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Member States' Responses to the COVID-19 pandemic in the context of European Commission recommendations

Specific Contract No SC 2020 71 01 in the context of the Single
Framework Contract Chafea/2018/Health/03

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Table of Contents

Executive Summary.....	6
1. Introduction.....	8
2. Clustering of topic areas and data sources.....	8
3. Reading guide.....	9
4. Results per main topic area.....	9
4.1. Testing.....	9
4.2. Vaccination strategies.....	10
4.3. Medical countermeasures and stockpiling.....	10
4.4. Contact tracing and surveillance.....	11
4.5. Protection and prevention measures across settings.....	11
4.6. Healthcare capacity.....	11
4.7. Travel.....	12
4.8. Mental health.....	12
4.9. Influenza.....	12
5. Effectiveness of measures based on literature review.....	13
6. Conclusions.....	14
Annex 1 Overview of a number of trackers and sources of information regarding the COVID-19 crisis.....	18
Annex 2 Effectiveness of COVID-19 response measures.....	19

Executive Summary

This study maps Member State level public health measures on COVID-19 as set out in the recommendations in recent Commission Communications and Commission Recommendations, it describes the effectiveness of measures and explores how to reinforce (real-time) monitoring of policy-relevant COVID-19 measures and activities at EU level. The study is based on publicly available sources accessed in January 2021, which should be considered when interpreting results, also as we were not able to make use of data from non-public sources such as the Early Warning and Response System (EWRS).

Nearly full uptake of selected recommendations

Member States implemented measures in the following areas: development and implementation of vaccination strategies, monitoring tests and test results, increasing access to testing and measures concerning the 3Cs (closed spaces, crowded places, and close contact settings). All are measures that are clearly identifiable and well-published in public sources.

Non-homogeneity or high variability in broadly implemented recommendations

A number of recommendation such as testing policies for travellers, quarantine rules or priority groups for vaccinations are implemented in most Member States, but this is done in a highly variable way. Inherent to the speed of the crisis and variable national conditions and contexts, a fragmented pattern of approaches is observed. While less or different implementation of recommendations might also indicate that some Member States need more support in terms of e.g. capacity, finances or purchasing power, we were not able to confirm this due to insufficient information.

Setting up an information cycle to monitor actions from future Communications

The swift responses needed to the COVID-19 pandemic did not allow for extensive coordination between the information needs of the Commission and Member States and the monitoring activities to support these. As the pandemic is not over, it is therefore useful to further expand existing information collection and exchange systems, able to adapt to the next phase. Ideally, future Communications will incorporate tangible and actionable indicators, while an information cycle is set up to support this. This means that databases may be complemented with newly defined indicators that are suitable to assess the uptake and impact of current and new recommendations, which currently is often not fully possible. For example, there are knowledge gaps concerning healthcare capacity, testing policies and mental health effects of the pandemic, which are not extensively reported in existing databases.

Strengthen real-time monitoring

Given the pros and cons of different types of the existing data sources, a step forward would be to provide a more structured and comparable way of collecting information, e.g. with ordinal scales where possible combined with a possibility to include free text in order to provide more specific information. The web-scraping approaches as used by ECDC-JRC can be developed further and expanded with machine learning / AI technologies to establish more real-time monitoring. Such technologies take time to fully develop and set up and may not suffice as stand-alone solutions. Therefore it will be necessary requiring to complement them with more traditional methods such as expert reports to allow for validation and refinement. Such triangulation might build on existing networks where possible, including those of WHO and OECD to avoid duplication.

Making use of support instruments

While the Commission Communications enhanced awareness of support services provided at EU level (such as guidance by the ECDC or the use of EU level platforms and EU level cooperation), the public sources did not provide sufficient information to assess whether a Member State had used such support services.

Learning from best practices

Similarly, the Communications referred to learning from best practices elsewhere, but so far the opportunity to learn from experience elsewhere appears limited, also as information is spread over multiple databases in a fragmented manner and time and capacity is too scarce to reflect on other than the national experience. Strengthening existing portals and dashboards to facilitate such horizontal comparisons, complemented with rapid expert assessments would improve mutual learning. Additional support to guide and coordinate feasible and comparable data collections would be useful.

Conclusion

The majority of Member States have implemented the recommended measures. Due to the observed gaps in data availability, improving the information cycle at the EU level seems necessary and essential to assess the level of implementation of measures, which are based on the Commission Recommendations. There is a need for improving, coordinating and harmonising national COVID-19 information systems to allow reporting with comparable indicators at the EU level and better enable learning from best practices. Timely and comparable data and information is essential as it will deliver the intelligence to combat the pandemic in the EU and serve as input to future preparedness plans.

1. Introduction

The COVID-19 pandemic is putting an unprecedented level of pressure on European health systems and populations. In response to the pandemic, the European Commission and the EU agencies have provided guidance and coordination while being mindful of the rules of subsidiarity, by initiating a number of actions, described in greater detail in the Commission Communications in the period July - December 2020:¹

- a) Short-term EU health preparedness for COVID-19 outbreaks, published on 15 July 2020.
- b) Additional COVID-19 response measures, published on 28 October 2020.
- c) Preparedness for COVID-19 vaccination strategies and vaccine deployment, published on 15 October 2020.
- d) Commission Recommendation on the use of rapid antigen tests for the diagnosis of SARS-CoV-2 infection, published on 18 November 2020.
- e) Staying safe from COVID-19 during winter, published on 2 December 2020.

This study aims to identify recommendations from these Communications, identify indicators for these in public international public databases and scan how far the Member States implemented actions on these indicators. Another purpose is to assess the available evidence of the effect of such actions based on the literature, and to explore ways to conduct such assessment in real time (as far as possible), also to inform future monitoring and preparedness plans.

2. Clustering of topic areas and data sources

The various Communications describe a broad range of pandemic response measures, which we clustered into nine (some with linkages to each other) categories²:

- Testing
- Medical countermeasures and stockpiling
- Surveillance and contact tracing
- Vaccination strategy
- Protection and prevention measures
- Health care capacity
- Travel
- Mental health
- Seasonal influenza

Data for each of the indicators were sought in a number of international data sources that have been set up in order to collect information on country responses to the COVID-19 pandemic. Annex 1 lists 12 data sources by international or European Union organisations, including the ECDC-JRC Response Monitor Database, WHO Public health and social measures (WHO-PHSM), OECD Country Policy Tracker and further non-governmental / voluntary networks.

¹July Communication: https://ec.europa.eu/info/sites/info/files/communication_-_short-term_eu_health_preparedness.pdf.

