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International Horizon Scanning and Learning to Inform Wales' COVID-19 Public Health Response and Recovery

Report 30, 01/07/2021

Canolfan Gydwethredol Sefydliad
Iechyd y Byd ar Fuddsoddi
ar gyfer Iechyd a Llesiant



World Health Organization
Collaborating Centre on Investment
for Health and Well-being

Overview

The International Horizon Scanning and Learning work stream was initiated as part of the COVID-19 public health response, to support response and recovery measures and planning in Wales.

The learning and intelligence is summarised in regular reports to inform decision-making. These may vary in focus and scope, depending on the evolving COVID-19 situation and public health/policy needs. The reports focus on COVID-19 international evidence, experience, measures, transition and recovery approaches. Evidence is provided to help understand and explore solutions for addressing the on-going and emerging health, wellbeing, social and economic impacts (potential harms and benefits) of COVID-19.

This work is aligned with and feeds into the Welsh Government Office for Science and into Public Health Wales Gold Command. It is part of a wider Public Health Wales' systematic approach to intelligence gathering to inform comprehensive, coherent, inclusive and evidence-informed policy action, which supports the Wellbeing of Future Generations (Wales) Act and the Prosperity for All national strategy towards a healthier, more equal, resilient, prosperous and globally responsible Wales.

Disclaimer: The reports provide high-level summary of emerging evidence from country experience and epidemiology; research papers (peer-reviewed/not); and key organisations' guidance/reports, including sources of information to allow further exploration. The reports do not provide detailed or in-depth data/evidence analysis. Due to the novelty of COVID-19 virus/disease and the dynamic epidemiological situation, studies, data and evidence can be conflicting, inconclusive or out-of-date depending on country/other context.

In focus this week

-  **COVID-19 impact on education and schooling practices**
-  **Environmental impact of COVID-19**
-  **Country insight: South Africa**

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At a glance: summary of international learning on COVID-19

“School closures carry high social and economic costs for people across communities. Their impact however is particularly severe for the most vulnerable and marginalized boys and girls and their families.” (UNESCO, 2021)

COVID-19 impact on education and schooling practices

- ✚ Immediate positive action is needed to address the **inequity** of COVID-19 on **educational attainment**, and the **future impact** this has on **health and well-being**
- ✚ Plans should take account of the needs of **vulnerable groups and existing disadvantage** so as not to widen the educational attainment gap further
- ✚ The **impact of COVID-19 on children’s physical and mental health** should be mitigated by applying appropriate interventions which **balance the needs of children to play and learn**
- ✚ Initiatives, such as increased public health messages in schools, parental engagement in children’s education and increased use of technology, can be utilised to improve future educational programmes

More information is summarised on pp.4-9

Environmental impact of COVID-19

- ✚ **Reduced travel** during COVID-19 restrictions has been related to **lower levels of air pollutants and particulate matter** across cities worldwide, which may not be sustained
- ✚ The use of **personal protective equipment (PPE)** has **increased** over the course of the pandemic, this **creates an environmental issue**
- ✚ **Sustainable solutions are needed** to reduce the environmental impact of increased use of PPE, including face masks, whilst still meeting the need for infection prevention and control measures due to COVID-19
- ✚ Strategies suggested to reduce the environmental impact of PPE in the health and care setting include: **removal of gloves** and using hand washing alone; **domestic manufacture** of PPE; and **extended use or reuse** of face shields and gowns

More information is summarised on pp.10-16

Country insight: South Africa

- ✚ South Africa has had **two major waves** of COVID-19 in June/July 2020 and December 2020/January 2021. The **number of positive tests increased** from April to June 2021
- ✚ The **testing strategy** will have an **impact on test numbers and case finding** and should be **considered when comparing data** between countries or over time
- ✚ **Vaccinations** being administered have **increased rapidly** in South Africa, the total numbers vaccinated per million are 28,500. For contrast, UK vaccination rates are approximately 662,700 per million (29 June 2021)

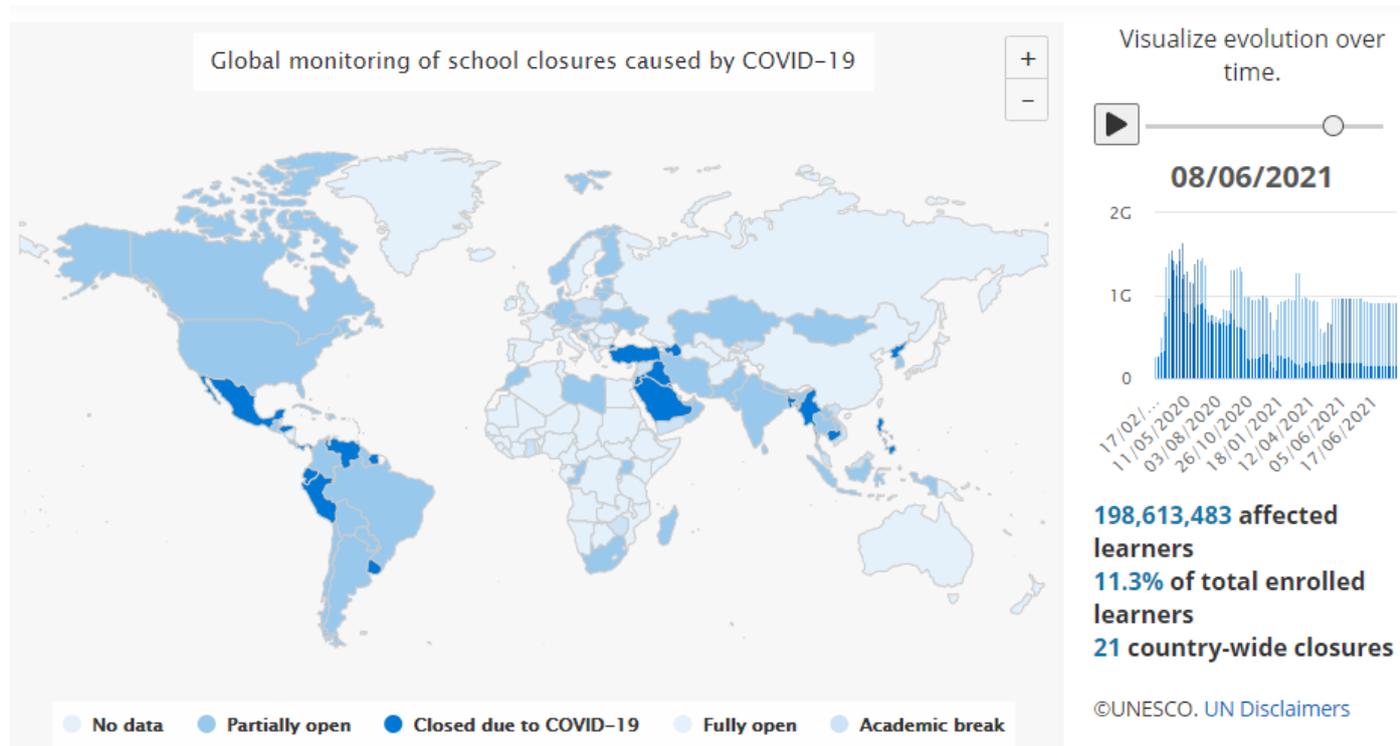
More information is summarised on pp. 17-21

COVID-19 impact on education and schooling practices

Disruption of education around the world

- At the peak of school disruptions **1,450,430,123 (82.8%) of total enrolled learners** and **167 country-wide closures occurred simultaneously** (March 2020)¹
- Over **156 million (8.9%) of enrolled learners still face substantial disruption** to their education in June 2021 with country-wide closures still ongoing in 21 countries (8 June 2020) see figure 1
- Over a **100 million children** may fall below the **minimum proficiency level in reading** as a result of the pandemic²
- School disruptions range from full school closures to reduced or part time academic schedules.³ Even as schools begin to re-open, they still face disruption with many introducing extra measures to reduce the risk of the spread of the virus⁴
- Some countries, such as **Norway and France, have kept schools open** for most of the pandemic (7 and 10 weeks of school closure, respectively), whereas others, such as Germany and the United Kingdom (UK), have relied more often on school closures for transmission control (19 and 21 weeks closure, respectively)⁵

Figure 1. Global monitoring of school closures caused by COVID-19 as of 8th June 2021⁶



