

Overstimulation and its consequences as a new challenge for global healthcare in a socioeconomic context

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ABSTRACT

Introduction: The dynamic development of new technologies, common access to the Internet, and globalisation allow for a source of physical and symbolic stimuli of unprecedented amounts. These stimuli lie at the bottom of objective and persistent overstimulation leading to sensory or information overload.

Materials and methods: This article is based on a review of the literature and statistical data related to the problem of chronic diseases in a socioeconomic context.

Results: Overstimulation constitutes the core area of research of this article. There is no doubt that information overstimulation leads to information stress manifesting on a physiological, emotional, psychical and behavioural level. Progression to chronic conditions leads globally to increased incidence of mental disorders and severe somatic diseases.

Conclusions: Since the range and rate of the transformation of civilisation accelerates, it should be envisaged that mental and somatic disorders underlain by information stress will take up a continuously increasing share of healthcare expenditures. This should call for the need for further medical specialisation in the field of treating the symptoms of diseases of affluence and primarily the need for preventive healthcare focused on balancing the excess stimuli. Success lies in their effective filtering and management. It seems therefore that the issue of overstimulation, including in particular information overstimulation, is one of the key challenges for public health in the near future.

Keywords: health care costs; sensory overload; information stress; civilization diseases; mental health.

INTRODUCTION

Diseases of affluence pose a serious threat to public health both in well-developed and developing countries. The main causes of death include coronary artery disease and cerebral apoplexy, which are responsible for nearly 17 million deaths each year [1]. Notwithstanding the fact that as many as 422.7 million people suffer from cardiovascular diseases (CVD) [2], almost twice as many people struggle with various mental disorders and substance addictions. The highest number suffer from anxiety disorders (264 million) and depression, for which statistical data demonstrate a continuously growing trend [3]. Though mental disorders may only temporarily destabilise the functioning of an individual, they frequently last throughout the whole life and trigger negative effects in mentally ill persons as well as in family members and the social environment. In some cases, they may even lead to suicidal behaviours [4]. Depression, which is considered the main cause of poor health conditions and disability in the world [5], is also conducive to the development of chronic somatic diseases and has a negative impact on their course and complicates treatment. In addition, depression is a common concomitant disorder in somatic and other mental diseases [6].

Total costs incurred in the EU-28 for mental diseases amounted to 600 billion euros in 2015, of which direct healthcare expenditures were 190 billion [7]. In the United States, the

projected cost of treatment of people with mental diseases and substance addictions in 2020 reached nearly USD 280.5 billion [8].

According to the WHO, the potential causes of mental disorders include individual attributes and behaviours, socioeconomic determinants and environmental factors [9]. The last 2 categories are affected by a number of variables that can be defined with a common name: deficiency factors. These apply to insufficient access or complete inaccessibility to vital goods (e.g., low income, unavailability of basic services) and lack of satisfaction of essential needs, including safety (e.g., violence, discrimination, social inequalities). Considering the contemporary cultural and socioeconomic determinants, it seems that excess has become a major issue for many countries. It covers phenomena such as overpopulation, urban development density and food overproduction as much as behaviours (e.g., overwork, abuse of psychoactive substances), physical stimuli (e.g., chemical food additives) or excess information.

The aim of the study was to review the literature related thematically to the growing problem of public health, which is overstimulation stress, in connection with the analysis of socioeconomic costs affecting the functioning of health care systems. The article also contains a set of proposals for further research, treatment and prevention of the effects of overstimulation.

MATERIALS AND METHODS

The article is based on a review of the literature and statistical data related to the problem of chronic diseases in a socioeconomic context. The available research about the problem was sought from a range of published research literature sources and by reviewing the websites of a number of national and international organizations, such as the WHO, Health Evidence Network, Health Policy Monitor and Organisation for Economic Co-operation and Development.

Priority was given to research evidence that was published more recently and that took equity considerations into account.

