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

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Abstract

This review appraises evidence for the role of personality in Covid-19 related emotions and behaviours. Three key models of personality are considered: the Five factor Model, HEXACO model and Reinforcement Sensitivity Theory. In line with personality research more generally, most studies focus on the Five-Factor model. Key findings are that neuroticism is most associated with poor mental health, and extraversion is associated with a reluctance to socially isolate. Conscientiousness predicts compliance with safety guidelines, but also with fewer prosocial behaviours, particularly stockpiling. Research within the HEXACO framework largely confirms these findings, especially for emotionality and mental health. The additional HEXACO Honesty-humility factor is found to be associated with prosocial views and abstention from panic buying. Studies based on the Reinforcement Sensitivity Theory of personality indicate 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-Flight-Freeze System (FFFS; fear-related) and the Behavioural Inhibition System (BIS; anxiety-related). The Behavioural Approach System (BAS) is implicated in approach-driven behaviours such as avoiding infection. These findings have implications for health communications and post-pandemic support.

KEYWORDS: Reinforcement Sensitivity Theory; Five Factor model; HEXACO; Covid-19; mental health

1. Introduction

Personality is one of the most widely studied aspects of psychology. Broadly speaking, personality traits reflect characteristic patterns of thoughts, feelings, and behaviour (Funder, 2001). They are partly heritable, with genetic factors interacting with environmental circumstances, including early life experiences (Vukasović & 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 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, Janicki-Deverts, Crittenden, & Sneed ~~et al~~., 2012; Irwin & 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 concerning levels of stress (Taylor et al., 2020), fear (Ahorsu et al., 2020) and anxiety (Lee, 2020). A review by Brooks et al. (2020) reported a range of additional negative psychological effects, including posttraumatic 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 managed effectively and the virus eradicated, it is vital to understand individual differences in emotional reactance and compliance with government safety regulations.

This short review examines some of the recent findings which help to explain how personality influences virus-related emotions and behaviours and is focused on research based on three well-established, validated and widely used models of personality: the Five-

Factor Model, HEXACO model, and Reinforcement Sensitivity Theory. The literature included was sourced from two databases, PSYCINFO and Pubmed using search term "Covid", together with terms to represent the three theories of interest (Five factor model; Big Five; reinforcement sensitivity; HEXACO). According to the PRISMA model, this search strategy yielded a total of 81 hits. We conducted a further search on Google Scholar using the same terms which yielded 600 hits. We selected 48 articles for the review. The rest could not be used because either they were not published in English, were not available to the authors in full text form, were replica entries in the databases, were unpublished student theses or, on closer examination, were found not to be relevant to our main focus. Articles for inclusion were agreed among the four authors. It is acknowledged that many more articles will have been published since this review was developed in early 2021.

2. The Five-Factor Model

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); 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 having 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 present with above-average levels of health anxiety in general (Asmundson, Taylor, & Cox, 2001), and this is known to be associated with Covid-19 specific anxiety (Jungmann & Witthöft, 2020). Neuroticism is associated with generally high levels of emotional reactivity, a perception of the world as threatening, and poor and 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-19 (Caci, Miceli, Scrima, & Cardaci, 2020). This effect is greater when individuals are also involved in negative fantasy – a well-documented form of maladaptive coping, which leads to detachment from, and denial of, everyday problems (Plante, Reysen, Groves, Roberts, & Gerbasi, 2017). A further challenge is an uncertainty. Frequently changing, and sometimes ambiguous, social guidelines together with unpredictable progress in terms of vaccine development have made the Covid-19 pandemic an intrinsically uncertain time. Individuals differ in their responses to uncertainty, and these differences have been linked to neuroticism (Hirsh & Inzlicht, 2008). Combined with a predisposition to health anxiety generally (Asmundson et al., 2001), this creates 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 that also suggest that individuals high in neuroticism experience more negative affect and higher affective variability (i.e., mood swings) compared to individuals lower in the trait. In addition, those individuals paid more attention to Covid-19-related information and experienced more negative affect in their daily lives during the pandemic (Kroencke,

Geukes, Utesch, Kuper, & Back, 2020). 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, Silver, & Holman, 2020). The incessant flow of largely negative news and social media reports about the pandemic may impact people high in neuroticism in particular.

Neuroticism has been associated with pandemic–related behaviours as well as anxieties. Asselmann, Borghans, Montizaan and Seegers (2020) examined behaviours in German students at the start of the pandemic, in March/April 2020. They found that those who were less emotionally stable (i.e., higher in neuroticism) felt insecure in public places, used public transport less often and hoarded supplies (see also Abdelrahman, 2020, who reports similar results in Qatar). This may be attributable to the anxiety-provoked vigilance often linked to high neuroticism (Friedman & Kern, 2014). Interestingly however, a US study conducted around the same time found differently. Aschwanden et al. (2021) collected personality data in January/February 2020, before the World Health Organisation declared the COVID-19 outbreak a global pandemic. At this time, though most US citizens were aware of Covid-19, most were less cognisant of its spread and seriousness. Aschwanden et. al. subsequently examined whether personality scores predicted behaviours in March 2020 after Americans were requested to follow social restrictions designed to slow the spread. They found that while higher neuroticism was associated with higher Covid-related anxiety and an expectation that the pandemic would last a long time, it was also associated with *fewer* pandemic-related precautions (such as hand-washing and avoiding close contact with others) and unrelated to preparatory behaviours, such as stocking up on food. Both these findings are in direct contrast to those of Asselmann et al. (2020). Aschwanden et al. (2021) used a measure of personality which allowed for examination of individual subfacets of each trait. On further examination, they found the observed effects were driven by one facet of

neuroticism, depression. They attribute their findings to maladaptive coping linked to poor mental health, which has previously been reported in association with higher neuroticism (e.g., Cooper, Agocha, & Sheldon, 2000). Other research has also suggested that neuroticism is a strong predictor of less adaptive psychological functioning both directly and through diminished resilience, during the pandemic (Kocjana, Kavcic, & Avsec, 2020). While Aschwanden et al. (2021) highlight the importance of comprehensive measures of personality which allow for a fine-grained analysis, it also suggests that participants in Asselmann et al. (2020) and Abdelrahman's (2020) research were not so depressed, despite high neuroticism. Hook and Rose Markus (2020) have discussed how some US cultural narratives contribute towards health-related stress and worry. As such, cultural differences and variation in how the pandemic was publicised and managed across nations may account for the disparity in results. Furthermore, an investigation incorporating data from 55 countries concluded that when government guidelines are perceived as stringent, neuroticism is a less strong predictor of precautionary behaviour (Götz, Gvirtz, Galinsky, & Jachimowicz,2021). At the beginning of the pandemic, neuroticism may have been relevant in determining behaviour, but decreased in importance once governmental intervention transformed the adoption of precautionary behaviours from individual decisions to enforced regulations and subsequently new social-norms (Götz et al., 2021).