¹ Education: From disruption to recovery (unesco.org)
² <https://en.unesco.org/covid19/educationresponse#schoolclosures>
³ <https://www.bmj.com/content/bmj/372/bmj.n524.full.pdf>
⁴ <https://unesdoc.unesco.org/ark:/48223/pt0000376984>
⁵ Covid-19: Keeping schools as safe as possible (bmj.com)
⁶ <https://en.unesco.org/covid19/educationresponse#schoolclosures>

Inequity and school closures

Early analyses and predictions of the impact of school closures highlight that:⁷

- **Children from disadvantaged backgrounds are likely to be affected more** due to fewer family resources and less access to online learning to offset lost instruction time
- Educational deficit could be compensated with additional teaching hours when schools reopen, though schools might need to put back more hours than were lost and this might not be feasible within the traditional school year
- **Gaps in educational attainment, physical and emotional health and wellbeing could have widened**, particularly during school closures⁸
- A key challenge for schools is identifying children's **different experiences** and responding to the volume of safeguarding concerns that are likely to arise as pupils begin to open up to their teachers⁹

Children from families who have experienced, or may face, a loss of employment or employment issues are at particular risk of negative impacts to their education:

- **Parental job loss** has a **negative impact on children's educational attainment**^{10,11}
- **Reduction in family income** is associated with a **reduction in children's educational attainment**¹²
- The more stable labour market attachment for the parent, the greater the impact on the child's education as a result of their job loss¹³

Soft capital (e.g. parental support) and physical capital (e.g. access to home computer) were found to play an important role in students learning outcomes and wellbeing:

- In Ireland, parents' ability to assist children with schoolwork was correlated with improved mental health for child¹⁴ but screen time increased for most children during lockdown, and they spent significantly **more time on schoolwork if they had access to a computer or laptop**¹⁵
- Challenging home and other circumstances for children and young people could have been amplified by the use of non-pharmaceutical interventions (NPIs), including school closures¹⁶
- The pandemic has highlighted inequities that should be addressed to improve equity in education in the future, including a **significant digital divide** that enforced distance learning has highlighted¹⁷

Physical and mental impact of school closures on children

Impacts of school closures during the COVID-19 pandemic include¹⁸:

- loss of access to school-based and critical services
- loss of resources particularly for children with disabilities
- loss of resources for those living in poorer families
- increased stress among children and emotional reactions
- the longer the school closure, the higher the predicted increase in obesity

Children's worries and anxieties relate to:¹⁹

⁷ http://eprints.lse.ac.uk/104675/3/Eyles_covid_19_school_shutdowns_published.pdf

⁸ https://www.pnas.org/content/118/17/e2022376118?fbclid=IwAR0B0gKsv_iBS3SdoSJpqPQWkFezms20Z2vkEKcNgPqgCViifMhJTAXrxa7Q

¹⁰ <https://cep.lse.ac.uk/pubs/download/dp1364.pdf>

¹¹ <https://academic.oup.com/restud/article-abstract/78/4/1462/1592095>

¹² <https://www.aeaweb.org/articles?id=10.1257/aer.102.5.1927>

¹³ <https://cep.lse.ac.uk/pubs/download/dp1364.pdf>

¹⁴ <https://www.tandfonline.com/doi/abs/10.1080/03323315.2021.1932555?journalCode=ries20>

¹⁵ <https://www.tandfonline.com/doi/abs/10.1080/03323315.2021.1932551>

¹⁶ [The challenge facing schools and pupils | Mental Health Foundation](https://www.tandfonline.com/doi/abs/10.1080/03323315.2021.1932551)

¹⁷ [COVID-19 and the digital divide in the UK \(thelancet.com\)](https://www.thelancet.com)

¹⁸ <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8159143/>

¹⁹ <https://phw.nhs.wales/publications/publications1/children-and-young-peoples-mental-well-being-during-the-covid-19-pandemic-research-brief/>

- loss of accessibility of non-academic support from schools
 - the quality of education received
- Contributing factors to increased stress among young people include:
- lack of familiarity of the new teaching and assessment modalities
 - lack of clarity in communication
 - distant supervision from teachers
 - perceived poorer quality of online education
 - concerns about graduating
- **Consideration will need to be given to mental health and well-being** of all children, but especially those who return to school having experienced feelings of abandonment, exclusion and alienation²⁰
 - Child mental well-being could be protected by promoting parental knowledge, skills, and resources about how to talk to children²¹
 - **School-based mental health services need to expand and adapt** to increased demand²²
 - Child and adolescent psychiatrists need to ensure **continuity of care** with a **specific focus on children and adolescents who are already disadvantaged and marginalised**²³
 - Successful **management of stress and trauma** can lead to personal growth, which in turn reinforces the sense of competence and becomes a protective factor for coping with future stressors²⁴

Table 1: Psychological and behavioural impacts of lockdown and school closure on children and young adults in selected countries²⁵

Country	Number (Age)	Findings
Belgium, Canada and France ²⁶	2871 (51.5% young adults)	Around half of the young people surveyed were students who reported being overwhelmed with uncertainties regarding their future and education.
China ²⁷²⁸	8079 (12-18)	43% had symptoms of depression while 37% had anxiety. Females, rural and students in senior school more likely to experience depression and anxiety.
	3254 (7-18) 5286 (university)	54% felt learning had been negatively impacted by pandemic. 13% of females and 10% of males reported symptoms of smartphone addiction.
Italy ²⁹³⁰	5989 (4-10)	26% excessive clinginess, 5.5% worse vocabulary, 18% developed excessive fears.
	1124 (students)	The study did not find significant psychological impact in its participants; stress levels among the participating students were not significantly different than pre- COVID student samples
Italy and Spain ³¹	1143 (3-18)	85% of parents felt a worsening of children's emotions and behaviours.

²⁰ <https://www.tandfonline.com/doi/full/10.1080/02643944.2021.1916180>

²¹ <https://www.frontiersin.org/articles/10.3389/fpsyg.2020.01713/full>

²² <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7550083/>

²³ <https://link.springer.com/content/pdf/10.1186/s13034-020-00329-3.pdf>

²⁴ <https://www.mdpi.com/2071-1050/12/17/7039>

²⁵ <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7798512/#:~:maa122-B13>

²⁶ <https://bmcpediatrics.biomedcentral.com/articles/10.1186/s12888-021-03109-1>

²⁷ <https://pubmed.ncbi.nlm.nih.gov/32363492/>

²⁸ <https://pubmed.ncbi.nlm.nih.gov/32658812/>

²⁹ <https://psvaxiv.com/stwbn/>

³⁰ <https://www.mdpi.com/2071-1050/12/17/7039>

³¹ <https://pubmed.ncbi.nlm.nih.gov/33240167/>

Country Insights

Estimated learning loss in the Netherlands show³²:

- Students from **disadvantaged backgrounds suffered the most** learning loss during lockdown
- Lower **parental education correlated with more significant learning loss**
- **Girls worse affected** than boys
- Ages **9 and 10 suffer most** significant learning loss

Evidence from during the course of lockdown periods in different countries has found that:

- In the Czech Republic, students tend not to spend sufficient time studying: **pupils were studying between 2 and 4 hours a day**, while parents tended to help for about half the time³³
- In Uruguay, only 26% of participants mentioned educational activities when describing a typical day of their children during the pandemic³⁴
- In Turkey, parents have greater appreciation for teachers and take more active roles in their children's education³⁵
- In Cyprus, **parents were willing** to be more involved in children's education, **but required training** to develop appropriate knowledge and skills (particularly in relation to mathematics)³⁶
- Whilst in the main the effect of the pandemic on children is described as negative, in Germany, smaller class sizes lead to improved student-teacher relations, creating positive impacts for pupils social and emotional development for those children able to physically attend class³⁷

Interventions to reduce the spread of COVID-19 in educational settings

A range of **NPIs have been implemented to reduce transmission of COVID-19 in the school setting**.³⁸ Most European countries have introduced measures, including:

- **Cohorting** of pupils, **physical distancing**, wearing of face **masks**, improving **ventilation**, moving physical activities **outdoors**, regular **cleaning** of surfaces, and improving **hand hygiene and respiratory etiquette**³⁹
- Infection prevention and control measures **beyond the classroom**, particularly transport to and from school, during pick-up and drop-off times for both children and adults, and during meal times in the school day
- Blended learning (a mixture of online and in-person learning) in secondary schools
- Use of testing for surveillance in schools and prioritisation of teachers for immunisation
- There is increasing evidence that COVID-19 in educational settings is strongly associated with community infection rates in adults⁴⁰
- Maintaining low community infection rates is critical for reducing the risk of virus entering educational settings
- **Further studies** are needed to understand the contribution of in-school and outside-school transmission, especially the role of **asymptomatic infection and transmission among staff and students**

