

Credible Roles of Bioengineering and Social Welfare: The Case of Post Covid-19 Social Anxiety and Other Nuances

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Abstract

Social anxiety has become a chronic mental illness where people experience many symptoms related to social anxiety issues and it affects their daily social interactions. Current times have also witnessed the impact of Covid-19 in this context. Society has faced anxiety and fear, due to medical and social reasons. A developed self-awareness has come forward. Different types of mechanisms have been identified to cure social anxiety. Along with talk therapy and the use of antidepressants, bioengineering has become central to trying to boost people's confidence. The article discusses basic concepts and presents recent developments in this field. Various tools, technological applications have been presented to improve the situation.

Keywords: Social anxiety; Mental health condition; Social interactions; Covid-19; Self-consciousness; Bioengineering; Bio-medical technologies applications.

INTRODUCTION

Social Anxiety and Current Scenario

Social anxiety can be defined as “a fear that does not go away and affects everyday activities, self-confidence, relationships and work or school life”.¹ People affected with this disorder feel anxious before, after and during any social event. While usually chronic, coping mechanisms and psychiatric help can enable people to reduce the extent of the disorder. The symptoms of this disorder are fluid and may fluctuate depending on the phase of patient's life. While short-term social security may

be gained by suppressing or avoiding the event, it is necessary to gain exposure to overcome this issue. Even the Covid-19 has created tremendous issues in social anxiety and methods to overcome. Jefferies and Ungar (2020)² conducted a study to showcase that this disorder is prevalent for young adults who may fail to identify these symptoms they experience. Various symptoms^{1,3} are given as:

- Suffering from panic attacks, which are short bursts of stress and other mental problems.
- Anxious by normal events, such as conversations over phone/ in-person, working, meeting strangers etc.
- Averting from social events involving group meetings and eating at gatherings.
- Afraid of criticism and lacking self-esteem.
- Often showcases signs such as sweating, palpitations or sickness.

Most people suffering from social anxiety are afflicted with other issues such as depression and other mental problems.

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THE CATEGORIZED SYMPTOMS

Emotional and behavioral symptoms

Some symptoms of this disorder are

- Afraid of negatively evaluated social events
- Fear of interacting with strangers
- Afraid that others will see the anxiousness
- Occurrence of sweating, trembling or shaky voice
- Social exclusion and fear of embarrassment
- Anxiety due to anticipation of some event or problem
- Hoping only negative outcomes from social events

Physical Symptoms

The physical symptoms in this disorder involve various aspects such as blushing, sweating, fast heartbeat, muscle tension, upset stomach or nausea, feeling breathlessness, dizziness or light headedness, along with the blank sensation in mind.

TREATMENTS FOR SOCIAL ANXIETY

Social anxiety can be treated through various means such as:

- Consulting a therapist for Cognitive Behaviour Therapy to identify and correct incorrect behavior patterns.
- Using CBT-based books or therapist support, also known as Guided self help.
- Using Antidepressant drugs such as sertraline or escitalopram. However the patient is usually older than the age of 15.

MODERN LIFESTYLE, SOCIAL MEDICINE AND BIOENGINEERING

After initiation in France and Germany in 1848, social medicine has been accepted as a medical specialty and has expanded dramatically. A central belief states that social and economic condition of the subject have a diverse effect on disease, and it must be studied. To improve the ease of social medicine, it must be introduced in colleges as 'preventive and social medicine' instead of just 'preventive medicine', and to alter the contents

suitably.⁴ 19th century brought industrialization and urbanization at an immense rate, leading to social problems in European countries such as low-wage working, deplorable working environment, disease, etc. Within the first 3 decades of 19th century, classical medicine was replaced by modern clinical medicine. A social revolution in France had made the physicians realize that therapeutic medicines and methods failed, and therefore social medicine was proposed instead. The French revolution in 1848 also led to the first coining of the term social medicine. Man is a social animal, hence health is factored not by just biological but as well as social factors.

The academic aspects of social medicine can be summarized as

- The population's health concerns the social health directly.
- Conducting scientific research to understand the health, social situations and sanitations of the people this forms an integral part of human health.
- Undertake social and medical measures to prevent and treat diseases.

Various fields have now emerged from social medicine, such as social psychology, population health, and many more.

