

The role of smell in medical and psychological disorders: An interdisciplinary approach

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In the past decade, many studies on olfactory function have been published. The sense of smell has been underestimated for years, until its role has been rediscovered and more deeply analyzed. In particular, researchers have investigated the importance of smell disorders in some neurological diseases, its involvement as side effect of several treatments, and its relationships with socio-psychological aspects of patients' life.

In 2017, the position paper by Hummel et al. on olfactory dysfunction gave the definitions of qualitative and quantitative smell impairments [1]. Hyposmia is a reduced ability to detect odors, anosmia is the complete inability to detect odors, parosmia is a change in the normal perception of odors, such as when the smell of something familiar is distorted, or when something that normally smells pleasant now smells foul. Phantosmia is the sensation of an odor that is not there [2].

Although olfactory alterations are increasingly recognized, their true incidence across the world is not clear. The prevalence of functional anosmia is approximately 5% of the general population worldwide [1]. Major population studies were mainly conducted in developed countries: the prevalence of self-reported olfactory dysfunction was 27% in Australia, 24.5% in USA, 19.4% in Spain, 19.1% in Sweden, and 4.5% in South Korea [3]. Epidemiologic studies about smell disorders in developing countries are still lacking. Olfactory dysfunction could be conductive, sensorineural, or central. Conductive alterations are related to blockage of odourant transmission to the olfactory neuroepithelium, due to sinonasal pathologies like turbinate hypertrophy or nasal polyps. Sensorineural disorders are usually related to infectious or traumatic damage to the olfactory neuroepithelium. Finally, central causes of smell altera-

KEY WORDS: Nervous system diseases; olfaction disorders; olfactory perception; quality of life; public health; smell.

tions result from the damage of the olfactory processing pathways of the central nervous system, such as neurodegenerative diseases [1]. Olfactory testing includes subjective, psychophysical, and objective evaluations [4]. In particular, electrophysiological studies and magnetic resonance imaging, which are very expensive, are emerging as diagnostic and research tools.

For decades the medical community underestimated the importance of the sense of smell due to the perceived subtle effects of olfactory dysfunction and to the lack of treatment options. However, an increasing evidence shows that olfactory alterations can affect quality of life, through environmental and social anxiety, food and weight disturbances and depression [5]. Furthermore, other studies connect smell to major health outcomes, including neurodegenerative disorders [6]. Therefore, it is important to investigate and treat olfactory dysfunction when possible.

Concerning neurodegenerative disorders, smell impairments are often observed in Parkinson's and Alzheimer's diseases [7]. Functional imaging studies showed a reduced activity of the hippocampus and amygdala in response to odourous stimuli in patients with Parkinson's disease compared with healthy controls. Moreover, olfactory dysfunction frequently precedes motor and cognitive symptoms [8]. Therefore, the functional evaluation of smell disorder has increased in the last years, using olfaction as a clinical marker for the characterization of prodromal stages of neurodegenerative diseases. Further studies

are however needed for an early treatment in order to increase the patients' quality of life [9] and to reduce the direct and indirect costs for the healthcare systems.

Furthermore, the psychophysical evaluation of olfactory impairments associated with some treatments, such as radiotherapy and chemotherapy, and with several types of rhinitis could help address patients' complaints, and increase the patient's quality of life [10, 11]. A list of potential causes of smell disorders is showed in Table 1 [12].

There are only limited treatments available for smell disorders. A proven effective treatment is only available where nasal illnesses causes the smell disorder and consists of surgical treatment (endoscopic sinonasal surgery) and the application of corticosteroids [12, 13]. With regards to surgical and also non-surgical treatments, the so-called olfactory cleft disease is particularly difficult to treat, because it is needed isolating swelling in the olfactory cleft area [14].

Finally, smell is fundamental for social life and interaction with other people. Anosmia leads to some disturbances in food enjoyment, detecting harmful food and smoke, and to some extent in social situations and working life. The majority of individuals deal well and manage those restrictions with appropriate coping strategies. However, some patients express a noticeable reduction in quality of life and develop mental health impairment and depression [4]. A psychological assessment of these patients should not be disconnected by an olfactory evaluation aimed at treating

Competing interests - none declared.

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Cite this article as - Riva G. The role of smell in medical and psychological disorders: An interdisciplinary approach. *J Health Soc Sci.* 2019;4(3):301-304

DOI 10.19204/2019/thrl2

Received: 15/10/2019

Accepted: 27/10/2019

Published: 15/11/2019

Table 1. Main causes of smell disorders.

Aging
Trauma
Viral infections
Nasal diseases, such as sinusitis or nasal polyposis
Neurological diseases, such as s Parkinson's disease or Alzheimer's disease
Drugs, including some antibiotics
Radiation for head and neck cancer

smell alterations whenever possible.

In conclusion, the increasing evidence of the important role of the sense of smell in many medical and psychological disorders could negatively affect social and working life of people of all social and economic strata, and, therefore, be relevant to public health field. Therefore, further research should assess the prevalence of olfactory disorders both

in developed and developing countries and should identify adequate treatments and less expensive diagnostic tools. An interdisciplinary approach to address this issue is further needed.

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Editorial Board Member of the
Journal of Health and Social Sciences*

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