

# Global Health Screening & Tracking Initiative

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## Goals of This Paper

To describe

- the feasibility of a health screening system based on mobile devices
- the desirability of deploying this system on a global scale
- the opportunities to participate, support, and help lead this initiative.

## Background

Critically important for public health in general, and in the case of COVID-19 in particular, are health screening and tracking methods to detect disease early enough to minimize its spread, to identify correctly the illness and its cause, to identify known and emerging signs and symptoms, and to evaluate the effectiveness of preventive measures and treatments.

## SCREENING FOR COVID-19

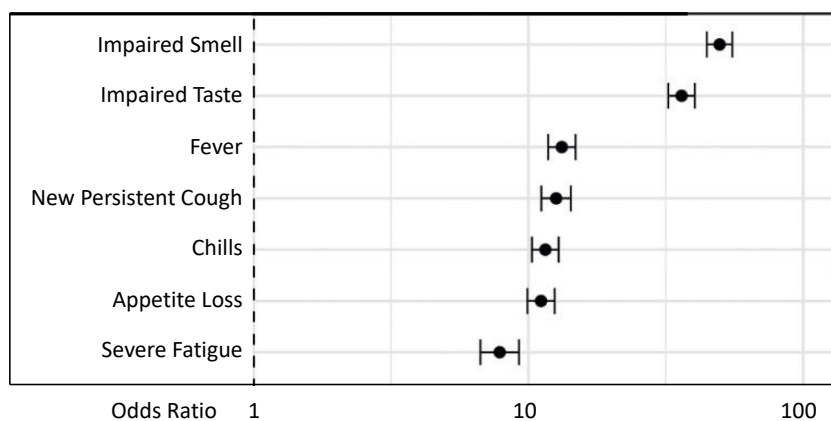
Elliott et al (2021)<sup>1</sup> showed that impaired Smell and Taste were very strong predictors of COVID-19, Figure 1.

Impairment of sense of smell and taste are not only excellent predictors of COVID-19 but also temporally precede onset of fever and other conventional signs and symptoms of respiratory illness.

Typically, infection by SARS-CoV-2, the causative organism of COVID-19, begins in the nasopharynx, frequently produces disturbance of taste and smell (likely due to damage to sustentacular cells, the cells that support and assist the olfactory

Figure 1

7 Most Predictive Signs & Symptoms of COVID-19



neurons), then spreads to infect the lungs and other parts of the body, triggering a more robust

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<sup>1</sup> Elliott, J., Whitaker, M., Bodinier, B., Eales, O., Riley, S., Ward, H., Cooke, G., Darzi, A., Chadeau-Hyam, M., & Elliott, P., (2021, September, 28), Predictive symptoms for COVID-19 in the community: REACT-1 study of over 1 million people, PLOS Medicine, <https://doi.org/10.1371/journal.pmed.1003777>

immune response, and producing a variety of signs and symptoms as a consequence of both infection and immune reaction, Figure 2.

A smell or taste stimulus will normally cause pupils to dilate via activation of the autonomic nervous system. The Pupillary Response to Olfactory Stimuli system, PROS<sup>2</sup>, measures that dilation using a mobile device, Figure 3.

To prevent spread of COVID-19, screening should ideally be performed daily before interaction with others in public or in the home. PROS screening can be done by anyone with access to an Internet connected mobile device, wherever they are, and for free. The results are objective, so no interpretation by the individual is needed. If PROS indicates the possibility of COVID-19, the individual can immediately take measures to prevent spread, such as masking, self-quarantine and obtaining definitive nucleic acid amplification testing.

Some people have impaired sense of taste or smell for other reasons, including age, nasal congestion, and neuro-degenerative diseases, among others. To recognize the rapid onset of smell and/or taste

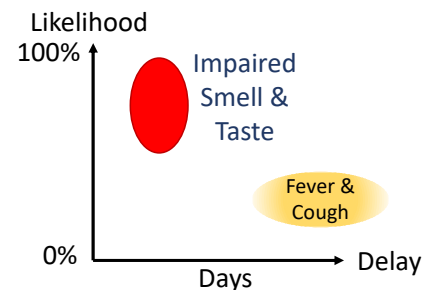
disturbance which is characteristic of a significant subset of people with COVID-19, PROS uses the record of prior measurements to create a personal baseline and track measurements over time.