Main October Communication: <https://ec.europa.eu/info/sites/info/files/commun-additional-covid-19-response-measures.pdf>

Additional October Communication: https://ec.europa.eu/health/sites/health/files/vaccination/docs/2020_strategies_deployment_en.pdf

November Communication: https://ec.europa.eu/health/sites/health/files/preparedness_response/docs/sarscov2_rapidantigentests_recommendation_en.pdf

December Communication: https://ec.europa.eu/health/sites/health/files/preparedness_response/docs/covid-19_stayingsafe_communication_en.pdf

² A cross-cutting topic area was 'Communication to citizens', which applies to issues such as testing policies, vaccination plans, travel restrictions etc, and is addressed under each of these headers separately.

We first assessed whether information was available from Commission sources, including reports and studies from ECDC and the joint ECDC-JRC Response Measures Database. Where needed, we then moved to other data sources of which the WHO-PHSM database proved to be most extensive and useful.

3. Reading guide

For some indicators included in the study, no data or only limited information could be found in the assessed databases and information sources. This report focuses on those indicators for which at least some substantial information was found that provided insight into whether Member States' actions are aligned with the Commission Communications. It is emphasised that in case no information was found, this does not necessarily imply that the concerned Member States are not undertaking actions related to Commission Communications, but only that we had not been able to retrieve this based on the public sources consulted. Furthermore, validating the information found in the publicly accessible databases was beyond the scope of this study. Also, data from non-public sources such as the Early Warning and Response System (EWRS) were not used, as these are confidential and not collected for this purpose. Therefore, it cannot be ruled out that some of the information found was inadequate or incomplete. Finally, some of the information presented in this report can be outdated and it is possible that the situation in Member States has since changed. These limitations should be taken into account when reading this report and interpreting its result.

4. Results per main topic area

4.1. Testing

For the subject of testing, the most comprehensive information is available on access to testing and testing of incoming travellers. For other elements far less information was available and with considerable variation in details. ECDC surveys provided valuable additions.

With regard to *national testing strategies*, information on **testing volume and the number of positive cases** is reported on a weekly basis to the European Surveillance System (TESSy) from ECDC. All Member States have increased **access to testing** over time (Oxford COVID-19 Government Response Tracker (OxCGRT) database). As of November 2020, all but one Member State test anyone having COVID-19 symptoms and 11 Member States also provide open public testing (e.g. for asymptomatic people). The use of **mass testing to identify local outbreaks** is not comprehensively available but was found to be used by at least 9 Member States (JRC-ECDC and WHO-PHSM).

The JRC-ECDC and WHO-PHSM database were useful for assessing *testing policies for specific groups*. Most comprehensive information is available for **incoming travellers** (policies vary from voluntary, depending on country of departure, all travellers, etc. though there are many changes over time). For five Member States some information was found on policies for **frontline workers**, and for seven Member States on **vulnerable groups**.³ Also for the latter two indicators, policies vary from Member State to Member State, including the level of detail.

Some indicators centred around the *use of Rapid Antigen Detection Testing (RADT)*, though only little information was found in public databases. 6 out of 16 Member States responding to an ECDC survey early December use RADTs in the national testing strategy, which might have increased

³ With regard to vulnerable groups we have collected information on any specific group mentioned, such as patients, visitors of elderly, children.

now (ECDC, Jan 2021). **Policies for antigen tests** target mass testing, healthcare personnel, and patients (WHO-PHSM), but reporting periods differ considerably. Another ECDC survey found that 9 out of 15 responding Member States have been or are currently assessing **clinical validation for RADTs** (ECDC, Nov 2020). Also 12 Member States contributed to a meta-analysis on clinical performance data of commercial tests to ECDC (Van Walle et al., Nov 2020). National **performance requirements** of antigen tests was found for only 1 Member State (WHO-PHSM).

Testing indicators with reference to EU-level communication or collaboration are not available in databases. Information on the **use of centrally purchased antigen tests and mutual recognition of test results** are also not available at ECDC. Only few Member States regularly update their national testing strategy to ECDC. Regarding whether **other population surveillance programmes are put on hold**, ECDC found that influenza surveillance has started later in some Member States (Melidou et al., 2020).

4.2. Vaccination strategies

All Member States have developed or are developing their vaccination strategy, 9 Member States have submitted them to ECDC. Almost all Member States have defined or are defining priority groups, and reported on organisational structures for implementation and staffing of vaccination campaigns. Monitoring strategies regarding vaccine safety and registration systems for vaccinations are reported to be in place in 24 Member States (in the ECDC report of November 2020). However, no information was found on whether Member States specifically had instituted a reminder system for vaccines that require a second dose. In addition, a recent survey by SANTE Unit B3 Digital Health and European Reference Networks (Jan 2021) shows that 11 Member States reported issuing vaccination certificates/proofs for COVID-19 vaccinated persons, and 7 Member States foresaw this in the future. According to the latest ECDC report (1st February 2021)⁴, 11 Member States have finalised detailed communications plans, 6 Member States have drafted plans and 5 Member States are still developing their communication plans. Regarding plans for modelling exercises, information is available for 24 Member States, of which 10 reported that they did not have such plans.

4.3. Medical countermeasures and stockpiling

Most Member States have taken action on the import and deployment of Personal Protective Equipment (PPE), with 12 also using procurement framework contracts. Reports on the import and deployment of PPE in concrete numbers are available for 25 Member States. In contrast, only limited information is available on the needs for medical supplies, national production capacities and stockpiles of essential equipment: only three Member States provided information on this. Twelve Member States reported that they used procurement framework contracts to buy medical equipment. Less than half of the Member States reported that their country incentivises and supports business collaboration to speed up domestic production of essential supplies.

Information was found in the ECDC-JRC, WHO and HSRM databases. There was no clear information on whether Member States used the "Clearing House" for medical equipment for COVID-19 and on the exchange of best practices on repurposing. Member States report on the availability of PPE, but not on their need for PPE and their strategies to increase availability.

⁴ ECDC. Overview of COVID-19 vaccination strategies and vaccine deployment plans in the EU/EEA and the UK, February 2021

Information on the use of EU-level support was not available. It is also unclear in how far Member States or health systems still face availability issues that may require EU support.

4.4. Contact tracing and surveillance

21 Member States have developed and implemented a contact tracing app, most with interoperability features to connect with other apps and services. At the end of Jan 2021, at least 11 Member States have joined the European Federation Gateway Service (EFGS) that allows interconnectivity between apps of different Member States to allow the rapid exchange of contact tracing information generated through the apps. For 17 Member States, it was reported that they implemented various preparedness measures at entry points into the EU. All Member States have routinely shared epidemiological data to ECDC. Other surveillance measures have been taken by some Member States: 8 Member States have taken measures to monitor risk groups to prevent the spread of the pandemic among vulnerable populations, and at least 7 Member States have conducted seroprevalence studies. Barely any information was available about whether Member States make use of testing of wastewater (only reported for one Member State). We also did not find any data on whether Member States joined the exchange platform for air transport in time for the end-of 2020 travelling season. Member States may also receive guidance from ECDC on reinforcing the population based sentinel primary care and hospital surveillance system, but we did not find any data on this indicator from any Member State.

