

Published: February 28, 2023

**Citation:** Sagripanti J-L and Aquilano DR, 2023. Reduced Social Distancing and Face Mask Wearing at Massive Soccer-Related Gatherings Did Not Affect Daily COVID-19 Infections in Argentina, Medical Research Archives, [online] 11(2). <https://doi.org/10.18103/mra.v11i2.3471>

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DOI <https://doi.org/10.18103/mra.v11i2.3471>

ISSN: 2375-1924

## RESEARCH ARTICLE

# Reduced Social Distancing and Face Mask Wearing at Massive Soccer-Related Gatherings Did Not Affect Daily COVID-19 Infections in Argentina

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## ABSTRACT

**AIMS.** To determine the contribution of social distancing and face mask wearing in the prevention of COVID-19 infections in Argentina.

**METHODS.** Attendance to the funeral of ex-soccer star Diego Maradona was estimated by the area occupied by the mourners and their density. The people congregated to celebrate the America's Cup victory was deduced mainly from TV ratings. The proportion of individuals wearing or not face masks was calculated from photographs taken at both events. The COVID-19 epidemiological data used was released by the Argentinean Ministry of Health from March 3<sup>rd</sup> 2020 to August 31<sup>st</sup> 2021.

**RESULTS.** We estimated that Maradona's funeral was attended by approximately 250,000 mourners. On the other hand, approximately 5.084.000 followed by television the America's cup final in Buenos Aires alone. Extrapolating to the whole country suggests that over 4 million individuals congregated in person to celebrate the victory. The percentage of individuals not wearing face masks at the funeral was 54.0% ± 5.2 % and at the soccer victory celebrations 84.5 % ± 6.9 %, both estimates with a confidence of 99%. Daily COVID-19 infections in Buenos Aires remained at less than 5,000 per day during 30 days before- as well as during 24 days following-the funeral. New infections in Argentina remained less than 21,000 during 10 days before as well as 30 days following the soccer cup celebrations.

**CONCLUSIONS.** Considering that SARS-CoV-2 median incubation is 5.1 days, the time periods following Maradona's funeral and the America Soccer Cup celebrations provided ample time for COVID-19 to flare up if significant contagion would have proliferated amongst the crowds. The lack of an increase in COVID-19 infections after two independent and large gatherings with people in close proximity and limited wearing of face masks, contradicts any beneficial effect of social distancing and of mask wearing during the pandemic. These findings seem particularly important when considering that social distancing and mask wearing limited attendance to public events, negatively impacted commerce, burdening restaurants and many other businesses; and overall taxed society unnecessarily, according to the data presented here.

*(A summary of some of these findings were presented at the European Society of Medicine Annual Meeting. August 04, 2022. Entitled: Unexpected effect of sunlight, the environment, and public health measures in the progression of COVID-19) <https://esmed.org/video-detail/?id=86>.)*

**Keywords:** COVID-19, SARS-CoV-2, pandemic, social distancing, face mask, person-to-person transmission, developing countries.

## INTRODUCTION

The non-pharmaceutical public health policies implemented by most countries in response to COVID-19 included mandating social distancing (usually 6 feet or 2 meters) and wearing face masks (generally made of a single layer cloth). In addition, public health measures taken in Argentina during 2020 (from March 19, 2020 to December 31, 2020) resulted in 119 days of strict nation-wide lock-down, 166 days of less restrictive lock-downs, cancellation of public and family gatherings as well as closure of international borders, schools, and commerces.<sup>1</sup> On November 26, 2020, the National Government temporarily lifted all of the restrictions under General Decree # 936/2020 which authorized three days of national mourning for the death of Diego Maradona (an ex-soccer star worshiped in Argentina).<sup>2</sup> The funeral included the viewing of the casket by mourners on November

26th and Maradona's burial the following day on November 27, 2020. The sudden lifting of stringent measures provided an uncommon opportunity to study any increase in COVID-19 infections due a massive gathering of people. Another occasion to analyze the effect of large gathering on the pandemic arose seven months after Maradona's funeral.

After 28 years without victory in spite of reaching the finals seven times, the Argentina's soccer national team conquered the America's Soccer Cup (Copa América de Football) on July 10th, 2021. In all corners of Argentina, the spontaneous crowds celebrating the victory were of considerably magnitude<sup>3-7</sup>.

In addition to social distancing and use of face masks, at the time of Maradona's funeral and the Americas cup celebrations were in place the restrictions listed in Table 1.

