

# NOVESHIA: Novel Smart Health Informatics Architecture to Cater for the Emotional and Mental Wellbeing of England NHS Workers in the United Kingdom

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**Abstract.** One of the major day-to-day problems confronting NHS health workers in the United Kingdom is the one that conflicts with their emotional and mental wellness. This is because of various factors, namely, huge workloads because of higher number of patients, which currently leads to long waiting times, overstretched health facilities, understaffing, stress experienced during the recent COVID-19 pandemic, workplace abuses, bullying, harassments, discrimination, and stigmatization based on race, gender, sexual preferences, and exposure to occupational hazards, amongst others. The aim of this research is to propose a smart health informatics architecture that will be useful in promoting emotional and mental wellness among National Health System (NHS) Workers in the United Kingdom. The aim of this project was achieved through the following objectives: (i) survey of current causes of emotional and mental health challenges and needs to solve the problem, amongst NHS workers in England. (ii) designing of a web-based app to assist healthcare professionals cater for emotional and mental challenges (iii) evaluating the web-based app and (iv) proposing a novel Smart Health Architecture for emotional and Mental Wellness for National Health System (NHS) Workers in England, United Kingdom. The significance of this smart architecture cannot be over emphasized. This newly proposed smart health architecture will assist NHS staff to overcome emotional and mental health challenges, especially during, before and after major global pandemic.

**Keywords.** smart health informatics, architecture, emotional wellbeing; mental health wellness, United Kingdom

## 1. Introduction

It has been found that work-related stress can lead to mental health breakdown or emotional health challenges among NHS health workers in the UK [1]. Some NHS workers often encounter emotional and mental health challenges from time to time [1].

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Mental health is a very important aspect of human life. The productivity of workers can be enhanced when they are in a good state of health. Emotional and mental health wellbeing of health workers are essential in affecting the discharge of quality health services at workplaces [2,3].

The recent COVID-19 pandemic led to many complicated scenarios on the UK health sector. Hospital resources were in very high demands and thus stretched beyond limits [4,5]; Health workers were overworked, and many had emotional and mental health problems [4,5]. Now, Post Covid-19 pandemic era, the aftereffects of COVID-19 which led to health staff shortages resulting in some health workers changing their career paths thus placing more demands upon existing health workers, is currently affecting health workers in the UK. Such effects include work-related stress and other related consequences such as mental health challenge, emotional wellbeing challenges and psychological problems [6]. Other causes of mental and emotional challenges include workplace abuses, bullying, harassments, discrimination, and stigmatisation based on race, gender, sexual preferences, and exposure to occupational hazards [7]. Health informatics tools are very significant in managing different types of diseases. Other crucial applications of health informatics tools include: managing health challenges, conducting biomedical research, and improving health outcomes [8–13].

In this research paper, we conducted a survey on the current causes of emotional, mental health challenges amongst NHS hospital workers in the UK in this post COVID-19 pandemic era, and the type of web-application that NHS workers feel would address their emotional and mental health needs; We developed a Web-based health informatics application to cater for the emotional and mental health needs of UK NHS health workers; many of the NHS workers found our web-based application to meet their needs. We evaluated the web-based application; and finally, we proposed a Smart Health Informatics Architecture for Emotional and mental health wellbeing of NHS workers in England, United Kingdom. We believe that our proposed architecture will promote emotional wellbeing and good mental health amongst NHS health workers in the UK.

## 2. Literature Review

According to a 2013 RCN survey of 2,000 nurses employed in the NHS and the private sector 50% of the workers noted that work-related stress made them feel unwell [14]. Work-related stress is caused by excessive work-related pressure and excessive demands placed upon health workers in a hospital or healthcare environment.

According to the NHS staff survey in year 2018, 43.5% of the over 127,000 nurses and midwives reported that they were feeling sick as a result of work-related stress [15].

According to the results of the 2023 NHS National Staff survey, improvements were observed on most health and wellbeing measures. Cases of bullying, harassment and abuse experiences in the workplace slightly reduced. However, it was observed that two in five staff (40%) reported feeling unwell due to work-related stress [16].

Some of the factors that negatively affect the mental health and emotional wellbeing of UK health workers include anxiety [17] as result patients' aggression or behavior and of inconsistent policy, fear of being infected in a hospital environment, trauma due to high mortality rates within healthcare settings, guilt, and work-related stress due to increased workload and long working hours [18,19]. Other factors include bullying, harassment, and abuse experiences.

