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EMBARGOED UNTIL 31 MARCH 2022 AT 00.01 CET TIME

New Study Assesses the Health Impacts of the 2020 Lockdowns in Three European Cities

While reductions in air pollution and noise during confinement would have positive effects on health, negative consequences of falling physical activity levels were generally greater

Barcelona, 31 March, 2022-. The lockdown measures imposed in March 2020 to contain the COVID-19 pandemic led **to unprecedented declines in air pollution, noise and physical activity** levels in cities. The consequences of these changes for people's health differed depending on the stringency of the confinement measures and local context, giving insights into how emergency measures can more broadly affect population health. What lessons can be learned for future urban planning policies and emergency preparedness? A study published in *Environmental Pollution* led by the Barcelona Institute for Global Health (ISGlobal), a centre supported by the "la Caixa" Foundation, has attempted to answer these questions.

To compare different contexts, the research team selected **three European cities** with different degrees of confinement measures: **Barcelona**, where a strict lockdown was imposed including law-enforced home confinement; **Stockholm**, where the measures were much more relaxed and ultimately subject to individual responsibility and ¨common sense¨; and, finally, **Vienna**, which had intermediate measures.

For each of the three cities, they collected or estimated data on **air pollution, noise and physical activity** from three different points in time: before the pandemic, during the acute confinement and in the subsequent deconfinement period. In a first step, the researchers calculated the differences in these environmental exposures and health behaviours between pre-pandemic and pandemic levels. In a second step, those differences were compared with existing health data and translated into how many annual diagnoses of heart attacks, strokes, depression, and anxiety could have been prevented or would have been caused in addition in every city, if the changes in air pollution, noise, physical activity and greenspace visits had been extended for one year.

Decreases in physical activity levels of up to 95%

The first findings of the study showed that the strictness of the confinement measures was directly related to the decline in exposures and behaviours studied. Thus, the city with the toughest confinement, **Barcelona**, was also the one that recorded the largest decreases with respect to the pre-pandemic levels of air and noise pollution, physical activity, and greenspace visits. Specifically, during the first lockdown, **nitrogen dioxide (NO_2) concentrations fell by 50% on average**, **daily noise levels were reduced by 5 decibels (dB A)** and **physical activity was reduced by 95%.**

During the same period, in **Vienna**, **NO_2** pollution fell by **22%**, average daily noise levels were **reduced by 1 dB(A)**, while **physical activity was decreased by 76%**.

For **Stockholm**, **NO_2** levels fell by **9%**, **daily noise** levels were reduced by **2 dB(A) and physical activity** fell by **42%**.

Physical activity as a health determinant

Having quantified the changes in each city compared to the pre-pandemic levels, the team calculated the impact of each of these changes on health. To do this, they drew on

evidence from previous studies that established relationships among each of the exposures and behaviours studied and various cardiovascular diseases and mental disorders. Finally, to reflect the true magnitude of the changes studied in the long-term, a data model was used to simulate the **impact that the containment measures would have had if extended over a full year**.

From all the factors included in the study, **physical activity was the main driver of health outcomes**. Thus, a hypothetical extension of strict confinement in **Barcelona** for a full year would have resulted in a **10% increase in strokes and heart attacks** and an 8% and 12% increase in diagnoses of depression and anxiety, respectively, due to the reductions in physical activity.

Reduction of physical activity in **Vienna** for a whole year, in turn, could have led to a **5% increase in the annual incidence of strokes and heart attacks**, as well as 4% and 7% increase in diagnoses of depression and anxiety, respectively.

Even in **Stockholm**, the city with the slightest decline in physical activity levels, there would have been negative health effects if the situation had lasted for a year. The model estimated a **3% increase in the respective incidences of strokes and heart attacks**, 2% additional diagnoses of depression and 3% additional cases of anxiety.