**Table 1: Comparative restrictions between Maradona's funeral and Soccer Cup celebrations**

Public Health Measures	Details	November 2020	July 2021
Group Traveling	Sport teams, graduation classes, tourism, etc.	Prohibited	
Family Gatherings	More than ten people at particular residences	Prohibited	
Public Transportation	Limited to essential personnel	Prohibited	
Social Gatherings Indoors	Cultural, religious, social or recreational	Prohibited	
Indoor Activities	Cinemas, theaters, gymnasiums, clubs	Prohibited	
Restaurants	Allowed home delivery and pick-up)	Closed between 23:00 and 06:00	
Labor and Services Indoor	Ventilation following special protocols	Operation at 50% capacity	
National Borders		Open	Closed
Curfews	Enforced public curfew from 0:00 to 06:00	Lifted	Imposed

By comparing the infection rates in Argentina before and after the two massive gatherings, we expected to estimate the contribution of social distancing and mask wearing to the control or delay of the pandemic. Our findings surprised us.

## METHODS

The policies implemented in Argentina to control COVID-19 were those published daily by the Ministry of Health of Argentina from March 3rd 2020 to August 31st 2021.<sup>8</sup> The epidemiological data corresponding to COVID-19 for Argentina were confirmed by the compilation made by the John's Hopkins' Center for System Sciences and Engineering.<sup>9</sup>

According to WHO recommendations, face masks must cover both, nose and mouth to be considered adequate<sup>10</sup>; thus, people at both events

without face masks or those covering only their mouth were scored as not wearing a mask. The compliance of mask wearing at the funeral of ex-soccer star Diego Maradona and during the celebrations of America's cup victory was estimated from different photographs posted in the internet by various sources. Thirty-six of the online photographs that were taken during the two-day funeral had enough definition to score accurately 329 persons as either wearing face mask or not. Face mask wearing during America's Cup celebrations was performed on 348 recognizable faces from 18 independent photos taken during the event at various locations. The proportion of persons wearing or not face mask was determined in each photograph, the standard deviation was calculated among all images and the level of error of the face mask wearing mean was reported with a confidence of 99%, obtained by input into a

sampling size calculator the number of scored faces and the estimated crowd sizes of each event.<sup>11</sup>

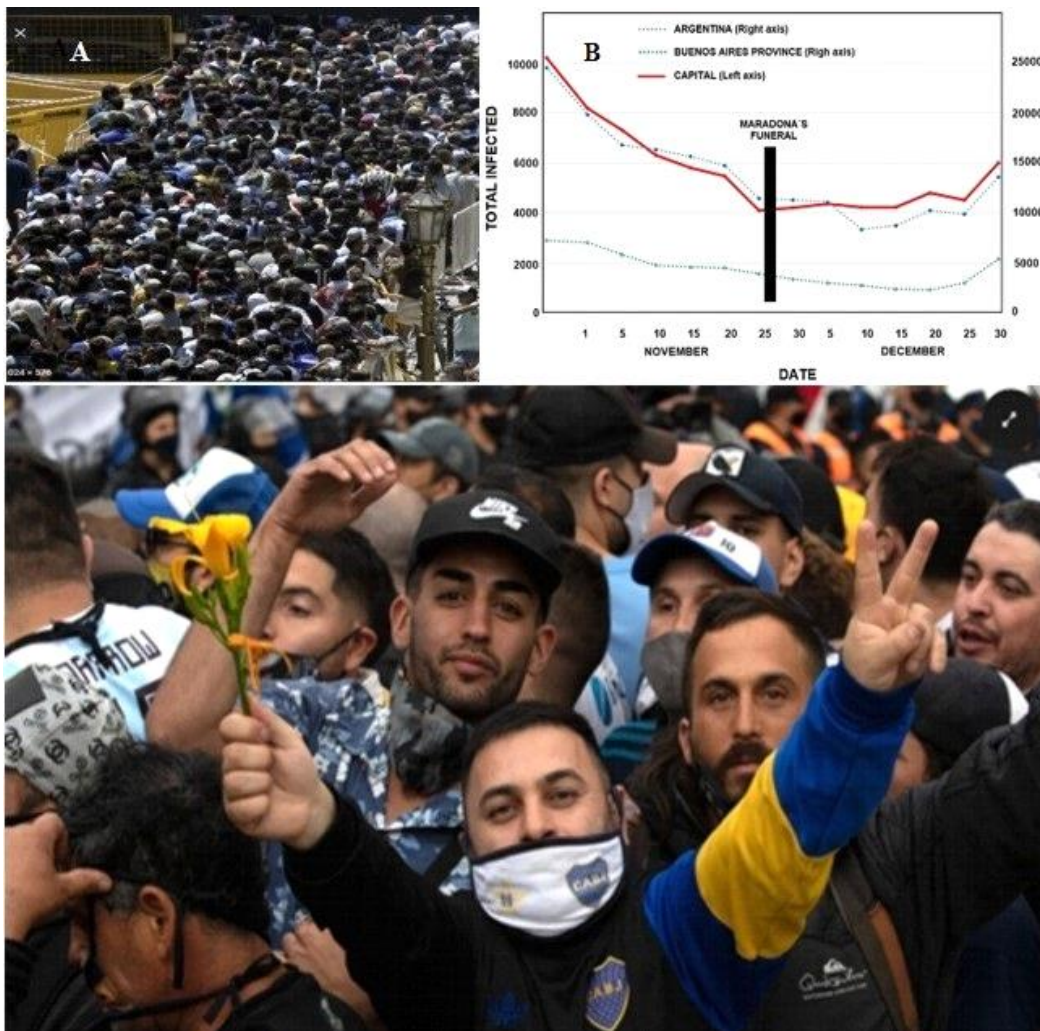
The number of people attending the funeral of Maradona was calculated by the area occupied by the crowd and the density (people per square meter) obtained from photographs of the event. We approximated the population celebrating the America's Cup victory from the TV ratings reported for the final match.<sup>12</sup>