4.5. Protection and prevention measures across settings

Member States reported on a wide range of measures concerning the 3Cs, in particular containment measures such as social distancing, curfews, closure or restriction of non-essential businesses, public transport and gathering limitations. Occupational guidance was provided for long term care and elderly home staff (13 Member States), social and/or health services (12 Member States), education (8 Member States), hospital staff (4 Member States), police or prison staff (4 Member States), childcare (2 Member States), and mink farmers (2 Member States).

When specified, the most mentioned vulnerable and at-risk groups were the elderly or people in care settings. Measures to protect vulnerable groups included visiting restrictions in 17 Member States; encouraging home isolation or reduced contact in 8 Member States; introducing restricted essential items or food shopping hours in 6 Member States; refugee and migrant measures in 5 Member States; emergency accommodation and support for homeless people in 4 Member States; and prisoner lockdown or homestay in 4 Member States. Last, no information is available in public sources on sharing of best practices nor the use of EU-level recommendations including the handbook, as published by ECDC. A variety of containment measures, such as curfews, social distancing, business hours restrictions etc. were reported by most Member States.

4.6. Healthcare capacity

Regarding healthcare capacity only very limited information was found. 19 Member States were found to have one or more measures intended to relieve pressure on healthcare personnel. The measures addressed actions to increase the number of personnel available, scaling up healthcare facilities and reorganising how and by whom healthcare related tasks were delivered. For only 1 Member States information was found in the databases on the use of cross border health capacity, although news-sites on the internet report on more situations where Member States exchanged patients. Information on reinforcing healthcare services of hospital and ICU admissions in view of the festive season was not found. 10 Member States reported on training modules for several medical groups, for instance on the use of PPE, infection prevention and for people without a

healthcare background to commence work in the health sector (LTCCovid, ECDC-JRC and WHO databases).

There was no information on actions undertaken to assure sufficient PPE for healthcare personnel or networks of clinicians. However, 23 Member States reported on a wide variety of measures to that could be interpreted as to ensure availability of PPE for healthcare personnel, such as providing guidelines and training for the use of PPE, extra stockpiling of PPE, measures to increase production and import of PPE, procurement rules for PPE and allocation of extra budget for PPE.

The actions that were reported in this category were mainly initiated during the first wave (March-June 2020), so these actions were initiated already before the EU recommendations on this topic. Barely any information was found for the second half of 2020.

4.7. Travel

Member States have taken considerable, but also quite variable action regarding travel measures. Most Member States (23) have published a downloadable or digital passenger locator form for relevant transport sectors. Most established border control measures from March 2020, with exceptions. To justify border control, some Member States indicated their responsibility to ensure public health by helping reduce the transmission of the virus and / or halt the spread of novel variants with decisions to implement border control based on risk, whereas most did not specifically articulate reasons in public sources beyond the pandemic itself (WHO, ECDC-JRC). Member States have been permitting entry for residents of their own country, and where possible, other EU / EEA / Schengen citizens and residents who met entry requirements (OECD, WHO, ECDC, LTCCovid). Information on the availability of a digitalised passenger location form was mainly found on individual Member State websites. Almost all countries reported on the indicators related to the recommendations regarding travel.

4.8. Mental health

Only limited information is available in relevant databases for current and future monitoring of the mental health of the population. 6 Member States were found to have introduced mental health hotlines during March-April 2020 and three published mental health recommendations. Psychological counselling was reported for 2 Member States. Only for a few Member States we retrieved reported actions relating to psychological support for specific vulnerable groups. With regard to specific populations, few initiatives were mentioned, for example, 3 Member States developed mental health information and support specifically for children and young people, and other single Member States for family violence victims, mink farmers and health and social workers. There was no information on the sharing of best practices available.

4.9. Influenza

Again, only limited information is available regarding which Member States have undertaken action on influenza programmes. Five Member States reported on broadening the target group or providing the flu vaccine free of charge in 2020. Two Member States reported on procurement initiatives (one making more flu vaccines available for GPs and on joining a joint procurement programme).

In both the ECDC-JRC and WHO databases only one Member State reported on influenza vaccination strategies. Additional information was found in the Health Systems Response Monitor of the European Observatory on Health Systems and Policies (HSRM) database.

5. Effectiveness of measures based on literature review

A non-systematic literature review was conducted on the effectiveness of COVID-19 control actions on measures of COVID-19 infection control (e.g., virus growth rate). The review has a number of limitations, including the inability to identify independent effects of specific interventions as these were often introduced in parallel with other interventions. The main findings are summarised in Annex 2 and include:

- ***Multifactorial interventions:*** A study of government interventions across multiple countries found that while there was no specific measure that was a 'silver bullet', measures such as curfews, lockdowns, restricting gatherings and school closures were among the most effective in the countries examined (Haug et al, 2020). Two systematic reviews (Girum T et al, 2020; n= 22 studies (9 observational and 13 modelling); Juneau CE et al, 2020 (n=62 studies)) that examined multiple measures observed consistent findings supporting the effectiveness of a number of COVID-19 concurrent policy response measures (quarantine, contact tracing, isolation etc.). The introduction of COVID-19 control policies significantly reduced growth rate in incidence of infection with variations observed within Member States (Wibbens et al, 2020). The conclusions were that policies to control COVID-19 must be implemented to see an impact and that the socially tolerable policies are only effective in jurisdictions with high compliance.
- ***Social distancing:*** Studies examining the effectiveness of social distancing measures found that the earlier the intervention was introduced the more effective it was. In a study of 190 countries Bo et al compared the effectiveness of social distancing, mask wearing or quarantine on the rate of COVID-19 infections, with social distancing being more effective than other measures.
- ***Closure of schools/business:*** A study using Bayesian hierarchical modelling of 34 European countries found that school (all schools and universities) and business closures and a ban on gatherings each were effective in reducing virus daily reproduction numbers and that these interventions may be more beneficial than a stay at home order (Brauner et al, 2020).

Lessons learned from the literature:

- It is important to ensure that sufficient surveillance data and detailed information on specific response measures and their adherence is collected at regional and local levels to examine COVID-19 policy response measure effectiveness.
- Many studies highlighted the importance of early policy implementation across European countries in reducing incidence and mortality.
- Policy response measures where adherence is poor may need to be reconsidered or strengthened so that benefit can be realised, while high impact measures can be identified rapidly to facilitate sharing of best practices.
- As the field is moving too rapidly to rely on published research alone, it is advisable to consult a pool of national experts on new policy measures suitable for upscaling or existing measures suitable for downscaling, and to support the identification and sharing of best practices.
- In addition, efforts to analyse the vastly expanding research on effectiveness of policy interventions via machine learning have promising results, and should be considered in parallel.⁵

⁵ Anhvinh Doanvo, Xiaolu Qian, Divya Ramjee, Helen Piontkivska, Angel Desai, Maimuna Majumder (2020), Machine Learning Maps Research Needs in COVID-19 Literature, Patterns, Vol 1 (9), 2020, <https://doi.org/10.1016/j.patter.2020.100123>.

