

## Written evidence submitted by University College (CL0023)

The following submission represents the collated views of academic experts from a range of disciplines from across University College London (UCL). As a multi-faculty, comprehensive university, UCL colleagues are well placed to respond to this call on what lessons can be learnt thus far from the COVID-19 pandemic and offer recommendations to improve future response.

### **A. Executive summary**

**A.1.** Trust in Government and the clarity of restrictions are essential for achieving compliance and adherence to non-pharmaceutical interventions, such as shielding, lockdowns and social distancing.

**A.2.** Factors associated with the issues affecting the find, test, trace, isolate and support system and availability of national data to respond to COVID-19 include:

- decades of failure to invest sufficiently in the public health and social care systems
- excessive centralisation and unavailability of data;
- the fragmentation of the testing system;
- a lack of coordination with both the local authorities and with the NHS, PHE and other agencies locally in understanding the behaviours and settings that lead to greater transmission and the causes of severe infection.

**A.3.** Concerted action is needed to protect the most vulnerable groups in our society who have been disproportionately impacted by the virus, including minority ethnic groups, prisoners, migrants, people from lower socioeconomic backgrounds and people living in care homes.

**A.4.** Informing strategies to reduce transmission using evidence- and theory-based principles from behavioural and social sciences, including clear, concise, consistent and specific guidance and messaging and co-producing strategies with relevant communities.

**A.5.** There is an extensive evidence base on disaster preparedness and infectious disease outbreaks; there must be a greater commitment to implementing recommendations from past nationwide pandemic simulations.

**A.6.** The development of technology and manufacturing processes for vaccines relies on consistent, long-term funding, as well as training for talented staff.

**A.7.** The indirect impact of the pandemic on non-COVID-19 healthcare was predicted

## **B. The deployment of non-pharmaceutical interventions like lockdown and social distancing rules to manage the pandemic<sup>1</sup>**

### **B.1.**

**Lesson:** Engagement with communities and a local response are essential if local lockdowns are to be implemented in the future.

**Example:** The lockdown in Leicester at the end of June caused levels of uncertainty, anxiety and anger amongst people living in affected areas.<sup>2</sup>

**Recommendation:** For future local lockdowns, the response should be led by local government, supported by agencies, such as PHE Health Protection Teams, the NHS and the Police and be supported by additional funding from central Government.<sup>3</sup>

### **B.2.**

**Lesson:** Social distancing is crucial for preventing the transmission of the virus.

**Example:** Experts on SAGE and on the Independent SAGE committee raised concerns regarding the safety of the Government's decision to reduce social distancing from 2 metres to 1 metre in June 2020.<sup>4</sup> A systematic review of the available evidence suggests that the risk of transmitting the virus reduces by half for every metre of social distance.<sup>5</sup> However, the 2 metre rule is significantly less important outside or in well ventilated indoor spaces when people are wearing face covering.<sup>5</sup>

**Recommendation:** Social distancing should be adapted and used alongside other strategies to reduce transmission, improving ventilation in indoor spaces, effective hand washing, regular surface cleaning, face coverings where appropriate and prompt isolation of those with symptoms or who have been in contact with cases.<sup>6</sup>

### **B.3.**

**Lesson:** Control of transmission in the home is essential to mitigate the pandemic's spread.

**Example:** Households appear to be the highest risk setting for transmission of COVID-19, nevertheless the fact that secondary attack rates within households are less than 50% shows that it is possible to prevent spread within the household.<sup>7</sup> The risk of secondary transmission is especially high when the primary case is a child. School aged children, particularly secondary school children, are also most likely to be the first case within a household.

**Recommendation:** There needs to be further emphasis on measures that people can take to prevent the spread of COVID-19 in the household. This is particularly important during lockdown periods when people spend longer at home. More stringent safety protocols are needed for schools and a system for monitoring transmission via children should be implemented.

### **B.4.**

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<sup>1</sup> We note that large scale behaviour change requires behavioural, environmental, social and systems interventions, of which lockdowns and social distancing rules represent a small fraction of the interventions that must be implemented to suppress the pandemic. Michie & West (2020)

<https://www.bmj.com/content/bmj/370/bmj.m2982.full.pdf>

<sup>2</sup> <https://www.bbc.co.uk/news/uk-england-leicestershire-54041985>

<sup>3</sup> <https://www.independentsage.org/independent-sage-statement-on-leicester-and-local-lockdowns/>

<sup>4</sup> <https://www.independentsage.org/wp-content/uploads/2020/07/2m-vs-1m-guidance-Independent-SAGE-statement-June-21.pdf>

<sup>5</sup> Chu et al. (2020) <https://www.thelancet.com/action/showPdf?pii=S0140-6736%2820%2931142-9>

<sup>6</sup> <https://www.cebm.net/covid-19/what-is-the-evidence-to-support-the-2-metre-social-distancing-rule-to-reduce-covid-19-transmission/>

<sup>7</sup> Bernal et al. (2020) <https://www.medrxiv.org/content/10.1101/2020.08.19.20177188v1> [pre-print]

**Lesson:** Collaborations across boundaries – both nations and sectors – are key to developing non-pharmaceutical innovations in the context of a pandemic.

**Example:** A clear example is the success of the UCL-Ventura CPAP devices.<sup>8</sup> At the start of the COVID-19 pandemic in the UK, national guidance called for early intubation and ventilation of patients, a demand that hospitals could not meet due to lack of resources. **Professor Mervyn Singer** (Division of Medicine) worked with colleagues in China to learn from their experiences of how to create more ventilator capacity. A consortium spanning UCLH clinicians, UCL engineers and Mercedes AMG High Performance Powertrains came together to focus their combined expertise on the large-scale manufacture of non-invasive respiratory support technology. The UCL-Ventura CPAPs were rapidly manufactured at scale and have been delivered to over 60 hospitals. The designs for these devices have also been made freely available online and over 1,900 organisations from 105 countries have requested the designs.<sup>9</sup>

**Recommendation:** Government and its funding bodies should provide funding for collaborative research across international and sectoral boundaries to find solutions to challenges in the context of a pandemic.

