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Distorted Time Perception Amongst Health Workers Treating SARS CoV-2 and the Repercussions on their Lives and Individual Performance

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Today's emergency and the forgotten problem

During the COVID-19 health emergency, there has been a lot of discussion regarding what should be done, unfortunately often in contradictory terms, while little has been said about the psychological, emotional and cognitive problems experienced by the health workers involved, particularly as regards the repercussions on their daily lives and individual performance.

Being hailed as heroes has not made it easier for them to express their psychological difficulties during this time of uncertainty: the stress of shift work and new treatment conditions (combined with continuous and sometimes inconsistent reviews of working practices) aggravate the enormous emotional burden of dealing with the suffering and high mortality rates of patients, with the highly isolated circumstances in which they work, often combined with a keen sense of impotence.

The sheer physical effort and pain caused by the use of PPE (Personal Protective Equipment), the death of colleagues, the fear of death and of infecting one's relatives and partners has made their daily lives even more emotionally challenging.

The new SARS CoV-2 Coronavirus

Coronaviruses are a large group of respiratory viruses known to cause illnesses that range from the common cold right through to serious respiratory syndromes. Common in many animal species, the main cells they target are those of the respiratory and digestive tract. On rare occasions, they can infect human beings and spread through the population by jumping the species barrier (spill over).

In December 2019, a new type of viral pneumonia was flagged up by the Chinese health authorities in the city of Wuhan (Hubei province, China). In January 2020, a pool of scientists from the International Committee on Taxonomy of Viruses (ICTV) found this new virus to be very similar to the one that had previously produced SARS, thus calling it 'Severe Acute Respiratory Syndrome Coronavirus 2' (SARS-CoV-2). The following February, the World Health Organisation (WHO) in turn called the associated disease COVID-19 (where CO stands for Corona, VI stands for virus, D for disease and 19 indicates the year the illness was first detected).

What we are dealing with here is a highly infectious disease, to the point where it has rapidly reached the level of a pandemic; a disease that found most countries unprepared, with a high number of hospitalised cases and mortality rates that probably vary depending on the healthcare system, though they are in any case fairly high.

The healthcare system's response and the way healthcare workers have adapted

The sudden impact of an unprecedented epidemic that was initially underestimated has resulted in unexpected organisational changes throughout the national health service, which was already suffering from a lack of equipment and human resources.

These changes have sometimes required the complete transformation of entire hospitals and the implementation of new healthcare networks. Health workers (doctors, nurses, healthcare assistants) have therefore been asked to rapidly adapt to new healthcare settings that are totally unlike those they are accustomed to, sometimes transferring them to different specialisations from those they were used to handling, often with demanding shifts, in circumstances that many have likened to a posting on the front line of a battle.

Such a battle is being waged against an invisible foe and an illness whose exact nature is, for the most part, still uncertain and unfathomed (there is still widespread scientific debate regarding it), a battle fought with what many have also complained is a lack of PPE.

Time perception

The ancient Greeks had different ways of considering the concept of time: Kairos, meaning 'quality time', and Chronos, meaning chronological time. The former was associated with the efficacy of human action, which must be swift and depends on an approach to an unmeasurable length of time that is however 'crucial' in unexpected and unusual circumstances.

In contrast, Einstein believed that the distinction between past, present and future is a mere, though persistent illusion. Nevertheless, the perception of time is, in any case, an essential aspect of daily life, and the series of actions that take place at the same time every day (eating, sleeping, etc.) is a condition that allows us to plan more complex activities (e.g. social relationships, work, conceptualisation, planning); it is an entirely personal perception of time that is, however, significantly influenced by one's physical and emotional surroundings [1].

The neuropsychological aspects of our sense of time

Our perception of time is a complex function based on an extensive strategy that involves a number of different nervous structures. All living beings with a nervous system probably have a sense of time.

As with language and the sense of space, the sense of time is produced by nerve mechanisms that evolved through natural selection. Our brain perceives the passage of time thanks to the gradually changing flow of information that reaches it.