There is also evidence for the influence of other Five-Factor traits, particularly in terms of compliance with pandemic-related restrictions. Extraversion predicts a lack of engagement with containment measures such as social distancing (Carvalho, Pianowski, & Gonçalves, 2020). Schmiedeberg and Thonnissen (2021) also found that extraverts had a negative perception of social restrictions, but only if they were single. Those with a romantic partner showed no such effect. Extraversion is intrinsically linked to sociability; extraverted individuals may find it difficult to refrain from being close to others, even though they show

a willingness to engage with other recommendations such as hand washing. Conversely, more conscientious individuals are most likely to comply with social restrictions (Krupić, Žuro, & Krupić, 2021). Conscientiousness is also linked with preparatory behaviours prior to lockdown, including stockpiling goods and changing travel plans in advance (Aschwanden et al., 2021). Qualitative research by Benker (2020) suggested that the procurement of additional goods may be a resilience strategy. Conscientiousness is known also to be associated with emotional resilience (Oshio, Taku, Hirano, & Saeed, 2018), with resilience mediating the relationship between conscientiousness and anxiety at stressful times (Shi, Liu, Wang, & Wang, 2015).

Individual differences in how people perceive the pandemic situation may interact with personality traits in determining behaviour. The pandemic is an example of a "strong situation" (Cooper & Withey, 2009; 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-19 related social restrictions. These researchers measured Five-Factor traits and how the Covid-19 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 than the Five-Factor traits, even neuroticism. Zajenkowski et al. (2020) 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 Five-Factor 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, Kolubinski, Leach, & Spada (2020) further examined the relationship between health anxiety, Five-Factor 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, anxiety about Covid-19 mediated the effects. Extraversion, agreeableness, and conscientiousness were negatively associated with Covid-19 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. (2020) 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 with psychological distress specifically related to the Covid-19 situation.

The majority of research has necessarily been cross-sectional, but Liu, Lithopoulos, Zhang, Garcia-Barrera, & Rhodes (2021) attempted to address the limitations of this by asking their participants to retrospectively report their perceived stress levels before the pandemic began, as well as at the time of the study. They found that higher neuroticism and extroversion were associated with higher levels of stress during the pandemic and a greater increase in stress levels compared to levels before the pandemic. They further reported that

the perceived threat of Covid-19 and self-efficacy for following government guidelines significantly mediated the relationship between neuroticism and stress, suggesting that individuals with higher neuroticism experienced higher levels of stress due to higher levels of the perceived threat and lower levels of efficacy. There was, however, no mediating effect on the relationship between stress and extraversion. Liu et al. (2021) suggest that for extraverts, stress comes from sources other than a health threat, possibly from enforced social isolation, a state alien to the intrinsic nature of that trait.

Anglim and Horwood (2020) were able to compare data collected during the pandemic with measures taken pre-Covid-19. Contrary to expectations, the association between personality and well-being did not seem to change substantially. In contrast to the conclusions of Nikčević et al. (2020), Anglim and Horwood suggest that negative well-being 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-19 related effects are negative irrespective of personality however, when added to existing levels of well-being, the overall effect is more severe for people with this trait profile. One change they did observe was that the effect of extraversion on wellbeing was reduced when measured during, as opposed to before, the pandemic. Further evidence that lockdown conditions are likely to have deprived extraverts in particular of a primary source of wellbeing. Anglim and Horwood (2020) also highlight that factors such as unemployment, increased financial insecurity, and suffering from Covid-19 also influence well-being, but are independent of personality. In the US, Sutin et al (2020) tested participants in January-February 2020 as details of the virus emerged, and again in March 2020 after pandemic was confirmed and behavioural guidelines were in place. Neuroticism was found to decrease, particularly the facets of Anxiety and Depression, while other traits scores did not change. Like Anglim and Horwood, Sutin et al

(2020) suggested that anxiety and distress may be attributed more to the pandemic than to personality. Their study supports the much debated theoretical standpoint that FFM traits are stable, even in the face of extreme, non-normative, life events and stressors.

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. (2020) 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 organised, imaginative and divergent thinkers, while homemakers are highly prosocial. These characterisations may appear to be based on stereotypes and might be culturally specific (the study was conducted in India); however, they concur with the results of a pre-Covid-19 meta-analysis (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.

3. 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. HEXACO is suggested to be a useful

ecological model of behavioural and emotional responses to risk situations (Modersitzki et al., 2020; Volk et al., 2021).

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 the likelihood of stockpiling goods (Bentall et al., 2020; Oljača et al., 2020; Zettler et al., 2020). Emotionality is linked to stronger perceptions of Covid-related threat, and then, indirectly, to stockpiling behaviour as individuals attempt to ameliorate their fear. This effect, and the relationship between high conscientiousness and stockpiling, as measured according to the HEXACO model, is reported robust across North American and European samples (Garbe, Rau, & Toppe, 2020). Given that stockpiling is objectively unrelated to saving lives or jobs during a health crisis, it is suggested that goods such as toilet paper function as purely subjective symbols of safety (Garbe 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 dilemma: 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 associated with the perception 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, Ashton, Ogunfowora, Bourdage, & Shin, 2010) 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.

Branovački et al (2021) surveyed a range of emotional and behavioural adjustment factors over 2 months during the official state of emergency in Serbia. They identified three clusters of responses which presented differing HEXACO personality profiles. The Adaptive cluster tended to comply with government guidelines and constraints. They showed higher scores on Honesty/Humility, Extraversion, Agreeableness and Conscientiousness compared to the other clusters and lower emotionality. Given that high Honesty promotes justness, modesty and avoidance of greed, individuals in the Adapted cluster may be able to postpone personal goals and activities with minimal frustration and feelings of deprivation. Comparatively, both the Antagonized and Passive clusters presented lower scores in Honesty, Extraversion, Agreeableness and Conscientiousness. What distinguishes between these is emotionality. The Antagonized were found to be emotionally stable and showed no fear of infection. Low honesty-humility can be associated with enhanced self-evaluation and when combined with low scores on Agreeableness and Conscientiousness this is suggested to promote the low adherence to pandemic-related constraints observed in this group. The Passive group presented higher emotionality scores, and it is suggested that they may internalise their emotions, with fear promoting greater compliance, though not necessarily with the magnanimity apparent in the Adapted group.