## RESULTS

**Funeral of Maradona:** News reports, as well as aerial photographs available online, confirm that the mourners -waiting to pay their respects- crowded along 25 city blocks surrounding the

national palace where the casket was located.<sup>13,14</sup> The length of city blocks in Buenos Aires are approximately 100 meters long and the streets 10 meters wide, suggesting that the crowd occupied approximately 25,000 square meters. Our analysis of available photographs from the event (see below) suggest that in at least 20 central blocks, the crowd was shoulder to shoulder (see Inset A in Figure 1), at a density of 5.5 persons per square meter. Additionally, a density of 3 persons per square meter could be estimated in the remaining 5 blocks at the periphery.

These estimates indicate an attendance of approximately 125,000 mourners to the viewing and a similar number next day to the burial.



**Figure 1:** Funeral of Diego Maradona in Buenos Aires, Argentina. The main panel depicts mourners waiting to pay respects in front of the casket. Inset A shows an elevated view of the crowd along a city block. Inset B presents the number of COVID-19 daily infections reported by government sources in the capital city of Buenos Aires (red line), its provincial suburbs (green line) or corresponding to national figures (blue line)

We could accurately score 329 persons as either wearing face mask in 36 of the photographs that were taken during the two-day funeral. The average of the percentage of individuals not

wearing face masks at the funeral (or wearing them improperly) in each of the photographs (N=36) was 54.0% and the standard error of the percentage was 2.0%. This sampling size (n=329) of a

population estimated at 250,000 (during the days of viewing and of burial) assigns to the average of 54% of the persons attending the funeral and not wearing face mask a 5.2 % error with a confidence of 99%. Furthermore, extensive shouting and singing occurred throughout the funeral highlighting the opportunity for bioaerosol emission and concomitant person-to-person-transmission.

We investigated whether contagion during the funeral had an impact on COVID-19 daily infections reported in: i) the whole country as released daily by the Ministry of Health of Argentina.<sup>8</sup>, ii) the city of Buenos Aires (where the funeral occurred) and iii) the suburban Province of Buenos Aires from where many mourners came.<sup>15</sup> The epidemiological data corresponding to COVID-19 in Argentina was compared and confirmed by the compilation made by the John's Hopkins' Center for System Sciences and Engineering.<sup>9</sup>

Inset B of Figure 1 shows that national COVID-19 infections did not increase during the dates of the funeral. The local epidemiological data depicted in the same graph indicates that daily infections in Buenos Aires City remained at less than 5000 new infections per day during 30 days before the funeral as well as during 24 days following the funeral (until December 19, 2020).<sup>8</sup> Similarly, daily infections did not increase in suburban Buenos Aires Province from where many mourners came.

#### America's Soccer Cup celebrations:

There is no available estimation of the total number of persons spontaneously celebrating the America Cup victory in every corner of Argentina. However, news reports as well as aerial photographs available online agree in that minutes after the end of the soccer final match, crowds of thousands people begun gathering to celebrate the victory in every corner of the country including Buenos Aires, every major city such as Rosario, Cordoba, Mar del Plata, Salta, Mendoza, Misiones, Tucuman, Santa Cruz, Corrientes, Catamarca, Entre Rios, Tierra del Fuego and even in Base Marambio in the Argentinean Antarctic sector.<sup>3-7</sup>

One of the most photographed of the gathering places was The Obelisk (see Figure 2) where

people crowded at least two blocks before and another two pass the Obelisk through 9 of July avenue (200 meters wide) and Corrientes Avenue (50 meters wide) (see photo 2A) occupying at least 40,000 square meters. At a minimal density of 3 persons per square meter, the crowd celebrating victory only at the Obelisk must have been no less than 120,000. In all the places throughout Argentina were people congregated to celebrate, the images and the press reports were qualitative with imprecise numbers and area coverage but no number estimates were available. We approximated the population celebrating the America's Cup victory from the TV ratings reported for the event. The TV rating for watching the America's Cup on 2021 in Capital (Buenos Aires city) and Greater Buenos Aires (GBA) was 52.53%.<sup>12</sup>

A one point of TV rating represents 1% of the target audience. There are 3,070,600 homes in Buenos Aires city and GBA with 9.678.200 potential viewers between 4 a 99 years of age. Thus, one point rating in Buenos Aires city and GBA corresponds to 30.706 homes and 96.782 individuals. Therefore, a TV rating of 52.53% indicates that were approximately 5.083.958 viewers following the match by TV in Buenos Aires and GBA.

