16th Users Conference

CÁCERES

14th - 15th September 2022

RED ESPAÑOLA DE SUPERCOMPUTACIÓN

Ciencia en tiempos de pandemia
Los datos, una pieza clave

Clara Prats, PhD

Computational Biology and Complex Systems (BIOCOM-SC) – UPC

Centre for Comparative Medicine and Bioimage (CMCiB)

Grup Interdisciplinari de Professionals Vinculats amb la Salut (GIPS)

14 de septiembre de 2022

Colabora:

UNIVERSITAT POLITÈCNICA DE CATALUNYA BARCELONATECH

Computational Biology and Complex Systems Research Group

CMCiB

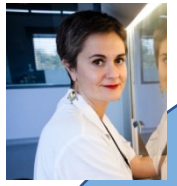
IGTP

GIPS Grup Interdisciplinari de Professionals Vinculats amb la Salut

COL·LEGIS DE METGES CONSELL DE CATALUNYA

Biología Computacional y Sistemas Complejos: Investigación multidisciplinar

Dr. Cardona



Dra. Vilaplana

IGTP Germans Trias i Pujol Research Institute

Microbiólogos

Dr. Clara Prats

Dr. Sergio Alonso

UNIVERSITAT POLITÈCNICA DE CATALUNYA BARCELONATECH

Dr. Daniel López

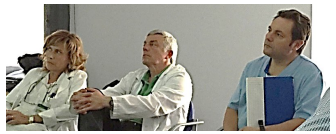
Biofísicos computacionales

Dr. Enric Álvarez

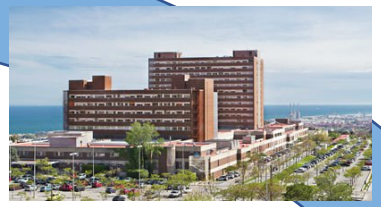
Aida Perramon

Dr. Martí Català

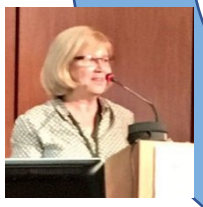
Germans Trias i Pujol Hospital



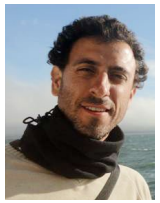
Dr. Bechini
Dra. Tenesa
Dr. Pérez
Dr. Nogueira



Radiólogos



Dra. Orcau



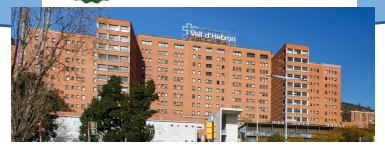
Dr. Millet

Agència de Salut Pública

Epidemiólogos

Dra. Gatell

Copedicat



Pediatras

Dr. Soriano

SJD Sant Joan de Déu Barcelona · Hospital

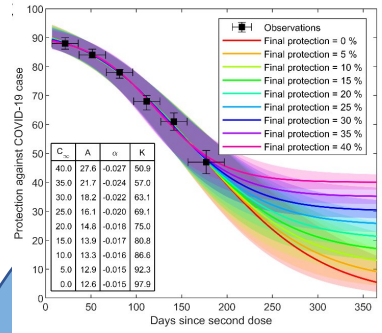
ISGlobal Institut de Salut Global Barcelona

Pediatras

Dr. Bassat

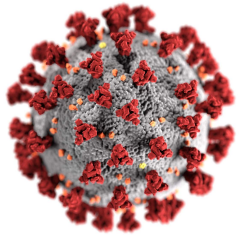
Dra. Jordan

Biología Computacional y Sistemas Complejos: Investigación multidisciplinar

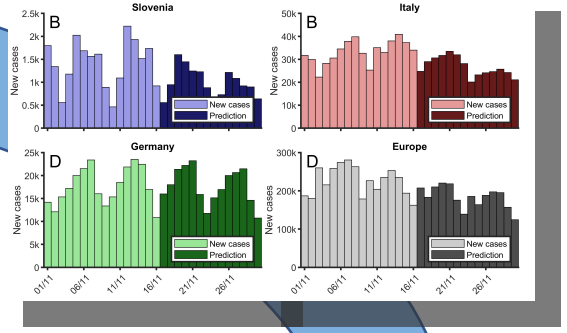


Dr. Clara Prats

Dr. Sergio Alonso



Dr. Daniel López



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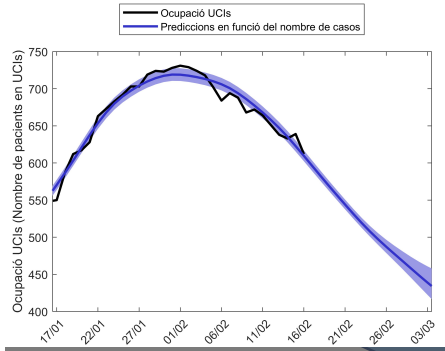
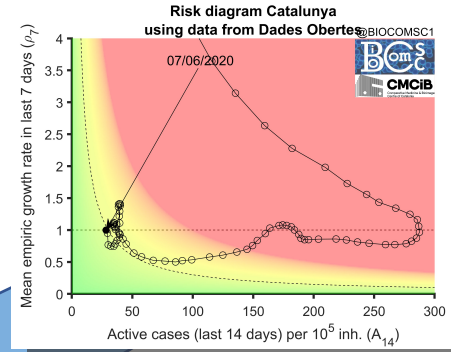
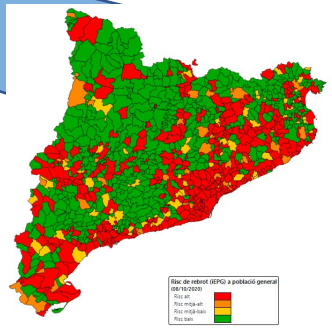
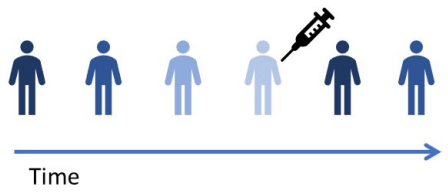