Other research has considered HEXACO traits in terms of coping and resilience. From data collected at the start of the pandemic, Gojković et al., (2021) identified three HEXACO personality profiles which they termed Resilient (high extraversion and conscientiousness), Undercontrolled (low conscientiousness) and Overcontrolled (high emotionality and conscientiousness, low extraversion). Resistant individuals used problem-focussed strategies such as planning as well as emotion-focussed strategies such as social

support seeking. Both other groups used more maldaptive strategies such as substance use and avoidance.

During lockdown restrictions in Canada, Volk et al., (2021) also examined the associations between HEXACO traits and coping strategies, however finding that seeking socio-emotional support is associated with *higher* emotionality and extraversion. These results are explained in term of the insecurity and low mood typical of emotionality triggering attachment behaviours, while extraverts generally crave interaction to maintain wellbeing. Banerjee and Rai (2020) have highlighted the negative effects of loneliness during lockdown and social isolation. Individuals high in emotionality or extraversion, though outwardly presenting very different personality profiles, may both use social contact as a coping strategy. Volk et al. (2021) also report that individuals high in emotionality use problem-focussed coping strategies where these promote safety, as do those higher in conscientiousness where a tendency to planning and forethought may support precaution behaviour. Volk et al. suggest that a tendency to planning and forethought associated with conscientiousness may support precaution behaviours. Orderliness has elsewhere been associated with less panic fear during the pandemic (Trzebiński et al., 2020). Lower levels of honesty-humility and conscientiousness however, were associated with maladaptive coping, including rule breaking and substance use, in link with their characteristic propensity for risk-taking (Ashton & Lee, 2007). Overall, Volk et al. (2021, p. 4) suggest that “a personality profile of being socially involved, socially sensitive and thoughtful/careful” is associated with healthier responses. This seems to contradict the well-documented evidence that high neuroticism (the FFM version of emotionality) is associated with poor health and health behaviours, in part linked to maladaptive coping (Lahey, 2009). Volk et al. (2021) highlight the dearth of coping research based on the HEXACO model, and espouse its value over the FFM in assessing coping responses. They assume that emotional support seeking is adaptive,

which it can be, if it features constructive help to deal with negative feelings. It forms part of the battery of strategies adopted by the resilient individuals identified by Gojković et al. (2021), above. However, often, emotion-focussed coping allows individuals to dwell on their negative feelings and delay addressing them. A detailed discussion of coping theory is beyond the scope of this review, however coping literature frequently shows emotion-focussed coping to be unhelpful (Penley, Tomaka, & Weibe, 2002). Gojković et al. (2021) describe how the key emotion driving the use of this strategy is fear. The very specific and novel contextual demands intrinsic to the Covid-19 pandemic may influence how coping strategies are used, both in general and over time as social circumstances change.

4. Reinforcement Sensitivity Theory

Reinforcement Sensitivity Theory (RST) is a prominent neuropsychological theory of personality that emphasises emotion, motivation, and learning. The original conceptualisation (Gray, 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* (FFFS) which mediates reactions to all aversive stimuli (conditioned or otherwise), leading to avoidance and escape behaviours, and a *Behavioural Inhibition System* (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 (2000) 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 recognised, in conceptual and psychometric 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 characterise the early stages of approach can be distinguished from “Reward Reactivity” and “Impulsivity” as the final reinforcer is approached and captured (Corr & Cooper, 2016; Corr & Krupić, 2017; 2020). 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 the BIS. Fear, on the other hand, is a response to an imminent threat linked to the FFFS, 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 (Katz, Matanky, Aviram, & Yovel, 2020), while BAS hyposensitivity is modestly linked to depression only (Bijttebier, Beck, Claes, & Vandereycken, 2009).

Despite the importance of motivational factors to behavioural compliance, few Covid-19 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-19 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, most concerned respondents scored highly on behavioural activation-related Reward Reactivity, suggesting that they were motivated to take protective action of some kind despite prevailing worry/anxiety. Since 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. In fact, Benker (2020) 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 defines how unconscious psychological responses, linked to an evolved disgust response, act as the first line of defence against potential pathogens (Murray & Schaller, 2012; Schaller & Park, 2011). Unlike the reactive physiological immune

system, the behavioural immune system 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 who are prone to experiencing fear see themselves as most vulnerable. 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, as defined within RST. Germ aversion represents distress in situations where the disease might potentially be transmitted. Proactive goal-drives may trigger preventative action, such as mask-wearing. However, the RST behavioural inhibition system was also activated, which 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.

4. General Discussion

Table 1 summarises the relationship between personality traits and distinct emotional and behavioural responses to Covid-19, in terms of the three models discussed.

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The nature of the circumstances has meant that most research is necessarily cross-sectional, and this could be argued to limit the extent to which conclusions can be drawn about the extent to which reported effects are due to the pandemic. Some research is concerned with factors that are intrinsically Covid-19 related (e.g., attitudes to Covid-19 vaccinations, strategies for coping with lockdown, etc.), and many of these issues are known from earlier research to trigger given outcomes. For instance, enforced lockdown resulted in greater social isolation for many people, a factor known to be associated with loneliness, decreased mental and physical well-being and even early mortality (Holt-Lunstad, Smith, Baker, Harris, & Stephenson, 2015). In terms of personality, social distancing and lockdown policies affect extraverts more negatively than introverts, because extraverts tend to have more social interaction generally. When this intrinsic part of their personality is curtailed, they may feel exceptionally burdened by loneliness (Gubler, Makowski, Troche, & Schlegel, 2020). Liu et al. (2021) drew similar conclusions from cross-sectional data where participants were asked to recall how they were feeling prior to the pandemic, in addition to the time of the study. Of course, this approach may be limited by reliance on memories of pre-Covid-19 times, which may be viewed through somewhat rose-tinted glasses. Sibley et al. (2020) compared matched samples of New Zealanders assessed before and during the first 18 days of lockdown. Although they did not measure personality directly, they report higher institutional trust, patriotism and mental distress post lockdown. All can be related to

personality differences. The one study which able to compare wellbeing before and during the pandemic (Anglim & Horwood, 2020) highlight how social factors related to employment or strained relationships, for instance, have affected almost everyone, irrespective of their personal characteristics. However, they also report that the generally positive relationship between extraversion and wellbeing was significantly attenuated during lockdown, when extraverts could not socialise in the way they were accustomed to. This suggests that emotional and behavioural changes may arise from an interaction between certain personality traits and pandemic-related factors, with some personalities affected more than others.

Finally, while consideration of social and personal factors, such as age, ethnicity or country of residence, are beyond the scope of a review focused on personality, it is notable that the vast majority of the research cited here was conducted in western cultures, particularly the UK, Europe and the US. While Covid-19 related research has been conducted elsewhere, for instance in China, it has not tended to focus on personality. Further, as Taylor (2019) has commented, understanding effects on well-being in developing countries is lacking and further research to this end is needed.

