Received 8/6/2020 9:07:57 PM Commonwealth Court of Pennsylvania

Filed 8/6/2020 9:07:57 PM Commonwealth Court of Pennsylvania
364 MD 2020

IN THE COMMONWEALTH COURT OF PENNSYLVANIA

NAACP PENNSYLVANIA STATE CONFERENCE, Petitioner, v. KATHY BOOCKVAR, SECRETARY OF THE COMMONWEALTH, AND JESSICA MATHIS, DIRECTOR OF THE BUREAU OF ELECTION SERVICES AND NOTARIES, Respondents.	No. 364 MD 2020

DECLARATION OF HARVEY RUBIN, M.D., Ph.D.

I, Dr. Harvey Rubin, M.D., Ph.D., declare as follows

I. Executive Summary

1. I am over the age of 18 and competent to provide this declaration.

2. The Petitioner in this case have asked me to investigate how the science and infectious disease aspects of COVID-19 will affect voting in the November, 3 2020 general election in Pennsylvania

3. My conclusions are set forth in the next paragraph. I reach these conclusions based on my knowledge of the basic virology of the SARS-CoV-2 virus, on the spread of the disease, of the models that are used to predict the trajectory of the disease. My report proceeds as follows:.

- Section II highlights my background and qualifications.

- Section III documents my sources of information.
- Section IV presents the biology of SARS-CoV-2, the causative agent of COVID-19
- Section V explains how the virus spreads from one person to another
- Section VI discusses who are vulnerable to COVID-19
- Section VII describes the clinical picture of COVID-19 disease
- Section VIII explains how is COVID-19 diagnosed
- Section IX describes current medical interventions
- Section X discusses what can be expected In November 2020
- Section XI describes recognition of the potential to spread COVID-19 at polling places
- Section XII includes a summary of my findings.

4. My primary conclusions are:

(a) SARS-CoV-2 is a highly infectious virus that can cause mild to life threatening disease.

(b) Currently, the only interventions available to limit and mitigate the spread of this disease are non-pharmaceutical interventions—social distancing, wearing masks, hand hygiene, and avoidance of touching face, eyes and nose.

(c) Herd immunity is not at the level that is required to impact the spread of disease.

(d) Pharmaceutical interventions, e.g., antiviral agents, anti-inflammatory agents, monoclonal antibodies, convalescent plasma and vaccines, while

promising, are not yet proven to positively impact disease progression, except in limited instances, nor prevent spread of the disease.

(e) Closed, indoor spaces, such as polling places, pose a major challenge for adequate control of viral spread and have the potential to seed or re-seed the infection in communities, even those that have done a good job in mitigating the pandemic.

(f) COVID-19 will remain a serious threat to the people of the Commonwealth of Pennsylvania in November 2020.

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II. Background and Qualification

A. Credentials

5. I provide a brief overview of my background and qualifications, which are more fully contained in my current curriculum vitae, which is attached to this Declaration in Exhibit A. I am a tenured Professor of Medicine with a secondary appointment as Professor of Computer Sciences at the University of Pennsylvania. The NIH, NSF, DARPA, the Global Alliance for TB Drug Discovery and the Gates Foundation have funded my basic biochemical and genetic research in infectious diseases, resulting in more than 100 peer-reviewed papers. I earned my Bachelor of Science degree in mathematics and physics at the State University of New York at Stony Brook (1969), my Ph.D. in molecular biology at the University of Pennsylvania (1974) and my MD from Columbia University College of Physicians and Surgeons in New York (1976). I did my house staff training in internal medicine at the Brigham and Woman's Hospital in Boston (1976-1978) and my Fellowship in Infectious Diseases at the Brigham and Woman's Hospital and Harvard

Medical School (1979-1983). I am board certified in internal medicine and "grandfathered" in Infectious Diseases.

6. I served on national and international scientific review panels including the NIH, NSF, NASA Intelligent Systems Program, DARPA, and The Medical Research Council, South Africa. I was a member of the U.S. National Science Advisory Board for Biosecurity and the Dept. of Defense/National Academy of Sciences Biological Cooperative Threat Reduction Program.

7. My published work includes research on mathematical models of the spread of smallpox as well as on the molecular basis of the pathogenesis of tuberculosis, an infectious disease spread by aerosolized particles.

8. I currently serve on the Faculty Senate Committee on Post Pandemic Planning for The University of Pennsylvania and I am on the University of Pennsylvania Committee to Re-open Research on campus. I also serve on the COVID-19 Advisory Committee for the National Wrestling Coaches Association (NWCA) and on the COVID-19 Advisory Board for Beat the Streets, a "collection of city based non-profit organization that improve opportunities for underprivileged youth in communities across America by motivating a passion for exceptional work, honesty, teamwork, and persistence through the sport of wrestling. Beat the Streets serves over 6,200 youth and 208 teams a year in 8 major cities (New York City, Philadelphia, Los Angeles, Chicago, Providence, Lancaster, Cleveland, and Boston)."