## C. The impact on the social care sector

### C.1.

**Lesson:** Managing the spread of infections among homeless individuals is key to reducing the spread of pandemics.

**Example:** A team including **Professor Robert Aldridge** (Institute of Health Informatics) and **Professor Andrew Hayward** (Epidemiology & Health Care) has shown that without preventative mechanisms in place, outbreaks in homeless settings in England will lead to over 12,000 infections and close to 200 deaths.<sup>10</sup> The Government's initial 'Everyone In' scheme saw local authorities receive £3.2 million to house almost 15,000 rough sleepers in hotels or emergency accommodation during the first lockdown in March 2020.<sup>11</sup> Allowing people to avoid large, group shelters where the virus could easily spread resulted in relatively few deaths amongst the homeless population compared to in other countries.<sup>12</sup> While the recent announcement of a further £15 million<sup>13</sup> of funding nationally is welcome, it is less than half of what would be needed in London alone to bring 'Everyone In' without using communal night shelters.

**Recommendation:** To maximise the effectiveness of the lockdown on minimising the spread of COVID-19, extensive resources are needed to prevent clinically vulnerable people from relying on communal night shelters, while having dormitory style accommodation for less clinically vulnerable individuals.

### C.2.

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<sup>8</sup> [https://www.thelancet.com/journals/lanres/article/PIIS2213-2600\(20\)30422-7/fulltext#%20](https://www.thelancet.com/journals/lanres/article/PIIS2213-2600(20)30422-7/fulltext#%20)

<sup>9</sup> <https://www.raeng.org.uk/grants-prizes/prizes/prizes-and-medals/awards/presidents-special-awards-pandemic-service/cpap-breathing-aids>

<sup>10</sup> Lewer et al. (2020) [https://doi.org/10.1016/S2213-2600\(20\)30396-9](https://doi.org/10.1016/S2213-2600(20)30396-9)

<sup>11</sup> <https://www.independent.co.uk/news/uk/home-news/coronavirus-homeless-rough-sleepers-hotels-a9571661.html>

<sup>12</sup> <https://www.london.gov.uk/press-releases/mayoral/government-urged-to-prepare-for-winter-homeless>

<sup>13</sup> <https://www.gov.uk/government/news/jenrick-launches-protect-programme-the-next-step-in-winter-rough-sleeping-plan>

**Lesson:** Care homes are a key area in which investment is needed to minimise the spread of infections during a pandemic.

**Example:** **Dr Laura Shallcross** (Institute of Health Informatics) and her team conducted a study of approximately 9,000 residents in care homes using electronic health records. The study has found that 1 in 5 residents had symptoms of infection, but many cases were not tested. Higher room occupancy and lower staffing levels were found to be independent risk factors for infection.<sup>14</sup>

**Recommendations:**

- For future respiratory infection-related pandemics, there needs to be substantial support, including testing capacity to identify outbreaks early, for institutional settings, such as care homes.
- A targeted investment in PPE, testing and training of staff is needed for care homes to minimise the spread of infections.
- Sufficient funding is needed to ensure staff are not financially penalised for needing to self-isolate and for ensuring sufficient staffing ratios to prevent the need for staff to work across settings.
- Separate discharge facilities should be established where people who have been hospitalised with COVID-19 can be discharged prior to being admitted to nursing homes.

### C.3.

**Lesson:** Infections acquired in hospital or in care homes, both in staff and patients, account for a large proportion of cases.

**Example:** Researchers from the UCL Institute of Global Health, including **Professor Dame Anne Johnson**, **Professor Guy Harling** and **Dr Nigel Field** have contributed to analyses by the Data Evaluation and Learning for Viral Epidemics (DELVE) group regarding minimising hospital-acquired infections.<sup>15</sup> The study estimated that at least 10% of all COVID-19 infections in England were among patient-facing healthcare workers and resident-facing social care workers during the period from 26th April to 7th June 2020.

**Recommendation:** Behaviours and safety protocols, such as routine testing of all hospital staff, forming cohorts of patients and staff and restricting movement around hospitals must be much more robust to prevent the spread and transmission of infection.

## D. The impact on BAME communities<sup>16</sup>

### D.1.

**Lesson:** The pandemic has exacerbated existing social, economic and health inequalities, especially in Minority Ethnic communities.

**Example:** As early as May 2020, **Professor Robert Aldridge** and his team identified that people from Minority Ethnic groups are at an increased risk of death from COVID-19.<sup>17</sup> The ethnicity subgroup of SAGE identified that there is no genetic basis<sup>18</sup> to explain this increased risk of mortality for minority

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<sup>14</sup> Magni et al. (2020) <https://doi.org/10.1101/2020.07.14.20152629> [pre-print]

<sup>15</sup> <https://rs-delve.github.io/reports/2020/07/06/nosocomial-scoping-report.html>

<sup>16</sup> While the term 'BAME' (Black, Asian and Minority Ethnic) is a UK term that has been used in prior COVID-19 work and other health research, it has been criticised due to the amalgamation of heterogeneous experiences and its emphasis on skin colour. The Ethnicity Sub-Group of SAGE has adopted the term 'Minority Ethnic' to refer to the groups, communities and individuals that encompass the ethnic categories developed for the UK census. <https://www.gov.uk/government/publications/evidence-summary-of-impacts-to-date-of-public-health-communications-to-minority-ethnic-groups-and-related-challenges-23-september-2020>

<sup>17</sup> Aldridge et al. (2020) <https://wellcomeopenresearch.org/articles/5-88/v2>

<sup>18</sup> <https://www.gov.uk/government/publications/drivers-of-the-higher-covid-19-incidence-morbidity-and-mortality-among-minority-ethnic-groups-23-september-2020>

ethnic groups and suggest that the inequality is likely due to structural and institutional racism leading to increased levels of poverty, some chronic illnesses, poor access to health care, overcrowding and greater likelihood of working in low paid, public facing jobs. These inequalities increase risk of infection and severe disease.