DISCUSSION

The term 'sensory overload' (overstimulation phenomenon) found in scientific literature is most frequently discussed with regard to specific health problems, the occurrence of which results in a deteriorated natural ability to filter the incoming stimuli. This relates to cases of, among others, posttraumatic stress disorder, autism spectrum disorder or schizophrenia [10]. Though certain authors characterise sensory overload by referring to the specifics of affecting stimuli, in most cases this term is identified with an individual, subjectively experienced insufficiency of perception [11].

The objective of this article is to study the overstimulation phenomenon understood as the generalised and objective property of the external environment, in particular of the social environment. It is specific to the presence of stimuli, quantity, volume (rate and intensity) or quality (complexity, diversity and atypicality) which exceeds the range that individuals are able to process and assimilate, leading to negative consequences. Excess stimulation may affect 1 or several senses (e.g., vision or hearing) or even systems in the body (e.g., nervous or digestive). It may derive from the natural environment or occur as an effect of the progress of civilisation.

According to the adopted hypothesis, overstimulation symptoms can be treated as identical with the symptoms of sensory overload. The latter are being characterised at all functioning stages of an individual. At the mental level, they refer to perception, focus, concentration and thinking (formal and material) disorders, difficulties in making decisions, hyperactivity, irritability, negative emotions (fear, sadness), feeling of losing control and disorientation. At the behavioural level, the symptoms manifest by evasive (e.g., withdrawal from social relationships) or aggressive behaviours, followed by an increased probability of making mistakes. Furthermore, the symptoms are correlated with physiological reactions: increased heart rate and blood pressure, faster breathing, increased muscle tension, physical anxiety, exhaustion and sleeping disorders [11, 12, 13, 14].

As we can see, these symptoms resemble an adaptive response triggered when exposed to stress, named non-specific response of the body to any demand in Tan and Yip conception [15]. In fact, overstimulation/overload symptoms are similar to stress

symptoms, which is why speaking of information stress in the case of information overstimulation is reasonable.

Dynamic development of new technologies, common access to the Internet, and globalisation are phenomena imposing a constantly increased focus which is needed to process a vast number of stimuli and absorb new knowledge. Bawden also pays attention to the changing nature of professional work requiring cooperation and communication and change of attitude towards the source of information and searching for direct access instead of using proxies [16]. In each case, the recipient of information is affected both by its linguistic (semantic) and utility (pragmatic) load, which incorporates the emotional and social context. These factors lead to information overload which – similarly to sensory overload – is a potential stressor [17]. A Reuters report published as early as at the end of 20th century reveals that managers employed in Great Britain, the United States, Australia, Hong-Kong and Singapore pointed to the Internet as a source of an information overload and attributed it with negative effects typical for chronic stress [14]. Since then, increment of information available in public space, also in Internet, has become avalanche. According to estimates, the volume of information published just in social media between 2009–2020 has increased 44 times and reach 35 zettabytes (35000⁷ bytes) [18].

Overstimulation and health – current status and future prospects

Overstimulation, including, in particular, information overstimulation, has become an increasingly common phenomenon in well-developed and developing countries. It is based on a continuous inflow of stimuli that cannot be processed by an individual due to its volume, intensity and diversity. Objective overstimulation is therefore the core cause of sensory overload in mentally healthy people, apart from the following causes identified earlier: individual hypersensitivity, untypical stimulation, ineffective adaptation or disease [12]. In this approach, overstimulation does not depend on a subjective interpretation of an individual as in the case of typical potential stressors, although Scheydt et al. point to the reasonability of referring to the negative effects of sensory overload to the relational stress theory by Lazarus [11]. It is obvious that individual persons differ in how they adapt to stimulation (including excess stimulation), which may result from their individual predispositions (e.g., type of nervous system) or training. Nonetheless, we believe that the negative effects of information overstimulation in the form of stress reaction are common and result from divergences between brain evolution and civilisation development rates. Other researchers also clearly associate information overload with a mismatch between the neuronal capacity of the human brain and human knowledge expansion rate [19].