5. Personality and public-health communications

There are some practical implications 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 a higher level of health compliance in a few studies (e.g., Harper et al., 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 simple 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, Baingana, & Neris, 2015; Taylor, 2019).

Research following the swine flu epidemic in 2009 showed that communications can be effective if: (a) the public believes the situation to be severe and the recommendations effective; (b) they believe themselves to be susceptible; (c) they trust the authorities issuing the guidelines, and; (d) there are few barriers to implementing the guidelines for them personally (Kanadiya & Sallar, 2011; Taylor, 2019). One approach is to enhance perceptions of self-efficacy. This, in turn, should elicit positive outcome expectancies and subsequently increase the desired behaviour. However, as the review above indicates, personality can differentially affect perceptions. 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 and predispose them to maladaptive coping behaviours. 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. Blagov (2021) showed that agreeableness and conscientiousness predicted the appeal of compassionate public health messages (e.g. protecting vulnerable people) while conscientiousness also predicted the appeal of messages encouraging personal responsibility. High neuroticism was linked to the appeal of disease avoidance messages. One possible explanation of the mechanism linking these traits and adaptive responses to the pandemic may be that they increase susceptibility to public health messages.

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 which underlies 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 the loss messages (Yan, Dillard & Shen, 2012). Behavioural approach system activation is inherently approach-motivated, and the system moves individuals in the direction of the desired goal (not catching the virus as an example of an active avoidance). Behavioural inhibition, on the other hand, is more concerned with avoidance or moving away from an undesired situation. This interpretation presents an explanation for Yan et al.'s (2012) results. They suggested that for televised communications, gain messages should be aired after programmes that highlight perceived injustice, value-inconsistent behaviour, or obstacles to goal achievement. Yan et al. (2012) 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 empathises 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., the 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-19 related health compliance. A comparable finding was reported by Krupić et al. (2021), 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, there are 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 posttraumatic 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.

Furthermore, evidence suggests that some people have developed what has been termed Covid-19 Stress Syndrome, characterized by fear of infection, touching surfaces or objects that might be contaminated, xenophobia (fear that foreigners might be infected), and traumatic stress symptoms (e.g., Covid-19 related intrusive thoughts and nightmares).

However, people with this extreme stress response also seem to be those who had predisposing psychopathology, particularly related to health anxiety (Taylor et al., 2020). The symptoms may abate with time, but it is possible that for some they may translate into a chronic stress disorder (Taylor & Asmundson, 2020). In sum, mental health is 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 a 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 the delivery of psychological care, with the 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-19 Confidential, an online resource for public healthcare workers in the UK (Bennett, Noble, Johnston, Jones, & Hunter, 2020). The website offers a safe and anonymous space for people to tell their Covid-19 stories verbally and express their emotions. Such activities are known to provide psychological benefits (Bennett, Hunter, Johnston, Jones, & Noble, 2020).

Our review suggests the importance of individualised support, taking into account personal circumstances, perceptions and barriers, as well as personality. Several Covid-19 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 the development of interventions is desirable.

7. Directions for Future Research

The Covid-19 pandemic has thrown into stark relief a number of issues that should be addressed in ongoing research, particularly given that the virus may never be fully eradicated (Phillips, 2021). A major priority will be the development of effective and reliable screening procedures to identify those most at risk of ongoing mental health difficulties, including PTSD (Taylor, 2019; Taylor & Asmundson, 2020). Screening and treatment procedures need to account for individual differences in personality if they are to recognise divergences in how people respond to Covid-19 related stress and how they cope with it. Psychological impacts of long-Covid-19 should also be addressed.

Another important topic is obtaining a better understanding of attitudes to vaccination. Vaccination hesitancy is frequently associated with belief in negative conspiracy theories, such as vaccines facilitating government control or profits for Big Pharma. However, recent research has indicated that while this may be the case for some individuals, in many cases Covid-19 related hesitancy is due to concerns about safety, particularly because the vaccines were developed so rapidly (Bacon & Taylor, 2021). This is also likely to be the case in future pandemics, so understanding more about how best to alleviate such concerns is imperative. The role of personality traits in vaccination hesitancy remains an under-researched topic. While individuals high in trait neuroticism will be particularly worried, there are likely other

traits that contribute to concerns in such extreme and novel circumstances. Bacon and Corr (2020a) went some way to examine this in terms of RST, but did not consider vaccination hesitancy specifically. Personality research may, for instance, focus on how to engender trust and an internal locus of control (the feeling that one can control one's own life outcomes). Similarly, a continued emphasis on personal hygiene measures, such as hand washing, will be important in keeping the virus at bay, and these traits are likely important in this respect also. People are most likely to comply if they feel their actions make a difference in terms of protecting themselves and their community.

To end on a 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, a greater appreciation for life, personal inner strength and changes in life philosophy (Bride, Dunwoody, Lowe-Strong, & Kennedy, 2008). Research might usefully consider this in the context of Covid-19, examining how personality traits contribute to posttraumatic growth and how these insights can inform interventions.

8. Conclusions

The research reviewed has illustrated the importance of considering individual differences in personality traits in the understanding of Covid-19 related emotions and behaviours. Evidence relating to the Five-Factor model, HEXACO model, and the Reinforcement Sensitivity Theory of personality conceptualise traits in different ways, however 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. 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 (see Table 1).

Additionally, physical health effects should also be considered as they may linger for a considerable time after the pandemic is over (Del Rio, Collins, & Malani, 2020), not least in terms of long-Covid-19, continued illness in people who have either recovered from Covid-19 but are still reporting 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, through behaviour which in the case of Covid-19, includes 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 the latter of these pathways in terms of Covid-19. Overall, the lingering effects of Covid-19 itself and its social and emotional correlates provide fertile ground for insightful research, including the opportunity for more longitudinal studies.

This review is not exhaustive; indeed, new research is emerging at such a pace that this would be extremely difficult to achieve, but has 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, these individual differences cannot be ignored.