The wider implications of mental health and wellbeing is that if not properly handled, it could lead to unfulfilled health workers, sick NHS workers, stressed workers, and workers will many diverse problems. These will in turn affect the rate of productivity of health the workers.

### 3. Methodology

After applying to the Middlesex University's Department of Computer Science's Ethics Review Committee (ERC), ethical approval was granted to collate relevant data. After the ethics approval was obtained, first, we proceeded to collating relevant data.

First, after seeking the consent of human participants, an online survey questionnaire was administered majorly centered on the causes of emotional and mental challenges and other relevant health questions for NHS workers in hospitals in England. NHS health workers ranging from Nurses, Physiotherapists, medical secretaries, healthcare assistants, catering assistants, Healthcare Science Assistants, Dietetic Assistants, medical students, and medical doctors. The NHS workers were sampled across different departments such as from Surgery, Emergency, Psychiatry, pediatrics, nursing, cancer center, oncology, outpatients, trauma, AHP therapies. The ages of the participants are between 18 and 64. The survey questions in the online questionnaire focused current causes of emotional, mental health challenges amongst NHS hospital workers in the UK, and what features NHS workers are looking out for in a web-app that would address their emotional and mental health needs.

Second, we designed a web-based app to assist healthcare professionals' emotional wellness. Third, the web-app was evaluated by human participants. This was done by inviting NHS workers and providing them with access to the web-app, to participate in the testing and usage of the website. Fourth, we proposed a novel Smart Health Architecture for emotional and Mental Wellness for National Health System (NHS) Workers in England, United Kingdom.

### 4. Results

After conducting a survey on the causes of emotional and mental health among NHS workers in London, England, United Kingdom in this post COVID-19 pandemic era, our survey results produced interesting results.

As regards causes of emotional and mental challenges in workplace, First, our results revealed that out of the 20 NHS workers that completed the questionnaires, eight (8, 40%) of them identified workplace workload, lack of energy, and lack of time as primary sources of stress or emotional challenges for them within the NHS. Three (3, 15%) of them identified that conflicts with their peers at work, problems with colleagues / unhealthy environment in office as their primary sources of stress or emotional challenges. Four (4, 20%) admitted that patients' health condition or status caused stress or emotional challenges for them. Two (2, 10%) of them mentioned that personal issues, lack of energy and lack of physical fitness are responsible for stress and emotional challenges. One (1, 5%) of them mentioned that sickness of colleagues causes stress and emotional challenges. See Figure 1.

Second, As regards the type of web-application that NHS workers felt would address their emotional and mental health needs; Thirteen (13, 65%) of the participants agreed

that it is very important for the emotional and mental wellness Web-app to have an appealing and emotionally engaging design.

Third, As regards the key challenges or needs NHS workers believe the app should address and consider certain things useful to them, Six (6, 30%) mentioned that the web-app should address Mental and physical well being challenges, should be easy to navigate, quick and efficient to provide help. Ten (10, 50%) of the participants agreed that the web-app should have integrated calming music, practical workout session modules. Seven (7, 35%) of the participants agreed that the web-app should be able to communicate with people. 11(55%) indicated that the emotional and mental wellbeing web-app should provide an Interactive emotional support. 12(60%) indicated that the emotional and mental wellbeing web-app should provide chat-based emotional support.

Based on the initial survey results received from the participants, we developed the Web-based application called Untangled NHS (See here and Figure 2a and Figure 2b for the web-based logo and application [20] (Home | NHS Well, synorabarretto.wixsite.com), to promote and cater for the emotional and mental health needs of NHS UK health workers. We developed a navigation model for the web-based mental health application (see Figure 3). Our model consists of the design templates for the home page of the web-application, which consists of different sections. The sections are as follows: (i) relaxing techniques – which consists of useful health tips and contents on deep breathing, muscle relaxation, meditation, listening to music, yoga, meditation, disconnecting from screens, choosing a hobby (ii) managing impolite interactions – which consists of the following methods – deep breathing, responding calmly, taking time out, displaying empathy, taking time out, and setting boundaries, amongst others (iii) how to manage our emotions and (iv) helpful short AI videoclips which both consists of comprehensive contents on (recognizing stressors, impact of mental health on persons, stress management, encouraging breaks, peer support, amongst others), (v) membership information and (vi) our contact details. We developed comprehensive contents for the sections within different pages of the web-application. The systems architecture of our web-application (see Figure 4) consists of a web browser as gateway by users to access our web application. The architecture has been specially designed to ensure a smooth flow of information between the front end and the back end. The front end consists of HTML, CSS, and JavaScript and the back end is driven by JavaScript.