It is safe to extrapolate a similar TV rating to all Argentina considering the passion for soccer in the provinces. Using a population figure for Argentina of 45.5 million<sup>16</sup>, nearly 20 million of Argentineans must have watched the final match of the America's Cup.

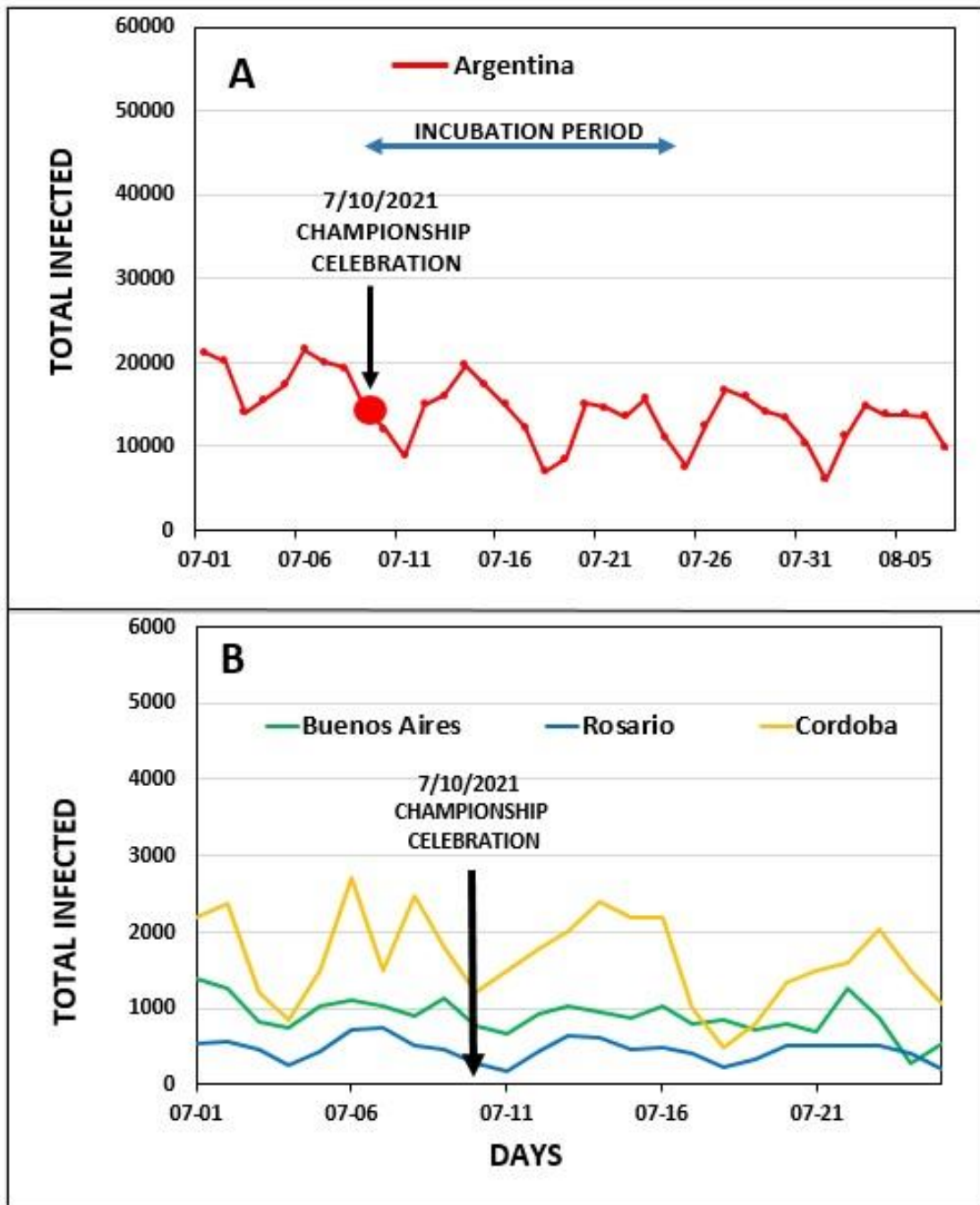
Everybody that the authors know come out of their homes to celebrate (personal communications) but certainly the sick, the very old and the very young could have stayed indoors. No matter what fraction of the nearly 20 million TV viewers gathered in celebration, the crowds were considerable. A conservative assumption would be that at least one-in-five of the people following the international match on TV gathered after its ending for rowdy celebrations of the national team's victory. This conservative assumption still indicates that at least 4 million people gathered in public centers of celebration in July 2021.



**Figure 2.** Soccer World Cup celebrations in largest cities of Argentina. Insets A, B C and D shows elevated views of the crowd in Buenos Aires, Rosario, Cordoba and Salta, respectively.