ecdc EUROPEAN CENTRE FOR DISEASE PREVENTION AND CONTROL

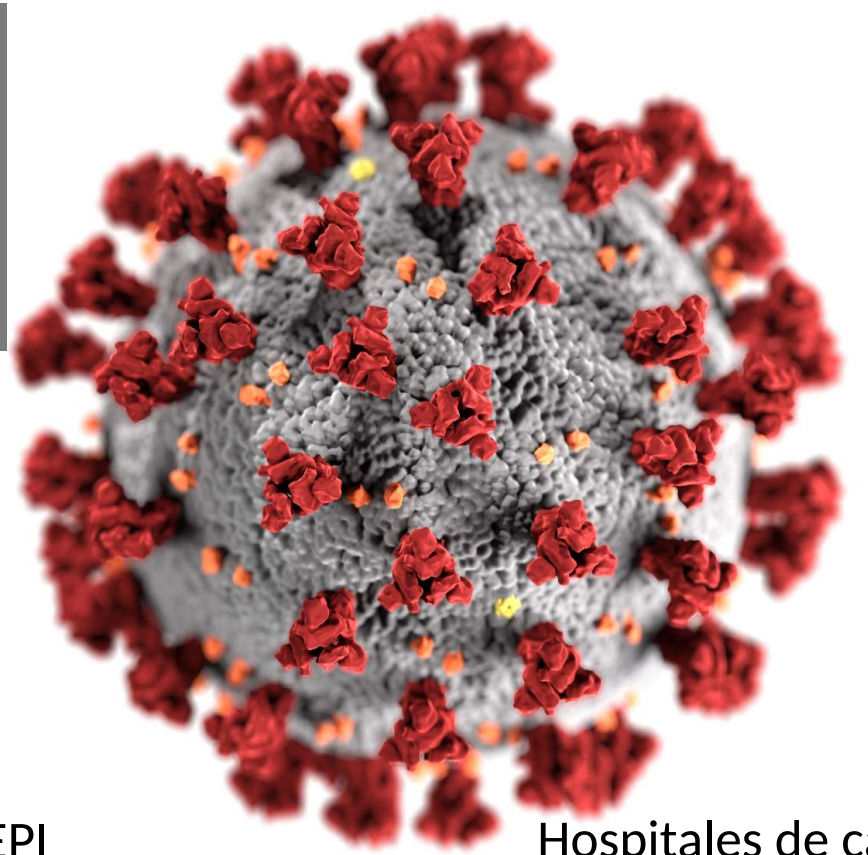
European Commission

/Salut

Agència de Qualitat i Avaluació Sanitàries de Catalunya

Hace 2 años y medio…

Epidemia – pandemia



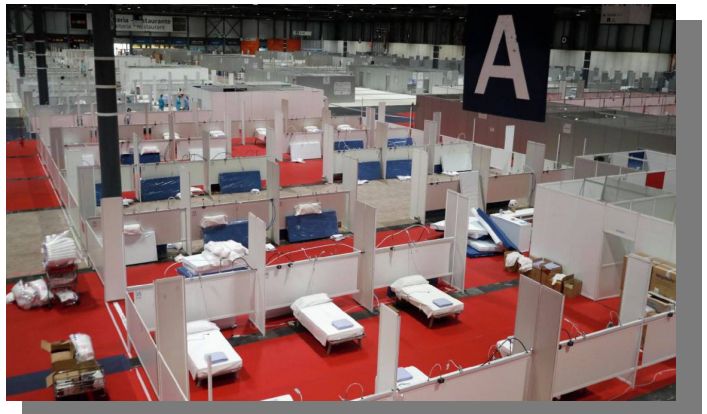
Exceso de mortalidad

Falta respiradores

Residencias y personas mayores

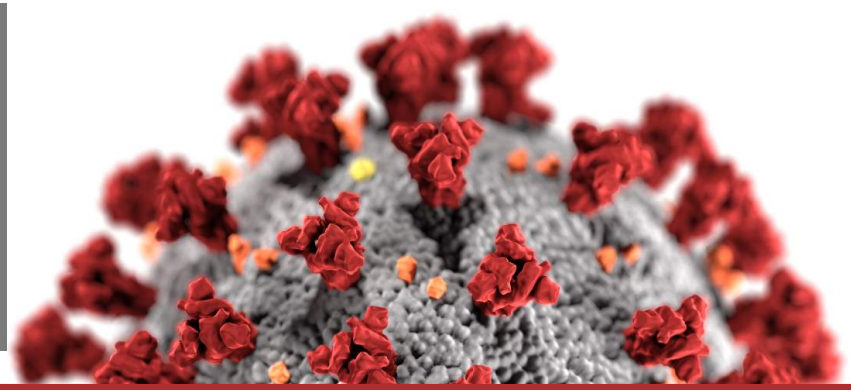
Falta EPI

Hospitales de campaña



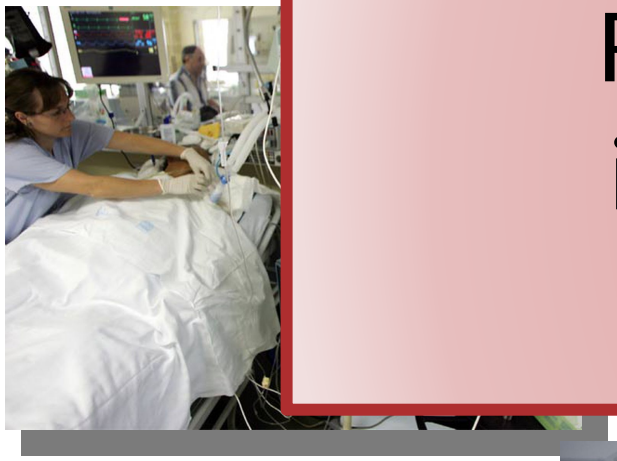
Hace 2 años y medio…

Epidemia – pandemia



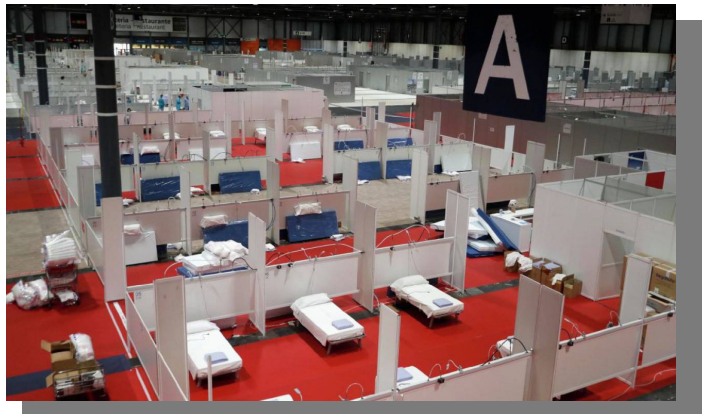
Exceso de mortalidad

Falta res



…yores

Respuesta científico-tecnológica interdisciplinaria, intersectorial, intercontinental → **Datos**



(I) Los datos en la pandemia de COVID-19

(II) ¿Para qué han servido? Algunos ejemplos...

(III) Discusión

Datos en ciencia… ¿Por qué? ¿Para qué?

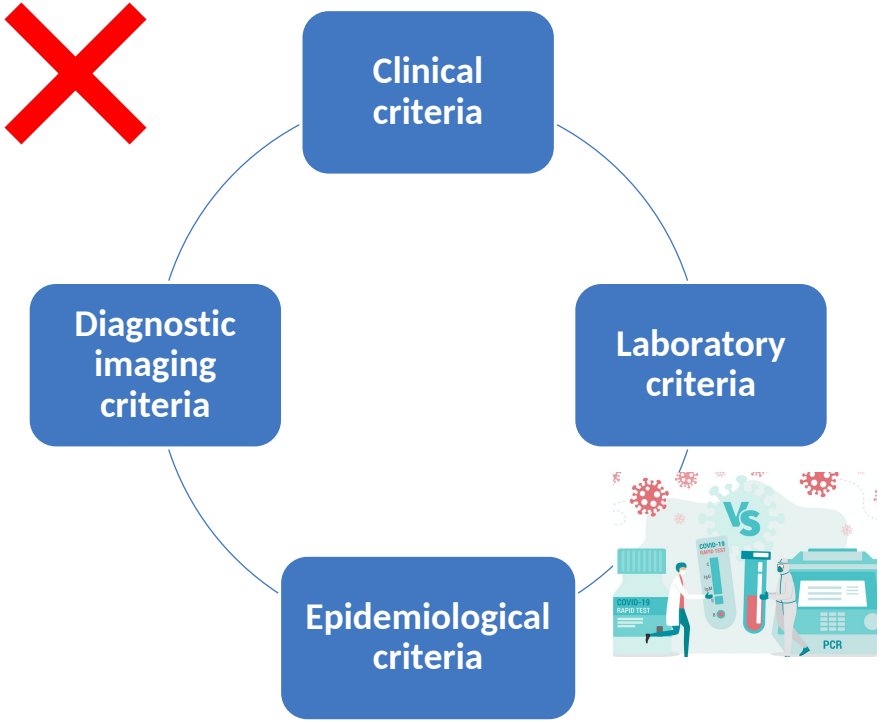
- ✓ A pesar de sus limitaciones, los datos son la mejor forma de **objetivar y cuantificar** una situación
- ✓ Los datos permiten **describir** una situación antes de abordar el problema asociado
- ✓ Los datos permiten **analizar** esta situación y explorar causalidad, interacciones, conexiones…
- ✓ Los datos permiten construir **modelos** para **entender, predecir** y explorar intervenciones de **control**, entre otros

Los datos son la **piedra angular** del progreso científico

Image from: https://naveenkeshava.com/2017/03/11/understanding-the-data-world/

Datos de la pandemia al inicio del 2020

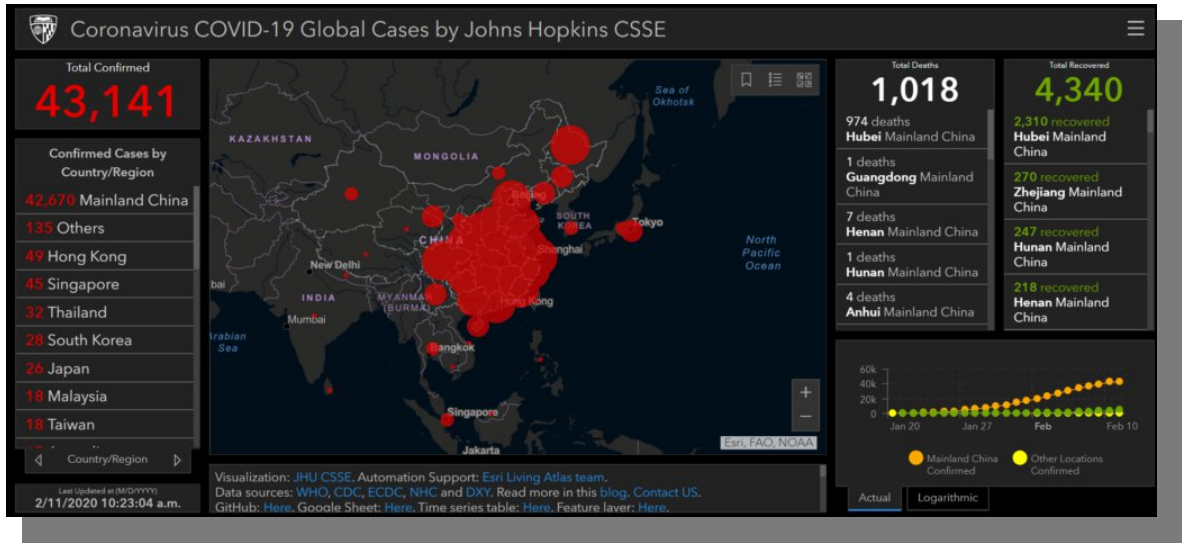
Capacity diagnosis



Case definition

Information systems

Datos de la pandemia al inicio del 2020



Search by Country, Territory, or Area

Overview | Measures | Table View | Data | More Resources

WHO Coronavirus (COVID-19) Dashboard

Back to top

Data Download

Data displayed in this dashboard are available for download as the following comma-separated values (CSV) files:

Daily cases and deaths by date reported to WHO

Download link: https://covid19.who.int/WHO-COVID-19-global-data.csv

Field name	Type	Description
Date_reported	Date	Date of reporting to WHO
Country_code	String	ISO Alpha-2 country code
Country	String	Country, territory, area
WHO_region	String	WHO regional offices: WHO Member States are grouped into six WHO regions -- Regional Office for Africa (AFRO), Regional Office for the Americas (AMRO), Regional Office for South-East Asia (SEARO), Regional Office for Europe (EURO), Regional Office for the Eastern Mediterranean (EMRO), and Regional Office for the Western Pacific (WPRO).
New_cases	Integer	New confirmed cases. Calculated by subtracting previous cumulative case count from current cumulative cases count.*
Cumulative_cases	Integer	Cumulative confirmed cases reported to WHO to date.
New_deaths	Integer	New confirmed deaths. Calculated by subtracting previous cumulative deaths from current cumulative deaths.*
Cumulative_deaths	Integer	Cumulative confirmed deaths reported to WHO to date.