Definition of social medicine⁵: "Organized investigation of social, genetic, and environmental factors influencing human disease and disability and promotion of methods of prevention of disease and health measures protective of individual and community". Social medicine in simple words is the utilization of other branches of science to evaluate the health of community and prevent problems. Its goals are simply to protect the population's health⁶ and can be elaborated as:

- Evaluate the population's health and development.
- Explore new methods to better health and reduce disease and other impediments.
- Provide medical facilities for the entire population.
- Manipulate the population's death and birth rate.
- To assess the health of the population and its development.

To link different social and biomedical aspects around the major theme of community health, the scientific community has been working a framework

that encompasses social and environmental elements of health and their effects at various levels of analysis.⁷ This type of interdisciplinary research work is necessary for the future in biomedicine and bioengineering. This would provide the interaction between lab created tools to facilitate and work within the realities of people's everyday lives.

Biomedical engineering has a profound effect on health care and our information in medicine and biology. The research and commercialization of this field can be heavily improved through regulation and research funding policies. Society may benefit as well from these innovations. This combination of biomedical engineering and society should be communicated amongst scientists, public, engineers, etc.⁸ Scientists and engineers must be involved in macroethical education to inform how science, engineering and society interact with each other and can benefit each other. The cycle of how engineering and scientific research and innovations benefitting the society is how we can understand the continuous application of contributions that bioengineering has made to the society. Hence, the scientists and engineers must rethink their beliefs about the attributes of science and engineering in society.⁹

BIOENGINEERING RESEARCH AREAS

The various subject fields are ever evolving and range from biological engineering, where the subjects are different microbes such as viruses, fungi etc to biomedical engineering, where engineering principles are applied to improve human health, and biomaterial engineering where engineering is used with therapeutic procedure to improve machines.¹⁰

- Synthetic Biology is the field in which biological and genetic materials of the nature are reprogrammed to improve functionality to ease their use.
- Protein engineering involves manipulating protein structures and understanding so they can be created and implanted in living creatures.
- The microbiome is made up of billions of microbes that inhabit the human body and have a positive effect on human health and functioning. The microbiome consists of hundreds of trillions of bacterial and viral organisms.
- Systems biology uses mathematical functions facilitated by data collection methods to

make holistic models of biological systems.

- Bioinformatics helps in dealing with large databases with the help of computer science and advanced mathematics.
- Metabolic engineering helps to create new bioproducts by manipulating natural biosynthesis pathways.
- Neuroengineering produces new techniques and machines to investigate further the nervous system and brain, which are used to better understand the functioning and processing of these parts.

BIOENGINEERING RESEARCH GROWTH AND BIOSENSORS APPLICATIONS

In the contemporary times, it is essential for students to be trained in more than just conventional, single disciplines, and gain expertise in interlinked disciplines. For example, a student fluent in both biotechnology and computer sciences would be able to combine these two and develop applications/devices compatible in both regards. It is observed that the study from the past¹¹ attempted to showcase that interdisciplinary studies/teaching is the way of the future and marks a set trend for the time to come. Bioengineering is evolving in multiple directions due to its infusion in many domains and its immense scope created path in disciplinary interfaces. The study¹² ultimately is just a compilation of the key notes one must adhere to while conducting research in the field of bioengineering.

Since the beginning of the millennium, there have been observations of the trends of biosensor development field at the time of publication. As it stated¹³ during the beginning of the last decade enzymes were the target of most of the innovations and researches being carried out. After a long gap, another study shed some light onto the ever increasing interest of scientists in DNA based biosensors. It was discerned how modern technology, such as carbon nanotubes will eventually lead to more compact and sensitive biosensors, eventually increasing their quality to the max¹⁴, thus hinting immense possibilities. There have been indications about some future improvements that have indicated that biosensors have now evolved to a level that they can be conveniently transported within the body and act even for miniscule hormonal/elemental level fluctuations.¹⁵ So, a simple analysis of these developments over a period of time indicate that

biosensors are now moving towards being portable and adaptive¹⁶, and such that they may be used as simply as possible. Since the beginning of last two decades sheds a light on the social benefits of wearing prosthesis to replace a lost limb, and how these visual/ functional additions can help reduce/ eliminate social stress from losing a limb¹⁷ as well help in coping and psychological recovery from the event. The continued research and development on the topic of upper prosthesis elaborates on how prosthesis (specifically in the body layout of upper limbs) helped to explain how modern technology had paved the way to functionally accurate bioprosthesis. These artificial arms were capable of not just basic grabbing and visual functions but could be connected to the nervous tissue to perform a whole variety of advanced functioning.¹⁸ The gradual efforts have undergone to such an extent as to attempted to evaluate the efficiency of the techniques employed currently for developing heart prosthesis, and how new techniques could be introduced for heart valve endocarditis. The gradual develop and target centric researches have come up¹⁹ to improve the efficiency of heart valve transplants through quantitative and qualitative.