We performed an analysis of face mask wearing during America's Cup celebrations similar to that described for Maradona's funeral. Such an analysis of 348 recognizable faces (in 18 independent photos at various locations) revealed that  $84.5\% \pm 17\%$  of the participants in the Americas cup celebrations did not wear face masks. This sampling size ( $n=348$ ) of a population estimated at over 4 million across the country (see above) assigns to the average of 84.5 % of the persons celebrating the soccer victory and not wearing face mask a 6.9 %

error with a confidence of 99%. The continued chanting and shouting of people in close proximity during many hours of celebrating the Americas cup victory throughout the evening and night of July 10, 2021 should have enhanced the opportunity for SARS-Co V-2 contagion. We investigated whether contagion during the world cup celebrations had an impact on COVID-19 daily infections reported in: i) the whole country (Figure 3A), ii) the nation's capital of Buenos Aires, and iii) large cities such as Rosario and Cordoba (Figure 3B).



**Figure 3.** COVID-19 Infections. Panel A presents the number of daily COVID-19 infections reported by government sources in the nation (red line), whereas Panel B shows the data for the capital city of Buenos Aires (green line), Rosario (blue line), Cordoba (yellow line) relative to the date of the Soccer Cup celebrations (vertical line).

Panel A of Figure 3 shows that national COVID-19 infections remained relatively stable with a slightly decreasing trend between July and August 2021. The local epidemiological data<sup>8</sup> depicted in the same graph indicates that daily infections in Argentina remained at less than 21,000 new infections per day during 10 days before the celebrations as well as during 30 days following the gatherings. Similarly, daily infections did not

increase in Buenos Aires, Rosario, nor Cordoba (Fig 3B). Relatively stable number of infections before and after the date of the America Cup celebrations was also reported in other Argentinian cities (data not shown).

#### DISCUSSION

The 2020 funeral of Diego Maradona in Buenos Aires, Argentina appears to have been the largest

global gathering during that year. Similarly, the celebrations of the America's Soccer Cup victory throughout Argentinian cities, may have been the largest gathering of people in the world during 2021. Studying both events allows unique analysis and conclusions.

The presented data demonstrates that a gathering of 250,000 people during Maradona's funeral (Figure 1), crowded within a relatively small area (Figure 1 Inset A) where approximately half of the people did not wear face masks, failed to increase daily COVID-19 infections (Inset B) during 24 days following-the funeral. Similarly, the gathering of at least four million nation-wide after the soccer cup victory, where nearly 84% of people did not wear face masks, failed to increase COVID-19 infections across Argentina 30 days after-the celebrations (Figure 3).

Considering that SARS-Co V-2 median incubation period is 5.1 days<sup>17</sup> and 97.5% of those who develop symptoms will do so within 8.2 to 15.6 days of infection; the 24-day period following Maradona's funeral and 30 days after the America Soccer Cup celebrations provided ample time for COVID-19 to flare up if significant contagion would have proliferated amongst the crowds.

The vaccination campaign in Argentina started on December 29, 2020.<sup>18</sup> Thus, nobody was vaccinated in Argentina during Maradona's funeral in November of that year. Conversely, during the America's Cup celebrations, 43% of Argentina's population had at least one dose and 11% had two doses of anti-COVID-19 vaccines.<sup>19,20</sup> Thus, similar absence of any increase in infections after crowding and limited face mask wearing at two large gatherings cannot be ascribed to vaccination due to the lack of vaccines during Maradona's funeral. Any potential reporting errors by the government on the number of SARS-Co V-2 infections should have occurred before, during and after the two events, therefore, eliminating any potential bias in the present analysis and preventing concerns about the accuracy of our findings.

The WHO initially advised against widespread mask-wearing by the public, but reversed course and recommended masks in public on June 5, 2020.<sup>21</sup> To elucidate the scientific grounds for this policy reversal, we searched PubMed for articles on the "benefit of face masks". The number of hits numbered 12 articles in the year 2000, 24 in 2018, 33 in 2019, increasing to 106 in 2020 and to 190 articles in 2022. This apparent explosive interest in the use of face masks could indicate a rapid and profound advancement in the field that should justify the obligatory use of face masks. However, upon our critical review of the available literature, we found weak evidence for wearing cloth face

masks as a safe and effective tool to prevent the spread of SARS-Co V-2. Many of the publications are reviews without original data.<sup>22-25</sup> These review articles strongly recommend the use of face masks. However among them, the extensive review by Howard et. Al. notes that the supportive evidence includes only one observational trial concluding that "Overall, direct evidence of the efficacy of mask use is supportive, but inconclusive".<sup>22</sup>