After development, we evaluated the web-app. During the evaluation, many of the NHS workers found our web-based application to meet their emotional and mental health needs.

Fourth, we inquired if any of the 20 NHS worker participants have previously used mental health apps or platforms before, which ones and why. Fourteen (14, 70%) of them answered YES, while six (6, 30%) of them answered NO. Many of them claimed that they used it to manage stress and achieve calm and relaxation.

## Survey Results on Primary sources of stress and emotional challenges for NHS London, England workers

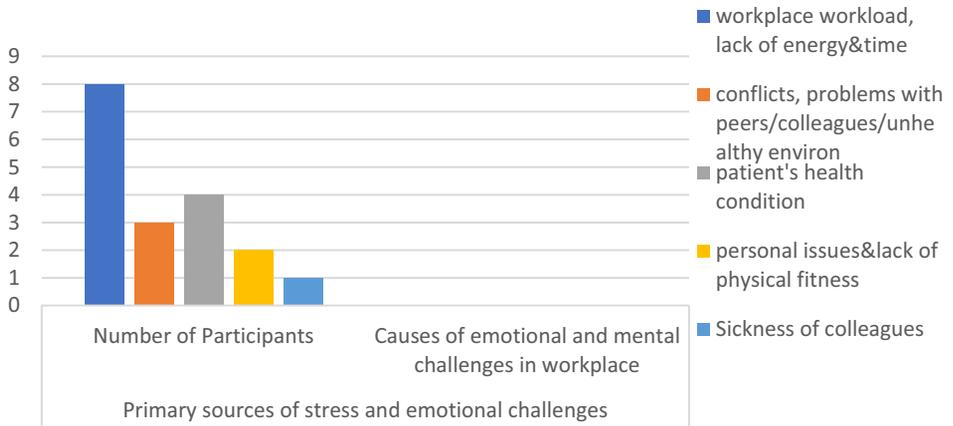


Figure 1. Survey results of primary sources of stress and emotional challenges for NHS London, England workers.



Figure 2a: Our Web-application logo.

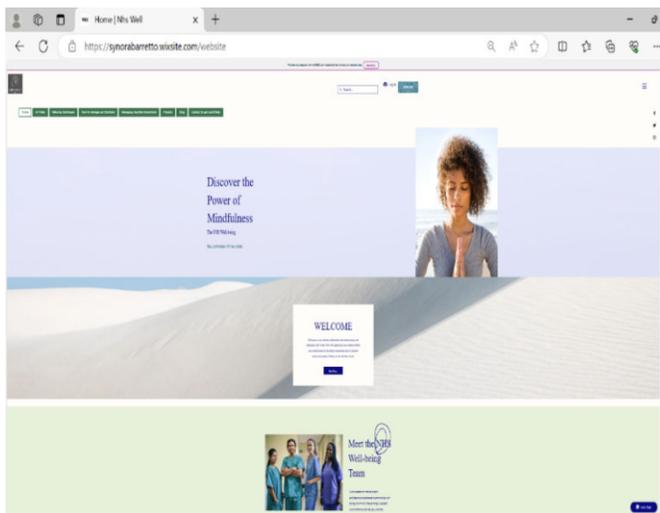


Figure 2b: Untangled NHS. Source: [Home | NHS Well \(synorabarretto.wixsite.com\)](https://synorabarretto.wixsite.com/).