9. I am the Chair of the Philadelphia Pandemic Preparedness Committee at the College of Physicians of Philadelphia. We are completing our report to be published in the near future.

10. I am the faculty director of the COVID-19 elective for fourth year medical Students at the University of Pennsylvania Perelman School of Medicine.

11. I am the founder of Energize the Chain a non-profit organization and GAVI INFUSE and funded partner that ensures the delivery of vaccines to people in the most remote regions of the world by utilizing power and connectivity available at cell tower sites and other sources of energy to power the refrigeration systems that are necessary to keep vaccines at the proper temperature.

B. Compensation

12. I have not participated in any legal action relating to COVID-19. Plaintiff's counsel is compensating me at the rate of $350.00 per hour for my work on this case. This compensation is in no way dependent on the conclusions that I reach.

III. Sources of Information

13. This declaration is informed by peer reviewed and non peer-reviewed publications in the public domain. It is also informed by my own observations, examinations and data of COVID-19 patients.

IV. What causes COVID-19?

14. COVID-19 is a disease caused by a novel Coronavirus, which is an enveloped, non-segmented, single-stranded, positive sense RNA virus with a helical capsule that infects both animals and humans. It is a member of the Betacoronavirus Subgroup of coronavirus that includes MERS-CoV, SARS-CoV, SARS-CoV-2. This virus infects cells that express the ACE2 receptor on its surface membranes. The spike protein which is on the surface of the virus facilitates viral entry into those host cells that express the ACE2 receptor. The spike protein is a target of many of the vaccines that are in development. (Letko M, Marzi A, Munster V (February 2020)). "Functional assessment of cell entry and receptor usage for SARS-CoV-2 and other lineage B betacoronaviruses". Nature Microbiology. ***5*** *(4): 562–569.* doi:10.1038/s41564-020-0688-y.

PMC 7095430. PMID 32094589. Hoffman M, Kliene-Weber H, Krüger N, Herrler T, Erichsen S, Schiergens TS, et al. (16 April 2020). "SARS-CoV-2 Cell Entry Depends on ACE2 and TMPRSS2 and Is Blocked by a Clinically Proven Protease Inhibitor". Cell. ***181*** *(2)*: 271–280.e8. doi:10.1016/j.cell.2020.02.052. PMC 7102627. PMID 32142651. Neerukonda SN and Katnei U (2020). A Review on SARS-CoV-2 Virology, Pathophysiology, Animal Models, and Anti-Viral Interventions. *Pathogens, 9(*426). Jin *et al.* (2020). Virology, epidemiology, pathogenesis, and control of COVID-19.

V. When and how is the virus spread from one person to another?

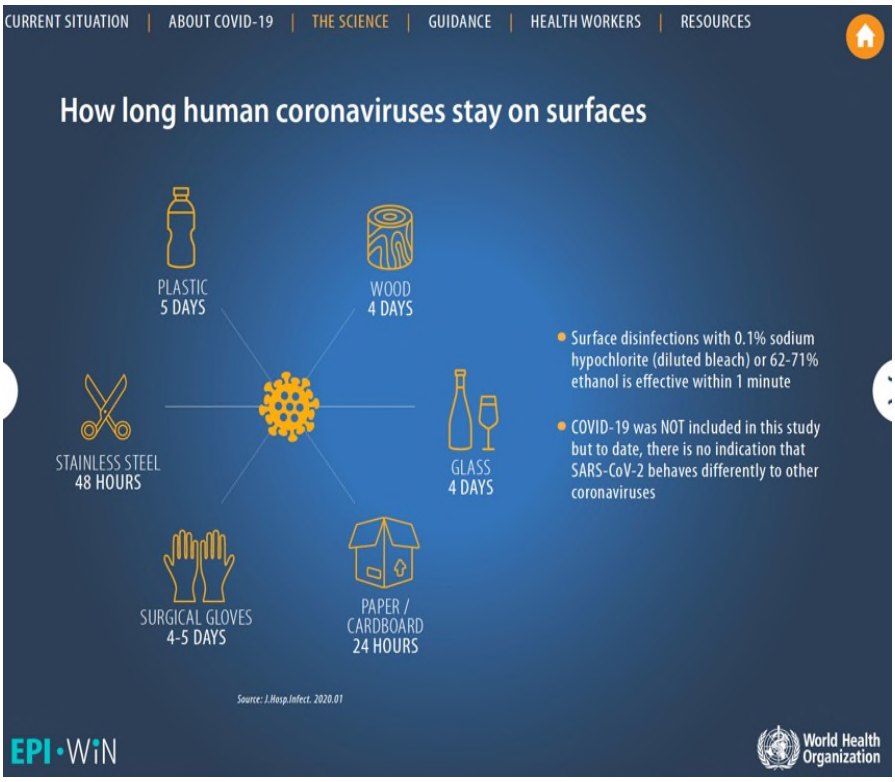
15. Respiratory droplets from infected individuals when inhaled, or transmitted to the eyes, mouth or nose of another individual can spread the disease, especially when individuals are less than 2 meters (six feet) apart. These infectious droplets are released when individuals sneeze, talk, or cough. Particles smaller than droplet size, so called aerosolized particles, have the potential to carry infections for longer distances and can stay in the air for longer periods of time. Recently 239 scientists published an appeal to the medical community and to the relevant national and international bodies to recognize the potential for airborne spread of COVID-19. They state, "There is significant potential for inhalation exposure to viruses in microscopic respiratory droplets (microdroplets) at short to medium distances (up to several meters, or room scale), and we are advocating for the use of preventive measures to mitigate this route of airborne transmission." *Clinical Infectious Diseases*, https://doi.org/10.1093/cid/ciaa939.