Another review by Raymond<sup>25</sup> also acknowledges that there was only one randomized controlled study of the efficacy of masks to mitigate the spread of COVID-19. The same review concludes that wearing masks should slow the spread of COVID-19, considering as strong evidence the effectiveness of masks to slow the spread of the (misnamed) Spanish Flu epidemic of 1918.<sup>25</sup> However, how the author can be so certain that massive face mask wearing was so effective in a pandemic that remained unchecked for several years and killed between 20-30 million people.<sup>26</sup> A more objective conclusion would be that the widespread mask use did not alter the course of that flu pandemic, which more likely progressed until the number of susceptible hosts decreased below the epidemic maintenance level and/or the virus underwent natural attenuation. Curiously, natural attenuation was disregarded also in the control of COVID-19, in spite of being described and well understood by the work of Sabin during the 1950's.<sup>27</sup>

Another historical triumph of face masks is attributed to Wu Lien Teh's work to control the 1910 Manchurian Plague<sup>28</sup>. The end of the 1910 plague is acclaimed (mainly by Chinese authors) as "a milestone in the systematic practice of epidemiological principles in disease control"<sup>29</sup>, in which Wu identified the cloth mask as "the principal means of personal protection." However, this claim cannot be substantiated without knowing how the disease evolved or the contribution of general hygiene measures taken in Manchuria at that time to control infected rodents and the flea vector of the disease. In addition, airborne transmission of plague was known since the 13th century, and face coverings were recommended for protection from respiratory epidemics since the 14th century.<sup>29</sup> If face mask covering had apparent little impact in the control of pandemics that decimated Europe for hundreds of years, it appears presumptuous claiming that the same measure controlled the Manchurian plague.

The earliest recorded mask is attributed to Leonardo Da Vinci in the 15<sup>th</sup> century and the earliest protective masks patented in the USA was filed by Lewis P. Haslett in 1847 which consisted of a thick moistened wool mask with an exhaust.<sup>30</sup> Thus,

the US Patents and Trademark records granting patents to more complex devices demonstrate that it was clear since (at least) the mid-19th century that a single cloth mask was ineffective protection against respiratory diseases.

The most cited primary study on use of face masks in the prevention of COVID-19 is that by Leffler et al.<sup>31</sup> who used a multiple regression approach, including a range of policy interventions and country and population characteristics, to infer the relationship between mask use and SARS-Co V-2 transmission. They reported that SARS-Co V-2 transmission was 7.5 times higher in countries that did not have a mask mandate or universal mask use. These dramatic differences appeared by comparing countries that implemented relatively late mask wearing mandates to 24 countries with recommendations or cultural norms favoring mask-wearing by the public within 20 days of the estimated onset of the country's outbreak. These 24 countries included Japan, the Philippines, Macau, Hong Kong, Sierra Leone, Cambodia, Timor-Leste, Vietnam, Malaysia, Bhutan, Venezuela, Taiwan, Slovakia, St. Kitts and Nevis, South Korea, Indonesia, Brunei, Grenada, Mozambique, Uzbekistan, Thailand, and Malawi.<sup>31</sup> Given the considerable impact of this particular study (highlighted in most reviews) in mandatory face mask wearing worldwide, it would appear necessary to have determined how representative were these countries, culturally and genetically, to the rest of the world. And more importantly, how were hospitalization and intubation rates in these low mortality countries compared with countries with the means and standards for aggressive hospitalization and invasive treatments. The 24 countries highlighted in Leffler et. al. could have implemented a less comprehensive hospitalization program with invasive practices less frequent than those in European and North American countries. In contrast, developed countries with standard operating procedures resulting in a more frequent ventilation, intubation and other invasive procedures could have resulted in an increased prevalence of hospital infections and mortality attributed to COVID-19, relatively independent from mask wearing.

Another study analyzing actual data looked at the difference in infections between US states with mask mandates and those without, and found that the daily growth rate was 2.0 percentage points lower in states with mask mandates, estimating that the mandates had prevented 230,000 to 450,000 COVID-19 cases by May 22, 2020.<sup>32</sup> However, the authors warn that they were unable to measure face cover use in the community (that is, compliance with the mandate)

nor they measured enforcement of the mandates. The study also did not have data on county-level mandates for wearing face masks in public nor differences in state's hospitalization rates. These shortcoming question whether the 2% efficacy rate of single cloth masks is accurate or even true.

Meanwhile, studies that did not find wearing of face masks beneficial, did not receive high diffusion by scientific journals or the press. For example, a randomized controlled study of mask wearing did not find a statistically significant beneficial effect of use of masks to mitigate the spread of COVID-19 but remains as an unpublished pre-print.<sup>33</sup> The potential bias of scientific journals during COVID-19 has been previously discussed.<sup>34</sup>

In contrast with the predicted beneficial effects of mask usage, the findings of cerebral hemodynamic alterations produced by wearing face masks went relatively unnoticed. Fisher et al.<sup>35</sup> investigated the effects of commonly available face masks (FFP2 and surgical) on the physiology of healthy humans, finding small but significant changes in cerebral hemodynamics and oxygenation while wearing a mask. The long-term effect of this cerebral deprivation is still yet to be determined.