### Long-Covid

A meta-study<sup>3</sup> showed “5 of 10 survivors of COVID-19 developed a broad array of pulmonary and extrapulmonary clinical manifestations, including nervous system and

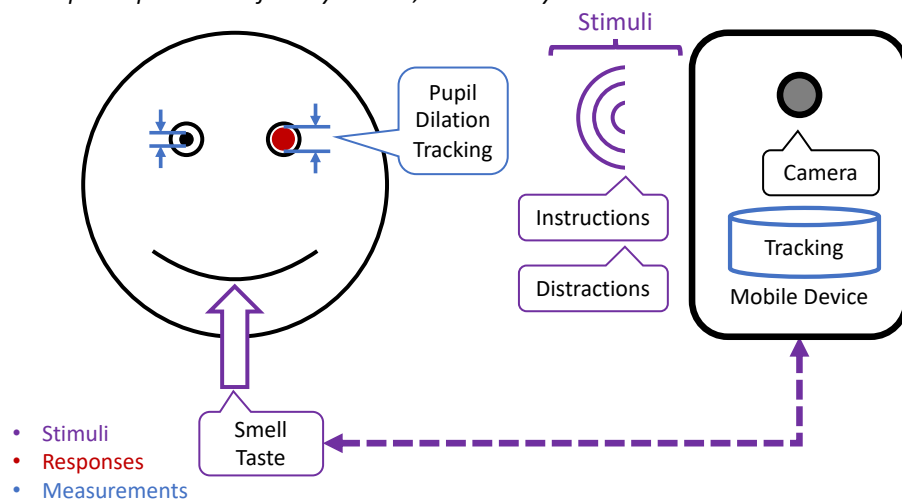
**Figure 2**

*Smell & Taste vs. Fever & Cough*



**Figure 3**

*Pupil Response to Olfactory Stimuli, the PROS System*



<sup>2</sup> Lacy, C. R., Gifford, W. S., & Turock, D. L., (2021, February, 4), Systems and methods for screening subjects based on pupillary response to olfactory stimulation, U.S. Patent No. 11,083,405

<sup>3</sup> Groff, D., Sun, A., Ssentongo, A. E., Ba, D. M., Parsons, N., Poudel, G. R., Lekoubou, A., Oh, J. S., Ericson, J. E., Ssentongo, P. & Chinchilli, V. M., (2021, October, 18), Short-term and Long-term Rates of Post-Acute Sequelae of SARS-CoV-2 Infection A Systematic Review, JAMA Network Open. 2021;4(10):e2128568. <https://doi.org/10.1001/jamanetworkopen.2021.28568>

neurocognitive disorders, mental health disorders, cardiovascular disorders, gastrointestinal disorders, skin disorders, and signs and symptoms related to poor general well-being, including malaise, fatigue, musculoskeletal pain, and reduced quality of life.”

In addition, the authors concluded that, “... clinical management will require a whole-patient perspective. ... many individuals experience disability, greatly exacerbating the disease burden. Such a burden is more than enough to overwhelm existing health care system capacities, particularly in resource-constrained settings.”

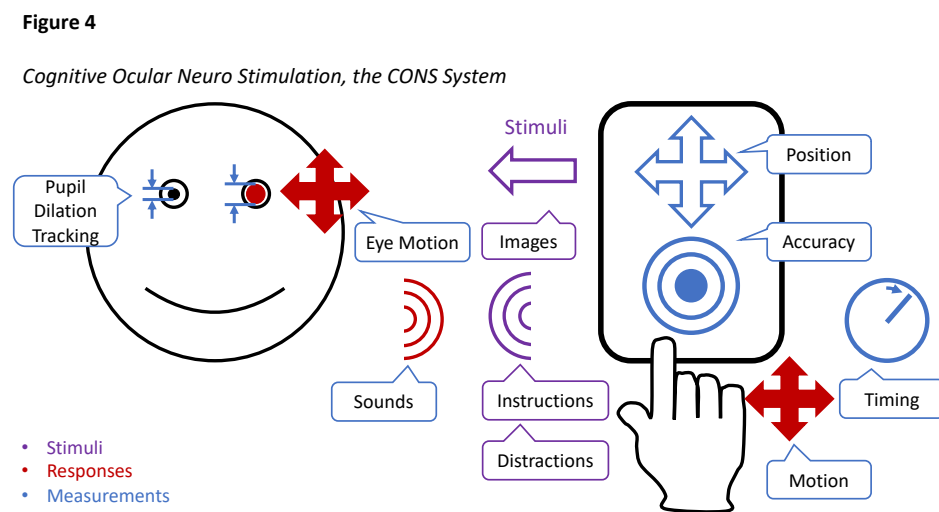
### **Screening for Long-Covid**

Not all individuals who contract COVID-19 experience impaired senses of smell or taste. For these cases, and to help distinguish COVID-19 from other potential causes, additional screening methods are needed.

Many people with Long-COVID complain of “brain fog” – disturbances in thinking, memory, and/or concentration. There are no widely used tests for this condition. Brain fog can also be a sign of other diseases and conditions, such as Chronic Fatigue Syndrome, Lyme disease, etc.

The Cognitive Ocular Neuro Stimulation system, CONS<sup>4</sup>, Figure 4, is a method to detect disease-related changes in response to a battery of mobile device-based neuro-physiological challenges.

The individual performs a variety of tasks, such as connecting dots in numerical and alphabetical order (Trail-Making), or tapping on objects displayed on the screen according



to directions (Finger Tapping). The tasks are quick, and can even be fun, so people are encouraged to perform them regularly as part of screening. The tasks can be made more challenging, and more discriminating, by varying the tasks and by providing distractions. These tests can detect and distinguish a wide variety of neuro-physiological changes.