Studies on sensory overload focus mostly on the occurrence of this phenomenon in mentally ill subjects (e.g., with schizophrenia) [20], while the available results of laboratory tests performed on healthy subjects come from the 1970s [21]. Therefore, the position taken by Scheydt and Needham anticipating the need for studies in this area and specification of both

the sensory overload definition and its diagnostic criteria [12]. At the same time, we call for comparative studies performed on a group of healthy subjects, which differ in access to information limited by the advancement of civilizational development, including access to the Internet.

The negative influence of stress on mental and somatic health has been confirmed [22, 23, 24]. In our opinion, there are grounds for treating information overstimulation as a kind of objective chronic stressor and for considering it an independent mental disorder risk factor. Persisting tension and anxiety, psychomotor agitation, insomnia, non-adaptive coping attempts (e.g., alcohol or drug abuse) being the effect of information stress may progress into clinical conditions, such as anxiety or depressive disorders or psychoactive substance addiction.

Specific lifestyles, developed as a result of the progress of civilisation and accompanying stress encourages somatic disorders and issues, decreased immunity and, in the long-term perspective, leads to the development of chronic diseases called the diseases of affluence. This is, for example, the main cause of death in the world – CVD. Stress is considered a significant risk factor in myocardial infarction and cerebral apoplexy, induced not only by bad habits or lifestyle, but, for example, by the effect of stress on endothelial function, which results in neuroendocrine regulation disorders, haemostatic lesions, increased oxidative stress and inflammatory lesions [25]. There is also evidence that mental disorders (in particular depression) increases the risk of stroke [26] and myocardial infarction [27]. Thus, a question arises whether information stress can be considered a risk factor for CVD and the development of other chronic diseases. We believe it can. The Figure 1 presents the draft-working model of relationships between overstimulation, sensory/information overload, stress (including information stress) and stress-induced mental and somatic disorders.

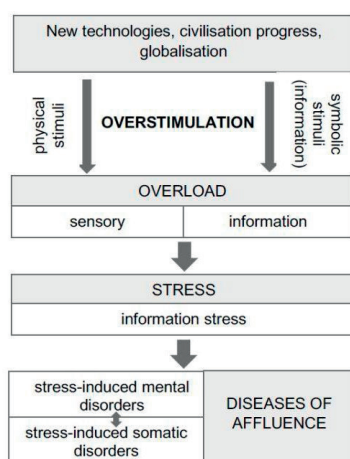


FIGURE 1. A working model of the relationship between information overstimulation, information overload, information stress and the risk of developing diseases of affluence

The hypothesis described by this model requires confirmation by wide-scale scientific studies. In the past, the issue of health-related information overload has been explored mainly with regard to the effectiveness of the performance of medical

practitioners and other healthcare professionals (among others, their decision-making processes) [28, 29], medical practitioner – patient relations [15, 30] and the impact of excess health information on patient behaviours (e.g., searching for medical information on the Internet) [31]. Despite the fact that the consequences of information overstimulation affect not only individuals and become a public issue which leads to a general cost increase in terms of diagnostics and treatment of chronic diseases, mental disorders and absence at work, the issue of information overload and its health impact has not been sufficiently studied in the scientific community. Overstimulation and its consequences for chronic diseases are among the most prevalent and costly health conditions. Nearly half of Americans suffer from at least 1 chronic condition, and the number is growing. Chronic diseases, such as cancer, diabetes, hypertension, stroke, heart disease, respiratory diseases, arthritis, obesity, and oral diseases can lead to hospitalization, long-term disability, reduced quality of life and, often, death [32].

The economic effects of chronic disease extend beyond the cost of health care. The increasing prevalence of chronic diseases reduces economic productivity through higher rates of absenteeism and poor job performance. A study by DeVol and Bedroussian, a nonpartisan think tank, found that the chronic diseases listed above cost the United States economy nearly 1.3 trillion dollars annually, including 277 billion dollars for treating chronic conditions and 1 trillion dollars in lost productivity [33].