6. Conclusions

Health systems, policy makers and citizens are learning from each other in real time how to face the COVID-19 pandemic. However, there is a need for enhanced exchange of knowledge on our responses to the COVID-19 pandemic and the degree to which these can be compared and potentially transferred across different contexts in order to improve and strengthen the health and care systems in the face of this unprecedented crisis.

The mapping exercise presented in this report shows that while for several indicators information could be found in the databases included in the study, for other indicators no information was available, or the available information did not match completely with the indicator. Another limitation of this study was that it was only able to provide an indication of whether Member State responses took place in concordance with EU recommendations. We have not been able to systematically assess if the measures took place in response to the recommendations, as this implies determining the exact timing of those responses (before or after such recommendations) and doing a policy analysis whether their decisions were indeed influenced by such information.

Notwithstanding its limitations, the study was conducted as robustly as possible and offers a useful quick scan of Member States responses to the COVID-19 pandemic based on public sources. We also conclude that the first essential building blocks for an effective COVID-information systems are in place, given the large steps taken by agencies and networks within and outside the EU to collect policy relevant information. Such information systems serve wider research and monitoring purposes such as for the compilation of evidence on how to best and effectively combat the epidemic in the future, reduce the burden of disease and the social and economic consequences.

To strengthen the information cycle, both related to the current and still progressing COVID-19 pandemic and future large epidemics and pandemics, it seems worthwhile to take the following points into consideration:

- Clear goals and objectives linked to the Commission recommendations may better enable to define indicators and data needs for evaluating their follow up and impact.
- Data collection systems should become an integral part of future preparedness and response planning, as set out in the proposed new regulation on cross-border health threats, ideally also better covering information about the use of EU level guidance and support, and the reasons for (not) using such instruments.
- Further expand the use of technical possibilities for harvesting (new) information from governmental websites in real-time, expanding on the scraping techniques used by ECDC and JRC for gathering input for the Response Measures Database (RDM). Ideally, the data collection would be aligned with Member States, by asking them to provide or control certain types of regularly updated information at a dedicated webpage in a standardised manner and language.
- Official Member State information should preferably form the basis for monitoring, to be complemented by other sources (e.g., national focal points, expert networks and research projects) By balancing different methods both more structured information can be complemented with (where possible) free text to provide detail and nuance, as currently done in the ECDC-JRD and WHO-HSPM databases.
- Ongoing EU-funded projects and their expert networks could be involved to look for synergies. (E.g., the PHIRI project could provide information about how Member States organise their COVID-19 related statistical and epidemiological work, while the Joint Action InfAct has circulated a number of surveys among its partners to map responses from national health information systems on the COVID-19 crisis, results of which are to be published over the next months.)

Member States' Responses to the COVID-19 pandemic in the context of COM recommendations

- Preferably, roles and responsibilities related to data collection for monitoring the implementation of Commission Communications should be clearly defined. This will prevent duplications and discrepancies between different databases. The work could be divided between different agencies (e.g., ECDC, JRC, future HERA (health emergency preparedness and response authority), as well as OECD and WHO), but with a clear coordination and division of tasks.
- To map the reasons *why* Member States did or did not take certain actions, additional methodologies, including interviews with policy makers, would offer useful insights for tailoring and improving a future policy response at European level.

References

- Anglemyer A, Moore T, Parker L, Chambers T, Grady A, Chiu K, et al. Digital contact tracing technologies in epidemics: a rapid review. *Cochrane Database Syst Rev* [Internet]. 2020;(8). Available from: <https://doi.org/10.1002/14651858.CD013699>
- Burns J, Movsisyan A, Stratil J, Coenen M, Emmert-Fees K, Geffert K, et al. Travel-related control measures to contain the COVID-19 pandemic: a rapid review. *Cochrane Database Syst Rev* [Internet]. 2020;(9). Available from: <https://doi.org/10.1002/14651858.CD013717>
- Doanvo A., Qian X., Ramjee D, Piontkivska H., Desai A., Majumder, M. (2020), Machine Learning Maps Research Needs in COVID-19 Literature, Patterns, Vol 1 (9), 2020, <https://doi.org/10.1016/j.patter.2020.100123>.
- ECDC. 19 November 2020. Options for the use of rapid antigen tests for COVID-19 in the EU/EEA and the UK. ECDC: Stockholm. https://www.ecdc.europa.eu/sites/default/files/documents/Options-use-of-rapid-antigen-tests-for-COVID-19_0.pdf
- ECDC. 2 December 2021. Overview of COVID-19 vaccination strategies and vaccine deployment plans in the EU/EEA and the UK, 02 December 2020. <https://www.ecdc.europa.eu/en/publications-data/overview-current-eu-eea-uk-plans-covid-19-vaccines>
- ECDC. 18 January 2021. ECDC rapid assessment of laboratory practices and needs related to COVID-19. ECDC: Stockholm. <https://www.ecdc.europa.eu/sites/default/files/documents/covid-19-rapid-assessment-laboratory-practices-needs.pdf>
- ECDC. 1 February 2021. Overview of the implementation of COVID-19 vaccination strategies and vaccine deployment plans in the EU/EEA, 01 February 2021; <https://www.ecdc.europa.eu/en/publications-data/overview-implementation-covid-19-vaccination-strategies-and-vaccine-deployment>
- European Commission (EC). Vaccination Certificates Survey to the Health Security Committee (HSC) Members, 14 January 2021
- Fischer R, Bortolini T, Karl JA, Zilberberg M, Robinson K, Rabelo A, et al. Rapid Review and Meta-Analysis of Self-Guided Interventions to Address Anxiety, Depression, and Stress During COVID-19 Social Distancing. *Front Psychol*. 2020;11:2795.
- Girum T, Lentiro K, Geremew M, Migora B, Shewamare S. Global strategies and effectiveness for COVID-19 prevention through contact tracing, screening, quarantine, and isolation: a systematic review. *Trop Med Health*. 2020 Nov 23;48(1):91
- Juneau C-E, Briand A-S, Pueyo T, Collazzo P, Potvin L. Effective Contact Tracing for COVID-19: A Systematic Review. *medRxiv*. 2020 Jan 1;2020.07.23.20160234.
- Melidou et al. 19 November 2020. Virological surveillance of influenza viruses in the WHO European Region in 2019/20 – impact of the COVID-19 pandemic. *Eurosurveillance*. <https://www.eurosurveillance.org/content/10.2807/1560-7917.ES.2020.25.46.2001822>

Nussbaumer-Streit B, Mayr V, Dobrescu Ai, Chapman A, Persad E, Klerings I, et al. Quarantine alone or in combination with other public health measures to control COVID-19: a rapid review. *Cochrane Database Syst Rev* [Internet]. 2020;(4). Available from: <https://doi.org/10.1002/14651858.CD013574>

Puyat JH, Ahmad H, Avina-Galindo AM, Kazanjian A, Gupta A, Ellis U, et al. A rapid review of home-based activities that can promote mental wellness during the COVID-19 pandemic. *PLOS ONE*. 2020 Dec 3;15(12):e0243125.