References

Abdelrahman, M. (2020). Personality traits, risk perception, and protective behaviors of Arab residents of Qatar during the COVID-19 pandemic. *International Journal of Mental Health and Addiction*. https://doi.org/10.1007/s11469-020-00352-7

Ahorsu, D. K., Lin, C. Y., Imani, V., Saffari, M., Griffiths, M. D., & Pakpour, A. H. (2020). The fear of COVID-19 Scale: Development and initial validation. *International Journal of Mental Health and Addiction*, 1–9. https://dx.doi.org/10.1007%2Fs11469-020-00270-8

Anglim, J., & Horwood, S. (2020). Effect of the COVID-19 pandemic and Big Five personality on subjective and psychological well-being. *Social Psychological and Personality Science*, https://doi.org/10.1177%2F1948550620983047

Aschwanden, D., Strickhouser, J. E., Sesker, A. A., Lee, J. H., Luchetti, M., Stephan, Y., Sutin, A. R., & Terracciano, A. (2020). Psychological and behavioural responses to coronavirus disease 2019: The role of personality. *European Journal of Personality*, *35*, 51-66. https://doi.org/10.1002/per.2281

Ashton, M. C., & Lee, K. (2007). Empirical, theoretical, and practical advantages of the HEXACO model of personality structure. *Personality and Social Psychology Review*, *11*, 150–166. https://doi.org/10.1177/1088868306294907.

Asmundson, G. J. G., Taylor, S., & Cox, B. J. (2001). *Health Anxiety*. New York: Wiley.

Asselmann, E., Borghans, L., Montizaan, R., & Seegers, P. (2020). The role of personality in the thoughts, feelings, and behaviors of students in Germany during the first weeks of theCOVID-19 pandemic. *PLoS ONE 15(11): e0242904*. https://doi.org/10.1371/journal.pone.0242904

Bacon, A. M., & Corr, P. J. (2020a). Coronavirus (COVID-19) in the United Kingdom: A personality-based perspective on concerns and intention to self-isolate. *British Journal of Health Psychology*, *25*, 839-848. https://doi.org/10.1111/bjhp.12423

Bacon, A. M., & Corr, P. J. (2020b). Behavioural immune system responses to coronavirus: A reinforcement sensitivity theory explanation of conformity, warmth towards others and attitudes towards lockdown. *Frontiers in Psychology*. https://doi.org/10.3389/fpsyg.2020.566237

Bacon, A. M., & Taylor, S. (2021). Vaccination hesitancy and conspiracy beliefs in the UK during the Covid-19 pandemic. *Manuscript in revision*.

Banerjee, D., & Rai, M. (2020). Social isolation in Covid-19: The impact of loneliness. *International Journal of Social Psychiatry*, *66*, 525-527. https://doi.org/10.1177%2F0020764020922269

Benker, B. (2020). Stockpiling as resilience: Defending and contextualising extra food procurement during lockdown. *Appetite*, *156*, 104981. https://doi.org/10.1016/j.appet.2020.104981

Bennett, P., Hunter, R., Johnston, S., Jones, D., & Noble, S. (2020). Covid-19: Recording their stories provides emotional benefit to healthcare workers. *BMJ*, *369*. m2536. https://doi.org/10.1136/bmj.m2536

Bennett, P., Noble, S., Johnston, S., Jones, D., & Hunter, R. (2020). COVID-19 confessions: A qualitative exploration of healthcare workers experiences of working with COVID-19. *BMJ Open*, 10:e043949. https://doi.org/10.1136/bmjopen-2020-043949

Bentall, R. P., Lloyd, A., Bennett, K., McKay, R., Mason, L., Murphy, J., . . . Shevlin, M. (2020). Pandemic buying: Testing a psychological model of over-purchasing and panic buying using data from the United Kingdom and the Republic of Ireland during the early phase of the COVID-19 pandemic. https://psyarxiv.com/u7vqp/ (preprint)

Bijttebier, P., Beck, I., Claes, L., & Vandereycken, W. (2009). Gray's reinforcement sensitivity theory as a framework for research on personality-psychopathology associations. *Clinical Psychology Review, 29,* 421-430. https://doi.org/10.1016/j.cpr.2009.04.002

Blagov, P. S. (2021). Adaptive and dark personality traits in the COVID-19 pandemic: Predicting health-behavior endorsement and the appeal of public-health messages. *Social Psychological and Personality Science, 12,* 697-707. https://doi.org/10.1177/1948550620936439

Bogg, T., & Roberts, B. W. (2013). The case for conscientiousness: Evidence and implications for a personality trait marker of health and longevity. *Annals of Behavioral Medicine, 45,* 278–88. https://doi.org/10.1007/s12160-012-9454-6

Branovački, B., Sadiković, S., Smederevac, S., Mitrović, D. & Pajić, D. (2021). A person-centered approach in studying coronavirus pandemic response: The role of HEXACO-PI-R and PANAS dimensions. *Personality and Individual Differences, 171.* https://doi.org/10.1016/j.paid.2020.110536.

Bride, O. M. C., Dunwoody, L., Lowe-Strong, A., & Kennedy, S. M. (2008). Examining adversarial growth in illness: The factor structure of the Silver Lining Questionnaire (SLQ-38). *Psychology and Health, 23,* 661–678. https://doi.org/10.1080/14768320701356540

Brooks, S. K., Webster, R. K., Smith, L. E., Woodland, L., Wessely, S., Greenberg, N., & Rubin, G. J. (2020). The psychological impact of quarantine and how to reduce it: Rapid review of the evidence. *Lancet, 395,* 912–920. https://doi.org/10.1016/

Caci, B., Miceli, S., Scrima, F., & Cardaci, M. (2020). Neuroticism and fear of COVID-19. The interplay between boredom, fantasy engagement, and perceived control over time. *Frontiers Psychology, 11,* 574393, https://doi.org/10.3389/fpsyg.2020.574393

Carvalho, L. F., Pianowski, G., & Gonçalves, A. P. (2020). Personality differences and COVID-19: Are extroversion and conscientiousness personality traits associated with engagement with containment measures? *Trends in Psychiatry and Psychotherapy.* https://doi.org/10.1590/2237-6089-2020-0029

Cohen, S., Janicki-Deverts, D., Crittenden, C. N., & Sneed, R. S. (2012). Personality and human immunity. In S.C. Segerstrom (Ed.), *The Oxford Handbook of Psychoneuroimmunology* (pp. 146-169). Oxford: Oxford University Press.

Columbus, S. (2020). Honesty-Humility, beliefs, and prosocial behaviour: A test on stockpiling during the COVID-19 pandemic. https://psyarxiv.com/8e62v (preprint).

Cooper, W. H., & Withey, M. J. (2009). The strong situation hypothesis. *Personality and Social Psychology Review*, *13*, 62-72. https://doi.org/10.1177%2F1088868308329378

Corr, P. J. (2008). Reinforcement sensitivity theory (RST): Introduction. In P.J. Corr (Ed.), *The Reinforcement Sensitivity Theory of Personality* (pp. 1–43). Cambridge: Cambridge University Press.