MODERN BIOLOGY AND TECHNOLOGICAL SUPPORTS

An amazing subject, Bioengineering combines healthcare with engineering.²⁰ An article by the "American Society of Mechanical Engineers" says- "bioengineers work to help improve the lives of patients^{20,21} living with various conditions in a variety of ways," this includes the development of digital tools, new software and devices that can help the health care industry, one way or the other. Innovation in this field has led to improvement in the life of patients through various inventions such as the MRI machine and dialysis machine. Some areas where bioengineering has helped the healthcare industry are:

Biomechanics: This involves the movement of the body and the processes so involved, along with the body's reaction to external pressure.

This research can be helpful in building athletic and training device.

Biomechatronics: This is the development of machines that can be operated within the human body, with the aim of bettering the life of any patient that may have lost body functions due to disability or illness.

Despite much of the research being in design

phase, many helpful inventions such as neuro-responsive prosthetics may help in improving limited movement. For example, a bionic knee helps the amputees to regain regular functioning of legs and body through an interface of software and hardware.

Biomedical electronics: This branch has led to the development of multiple devices such as CT imaging systems, ICU monitoring systems, surgical lasers and more which have immensely helped the health industry.

Tissue engineering: An article in Nature's magazine states still in infancy, this research is expected to enhance multifold the future of health care prospects as it provides alternate solutions to organ failure and related issues.²²

For instance, the American Institute for Medical and Biological Engineering (AIMBE) has recognized many of the previous, often overlooked innovations in the field of food safety and quality, pharmaceuticals etc, without which life would not have improved so well within the last few decades.²³ AIMBE²⁴ states that engineers in the medical and biological field don't handle social problems alone, and a number of professions such as trade, social welfare, corporate, etc. are instrumental in making it work. Personalized healthcare not only involves genetically matching treatment and genetically fashioned medicine, but also involves "prevention and treatment strategies" to certain populations, monitoring patient's compatibility with treatment, analyzing the relationship between a patient and an individual, finding risk factors, etc. These are in line with AIMBE's goals for "engineering solutions to Chronic Disease and Engineering Personalized Health". For the context, the second goal is to be achieved through:

- Advanced sensors for home and mobile use to manage tracking of chronic diseases.
- Information gathering for personal tracking.
- Wireless information tracking and mobile health technology.

COVID-19 ISSUES, SOCIAL ANXIETY AND ROLES OF BIOENGINEERING TOOLS

Covid-19 has caused multiple mental disorders in the world due to the social stress create such as depression, loneliness and anxiety, which lost importance due to the pandemic. However, socially related anxiety has increased due to the reduced face to face interaction,²⁵⁻²⁷ also facilitated by the usage of social media for communication. To

support the SARS studying scientists²⁸, “discovery and preclinical testing” of vaccines was accelerated as well. “Biomedical Engineering Tools for Management of Patients with COVID-19” provides bioengineering tools to facilitate Covid-19 treatment among patients and vaccine production and methods to promote positive social impact. Reverse engineering and ingenuity are used to produce instruments that would normally take months to be created, within weeks and days while keeping up with the safety standards such as sterilization benchmark declared by Medicines and Healthcare products Regulatory Agency (MHRA).²⁹

Social anxiety disorder takes a huge toll on the patient, but it's under diagnosed and the symptoms are not taken seriously, hence more research should be conducted to ensure analyzing of these symptoms in the future. A study stated that social anxiety disorders amongst teenagers and their social – demographic aspects.³⁰ A research endeavored “to determine whether passive sensor data acquired from smartphone data can accurately predict social anxiety symptom severity using a publicly available dataset”.³¹ It was observed that participants completed own assessments reports of their “social anxiety symptom severity”, etc. Further, they installed an app to collect data passively about their “movement (accelerometers) and social contact” (to track the record of incoming and outgoing communication such as calls and texts) for the two weeks period. Next, these “passive sensor data” were used to form “digital biomarkers, which were paired with machine learning models to predict participants’ social anxiety symptom severity”. The application of “smartphone sensor data” may be useful “to accurately detect social anxiety symptom severity and discriminate social anxiety symptom severity from depressive symptoms, negative affect, and positive affect”. Wearable sensors to detect close body parameters such as heart rates, blood pressure, sweat rates, etc. Sensors such as watches, bands etc can be used to provide real time data to analyze signs of social anxiety.³² A recent study showcased how biological inspirations from plants and animals could be used to make studies faster.^{33,34} It has shown that tools such as proteome, transcriptome, etc., have a positive effect on products of the pharmaceutical industry, and discussion of the tools have been also been made. There is a need for deep look into the future of pharmaceutical products through bioengineering industry.