Soklaridis S, Lin E, Lalani Y, Rodak T, Sockalingam S. Mental health interventions and supports during COVID- 19 and other medical pandemics: A rapid systematic review of the evidence. *Gen Hosp Psychiatry*. 2020/08/22 ed. 2020;66:133–46.

Van Walle, I., Leitmeyer, K., & Broberg, E.K. on behalf of the European COVID-19 microbiological laboratories group. 18 November 2020. Meta-analysis of the clinical performance of commercial SARS-CoV-2 nucleic acid, antigen and antibody tests up to 22 August 2020. *MedRxiv*. <https://www.medrxiv.org/content/10.1101/2020.09.16.20195917v1.full.pdf>

Annex 1 Overview of a number of trackers and sources of information regarding the COVID-19 crisis

Name and link	Abbreviation used in this report
ECDC-JRC Response Measures Database	ECDC-JRC
ECDC country response measures	ECDC
WHO Public health and social measures (PHSM) Database	WHO-PHSM
European Observatory of Health Systems and Policies COVID-19 Health System Response Monitor	HSRM
OECD Country Policy Tracker and OECD Employment and Social Policy Responses Tracker	OECD
Oxford COVID-19 Government Response Tracker	OxCGRT
Cambridge Country Responses to the Covid19 Pandemic	Cambridge
DEVEX Funding the Response To COVID-19	DEVEX
International Long-Term Care Policy Network responses to COVID-19 (LTCcovid)	LTCovid
The Lancet's COVID 19 Resource Centre	Lancet
OpenCovid19 initiative	OpenCovid
Worldometer Coronavirus	Worldometer

Annex 2 Effectiveness of COVID-19 response measures

Question to be addressed:

The second question was to "assess the impact of Member State level actions and measures in order to better understand and advise what measures work/do not work. A non-systematic search of published literature examining the effectiveness of COVID-19 policy response measures was conducted using the following bibliographic databases: PubMed, Web of Science, Google Scholar, Publons and the JRC database.

Main findings:

An overview of the published literature identified during the search strategy is shown in the Tables below and summarised in this section.

Studies that examined multiple interventions:

Multiple interventions: A study of the investigations of government interventions found that while there was no one specific measure that was a 'silver bullet', and found that curfews, lockdowns, restricting gatherings and school closures were among the most effective policy response measures in those countries examined. Haug and colleagues' study in Nature on 16 November 2020, provides a ranking of the effectiveness of over 6,000 non-pharmaceutical COVID-19 government interventions in 79 regions/countries by means of sophisticated statistical modelling, but also – inevitably – facing a number of limitations and assumptions.

Two further systematic reviews (Girum et al, 2020; Juneau et al, 2020) that examined multiple indicators observed consistent findings supporting the effectiveness of COVID-19 policy response measures (quarantine, contact tracing, isolation etc). They also found that the measures should be implemented early and that wide adoption of the measures are needed. In Member States included in the analysis by Wibbens et al (2020), the introduction of COVID-control policies significantly reduced growth rate in incidence of the virus, with variations observed across the countries examined and that more than one policy must be implemented to see an impact.

Studies that examined specific response measures:

Social distancing: Studies examining the effectiveness of social distancing measures found that earlier intervention was most effective (Oberhammer, 2020; Chian Koh et al, 2020; Phuoc Bao Thu et al, 2020). In a study of 190 countries Bo et al, compared the effectiveness of social distancing, mask wearing or quarantine on the rate of COVID-19 infection, with social distancing being more effective than other measures.⁶

Closure of schools/business: Brauner JM et al, found that school and business closures and a ban on gatherings were effective in reducing virus daily reproduction numbers and that these interventions may be more beneficial than a stay at home intervention alone.

Contract tracing applications: An overview of studies examining the effectiveness of contract tracing applications in response to the COVID-19 pandemic is shown in the Tables below. Most of the studies were conducted using mathematical modelling. Findings from the modelling studies suggest the efficacy of application based technology to enhance contact tracing efforts and are most effective when combined with other response measures.

⁶ Other studies (Oberhammer J, 2020; Chian Koh et al, 2020; Phuoc Bao Thu T et al, 2020) focused on the effectiveness of social distancing measures, showing a 73% reduction in transmission rate among the general population and 79% reduction in care homes in Sweden. The impact on reducing daily numbers of cases varied across countries.

Lessons learned from the literature:

- Member States should ensure that sufficient surveillance data and detailed information on specific response measures is collected at regional and local levels to examine COVID-19 policy response measure effectiveness.
- Further, much of the published literature used mathematical based modelling to examine policy effectiveness and most studies were conducted using data from publicly available data sources. Therefore, studies using real-world surveillance data from Member States will be needed to examine effectiveness in real-time and also to confirm findings of modelling studies.
- Future work should determine levels of adherence to COVID-19 policy response measures, through EU-wide data collection and monitoring, to determine which specific measures may be impacting COVID-19 growth rates more than others. Policy response measures where adherence is poor should be reconsidered or strengthened so their benefit can be realised, while high impact measures should be identified rapidly to facilitate sharing of best practices.
- Bargain and Aminjonow examined the association between public trust and compliance with public health interventions, finding that regions of high public trust reduced their mobility compared to low-trust regions and that the effectiveness of policy stringency increases with trust. Thus public trust in policies is needed to enhance compliance among the public.
- Many studies highlighted the importance of early policy implementation across European countries for reducing incidence and mortality. A study by Fuller JA and colleagues examined the impact of timing of policies on mortality. Their study concluded that earlier policy implementation across European countries was associated with lower mortality from COVID-19. Member States should ensure that COVID-19 policy response measures are implemented as early as feasible.
- As it was only feasible to provide a first indication of available evidence based on secondary literature review, an alternative to assessing effectiveness objectively would be to ask the coordinating centres in Member States which of these measures they considered a contribution to their national strategy, thus providing tentative overviews of information based on expert assessment.

Limitations:

While examining the literature, it is important to acknowledge that there are many limitations in interpreting the studies completed to date.

