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Net effect of wealth on health for COVID-19 – worldwide state comparison

Abstract: The wealth-health relationship is not unambiguous and constant. Indeed, a higher level of wealth affects individual and population health in two opposite ways. Increased risk factors raise the probability of some diseases. Conversely, better healthcare and awareness reduce the chances of developing these diseases or raise the likelihood of treatment and cure. Therefore, the overall impact on health or the "net effect" of wealth (positive or negative) may be challenging to determine. Moreover, this effect may not be fixed for different income groups. Thus, it states to reason that there may exist an "affluence point" changing the predominant impact of wealth (positive/negative), which we will refer to as the "health economic threshold".

This paper aims to assess and quantify the hard-to-grasp overall impact of prosperity on the prevalence and mortality of COVID-19. In particular, we attempt to estimate both the net effect of affluence and the health economic threshold by applying a dedicated analytical tool and problem-specific forecasting methods. Namely, we employ the existing idea of joinpoint regression to produce a specification that models the relationship between GDP and prevalence or mortality which is allowed to exhibit non-constant monotonicity. Finally, we calculate the numerical value of the net effect of affluence through extrapolation.

Our results show that for COVID-19 morbidity and mortality, up to a certain level of GDP, the richer the country, the higher the prevalence. After exceeding this threshold, the number of cases stabilises at a very high level, while mortality decreases along with the prosperity of countries. It turned out that the countries of Western and Northern Europe used their wealth effectively, significantly reducing mortality. Unfortunately, in CEE the net effect of wealth was insignificant. Therefore, even with relatively high levels of prosperity compared to the rest of the world, governments and health systems have not risen to the challenge.

Key words: health economics, health economic threshold, COVID-19, joinpoint regression, net effect of affluence, regional studies

JEL: C50, C31, R11, I15, I18

Introduction

Numerous studies have indicated the existence of associations between affluence and health (Vanitallie 2002, p. 40–45, Smeester et al. 2015, p. 107–121, Kim et al. 2018, p. 75–85, Wolf et al. 2018, p. 5–85, WHO Report: Climate change… 2003, p. 10–164, WHO Factsheet for World… 2018, WHO Report: Improving mental health… 2019, WHO Factsheet: Mental health… 2019). By-products of "modern life" and socioeconomic development, such as environmental pollution, omnipresent stress, unhealthy diet, lacking physical activity, changing sleeping patterns, and exposure to artificial light at night, negatively impact the population's health. As a result, there is a systemic incline of global morbidity and mortality from many illnesses. Thus, the interest in assessing the overall medical impact of socioeconomic conditions on health has been increasing over time. However, many studies show ambiguous or conflicting results, which indicates that the association between affluence and prevalence is complex and, possibly, non-constant over time, space and the level of development (see Offer 2006, Link 2007, Farrell 2010, Labarthe 2010, Danaei et al. 2013). On one hand, as stated before, harmful by-products of modern life constitute major health risk factors. On the other hand, the quality and quantity of healthcare resources are determined mainly by the development level and financial constraints. This duality makes it very difficult to assess the resultant impact of wealth on health. It is sometimes even not entirely clear whether the final (or net) effect is positive or negative.

Though the World Health Organization (WHO) has been focusing mainly on the growing problem of chronic non-communicable diseases (NCDs) (WHO: Unknown author 2010, p. 1–2, WHO Report: Global action plan… 2013, p. 2–101), infectious diseases continuously pose a challenge. Unlike NCDs, in the case of infectious diseases, accessible healthcare and affordable medicine are sufficient to relieve a population's burden. Hence, their prevalence and mortality should be lower in affluent regions than in poorer ones. However, infectious diseases are often transmitted through human contact, which means that high population density and levels of urbanisation increase the risk of infection. Also, interregional and international travel, common in more affluent countries, favours the rapid spread of diseases across borders. Secondly, although contemporary medicine is able to deal with most infectious diseases, modern societies create a genuine threat of new epidemics due to wrongly perceived freedom or lack of general medical education (e.g. the antivaccination movement). Moreover, there is no cure or effective treatment for some diseases, especially new ones. The ongoing global pandemic of COVID-19 is an accurate example.