In contrast to the few epidemiological studies uncovered by our PubMed search, the majority of articles recommending the use of face masks predicted their benefit based on theoretical modeling and computer simulation. To enumerate as examples a few articles that received attention: Stutt et al. <sup>36</sup> explained that it is impossible to get accurate experimental evidence for any control interventions, but that effectiveness of face masks can be approached by using mathematical modeling tools to aid rational decision-making. Kai et al. <sup>37</sup> presented two models for predicting the impact of universal mask wearing. Tian et al. <sup>38</sup> developed a simple transmission model that incorporated mask wearing and mask efficacy as a factor in the model. Economic analysis, also by computer simulation, predicted that mask wearing mandates could add 1 trillion dollars to the US GDP.<sup>39</sup> Fisman et al.<sup>40</sup> used a matrix approach to estimate the conditions under which masks would reduce the reproduction number of COVID-19 under a threshold of 1. They reported that masks, even with suboptimal efficacy in prevention and transmission of infection, could substantially decrease the reproduction number. Yan et. al.<sup>41</sup> modeled that a sufficiently high adherence rate (~80% of the population) would result in the elimination of the outbreak with most respiratory protective devices. Ngonghala et. al. <sup>42</sup> covered a wide variety of interventions, and completing numerous numerical simulations, they reported that



“combining face-masks and social-distancing is more effective in COVID-19 control” and that “high use of face-masks in public could lead to COVID-19 elimination,”

Of course, as it is now obvious (at the beginning of 2023), that mandatory and highly compliant use of face masks (enforced by police in some countries) and social distancing did not eliminate COVID-19 even with additional vaccinations. Similar to other types of predictions (end-of-the-world, astrological, etc.), predictions made by computer simulation are cited and only remembered if they happened to be correct. Virtual predictions on COVID-19 made by virtual simulation (as summarized above) appear to have been rather consistently wrong.

The lack of a protective effect of a relatively inexpensive single cloth face masks can be argued from a practical perspective by considering that the M50 series military mask (officially known as the US-Joint Service General Protective Mask) used previously by one of the authors (JLS) required exact face fitting, extensive testing for air leaking, and cost \$250 excluding research and development.<sup>43,44</sup> In contrast to the considerable effort (ongoing since Leonardo Da Vinci’s time [see above], the American Civil war, and World War I) to protect military personnel from germs and toxins<sup>45</sup> the choice of multi-use cloth face masks, loosely fitted and costing less than a dollar, should be expected to have negligible protection against COVID-19, as observed in our present analysis.

Face masks as well as social distancing, sought to distance healthy individuals from SARS-Co V-2 aerosolized particles spread from the sick. It is well known from biological and chemical warfare science that under specific conditions (like during atmospheric inversions) aerosolized germs can persist airborne during very long periods (even days).<sup>45,46</sup> The findings reported here on the inefficacy of 2 meters (6 feet) individual distancing are in general agreement with previous studies indicating that infectious micro droplets can reach distances of 12.5 meters (over 40 feet).<sup>47</sup> Therefore, the world-wide imposed social distancing measures of only 2 meters (6 feet) should have been known to be ineffective in controlling COVID-19 given the pre-established knowledge on the reach of aerosolized micro droplets.<sup>45-47</sup>

To understand the scientific basis for mandating social distancing, our search of PubMed on “benefit social distancing COVID” revealed 193 articles published during 2020, 381 during 2021 and 200 during 2022. These numbers again would suggest that the health benefits of keeping individuals apart (generally 2 meters or 6 feet) are well established. However, many of these articles

referred to social distancing in the context of country lock-downs, curfews or at-home restrictions which we analyzed in our previous research.<sup>1,48</sup> Overall, studies of the effectiveness of social (perhaps more precisely named physical) distancing followed the general pattern of those discussed above for wearing of face masks – most studies recommended social distancing but few studies presented underlying primary data. Many articles listed in the PubMed search assumed a benefit of keeping individuals apart based on computer predictions by virtual simulation. Arguably the most influential of these articles was the non-peer review of Fergusson et.al. at the Imperial College of London,<sup>49,50</sup> released early in the pandemic, whose predictions on the benefit of social distancing relied on virtual simulation modeling. The works of DeSouza et. al.<sup>51</sup> defined an ‘isolation index’ (social distancing index) whereby its increase by 1% led to a reduction of 6.91% in new cases and 6.90% in the number of deaths, thus concluding that adoption of distancing measures should have a substantial impact on the number of infected individuals and deaths by COVID-19. The social distancing index was also employed by Liu et. al. to study the daily reproduction number in the 5 US states that mandated early social distancing directives during March 19-24, 2020.<sup>52</sup> These authors found that the social distancing index was negatively associated with the daily reproduction number, concluding that social distancing should be an effective strategy to reduce the incidence of COVID-19.<sup>52</sup> However, the study lacked the comparative data from states where social distancing was not implemented. Reductions in infections or death in the states studied could be due to multiple factors including natural viral attenuation, better treatment options, lower hospitalization rates leading to fewer nosocomial infections, geographical and ecological factors, and more.

