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Short Review

The Psychology of the Common Cold and Influenza: Implications for COVID-19

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Abstract

Research on psychological risk factors for upper respiratory tract illnesses (URTIs) has been conducted for over fifty years. Early studies failed to control for exposure and also often relied on self-report rather than clinical and virological assessment. A universal policy used in the current COVID-19 pandemic has been to restrict exposure by social isolation. This leads to increased stress and removal of social interaction. In addition, information overload about the disease, and incorrect information, can also reduce wellbeing. Studies of experimentally-induced URTIs have shown that stress increases susceptibility to infection. Other research has shown that stress due to job insecurity and few social contacts are key risk factors for infection. This suggests that while social isolation will reduce exposure, it will also lead to an increased risk of illnesses, due to increased stress and reduced social support, should the person become infected with the virus. Other research has shown that infection and illness lead to changes in behaviour. These effects include greater negative affect and impaired attention and slower speed of response. Such effects are not only present when the person is symptomatic but also occur with sub-clinical infections, during the incubation period and after the illness. People with the illness are also more sensitive to other negative influences such as fatigue, and this has implications for safety critical jobs such as those carried out by healthcare professionals treating those with COVID-19.

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Introduction

The purpose of this short article is to draw attention to an area of research that has major implications for the COVID-19 pandemic. Psychologists have investigated psychological risk factors for susceptibility to URTIs for over fifty years. Early research has been reviewed by Cohen and Williamson [1], and was criticised for failing to control for exposure to the virus, lack of objective assessment of the disease (no clinical observations or virological assays), the use of retrospective or cross-sectional designs, and poor conceptualisation of psychological constructs such as the stress process. Since that review a substantial body of research has rectified these issues using experimentally-induced URTIs, longitudinal designs, control of a range of other risk factors, and more clearly defined psychological constructs.

Psychological effects of quarantine and information overload

Before reviewing the more recent studies of experimentally-induced URTIs, it is important to note that there is a body of literature related to attempts to control exposure to URTIs. The major approach currently used with COVID-19 is social isolation. This has a number of negative effects, increasing stress, not only about the direct risk from the disease, but due to job insecurity and lack of social interaction. Indeed, a recent review of the effects of quarantine showed that there a clear reductions in the wellbeing of those being quarantined [2]. Other sources of stress during the COVID-19 pandemic come from incorrect or inappropriate information about policy and practice, and also the information overload related to the disease [3]. Isolation is often recommended in an attempt to reduce the effects of the pandemic on healthcare staff. These staff will be under considerable stress and there is strong evidence of increases of mental health problems in these groups [4]. This may lead to inefficient performance at work and also greater susceptibility to infection from those being treated.

Experimentally-induce URTIs

Initial research on experimentally-induced URTIs, was conducted at the MRC Common Cold Unit, UK, and a list of psychological studies conducted at the MRC Common Cold Unit is shown in table 1.

Table 1: Psychological studies of stress and experimentally-induced colds.

