has been linked to fear of Covid (Caci, Miceli, Scrima, & Cardaci, 2020). This effect is greater when individuals are also involved in negative fantasy – this is a well-documented form of maladaptive coping which leads to detachment from, and denial of, everyday problems (Plante et al., 2017). A further challenge is uncertainty. Frequently changing, and sometimes ambiguous, social guidelines together with unpredictable progress in terms of vaccine develepment have made the Covid-19 pandemic an intrisically uncertain time. Individuals differ in their responses to uncertainty and these differences have been linked to neuroticism (Hirsh & Inzlicht, 2008). Combined with a predipostion to health anxiety generally (Asmundson et al., 2001), we have a recipe for high levels of illness uncertainty, a cognitive stressor associated with the feeling of having no control. This can lead to perceptions of greater symptom severity, psychological distress, poor coping and reduced quality of life (Wright, Afari, & Zautra, 2009).

Unsurprisingly, several studies have found associations between neuroticism scores and mental health during the pandemic and some have highlighted interesting aspects of behaviour which also contribute to explaining the mechanisms at work. Kroencke, Geukes, Utesch, Kuper and Back (in press) showed that individuals high in neuroticism experienced more negative affect and higher affective variability (i.e., mood swings) compared to individuals lower in the trait. In addition, those individuals also paid more attention to COVID-19-related information. While this may be linked to health anxiety more widely, it is notable that repeated media exposure cannot only increase anxiety, but may also result in misplaced and resource intensive health-protective and help-seeking behaviours (Garfin et al., 2020). The incessant flow of largely negative news and social media reports about the pandemic may impact people high in neuroticism in particular.

There is also evidence for the influence of other Big Five traits, particularly in terms of compliance with pandemic related restrictions. Extraversion predicts a lack of engagement with containment measures such as social distancing (Carvalho et al., 2020). This may be due to extraversion being intrincially linked to sociability, therefore individuals higher in this trait have difficulty in refraining from being close to others, even though they show willingness to engage with other recommendations such as hand washing. Conversely, more conscientious individiuals are most likly to comply with social restrictions. Conscientiousness is also linked with preparatory behaviours prior to lockdown, including stockpiling goods and changing travel plans in advance (Aschwanden et al., 2020). Qualitative research by Benker (2021) has suggested that procurement of additional goods may be a resilience strategy. Conscientiousness is known also to be asscociated with emotional resilience (Oshio et al., 2018) with resilience mediating the relationship between conscientiousness and anxiety at stressful times (Shi, Liu, Wang, & Wang, 2015).

Furthermore, individual differences in how people perceive the pandemic situation may interact with personality traits in determining behaviour. The pandemic may represent a case of what has been termed a “strong situation” (Cooper & Withey, 2019; Snyder & Ickes, 1985) – this hypothesis suggests that in certain contexts, situational cues can overpower personality dispositions and, therefore, personality may be a less powerful predictor of behaviour than it might otherwise be. This question motivated research by Zajenkowski, Jonason, Leniarska and Kozakiewicz (2020) on compliance with Covid-related social restrictions. These researchers measured Big Five traits and how the Covid-10 pandemic is perceived using the DIAMONDS (i.e., Duty, Intellect, Adversity, Mating, pOsitivity, Negativity, Deception, and Sociality) framework (Rauthmann & Sherman, 2016), a taxonomy of measurable dimensions of situational perceptions. Participants who perceived the pandemic regulations as characterised by duty as well as negativity were most likely to comply with the restrictions. These perceptions explained more variance in behaviour that did the Big Five, even neuroticism. Zajenkowski et al. suggest that a sense of moral obligation may be an important quality to convey in attempts to persuade the population to comply with safety guidelines. In their study, the only Big Five trait to be directly associated with compliance was agreeableness, generally typified by helpfulness and altruism. Neuroticism was unsurprisingly associated with generally unfavourable perceptions of the situation (i.e., high adversity and negativity along with low positivity and mating) which is consistent with the characteristic of this trait (Jonason & Sherman, 2020).