The lack of control data, (generally required for peer-review publication before COVID-19) cause the conclusions of many articles on the benefit of social distancing to be questionable. Furthermore, questionable articles during the pandemic tended to build upon one another, feeding the general acceptance of a wide-variety of unsubstantiated conclusions. For example, a n article published by a scientific journal even went so far as describing and recommending continuous monitoring of physical distancing by a robot programed to automatically detect and alert authorities about those not maintaining social distancing.<sup>53</sup>

Again, despite lack of primary data and exhaustive efficacy analysis, nation-wide social distancing like physical distancing, lock-downs,

curfews and other restrictive measures endured throughout 2020 and 2021. Meanwhile reports indicated as early as July-August 2020 that infection rates and mortality rates of COVID-19 among countries with and without social distancing restrictions did not show a significant correlation and that social restrictions were not associated with statistically significant reductions in the number of critical cases or overall mortality.<sup>48,50,54,55</sup> Moreover, a study by Kuhbandner et.al. ruled out lock-downs and social distancing as responsible of any decrease in the effective epidemic reproductive rate in the UK, suggesting these authors that predictions by computer simulation accepted early in the pandemic should be considered artifacts.<sup>56</sup>

Articles criticizing policies based upon virtual simulation, together with abundant previous data on bioaerosols filtration<sup>57</sup> and epidemiological data (as presented in this work), demonstrate that predictions by virtual simulation are unreliable and ill-suited for policy making. However, a world dazzled by computers whose citizens under sustained panic (by presumptive lethal consequences of COVID-19 often inflated by the media) and fear (of stigmatization for the non-compliant) accepted their individual freedom be severely curtailed and tolerated a considerable reduction in government transparency; all originating from measures largely derived from predictions made by virtual computer simulations.

The publications on the harmful effects of social distancing were more numerous than the reports on the adverse effects of face masks wearing (see above). A review by Conejero et al<sup>58</sup> reported that during the pandemic, a) more than 29% of patients with COVID-19 may have developed depressive symptoms<sup>59</sup>, b) around 20% of patients with a pre-existing psychiatric disorder reported worsening of their psychological state and interruption of psychiatric care during the pandemic<sup>60</sup>, c) the negative psychological impact was severe in psychiatric patients, particularly for anger, impulsivity, and suicidal ideation<sup>61</sup>, and d) it was also suggested that young or old people were at higher risk of increased depressive symptoms and suicidal acts.<sup>62</sup> For example, forcing children with autism to use face masks, keeping their distancing and shutting down special education systems meant that parents of children with special needs lost a vital support network and had to be the sole full-time caregivers despite - often lacking the skills to cope with this new and daunting situation.<sup>63</sup> Another study found that social distancing had a negative impact on mood and memory, revealing that memory errors were worsened by lonely moods.<sup>64</sup> Evidence emerging

from various disciplines made it abundantly clear that perceived social isolation (i.e., loneliness) may be the most potent threat to survival and longevity.<sup>65</sup>

Thus, the indisputable profound and negative effect in the overall health of the world population (as well as the devastating global economic impact) resulted largely by ordering social distancing and face mask wearing during the pandemic. These severe outcomes resulted from measures imposed by governments disregarding abundant historical evidence, well established scientific principles (of epidemiology, virology, immunology, biowarfare and bioaerosol technology) and ignoring (often censoring) contradicting actual epidemiological data as discussed above. It is not in an article like this but in the courts of law where to elucidate whether the catastrophic damage produced by ineffective mandated public health policies against a relatively mild disease like COVID-19 were either the result of well-intended ignorance or the product of criminal malice.

#### CONCLUSION

The lack of impact on COVID-19 infections of large crowds with people in close proximity and limited wear of face masks, originally observed after Maradona's funeral and confirmed 7 months later by analysis of the America Soccer Cup celebrations in Argentina, contradicts a beneficial effect of the generally prescribed social distancing (6 feet or 2 meters) and of (single cloth) mask wearing during the pandemic. In any case, the burden of proof should fall on proving (with real data instead of virtual simulations) the benefit of any obligatory policies and not on demonstrating their irrelevance. The analysis reported here should be considered by countries mandating mask wearing and/or social distancing to control either COVID-19 or future pandemics. to come.

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**Conflict of Interests Statement:** *This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors. The authors are not associated to any industrial or commercial enterprise nor to any political party. No political issues were considered during the study presented here and the findings should not be construed as supporting or criticizing any party or particular government.*

**Author contribution:** *Dr. Aquilano gathered data from the Health Ministry and other sources in Argentina and produced the graphs. Dr. Sagripanti drafted the manuscript and analyzed the data. Contribution was 50% by each author.*

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