16. The CDC's "Current guidance based on community exposure, for people exposed to people with known or suspected COVID-19 or possible COVID-19" consider an exposure to be an "Individual who has had close contact (< 6 feet) for ≥15 minutes." They further qualify this time by noting, "Data are insufficient to precisely define the duration of time that constitutes a

prolonged exposure. Recommendations vary on the length of time of exposure, but 15 minutes of close exposure can be used as an operational definition. Brief interactions are less likely to result in transmission; however, symptoms and the type of interaction (e.g., did the infected person cough directly into the face of the exposed individual) remain important." (https://www.cdc.gov/coronavirus/2019-ncov/php/public-health-recommendations.html)

17. Contact with surfaces contaminated with viral particles is a component of environmental spread of COVID-19. While the virus can be found in stool, current understanding is that it is unlikely to spread via a fecal-oral route. A recent report (https://www.medpagetoday.com/infectiousdisease/covid19/87511) indicates that the virus may be spread mother to child in utero—although extent to which this happens in still under investigation.

18. The highest risk of transmission is during the early stages of infection, prior to or soon after symptom onset. Infectivity begins 2-3 days prior to symptoms (can be up to 7 days before with peak infectivity approximately 2 days before symptoms appear). Asymptomatic transmission does occur. (https://www.uptodate.com/contents/coronavirus-disease-2019-covid-19-epidemiology-virology-and-prevention#H3271257201).



19. The role of the environment is a critical component in understanding the spread of COVID-19. Indoor, poorly ventilated spaces and spaces in which distancing cannot be maintained are higher risk environments for spread of the disease. The virus can be viable on surfaces for varying lengths of time depending on the composition of the surface and cause disease. (https://www.who.int/docs/default-source/coronaviruse/risk-comms-updates/update-21-epi-win-covid-19-transmission-q-a.pdf?sfvrsn=796a4b2b_2)..

VI. Who are vulnerable?

20. It is important to recognize that Black and Latinx people have a higher risk of getting COVID-19 and dying from it than white people the same age. Indeed, the CDC has recognized the racial disparities that this disease has made evident: "Long-standing systemic health and social inequities have put some members of racial and ethnic groups at increased risk of getting COVID-19 or experiencing severe illness, regardless of age." https://www.cdc.gov/coronavirus/2019-ncov/need-extra-precautions/racial-ethnic-minorities.html. News accounts also trace the problems locally, as well. According to a May 15,

2020 report from WHYY, "The disparity is especially stark in Pennsylvania, where African Americans account for just 11.3% of the state's population but represent almost a third of the 22,725 COVID-19 cases where the race of the patient was recorded. Black Pennsylvanians represented 30% of the 2,133 deaths where the race of the victim was known." (https://whyy.org/articles/racial-disparity-grows-as-the-coronavirus-disproportionately-claims-black-lives-in-pa-jersey-and-delaware/). This trend was also recognized in a July 23, 2020 article in the *Philadelphia Inquirer* where it was reported, "New figures released Thursday show black Pennsylvanians make up a disproportionate amount of coronavirus cases across the commonwealth." (https://www.inquirer.com/health/coronavirus/spl/coronavirus-covid-19-demographic-data-pennsylvania-geographic-race-20200417.html)