**Recommendation:** Actions are needed to reduce these inequities, including ensuring income protection, reducing occupational risks, reducing barriers in accessing healthcare and providing culturally and linguistically appropriate public health communications.

## D.2.

**Lesson:** Despite the launching of the Commission on Race and Ethnic Disparities, there has been little concerted action to better protect minority ethnic communities from COVID-19. Actively addressing these inequalities is paramount, especially as the country begins its second national lockdown and enters the winter months.

**Example:** While the Government invested in communications from March-July 2020, the task of communicating and translating public health messaging for different ethno-cultural groups has largely been left to voluntary groups and local authorities.<sup>19</sup> Additionally, while the Government's isolation pay support scheme has been a relief to many, it is not available to the more than 1.3 million visa-holders with no recourse to public funds (NRPF) or to asylum seekers (i.e. those without immigration status).

### **Recommendations:**

- Delivering an emergency health protection funding package to all local authorities this winter would enable local authorities to implement Local Outbreak Plans and scale community COVID-19 champion schemes.
- Scaling up the 'Everyone In' scheme from the first lockdown to also provide temporary housing for people who need to isolate, but cannot do so due to their living conditions would help prevent household transmission.
- The isolation pay support scheme should be extended to visa-holders with NRPF and asylum seekers.

## E. Testing and contact tracing

### E.1.

**Lesson:** Greater lab testing capacity at the beginning of the pandemic would have slowed the spread of the virus. An effective test and trace system would have suppressed case numbers for a longer period of time.

**Example:** The Government's decision to use a commercial, centralised system has been a major contributor to the lack of testing capacity.<sup>20</sup> The UK has a vast network of academic institutions, hospitals and research centres with the capabilities for conducting COVID-19 testing, however, this network has not been utilised.

**Recommendation:** Setting up a national consortium would enable the rapid expansion of a testing structure on which to grow. Additionally, having more, local testing facilities would potentially reduce the number of ill people who have to travel significant distances by car (and often with a healthy family member) to an available testing site.

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<sup>19</sup> <https://www.bbc.co.uk/news/uk-53537062>

<sup>20</sup> <https://www.bmj.com/content/370/bmj.m3678>

## E.2.

**Lesson:** Having an effective community surveillance system for respiratory infections is crucial in identifying hotspots throughout the country and providing advance warning to increases in transmission rates.

**Example:** After the announcement that a UK-wide 'health protection' agency is replacing PHE, it is now unclear who is currently responsible for national surveillance. Enhanced surveillance and testing capacity are crucial, especially in care homes where we have some of the most clinically vulnerable patients. While community surveillance systems of respiratory infections are expensive to ramp up, they are relatively inexpensive to maintain.

**Recommendation:** Public health specialists, such as **Professor Andrew Hayward** (Dept. of Epidemiology and Public Health; Institute of Epidemiology and Health), recommend maintaining community surveillance in 'peace time' to enable the rapid mobilisation in the case of a pandemic so that the extent of spread of a new infection can immediately be assessed leading to earlier intervention.

## E.3.

**Lesson:** Contact tracing would have been most effective at the early stages of the pandemic to monitor transmission from people arriving in the country.<sup>21</sup> Such testing should be done by people who know the community and are trusted by them.

**Example:** When the main roots of transmission became community-based, the ability of the contract tracing programme to stay on top of the spread became exponentially harder, as we saw in March when contact tracing was abandoned.<sup>22</sup> Unlike other countries the UK abandoned test and trace procedures when community transmission became more widespread due to severe limitations in testing capacity. Similar to the challenges with the UK's testing programme, the centralisation of the test and trace system has contributed to the ongoing problems.

**Recommendation:** Instead of outsourcing contact tracing to commercial companies with limited knowledge of local areas, greater investment should be put in local authority public health teams, who have a more in depth understanding of their communities and individuals' contexts, working with local primary care and co-ordinated by NHS England.<sup>23</sup>

## E.4.

**Lesson:** Test and trace represents an opportunity to understand where and how transmission is occurring, which could guide control measures, and to be able to suppress outbreaks when they occur.

**Example:** The benefit of having a strong test and trace programme is to ensure that when a country emerges from a strict lockdown, the programme can then identify small outbreaks and community spread. This was the hope for the UK's test and trace system in August when lockdown measures were eased. However, fundamental problems in the design of the centralised contact tracing system organised by commercial contracts and the app's limitations has meant that we essentially have a broken test and trace system requiring reform as outlined above. In addition to the test and trace system, **Professor Judith Breuer** (Division of Infection and Immunity) is leading the COVID-19 Genomics UK (COG-UK) trial, which is conducting a number of studies to better understand the transmission and evolution of the virus over time.<sup>24</sup> The trial is using viral genomics to track the spread of COVID-19 in hospitals and potentially reveal chains of transmission.

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<sup>21</sup> Keeling et al. (2020). [10.1136/jech-2020-214051](https://doi.org/10.1136/jech-2020-214051)

<sup>22</sup> Baraniuk (2020). <https://www.bmj.com/content/369/bmj.m1859>

<sup>23</sup> <https://www.independentsage.org/blueprint-for-rebuilding-find-test-trace-isolate-and-support/>

<sup>24</sup> <https://www.cogconsortium.uk/studies/>

**Recommendation:** Issues with the test and trace system must be addressed so that we have a functioning system to assist in guiding control measures and as we emerge from the present lockdown.

#### E.5.

**Lesson:** Ensuring that people are enabled and supported to isolate when they have tested positive, are experiencing symptoms, or have come in contact with someone who has tested positive, is key to stop the transmission of the virus. The CORSAIR weekly survey commissioned by the Department of Health and Social care, of which **Professor Susan Michie** is an Investigator, has found that only 20% of those with symptoms stay at home for 14 days as advised, a situation that has been little changed over the last few months.<sup>25</sup>

**Example:** While Scotland has adopted a Test, Trace, Isolate, Support response<sup>26</sup> to the pandemic, the same has not been done in England. Managing the isolation of people with confirmed cases of COVID-19, or who may have been exposed to the virus, is absolutely crucial for preventing further transmission.