³² https://www.pnas.org/content/118/17/e2022376118?fbclid=IwAR0B0qKSv_iBS3SdoSJpgPQWkFezms20Z2vkEKcNgPqgCVlIfMhJTAXxa7Q

³³ https://www.frontiersin.org/articles/10.3389/feduc.2020.00103/full?fbclid=IwAR1XIPYVHi7puCILHJcvRDEV09UW4GMN4c_VKpvaR_vQnpxLbn8onE4excY#F1

³⁴ <https://www.sciencedirect.com/science/article/pii/S0190740920323288>

³⁵ <https://dergipark.org.tr/en/pub/toide/issue/61115/906485>

³⁶ <https://ojs.wiserpub.com/index.php/SER/article/view/547>

³⁷ <https://www.frontiersin.org/articles/10.3389/feduc.2021.635180/full>

³⁸ <https://www.cdc.gov/coronavirus/2019-ncov/community/ventilation.html>

³⁹ <https://www.bmj.com/content/bmj/372/bmj.n524.full.pdf>

⁴⁰ <https://www.thelancet.com/action/showPdf?pii=S2666-7762%2821%2900097-1>

In the US, an Operational Strategy for schools through ‘Phased Prevention’ outlines:

1. Evidence that many schools that have strictly implemented prevention strategies have been able to safely open for in-person instruction and remain open
2. A pathway for schools to provide in-person instruction safely through consistent use of prevention strategies, including universal and correct use of masks and physical distancing
3. All schools should implement and layer prevention strategies and should prioritise universal and correct use of masks and physical distancing
4. Testing and vaccination for teachers and staff provide additional layers of protection

Recommendations to reduce the risk of transmission in schools and mitigate the impact of COVID-19 on children and families is presented in figure 2⁴¹

Figure 2: Recommendations to reduce transmission of COVID-19 in educational settings⁴²



Opportunities for education

- In higher education, the additional support offered to students to assist them continue their studies could be beneficial after the pandemic has ended, including: positive changes to student assessment, clarity and flexibility of online learning, compassion, financial support, extra well-being support, university community engagement and others⁴³

Recommendations for education settings re-opening and continuation are outlined in Table 2

⁴¹ [mmc1.pdf \(thelancet.com\)](https://www.thelancet.com/mmc1.pdf)

⁴² [https://www.thelancet.com/cms/10.1016/S0140-6736\(21\)00622-X/attachment/524b9f7e-5847-4cc2-9cac-75d4beeff556/mmc1.pdf](https://www.thelancet.com/cms/10.1016/S0140-6736(21)00622-X/attachment/524b9f7e-5847-4cc2-9cac-75d4beeff556/mmc1.pdf)

⁴³ [The impact of COVID-19 on higher education - Publications Office of the EU \(europa.eu\)](https://ec.europa.eu/euro-iss/impact-of-covid-19-on-higher-education)

Table 2. Recommendations: re-opening and continuation of educational settings

The Centre for Global Development's five dimensions of school re-opening and recovery⁴⁴	
1.	Engaging communities in reopening plans <ul style="list-style-type: none"> ✓ Inclusive community engagement should occur early on in the planning process in order to build trust ✓ Open and clear communication with the wider community should be maintained throughout the planning process
2.	Targeting resources to where they are most needed <ul style="list-style-type: none"> ✓ There needs to be coordination across different sectors and agencies in order to manage competing priorities for the available resources ✓ Target communities with the greatest needs ✓ Plans must take account for underlying risk factors such as vulnerable groups, disadvantage and attendance rates
3.	Getting children back to school <ul style="list-style-type: none"> ✓ Prioritise students most likely to drop out using information on deprivation and attendance to help identify those most at risk ✓ Provide financial support to the most vulnerable to help tackle costs associated with returning to school, including fee waivers and school feeding
4.	Making school environments safe <ul style="list-style-type: none"> ✓ Ensure schools are equipped with adequate health and hygiene infrastructure, including the distribution of alcohol-based hand sanitiser and adequate hand washing facilities ✓ Students and staff should be regularly screened for temperature and symptoms ✓ Prioritise learning and social-emotional wellbeing to support children back into education
5.	Recovering learning loss and building back better <ul style="list-style-type: none"> ✓ Engage students in accelerated learning programmes ✓ Engage teachers in training and coaching to help students catch up ✓ Engage parents by building upon their current involvement in remote learning
World Bank: Re-imagining education- a continuous and accelerated learning approach (May 2021)^{45,46}	
	<ul style="list-style-type: none"> – Focus is on re-imagining education to blur the lines between school and home – The report states that the world must respond quickly and deliberately to mitigate impacts while seizing opportunities to make education more inclusive, effective and resilient than pre-COVID-19. This will require adopting two main strategies: <ol style="list-style-type: none"> 1. Countries should support reforms of teaching, curricula and assessment of learning to enable resilience and accelerated learning anytime, anywhere; 2. Develop mechanisms to support children and parents at home for continuous learning
The National Education Union (NEU) recommendations⁴⁷	
1.	Safety in schools and colleges <ul style="list-style-type: none"> ✓ Social distancing in schools and colleges ✓ Limit numbers on site through rotas and remote education ✓ Increase the use of face coverings and better ventilation ✓ Education staff should be vaccinated as a priority
2.	Building a better education system <ul style="list-style-type: none"> ✓ A reintegration plan, with flexibility for schools to meet the needs of their communities ✓ Employ supply teachers and qualified teachers who have left the profession to work in schools and colleges ✓ Develop and properly resource a recovery curriculum to run over a number of years ✓ Plans must be made for those who are in transition years
3.	Work as a nation to give all children and young people the best start in life <ul style="list-style-type: none"> ✓ All pupils must be guaranteed access to broadband and laptops, which will enable them to learn remotely, and to study and develop their skills once schools are fully open ✓ A fully-resourced national plan for children's wellbeing should be launched to support those who suffered trauma in the pandemic ✓ Welfare reform is needed so that parents are not working for their family's poverty

⁴⁴ [Planning for School Reopening and Recovery After COVID-19 \(cgdev.org\)](https://blogs.worldbank.org/education/getting-back-learning-key-policy-actions-reopening-schools)

⁴⁵ <https://blogs.worldbank.org/education/getting-back-learning-key-policy-actions-reopening-schools>

⁴⁶ <https://www.worldbank.org/en/topic/education/brief/joint-initiative-for-continuous-accelerated-learning-in-response-to-covid-19>

⁴⁷ <https://neu.org.uk/recovery-plan>

Environmental impact of COVID-19

Air pollution

Of all environmental factors outdoor **air pollution**, particularly in high-income countries, **is regarded as the most influential environmental determinant of health**.⁴⁸

- Globally, prior to the COVID-19 pandemic, air pollution was responsible for 16% of deaths making it the primary cause of preventable premature death worldwide.⁴⁹ Air quality problems are caused by 3 main pollutants: nitrogen oxides, ozone and particulate matter (PM₁₀ and PM_{2.5})⁵⁰
- Carbon dioxide contributes to air pollution in its role in the greenhouse effect.

COVID-19 impact

The implementation of NPIs has produced **positive improvement in air quality** in many cities, for example:

- NPIs were responsible for a **30% reduction in nitrogen dioxide** emissions during the first lockdown period in Asian and European Countries⁵¹
- Cities such as Mumbai, Delhi and Wuhan saw large **reductions in PM₁₀**, which can be taken into the lungs (figure 3)
- Delhi, Seoul and Los Angeles saw **substantial decreases in PM_{2.5}**, which can be taken into the lungs and bloodstream (figure 4)
- Rome bucked the trend and saw an increase in both PM_{2.5} and PM₁₀ (figure 3 and 4)
- While the decline in emissions were significant in major cities globally, PM_{2.5} levels did not reach World Health Organization (WHO) accepted standards in Delhi or Wuhan, this is largely due to the types of solid fuels burned in these cities
- Lockdowns across the globe has caused **sharp declines in the movement of goods and people, resulting in less air pollutants** (table 3, figure 3 and figure 4)

Table 3: Mobility index report based on Google tracking for period 23 February to 5 April 2021 (Muhammad et al, 2020)⁵²

Location	Public Transport	Grocery & pharmacy	Retail & recreation	Workplace	Parks & outings	Residential
USA	-54%	-20%	-49%	-40%	-20%	+13%
Spain	-89%	-77%	-94%	-68%	-90%	+23%
Italy	-86%	-82%	-95%	-62%	-90%	+24%
France	-82%	-62%	-85%	-53%	-73%	+17%
Germany	-47%	-13%	-58%	-30%	+61%	+8%
UK	-70%	-41%	-82%	-54%	-29%	+15%

⁴⁸ WHO (2013). Health risks of air pollution in Europe – HRAPIE project; recommendations for concentration–response functions for cost–benefit analysis of particulate matter, ozone and nitrogen dioxide. WHO Regional Office for Europe; Copenhagen, Denmark).