21. Those more likely to die with COVID-19 are older individuals with more men dying than women, those with co-existing medical conditions such as obesity, diabetes (especially with elevated hemoglobin A_{1c}), severe asthma, respiratory or heart disease, autoimmune and immunosuppressive conditions, renal failure, and hematologic malignancy or other cancers, and those living under socioeconomic deprivation. The risk for severe illness or death from COVID-19 increases as people get older, as evidenced by the fact that individuals older than 80 years have a 20-fold higher risk for death than those aged 50 to 59 years. Black, Latinx, South Asian, and mixed ethnicities is associated with higher risk for death than white ethnicities. Only a small part of the excess risk associated with deprivation and nonwhite ethnicity was related to medical conditions.(https://www.cdc.gov/coronavirus/2019-ncov/need-extra-precautions/people-with-medical-conditions.html); The Disproportionate Impact of Covid-19 on Communities of Color https://catalyst.nejm.org/doi/full/10.1056/CAT.20.0370)

22. In addition to deaths directly attributed to infection with SAR-CoV-2, there is a burden of excess disease and deaths due to COVID-19 in the community. It is now evident for example, that children are not staying up to date with their immunization schedules and vaccine preventable diseases will rise in the coming months**.** As the CDC notes**,** "Vaccine Tracking System data indicate a notable decrease in orders for VFC-funded, ACIP-recommended noninfluenza childhood vaccines and for measles-containing vaccines during period 2 compared with period 1" (Figure). The decline began the week after the national emergency declaration; similar declines in orders for other vaccines were also observed. https://www.cdc.gov/mmwr/volumes/69/wr/mm6919e2.htm

VII. The clinical picture

23. Clinically, the incubation period for COVID-19 is generally 4-5 days but can be up to 14 days. The severity of the disease ranges from mild (~80%) to severe (~15%) to critical illness (~5%) with an overall fatality, which varies by region, of between 1% and10%.

24. The initial presentation can include: general complaints of fever, fatigue, loss of appetite, muscle aches, flu like symptoms, GI symptoms: diarrhea, nausea/vomiting, abdominal pain; neurologic symptoms--loss of smell or taste, headache, dizziness, ataxia, myelitis, stroke, encephalopathy, Guillain-Barre syndrome; dermatologic findings-chilblains, urticaria, rash; pneumonia--fever, cough, shortness of breath, infiltrates on chest x-ray, chest CT scans; heart issues--palpitations, chest pain, abnormal heart rate and rhythm; blood clots; in children a multisystem inflammatory syndrome, the Kawasaki-like syndrome. The initial presentation can quickly progress to acute respiratory distress syndrome (ARDS), respiratory failure, cardiac arrhythmias, acute cardiac injury, shock, thromboembolic events-pulmonary embolism, stroke, cytokine storm and multisystem inflammatory syndrome (in pediatric population).

25. COVID-19 is a very serious disease. It affects many organ systems including: the respiratory tract including the large airways and small airways, the trachea and nasal secretory cells; the heart and coronary vessels; the kidneys; the gastrointestinal tract; the eye; liver; testes; skin and brain. Notably, it also causes reduction in immune cells including both CD4 and CD8 T-cells, which causes a lowering of lymphocytes in the blood. One of the more devastating effects of infection with SARS-CoV-2 is its effect on the clotting system leading to venous and arterial clots. It can cause an uncontrolled systemic inflammatory response resulting from massive release of pro-inflammatory cytokines which results in immune-mediated damage to multiple organ systems.

VIII. How is COVID-19 diagnosed?

26. Nucleic acid amplification test (NAAT RT-PCR) is used to diagnose current infection using oropharyngeal or nasopharyngeal swabs or sometimes lower respiratory specimen as the test material. RT-PCR assays amplify regions of the SARS-CoV-2 genome to allow for detection. Different assays detect the nucleocapsid (N), envelope (E), or spike (S) genes. No test is 100% sensitive or 100% specific—i.e., there are false negative and false positive test results. Serology testing can identify evidence of past infection Detection of antibodies to SARS-CoV-2 via ELISA (enzyme-linked immunosorbent assay) where IgM antibodies appear first, followed by IgG antibodies. It is not clear if presence of these antibodies prevents future SARS-CoV-2 infections. (https://www.uptodate.com/contents/coronavirus-disease-2019-covid-19-diagnosis?topicRef=126981&source=related_link)

IX. Medical interventions

27. Over the course of the pandemic, we have learned how to manage COVID-19 patients and in that time, treatments with real but limited efficacy have emerged, including the

antiviral RNA dependent RNA polymerase inhibitor, remdesivir. Steroids have also been found to benefit a subgroup of patients with compromised pulmonary function. Clinical trials are underway with other modalities including convalescent plasma.

28. There is no cure for COVID-19 at the present time. However, the development of safe and efficacious vaccine or vaccines will be important advances in controlling the disease. Unfortunately, the release of a safe and effective vaccine is estimated to be at least one year away. The challenges to successful vaccine deployment include a timeline that must address safety and efficacy, the need to produce adequate supplies to meet worldwide demands, the ability of the supply chain to guarantee temperature standards of transportation and storage, the data system to accurately track and trace recipients of the vaccine. Researchers around the world are developing more than 155 vaccines against the coronavirus, and 23 vaccines are in human trials.