**Recommendation:** Supports must be implemented, particularly for those in precarious employment or housing, as many are unable to isolate due to financial reasons, practical reasons such as leaving the house for caring responsibilities or to get provision, or living in accommodation that prevents isolating.<sup>27</sup> Support in other countries includes daily visiting to check on physical and mental health and to ensure enough practical support is in place, compensating people for lost income and offering free or very cheap alternative accommodation.

### F. Modelling and the use of statistics

#### F.1.

**Lesson:** In the presence a novel coronavirus, modelling has proven valuable in informing policy in the absence of an existing research base.

**Example:** Several days before the first national lockdown was announced, modelling led by **Dr Amitava Banerjee**, **Professor Spiros Denaxas** and **Professor Harry Hemingway** (Institute of Health Informatics) that used health records from 3.8 million adults in England showed that Government measures at the time were insufficient in stopping the spread of the virus or identifying the most high-risk groups.<sup>28</sup> In March, they predicted that there would be 35,000-70,000 excess deaths in England due to the pandemic over the next year.

**Recommendation:** Examining a range of models produced from a number of different sources and datasets will provide greater insight into the potential impacts of the pandemic and interventions attempting to mitigate its effects.

#### F.2.

**Lesson:** The lack of timely and systematic collection, collation and recording of data limits the validity of findings from models.

**Example:** In response to the inaccessibility of national real-time detailed information about the COVID-19 epidemic in hospitals and intensive care units, **Professor Andrew Hayward** (Dept. of Epidemiology and Public Health; Institute of Epidemiology and Health) and **Dr Eleni Nastouli** (UCLH;

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<sup>25</sup> Smith et al. (2020). <https://doi.org/10.1101/2020.09.15.20191957>

<sup>26</sup> <https://www.gov.scot/publications/coronavirus-covid-19-test-trace-isolate-support/>

<sup>27</sup> <https://www.independentsage.org/statement-on-the-management-of-nhs-test-and-trace/>

<sup>28</sup> <https://www.ucl.ac.uk/news/2020/mar/new-estimates-excess-mortality-covid-19-suggest-stronger-suppression-measures-needed>

UCL Great Ormond Street Institute of Child Health) is leading the 'Virus Watch' study to test thousands of people for COVID-19 antibodies across the country. The fast track funding by the MRC of 'Virus Watch' has provided vital real time evidence of transmission among communities and NHS workers and demonstrates the benefits that can be realised when there is a streamlined funding process.

**Recommendation:** Nationwide NHS data needs to be made available so that clinicians and services can rapidly learn ways to tackle the consequences of the pandemic in both those with and those without the virus.

### F.3.

**Lesson:** The current regulatory and legislative environment around NHS data hampers the public health emergency response to the COVID-19 pandemic.

**Example:** It was also due to the gaps in the available data that **Dr Megdie Zhuang** and **Professor Ed Manley** (Centre for Advanced Spatial Analysis) and **Professor Deenan Pillay** (Division of Infection & Immunity) led the rapid adaptation of existing i-sense tools and technologies to create the i-sense COVID Response Evaluation Dashboard (COVID RED).<sup>29</sup> COVID RED collates and presents data from the ONS, Public Health England and NHS and is currently the only dashboard that explores the entire COVID response system as a whole.

**Recommendation:** There needs to be greater coordination and sharing of data as the current siloed and monetised approach amongst research teams is ineffective and hampers rapid research.

## G. Government communications and public health messaging

### G.1.

**Lesson:** Behaviour science evidence, methods and models can be used to inform the development of interventions to control infection transmission, mitigate harm caused by the pandemic and develop new patterns of behaviour to prepare for future pandemics.<sup>30</sup>

**Example:** **Professor Susan Michie** (Division Psychology and Language Studies), **Professor Robert West** (Dept. of Epidemiology and Public Health) and other behavioural scientists have published guidance on harnessing behavioural science in public health campaigns to maintain 'social distancing' during the pandemic.<sup>31</sup> Their commentary outlined key principles including: clear and specific guidance; protect each other; stand together; theory of change and co-design.

**Recommendation:** Incorporating communication principles from behavioural science frameworks is needed to develop effective interventions to break transmission, for both the fomite (infected surfaces) and airborne (droplets and aerosol) routes.

### G.2.

**Lesson:** A small number of simple and clear rules enables effective public health messaging. Enabling people to understand the principles behind regulations and applying this to their own circumstances will increase compliance.

**Example:** **Dr Daisy Fancourt** (Institute of Epidemiology and Health) is leading the COVID-19 Social Study, which is exploring the effects of the virus and social distancing measures on adults in the UK.<sup>32</sup> The data from the study are analysed in real time and results are made available each week. During strict lockdown (when the same rules were applied across the UK), levels of understanding were

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<sup>29</sup> <https://www.i-sense.org.uk/covid-19/covid-19-response>

<sup>30</sup> West et al. (2020) <https://www.nature.com/articles/s41562-020-0887-9>

<sup>31</sup> Bonell et al. (2020) <https://jech.bmj.com/content/74/8/617.abstract>

<sup>32</sup> <https://www.covidsocialstudy.org/>

reported by individuals to be very high and over 70% of survey respondents reported ‘complete compliance’ with guidelines.<sup>33</sup> However, there was much poorer comprehension of the rules after lockdown easing began. In England, fewer than half of adults reported broad understanding of the rules (45%), with just 14% understanding them ‘very much’.<sup>34</sup> Consequently, the latest published results from the COVID-19 Social Study showed that just over 40% of people reported ‘complete compliance’ (compared to 70% earlier in the pandemic) with guidelines as of 12<sup>th</sup> October 2020.<sup>35</sup> Compliance levels have consistently been lowest amongst those under the age of 30.<sup>24</sup>

**Recommendation:** The current communication strategy could be enhanced by creating a centralised web portal in which to post all guidance and supplement this with an AI-enabled chatbot or FAQ page. Using the media and social media to signpost people to this resource would be an inexpensive, yet effective way to ensure that people know where to go to seek clarification on new guidance.