** Users should note that, in addition to capturing new cases and deaths reported on any given day, updates are made retrospectively to correct counts on previous days as needed based on subsequent information received. See "Daily aggregate case and death count data" above for further details on the calculation of new cases/deaths.*

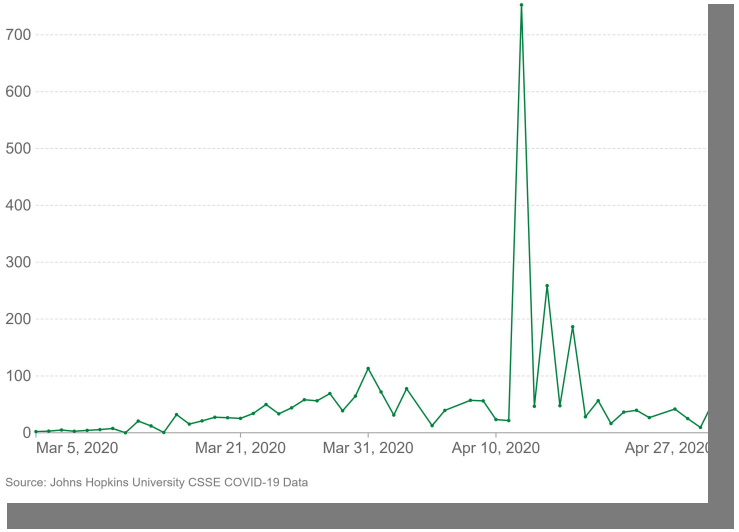
MINISTERIO DE SANIDAD

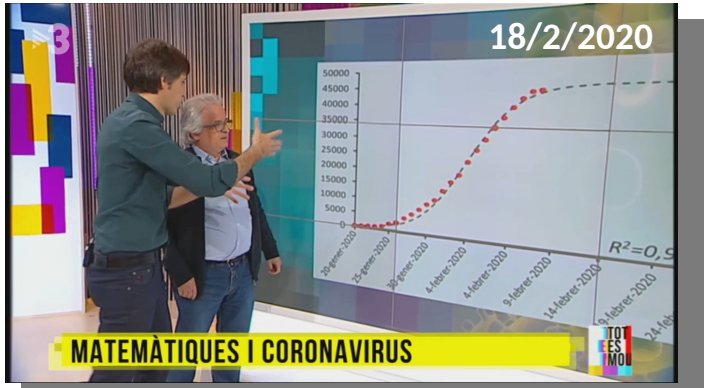
DATOS DE CORONAVIRUS

EN ESPAÑA

sábado 28 de Marzo de 2020

CCAA	TOTAL casos confirmados	Pacientes que han precisado UCI	Fallecidos	Curados
Andalucía	4.277	172	175	139
Aragón	1.592	124	58	8
Asturias	1.004	50	33	65
Baleares	862	59	26	80
Canarias	1025	68	36	25
Cantabria	937	37	22	21
Castilla La Mancha	4.512	289	448	197
Castilla y León	4.791	249	321	585
Cataluña	14.263	1.324	1.070	3.106
Ceuta	17	2	1	0
C. Valenciana	4.034	282	234	92
Extremadura	1.394	40	88	49
Galicia	2.772	112	47	95
Madrid	21.520	1.404	2.757	6.326
Melilla	45	2	1	0
Murcia	802	58	17	12
Navarra	1.829	84	70	98
País Vasco	5.136	176	221	1.023
La Rioja	1.436	43	65	364
ESPAÑA	72.248	4.575	5.690	12.285





Datos de la pandemia en 2021-2022

World Health Organization

Covid-19 Response Fund

Donate

WHO Coronavirus (COVID-19) Dashboard

Overview | Measures | Data Table | Explore

Latest | Yesterday | Search by Region/Country/Territory/Area

Situation by Region, Country, Territory & Area

Name	Cases - cumulative total	Cases - newly reported in last 24 hours	Deaths - cumulative total	Deaths - newly reported in last 24 hours
Global	**241.411.380**	**457.013**	**4.912.112**	**8.093**
Americas	92.399.661	145.502	2.266.491	3.672
Europe	73.921.143	239.174	1.388.047	3.193
South-East Asia	43.664.119	26.267	685.654	351
Eastern Mediterranean	16.166.305	21.320	297.411	333
Western Pacific	9.140.020	22.598	125.113	432
Africa	6.119.368	2.152	149.383	112

ecdc

European Centre for Disease Prevention and Control

An agency of the European Union

All sections | Enter your keyword(s)

All topics: A to Z | Newsroom | Publications & data | Tools | About us

Home > All topics: A to Z > COVID-19 > Situation updates on COVID-19 > Download COVID-19 datasets

- Situation updates on COVID-19
- Latest situation update for the EU/EEA
- Latest situation update worldwide
- Variants dashboard
- Variants of concern
- Weekly country overview
- Weekly maps in support of the Council Recommendation
- Weekly surveillance report
- **Download COVID-19 datasets**
- Data - COVID-19 vaccination in the EU/EEA
- Data - SARS-CoV-2 variants in the EU/EEA
- Data - daily number of new COVID-19 cases and deaths by EU/EEA country

Download COVID-19 datasets

At the request of Member States, data on the daily number of new reported COVID-19 cases and deaths by EU/EEA country will be available to download from 11 March 2021. ECDC will continue to publish weekly updates on the number of cases and deaths reported in the EU/EEA and worldwide every Thursday. The daily and weekly data are available as downloadable files in the following formats: XLSX, CSV, JSON and XML.

Vaccination data

Data
Data on COVID-19 vaccination in the EU/EEA
Data set - 20 Oct 2021

Daily data

Data
Data on the daily number of new reported COVID-19 cases and deaths by EU/EEA country
Data set - 20 Oct 2021

Weekly data

COVID-19 Dashboard by the Center for Systems Science and Engineering (CSSE) at Johns Hopkins University (JHU)

Last Updated at (M/D/YYYY) 8/9/2021 14:21

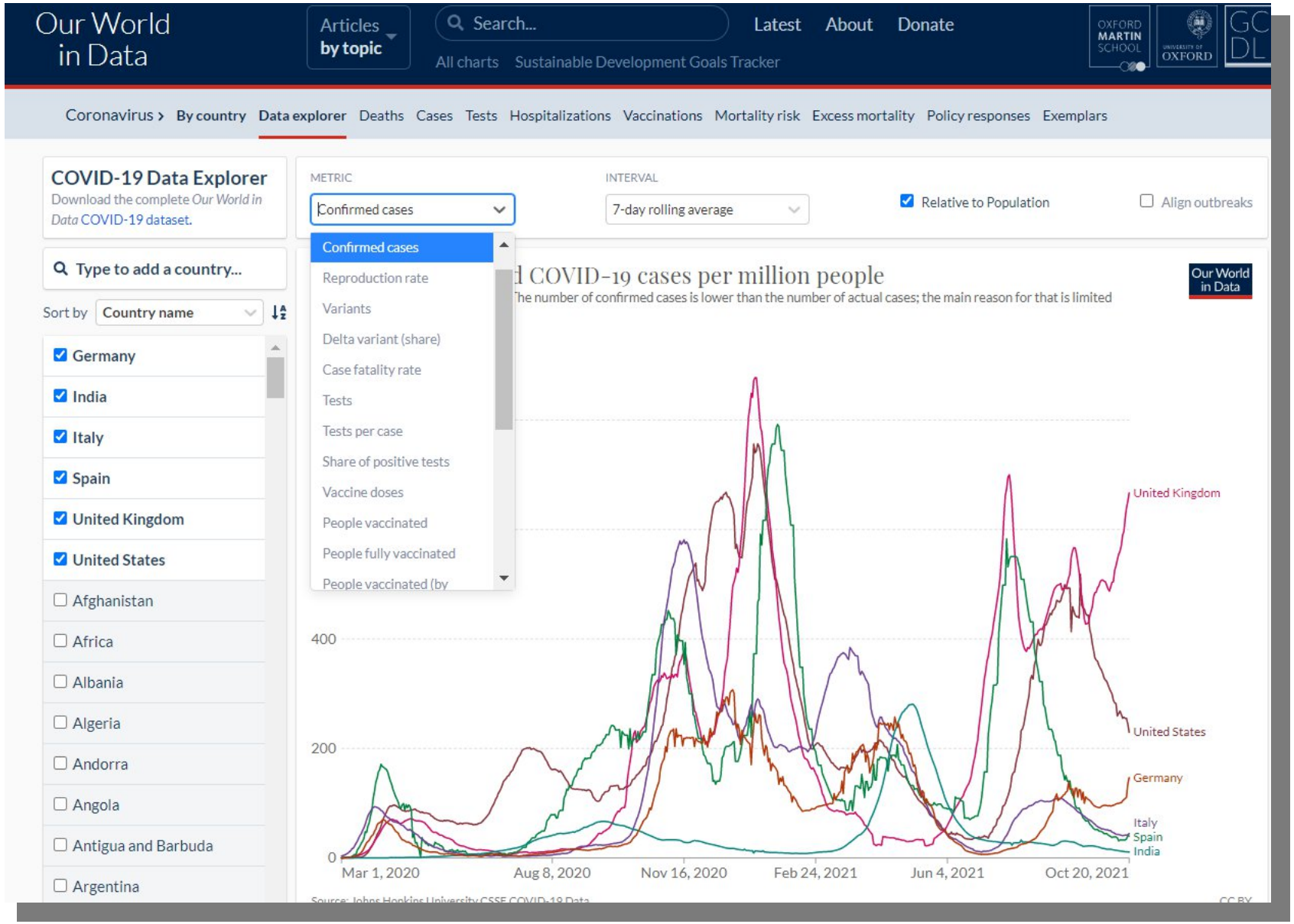
Total Cases	Total Deaths	Total Vaccine Doses Administered
222.042.024	4.588.950	5.549.321.918
28-Day Cases	**28-Day Deaths**	**28-Day Vaccine Doses Administered**
17.912.568	272.104	978.127.682

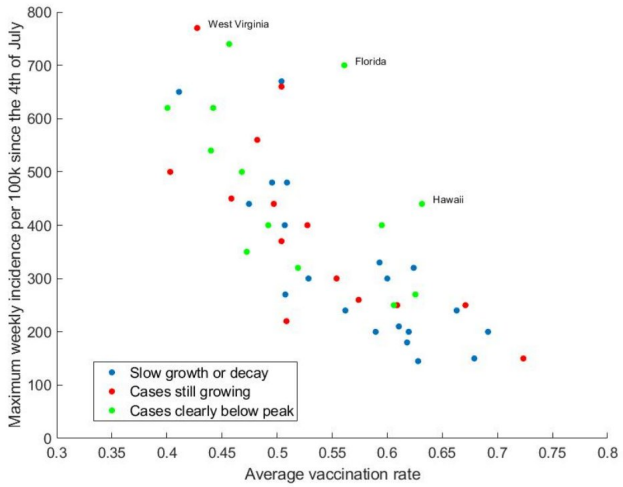
Cases | Deaths by Country/Region/Sovereignty

Country	28-Day Cases	28-Day Deaths	Totals Cases	Totals Deaths
US	4.224.866	32.190	40.282.910	650.691
India	1.060.207	12.232	33.096.718	441.411
Iran	945.448	16.781	5.210.978	112.430
United Kingdom	942.409	2.995	7.089.051	133.808
Brazil	701.595	19.335	20.914.257	584.108
Malaysia	580.967	7.640	1.880.734	18.802
Turkey	573.786	6.214	6.542.624	58.651
Russia	541.963	21.818	6.994.595	186.224
Japan	538.733	1.144	1.606.609	16.521
France	531.293	3.089	6.938.874	115.680