⁴⁹ <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7571423/>

⁵⁰ [https://www.who.int/news-room/fact-sheets/detail/ambient-\(outdoor\)-air-quality-and-health](https://www.who.int/news-room/fact-sheets/detail/ambient-(outdoor)-air-quality-and-health)

⁵¹ <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7241861/>

⁵² <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7169881/>

Figure 3. Average PM₁₀ concentration before and after lockdown (2020)⁵³

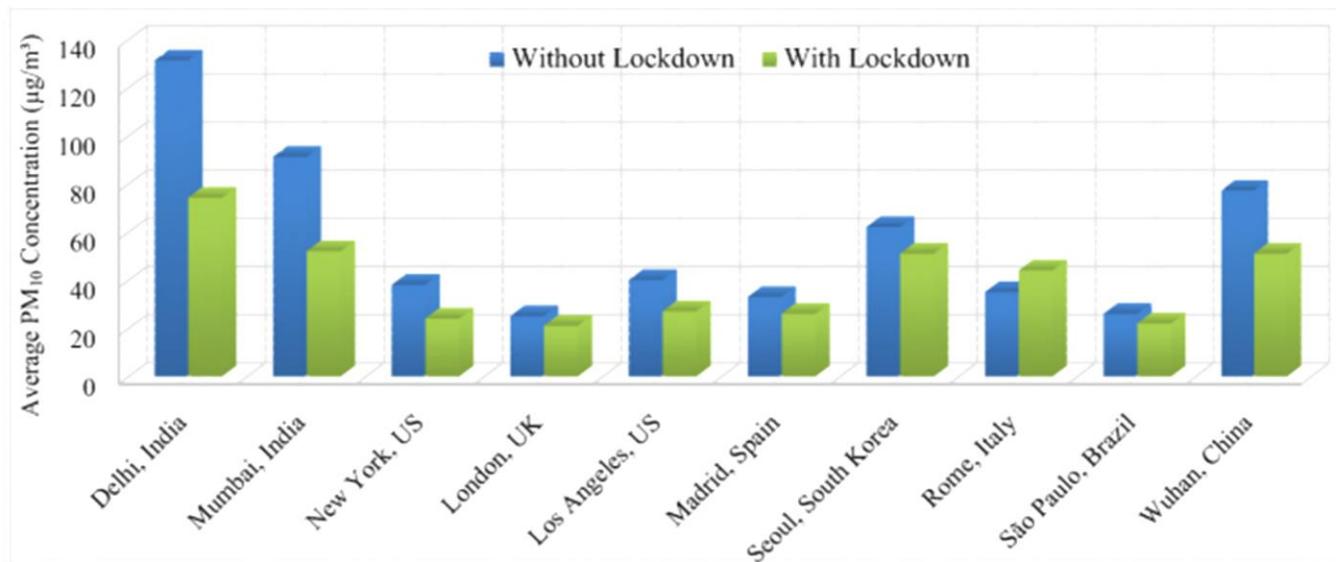
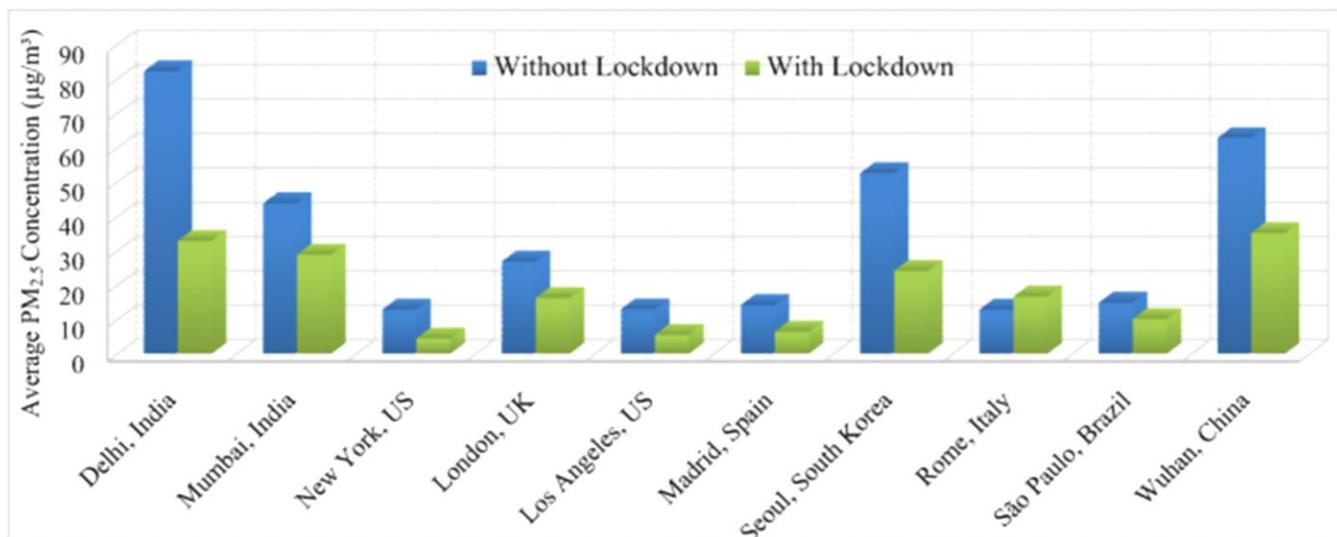


Figure 4: Average PM_{2.5} concentration with and without lockdown (2020)⁵⁴



In India the following have also been reported^{55,56}

- Between 16 March 2020 and 14 April 2020 a large scale reduction in PM_{2.5} and PM₁₀, was noted across 22 major cities in India
- PM_{2.5} and PM₁₀ decreased by 200% in Delhi during the first lockdown
- A reduction in transport saw carbon monoxide emissions from car and motorbike fumes fall by 27 gigagrams in Delhi and 20 gigagrams in Mumbai

⁵³ <https://link.springer.com/article/10.1007/s11356-021-14462-9>

⁵⁴ <https://link.springer.com/article/10.1007/s11356-021-14462-9>

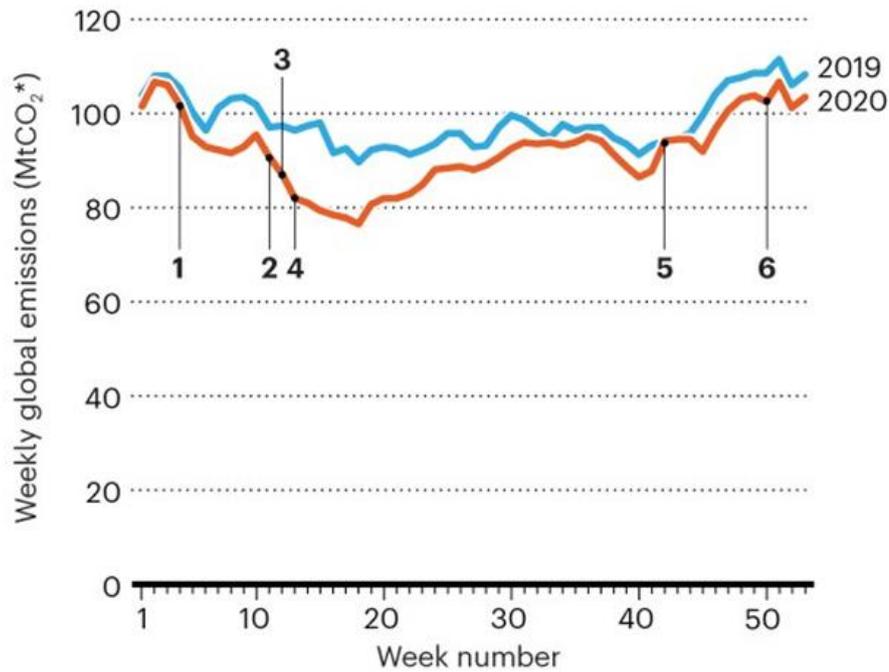
⁵⁵ <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7175882/>