CONCLUSION

Bioengineering tools can be utilized to provide authentic information for information in fields as horticulture, pharmaceutical compounds and more. However, despite their cheap and efficient product, a lot of moral and environmental issues may arise. As displayed, wrist sensors could provide detection for social anxiety in teenagers through psychological data collection. In the future it will be possible to detect social anxiety disorder in the preliminary stages through such wearable devices. This technology to detect anxiety disorders before they set in shall be instrumental in reducing and hence eliminating social anxiety in the future.

REFERENCES

1. Social anxiety (social phobia). <https://www.nhs.uk/mental-health/conditions/social-anxiety/>.
2. Jefferies P, Ungar M. Social anxiety in young people: A prevalence study in seven countries. *PLoS ONE* 2020;15(9): e0239133. <https://doi.org/10.1371/journal.pone.0239133>.
3. Social anxiety disorder (social phobia) <https://www.mayoclinic.org/diseases-conditions/social-anxiety-disorder/symptoms-causes/syc-20353561>.
4. Han DS, Bae SS, Kim DH, Choi YJ. Origins and Evolution of Social Medicine and Contemporary Social Medicine in Korea. *J Prev Med Public Health*. 2017;50(3):141-157. doi: 10.3961/jpmph.16.106. PMID: 28605888; PMCID: PMC5495682.
5. Social medicine definition. <https://www.merriam-webster.com/dictionary/social%20medicine>.
6. <https://www.studocu.com/bg/document/medical-university-pleven/social-medicine/social-medicine-summary/7011387>.
7. <https://petitoinstitute.gatech.edu/news/linking-biomedical-engineering-and-sociology>.
8. Flexman JA, Lazareck L. Biomedical engineering and society: policy and ethics. *Annu Int Conf IEEE Eng Med Biol Soc*. 2007;2007:6156-8. doi: 10.1109/IEMBS.2007.4353758. PMID: 18003424.
9. Bernstein MJ, Reifschneider K, Bennett I, Wetmore JM. Science Outside the Lab: Helping Graduate Students in Science and Engineering Understand the Complexities of Science Policy. *Sci Eng Ethics*. 2017 Jun;23(3):861-882. doi:

- 10.1007/s11948-016-9818-6. Epub 2016 Sep 28. PMID: 27682451.
10. <https://bioengineering.stanford.edu/research-impact/our-research-areas>.
11. Humphrey, J. D., Coté, G. L., Walton, J. R., Meininger, G. A., & Laine, G. A. A new paradigm for graduate research and training in the biomedical sciences and engineering. *Advances in Physiology Education* 2005.
12. Taba Jr, M., Jin, Q., Sugai, J. V., & Giannobile, W. V. Current concepts in periodontal bioengineering. *Orthodontics & craniofacial research*, 2005;8(4): 292-302.
13. Scheller, F. W., Wollenberger, U., Warsinke, A., & Lisdat, F. (2001). Research and development in biosensors. *Current Opinion in Biotechnology* 2001; 12(1): 35-40.
14. Teles, F. R. R., & Fonseca, L. P. Trends in DNA biosensors. *Talanta* 2008; 77(2): 606-623.
15. Shang, W., Lu, F., Sun, T., et.al. Imaging Ca²⁺ nanosparks in heart with a new targeted biosensor. *Circulation research* 2014; 114(3): 412-420.
16. Tu, J., Torrente Rodríguez, R. M., Wang, M., & Gao, W. The era of digital health: A review of portable and wearable affinity biosensors. *Advanced Functional Materials*, 2020;30(29):1906713.
17. Murray, C. D. The social meanings of prosthesis use. *Journal of health psychology* 2005;10(3): 425-441.
18. Cordella, F., Ciancio, A. L., Sacchetti, R., Davalli, A., Cutti, A. G., Guglielmelli, E., & Zollo, L. Literature review on needs of upper limb prosthesis users. *Frontiers in neuroscience* 2016; 10: 209.
19. Swart, L. E., Gomes, A., Scholtens, A. M., Sinha, B., Tanis, W., Lam, M. G., ... & Budde, R. P. Improving the diagnostic performance of 18F-fluorodeoxyglucose positron-emission tomography/computed tomography in prosthetic heart valve endocarditis. *Circulation* 2018;138(14): 1412-1427.
20. <https://engineeringonline.ucr.edu/blog/4-ways-bioengineering-has-enhanced-health-care/>.
21. <https://www.asme.org/topics-resources/content/bioengineers-are-enhancing-quality-of-healthcare>.
22. Tissue engineering. *Nat Biotechnol* 18, IT56-IT58 (2000). <https://doi.org/10.1038/80103>.
23. Hall of Fame: <http://www.aimbe.org/aimbe-programs/aimbe-hall-of-fame/>.
24. Medical and Biological Engineering in the Next 20 Years: The Promise and the Challenges. *IEEE Transactions on Biomedical Engineering* 2013;60(7):1767. <https://aimbe.org/news/Medical-and-Biological-Engineering-in-the-Next-20-Years.pdf>.
25. American Psychiatric Association, DSM-5 Task Force. (2013). (5th ed.). American Psychiatric Publishing, Inc.. <https://doi.org/10.1176/appi.books.9780890425596>.
26. D Amutha, Arockia Jenecius Alphonse A, Flora G. Covid 19 Outbreak: Effect on Society in India. *Journal of Social Welfare and Management* 2021;13(4): 101-110.
27. Surabhi Verma. COVID-19: A Rising Mental Health Crisis and an Unflagging Mental Health Issue. *Journal of Social Welfare and Management* 2022;14(2): 53-57.
28. Raimondi MT, Donnalaja F, Barzaghini B, Bocconi A, Conci C, Parodi V, Jacchetti E, Carelli S. Bioengineering tools to speed up the discovery and preclinical testing of vaccines for SARS-CoV-2 and therapeutic agents for COVID-19. *Theranostics* 2020;10(16):7034-7052. doi: 10.7150/thno.47406. PMID: 32641977; PMCID: PMC7330866.
29. Biomedical Engineers: The hidden heroes of the COVID-19 crisis! <https://www.bcu.ac.uk/health-sciences/about-us/school-blog/biomedical-engineers-the-hidden-heroes-of-the-covid-19-crisis>.
30. Nagarjun Mundinamani, Renukaraj Nagammanavar, Deelip S Natekar, Utalbasha N Dandaragi, An Explorative Study to Assess the Prevalence of Social Anxiety Disorder (SAD) and Its Determinants among High School Students of Selected High School of Bagalkot. *International Journal of Health Sciences and Research* 2022;12(1):DOI: <https://doi.org/10.52403/ijhsr.20220117>.
31. Jacobson NC, Summers B, Wilhelm S. Digital Biomarkers of Social Anxiety Severity: Digital Phenotyping Using Passive Smartphone Sensors. *J Med Internet Res* 2020;22(5):e16875 doi: 10.2196/16875 PMID: 32348284 PMCID: 7293055.
32. Shaikat-Jali R, van Zalk N, Boyle DE. Detecting Subclinical Social Anxiety Using Physiological Data From a Wrist-Worn Wearable: Small-Scale Feasibility Study. *JMIR Form Res*. 2021

- Oct 7;5(10):e32656. doi: 10.2196/32656. PMID: 34617905; PMCID: PMC8532020.
33. Surendra Sarsaiya, Jingshan Shi & Jishuang Chen. Bioengineering tools for the production of pharmaceuticals: current perspective and future outlook, *Bioengineered* 2019; 10(1): 469-492, DOI: 10.1080/21655979.2019.1682108.
34. Peters, Micah D.J., Godfrey, Christina M. RN, Khalil, Hanan, McInerney, Patricia, Parker, Deborah, Soares, Cassia Baldini, Guidance for conducting systematic scoping reviews, *International Journal of Evidence-Based Healthcare* 2015; 13(3): 141-146 doi: 10.1097/XEB.0000000000000050.
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