Admin0 | Admin1 | Admin2 | 28-Day | Totals | Incidence | Case-Fatality Ratio | Global Vaccinations | US Vaccinations | Terms of Use | Weekly | Daily

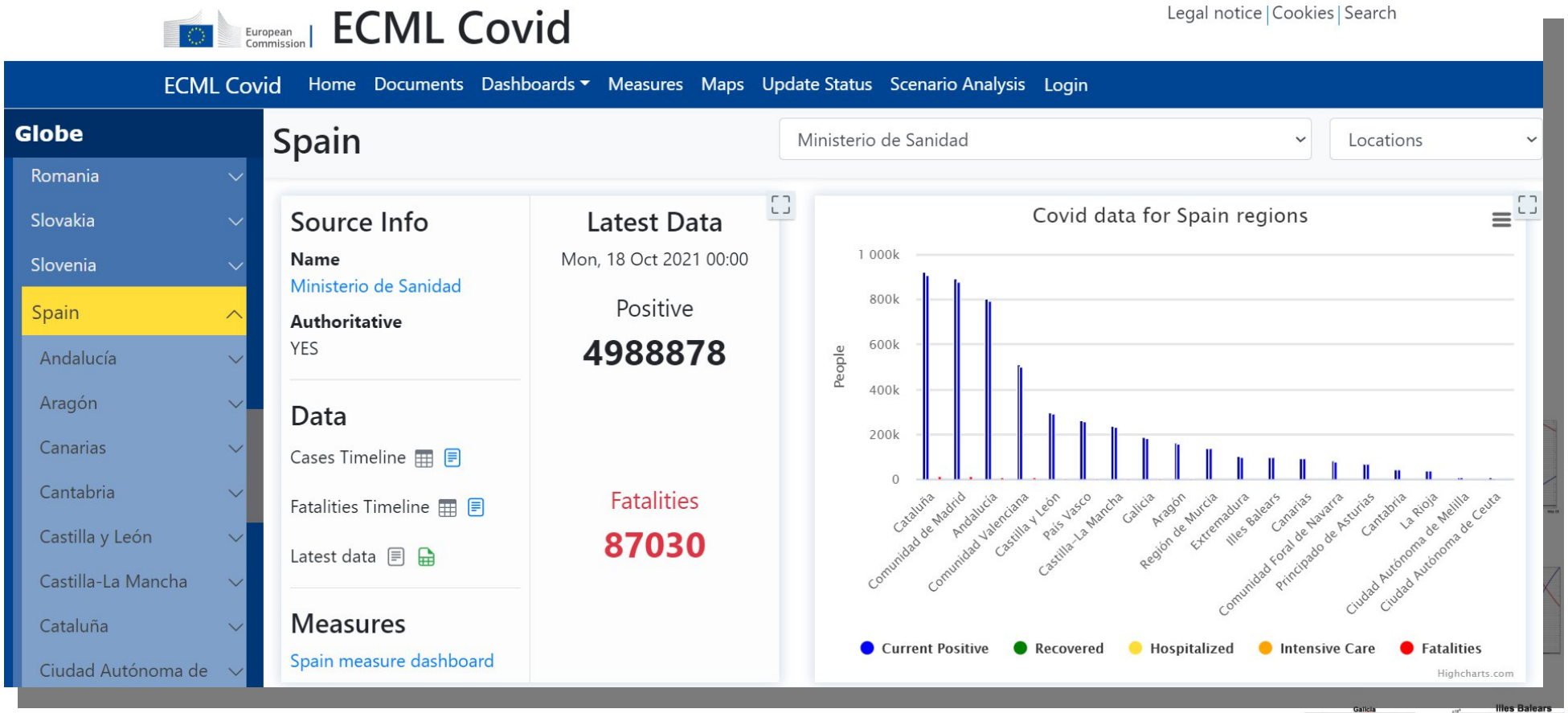
Datos de la pandemia en 2021-2022

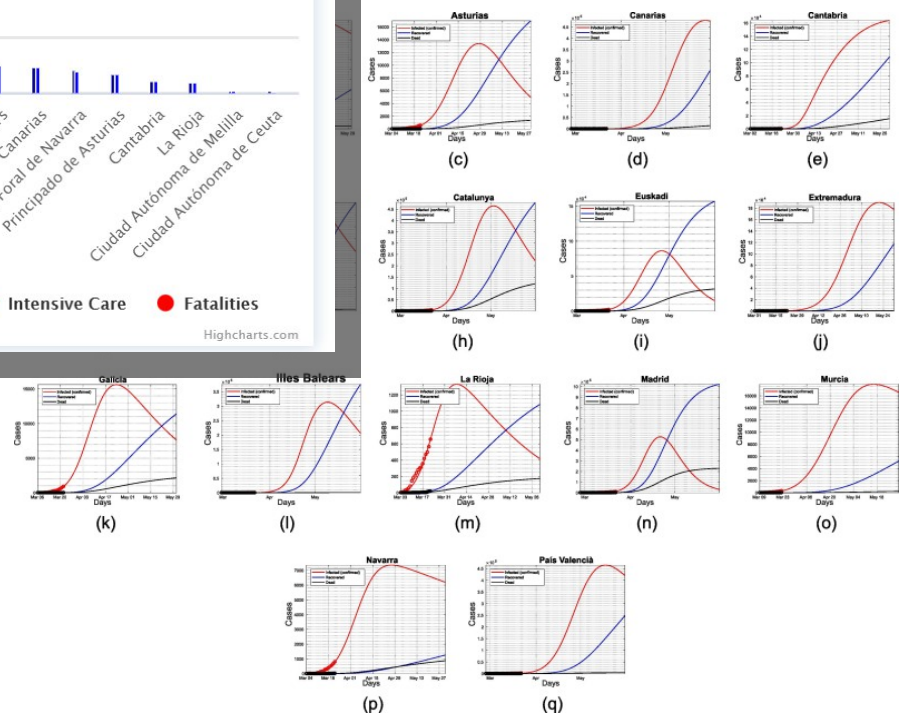




BIOCOM-SC, septiembre 2021

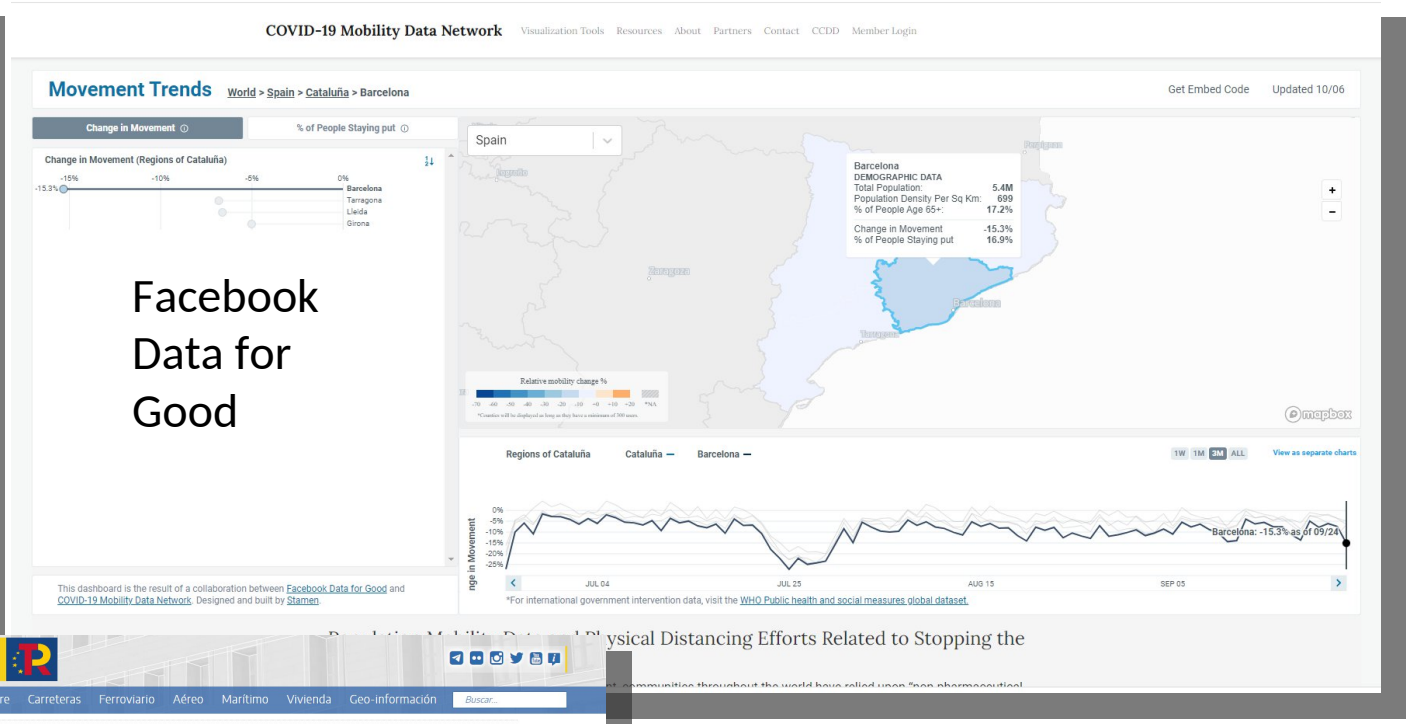
Datos de la pandemia en 2021-2022



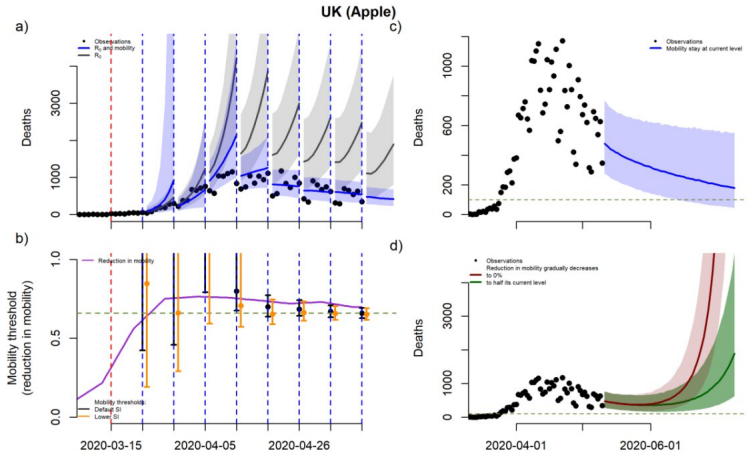


López and Rodó, 2021

Datos de la pandemia en 2021-2022



Facebook Data for Good



Imperial College, abril 2020

Datos de la pandemia en 2021-2022

Inteligencia Artificial / *Big data*

AI and Ethics (2022) 2:325–340
https://doi.org/10.1007/s43681-021-00056-1

ORIGINAL RESEARCH

Check for updates

The ethical use of high-performance computing and artificial intelligence: fighting COVID-19 at Barcelona Supercomputing Center