⁵⁶ <https://link.springer.com/content/pdf/10.1007/s41810-020-00062-6.pdf>

Carbon dioxide levels⁵⁷

- Large volumes of carbon dioxide are generated by human activity: this is one of the gases having an impact on global warming
- Despite the NPIs, weekly global carbon dioxide emissions largely returned to their 2019 levels by mid-2020, with subsequent restrictions introduced for second and third waves having less of an impact than during the first wave (figure 5, below)
- This is despite aviation's substantial decline in activity globally: aviation fuel produces carbon dioxide

Figure 5: Weekly global CO₂ emissions in 2020⁵⁸⁵⁹



KEY

- 1 – First lockdown in Wuhan, China.
- 2 – National lockdown implemented in Italy.
- 3 – California enters lockdown.
- 4 – India enters nationwide lockdown.
- 5 – New restrictions introduced in Europe to counter emerging second waves.
- 6 – California enters 3 week lockdown.

⁵⁷ <https://www.nature.com/articles/d41586-021-00090-3>

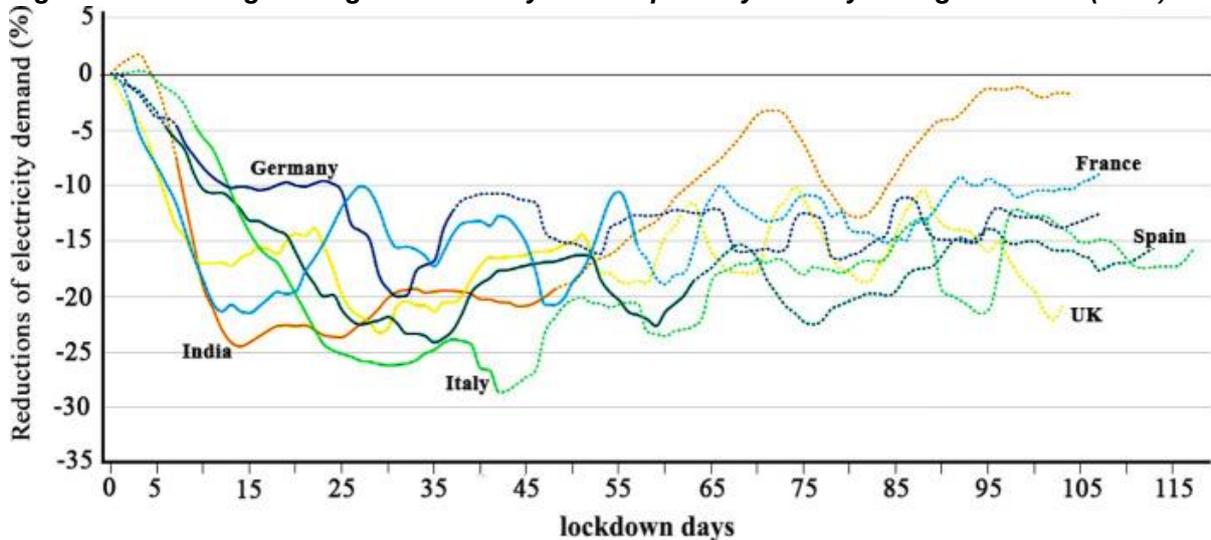
⁵⁸ <https://www.nature.com/articles/d41586-021-00090-3>

⁵⁹ NOTE: 1 – First lockdown in Wuhan, China. 2 – National lockdown implemented in Italy. 3 – California enters lockdown. 4 – India enters nationwide lockdown. 5 – New restrictions introduced in Europe to counter emerging second waves. 6 – California enters 3 week lockdown.

Electricity consumption

Global electricity consumption has decreased as a result of the pandemic (figure 6). The split between domestic use and commercial use cannot be identified from these data.

Figure 6: Percentage change in electricity consumption by country during lockdown (2020)⁶⁰



Domestic waste

Measures to reduce the spread of COVID-19 have had a **significant impact on the purchasing habits** of consumers globally:

- Online sales in the UK accounted for 35.2% of all retail sales in January 2021, up from a previous high of 34.1% in May 2020.⁶¹
- An increase in online shopping may result in an **increase in packaging**.⁶²
- During the pandemic, 46% of UK consumers had purchased something online that they had previously only ever bought in store.⁶³

Food shopping changed in the following ways during the pandemic:

- Consumption of packaged food and **food delivery increased**⁶⁴
- In Italy, USA, France and the UK (during the first wave) consumption of frozen foods increased, as consumers sought long lasting goods, purchasing of longer lasting goods in Italy lead to a decrease in the amount of food waste produced⁶⁵
- **Panic buying** and trends in frozen food purchases **did not continue into the second wave**, as consumers adjusted to the pandemic measures⁶⁶
- In USA, Italy and Japan food delivery increased by 15-29%⁶⁷
- In a UK study on food purchasing, respondents reported purchasing more long lasting items (such as tinned foods and pasta) than usual⁶⁸

The COVID-19 pandemic has also had inadvertent effects on the management of recycling:

- Italy did not allow infected residents to sort their waste⁶⁹

⁶⁰ <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7859094/>

⁶¹ <https://www.ons.gov.uk/businessindustryandtrade/retailindustry/bulletins/retailsales/january2021>

⁶² <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7556229/>

⁶³ <https://www.retailconomics.co.uk/white-papers/outlook-for-uk-retail-and-leisure-2021-ten-trends>

⁶⁴ <https://www.sciencedirect.com/science/article/pii/S0048969721010640>

⁶⁵ <https://www.frontiersin.org/articles/10.3389/fnut.2020.585090/full>

⁶⁶ <https://www.frontiersin.org/articles/10.3389/fnut.2020.585090/full>

⁶⁷ <https://www.frontiersin.org/articles/10.3389/fnut.2020.585090/full>

⁶⁸ <https://wrap.org.uk/sites/default/files/2021-02/WRAP-Life-under-Covid-19-Food-waste-attitudes-and-behaviours-in-2020.pdf>

⁶⁹ <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7169883/>

- In the USA, residential waste peaked at 20% above the normal average in late April, causing some communities to temporarily suspend collection services in order to ensure correct waste management^{70,71}

Personal Protective Equipment (PPE)

- The use of PPE has been a common method used to try to reduce the spread of COVID-19 globally
- **If production and disposal are managed poorly**, PPE can have a devastating **impact on the environment** and pose a threat to human health, as well as terrestrial and marine ecosystems⁷²
- The COVID-19 pandemic has resulted in an **unprecedented increase** in the production, **use and disposal of PPE**, including face masks, face shields, disposable gowns, disposable gloves and disinfectant wipes, which often contain single use plastic⁷³
- **Demand for PPE is expected to increase** annually, with a 20% increase in the production of single use face masks between the years 2020 and 2025⁷⁴
- Evidence suggests that the exacerbated plastic pollution globally may impact the marine environment causing an increase of microplastics in the ocean⁷⁵
- The extensive use of face masks in clinical as well as public settings, has resulted in disruptions of the supply chain and waste disposal system, with studies suggesting that globally around 3.4 billion single-use facemasks/face shields are discarded daily as a result of the COVID-19 pandemic.⁷⁶ This is having an impact on the progress in reducing plastic waste.