Authors	Title	Date of publication
Cohen S, Tyrrell DAJ, Smith AP [5].	Psychological stress in humans and susceptibility to the common cold.	1991
Cohen S, Tyrrell DAJ, Russell M, Jarvis MJ, Smith AP [6].	Smoking, alcohol consumption and susceptibility to the common cold.	1993
Cohen S, Tyrrell DAJ, Smith AP [7].	Negative Life Events, Perceived Stress, Negative Affect and Susceptibility to the Common Cold.	1993
Cohen S, Doyle WJ, Skoner DP, Fireman P, Gwaltney J, et al. [11].	State and trait negative affect as predictors of objective and subjective symptoms of respiratory viral infections.	1995
Cohen S, Line S, Manuck SB, Rabin BS, Heise E, et al. [12].	Chronic social stress, social status and susceptibility to upper respiratory infections in nonhuman primates	1997
Cohen S, Doyle WJ, Skoner DP, Rabin BS, Gwaltney JM Jr. [13].	Social ties and susceptibility to the common cold.	1997
Cohen S, Frank E, Doyle WJ, Skoner DP, Rabin BS, et al. [14].	Types of stressors that increase susceptibility to the common cold in healthy adults	1998
Cohen S, Doyle WJ, Skoner DP. [15].	Psychological stress, cytokine production, and severity of upper respiratory illness.	1999
Cohen S, Doyle WJ, Turner RB, Alper CM, Skoner DP [16].	Childhood socioeconomic status and host resistance to infectious illness in adulthood.	2004
Cohen S, Alper CM, Doyle WJ, Treanor JJ, Turner RB [17].	Positive emotional style predicts resistance to illness after experimental exposure to rhinovirus or influenza A virus	2006
Doyle WJ, Gentile DA, Cohen S [18].	Emotional style, nasal cytokines, and illness expression after experimental rhinovirus exposure.	2006
Janicki-Deverts D, Cohen S, Doyle WJ, Turner RB, Treanor JJ. [19].	Infection-induced pro-inflammatory cytokines are associated with decreases in positive affect, but not increases in negative affect.	2007
Doyle WJ, Casselbrant ML, Li-Korotky H, Cullen Doyle AP, Lo C, et al. [20].	The interleukin 6 -174 C/C genotype predicts greater rhinovirus illness.	2010
Cohen S, Janicki-Deverts D, Doyle WJ, Miller GE, Frank E, et al. [21].	Chronic stress, glucocorticoid receptor resistance, inflammation, and disease risk.	2012
Cohen S, Janicki-Deverts D, Turner RB, Casselbrant ML, Li-Korotky H, et al. [22].	Association between telomere length and experimentally induced upper respiratory viral infection in healthy adults	2013
Cohen S, Janicki-Deverts D, Turner RB, Marsland AL, Casselbrant ML, et al. [23].	Childhood socioeconomic status, telomere length, and susceptibility to upper respiratory infection.	2013
Cohen S, Janicki-Deverts D, Turner RB, Doyle WJ. [24].	Does hugging provide stress-buffering social support? A study of susceptibility to upper respiratory infection and illness	2015
Prather AA, Janicki-Deverts D, Hall MH, Cohen S. [25].	Behaviorally assessed sleep and susceptibility to the common cold.	2015
Cohen S, Janicki-Deverts D, Doyle WJ. [26].	Self-rated health in healthy adults and susceptibility to the common cold.	2015
Janicki-Deverts D, Cohen S, Turner RB, Doyle WJ. [27].	Basal salivary cortisol secretion and susceptibility to upper respiratory infection.	2016
Miller GE, Cohen S, Janicki-Deverts D, Brody GH, Chen E. [28].	Viral challenge reveals further evidence of skin-deep resilience in African Americans from disadvantaged backgrounds.	2016
Janicki Deverts D, Cohen S, Doyle WJ. [29].	Dispositional affect moderates the stress-buffering effect of social support on risk for developing the common cold	2017
Murphy MLM, Cohen S, Janicki-Deverts D, Doyle WJ. [30].	Offspring of parents who were separated and not speaking to one another have reduced resistance to the common cold as adults.	2017
Prather AA, Janicki-Deverts D, Adler NE, Hall M, Cohen S. [31].	Sleep habits and susceptibility to upper respiratory illness: the moderating role of subjective socioeconomic status.	2017

The results of the first large scale study [5] showed that those with high overall stress scores were more likely to develop colds than those reporting lower levels of stress. These effects were due to increased susceptibility to infection rather than a greater likelihood of developing symptoms after infection. The effects of stress were not due to health-related behaviours, although subsequent analyses [6] showed that smoking increased both the risk of infection and illness, and a small amount of alcohol consumption reduced symptom severity, possibly due to anti-inflammatory effects. Other analyses showed that different aspects of stress influenced different parts of the disease process. Perceived stress and negative affect increased the likelihood of infection, whereas negative life events were associated with greater symptom severity [7].

Many of the results from experimentally-induced URTI studies have been replicated in research on naturally-occurring illnesses [8,9]. In addition, a series of studies (the Pittsburgh studies) continued to examine experimentally-induced colds (for a review, see [10], a list of studies [11- 31] is given in table 1]). This research showed that chronic stress was the key risk factor, especially stress due to job insecurity and lack of social support. These effects could not be attributed to personality or health-related behaviours, although these latter factors had independent effects on the disease outcomes. The research also aimed to identify the underlying biological mechanisms linking stress and URTIs. Most of the traditional explanations of health-effects of stress (e.g. changes in health-related behaviours; neuroendocrine effects) could not account for the obtained associations. One explanation [32] suggests that chronic stress interferes with the immune system's ability to respond to hormonal signals that turn off pro-inflammatory cytokines. The immune system then over responds and this prolongs and increases the symptoms of the URTI. Chronic stress increase the glucocorticoid response (GCR), and GCR

reduces the sensitivity of immune cells to the glucocorticoid hormones that normally turn off the inflammatory response. Results confirm that stress increases GCR and GCR is associated with the likelihood of getting a cold and the production of more pro-inflammatory cytokines (TNF-alpha, IL-beta and IL-6).