X. What Can Be Expected In November 2020?

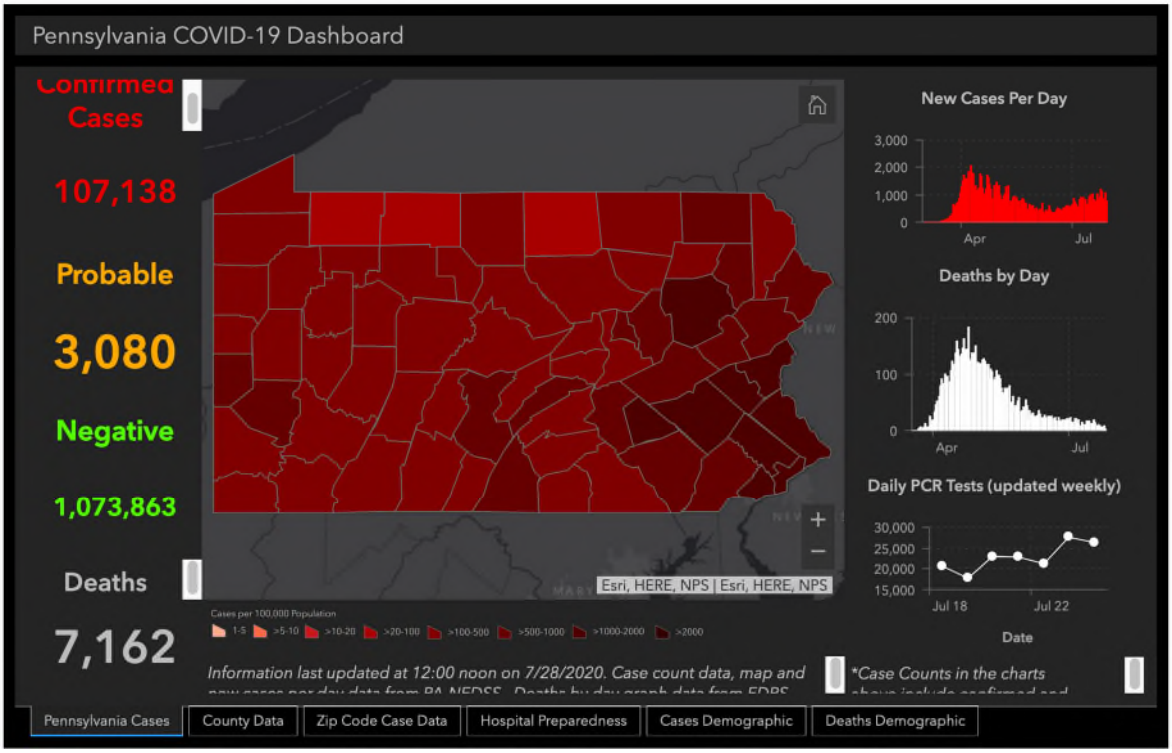
29. The COVID-19 pandemic has been ongoing for more than 6 months and continues to accelerate, especially in the United States. Globally, as of 3:49pm Central European Summer Time (CEST), 21 July 2020, there have been 14,562,550 confirmed cases of COVID-19, including 607,781 deaths, reported to WHO. (https://covid19.who.int/).

30. It is clear that mask wearing and social distancing, hand hygiene, surface cleaning and adequate ventilation would decrease spread of the virus. https://www.hopkinsguides.com/hopkins/view/Johns_Hopkins_ABX_Guide/540747/all/Coronavirus_COVID_19__SARS_CoV_2_

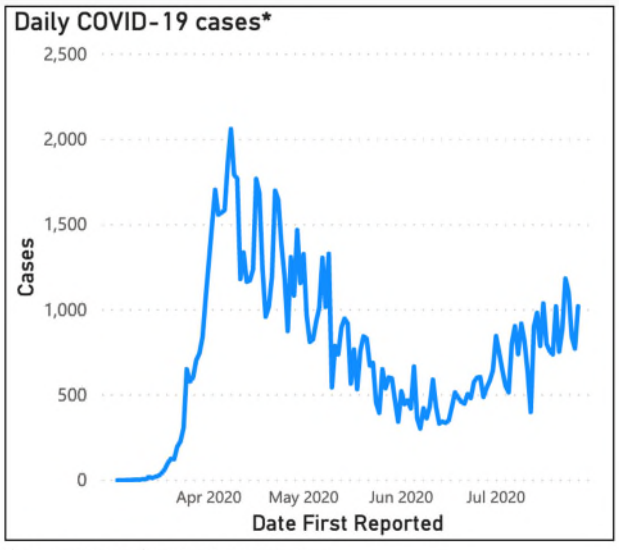
31. A new study from the CDC found, "The estimated number of infections ranged from 6 to 24 times the number of reported cases; for 7 sites (Connecticut, Florida, Louisiana, Missouri, New York City metro area, Utah, and western Washington State), an estimated greater