Ulises Cortés[1,2] · Atia Cortés[2] · Dario Garcia-Gasulla[2] · Raquel Pérez-Arnal[2] · Sergio Álvarez-Napagao[2] · Enric Àlvarez[1]

Received: 22 January 2021 / Accepted: 15 April 2021 / Published online: 6 May 2021
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Abstract
The COVID-19 pandemic has created an extraordinary medical, economic and humanitarian emergency. Artificial intelligence, in combination with other digital technologies, is being used as a tool to support the fight against the viral pandemic that has affected the entire world since the beginning of 2020. Barcelona Supercomputing Center collaborates in the battle against the coronavirus in different areas: the application of bioinformatics for the research on the virus and its possible treatments, the use of artificial intelligence, natural language processing and big data techniques to analyse the spread and impact of the pandemic, and the use of the MareNostrum 4 supercomputer to enable massive analysis on COVID-19 data. Many of these activities have included the use of personal and sensitive data of citizens, which, even during a pandemic, should be treated and handled with care. In this work we discuss our approach based on an ethical, transparent and fair use of this information, an approach aligned with the guidelines proposed by the European Union.

Image from: https://www.bmj.com/AIcovid19

Recursos de supercomputación

RED ESPAÑOLA DE SUPERCOMPUTACIÓN

Infraestructuras Científicas y Técnicas Singulares

Image from: https://www.res.es/es/noticias/la-red-espa%C3%B1supercomputaci%C3%B3n-forma-parte-del-nuevo-mapa-de-infraestr

(I) Los datos en la pandemia de COVID-19

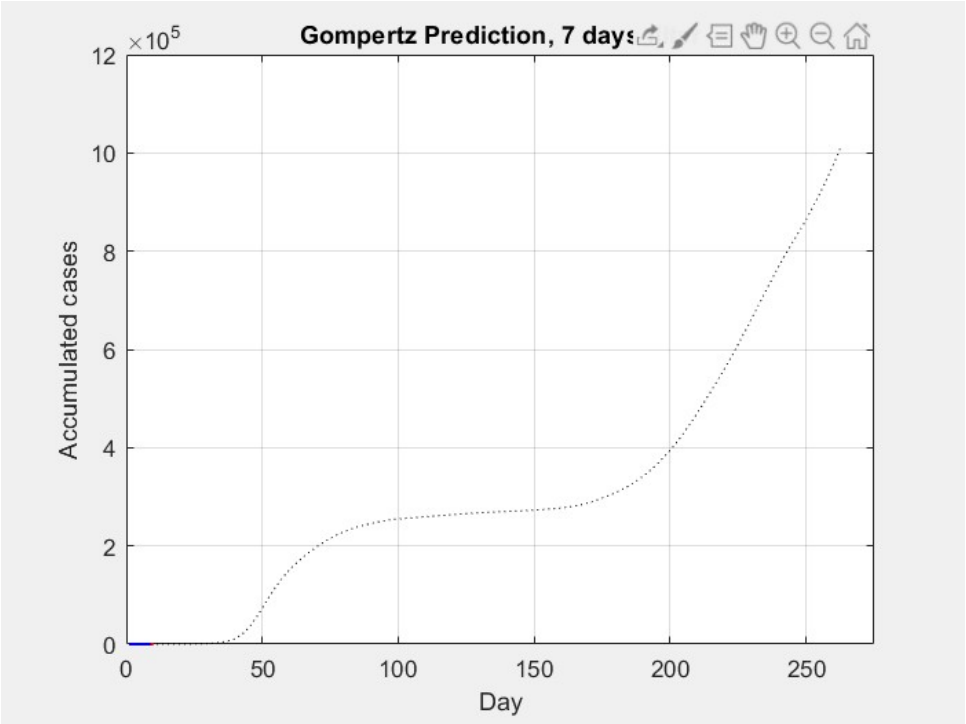
(II) ¿Para qué han servido? Algunos ejemplos…

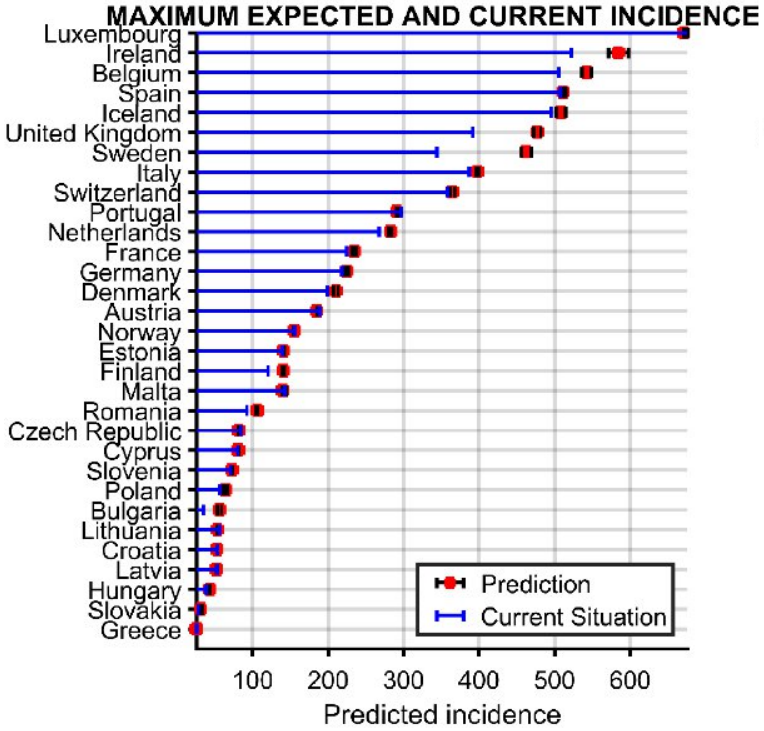
(III) Discusión

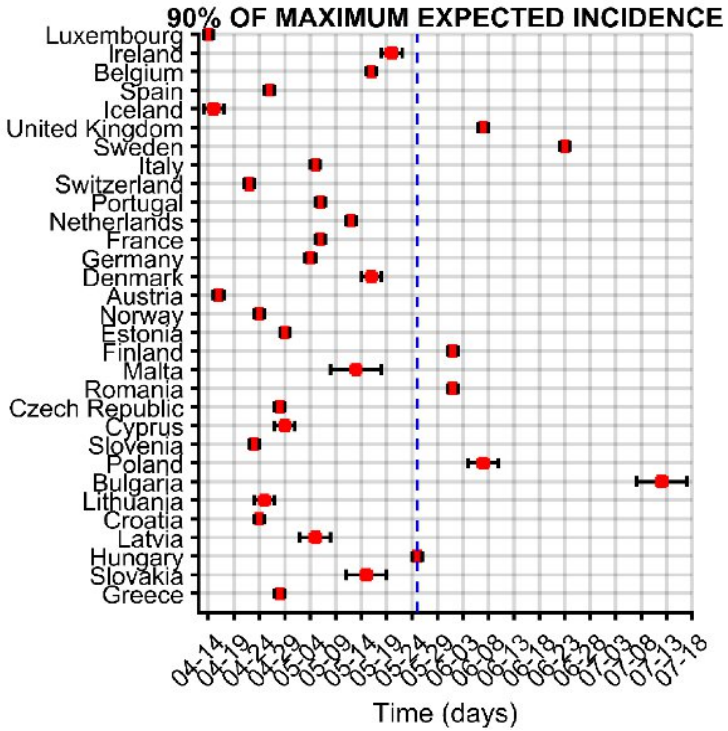
Ejemplo 1: predicción a 2 semanas – España, Europa

Datos **epidemiológicos**

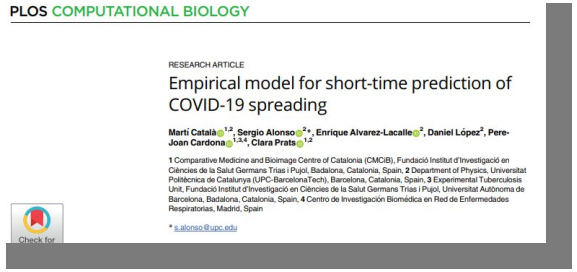
¿Cuál será la evolución de la pandemia en el corto plazo? ¿Cuándo llegará el pico?