### G.3.

**Lesson:** ‘Protect each other’ messages should stress how desired behaviours benefit the group.

**Example:** The COVID-19 Social Study has identified that 22% of respondents ranged from ‘more unlikely than likely to very unlikely’ to get the vaccine, if a successful COVID-19 vaccine were to be rolled out.<sup>22</sup> Additionally, 16% of respondents reported not feeling completely sure that vaccines provide protection to strongly mistrusting vaccines. Older adults were more likely to display worries about unforeseen effects, preferences for natural immunity, concerns about commercial profiteering, and mistrust of vaccine benefits, as were people from lower-income households. This is particularly concerning given that older people and people from lower-income households are disproportionately impacted by the virus. A vaccine will only be effective if a sufficient number of people are vaccinated.

**Recommendation:** While a vaccine is still under development, it would be beneficial to work with behavioural scientists to identify what interventions could be implemented to address mistrust of vaccines and increase uptake. Again, methods like the use of an AI-enabled chatbot could be considered.

### G.4.

**Lesson:** Public health messaging exists at the interface of politics and science, where trust in the Government is an important variable. The openness of decision-making is also vital for bringing the public alongside a Government’s strategies, especially during times of national emergencies.

**Example:** Levels of confidence in central and devolved governments to handle the COVID-19 epidemic have dropped further in the past few weeks. Levels remain highest in Scotland and Wales and lowest levels in England.<sup>36</sup> Notably, confidence in Government has consistently been lower amongst people from Minority Ethnic groups throughout the pandemic.<sup>37</sup>

**Recommendation:** Improve communication about science with the press and the public using accessible easy to understand graphs as demonstrated by Independent SAGE in their weekly conferences with press and public.

### G.5.

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<sup>33</sup> [https://b6bdcb03-332c-4ff9-8b9d-28f9c957493a.filesusr.com/ugd/3d9db5\\_13e8d6ef4dd34caf94a7a7b9ae359c95.pdf](https://b6bdcb03-332c-4ff9-8b9d-28f9c957493a.filesusr.com/ugd/3d9db5_13e8d6ef4dd34caf94a7a7b9ae359c95.pdf)

<sup>34</sup> [https://b6bdcb03-332c-4ff9-8b9d-28f9c957493a.filesusr.com/ugd/3d9db5\\_770e0e1cd00a4f9eace2191ffa65353e.pdf](https://b6bdcb03-332c-4ff9-8b9d-28f9c957493a.filesusr.com/ugd/3d9db5_770e0e1cd00a4f9eace2191ffa65353e.pdf)

<sup>35</sup> [https://b6bdcb03-332c-4ff9-8b9d-28f9c957493a.filesusr.com/ugd/3d9db5\\_770e0e1cd00a4f9eace2191ffa65353e.pdf](https://b6bdcb03-332c-4ff9-8b9d-28f9c957493a.filesusr.com/ugd/3d9db5_770e0e1cd00a4f9eace2191ffa65353e.pdf)

<sup>36</sup> [https://b6bdcb03-332c-4ff9-8b9d-28f9c957493a.filesusr.com/ugd/3d9db5\\_770e0e1cd00a4f9eace2191ffa65353e.pdf](https://b6bdcb03-332c-4ff9-8b9d-28f9c957493a.filesusr.com/ugd/3d9db5_770e0e1cd00a4f9eace2191ffa65353e.pdf)

<sup>37</sup> [https://b6bdcb03-332c-4ff9-8b9d-28f9c957493a.filesusr.com/ugd/3d9db5\\_550cfc49b63c437f9739bae09b94f11b.pdf](https://b6bdcb03-332c-4ff9-8b9d-28f9c957493a.filesusr.com/ugd/3d9db5_550cfc49b63c437f9739bae09b94f11b.pdf)

**Lesson:** Considering the theory of change of how a public health message intends to affect behaviour and potential unintended consequences will create a coherent overall programme.

**Example:** An unintended consequence of the Government's 'Stay home. Save lives. Protect the NHS.' was that people across the UK began to avoid hospitals or attending appointments for fears of catching the virus or burdening the health system.<sup>38</sup> The COVID-19 Social Study reported that 26% of people reported not accessing healthcare even when it was available and 1 in 5 people reported not telling a GP about symptoms of an illness when they would usually have done. Additionally, 2.8% of people reported stopping taking medication due to difficulties in accessing it, and 1 in 25 people reported not going for tests even though they were available. Unfortunately, due to this decrease in health-seeking behaviour, the ONS reported that there were 25,472 more deaths from 28 December 2019 to 11 September 2020 than the previous five-year average for the same period.<sup>39</sup>

**Recommendation:** The public needs clear, targeted messaging to encourage vulnerable populations to seek timely care.

## G.6.

**Lesson:** Interventions should be co-designed and piloted with relevant audiences. Government communications need to be shaped by the realities of people's lives so people feel that these messages apply to them.

**Example:** Messaging has not been co-designed with key demographic groups, such as young people or people from Minority Ethnic communities. Results published by **Professor Henry Potts** (Institute of Health Informatics) and **Professor Susan Michie** (Division of Psychology and Language Studies) from the CORSAIR study (discussed in greater detail in Section H.3.) have shown that people from younger age groups, and especially young men, are less likely to adhere to the test, trace and isolate system.

**Recommendation:** The Government should engage with key target demographics (such as groups less likely to adhere to guidance) to co-produce messaging that is relevant to these groups. For example, given that young people are most like to access the news via a smartphone the Government should leverage social media platforms and involve people such as sportspeople, music artists or influencers to make the messages relevant to younger groups<sup>40</sup>.