than 10 times more SARS-CoV-2 infections occurred than the number of reported cases." July 21, 2020 Seroprevalence of Antibodies to SARS-CoV-2 in 10 Sites in the United States, March 23-May 12, 2020. Havers FP., Reed C., Lim T., et al. JAMA Intern Med. Published online July 21, 2020. doi:10.1001/jamainternmed.2020.4130.

32. The Rockefeller Foundation, recognizing the urgency of the problem, called for "rapidly expanded diagnostic testing capacity from 1 million tests per week to 3 million tests per week by June, and to 30 million tests per week by October. Today we're at 4.5 million tests per week, but unfortunately it's taking far too long to get to 30 million tests per week, and communities that most need them – low-income families, minorities, and highly vulnerable essential workers – find it most difficult to gain access, while elite institutions, companies, and enterprises seem to be able to access them on the private market. We need to urgently fix clinical diagnostic testing and accelerate the introduction of faster, cheaper, point-of-care screening tests to prepare for next flu season." (https://www.rockefellerfoundation.org/national-covid-19-testing-and-tracing-action-plan/).



I refer to the PA Dept of Health chart above. In Pennsylvania as of 12 noon on 7/28/2020 there were 107,138 confirmed cases with 7,162 deaths.



Source: (**https://www.health.pa.gov/topics/disease/coronavirus/Pages/Coronavirus.aspx**

https://www.health.pa.gov/topics/disease/coronavirus/Pages/Cases.aspx)

33. The graph above from the PA Dept of Health shows that the number of COVID-19 cases in Pennsylvania decreased substantially from April, but then has begun to rise again.

34. Note that during the month of July the number of COVID-19 cases have increased, reflecting the trend throughout the United States.

35. There are multiple and interdependent explanations for the recent spike in cases including, but not limited to, failure of certain jurisdictions to adhere to the guidelines to reopen that the federal government issued in April 2020, which included a 14-day decline of confirmed coronavirus cases or a decline of positive tests as a percent of total tests within that period; super spreaders and super-spreading events; the lack of social distancing, face mask wearing and other non-pharmaceutical prevention methods, constraints on testing and extended turn-around time of test results and the lack of adequate contact tracing. I believe that the increase in the number of cases will lead to increased hospitalizations followed by an increase in numbers of deaths.

36. Predictions of the future trajectory of the pandemic and policy decisions concerning COVID-19 have been informed by mathematical models of the disease recognizing that no model is perfect. Nevertheless, inspection of the timetable of infections in the Commonwealth of Pennsylvania and in the US shows that after the first cases of COVID-19 appeared and the number of cases started to increase dramatically, the state imposed a rigorous social distancing regime and

encouraged residents to wear masks. As expected, it took time for the curve to start to flatten. Cases continued to rise and peaked in mid-April at which time the beneficial effect of these non-pharmaceutical interventions appeared. The number of cases continued to slowly decline as long as the interventions were maintained. Then the number of cases again dramatically increased in late June as the interventions were lifted in many parts of the US and to a lesser extent in Pennsylvania. The number of cases is now at an all-time high, with no indication of a flattening. Therefore, even if the same level of mitigation is imposed immediately and rigorously adhered to, the response curve will flatten, but not go to zero by November. Any deviation from strict mitigation will lead to an increase in cases, hospitalizations and deaths. The number of cases in November 2020 will not be impacted by a vaccine, which is still many months in the future. An additional concern is that there is no evidence from viral genetic sequence data that it is mutating to a less virulent, less contagious strain (Tracking changes in SARS-CoV-2 Spike: evidence that D614G increases infectivity of the COVID-19 virus. Korber B., Fischer WM., Gnanakaran S., Saphire EO., Montefiori DC. Cell. July 02, 2020 DOI:https://doi.org/10.1016/j.cell.2020.06.043). That means that there is no evidence that the virus is weakening or getting less dangerous.