Neuropsychological studies indicate that the frontal lobe can recognise the sequence of events that occur in time, as it can identify what conditions must exist at first in order to make subsequent conditions possible. As well as this logical sequence, our perception of time is linked to learnt temporal benchmarks (days, months, years, seconds, minutes, hours).

Time perception is, therefore, an entirely subjective experience which also involves episodic memory: a type of autobiographical memory that belongs to an individual and forms following an event, indicating the what, the where, as well as the when of that situation.

Tsao et al. [2] have shown how episodic memory is created in adjacent areas of the brain which process spatial information and which are responsible for the way we experience time. A previous study conducted by Moser and Moser [3] had already identified a group of neurons known as 'grid cells' in a section of the hippocampus, the Medial Entorhinal Cortex (MEC). These cells contain a neural map of the spatial environment that is directional and topographically organised, making it possible to encode the spatial environment.

The MEC's neurons represent time as a codification of experience, acting as a 'neural clock': i.e. organising experience into a precise sequence of different events, thus making sense of time. Indeed, neural activity doesn't actually represent the precise measurement of objective time, but rather a subjective perception of time influenced by the flow of experiences as they occur, interpreted as pleasant or unpleasant.

To conclude, the hippocampus is able to store a homogeneous representation of what, when and where.

Joe Paton et al. [4] have also shown how, by manipulating neuron activity in the deepest parts of rodents' brains, it is possible to

increase or reduce their perception of time, through the alteration of dopaminergic neurons. The more neural activity increased, the more the mice underestimated the length of time.

Distorting time perception: dopamine, emotions and the sense of being under threat

It now seems proven that time perception is a product of the dopamine produced by neurons located in the substantia nigra . Experimental research has found that the increased production of dopamine leads individuals to underestimate the passage of time, while its reduction leads to its overestimation [5].

It is a well-known fact that pleasant experiences stimulate the production of dopamine in the brain. In such cases, our inner clock accelerates, making time seem to pass more quickly. When, vice-versa, dopamine production is reduced, such as on sad occasions or during illnesses such as depression, time seems to pass more slowly.

Another peculiarity is that emotions influence time perception. Particularly intense emotional stimuli can lead an individual to become entirely unaware that time has gone by.

In some circumstances, the difficulty of judging how much time has passed during an activity makes us appreciate that same activity even more, as it seems able to capture our attention to the point where we are 'distracted' from our usual temporal benchmarks.

It has also been shown how individuals exposed to a series of negative stimuli, using different sensory modalities as well, can have a distorted sense of time [6], which generally tends to give them the impression that time has stood still, slowing it down to the point where an individual has the distinct sense of expansion known as 'time dilation' [7,8].

Thus threatening or negative stimuli can dilate time perception, perhaps even activating a physiological mechanism that encourages analysis, concentrating our attention on the threat; it has been shown how such perception can also be created by stressful social events, or 'social stressors' [9,10].

When it comes to survival, such as when facing a threat, time dilation allows prey to attempt to avoid falling victim to that threat because it amplifies all those micro-signals that warn of the possibility of death, offering prey a chance to escape from the attack.

In a crisis like ours, could time dilation prove useful to that end?

The radical external changes that have been imposed have led to an expansion of time, in that they have, to some extent, threatened the identity (physical, social, religious, national, etc.) of each and every one of us, creating a state of alarm and scaremongering that lacks any end in sight and any clear perception of the essential changes that must be implemented and their duration. Combined with a state of disorientation, we feel an imperative need to rediscover our sense of belonging (to a family, a neighbourhood, a nation, etc.), just when our proxemic space is being shielded from relationships with others.

The general impression made on our memory is that months have gone by instead of days, years instead of months. Our inner world has had to deal with radical changes that are still underway, as Piaget would say; it is trying to adjust, whilst keeping in mind its individual, family, social, working and religious make-up, in order to gradually adapt properly to the external environment [11], though it too is constantly evolving.