- This review was not systematic and therefore does not include all published articles in this area; there may have been some initiatives that were effective but not published.
- Another factor is the fact that measures have often been introduced in Member States in parallel with other measures. Given this multidimensional nature of policy interventions it will be difficult to pinpoint which particular intervention was in fact most effective. Additional information is needed on the effectiveness of interventions across all Member States.
- An important consideration is the measurement of the intervention, and whether this is comparable across settings.⁷
- An assessment is also complicated by the fact that similar measures may have been taken at different phases in the pandemic by different countries, such as countries that

⁷ Taking the list of ECDC indicators on social distancing as an example, one can observe substantial heterogeneity between countries in the definition and application of such measures, the level of enforcement/sanctioning, the application of specific exceptions, and the level to which within-country variations occur between locations or regions, depending on the level of an outbreak. E.g., in some (regions of a) Member States the cancellation of mass gatherings referred to the cancellation for specific events, while for others it referred to gatherings of a particular size. Similarly, closure of public spaces can in some cases be limited to restaurants and entertainment venues, while in other cases it also includes partial or full closure of public transport; closure of educational institutions, etc. All these elements potentially increase the level of detail and thus complexity in an analysis of effects.

introduced a lock down at a relatively low infection rate vs countries that started such measures in a much later phase, making the effectiveness of both difficult to compare.

- Furthermore, we have the difficulty of differences in measuring infected cases, hospitalizations and mortality due to COVID-19. E.g., as countries have different testing policies, it becomes difficult to interpret and compare infection rates between such countries in the same manner. The same applies to mortality rates.
- Also differences in culture may lead to differences between, for instance, ICU admissions. In the Netherlands, cases that are suspected not to survive or to come out of the ICU in a much worse condition than before the infection often are not admitted to the ICU (always in consultation with the patient or patient's family) whereas in Italy, all people who need ICU treatment are treated there, regardless their initial condition. The higher admission rates compared to the Netherlands may in part be explained by this phenomenon. This is an illustration to explain the difficulty of assessing effects of measures.
- Last, the support for the measures by the population may differ among countries, leading to possible differences in effectiveness whereas measures are on paper the same.

Member States' Responses to the COVID-19 pandemic in the context of COM recommendations

Table A.2.14: Systematic and rapid review that examined the effectiveness of COVID-19 policy response measures.

Theme	AUTHOR	Title / Theme	Multi or single country study	Main Findings
Multiple indicators	Girum T et al, 2020	Global strategies and effectiveness for COVID-19 prevention through contact tracing, screening, quarantine, and isolation: a systematic review	Systematic review	"Quarantine, contact tracing, screening, and isolation are effective measures of COVID-19 prevention, particularly when integrated together. In order to be more effective, quarantine should be implemented early and should cover a larger community."
Multiple indicators	Juneau CE et al, 2020	Evidence-Based, Cost-Effective Interventions To Suppress The COVID-19 Pandemic: A Systematic Review	Systematic review	Evidence supports effectiveness of hand washing and face masks; NPI are effective but costly; "lower-quality evidence suggested that: (1) the most cost-effective interventions are swift contact tracing and case isolation, surveillance networks, protective equipment for healthcare workers, and early vaccination (when available); (2) home quarantines and stockpiling antivirals are less cost-effective; (3) social distancing measures like workplace and school closures are effective but costly, making them the least cost-effective options; (4) combinations are more cost-effective than single interventions"
Quarantine	Nussbaumer-Streit B et al, 2020	Updated Cochrane Rapid Review assesses the effectiveness of quarantine during the COVID-19 pandemic	Rapid review	Studies suggest effectiveness of quarantine to reduce incidence and mortality but magnitude of effect unclear. Early implementation is important to ensure effectiveness.
Quarantine	Nussbaumer-Streit B et al, 2020	Quarantine alone or in combination with other public health measures to control COVID-19: a rapid review	Rapid review	Evidence is limited and most evidence from mathematical modelling studies and support the effectiveness of quarantine.
Travel-related	Burns J et al, 2020	Travel-related control measures to contain the COVID-19 pandemic: a rapid review	Rapid review	Evidence is limited and most evidence from modelling studies. However some travel control measures may be effective on infection control.
Apps	Anglemyer A et al, 2020	Digital contact tracing technologies in epidemics: a rapid review	Rapid review	Effectiveness unknown due to lack of published data. However modelling studies support effectiveness of the use of digital contact tracing; more evidence is needed
Mental health	Soklaridis S et	Mental health interventions and supports during COVID- 19 and other medical	Rapid systematic	Findings suggest that non-psychiatric MH supports can be effective and beneficial in addressing pandemic associated mental health concerns

Member States' Responses to the COVID-19 pandemic in the context of COM recommendations

	al, 2020	pandemics: A rapid systematic review of the evidence	review	(social networks, safety wellbeing among HCPs)
Mental health	Puyat JH et al (Plos One)	A rapid review of home-based activities that can promote mental wellness during the COVID-19 pandemic	Rapid review	Findings suggest that home-based activities (exercise, yoga, progressive muscle relaxation, and listening to relaxing music) may be beneficial for promoting wellness during the pandemic
Mental health	Fischer R et al, 2020 (Front Psychol)	Rapid Review and Meta-Meta-Analysis of Self-Guided Interventions to Address Anxiety, Depression, and Stress During COVID-19 Social Distancing	Rapid and Meta-Analysis	Some self-guided interventions may be effective to manage the mental health impacts of a COVID19 lockdown but were not as effective as in-person or group-based interventions

Table A2.15: Literature that examined the effectiveness of COVID-19 policy response measures within the EU.

AUTHOR	Theme	Multi or single country study	Outcome measures	Main Findings
Bargain, O., et al. (2020)	Effect of trust on public policy	17 European countries	COVID-related deaths	Higher level of compliance to national directives in high-trust regions. Coincides in magnitude with the effect of trust on the efficacy of policy stringency.
Brauner JM et al (2020)	Closing education; large gatherings and businesses	34 European countries	reduction in Rt (reproduction number)	Closing all educational institutions, limiting gatherings to 10 people or less, and closing face-to-face businesses each reduced transmission considerably. The additional effect of stay-at-home orders was comparatively small
Barrera-Algarín, E., et al. (2020)	Public health investment	30 European countries	Deaths	Higher number of deaths associated with lower investment in Public health
Carroll, W.D., et al (2020)	Lack of preparation and poor co-ordination early in pandemic	Italy, Austria, Germany, and the United Kingdom	Cases/hospitalisation	Under-preparedness for a pandemic was evident; poor co-ordination between federal, state and regional jurisdictions was common; in worst affected countries paediatric resources were redeployed to support adults
Dehning, J., et al. (2020)	Change points	Germany	Growth rate	Change points in the effective growth rate that correlate well with the times of publicly announced interventions
Della Rossa, F.,	Co-ordinated	Italy	Growth rate	Network model of Italy shows that intermittent regional strategies can