CONCLUSION

Since the range and rate of transformation in civilisation accelerates, it should be envisaged that mental and somatic disorders underlain by information stress will take up a continuously increasing share of healthcare expenditures. This highlights the need for further medical specialisation in the field of treating the symptoms of diseases of affluence and primarily the need for effective preventive healthcare focused on balancing excess stimuli. Success lies in their effective filtering and management. It seems therefore that the issue of overstimulation, including, in particular, information overstimulation, is one of the key challenges for public health in the near future.

Since the changes created by the globalization process will affect the broadly-understood socioeconomic areas of entire societies, integrated actions should be taken to systematically mitigate the anticipated threats. Detailed policies to counteract negative consequences should therefore be well planned and implemented early enough at the level of countries or areas of highly developed societies which these changes will affect at the earliest, and then also incorporated into systems with a lower level of socioeconomic development.

REFERENCES

1. Global Health Estimates 2016: deaths by cause, age, sex, by country and by region, 2000–2016. Geneva: World Health Organization; 2018.

2. Roth GA, Johnson C, Abajobir A, Abd-Allah F, Abera SF, Abyu G, et al. Global, regional, and national burden of cardiovascular diseases for 10 causes, 1990 to 2015. *J Am Coll Cardiol* 2017;70(1):1-25. doi: 10.1016/j.jacc.2017.04.052.
3. Global Burden of Disease Collaborative Network. Global Burden of Disease Study 2016 (GBD 2016). Disability-adjusted life years and healthy life expectancy 1990–2016. Seattle: Institute for Health Metrics and Evaluation (IHME); 2017.
4. Brådvik L. Suicide risk and mental disorders. *Int J Environ Res Public Health* 2018;15(9):2028. doi: 10.3390/ijerph15092028.
5. Shrivastava SR, Shrivastava PS, Ramasamy J. Depression. A global public health priority. *Biol Med (Aligarh)* 2017;9(4):1000e127. doi: 10.4172/0974-8369.1000e127.
6. Chapman DP, Perry GS, Strine TW. The vital link between chronic disease and depressive disorders. *Prev Chronic Dis* 2005;2(1):A14.
7. OECD/European Union. Health at a glance: Europe 2018. <https://www.oecd.org/health-at-a-glance-europe-2018> (20.12.2018).
8. Substance Abuse and Mental Health Services Administration (SAMHSA). Projections of National Expenditures for Treatment of Mental and Substance Use Disorders, 2010–2020. HHS Publication No. SMA-14-4883. Rockville, MD: Substance Abuse and Mental Health Services Administration. <https://store.samhsa.gov/system/files/sma14-4883.pdf> (20.12.2014).
9. World Health Organization Risks to mental health: an overview of vulnerabilities and risk factors. Geneva. <https://www.who.int/mental-health/mhgap/risk-to-mental-health-EN> (20.12.2012).
10. Acevedo B, Aron E, Pospos S, Jessen D. The functional highly sensitive brain: a review of the brain circuits underlying sensory processing sensitivity and seemingly related disorders. *Philos Trans R Soc Lond B Biol Sci* 2018;373(1744):20170161. doi: 10.1098/rstb.2017.0161.
11. Scheydt S, Müller Staub M, Frauenfelder F, Nielsen GH, Behrens J, Needham I. Sensory overload: a concept analysis. *Int J Ment Health Nurs* 2017;26(2):110-20. doi: 10.1111/inm.12303.
12. Scheydt S, Needham I. Mögliche Kennzeichen der Reizüberflutung: eine Literaturübersicht. *Psychiatr Prax* 2017;44(3):128-33. doi: 10.1055/s-0042-118988.
13. Hall A, Walton G. Information overload within the health care system: a literature review. *Health Info Libr J* 2004;21(2):102-8. doi: 10.1111/j.1471-1842.2004.00506.x.