Time distortion-related risks for healthcare workers and prevention strategies

If we look at the language of choice at this time, the metaphor of a war erroneously leads us to a dichotomous and aggressive approach to survival, where we kill others to save ourselves and where healthcare workers seem to be the sacrificial victims of a social system that lacks responsibility and shifts the power of life or death onto their shoulders, consequently hailing them as heroes only to discredit them later just as easily.

Strategic choices that are hardly agreed, or not at all, also affect the human tool that is a doctor, nurse, obstetrician; such choices have now weighed them down with apparel that only allows us to glimpse their eyes and deprives them of their usual diagnostic methods (conversation, physical contact).

The wider community should feel obliged to safeguard this essential human tool, by strengthening protective factors (masks, mental health) whilst, at the same time, lowering risk factors so as to foster resilience and reviewing the entire system of medical treatments and living standards.

Treatment times on a COVID ward are different to those of other places where waiting times are the norm: decisions are

made quickly, without prior knowledge of the patient, and death is announced to equally unfamiliar relatives by phone.

In such circumstances, healthcare workers often feel they are living in a time warp, a true time dilation where days become months and months become years, during which the sense of impotence and the possible onset of burn-out (where energy levels diminish and mental distance increases, as well as cynicism regarding one's own work and that of others, and where working efficiency is reduced) can have a significant effect on important functions, such as concentration, memory and sleep.

All this inner distress can then expose healthcare workers to inadequate assessments and a greater risk of making mistakes and becoming infected.

Therefore, in emergency situations, the importance of organisational, relational and psychological conditions should not be underestimated; rather, measures to contain risk should be considered alongside protection methods. For example, when organising shifts, while it's important to imagine a pair of workers who reciprocally check each other to ensure they have carried out protective manoeuvres properly, it is equally important that those same workers should know each other well enough to act as assistants to each other, aiding their colleague with any problems they may have.

Similarly, the chance to express one's fears and weaknesses to someone we trust allows us to employ our energy to the task at hand with renewed vigour, allowing us to gradually change any behaviour that may not be considered adequate when handling cases. Given the lack of time available and the high emotional tension in times of emergency, wards should try to allow colleagues to express their emotional vulnerability in a cathartic moment during breaks, exchanging experiences with 'bridge-figures' who could have experience in psychological supervision. This is also useful because as colleagues go through the same experiences, communication is easier and provides a further opportunity to treat our own psychological wounds. During an emergency, shifts need to be organised in such a way that each health worker has a chance to recover from the intense physical and mental strain, so it is important to adopt a team approach guided by a system that coordinates a clear, direct and efficacious changeover phase that is reduced to the absolute minimum required [12].

Social isolation (distancing) has been the hallmark of this epidemic, and healthcare workers, above and beyond the risk of catching SARS CoV-2, risk being 'infected' by such isolation, with further damage to their mental health; and yet hardly anything has been said about their state of mind or about the adoption of strategies for psychologically protecting them when outside the workplace.

Instead, this is undoubtedly a significant problem and recent Chinese research, though lacking follow-up and limited to short observation periods, has noted common symptoms of depression (50.4%), anxiety (44.6%) and insomnia (34%) amongst personnel working on Covid-19 wards [13,14]. Nevertheless, those forced to tackle an emergency won't necessarily develop a mental illness or post-traumatic stress disorder. A great deal depends on the temporal perspective we envisage for ourselves in the future [15], how we plan our actions and our daily lives.

We have already seen how crucial time perception is in highly stressful and isolating conditions, and how timely action to address the formation of distorted subjective perception and a subjective sense of threat can lead to different planning strategies designed to avoid harmful consequences for personnel and systems.

Maintaining a daily routine, exchanging/discussing feelings and protecting people from isolation are just some of the possible solutions.

Whilst taking into account people's individual level of resilience and coping ability, we should also reinforce workers' sense of belonging to a society that accepts all feelings (without judging them), thus fostering both an awareness and acceptance of one's own limits, and trust in the creative and protective abilities of their team.

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