Member States' Responses to the COVID-19 pandemic in the context of COM recommendations

et al. (2020)	local/regional strategies				alleviate the COVID-19 epidemic
Di Domenico, L., et al. (2020)	Lockdown strategies	and exit	France		As France experiences the first wave of COVID-19 pandemic in lockdown, intensive forms of social distancing are required. Extensive case finding and isolation should follow.
Ding, Y. M. et al (2020)	Stay-at-home; tracing measures	contact quarantine	Italy modelling study		Decrease in infected people due to stay-at-home orders and tracing quarantine intervention
Dziugys, A., et al. (2020)	Quarantine measures		Model based study	Growth rate	Daily growth rate of new infections has tendency to decrease linearly when the quarantine is imposed in a country (or a region)
Fang, Y, Nie, Y, Penny, M. 2020	Rigorous measures	control	Simulation model	Incidence of covid (infection rate)	More rigorous government control policies were associated with a slower increase in the infected population
Fuller, J.A. et al. (2020)	Early mitigation policies		Multi-country study	Deaths	Earlier implementation of mitigation policies, even by just a few weeks, might be an important strategy to reduce the number of deaths
Kaxiras, E. et al. (2020).	Countries response to pandemic	-Pandemic Response Index	Simulation/multi-country	Growth rate	The COVID-19 pandemic can be successfully modeled as a series of epidemic waves (subepidemics) and that it is possible to infer to what extent the imposition of early intervention measures can slow the spread of the disease
Kumar, V., et al. 2020	Prevention and promotion focused interventions		Multi-country; data analysis	Disease incidence and mortality	Prevention-focused interventions inhibit disease incidence, while promotion-focused interventions enhance the nation's ability to respond to medical emergencies and augment ability to isolate and slow the spread
Malheiro, R., et al. (2020)	Contact tracing and quarantine		Portugal	Incidence of COVID (infection rate)	Local public health measures were effective in reducing the time between symptom onset and laboratory diagnosis and the number of close contacts per case
Saez M., et al (2020)	Physical distancing	Mitigation methods	Single country- Spain	Incidence	The measures taken by the Spanish Government on March 14, 2020 to mitigate the epidemic curve of COVID-19 managed to flatten the curve
Mehl, A., et al. (2020)	Symptom app	assessment	Germany and UK		Symptom assessment apps have an important role to play in facilitating improved understanding of the implications of public health policies such as COVID-19 lockdown measures

Member States' Responses to the COVID-19 pandemic in the context of COM recommendations

Palomino, J.C., et al. (2020)	Economics - wage inequality	29 European countries	Model-based study/analysis	Lockdown and social distance measures produce a double process of divergence: both inequality within and between countries increase.
Karnakov, P., et al. (2020)	Geographic proximity and time of interventions	Online tool applied to 51 European countries	Reproduction number/rate	Data-driven inference of the reproduction number for COVID-19 before and after interventions for 51 European countries
Stutt, R., et al. (2020).	Face masks and lockdown measures	Simulation study UK	Model-based study/analysis	This modelling study suggests that the use of facemasks in combination with physical distancing or lock-down, may provide an approach for managing the COVID-19 pandemic and re-opening economic activity
Teslya, A., et al. (2020)	social distancing and self-imposed prevention measures	Simulation study		This study supports the effectiveness of social distancing measures if they are initiated early in the pandemic
Tran Phuoc Bao Thu, et al. (2020)	Social distancing	US, Spain, Italy, The U.K., France, Germany, Russia, Turkey, Iran and China	Confirmed-cases and deaths	This study found that the effectiveness of the social distancing measures varied between the 10 focused countries
Vasconcelos GL, Macêdo AMS, Ospina R, Almeida FAG, Duarte-Filho GC, Brum AA, Souza ICL. 2020.	Early mitigation policies	China, France, Germany, Iran, Italy, South Korea, and Spain.	Fatality curve (cumulative deaths) and modelling	Findings from this study suggest that there is a narrow timeframe to ensure the effectiveness of countermeasures against the pandemic.
Vokó, Z., et al. (2020)	Social distancing	28 European countries	Disease incidence	Findings from this study examined the changepoint in COVID-19 spread across Europe and evaluated the association with social distancing measures
Wibbens, P.D., et al. (2020)	Multiple COVID-control measures (11 examined)	Modelling in European countries	New infections and growth rate	Using a Bayesian analysis to examine the effectiveness of eleven COVID-control policies that have been implemented at various levels of intensity in 40 countries and U.S. states, this study found that virus spread was reduced but was not enough to contain the pandemic.
Xia, F., et al (2020)	Government consideration of multiple factors (resources, compliance	China, South Korea, Japan and Spain	Reproduction number/rate	Findings suggest that multiple factors should be considered by governments including medical resources, public compliance and economic situation when

Member States' Responses to the COVID-19 pandemic in the context of COM recommendations

and economics) to design effective policies

developing policies against the COVID-19 pandemic.

Table A2.16: Literature that examined the effectiveness of contact tracing apps as part of COVID-19 policy response measures within the EU.

App specific studies				
AUTHOR	Title	Multi or single country study	Outcome measures	Main Findings
Almagor J, Picascia S. Scientific Reports (2020)	Exploring the effectiveness of a COVID-19 contact tracing app using an agent-based model	Modelling study using synthetic population representing Glasgow	Infection rates	Results suggest that an app has efficacy in reducing virus spread but that its efficacy relies on other NPI elements (e.g. testing)
Kretzschmar ME et al, Lancet Public Health (2020)	Impact of delays on effectiveness of contact tracing strategies for COVID-19: a modelling study	Mathematical model	Reproduction number	App based technology may enhance contact tracing effectiveness and reduce delays in the contact tracing process and help coverage
Hernández-Orallo E et al, Appl. Sci (2020)	Evaluating the Effectiveness of COVID-19 Bluetooth-Based Smartphone Contact Tracing Applications	Mathematical model	Infection rates (?)	Findings show that apps aimed to support contact tracing are only effective when combined with other NPI measures that reduce the reproduction number.
Jacob S & Lawaree, Policy Design and Practice (2020)	The adoption of contact tracing applications of COVID-19 by European governments	A thematic analysis to identify technological and policy issues relating to apps for digital tracing in three European countries		Using 3 countries, this study identified political and technical challenges for implementing apps for contact tracing
Salathé M., et al, 2020	Early evidence of effectiveness of digital contact tracing for SARS-CoV-2 in Switzerland	Single	Number of positive cases per index case	This findings show 'proof-of-principle' results that show that apps reached exposed contacts who subsequently tested positive and maybe effective in contact tracing

Member States' Responses to the COVID-19 pandemic in the context of COM recommendations

Table A2.17: Sources (Author, title and link to source)