⁷⁰ https://swana.org/docs/default-source/advocacy-documents/senate-epw---final-swana-testimony---june-17-2020.pdf?sfvrsn=c3af10a2_2

⁷¹ <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7169883/>

⁷² <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7430241/>

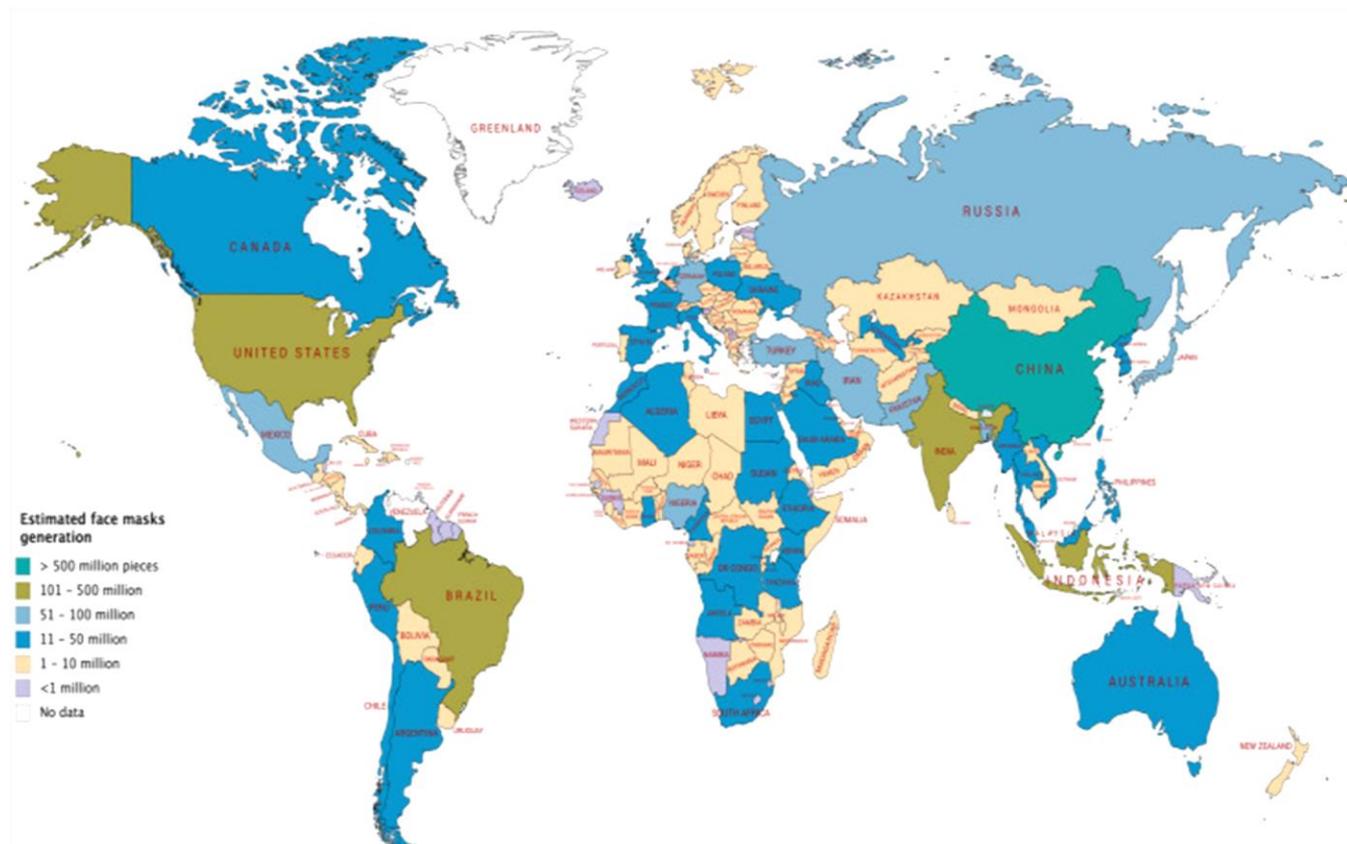
⁷³ <https://www.sciencedirect.com/science/article/pii/S0269749120368494>

⁷⁴ [Personal Protective Equipment \(PPE\) Market Global Forecast to 2022 | MarketsandMarkets](#)

⁷⁵ [What we need to know about PPE associated with the COVID-19 pandemic in the marine environment - ScienceDirect](#)

⁷⁶ <https://www.sciencedirect.com/science/article/pii/S2405844021004485>

Figure 7: Estimated number of face masks discarded as COVID-19 waste by country⁷⁷



Further research is necessary to find **sustainable solutions and mitigation measures** to **reduce the environmental impact of PPE** waste, such as eco-friendly materials, the development of reusable equipment (that meets the needs of healthcare professionals) and greener manufacturing processes.⁷⁸

Country insights Italy (Lombardy)⁷⁹

Findings from the Lombardy study show:

- An increased costs for waste management
- PPE materials (specifically masks) have the potential to increase levels of microplastics in the marine environment
- The amount of waste from PPE used by the general population was more than all the other categories (figure 8), for all phases of the pandemic for masks (a) and in phases 1 and 2⁸⁰ only of the pandemic for gloves (b)

Three more **environmentally friendly alternatives** to PPE use proposed:

1. Hand Sanitisers
2. Social distancing
3. Reusable masks

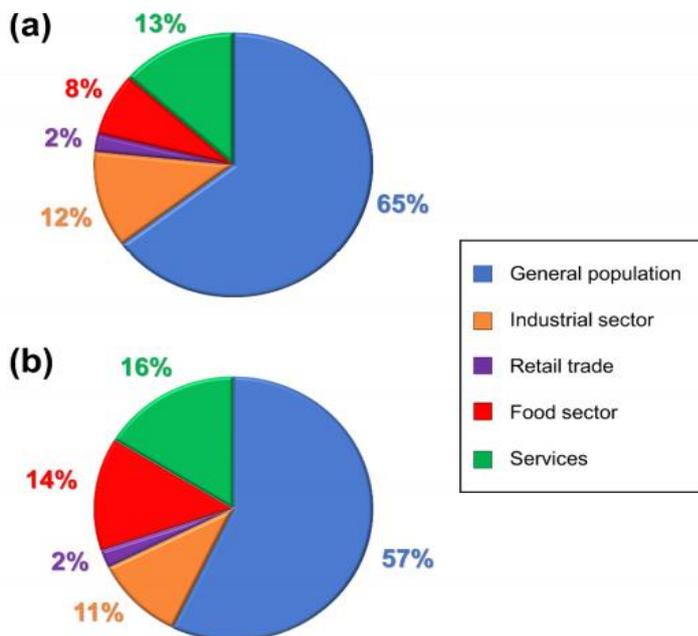
⁷⁷ <https://www.sciencedirect.com/science/article/pii/S2405844021004485>

⁷⁸ <https://www.sciencedirect.com/science/article/pii/S2405844021004485>

⁷⁹ [Environments | Free Full-Text | Evaluating the Environmental Impacts of Personal Protective Equipment Use by the General Population during the COVID-19 Pandemic: A Case Study of Lombardy \(Northern Italy\) \(mdpi.com\)](#)

⁸⁰ Phase 1- 9th March until 18 May 2020 (first lockdown); phase 2 - 19 May 14 June (period of easing following of lockdown)

Figure 8 Production rates of wastes from different sectors for masks for all of 2020 (a) and for gloves for phases 1 and 2 only (b)



Sub-Saharan Africa⁸¹

Research from Sub-Saharan Africa makes the following recommendations to reduce the impact on the environment and human health of increased PPE:

- Health and environmental advocates, governments and non-governmental organisations (NGOs) need to **improve public education** on the need to **properly discard used PPE** to reduce sources of environmental pollution and harming human lives
- **Collection bins** should be provided for disposing of PPE equipment materials alongside other wastes (including markets, truck parks, tourist sites, and attraction centres)
- Governments should encourage the use of PPE that can be treated with disinfectant and **reused** and masks that are eco-friendly
- **Innovative ways of recycling** used PPE are necessary to avoid litter

United Kingdom⁸²

A UK study exploring the environmental impact from the most common PPE items estimated that:

- Carbon footprint of PPE distributed during the study period (6 months) totalled 106,478 tonnes of carbon dioxide equivalents with the **greatest contributions from gloves, aprons, face shields and Type IIR surgical masks**
- Scenario modelling indicated **UK manufacture** would have reduced the carbon footprint by 12%; **eliminating gloves** (handwashing only) would have reduced carbon footprint by 45%; **reusing** gowns (laundered 75 times) and face shields (cleaned with detergent wipes five times) would reduce carbon footprint by 10% and **maximal recycling** of products (including seeking recycled materials) would reduce carbon footprint by 35%

Whilst this study is based on modelling and has some limitations it is useful to help explore the potential options to try to minimise and mitigate the environmental impact of increased use of PPE.