## H. The UK's prior preparedness for a pandemic

### H.1.

**Lesson:** It is possible to predict infectious disease outbreaks with a high degree of accuracy.

**Example:** **Professor Kate Jones** (Division of Biosciences) has conducted extensive research into the relationship between infectious disease and habitat loss, biodiversity, bats and live wildlife markets. Her work has focused on predicting and modelling other infectious diseases, such as Ebola<sup>41</sup> and Lassa fever<sup>42</sup>. Before the emergence of the COVID-19 pandemic, Professor Jones and her colleagues had repeatedly warned that environmental degradation around the world was increasing the likelihood of 'spillover' events and pandemics. Additionally, at least three papers<sup>43</sup> published in 2019 identified a risk of bat coronavirus spillover potential in Southern China.

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<sup>38</sup> [https://b6bdcb03-332c-4ff9-8b9d-28f9c957493a.filesusr.com/ugd/3d9db5\\_8f72d734373243f68867ad8465fb9588.pdf](https://b6bdcb03-332c-4ff9-8b9d-28f9c957493a.filesusr.com/ugd/3d9db5_8f72d734373243f68867ad8465fb9588.pdf)

<sup>39</sup>

<https://www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/deaths/articles/deathsinprivatehomesenglandandwalesprovisional/deathsregisteredfrom28december2019to11september2020>

<sup>40</sup> <https://www.digitalnewsreport.org/survey/2019/how-younger-generations-consume-news-differently/>

<sup>41</sup> <https://www.nature.com/articles/s41467-019-12499-6>

<sup>42</sup>

[https://www.tandfonline.com/doi/full/10.1080/20477724.2017.1369643?casa\\_token=Djz9I1CE0qsAAAAA%3AfBxgmk151wTk7tXq94jDDPuiSuDv4LQCpW2SBody0H7MvhSEA8vzJYki3oYFdG9vHqntOZZjr58](https://www.tandfonline.com/doi/full/10.1080/20477724.2017.1369643?casa_token=Djz9I1CE0qsAAAAA%3AfBxgmk151wTk7tXq94jDDPuiSuDv4LQCpW2SBody0H7MvhSEA8vzJYki3oYFdG9vHqntOZZjr58)

**Recommendation:** To prevent devastating disease outbreaks<sup>44</sup> becoming more common, public health organisations, ecologists and conservationists must work together to look at the ultimate causes of disease (i.e. spillover from wildlife) as opposed to solely focusing on proximate causes (i.e. human-to-human spreading).

## H.2.

**Lesson:** Nationwide simulations of a flu pandemic took place in 2007 (Winter Willow) and in 2016 (Exercise Cygnus).<sup>45</sup> However, approaches and strategies to date suggest that there has been little recognition of the plans and procedures developed previously.

**Example:** These rehearsals showed that in the event of pandemic influenza, there would be a shortage of personal protective equipment (PPE) and ventilators, but strategies for addressing these identified risks were not actioned. Additionally, no recommendations from Dame Deirdre Hines' independent review<sup>46</sup> of the UK Government's preparedness and management of the H1N1 pandemic have been implemented. Respiratory disease specialists, such as **Professor David Lomas** (Office of the Vice-Provost [Health]) have noted that a blind spot in the UK's rehearsals was the focus on pandemic influenza, instead of also considering pandemic coronaviruses, such as SARS or MERS.

Additionally, failing to consult with Asian countries when they were in the midst of managing the first wave of their COVID-19 pandemics meant that the UK missed valuable opportunities to learn how to best prepare for the virus when it eventually struck.

**Recommendations:** Disaster reduction experts, such as **Professor David Alexander** (Institute for Risk and Disaster Reduction), recommend that to prepare for future outbreaks, the Government must ensure that there are appropriate emergency plans in place, which can be rapidly implemented when necessary.

## H.3.

**Lesson:** The ability to rapidly mobilise research teams is crucial in meeting the research and development demands associated with combatting a novel pandemic.

**Example:** The key element of the NIHR's Themed call: Pandemic Flu (2011)<sup>47</sup> was that the research itself would not start until a pandemic occurred that was affecting the UK. It was through this funding call that **Professor Susan Michie** (Division of Psychology and Language Studies) and **Professor Henry Potts** (Institute of Health Informatics), members of the Independent Scientific Pandemic Insights Group on Behaviours (SPI-B) SAGE subgroup, have been leading the 'COVID-19 Rapid Survey of Adherence to Interventions and Responses' (CORSAIR) study with Kings College London using national survey data provided by the Department of Health and Social Care.<sup>48</sup> While the scale of the pandemic has revealed that the amount of funding offered has been insufficient, the

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<sup>43</sup> Wang, L. F., & Anderson, D. E. (2019). Viruses in bats and potential spillover to animals and humans. *Current opinion in virology*, 34, 79-89; Sun, Y. K., Han, X. L., Wei, Y. F., Yu, Z. Q., Ji, C. H., Li, Q., ... & Zhang, G. H. (2019). Phylogeography, phylodynamics and the recent outbreak of lineage 3 porcine reproductive and respiratory syndrome viruses in China. *Transboundary and emerging diseases*, 66(5), 2152-2162; Li, H., Mendelsohn, E., Zong, C., Zhang, W., Hagan, E., Wang, N., & Ross, N. (2019). Human-animal interactions and bat coronavirus spillover potential among rural residents in Southern China. *Biosafety and Health*, 1(2), 84-90.

<sup>44</sup> <https://thebiologist.rsb.org.uk/biologist/158-biologist/features/2404-there-were-at-least-three-papers-in-2019-that-said-coronaviruses-might-be-a-real-problem-in-south-china-3>

<sup>45</sup> <https://www.theguardian.com/world/2020/may/21/did-the-uk-government-prepare-for-the-wrong-kind-of-pandemic>

<sup>46</sup> <https://www.gov.uk/government/publications/independent-review-into-the-response-to-the-2009-swine-flu-pandemic>

<sup>47</sup> <https://www.nihr.ac.uk/documents/pandemic-flu/20138>

<sup>48</sup> <https://www.medrxiv.org/content/10.1101/2020.09.15.20191957v1>

NIHR's funding structure (i.e. researchers did not need to complete an additional funding bid) meant that they could rapidly mobilise to implement the study.