Nikčević and Spada (2020) identified an anxiety syndrome specifically related to Covid-19, characterised by avoidance, worrying and threat monitoring. Nikčević, Marino et al. (2020) further examined the relationship between Health Anxiety, Big Five traits and established measures of general anxiety and depression. Perhaps unsurprisingly again, neuroticism was positively and directly associated with generalised anxiety and depression symptoms, while agreeableness was negatively associated. In terms of the other traits however, Covid-specific anxiety mediated the effects. Extraversion, agreeableness, and conscientiousness were negatively associated with Covid anxiety, which, in turn, was positively associated with generalised anxiety and depression symptoms. Extraversion was negatively associated with the COVID-19 anxiety syndrome, whilst openness was positively associated suggesting that the two traits are likely to have protective, versus vulnerability inducing, effects respectively. Nikčević et al. concluded that generalised anxiety and depression symptoms assessed during the time of the pandemic are not only associated with personality traits and the tendency towards health anxiety, but also by psychological distress specifically related to the Covid-19 situation.

The majority of research has necessarily been cross-sectional, but a study conducted by Anglim and Horwood (2020) allowed for comparison with measures taken pre-Covid. Contrary to expectations, the association between personality and wellbeing did not seem to change substantially. In contrast to the conclusions of Nikčević et al. (2020, above), Anglim and Horwood suggest that negative wellbeing observed during the pandemic *is* driven by personality because the effects are additive. In other words, if an individual has high neuroticism, low extraversion and low conscientiousness, they are likely to have lower well-being. Covid-related effects are negative irrespective of personality, however when added to existing levels of wellbeing, the overall effect is more severe for people with this trait profile. Anglim and Horwood (2020) also make the relevant point that factors such as

unemployment, increased financial insecurity, and suffering from COVID-19 influence wellbeing independent of personality.

Finally, Sahni, Kumari and Pachaury (2020) offered insight into between-group effects of personality on resilience during the pandemic. They found extraversion, conscientiousness and low neuroticism to positively correlate with emotional resilience in working adults, whereas for students, resilience was associated with conscientiousness and openness to experience. For a sample of “homemakers” (all adult women), agreeableness was the significant factor. Sahni et al. interpret these results in terms of perceived characteristics of these groups: working adults being outgoing, energetic, dependable and self-confident, students, being active learners, are considered to be organized, imaginative and divergent thinkers, while homemakers are highly prosocial. These characterisations may appear to be based on stereotypes, and may be culturally specific (the study was conducted in India), however, they concur with the results of a pre-Covid metaanalysis (Oshio et al., 2018) which reported that resilience was positively associated with agreeableness, extraversion, conscientiousness and openness, and negatively associated with neuroticism. They also indicate the importance of considering social group differences for the understanding of pandemic related effects

1. **HEXACO**

The HEXACO (*H*onesty-Humility, *E*motionality, E*X*traversion, *A*greeableness, *C*onscientiousness, and *O*penness to Experience; Ashton & Lee, 2007) framework was developed as an extension to the five-factor model. It adds a sixth factor, honesty-humility, reflecting a tendency to be fair and genuine in dealing with others, and emotionality replaces neuroticism but remains basically the same construct. Studies employing the HEXACO framework in Covid-19 are fewer than for the five-factor model and results have tended to replicate. For instance, emotionality is associated with worry and anxiety, and higher levels of conscientiousness with behavioural compliance and likelihood of stockpiling goods (Bentall et al., 2020; Garbe, Rau, & Toppe, 2020; Oljača et al., 2020; Zettler et al., 2020).

Of more interest is the honesty-humility (HH) component, associated with prosocial behaviour even at personal cost. Where significant effects are reported, they have mostly focused on stockpiling with HH positively associated with refraining from stockpiling behaviours (Columbus, 2020; Garbe et al., 2020). Although individuals can see the potential personal benefit, higher HH presents them with a social dilmma: that between their own needs and those of wider society. They may refrain from stockpiling because they are motivated to maximise societal outcomes, and willing to forego their own welfare maximisation (Columbus, 2020). Furthermore, HH is asscoiated with the percpetion of social cohesion in fighting Covid-19 (Zettler et al., 2020). This is interesting in the light of earlier work which has found that HH correlates negatively with inequality related worldviews, such as social dominance orientation (Lee et al., 2012) and with a desire to obtain luxury goods or high social status (Ashton & Lee, 2007). This implies a lower motivation in terms of competitiveness to acquire social or material advantages which may explain abstention from stockpiling under pandemic conditions.