España > Predicción a 10 días


PLOS COMPUTATIONAL BIOLOGY

RESEARCH ARTICLE

Empirical model for short-time prediction of COVID-19 spreading

Europa > Predicción a 2 semanas

Limitaciones:
- Capacidad diagnóstica y gestión datos
- Ventana predicción variable

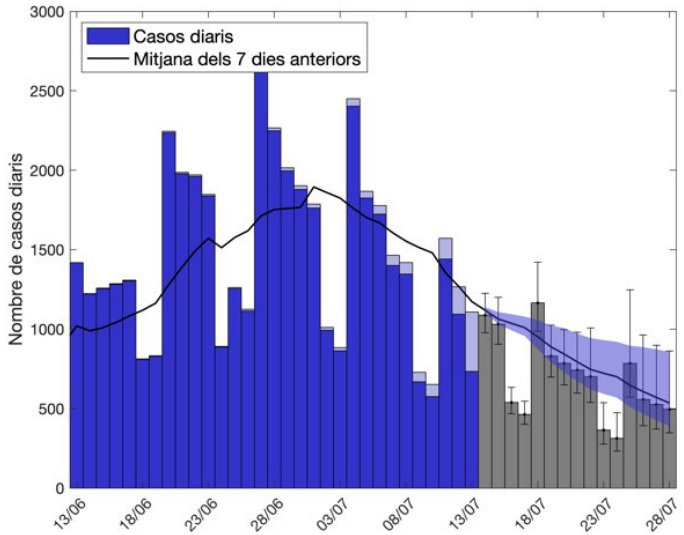
European Commission

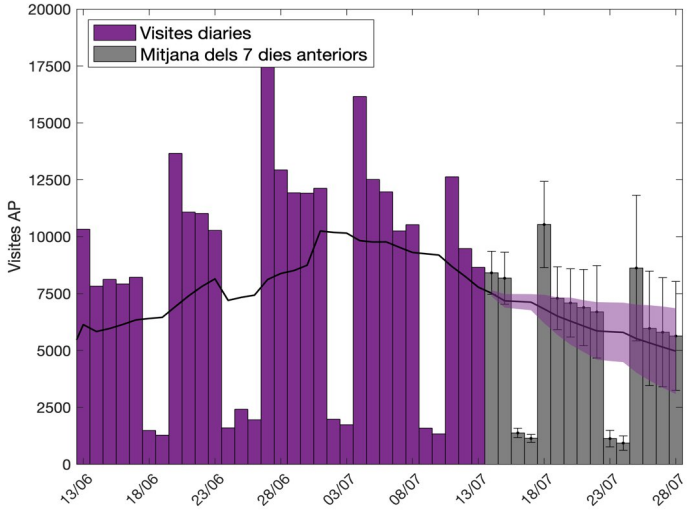
ecdc EUROPEAN CENTRE FOR DISEASE PREVENTION AND CONTROL

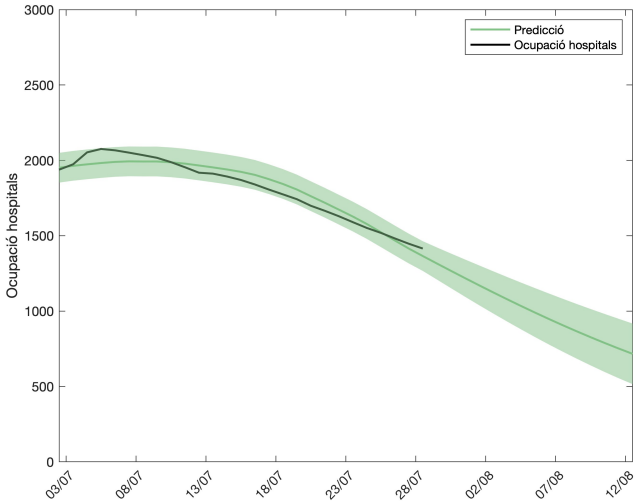
Ejemplo 1: predicción a 2 semanas – Cataluña

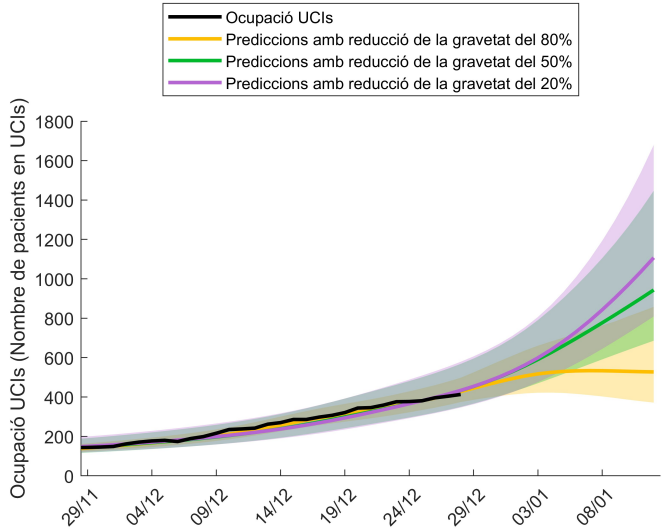
Datos epidemiológicos
Datos **primaria y hospitales**

¿Podemos prever las consecuencias en el sistema sanitario?







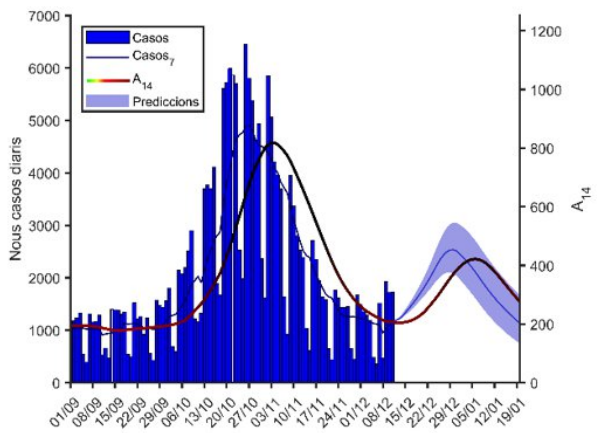
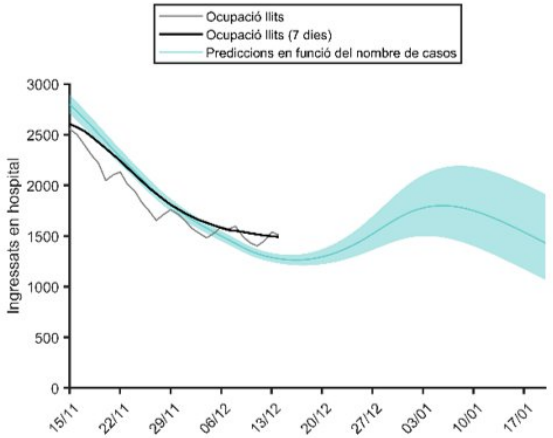
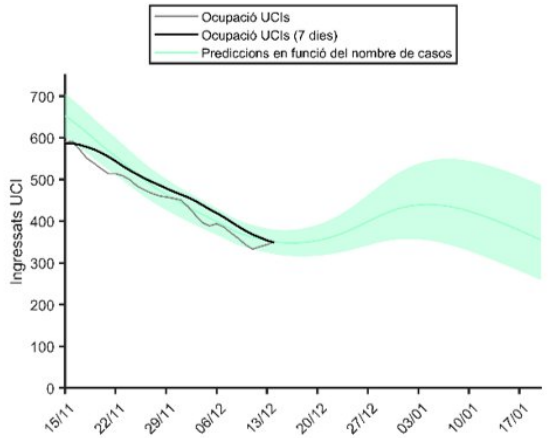
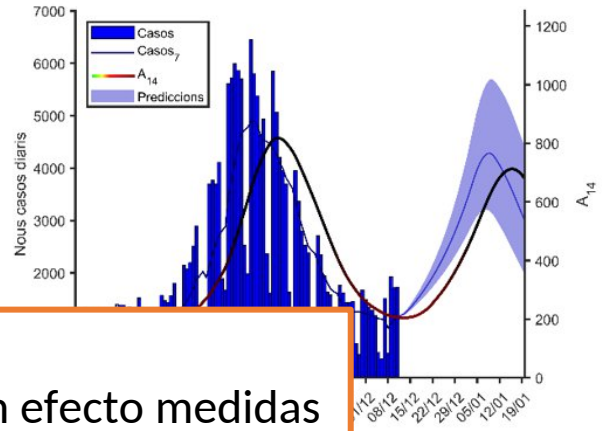
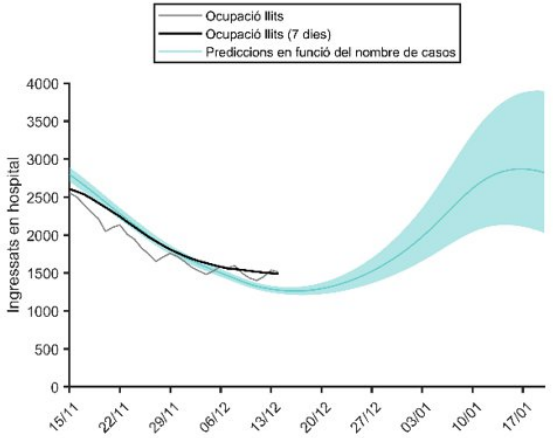
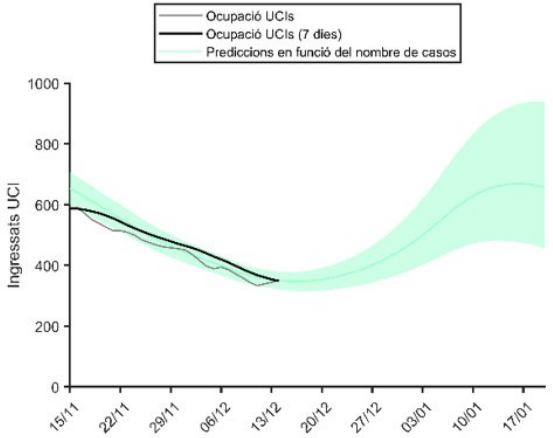


Limitaciones:
- Nuevas variantes
- Cambios en los protocolos de diagnóstico

Ejemplo 2: Análisis de escenarios

Datos epidemiológicos
Datos **primaria y hospitales**

¿Cuál será el escenario a medio plazo en función de las medidas aplicadas?