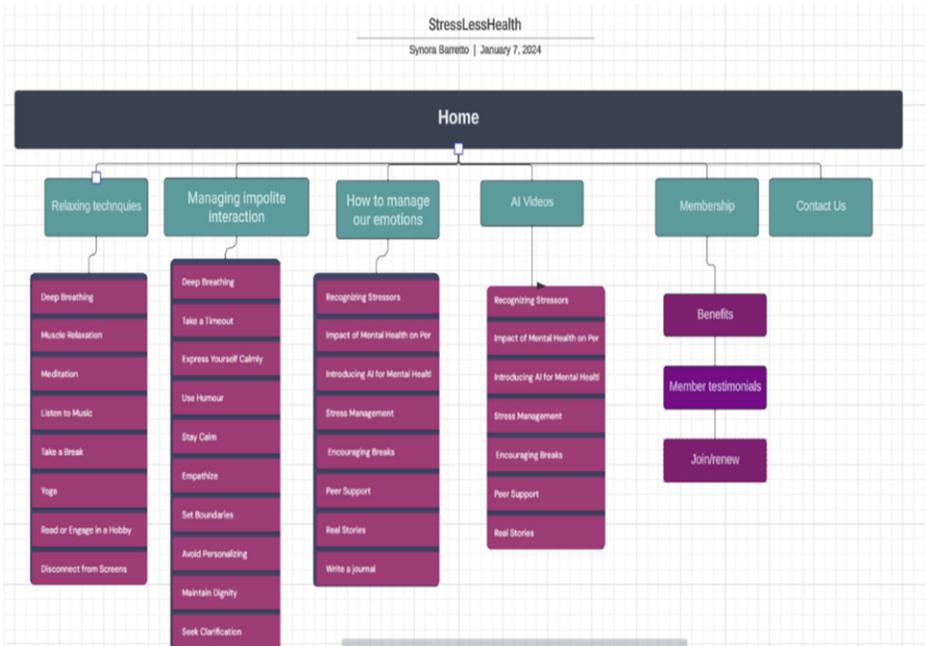


Figure 3: A navigation model for the web-based mental health and emotional well-being application.

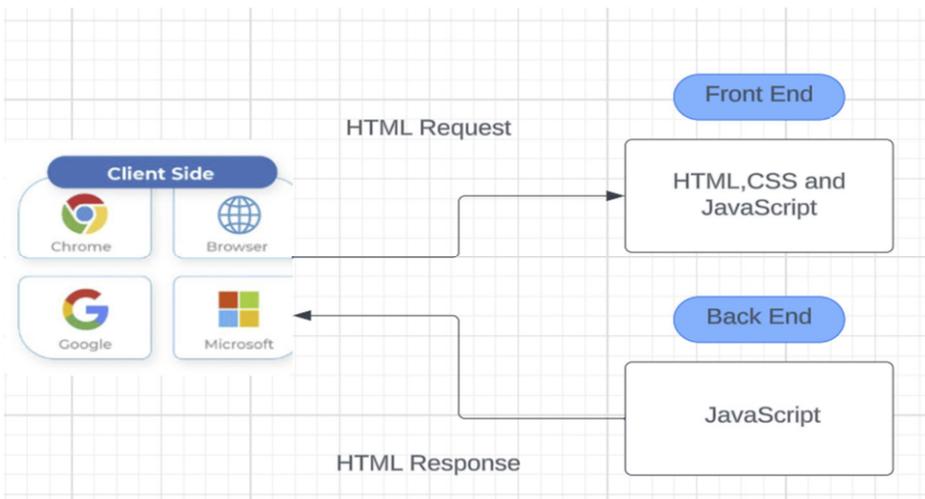


Figure 4: System Architecture of the web-based mental health and emotional well-being application.

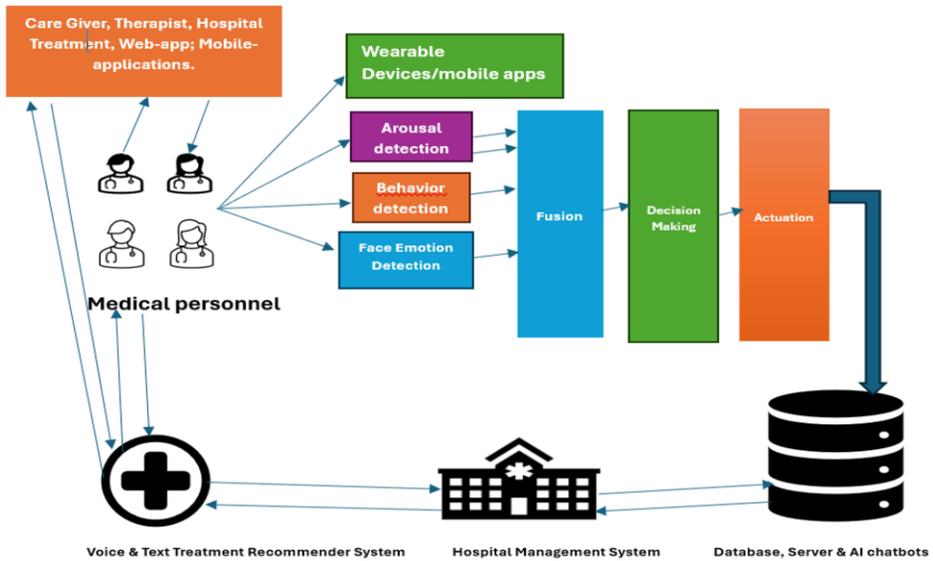
Fifth, on a scale of 1 to 10, the NHS workers rated their the clarity and simplicity of the user interface, and the overall impression of the web-based mental health wellness platform; Two (2, 10%) rated our web-app on scale of 10/10; One (1, 5%) rated our web-

app on scale of 9/10; Three (3, 15%) rated our web-app on scale of 7/10; Two (2, 10%) rated our web-app on scale of 6/10; Two (2, 10%) rated our web-app on scale of 5/10; Four (4, 20%) rated our web-app on scale of 4/10; Four (4, 20%) rated our web-app on scale of 3/10; One (1, 5%) rated our web-app on scale of 2/10 and 1/10 respectively.