37. On point, again keeping in mind the caveats of all mathematical modeling, one of the most influential models from the University of Washington, just published the following prediction for November (https://www.medscape.com/viewarticle/933958?nlid=136460_3243&src=WNL_mdplsfeat_200721_mscpedit_imed&uac=51467FG&spon=18&impID=2470244&faf=1) as reported in Reuters: "A newly revised University of Washington model projects the U.S. death toll from COVID-19 will climb to just above 224,000 by Nov. 1, up 16,000 from a prior forecast, due to rising infections and hospitalizations in many states. But the latest forecast from the university's Institute for Health

Metrics and Evaluation (IHME), released late on Tuesday, also predicts the death toll could be reduced by 40,000 if nearly all Americans wore masks in public. "Use of masks is up, but not as high as it should be. If 95% of Americans wore masks each time they left their homes, infection rates would drop, hospitalizations would drop, and forecast deaths would drop," the IHME said in a statement. The IHME's new forecast came after Alabama, Florida and North Carolina on Tuesday reported record daily increases in deaths from COVID-19, marking grim new milestones of a second wave of infections surging across much of the U.S. The new IHME forecast - 224,089 U.S. lives lost by Nov. 1 - was revised upward from the 208,254 deaths projected on July 7. At least 136,052 Americans have died from COVID-19, the illness caused by the novel coronavirus, while reported U.S. infections have surpassed 3.4 million, according to a tally by Reuters. The IHME's projections have been cited in the past by the White House and are watched closely by public health officials."

38. I conclude from this that COVID-19 will remain a serious threat to the people of the Commonwealth of Pennsylvania in November 2020 at the time of the General Election.

XI. Recognition of the potential to spread COVID-19 at polling places:

39. These data and the model show that there is a definite threat that polling places in November can be sites where the SARS-CoV-2 will spread and cause disease. In fact, I agree with the CDC in recognizing some of the challenges posed by voting during a pandemic: Guiding Principles to Keep in Mind (https://www.cdc.gov/coronavirus/2019-ncov/community/election-polling-locations.html)

40. According to the CDC:

The more an individual interacts with others, and the longer that interaction, the higher the risk of COVID-19 spread. Elections with only in-person voting on a single day are higher

risk for COVID-19 spread because there will be larger crowds and longer wait times. Lower risk election polling settings include those with:

- a wide variety of voting options
- longer voting periods (more days and/or more hours)
- any other feasible options for reducing the number of voters who congregate indoors in polling locations at the same time The virus that causes COVID-19, is mostly spread by respiratory droplets released when people talk, cough, or sneeze. It may be possible that a person can get COVID-19 by touching a surface or object that has the virus on it and then touching their own mouth, nose, or possibly their eyes. Personal prevention practices (such as handwashing, staying home when sick) and environmental cleaning and disinfection are important actions election officials, poll workers, and voters can take to help lower the risk of COVID-19 spread. (https://www.cdc.gov/coronavirus/2019-ncov/community/election-polling-locations.html.)

41. As I mentioned, I agree with the CDC's recommendations above. There are voting methods that could minimize the threat of COVID-19 outbreak by increasing the ability to socially distance in a polling place, by requiring mask wearing, by decreasing person to person contact time, by adequate and rigorous surface cleaning, and by encouraging mail in ballots.

42. I understand that even the Commonwealth of Pennsylvania, through the Secretary of State, has also recognized the potential for the spread of COVID-19 in polling places and issued guidelines in response. These guidelines, unfortunately, do not make any special accommodations for older or medically vulnerable voters or poll workers, who, as I mentioned above, face the greatest risk of serious illness or death from COVID 19. Moreover, the mitigation efforts issued

by the Commonwealth, even if scrupulously applied, cannot guarantee against the spread of the virus in the polling place. In this regard, it is important to recognize the dynamics and flow of people in high-trafficked areas such as polling places. Congregate settings, like polling places, present a great risk of transmission because of the potential for close contacts (exposure to a COVID-19 positive individual, i.e., within 6 feet for more than 15 minutes). Pollworkers and voters may be in the same location, especially indoors, for a long time, meaning that this increases the risk of transmission of the virus.

43. A further challenge is that transmission of SARS-CoV-2 may occur from asymptomatic people (who never develop symptoms) or presymptomatic people (who later develop systems). As a result, there is real concern of transmission form someone, such as one of the "spreaders," who has no visible symptoms and whose illness will not necessarily be obvious to others in the polling place. Indeed, a note the WHYY story documenting a poll worker in Philadelphia who tested positive in circumstances where many of the mitigation measures, such as social distancing, were not consistently applied and personal protective equipment was limited. (https://whyy.org/articles/a-philly-poll-watcher-got-covid-19-but-the-city-isnt-notifying-voters/)

44. While the mitigation measures that are recommended by the Secretary of State are important, I agree with the CDC that the most effective form of mitigation is for election officials to pursue, "any other feasible options for reducing the number of voters who congregate indoors in polling locations at the same time." In that regard, mail-in voting is especially relevant. Jurisdictions that make every effort to expand the use of this option and make it easier -- such as sending automatic ballots or ballot applications, or maximizing the number of ways that a voter can return the ballot (mail, drop boxes, in-person) – will likely decrease the number of people who

have to physically come to vote in person. Consistent with the CDC guidance, such an effort would make the in-person voting experience safer.