Author	Title	Link to full article
Bargain, O., et al. (2020)	Trust and compliance to public health policies in times of COVID-19	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7598751/
Barrera-Algarín, E., et al. (2020)	COVID-19, neoliberalism and health systems in 30 european countries: relationship to deceases	https://www.msccbs.gob.es/biblioPublic/publicaciones/recursos_propios/esp/revista_cdrom/VOL94/ORIGINALES/RS94C_202010140.pdf
Carroll, W.D., et al (2020)	European and United Kingdom COVID-19 pandemic experience: The same but different	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7334652/
Deckert, A., (2020)	Effectiveness and cost-effectiveness of four different strategies for SARS-CoV-2 surveillance in the general population (CoV-Surv Study): a structured summary of a study protocol for a cluster-randomised, two-factorial controlled trial	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7791150/
Dehning, J., et al. (2020)	Inferring change points in the spread of COVID-19 reveals the effectiveness of interventions	Science 369(6500): 160-+.
Della Rossa, F., et al. (2020)	A network model of Italy shows that intermittent regional strategies can alleviate the COVID-19 epidemic	Nature Communications 11(1): 9.
Di Domenico, L., et al. (2020)	Impact of lockdown on COVID-19 epidemic in ile-de-France and possible exit strategies	Bmc Medicine 18(1): 13.
Ding, X., et al. (2020)	Study on the Spatial Differentiation of Public Health Service Capabilities of European Union under the Background of the COVID-19 Crisis	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7711771/
Ding, Y. M. and L. Y. Gao (2020)	An evaluation of COVID-19 in Italy: A data-driven modeling analysis	Infectious Disease Modelling 5: 495-501.
Dziugys, A., et al. (2020)	Simplified model of Covid-19 epidemic prognosis under quarantine and estimation of quarantine effectiveness	Chaos Solitons & Fractals 140: 11.
Esposito, S. and N. Principi (2020)	School Closure During the Coronavirus Disease 2019 (COVID-19) Pandemic: An Effective Intervention at the Global Level?	JAMA Pediatr 174(10): 921-922.

Member States' Responses to the COVID-19 pandemic in the context of COM recommendations

Fang, Y, Nie, Y, Penny, M. 2020	Transmission dynamics of the COVID-19 outbreak and effectiveness of government interventions: A data-driven analysis.	https://doi.org/10.1002/jmv.25750
Frank, T. D. (2020)	COVID-19 interventions in some European countries induced bifurcations stabilizing low death states against high death states: An eigenvalue analysis based on the order parameter concept of synergetics	Chaos Solitons & Fractals 140: 7.
Fuller, J.A. et al. (2020)	Mitigation Policies and COVID-19-Associated Mortality - 37 European Countries, January 23-June 30, 2020	https://www.cdc.gov/mmwr/volumes/70/wr/mm7002e4.htm
Han, E., et al. (2020)	Lessons learnt from easing COVID-19 restrictions: an analysis of countries and regions in Asia Pacific and Europe	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7515628/
Hou, C, Chen, J, Zhou, Y, et al.	The effectiveness of quarantine of Wuhan city against the Corona Virus Disease 2019 (COVID-19): A well-mixed SEIR model analysis. J Med Virol. 2020; 92: 841– 848. https://doi.org/10.1002/jmv.25827	https://onlinelibrary.wiley.com/doi/full/10.1002/jmv.25827
Kaxiras, E. and G. Neofotistos (2020).	Multiple Epidemic Wave Model of the COVID-19 Pandemic: Modeling Study	Journal of Medical Internet Research 22(7): 14.
Kumar, V., et al. 2020	Prevention- Versus Promotion-Focus Regulatory Efforts on the Disease Incidence and Mortality of COVID-19: A Multinational Diffusion Study Using Functional Data Analysis	Journal of International Marketing: 22.
Malheiro, R., et al. (2020)	Effectiveness of contact tracing and quarantine on reducing COVID-19 transmission: a retrospective cohort study	Public Health 189: 54-59.
Marc Saez, Aurelio Tobias, Diego Varga, María Antònia Barceló,	Effectiveness of the measures to flatten the epidemic curve of COVID-19. The case of Spain, Science of The Total Environment, volume 727	https://www.sciencedirect.com/science/article/abs/pii/S0048969720322786
Matrajt L, Leung T.	Evaluating the effectiveness of social distancing interventions to delay or flatten the epidemic curve of coronavirus disease. Emerg Infect Dis. 2020 Aug [date cited]. https://doi.org/10.3201/eid2608.201093	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7392458/

Member States' Responses to the COVID-19 pandemic in the context of COM recommendations

Mehl, A., et al. (2020)	Syndromic Surveillance Insights from a Symptom Assessment App Before and During COVID-19 Measures in Germany and the United Kingdom: Results From Repeated Cross-Sectional Analyses	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7561445/
Meier, K., et al (2020)	Public perspectives on protective measures during the COVID-19 pandemic in the Netherlands, Germany and Italy: A survey study	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7406072/
Palomino, J.C., et al. (2020)	Wage inequality and poverty effects of lockdown and social distancing in Europe	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7417923/
Petr, K., et al. (2020)	Data-driven inference of the reproduction number for COVID-19 before and after interventions for 51 European countries	Swiss Medical Weekly 150: 9.
Stutt, R., et al. (2020).	A modelling framework to assess the likely effectiveness of facemasks in combination with 'lock-down' in managing the COVID-19 pandemic.	Proceedings of the Royal Society a-Mathematical Physical and Engineering Sciences 476(2238): 21.
Teslya, A., et al. (2020)	Impact of self-imposed prevention measures and short-term government-imposed social distancing on mitigating and delaying a COVID-19 epidemic: A modelling study	Plos Medicine 17(7): 21.
Tran Phuoc Bao Thu, et al. (2020)	Effect of the social distancing measures on the spread of COVID-19 in 10 highly infected countries	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7307990/
Vasconcelos GL, Macêdo AMS, Ospina R, Almeida FAG, Duarte-Filho GC, Brum AA, Souza ICL. 2020.	Modelling fatality curves of COVID-19 and the effectiveness of intervention strategies. PeerJ 8:e9421 https://doi.org/10.7717/peerj.9421	https://peerj.com/articles/9421/
Vokó, Z., et al. (2020)	The effect of social distance measures on COVID-19 epidemics in Europe: an interrupted time series analysis	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7288252/
Wibbens, P.D., et al. (2020)	Which COVID policies are most effective? A Bayesian analysis of COVID-19 by jurisdiction	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7771876/
Wieland, T. (2020)	A phenomenological approach to assessing the effectiveness of COVID-19 related nonpharmaceutical interventions in Germany	Safety Science 131: 8.

Member States' Responses to the COVID-19 pandemic in the context of COM recommendations

Xia, F., et al (2020)

Differences in how interventions coupled with effective reproduction numbers account for marked variations in COVID-19 epidemic outcomes

<https://www.aimspress.com/article/10.3934/mbe.2020274>

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