The list of recognized signs and symptoms of COVID-19 is long and continues to grow. Many other diseases and conditions have findings that overlap with this list. We are exploring incorporating additional objective tests to further improve accuracy of screening

<sup>4</sup> Lacy, C. R., Gifford, W. S., & Turock, D. L., (2021, November, 17), Systems and methods for screening subjects for neuropathology associated with a condition utilizing a mobile device, U.S. Patent Application No. 17/528,417

for COVID-19, and to distinguish and differentiate between COVID-19 and other diseases and conditions.

## PROPOSED HEALTH SCREENING & TRACKING SYSTEM

The proposed health screening system is easy to use, Figure 5. The mobile device app can automatically recognize an existing user based on screening characteristics. The user's profile and history guide which screening test to run first in the session. Based on the results, the session continues with additional screening procedures, including objective tests (such as PROS and CONS) and subjective questions on the user's current status and recent events. At the end of the session, based on the individual's responses, the system may issue an alert suggesting the user seek medical attention and take other actions such as self-quarantine, masking, and definitive testing.

The system can be configured to send secure information about the user to authorized health workers to assist in supporting the user. This detailed health information helps health workers better support the user and saves time in repeating tests. Health workers can enter data into the system, such as test results and diagnoses. This data can improve the screening process, for example, by comparing screening results with corresponding test results.

Maintaining privacy and security of this information is essential. The system provides a number of secure services, including user identification, data access, and communications. A key feature of these secure services is the ability for the user to access and manage the services. The companion paper, *Global Health Data with Trust*, provides details on these and other aspects of the system.

The proposed Global Health Screening & Tracking system can provide the comprehensive data and documentation to support comprehensive health care.

**Analysis & Research**

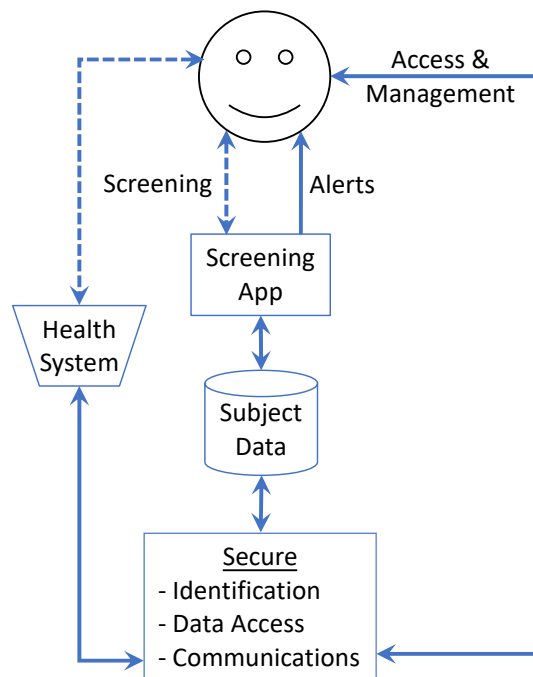
One of the key challenges encountered in the COVID-19 pandemic is differentiating between the signs and symptoms of COVID-19 and similarly-presenting diseases.

The data collected by the Global Health Screening and Tracking System can be invaluable in monitoring the detection, characterization, and evolution of signs and symptoms of disease.

This system's support of analysis and research aids in advancing understanding of the many

Figure 5

Global Health Screen & Tracking System, Individual



aspects of COVID-19, and its similarity, dissimilarity, and relationship to other diseases and conditions, Figure 6.

Use of de-identified data enables individual and group comparisons and structured evaluations of alternative tests and protocols to improve the effectiveness of screening, public health measures, and treatments. These results enable determination of “best practices” to be deployed in the screening system. They also provide comprehensive, objective, timely data to policy makers, public health and health care workers, and the general public. This is a unique opportunity to provide not only information and perspective, but also to promote learning and education to stimulate interest in better understanding of

health and disease. Perhaps this can become a stimulus for a whole generation of youth to get excited about science and health – much as the space race influenced our generation.

The system also enables research; for example, using the database and communications features to identify, recruit, track, and maintain research subjects.

Mechanisms to manage the analysis, research, and public information processes are described in the companion paper, *Global Health Data with Trust*.

## CONCLUSIONS

The COVID-19 global pandemic has clearly demonstrated the need for more frequent and more detailed health screening to detect and identify illness and to allow individuals to protect themselves and society. The pandemic has also clearly demonstrated the need for more accurate, detailed and extensive analysis and research of objective, validated data. *The Global Health Screening Initiative* provides the tools to perform this essential screening. The companion paper *Global Health Data with Trust* describes mechanisms to meet the simultaneous mandates of personal privacy and data-intensive research.

This is an ambitious proposal from many perspectives. Hopefully the combination of personal and social benefits will be sufficient impetus to drive toward implementation. We are actively seeking partners to fund, build, and operate the initiative.

**Figure 6**

*Global Health Screening & Tracking System, Management*