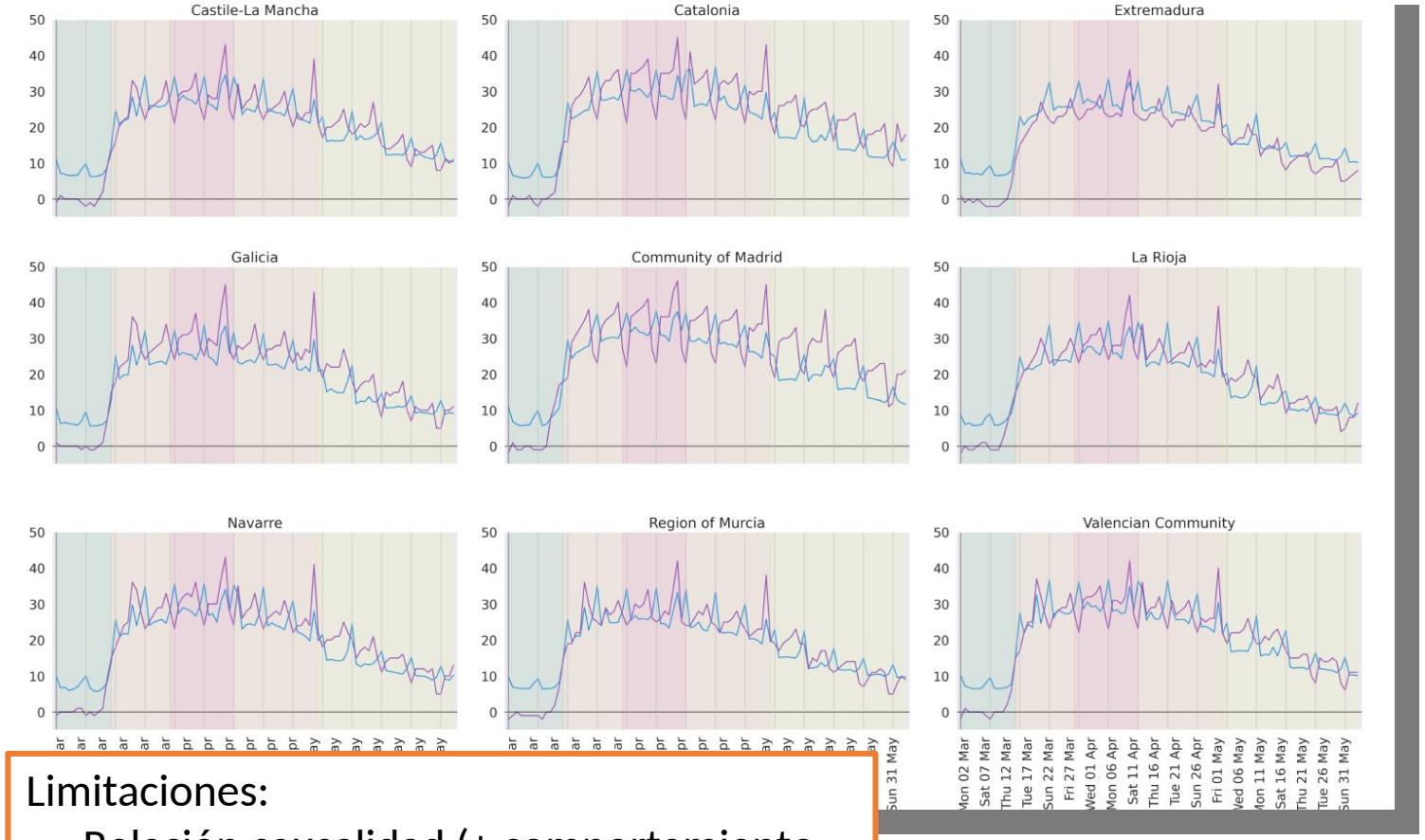
Data mesures	Nous casos i IA_{14}	Ocupació hospitals	Ocupació UCIs
17/12			
27/12			

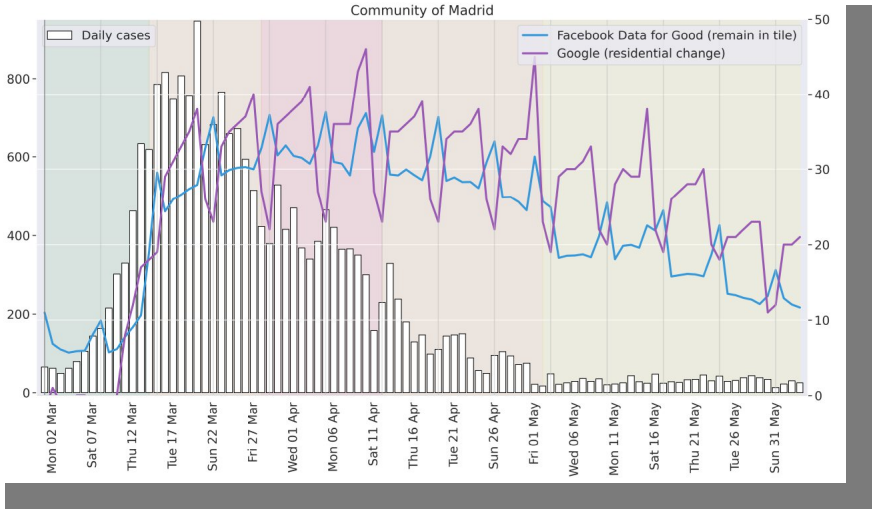
Limitaciones:
- Cuantificación efecto medidas

Ejemplo 3: Movilidad y confinamientos

Datos epidemiológicos
Datos **movilidad**

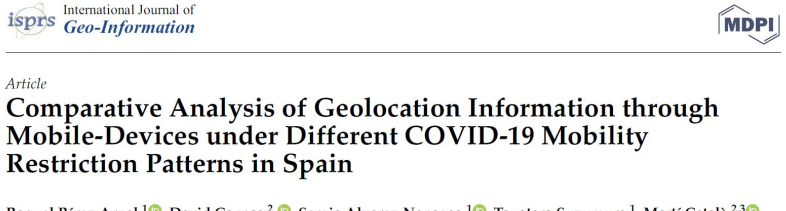
¿Cuál es el efecto de los confinamientos en la movilidad (→ interacciones)?





← *Reducción de movilidad (FB y Google)*
↑ *Relación con contagios*

Limitaciones:
- Relación causalidad (+ comportamiento humano, contexto, ...)


isprs International Journal of Geo-Information MDPI

Article

Comparative Analysis of Geolocation Information through Mobile-Devices under Different COVID-19 Mobility Restriction Patterns in Spain

Raquel Pérez-Arnal [1], David Conesa [2], Sergio Alvarez-Napagao [1], Toyotaro Suzumura [1], Martí Català [2,3], Enrique Alvarez-Lacalle [2,*] and Dario Garcia-Gasulla [1]

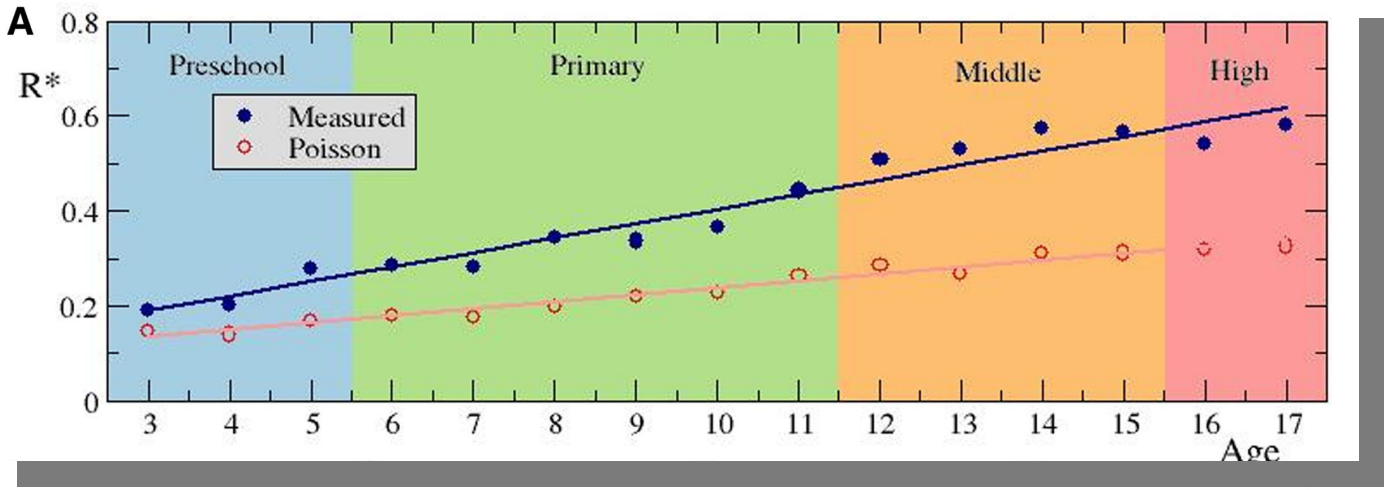
ht .doi.org/10.1136/archdischild-2022-324172

Ejemplo 4: Transmisión en las escuelas

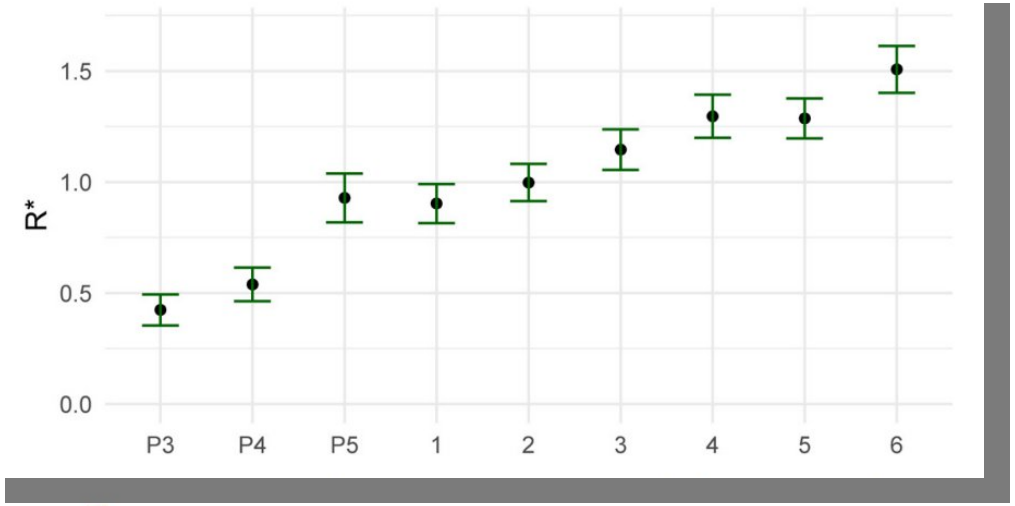
Datos epidemiológicos
Datos **sistema educativo**

¿Cuál es el nivel de transmisión dentro de los grupos burbuja de las escuelas?