**Recommendation:** Implementing wider-scale funding structures of this kind would facilitate research mobilisation for future disasters and pandemics.

#### H.4.

**Lesson:** The Health and Social Care Act 2012's dissolution of primary care trusts and strategic health authorities, and replacement with clinical commissioning groups effectively led to the disinvestment of a national public health system.

**Example:** While making local authorities responsible for public health in itself is not an issue, the subsequent cuts to public health funding (a loss of over £700 million in real terms between 2015/2016 and 2019/2020)<sup>49</sup> has led to an underfunded and disconnected public health system that has struggled to respond to the current pandemic. These cuts have also furthered existing social and economic inequalities by disproportionately affecting the most deprived areas. Almost £1 in every £7 cut from public health services has come from England's ten most deprived communities – compared to just £1 in every £46 in the country's ten least deprived places.<sup>33</sup>

**Recommendation:** The Government must invest in local governments and public health grants, targeting funding to deprived areas, to not only tackle the current pandemic, but to also improve the services that maintain health, produce cost efficiencies and lessen the burden of health inequalities.

#### H.5.

**Lesson:** The indirect impact of the pandemic on non-COVID-19 healthcare was predicted and preventable; services for non-communicable chronic conditions must be preserved and part of emergency preparedness and planning in this and future pandemics, in order to avert a substantial, avoidable burden of morbidity and mortality.

**Example:** Since April, **Dr Amitava Banerjee**, **Professor Harry Hemingway** and colleagues (Institute of Health Informatics) have modelled indirect impacts of the pandemic on non-COVID services, such as cancer<sup>50</sup> and cardiovascular diseases<sup>51</sup>, projecting significant excess deaths due to changes in patient and clinician behaviours and strain on the health system. With the CVD-COVID consortium, British Heart Foundation Data Science Centre, Keele University and the National Institute for Cardiovascular Outcomes Research, **Dr Amitava Banerjee** has shown that across cardiovascular diseases, there were major decreases in attendances in emergency department attendances, total admissions and procedure rates after lockdown, with only limited recovery to usual levels of some activities from mid-April<sup>52</sup>, and a deficit of 45,000 cardiac procedures from March-May 2020<sup>53</sup>.

**Recommendation:** Treatment and prevention of non-COVID-19 diseases must be prioritised during the pandemic, particularly in periods of lockdown, with clear messaging for patients, public and health professionals. Planning and preparedness for future pandemics should incorporate detailed analyses and projections for non-COVID-19 services, especially for long-term chronic conditions.

#### H.6.

**Lesson:** Excess morbidity and mortality are particularly related to individual (e.g. age, underlying conditions, multi-morbidity) and population-level factors (e.g. social deprivation), which are quantifiable in linked electronic health record data.

**Example:** Using UK primary care electronic health records, **Dr Amitava Banerjee** (Institute of Health Informatics), **Professor Andrew Hayward** and team demonstrated that homeless individuals have

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<sup>49</sup> <https://www.ippr.org/blog/public-health-cuts#anounce-of-prevention-is-worth-a-pound-of-cure>

<sup>50</sup> <https://www.bmj.com/content/369/bmj.m1735>

<sup>51</sup> <https://www.medrxiv.org/content/10.1101/2020.06.10.20127175v1>

<sup>52</sup> <https://heart.bmj.com/content/heartjnl/early/2020/10/05/heartjnl-2020-317870.full.pdf>

<sup>53</sup> <https://academic.oup.com/ehjqcco/advance-article/doi/10.1093/ehjqcco/qcaa079/5932442>

high prevalence, incidence, and 1-year mortality risk with earlier onset, and high burden of risk factors, compared with housed individuals.<sup>54</sup> These data can be used in predicting impact of the pandemic in high-risk individuals, planning of services and projection of potential populations for vaccination.

**Recommendation:** Routine data sources must be linked during planning and preparedness, before and during the pandemic in order to minimise impact in the individuals with highest risk of morbidity and mortality during the pandemic.

## I. The development of treatments and vaccines

### I.1.

**Lesson:** Coordination between hospitals, research institutions and funders is essential in the response to the COVID-19 pandemic.

**Example:** UCLH is participating in the RECOVERY trial, which is a major multi-arm randomised clinical trial that has enrolled 12,000 patients across 176 NHS hospitals. RECOVERY found that dexamethasone, an inexpensive and readily available drug, reduces death by up to one third in hospitalised patients with severe respiratory complications from COVID-19.<sup>55</sup> The success of RECOVERY is due to its pragmatic trial design and use of existing health datasets.<sup>56</sup>

**Recommendations:**

- RECOVERY has shown the enormous potential of coordinating research efforts across a large number of universities and hospitals, and leveraging data science to make the most from existing data sets and should be used as a model for future research endeavours.
- A coordinated effort would have been more effective as teams would not have been competing for the same pool of patients and data could be more easily linked and shared.

### I.2.

**Lesson:** Designing clinical trials so that they ask the right questions is important in the development of a vaccine.

**Example:** The COVID-19 Oxford Vaccine Trial's initial Phase 1/2 trial only included healthy, adult patients between the ages of 18-55.<sup>57</sup> Additionally, Phase 2/3 trial has only assessed a small number of older adults aged 56-69 or over the age of 70.<sup>58</sup> However, we have seen that those most at risk for mortality from the virus are people over the age of 70 and/or those with low immune function or with comorbidities.

Existing vaccine trials, while striving to answer the question of whether a vaccine effectively protects against the virus, are not assessing whether a vaccine prevents the transmission of the virus. The vaccines use and rollout depends on this – if it protects against the virus but does not block transmission, it should be targeted at risk groups. However, if it blocks transmission, it should be targeted at transmission hotspots.