45. I also note that the CDC has specific recommendations – https://www.cdc.gov/coronavirus/2019-ncov/community/election-polling-locations.html -- regarding crowd and line management in an effort to reduce the risk of virus transmission. Those recommendations are sound. In particular, rather than reducing the number of polling places, as I understand has happened in Pennsylvania and other states, it is important, as the CDC advised, for jurisdictions to "Consider increasing the number of polling locations available for early voting and extending the hours of operation" and to "Maintain or increase the total number of polling places available to the public on Election Day to improve the ability to social distance." As I mentioned, the more polling places that are available, the more likely that there will be social distancing because there will be fewer people on average in each polling place, and the greater opportunity for voters and pollworkers to protect themselves against the virus. However, there may be jurisdictions that for various reasons may feel the need to close, reduce, or consolidate polling places. To the extent that a jurisdiction is considering such consolidation, which is the opposite of CDC guidance, these jurisdictions need to ensure that there are criteria to avoid increasing the number of voters directed to vote in each polling location. Such an effort would lead to further crowding and increase the risk of transmission.

46. It will be necessary to disinfect and clean the repeat-touch surfaces that are found in polling places and voting booths after each use, an effort that will be time consuming and costly. Paper ballots, including mail-in ballots, appear to be a very safe alternative because the virus does not last as long on paper as it does on repeat-touch surfaces of voting systems commonly found in polling places.

XII Summary of Findings

47. SARS-CoV-2 is a highly infectious virus that can cause mild to life threatening disease.

48. Currently, the only interventions available to limit and mitigate the spread of this disease are non-pharmaceutical interventions—social distancing, wearing masks, hand hygiene, and avoidance of touching face, eyes and nose.

49. Herd immunity is not at the level that is required to impact the spread of disease.

50. Pharmaceutical interventions, e.g., antiviral agents, anti-inflammatory agents, monoclonal antibodies, convalescent plasma and vaccines, while promising, are not yet proven to positively impact disease progression, except in limited instances, nor prevent spread of the disease.

51. Closed, indoor spaces, such as polling places, pose a major challenge for adequate control of viral spread and have the potential to seed or re-seed the infection in communities, even those that have done a good job in mitigating the pandemic.

52. Other voting options, including the use of mail-in balloting, are safer alternatives to in-person voting, even with mitigation procedures in place at the physical voting locations.

53. COVID-19 will remain a serious threat to the people of the Commonwealth of Pennsylvania in November 2020..

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Harvey Rubin, M.D., Ph.D.

Dated: July 29 2020

EXHIBIT A

Dr. Rubin is Professor of Medicine with secondary appointment as Professor of Computer Sciences at the University of Pennsylvania. The NIH, NSF, DARPA, the Global Alliance for TB Drug Discovery and the Gates Foundation have funded his basic biochemical and genetic research in infectious diseases, resulting in more than 100 peer-reviewed papers. He served on national and international scientific review panels including the NIH, NSF, NASA Intelligent Systems Program, DARPA, and The Medical Research Council, South Africa. He was a member of the U.S. National Science Advisory Board for Biosecurity and the Dept. of Defense/National Academy of Sciences Biological Cooperative Threat Reduction Program. Dr. Rubin's published work include research on mathematical models of the spread of smallpox as well as on the molecular basis of the pathogenesis of tuberculosis, an infectious disease spread by aerosolized particles. He is on the Faculty Senate Committee on Post Pandemic Planning for The University of Pennsylvania and he is one the University of Pennsylvania Committee to Re-open Research on campus. He also serves on the COVID-19 Advisory Committee for the National Wrestling Coaches Association (NWCA) and on the COVID-19 Advisry Board for Beat the Streets, a "collection of city based non-profit organization that improve opportunities for underprivileged youth in communities across America by motivating a passion for exceptional work, honesty, teamwork, and persistence through the sport of wrestling. Beat the Streets serves over 6,200 youth and 208 teams a year in 8 major cities (New York City, Philadelphia, Los Angeles, Chicago, Providence, Lancaster, Cleveland, and Boston) and the program is looking to expand. As of 2018, Beat the Streets donors has invested fifteen million dollars into the sport of wrestling." He is the Chair of the Philadelphia Pandemic Preparedness Committee at the College of Physicians of Philadelphia. He is the faculty director of the COVID-19 elective for fourth year medical Students at the University of Pennsylvania Perelman School of Medicine.

Dr. Rubin is the founder of Energize the Chain a non-profit organization and GAVI INFUSE and funded partner that ensures the delivery of vaccines to people in the most remote regions of the world by utilizing power and connectivity available at cell tower sites to power the refrigeration systems that are necessary to keep vaccines at the proper temperature.