Corr, P. J., & Cooper, A. (2016). The reinforcement sensitivity theory of personality questionnaire (RST-PQ): Development and validation. *Psychological Assessment, 28,* 1427–1440. https://doi.org/10.1037/pas0000273

Corr, P. J., & Krupić, D. (2017). Motivating personality: Approach, avoidance, and their conflict. In A. J. Elliot (Ed.). *Advances in Motivation Science: Volume 4 (pp. 39-90).* London: Elsevier. https://doi.org/10.1016/bs.adms.2017.02.003

Corr, P. J., & Krupić, D. (2020). Approach and avoidance theories of personality. In P. J. Corr & G. Matthews (Eds.). *The Cambridge handbook of personality psychology (2nd ed.)(pp 259-272)* Cambridge: Cambridge University Press. https://doi.org/10.1017/9781108264822.025

Costa, P. T., & McCrae, R. R. (2006). *Revised NEO Personality Inventory (NEO PI –R) Manual (UK Edition)*. Oxford: Hogrefe.

Del Rio, C., Collins, L. F., & Malani, P. (2020). Long-term health consequences of COVID-19. *JAMA, 324*, 1723-1724. https://doi.org/10.1001/jama.2020.19719

Denissen, J. J. A., Luhmann, M., Chung, J. M., & Bleidorn, W. (2019). Transactions between life events and personality traits across the adult lifespan. *Journal of Personality and Social Psychology, 116*, 612–633. https://doi.org/10.1037/pspp0000196

DePascalis, V., Fracasso, F., & Corr, P. J. (2017). The behavioral approach system and augmenting/reducing in auditory event-related potentials during emotional visual stimulation. *Biological Psychology, 123*, 310-323. http://dx.doi.org/10.1016/j.biopsycho.2016.10.015

Duncan, L. A., Schaller, M., & Park, J. H. (2009). Perceived vulnerability to disease: Development and validation of a 15-item self-report instrument. *Personality and Individual Differences, 47*, 541–546. https://doi.org/10.1016/j.paid.2009.05.001

Evans, A. M., & Revelle, W. (2008). Survey and behavioral measurements of interpersonal trust. *Journal of Research in Personality, 42*, 1585–1593. https://doi.org/10.1016/j.jrp.2008.07.011

Friedman, H. S., & Kern, M. L. (2014). Personality, well-being, and health. *Annual Review of Psychology, 65*, 19-42. https://doi.org/10.1146/annurev-psych-010213-115123

Funder, D. C. (2001). Personality. *Annual Review of Psychology, 52*, 197-221. https://doi.org/10.1146/annurev.psych.52.1.197

Garbe, L., Rau, R., & Toppe, T. (2020). Influence of perceived threat of Covid-19 and HEXACO personality traits on toilet paper stockpiling. *PLoS ONE, 15*, e0234232. https://doi.org/10.1371/journal.pone.0234232

Garfin, D. R., Silver, R. C., & Holman, E. A (2020). The novel coronavirus (COVID-2019) Outbreak: Amplification of public health consequences by media exposure. *Health Psychology, 39,* 355–357. http://dx.doi.org/10.1037/hea0000875355

Gojković, V., Batić Očovaj, S., Dostanić, J. & Đurić, M. (2021). The First Wave of the COVID–19 Pandemic: HEXACO profiles affect coping mechanisms and adaptability of response. *Psihologija,* https://doi.org/10.2298/PSI200730001G.

Götz, F.M., Gvirtz, A., Galinsky, A.D. & Jachimowicz, J. M. (2021). How personality and policy predict pandemic behavior: Understanding sheltering-in-place in 55 countries at the onset of COVID-19. *American Psychologist, 76*, 39–49. http://dx.doi.org/10.1037/amp0000740

Gray, J. A. (1982). *The neuropsychology of anxiety: An enquiry into the functions of the septo-hippocampal system.* Oxford: Oxford University Press.

Gray, J. A., & McNaughton, N. (2000). *The neuropsychology of anxiety: An enquiry into the functions of the septo-hippocampal system* (2nd ed.). Oxford, UK: Oxford University Press.

Gubler, D. A., Makowski, L. M., Troche, S. J. & Schlegel, K. (2020). Loneliness and Well-Being During the Covid-19 Pandemic: Associations with personality and emotion regulation, *Journal of Happiness Studies*. https://doi.org/10.1007/s10902-020-00326-5

Harper, C. A., Satchell, L. P., Fido, D., & Latzman, R. D. (2020). Functional fear predicts public health compliance in the COVID-19 pandemic. *International Journal of Mental Health Addiction*. https://dx.doi.org/10.1007%2Fs11469-020-00281-5

Heilmayr, D., & Friedman, H. S. (2020). Models of physical health and personality. In P.J. Corr & G. Matthews (Eds,), *The Cambridge handbook of personality psychology* (pp. 193-207). Cambridge: Cambridge University Press

Hirsh, J. B., & Inzlicht, M. (2008). The devil you know: Neuroticism predicts neural response to uncertainty. *Psychological Science, 19,* 962-967. https://doi.org/10.1111%2Fj.1467-9280.2008.02183.x

Holt-Lunstad, J., Smith, T. B., Baker, M., Harris, T., & Stephenson, D. (2015). Loneliness and social isolation as risk factors for mortality: A meta-analytic review. *Perspectives on Psychological Science, 10,* 337-237. https://doi.org/10.1177%2F1745691614568352

Hong, X., Currier, G. W., Zhao, X., Jiang, Y., Zhou, W. & Wei, J. (2009). Posttraumatic stress disorder in convalescent severe acute respiratory syndrome patients: A 4-year follow up study. *General Hospital Psychiatry, 31*, 546-554. https://doi.org/10.1016/j.genhosppsych.2009.06.008

Hook, C. J., & Rose Markus, H. (2020). Health in the United States: Are appeals to choice and personal responsibility making Americans sick? *Perspectives on Psychological Science, 15,* 643–664. http://dx.doi.org/10.1177/1745691619896252

Irwin, M. R., & Slavich, G. M. (2017). Psychoneuroimmunology. In J. T. Cacioppo, L. G. Tassinary, & G. G. Berntson (Eds.). *Handbook of Psychophysiology* (4th ed.). (pp. 377-397). New York: Cambridge University Press.

Jonason, P. K., & Sherman, R. A. (2020). Personality and the perception of situations: The Big Five and Dark Triad traits. *Personality and Individual Differences, 163*, 110081. https://doi.org/10.1016/j.paid.2020.110081

Jungmann, S. M., & Witthöft, M. (2020). Health anxiety, cyberchondria, and coping in the current COVID-19 pandemic: Which factors are related to coronavirus anxiety? *Journal of Anxiety Disorders.* 102239. https://doi.org/10.1016/j.janxdis.2020.102239

Kanadiya, M. K., & Sallar, A. M. (2011). Preventative behaviours, beliefs and anxieties in relation to the swine flu outbreak among college students aged 18-24 years. *Journal of Public Health, 19,* 139-145. https://doi.org/110.1007/s10389-010-0373-3.