**4. Reinforcement sensitivity theory**

Reinforcement Sensitivity Theory (RST) is a prominent neuropsychological theory of personality which emphasises emotion, motivation, and learning. The original conceptualisation by Gray (e.g., 1982) focussed on two systems that underpin individual differences in personality and psychopathology. The *behavioural approach system* (BAS) was defined as sensitive to conditioned appetitive stimuli and motivating goal-directed approach behaviours. Activation of this system was said to lead to the experience of hopeful excitement, drive persistence to reach desired goals, and elation when they have been attained. Conversely, the *behavioural inhibition system* (BIS) was responsive to conditioned aversive stimuli. Its activation was said to motivate passive avoidance behaviours and contribute to risk assessment and rumination, which can eventuate in the experience of anxiety. In sum, whereas the BAS has been shown to be related to the experience of positive affect, the BIS relates to the experience of negative affect (Corr, 2008).

Revision of the original RST model presents a more detailed understanding of the motivational systems. Gray and McNaughton (2000) separated the avoidance mechanism into two components, a Fight-Flight-Freeze System which mediates reactions to *all* aversive stimuli (conditioned or otherwise), leading to avoidance and escape behaviours, and the BIS which is activated by goal conflict and occurs when there is equal activation of the fight-flight-freeze and behavioural approach systems. As such, Gray and McNaughton characterised the BIS as responsible for detecting and resolving this conflict, rather than being sensitive to punishing stimuli per se. This separation is now widely recognized, in conceptual and psychometrical terms (Gray & McNaughton, 2000; Perkins, Kemp, & Corr, 2007; Corr & Cooper, 2016).

Most recently the behavioural approach system has also been elaborated. The primary function of this system is to move an organism along a spatio-temporal gradient towards a final biological reinforcer. In order to achieve this goal, there are a number of distinct but related BAS processes. “Reward Interest” and “Goal-Drive persistence” that characterize the early stages of approach can be distinguished from “Reward Reactivity” and “Impulsivity” as the final reinforcer is approached and captured (Corr & Cooper, 2016). In terms of RST, anxiety and worry are future focussed, concerning thoughts about an uncertain future and what may, or may not, happen, and are linked to Behavioural Inhibition System. Fear, on the other hand, is a response to an imminent threat linked to the Fight-Flight-Freeze system, which is responsible for triggering action to move the organism away from that immediate threat (Corr & Cooper, 2016; Gray & McNaughton, 2000). BIS hypersensitivity is a common factor in depression and anxiety, while BAS sensitivity is modestly linked to depression only (Bijttebier, Beck, Claes, & Vandereycken, 2009).

Despite the importance of motivational factors to behavioural compliance, few Covid-related studies to date have considered RST. In the early stage of the pandemic, Bacon and Corr (2020a) examined how RST traits were associated with Covid health and safety concerns and intention to self-isolate, which was not mandatory in the UK at that time. After controlling for general negative health attitudes, respondents most concerned scored highly on Reward Reactivity, suggesting that they were motivated to take protective action of some kind despite prevailing worry/anxiety – reward reactivity is important in the neural processing of emotional stimuli (DePascalis, Fracasso, & Corr, 2017). Negative emotions around Covid-19 may trigger displacement activity, such as hoarding and panic buying. Such behaviours may alleviate concern by maintaining a sense that a semblance of a normal lifestyle can be maintained, even though no Government restrictions on social behaviour were in place at the time of this study - Benker (2021) has suggested that procurement of additional goods may be a resilience strategy in Covid-19. Furthermore, individuals higher in fight-flight-freeze traits often attend most to negative aspects of their environment. As such, they may be more susceptible to fear contagion, internalising the negative emotions and behaviours around them and perceiving them as social norms. Bacon and Corr (2020a) also found that personal safety concerns were highest in those who also scored most highly on fight-flight-freeze, which reflects fear/avoidance. They suggested that participants were experiencing psychological conflict: between the urge to stay safe (fight-flight-freeze related) and the desire to maintain a normal, pleasurable (behavioural approach system related reward reactivity) life. Ways of ameliorating conflict may include behaviours such as panic buying, reflecting reward-related displacement activity. Intention to voluntarily self-isolate was associated with FFFS scores, but also with low scores on the Behavioural Inhibition System, which relates to anxiety.