Otoño 2020



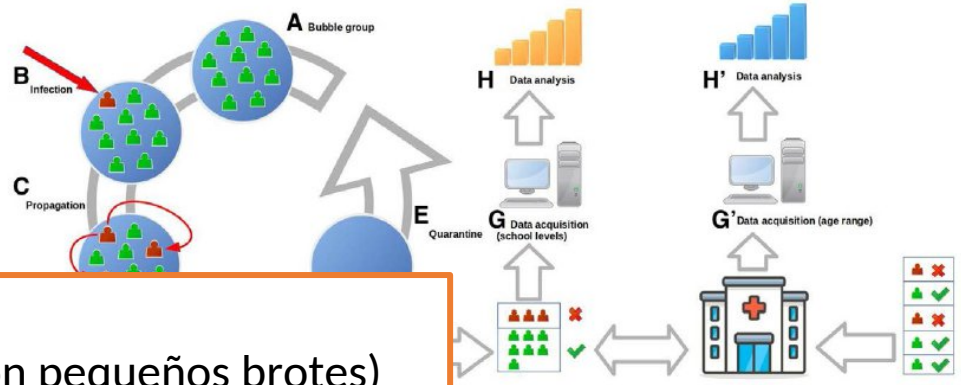
Otoño 2021



ORIGINAL STUDIES

Age-dependency of the Propagation Rate of Coronavirus Disease 2019 Inside School Bubble Groups in Catalonia, Spain

Alonso, Sergio PhD*; Alvarez-Lacalle, Enric PhD*; Català, Martí MSc*,†; López, Daniel PhD*; Jordan,



Original research

Unravelling the role of the mandatory use of face covering masks for the control of SARS-CoV-2 in schools: a quasi-experimental study nested in a population-based cohort in Catalonia (Spain)

Ermengol Coma [1], Martí Català [2], Leonardo Méndez-Boo [1], Sergio Alonso [3], Eduardo Hermosilla [1,4], Enric Alvarez-Lacalle [3], David Pino [3], Manuel Medina [1], Laia Asso [5], Anna Gatell [6], Quique Bassat [7,8,9,10,11], Ariadna Mas [12], Antoni Soriano-Arandes [13,14], Francesc Fina Avilés [1], Clara Prats [3]

Limitaciones:
- Casos asintomáticos (infraestimación pequeños brotes)
- Direccionalidad y contexto contagios

/archdischild-2022-324172

Ejemplo 5: Ingresos y muertes evitados con vacunación

Datos epidemiológicos
Datos **vacunación**

¿Cuál ha sido el efecto de la vacunación masiva? ¿Se puede monetizar?

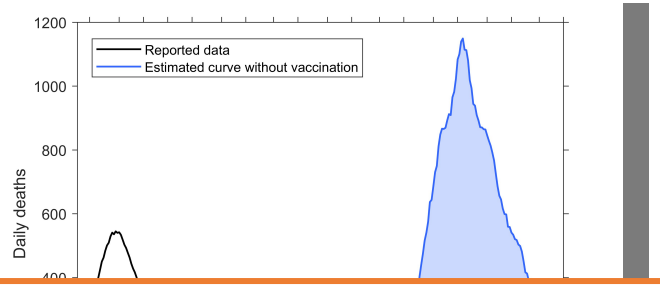
España:

Datos por edades → Desde el 21 de abril al 15 de octubre de 2021 (primeros **6 meses de vacunación masiva**), asumiendo que el contexto social y de medidas hubiese sido el mismo, en España se **habrían evitado…**

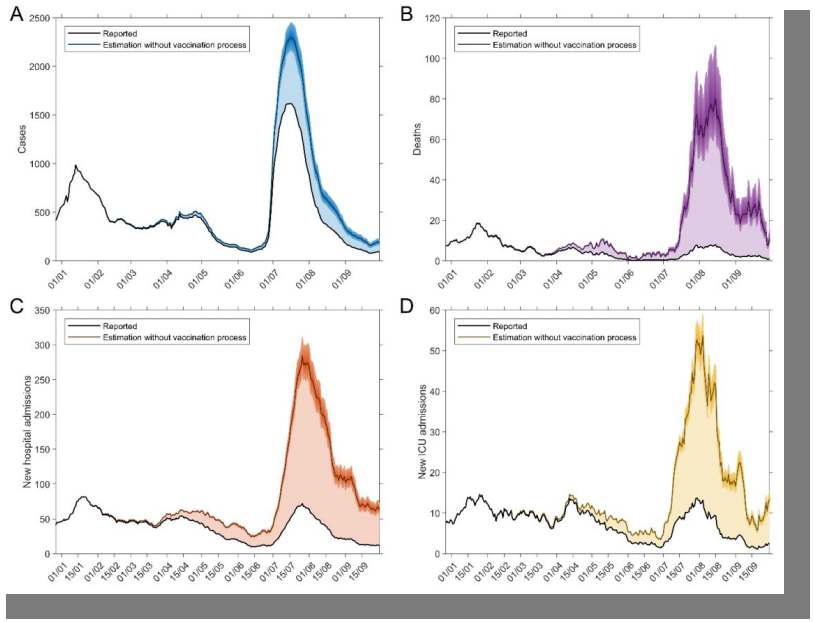
Entre 130.000 y 161.000 ingresos en planta

Entre 13.000 y 16.000 ingresos en UCI

Entre 46.000 y 79.000 defunciones



Cataluña:



According to these values, the following results can be inferred: the vaccination campaign generates positive impacts at the social level, amounting in monetary terms to €164.72 (€67.98 from the perspective of the health system) per dose administered (Table 4). Subtracting the cost of vaccination, the benefit was €116.67 and €19.93, respectively. From the perspective of the health system (considering the savings in hospital discharges and ICU units), the benefit/cost ratio is 1.4; if, in addition, the monetization of the reduction in mortality and morbidity (social perspective) is taken into account, this ratio increases to 3.4. These results are robust at the lower and upper threshold of vaccine effectiveness.

Article

A Cost–Benefit Analysis of COVID-19 Vaccination in Catalonia

Francesc López [1,2,3,*], Martí Català [4], Clara Prats [4,5], Oriol Estrada [1], Irene Oliva [1,2], Núria Prat [6], Mar Isnard [6], Roser Vallès [6], Marc Vilar [6], Bonaventura Clotet [3,7], Josep Maria Argimon [8], Anna Aran [9] and Jordi Ara [1]

https://doi.org/10.3390/vaccines10010059

Limitaciones:

- Inmunidad por vacunas variable en el tiempo y según variante
- Sólo efecto directo

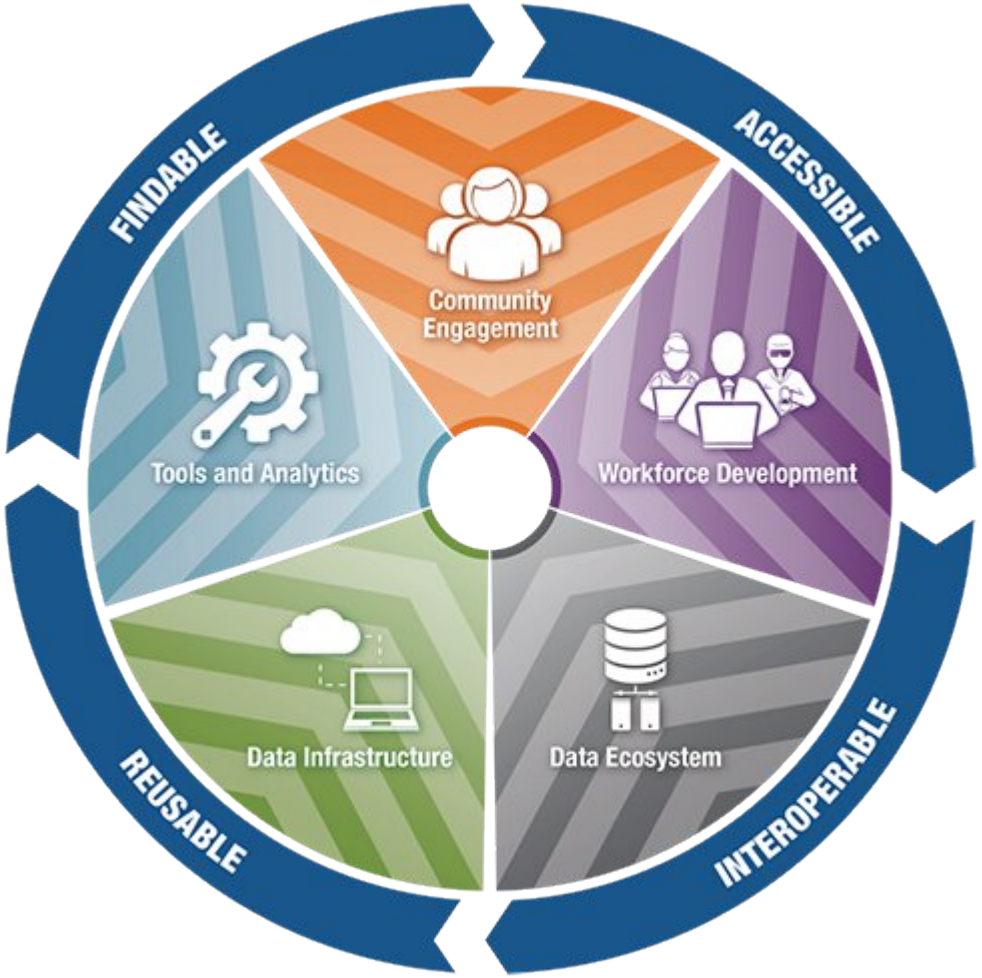
(I) Los datos en la pandemia de COVID-19

(II) ¿Para qué han servido? Algunos ejemplos…

(III) Discusión

Datos… ¿Cómo? Lecciones desde la pandemia

- ✓ *Principio FAIR: Findable, Accessible, Interoperable, Reusable*
- ✓ Transparentes, datos abiertos, documentados → investigación
- ✓ Principios éticos
- ✓ Homogéneos entre regiones y países > infraestructuras de datos centralizadas y supranacionales
- ✓ Herramientas de análisis y visualización → Supercomputación
- ✓ Comunicación (ciudadano → dato → retorno)



From: https://datascience.nih.gov/about/odss, 2019

16th Users Conference

CÁCERES

14th - 15th September 2022

RED ESPAÑOLA DE SUPERCOMPUTACIÓN

¡Muchas gracias!

Clara Prats, PhD

Computational Biology and Complex Systems (BIOCOM-SC) – UPC

Centre for Comparative Medicine and Bioimage (CMCiB)

Grup Interdisciplinari de Professionals Vinculats amb la Salut (GIPS)

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