Sixth, when asked what specific features the participants liked or found most appealing, thirteen (13, 65%) of them mentioned that our web-app has Interactive elements, nice color scheme and use of colors and images, easy web app navigation, informative contents, user-friendly interface, user-friendly website, and relatable images. Some of the participants were impressed by the motivational quotes at the end of some of the web-app pages, the unique concept in the web-app on emotion management, the customization of the web-app for NHS staff, and the blog section where participants can share their thoughts and emotion.

Seventh, fourteen (14, 70%) of the participants agreed that all the features of the web-app worked as expected. Twenty of the participants (20, 100%) agreed that the website appeared easy to navigate. Sixteen (16, 80%) of the participants admitted that our web-application assisted them in finding relaxation and resolving issues that were causing stress to them.

Finally, we proposed a Smart Health Informatics Architecture for Emotional wellbeing and mental health of NHS workers in England, United Kingdom (See Figure 5). We believe that our proposed architecture, if implemented by the UK Government and relevant authorities, will promote emotional wellbeing and good mental health amongst NHS health workers in the UK.



**Figure 5:** A novel smart health informatics architecture to cater for the emotional and mental wellbeing of NHS workers in the United Kingdom

The schematic depiction in Figure 5 represents a novel smart health informatics architecture that can help cater for the emotional and mental health of NHS workers in England. It's a distributed architecture that will help to detect and regulate emotion in a smart healthcare environment. It also helps to cater for mental health needs. The

architecture caters for diverse NHS workers by race, and gender. Facial, behavioral, arousal, wearable devices detect and take various readings from the health workers. The data goes through fusion, decision-making and actuation processes. The outcome of these processes gets stored in a central database with servers and AI chatbots. A central Hospital management system communicates with the database, servers, and AI chatbots. The data obtained is transferred to the voice and text treatment recommender system. This is communicated with the concerned medical personnel and the specialists to treat the medical personnel. The medical personnel go to see the specialists or receive treatments based on the recommendations of the voice and text recommender system. Security features can also be built into the architecture from one node to the other. This will help guarantee secure data transfers and data preservation.

## 5. Discussion

Results obtained from this research revealed that 90% of the participants recognized one or two factors responsible for emotional and mental health challenges. This shows that the NHS workers are aware of the happenings in their workplaces. Furthermore, based on the survey results, 65% of the NHS worker agreed that it is very important for the emotional and mental wellness Web-app to have an appealing and emotionally engaging design. This reveals that NHS workers value emotional and good mental health at workplaces.

While 55% of the NHS workers indicated that interactive emotional support should be provided by the web-app, 60% admitted that chat-based web-app emotional support would be preferred.

Among the participants involved in the evaluation of our web-app, 70% admitted that they have previously used emotional and mental health app to manage stress and achieve relaxation. This result shows that more than 60% of the health workers are managing work-related stress.

Over 50% of the NHS workers were satisfied with the clarity, simplicity, and overall impression of our web-based application.

There are important features about our web-application that makes it attractive to health workers willing to manage stress. These have been highlighted in the results section. Functionality, user-friendliness, ease of navigation are some of the important features a web application or mobile application must have for effective delivery of services.

Many of the participants agreed that the web-app met their expectations. However, when asked what areas of the web-app need improvement, 50% of the participants responded by mentioning that more mental health resources are needed, language options should be incorporated, mobile application version of the web-app should be developed, inclusion of user stories that will motivate others to use it, addition of more webinars to the web-app, the inclusion of breathing exercises, section in the web-app that help others on how to identify people who are depressed and how to help them, and features to schedule with mental health professionals.

## 6. Conclusion

In conclusion, emotional and mental health challenges can be solved by exploring and adopting the knowledge of AI-powered smart health informatics tools. Emotional recognition and smart health devices can be integrated into NHS workers workspaces, to assist NHS workers manage stress and maintain a good mental health. If this newly proposed smart health architecture, it will help proffer solutions to various mental and emotional health challenges among health workers in the UK.

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