⁸¹ <https://www.tandfonline.com/doi/full/10.1080/15487733.2020.1857571>

⁸² <https://journals.sagepub.com/doi/full/10.1177/01410768211001583>

Country insight: South Africa

South Africa has been following an alert level system (figure 9) to determine the levels of restrictions for the public, manage non-pharmaceutical interventions and the easing of lockdown measures⁸³

Figure 9: COVID-19 alert levels in South Africa

ALERT LEVEL 5	ALERT LEVEL 4	ALERT LEVEL 3	ALERT LEVEL 2	ALERT LEVEL 1
 OBJECTIVE				
Drastic measures to contain the spread of the virus and save lives.	Extreme precautions to limit community transmission and outbreaks, while allowing some activity to resume.	Restrictions on many activities, including at workplaces and socially, to address a high risk of transmission.	Physical distancing and restrictions on leisure and social activities to prevent a resurgence of the virus.	Most normal activity can resume, with precautions and health guidelines followed at all times. Population prepared for an increase in alert levels if necessary.

Co-morbidities and COVID-19 in South Africa

A study anticipating the impact of COVID-19 and comorbidities on the South African healthcare system by agent-based simulations published in April 2021⁸⁴ reported that:

- Since 2007, tuberculosis (TB) has been the leading cause of death from a single infectious agent worldwide, ranking above human immunodeficiency virus (HIV) and acquired immune deficiency syndrome (AIDS)
- The danger is not only a coinfection, as observed for TB and HIV for a long time, but that **both TB and COVID-19 affect the respiratory organs** and thus potentiate their effect or accelerate the critical course
- The African continent faces preconditions in regard to **healthcare capacities and social welfare** which **may hinder service delivery** for COVID-19 patients and given the high TB prevalence rates, COVID-19 could lead to a more severe outcome in African countries, e.g. South Africa
- Data estimation from the WHO TB and public infrastructure data, show that the symptomatic critical case rate, which affects the healthcare system, is between 8 and 12% due to the interaction of COVID-19 and TB, for a TB population of 0.52% in South

⁸³ <https://www.gov.za/covid-19/about/about-alert-system>

⁸⁴ <https://pubmed.ncbi.nlm.nih.gov/33846378/>

Africa. This TB prevalence leads to a significant increase in the peak load of critical cases of COVID-19 patients and potentially exceeds current healthcare capacities

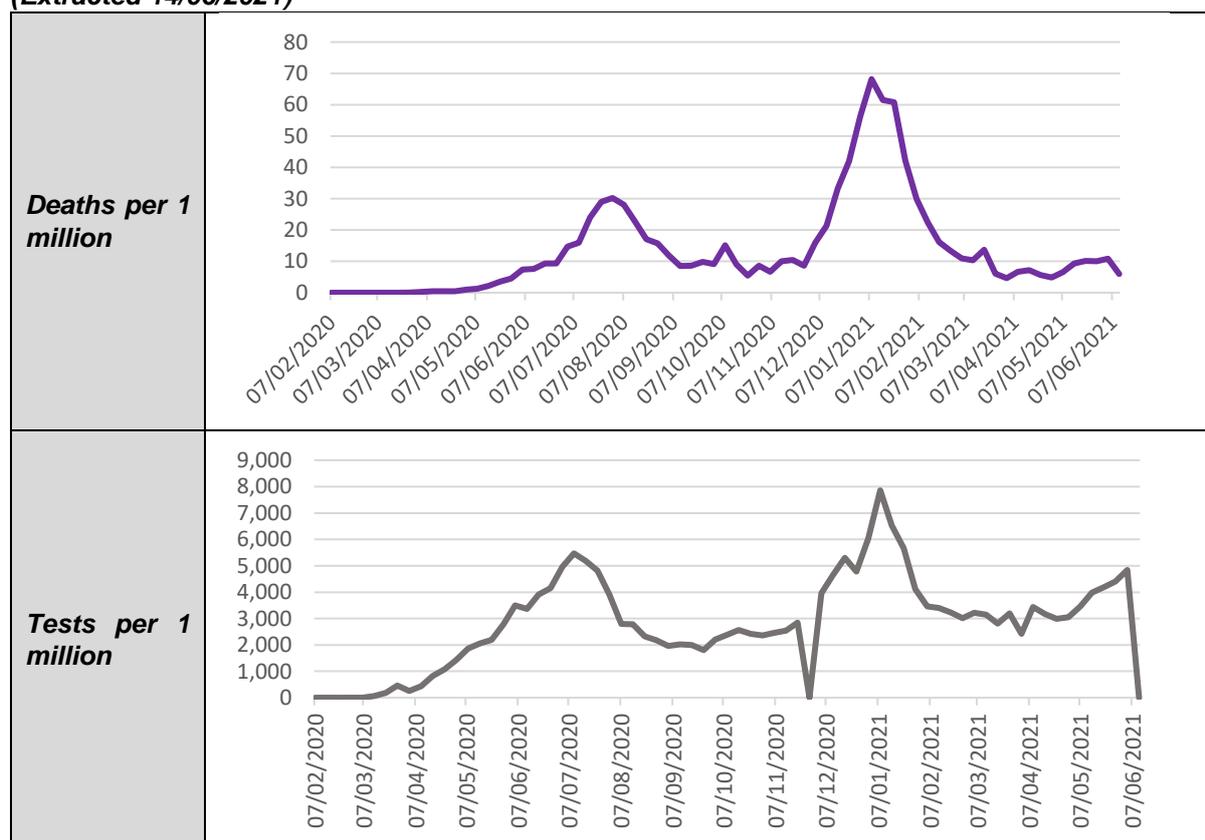
A further review of the impact of COVID-19 in Africa more generally indicated that the course and outcomes of the pandemic seem to be also **dependent on key morbidities prevalent** in a country as well as related **healthcare factors** such as:⁸⁵

- pathophysiological processes underlying the interaction of coinfections and comorbidities in shaping **prognosis of COVID-19 patients**
- epidemiology of key coinfections and comorbidities, and the state of related **healthcare infrastructure** that might shape the course of the pandemic and
- implications of the above for pandemic management and post-pandemic priorities

Epidemiological update from South Africa

- **Deaths and tests first peaked in summer 2020 with a further peak in January 2021** (figure 10)
- A sharp decline in testing capacity has been observed in the final week, although this may be due to incomplete data, further investigation would be required to verify this decline

Figure 10 COVID-19 deaths and tests in South Africa per 1 million from 07/02/2020 to 11/06/2021 (Extracted 14/06/2021)⁸⁶



⁸⁵ <https://onlinelibrary.wiley.com/doi/epdf/10.1111/tmi.13504>

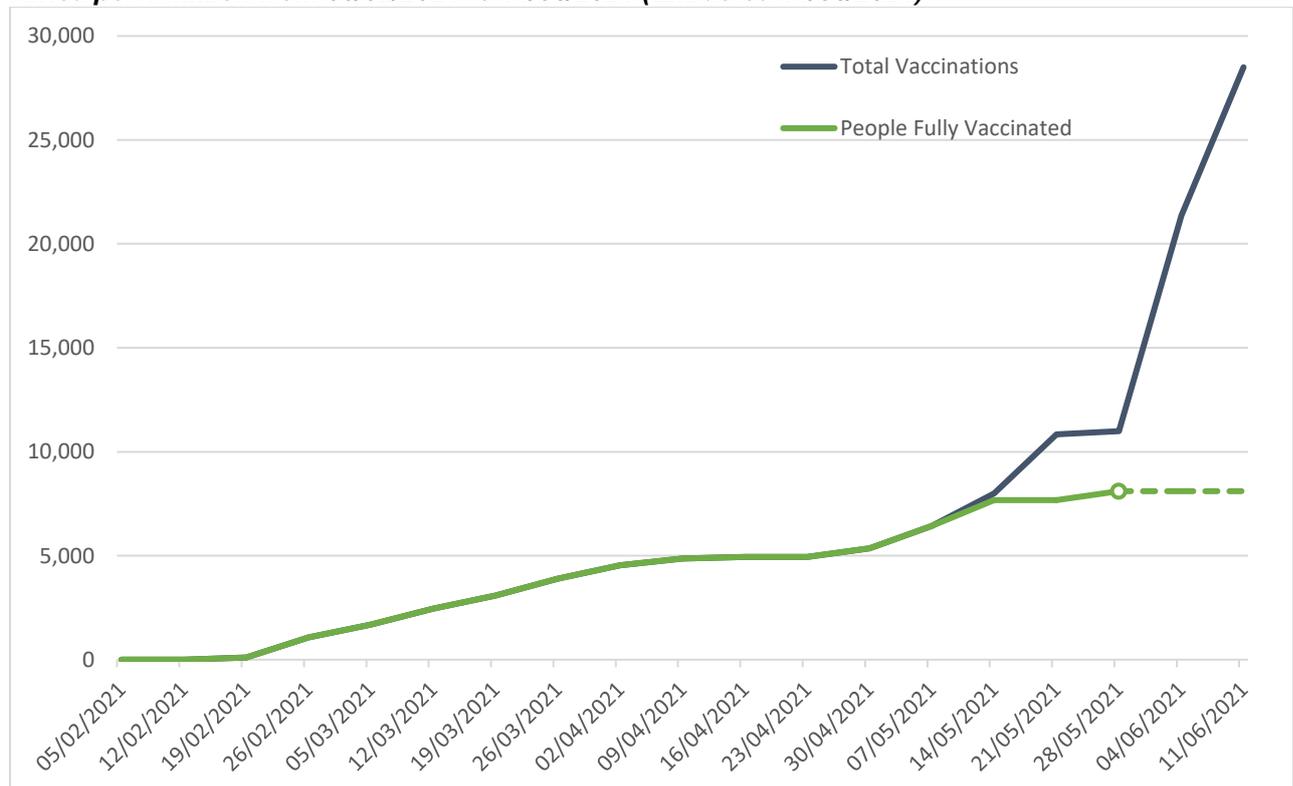
⁸⁶ <https://ourworldindata.org/coronavirus-data-explorer>