In later work, Bacon and Corr (2020b) showed how RST traits can act alongside elements of the behavioural immune system in triggering pandemic-related behaviour. The term behavioural immune system (BIS) defines how unconscious psychological responses, linked to an evolved disgust response, act as a first line of defence against potential pathogens (Murray & Schaller, 2012; Schaller & Park, 2011). Unlike the reactive physiological immune system, the BIS is proactive, facilitating behavioural avoidance before the organism becomes infected and triggering a perception of personal vulnerability to disease in any given context. In Bacon and Corr’s (2020b) study, this perception was related to the RST system fight-flight-freeze, reflecting that people predisposed to fear see themselves as most vulnerable, perhaps unsurprisingly. Fear has been related to higher levels of health compliance (Harper, Satchell, Fido, & Latzman, 2020; Pakpour & Griffiths, 2020), but also contributes to distress and lower mental health in general. However, perceived vulnerability to disease is considered to comprise two components, germ aversion and perceived infectability, which can be measured separately (Duncan, Schaller, & Park, 2009). Bacon and Corr (2020b) found that germ-aversion was related to goal-drive persistence and the behavioural inhibition system. Germ aversion represents distress in situations where disease might potentially be transmitted. Proactive goal-drives may trigger preventative action, such as mask-wearing. However, that the RST behavioural inhibition system was also activated suggests that even individuals who are germ-averse experience some level of dissonance – a cognitive conflict between an urge to stay safe and a wish to preserve normality.

RST traits are also linked to coping under stress, highly relevant to the pandemic situation. Over a three wave study, Katz and Yovel (2020) showed that behavioural inhibition system activation predicted depression and anxiety in the context of Covid-19, but this occurred indirectly via rumination. Behavioural approach system activation on the other hand was related to an adaptive cognitive coping strategy, reappraisal, which reflects the ability to think about a situation in a more positive light, and negatively to depression and anxiety. These results suggest not only that the relationship between these RST traits and negative affect is mediated by emotion regulation strategies, but also that these strategies may be related to each revised RST system.

**5. Personality and public-health communications**

In this section we consider some practical implications of personality research for health and risk communications. The purpose of such communication is to provide the public with the information they need to make appropriate behavioural choices, whilst also allaying fears. Although fear has been related to the higher level of health compliance (Harper, Satchell, Fido, & Latzman, 2020; Pakpour & Griffiths, 2020), it also contributes to a higher level of distress and lower mental health in general. For this reason, health messages must be designed in such a way to produce better health compliance while at the same time not adding to existing levels of fear, anxiety and depression. Ideally such messages should include more than simply instructions, but also guidance and ideas for coping and building resilience, alongside psychoeducational material on grief, anxiety, depression, helplessness, apathy, frustration and anger – all emotions which can be triggered by the public health situation and living under lockdown conditions (Shultz et al., 2008; Taylor, 2019 for review).