14. Dying for Information? An investigation into the effects of information overload in the UK and worldwide. London: Reuters Business Information; 1996.
15. Tan SY, Yip A. Hans Selye (1907–1982): Founder of the stress theory. *Singapore Med J* 2018;59(4):170-1. doi: 10.11622/smedj.2018043.
16. Bawden D. Information overload. London: Library Information Technology Centre; 2001.
17. Goldberger L, Breznitz S, editors. Handbook of stress. Theoretical and clinical aspects. New York: Free Press; 1993. p. 333-41.
18. Gantz J, Reinsel D. The digital universe decade: are you ready? <http://www.emc.com/collateral/analyst-reports/idc-digital-universe-are-you-ready.pdf> (20.12.2010).
19. Hanka R, Fuka K. Information overload and 'just-in-time' knowledge. *The Electronic Library* 2000;18(4):279-84. doi: 10.1108/02640470010346021.
20. Vlcek P, Bob P, Raboch J. Sensory disturbances, inhibitory deficits, and the P50 wave in schizophrenia. *Neuropsychiatr Dis Treat* 2014;10:1309-15. doi: 10.2147/NDT.S64219.
21. Ludwig AM. Sensory overload and psychopathology. *Dis Nerv Syst* 1975;36:357-60.
22. Pedersen AF, Bovbjerg DH, Zachariae R. Stress and susceptibility to infectious disease. In: Contrada RJ, Baum A, editors. *The handbook of stress science: biology, psychology, and health*. New York: Springer; 2011. p. 425-45.
23. Cohen S, Janicki-Deverts D, Miller GE. Psychological stress and disease. *JAMA* 2007;298(14):1685-7. doi: 10.1001/jama.298.14.1685.
24. Schneiderman N, Ironson G, Siegel SD. Stress and health: psychological, behavioral, and biological determinants. *Annu Rev Clin Psychol* 2005;1:607-28. doi: 10.1146/annurev.clinpsy.1.102803.144141.
25. Kronenberg G, Schöner J, Nolte C, Heinz A, Endres M, Gertz K. Charting the perfect storm: emerging biological interfaces between stress and stroke. *Eur Arch Psychiatry Clin Neurosci* 2017;267(6):487-94. doi: 10.1007/s00406-017-0794-x.
26. O'Donnell MJ, Chin SL, Rangarajan S, Xavier D, Liu L, Zhang H, et al. Global and regional effects of potentially modifiable risk factors associated with acute stroke in 32 countries (INTERSTROKE): a case-control study. *Lancet* 2016;388(10046):761-75. doi: 10.1016/S0140-6736(16)30506-2.
27. Rosengren A, Hawken S, Ounpuu S, Sliwa K, Zubaid M, Almahmeed WA, et al. Association of psychosocial risk factors with risk of acute myocardial infarction in 11119 cases and 13648 controls from 52 countries (the INTERHEART study): case-control study. *Lancet* 2004;364(9438):953-62. doi: 10.1016/S0140-6736(04)17019-0.
28. Klerings I, Weinhandl AS, Thaler KJ. Information overload in healthcare: too much of a good thing? *Z Evid Fortbild Qual Gesundheitsw* 2015;109(4-5):285-90. doi: 10.1016/j.zefq.2015.06.005.
29. Raymond D. Using artificial intelligence to combat information overload in research. *IEEE Pulse* 2019;10(1):18-21. doi: 10.1109/MPULS.2018.2885843.
30. Mundluru SN, Werbaneth K, Therkelsen KE, Larson AR, Santini VE. "But doctor, I googled it!": The "three Rs" of managing patients in the age of information overload. *Clin Dermatol* 2019;37(1):74-7. doi: 10.1016/j.clindermatol.2018.08.002.
31. Lee K, Roehrer E, Cummings E. Information overload in consumers of health-related information: a scoping review protocol. *JBIS Database System Rev Implement Rep* 2017;15(10):2457-63. doi: 10.11124/JBIS-RIR-2016-003287.
32. The power of prevention: chronic disease. The Public Health Challenge of the 21st Century. Atlanta: National Center for Chronic Disease Prevention and Health Promotion; 2009.
33. DeVol R, Bedroussian A. An unhealthy America: the economic burden of chronic disease, charting a new course to save lives and increase productivity and economic growth. Santa Monica: Milken Institute; 2007.