Pollution and noise on the positive side

The decreases in air and noise pollution data brought positive effects. If the reduction in NO_2 concentrations from the first lockdown had been sustained for a whole year, an estimated **5% of heart attacks, 6% of strokes and 11% of depression diagnoses could have been prevented in the city of Barcelona**. In Vienna, the estimated decreases would be 1% for strokes and heart attacks and 2% for depression. In Stockholm the positive health impact would be the prevention of 1% of depression diagnoses.

In the long-term, improved noise levels in Barcelona could have prevented an estimated **4% of annual heart attacks, 7% of strokes and 4% of diagnosed depression**. In Vienna, the incidence of myocardial infarction, stroke and depression could have been reduced by 1%. And finally, for Stockholm, a 2% reduction in diagnosed heart attacks and depression, and a 4% reduction in stroke cases related to noise reductions is estimated.

Negative balance

"Despite the differences observed in the three cities, there is a common pattern: the health benefits of improved air quality and noise fail to offset the profoundly negative effects of reduced physical activity levels," summarises **Sarah Koch**, ISGlobal researcher and first author of the study.

"In terms of urban health, the confinements and subsequent deconfinements gave us the opportunity to generate valuable evidence and understand how emergency strategies like lockdowns can have broader health impacts for the population. The results of our study show the benefits that could be obtained by implementing urban planning policies that significantly reduce air pollution and noise while encouraging physical activity and contact with green spaces", concludes **Mark Nieuwenhuijsen**, director of ISGlobal's Air Pollution and Built Environment programme and last author of the study.

Prevented (-) or additional (+) cases if acute containment levels had been maintained for 12 months				
	NO_2	**Noise**	**Physical Activity**	**Net Gains**
BARCELONA				
Myocardial infarction	-5%	-4%	+10%	+1%
Stroke	-6%	-7%	+10%	-3%
Depression	-11%	-4%	+8%	-7%
Anxiety		-4%	+12%	+8%
VIENNA				
Myocardial infarction	-1%	-1%	+5%	+3%
Stroke	-1%	-1%	+5%	+2%
Depression	-2%	-1%	+4%	-1%
Anxiety		-1%	+7%	+6%
STOCKHOLM				
Myocardial infarction	0%	-2%	+3%	+1%
Stroke	0%	-4%	+3%	-1%
Depression	-1%	-2%	+2%	-1%
Anxiety		-2%	+3%	+1%

Methodology

The study used a tool called **UTHOPIA** to assess the health risks associated with each exposure and behaviour studied in the pre-pandemic stage and compare them to the acute confinement and deconfinement scenarios. Data on the burden of cardiovascular disease and mental disorders for each city were obtained from public sources.

Reference

Sarah Koch, Sasha Khomenko, Marta Cirach, Mònica Ubalde-Lopez, Sacha Baclet, Carolyn Daher, Laura Hidalgo, Mare Lõhmus, Debora Rizzuto, Romain Rumpler, Yusak Susilo, Siddharth Venkataraman, Sandra Wegener, Gregory A. Wellenius, James Woodcock, Mark Nieuwenhuijsen Impacts of changes in environmental exposures and health behaviours due to COVID-19 pandemic on cardiovascular and mental health: A comparison of Barcelona, Vienna, and Stockholm. *Environmental Pollution*, March 2022.

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About ISGlobal

The Barcelona Institute for Global Health, ISGlobal, is the fruit of an innovative alliance between the ”la Caixa” Foundation and academic and government institutions to contribute to the efforts undertaken by the international community to address the challenges in global health. ISGlobal is a consolidated hub of excellence in research that has grown out of work first started in the world of health care by the Hospital Clínic and the Parc de Salut MAR and in the academic sphere by the University of Barcelona and Pompeu Fabra University. Its working model is based on the generation of scientific knowledge through Research Programmes and Groups, and its translation through the areas of Training and Analysis and Global Development. ISGlobal has been named a Severo Ochoa Centre of Excellence and is a member of the CERCA system of the Generalitat de Catalunya.

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