Research following the swine flu epidemic in 2009 showed that communications can be effective if: the public believe the situation to be severe and the recommendations effective; they believe themselves to be susceptible; they trust the authorities issuing the guidelines; and there are few barriers to implementing the guidelines for them personally (Kandiya & Sallar, 2011; Taylor 2019). One approach is to enhance a perceptions of self-efficacy. This, in turn, should elicit positive outcome expectancies and subsequently increase the desired behaviour (Schelle, Brandstatter, & Knopfil, 2010). However, personality can differentially affect perceptions as we have seen in the review above. Individuals high in neuroticism, for instance, may feel concerned and susceptible, but often lack trust (Evans & Revelle, 2008). Their propensity to low mood may also present a psychological barrier to proactive behaviour. Extraverts on the other hand, are more trusting, but may be less likely to obey social-distancing rules unless situational cues and concerns are strong enough to outweigh their natural predisposition and the psychological toll that comes with lack of social engagement. In terms of RST, people in a state of psychological goal conflict (related to the behavioural inhibition system) may attempt to relieve anxiety through approach behaviours, such as panic buying. Effective communication will need to target the anxiety rather than the behaviour.

Generally speaking, gain-framed health messages are considered to be more effective when targeting prevention behaviours (such as handwashing) than loss messages (e.g. the consequences of *not* handwashing). RST systems are found to influence perceptions of persuasive health messages, with emotions related to behavioural approach systems (including anger) receptive to gain messages. Conversely, behavioural inhibition system emotions (fear, end emotional conflict) make people more receptive to loss messages (Yan et al., 2012). Behavioural approach system activation is inherently approach motivated and the system moves individuals in the direction of a desired goal (not catching the virus). Behavioural inhibition on the other hand is more concerned with avoidance, or moving away from an undesired situation. Given this interpretation we can see an explanation for Yan et al.’s results. They suggested that for televised communications, gain messages should be aired after programmes which highlight perceived injustice, value-inconsistent behaviour, or obstacles to goal achievement. Yan et al. propose that these may induce a sense of anger which can trigger the behavioural approach system. Conversely, fear inducing programmes, such as many TV dramas, may activate the behavioural inhibition system and should therefore precede loss-framed communications. Their research did not concern health specifically, though they discuss how health-related issues may elicit fear (if the recipient feels vulnerable) or sadness (if the recipient empathizes with the plight of others). Both emotions can stimulate the behavioural inhibition system which may enhance receptivity to loss-framed appeals (Yan et al., 2010; 2012).

A few studies have suggested that compliance can be achieved by promoting more proactive or positive goals and targeting the behavioural approach system. For example, Bacon and Corr (2020a) found that reward reactivity tendencies (i.e., measure of how strongly one is experiencing the reward), alongside fear-related tendencies, are important in accounting for compliance. In their follow-up study, Bacon and Corr (2020b) reported a role for a further behavioural approach component, goal-drive persistence (perseverance to accomplish long-term goals), in the prediction of Covid-related health compliance. A comparable finding was reported by Žuro, Krupić, and Krupić, (2020), where the effect of both reward reactivity and goal-drive on health compliance was replicated with different psychometric measures and in a different culture (Croatia vs. UK). These findings suggest that it would be more effective (and/or less costly) if the public health messages were reframed to evoke approach motivation and behaviour, rather than by eliciting negative emotions.

**6. Post-pandemic implications**

Finally, we briefly consider the implications of personality in a post-pandemic world. Research following previous pandemics and serious disease outbreaks highlights the importance of psychological factors (Taylor, 2019). Following the SARS outbreak of 2003, many people experienced ongoing post-traumatic distress, even four years afterwards (Hong et al., 2009). Following Covid-19, Taylor and Asmundson (2020) estimate that 10 % of people, maybe many more, will develop severe psychological problems, such as mood disorders, anxiety disorders, or posttraumatic stress disorder. Alongside the vestigial effects of the pandemic itself (both psychological and medical), and the trauma of witnessing severe ill-health and death, many people will be experiencing ongoing personal difficulties with finance, employment or education. Mental health is, therefore, likely to be an ongoing concern for psychologists.