Stress, vaccination and stress management

There are two other areas that have come from stress research that are relevant to COVID-19. The first is related to vaccination and comes from studies of influenza vaccination. Vaccination is an important strategy for reducing the risk of viral infections but not everyone shows an increase in antibody levels after being given the vaccine. Meta-analysis reveals a negative association between stress and antibody production [33]. All of these results suggest that it is highly desirable to prevent or manage stress in order to reduce URTIs. One study [34] investigated the effects of stress management and relaxation on reported URTIs in a 13 week period. The intervention had no effect on the number of URTI episodes but the length of the colds was shorter and salivary IgA increased. The symptom reduction was still apparent at a 12 month follow up.

Effects of URTIs on behaviour

Stress and infection represents one of the branches of psychoneuroimmunology, where the brain and behaviour influence the immune system. The relationship between the brain and the immune system is bi-directional, and the next section is concerned with the effect of URTIs on cognition and mood. Again, the major body of research on this topic has come from studies of experimentally-induced colds and influenza, although many of the results of such studies have been confirmed in research on naturally-occurring URTIs (see [35] for a review – a list of studies [36-42] is given in table 2).

Initial studies demonstrated that both colds and influenza were associated with an increase in negative mood. The effects of colds and influenza on cognitive performance were slightly different, with colds being associated with psychomotor slowing and influenza with impaired attention. Effects were not restricted to the time the person was symptomatic but were observed in the incubation period, with sub-clinical infections, and after symptoms had finished. The effects of influenza could be mimicked by giving volunteers an injection of alpha interferon. Studies with naturally-occurring colds showed that the performance impairments could be reduced by caffeine or by a drug (Idazoxan) which increased the uptake of central noradrenaline. It was found that URTIs not only had direct effects on behaviour but made the person more sensitive to other negative influences (fatigue; noise or alcohol). The early studies used artificial computer-based cognitive tasks but later research showed that simulations of real-life activities, such as driving, demonstrated impaired performance when the person had an URTI.

The research described in this section may be highly relevant to the health and safety of individuals during the COVID-19 pandemic. The negative impact on behaviour may occur at level of the person with the infection or an infected healthcare professional treating a patient. As well as the direct effects of the infection, people with COVID-19 may be more sensitive to factors which they could normally cope with when healthy. Safety critical activities are clearly the greatest concern, but changes in mood and functionality will also reduce the quality of life of individuals going about everyday activities. There is also neurological evidence [43] that COVID-19 may have much more severe CNS effects than most URTIS and this is in line with the more extreme medical outcomes, such as the increased mortality, associated with the disease.

Conclusion

The aim of this article is to draw attention to prior research which is relevant to COVID-19 but has received little attention in current discussions. The changes in mental health associated with many aspects of the pandemic will be widespread and have a huge impact on quality of life and healthcare. These may also perpetuate the pandemic. Behavioural effects will always be considered minor relative to clinical symptoms, but their effects on safety and wellbeing are likely to be frequent and widespread. Further research on these topics in the context of COVID-19 is now required, and dissemination of past research provides the basis for future investigations.

Table 2: Psychological studies of effects of experimentally-induced colds and influenza on behaviour carried out at the MRC Common Cold Unit, Salisbury, UK.

Authors	Title	Date of publication
Smith AP, Tyrrell DA, Coyle K, Willman JS. [36].	Selective effects of minor illnesses on human performance	1987
Smith AP, Tyrrell DA, Al-Nakib W, Coyle KB, Donovan CB, et al. [37].	Effects of experimentally-induced virus infections and illnesses on psychomotor performance.	1987
Smith AP, Tyrrell DA, Al-Nakib W, Coyle KB, Donovan CB, et al. [38].	The effects of experimentally-induced respiratory virus infections on performance.	1988
Smith AP, Tyrrell DA, al-Nakib W, Barrow PG, Higgins PG, et al. [39].	Effects and after-effects of the common cold and influenza on human performance	1989
Smith AP, Tyrrell DA, Barrow GI, Coyle KB, Higgins PG, et al. [40].	The effects of experimentally induced colds on aspects of memory	1990
Smith AP, Tyrrell DAJ, Barrow GI, Higgins PG, Willman JS, et al. [41].	Mood and experimentally-induced respiratory virus infections and illnesses.	1992
Smith AP, Tyrrell DA, Barrow GI, Higgins PG, Bull S. [42].	The Common Cold, pattern sensitivity and contrast sensitivity	1992

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