**Recommendation: Professor Jeremy Brown** (Division of Medicine) who sits on the Joint Committee for Vaccines and Immunisation suggests that Phase 1/2 trials should run a parallel arm with those from at risk groups so that there is sufficient data with which to assess the efficacy of the vaccine for protecting those most vulnerable.

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<sup>54</sup> Nanjo A, Evans H, Direk K, Hayward A, Story A, Banerjee A. Prevalence, incidence, and outcomes across cardiovascular diseases in homeless individuals using national linked electronic health records. Eur Heart J. 2020. In press.

<sup>55</sup> <https://www.recoverytrial.net/results>

<sup>56</sup> <https://www.hdruc.ac.uk/news/filling-in-the-gaps-smart-use-of-health-data-lies-behind-the-recovery-trials-success/>

<sup>57</sup> Folegatti et al. (2020) [https://doi.org/10.1016/S0140-6736\(20\)31604-4](https://doi.org/10.1016/S0140-6736(20)31604-4)

<sup>58</sup> <https://www.ox.ac.uk/news/2020-05-22-oxford-covid-19-vaccine-begin-phase-iii-human-trials>

### I.3.

**Lesson:** Identifying correlates of protection from COVID-19 would assist in the development of a vaccine.

**Example:** Correlates of protection/immunity are measures that indicate that a person is immune to becoming infected or developing a disease. For examples, antibodies in serum or on mucosa that block infection would thus provide a correlate of protection. While intense efforts are being made to identify correlates of protection for COVID-19, none has yet been identified. If correlates can be determined, the comparison of vaccines will become easier as correlates of protection can be assessed in a relatively small cohort (perhaps 100, instead of 10,000 if correlates were unknown).

**Recommendation:** To develop an effective vaccine or biologic therapeutic, it is critical to understand the immune correlates of COVID-19 control.<sup>59</sup>

### I.4.

**Lesson:** The UK does not have enough formulation manufacturing sites (where the components of a vaccine are combined).

**Example:** Vax-Hub<sup>60</sup> is co-led by **Professor Martina Micheletti** (UCL Department of Biochemical Engineering) and Professor Sarah Gilbert (Jenner Institute, University of Oxford) and aims to meet the future manufacturing vision through an integrated programme of work to develop new technologies, platform manufacturing, better analytics and thermostable formulation. Currently, experts involved with Vax-Hub, including **Professor Paul Dalby** (Dept. of Biochemical Engineering), are working to accelerate the development and scale up of manufacturing processes and stable formulations for a COVID-19 vaccine.

**Recommendation:** Greater investment needs to be placed in funding collaborations and funding in order to manufacture a COVID-19 vaccine at speed when it is available.

### I.5.

**Lesson:** The ability to develop a COVID-19 vaccine at speed has only been possible due to the years of investment that has been put into the technologies being employed.

**Example:** The team developing the Oxford COVID-19 vaccine had already used ChAdOx1 vaccine technology to produce candidate vaccines against a number of pathogens including flu, Zika and Middle East Respiratory Syndrome (MERS).<sup>61</sup> They had already begun work on pandemic preparedness with the technology behind ChAdOx, in preparation for 'Disease X'. When the disease emerged in China, they moved quickly and as soon as the genetic sequence was available, they began work on a trial.

**Dr Stephen Morris** and **Professor Daniel Bracewell** (Dept of Biochemical Engineering) highlight that the success of the Oxford COVID-19 vaccine trials should not be interpreted as a demonstration that vaccines can easily be developed and manufactured in one year in the event of a pandemic. Rather, it shows the importance of preparation in the form of consistent, long-term funding for the development of basic technologies and manufacturing processes, as well as training for talented staff.

**Recommendation:** Long-term strategic investment in the UK's infrastructure and talent base is needed to not only develop efficacious vaccines for this current pandemic, but to also prepare for future disease outbreaks.

### I.6.

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<sup>59</sup> Poonia & Kottlilil (2020) <https://doi.org/10.3389/fimmu.2020.569611>

<sup>60</sup> <https://www.ucl.ac.uk/biochemical-engineering/research/research-and-training-centres/vax-hub>

<sup>61</sup> <https://www.research.ox.ac.uk/Article/2020-07-19-the-oxford-covid-19-vaccine>

**Lesson:** As research into the vaccine formulation progresses, we must also consider routes of delivery.

**Example:** We have seen that COVID-19 behaves very differently from influenza. Whereas the flu moves quickly through the body, COVID-19 affects a person's nose and throat first, which the body is usually able to fight, but in the second phase, this coronavirus affects the respiratory system. Though most trials are experimenting with intramuscular delivery, a nasal spray delivery may actually be more effective.

**Recommendation:** Greater investment must be made into the infrastructure and equipment needed to develop complex delivery routes for vaccines.

### **Acknowledgments**

This response has been prepared by UCL Public Policy<sup>62</sup> with contributions from:

- **Department of Biochemical Engineering** (Professor Daniel Bracewell; Professor Paul Dalby, Professor Martina Micheletti, Dr Stephen Morris);
- **Department of Computer Science** (Professor Ingemar Cox);
- **Department of Epidemiology and Public Health** (Professor Andrew Hayward; Professor Robert West);
- **Division of Biosciences** (Professor Kate Jones);
- **Division of Infection and Immunity** (Professor Dame Anne Johnson; Professor Deenan Pillay)
- **Division of Medicine** (Professor Jeremy Brown);
- **Division of Psychology and Language Studies** (Professor Susan Michie);
- **Institute for Risk and Disaster Reduction** (Professor David Alexander);
- **Institute of Epidemiology and Health** (Dr Daisy Fancourt; Professor Andrew Hayward);
- **Institute of Health Informatics** (Professor Robert Aldridge, Dr Amitava Banerjee, Professor Spiros Denaxas; Dr Parth Patel, Professor Henry Potts, Dr Laura Shallcross); and
- **Office of the Vice-Provost (Health)** (Professor David Lomas).

We would be pleased to speak further about our response. Please contact Audrey Tan

*Nov 2020*

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<sup>62</sup> <https://www.ucl.ac.uk/public-policy/>