Our review above clearly suggests that a one-size-fits-all approach will not be effective. The potential burden on already stretched health services in providing mental health support will be extensive. As such, there is need for low-cost and easily administered interventions, especially for those with more mild-moderate symptoms, and which can also take into account individual differences. The internet presents an especially fruitful platform for delivery of psychological care, with potential to get many people access to self-help services and therapy sessions in a cost-effective way. It has been suggested that the pandemic may be a turning point in the wider application of e-mental health (Wind, Rijkeboer, Andersson, & Riper, 2020. An example recently trialled is Covid-Confidential, an online resource for public healthcare workers in the UK (Bennett, Noble, Johnston, & Hunter, 2020). The website offers a safe and anonymous space for people to tell their Covid stories verbally and express their emotions. Such activities are known to provide psychological benefits (Bennett, Hunter, Johnston et al., 2020). The first author (XXXXX) is currently involved with research which is testing Covid-Confidential in the general public.

 Our review suggests the importance of individualised support, taking into account personal circumstances, perceptions and barriers, as well as personality. Several Covid-specific measurement scales have been developed during the pandemic, all of which are short and very quick and simple to administer (e.g., Ahorsu et al., 2020; Lee, 2020; Taylor et al., 2020). These have potential utility as screening tools to offer a more bespoke approach. Understanding how personality traits are associated with scores on these measures will allow for further individualisation and potentially more effective outcomes. Another issue to consider is who will take up these intervention opportunities. Individuals high in neuroticism or RST-defined behavioural inhibition system sensitivity may feel too anxious or helpless to take part, whereas such a proactive activity may appeal to those with a sensitive behavioural approach system, or those open to new experiences. Further research looking specifically at the lived experiences of the pandemic and involving members of the public and patients in development of interventions is desirable.

To end on a more positive note, there is evidence that some people are not only resilient, but can find a silver lining in serious negative life events, such as improved personal relationships, greater appreciation for life, personal inner strength and changes in life philosophy (Bride, Dunwoody, Lowe-Strong, & Kennedy, 2018). Research might usefully consider this in the context of Covid-19, how personality traits contribute to post-traumatic growth and how these insights can inform interventions.

**8. Conclusions**

This short review has illustrated the importance of considering individual differences in personality traits in understanding of Covid-19 related emotions and behaviours. We considered evidence relating to the Five-factor model, HEXACO model, and the Reinforcement Sensitivity Theory of personality. Although these models conceptualise traits in different ways, there is considerable agreement in terms of the type of personality profile most at risk, particularly in terms of mental health - psychological distress is related to the dispositional tendency to fear, anxiety and poor coping. Big five trait conscientiousness, and HEXACO trait honesty-humility are linked to behavioural compliance. Reinforcement sensitivity theory examines personality from a motivational perspective which is important not only in terms of poor mental health (tendency to behavioural inhibition/fight-flight freeze) but also in terms of how behaviour may be predicted by different components of the behavioural approach system.

This review did not address physical health effects, which may linger for considerable time after the pandemic is over (del Rio, Collins, & Malani, 2020). We have also seen the emergence of long-Covid, continued illness in people who have either recovered from Covid-19 but are still report lasting effects of the infection, or have had the usual symptoms for far longer than would be expected (Mahase, 2020). Generally speaking, there are three main pathways between personality and physical health outcomes; through reduced immunity, e.g. because of stress, through behaviour, e.g. smoking, or in the case of Covid, ignoring Government guidelines, and when personality changes because of ill-health or medication (Heilmayr & Friedman, 2020). Research to date has not considered how dispositional factors may influence these pathways in terms of Covid-19.

We do not claim this review to be exhaustive; indeed, new research is emerging at such a pace that this would be extremely difficult to achieve. We have considered research conducted within the framework of arguably the three most widely-used models of personality, but there are other trait characteristics that do not cleanly fit into the Big Five/Six or RST typologies, for instance, the so-called dark triad of narcissism, psychopathy and machiavellianism (e.g., Nowak et al., 2020), among others. A larger scale systematic review is recommended to inform evidence based initiatives post-pandemic. Additionally, recommended actions such as social-distancing and mask-wearing can be considered health behaviours and the extensive literature on this should not be disregarded. Overall, personality is a potentially important factor in the aetiology and maintenance of ill-health, both physical and psychological. To understand Covid-19 from a truly biopsychosocial perspective, we cannot afford to ignore these individual differences.

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