Katz, B. A., & Yovel, I. (2020). A cognitive coping model of reinforcement sensitivity, emotion regulation, and affective psychopathology: Cross-sectional, longitudinal and quasi-experimental evidence. https://doi.org/10.31234/osf.io/wmr25 (preprint)

Katz, B. A., Matanky, K., Aviram, G., & Yovel, I. (2020). Reinforcement sensitivity, depression and anxiety: A meta-analysis and meta-analytic structural equation model. *Clinical Psychology Review, 101842*. https://doi.org/10.1016/j.cpr.2020.101842

Kiecolt-Glaser, J. K. (2009). Psychoneuroimmunology: Psychology's gateway to the biomedical future. *Perspectives on Psychological Science, 4*, 367-369. https://dx.doi.org/10.1111%2Fj.1745-6924.2009.01139.x

Kocjana, G. Z., Kavcic, T., & Avseca, A. (2020). Resilience matters: Explaining the association between personality and psychological functioning during the COVID-19 pandemic. *International Journal of Clinical and Health Psychology, 21*, 100198. https://doi.org/10.1016/j.ijchp.2020.08.002

Kroencke, L., Geukes, K., Utesch, T., Kuper, N., & Back, M. (2020). Neuroticism and emotional risk during the COVID-19 pandemic. *Journal of Research in Personality, 89*, https://doi.org/10.1016/j.jrp.2020.104038

Krupić, D., Žuro, B., & Krupić, D. (2021). Big five traits, approach-avoidance motivation, concerns and adherence with COVID-19 prevention guidelines during peak of pandemics in Croatia. *Personality and Individual Differences, in press*. https://doi.org/10.31234/osf.io/3edyb

Lahey, B. B. (2009). Public health significance of neuroticism. *American Psychologist, 64*, 241–256. http://dx.doi.org/10.1037/a0015309

Lee, K., Ashton, M. C., Ogunfowora, B., Bourdage, J., & Shin, K. H. (2010). The personality bases of socio-political attitudes: The role of Honesty–Humility and Openness to

Experience. *Journal of Research in Personality, 44*, 115–119. https://doi.org/10.1016/j.jrp.2009.08.007

Lee, S. A. (2020). Coronavirus Anxiety Scale: A brief mental health screener for COVID-19 related anxiety. *Death Studies, 44*, 393-401. https://doi.org/10.1080/07481187.2020.1748481

Liu, S., Lithopoulos, A., Zhang, C., Garcia-Barrera, M.A., & Rhodes, R.E. (2021). Personality and perceived stress during COVID-19 pandemic: Testing the mediating role of perceived threat and efficacy. *Personality and Individual Differences, 168*, 110351,1-6, https://doi.org/10.1016/j.paid.2020.110351

Mahase, E. (2020). Covid-19: What do we know about "long covid"? *BMJ, 370*. https://doi.org/10.1136/bmj.m2815

Murray, D. R., & Schaller, M. (2012). Threat(s) and conformity deconstructed: Perceived threat of infectious disease and its implications for conformist attitudes and behaviour. *European Journal of Social Psychology, 42*, 180–188. https://doi.org/10.1002/ejsp.863

Nikčević, A. V., & Spada, M. M. (2020). The COVID-19 Anxiety Syndrome Scale: Development and psychometric properties. *Psychiatry Research, 292*, 113322. https://doi.org/10.1016/j.psychres.2020.113322x

Nikčević, A. V., Marino, C., Kolubinski, D. C., Leach, D., & Spada, M. M. (2020). Modelling the contribution of the Big Five personality traits, health anxiety, and COVID-19 psychological distress to generalised anxiety and depressive symptoms during the COVID-19 pandemic. *Journal of Affective Disorders, 279*, 578-584. https://doi.org/10.1016/j.jad.2020.10.053

Nowak, B., Brzóska, P., Piotrowski, B., Sedikides, C., Żemojtel-Piotrowska, M., & Jonason, P. K. (2020). Adaptive and maladaptive behavior during the COVID-19 pandemic: The

roles of Dark Triad traits, collective narcissism, and health beliefs. *Personality and Individual Differences, 167,* 110232. https://doi.org/10.1016/j.paid.2020.110232

Oljača, M., Sadiković, S., Branovacki, B., Pajić, D., Smederevac, S., & Mitrović, D. (2020). Unrealistic optimism and HEXACO traits as predictors of risk perception and compliance with COVID-19 preventive measures during the first wave of pandemic. https://doi.org/10.31234/osf.io/rt64j (preprint)

Oshio, A., Taku, K., Hirano, M., & Saeed, G. (2018). Resilience and big five personality traits: A meta-analysis. *Personality and Individual Differences, 127,* 54–60. https://doi.org/10.1016/j.paid.2018.01.048

Ozer, D. J., & Benet-Martínez, V. (2006). Personality and the prediction of consequential outcomes. *Annual Review of Psychology, 57,* 401-421. https://doi.org/10.1146/annurev.psych.57.102904.190127

Pakpour, A. H., & Griffiths, M. D. (2020). The fear of COVID-19 and its role in preventive behaviors. *Journal of Concurrent Disorders, 2,* 58–63. https://concurrentdisorders.ca/2020/04/03/the-fear-of-covid-19-and-its-role-in-preventive-behaviors/

Penley, J. A., Tomaka, J., & Wiebe, J. S. (2002). The association of coping to physical and psychological health outcomes: A meta-analytic review. *Journal of Behavioral Medicine, 25,* 551-603. https://doi.org/10.1023/A:1020641400589

Perkins, A. M., Kemp, S. E., & Corr, P. J. (2007). Fear and anxiety as separable emotions: An investigation of the revised reinforcement sensitivity theory of personality. *Emotion, 7,* 252–261. https://doi.org/10.1037/1528-3542.7.2.252 .