Vaccination in South Africa

Figure 11 shows the numbers vaccinated in South Africa from February 2021 to June 2021 and illustrates the following:

- There has been a **rapid increase in the number of vaccinations** reaching around 28,500 per 1 million in June 2020
- The number of people fully vaccinated is equal to the total number of **vaccinations administered until May 2020**: this is because most of the vaccinations that were being used in South Africa **were 1-dose vaccines**
- With regard to the number of people fully vaccinated, we begin to see the **line diverge** from total vaccinations in May, this may be a result of Pfizer BioNTech vaccinations (**2-dose vaccine**) **being introduced** in South Africa on 17 May 2021⁸⁷
- Data for people fully vaccinated stops at 28/05/2021 as a result of incomplete data, thus, as it is a cumulative count we have highlighted the remaining points as a dashed line, as we appreciate the true value would lie between the dashed line and the total vaccinations line
- The final weeks' worth of data may not be accurate due to incomplete data. However, further investigation would be required to verify this

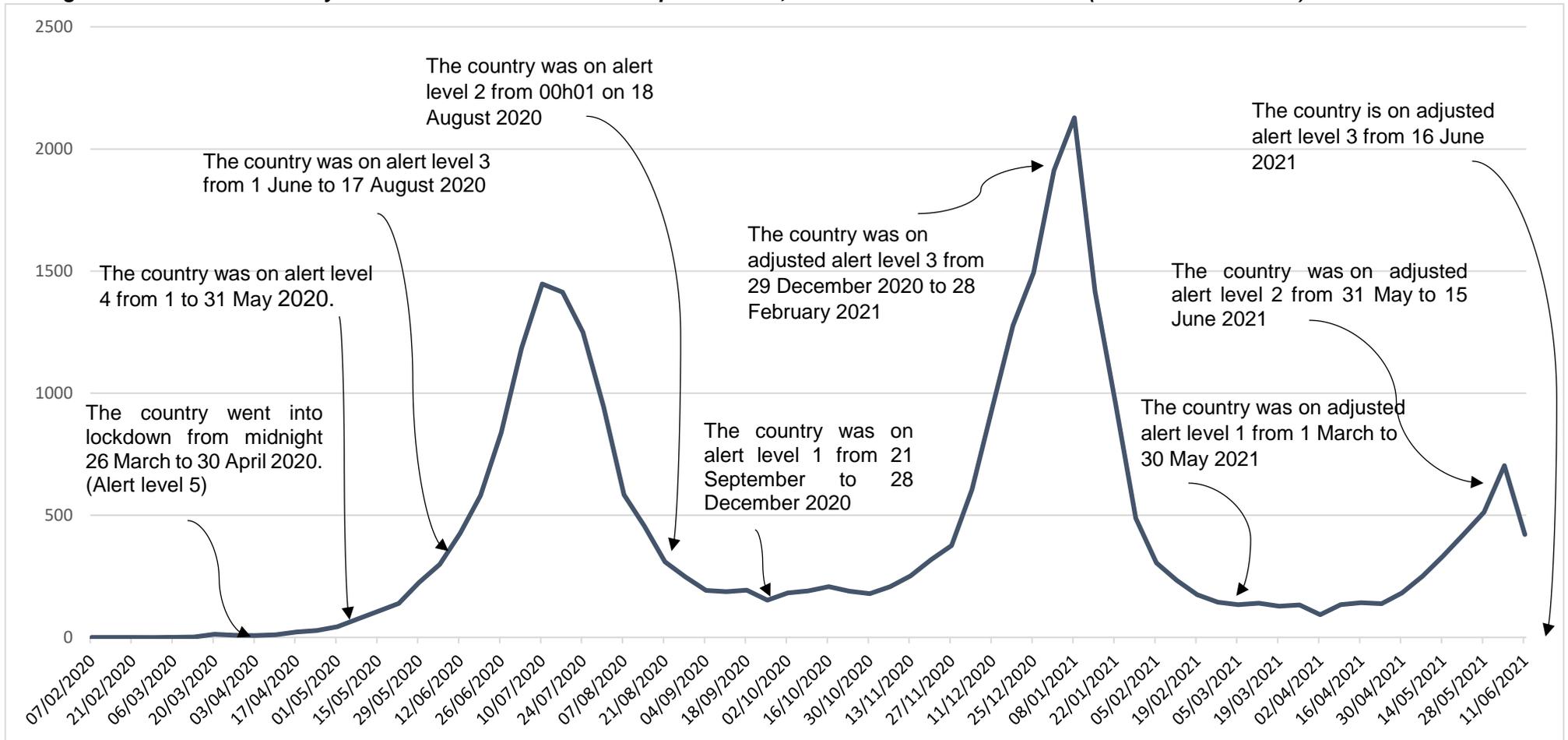
Figure 11: Cumulative COVID-19 vaccinations administered and people fully vaccinated in South Africa per 1 million from 05/02/2021 to 11/06/2021 (Extracted 14/06/2021)⁸⁸



⁸⁷ https://github.com/owid/covid-19-data/blob/master/public/data/vaccinations/country_data/South%20Africa.csv

⁸⁸ <https://ourworldindata.org/coronavirus-data-explorer>

Figure 12: Timeline of Weekly COVID-19 cases in South Africa per 1 million, from 05/02/2021 to 11/06/2021 (Extracted 14/06/2021)⁸⁹



⁸⁹ <https://ourworldindata.org/coronavirus-data-explorer>

- For the **majority of the time the testing** strategy has been **open public testing**⁹⁰
- There was a period of time in April 2020 where only those showing symptoms of COVID-19 were tested

Overall, with regard to cumulative totals:

- 200,902.7 tests have been carried out per 1 million in South Africa (time period: 07/02/2020 to 11/06/2021)
- 974 people per 1 million in South Africa have died in relation to COVID-19 (time period: 07/02/2020 to 11/06/2021)
- 29,901.5 vaccinations have been administered per 1 million people in South Africa (time period: 05/02/2021 to 11/06/2021)
- 29,457.4 cases have been reported per 1 million of South Africa's population (14 June 2021)

Variants of concern (VOC) in South Africa

- The GISAID Initiative promotes the **rapid sharing of data** from all influenza viruses and the coronavirus causing COVID-19 – including genetic sequencing and related clinical and associated epidemiological data⁹¹
- Data extracted from GISAID cannot be used to determine prevalence, however, it does **show the number of genomes sequenced and submitted** to the initiative
- The first detection of the Delta variant in South Africa was from a sample collected on the 24 April 2021. The latest report (28 June 2020) acknowledges that the **Delta variant is rapidly displacing the Beta variant in South Africa** and there is clear evidence of community transmission of the Delta variant.⁹²

⁹⁰ <https://worldhealthorg.shinyapps.io/covid/>

⁹¹ <https://www.gisaid.org/about-us/mission/>

⁹² <https://www.gov.za/speeches/minister-blade-nzimande-plans-post-school-education-and-training-institutions-coronavirus>

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