Phillips, N. (2021). The coronavirus is here to stay — here's what that means. *Nature, 590,* 382-384. https://doi.org/10.1038/d41586-021-00396-2.pmid:33594289

Plante, C. N., Reysen, S., Groves, C. L., Roberts S. E., & Gerbasi, K. (2017). The fantasy engagement scale: A flexible measure of positive and negative fantasy engagement. *Basic and Applied Social Psychology, 39,* 127–152. https://doi.org/10.1080/01973533.2017.1293538

Rauthmann, J. F., & Sherman, R. A. (2016). Measuring the Situational Eight DIAMONDS characteristics of situations: An optimization of the RSQ-8 to the S8. *European Journal of Psychological Assessment, 32,* 155–164. https://doi.org/10.1027/1015-5759/a000246

Sahni, S., Kumari, S., & Pachaury, P. (2020). Building Emotional Resilience with Big Five personality model against COVID-19 pandemic. *FIIB Business Review, 10, 39-51.* https://doi.org/10.1177/2319714520954559

Schaller, M., & Park, J. H. (2011). The behavioural immune system (and why it matters). *Current Directions in Psychological Science, 20,* 99–103. https://doi.org/10.1177/0963721411402596

Schmiedeberg, C. & Thönnissen, C. (2021). Positive and negative perceptions of the COVID-19 pandemic: Does personality play a role? *Social Science & Medicine, 276,* 113859. https://doi.org/10.1016/j.socscimed.2021.113859 .

Shi, M., Liu, L., Wang, Z. Y., & Wang, L. (2015). The mediating role of resilience in the relationship between Big Five personality and anxiety among Chinese medical students: A cross-sectional study. *PLoS One, 10,* e0119916. https://doi.org/10.1371/journal.pone.0119916

Shultz, J. M., Baingana, F., & Neris, Y. (2015). The 2014 Ebola outbreak and mental health: Current status and recommended responses. *JAMA, 313,* 567-568. https://doi.org/10.1001/jama.2014.17934.

Sibley, C. G., Greaves, L. M., Satherley, N., Wilson, M. S., Overall, N. C., Lee, C. H. J … Barlow, F. K. (2020). Effects of the COVID-19 Pandemic and nationwide lockdown on

trust, attitudes toward government, and well-being. *American Psychologist*, *75*, 618–630, http://dx.doi.org/10.1037/amp0000662

Snyder, M., & Ickes, W. (1985). Personality and social behavior. *Handbook of Social Psychology*, *2*, 883-947.

Strickhouser, J. E., Zell, E., & Krizan, Z. (2017). Does personality predict health and well-being? A metasynthesis. *Health Psychology*, *36*, 797-810. https://doi.org/10.1037/hea0000475

Sutin AR, Luchetti M, Aschwanden D, Lee JH, Sesker AA, Strickhouser JE, et al. (2020) Change in five-factor model personality traits during the acute phase of the coronavirus pandemic. *PLoS ONE 15(8)*, e0237056. https://doi.org/10.1371/journal.pone.0237056

Taylor, S. (2019). *The Psychology of Pandemics: Preparing for the next Global Outbreak of Infectious Disease*. Newcastle-Upon-Tyne, UK: Cambridge Scholars Publishing.

Taylor, S., & Asmundson, G. J. G. (2020). Life in a post-pandemic world: What to expect of anxiety-related conditions and their treatment. *Journal of Anxiety Disorders*, *72*, 102231. https://dx.doi.org/10.1016%2Fj.janxdis.2020.102231

Taylor, S., Landry, C. A., Paluszek, M. M., Fergus, T. A., McKay, D., & Asmundson, G. J. G. (2020). Development and initial validation of the COVID Stress Scales. *Journal of Anxiety Disorders 72*, 102232. https://doi.org/10.1016/j.janxdis.2020.102232

Trzebiński, J., Cabański, M., Czarnecka, J. Z. (year???). Reaction to the COVID-19 pandemic: The influence of meaning in life, life satisfaction, and assumptions on world orderliness and positivity. *Journal of Loss and Trauma*, *25*, 544–557. https://doi.org/10.1080/15325024.2020.1765098 .

Volk, A. A., Brazil, K. J., Franklin-Luther, P., Dane, A. V., & Vaillancourt, T. (2021). The influence of demographics and personality on COVID-19 coping in young adults.

Personality and Individual Differences, 168, 110398. https://doi.org/10.1016/j.paid.2020.110398.

Vukasović, T., & Bratko, D. (2015). Heritability of personality: A meta-analysis of behavior genetic studies. *Psychological Bulletin, 141,* 769 –785. http://dx.doi.org/10.1037/bul0000017

Wind, T. R., Rijkeboer, M., Andersson, G., & Riper, H. (2020). The COVID-19 pandemic: The "black swan" for mental health care and a turning point for e-health. *Internet Interventions, 20,* 100317. https://doi.org/10.1016/j.invent.2020.100317

Wright, L. J., Afari, N., & Zautra, A. (2009). The illness uncertainty concept: A review. *Current Pain and Headache Reports, 13,* 133–138. https://doi.org/10.1007/s11916-009-0023-z

Yan, C., Dillard, J. P., & Shen, F. (2010). The effects of mood, message framing, and behavioral advocacy on persuasion. *Journal of Communication, 60,* 344–363. https://doi.org/10.1111/j.1460-2466.2010.01485.x

Yan, C., Dillard, J. P., & Shen, F. (2012). Emotion, motivation, and the persuasive effects of message framing. *Journal of Communication, 62,* 682-700. https://doi.org/10.1111/j.1460-2466.2012.01655.x

Zajenkowski, M., Jonason, P. K., Leniarska, M., & Kozakiewicz, Z. (2020). Who complies with the restrictions to reduce the spread of COVID-19?: Personality and perceptions of the COVID-19 situation. *Personality and Individual Differences, 166,* 10199. https://doi.org/10.1016/j.paid.2020.110199

Zettler, I., Schild, C., Lilleholt, L., Kroencke, L., Utesch, T., Moshagen, M., ... & Geukes, K. (2020). The role of personality in COVID-19 related perceptions, evaluations, and behaviors: Findings across five samples, nine traits, and 17 criteria. https://doi.org/10.31234/osf.io/pkm2a (preprint).

Table 1- Summary table of relationship between personality traits and distinct emotional and behavioural responses to Covid-19

	Emotional response to Covid-19				**Behavioural response to Covid-19**		
	Distress (anxiety, depression)	**Worry**	**Resilience**	**Well-being**	**Social distancing**	**Protective behaviour (washing hands, wearing masks, germ aversion..)**	**Stock pilling**
Five-factor traits							
Extraversion	-		+	+	-	+	
Agreeableness	-		+				
Conscientiousness	-		+	+	+	+	+
Neuroticism/Emotionality	+	+	-	-	+/-	+	
Openness			+				
HEXACO							
Honesty-Humility							-
Reinforcement Sensitivity Theory							
BAS Reward Interest							
BAS Goal-Drive					+	+	
Persistence							
BAS Reward Reactivity		+			+		
BAS Impulsivity							
Behavioural Inhibition	+				-	+	
System							
Fight							
Flight-Freeze	+	+			+		

Note: + - positive correlation; - negative correlation; +/- - mixed findings; empty cell indicates either lack of data or zero effects; the summary for the same-name Five factor and HEXACO traits are presented together under the same row