Before the current COVID-19 pandemic, coronaviruses were considered common pathogens of the common cold. However, the 21st century brought two notable outbreaks of global epidemics described as moderate eastern respiratory system syndromes (MERS-CoV) and severe acute respiratory syndrome (SARS-CoV), causing hundreds of deaths (Bilal et al. 2020, p. 726–728). COVID-19 has been considered an international public health emergency by WHO since 31 January 2020 and a global pandemic since 11 February 2020 (Manzoor et al. 2020, p.

110–111). Although in current statistics, the death rate of COVID-19 is lower than MERS and SARS episodes, the total outcome of this pandemic is still unclear, as proven by the appearance of subsequent mutated strains (Bilal et al. 2020, p. 726–728, Read et al. 2021, p. 1–6) Moreover, the ongoing COVID-19 has irreversibly changed the world as we knew it, for instance, the global policies on social distancing, lockdowns, quickly adjusted vaccines, and evolving surveillance technologies utilised in epidemiology (Kampmark 2020, p. 59–67, Tomescu-Dumitrescu, Mihai 2020, p. 5–7, WHO COVID-19 policy briefs).

Even in a relatively short pandemic duration, it is well established that despite being an infectious disease COVID-19, the severity of symptoms, frequency of hospitalisations and deaths strongly depend on the pre-existing comorbidity of NCDs (Li et al. 2021, p. 1–4, Mohamadi et al. 2021, p. 4–10). It can therefore be suspected that in some respects COVID-19 may resemble diseases of affluence more than most of the infectious diseases. Additionally, most COVID-19 symptoms are manageable with existing medical resources, but their availability positively correlates with countries' prosperity. Currently, there are a few credible vaccination options, but again, availability is dependent on states' income levels. On the other hand, the highest incidence and mortality have been recorded in the middle- and high-income states. Hence, the resultant impact of wealth on health or the net effect of affluence (net effect, for short), either positive or negative, is difficult to assess. Furthermore, this overall impact may differ across countries' prosperity levels. If so, there may exist a hypothetical wealth point shifting the net effect for COVID-19, e.g. from positive to negative. We will refer to it as the "health economic threshold".

This paper aims to assess and quantify the hard-to-grasp overall impact of prosperity on the incidence and mortality of COVID-19. While we indeed recognise that the health determinants of COVID-19 are complex and heterogeneous in political, institutional, socio-cultural and regional terms, to enable global comparability of results, we focus on wealth as a leading factor. In particular, we attempt to estimate the net effect of affluence and the health economic threshold using an econometric approach. The paper is structured as follows. Section 2 offers a description of the incorporated data and basic distributional statistics. Section 3 presents our dedicated analytical instrument. The results of the research and discussion are included in Section 4. The final section highlights our conclusions.

Data

The data on COVID-19 incidence (or new cases) and mortality (or death rates) are taken from WHO Coronavirus Dashboard. The number of cases and deaths, being a cumulative total per 100 thousand population (on 1 July 2021), were collected for 178 states. To date, with few exceptions (see, for instance, Rendana et al. 2021), there are no wildly available reliable subnational and regional data. These statistics measure the incidence and mortality since the pandemic outbreak till the end of June 2021. This time frame allows for including at least the first high-incidence and high-mortality period (so-called “first wave”), which did not coincide in every WHO region. Furthermore, it is possible to incorporate the first results of national vaccination programs. The affluence is measured by the most recent GDP per capita (2019 or 2020) in purchasing power parity (PPP, current international dollars; The World Bank Data). All countries with non-zero mortality rates and available GDP values have been incorporated in the analysis. Due to Peru’s outlier status, with 582,81 deaths per 100 thousand inhabitants, the country was excluded from the mortality study.

Basic statistics of COVID-19 incidence and mortality are presented in Table 1, while spatial distribution is presented in Figs 1 and 2.

Table 1. Basic statistics for COVID-19 incidence and mortality, cumulative (till the end of June 2021) per 100 thousand population (world, countries)

COVID-19	Mean	Std. dev.	Min	Max
New cases	3805.10	3972.97	0.85	15957.18
Death rates	66.06	76.33	0.04	306.13

Source: author’s compilation based on WHO Coronavirus Dashboard data.

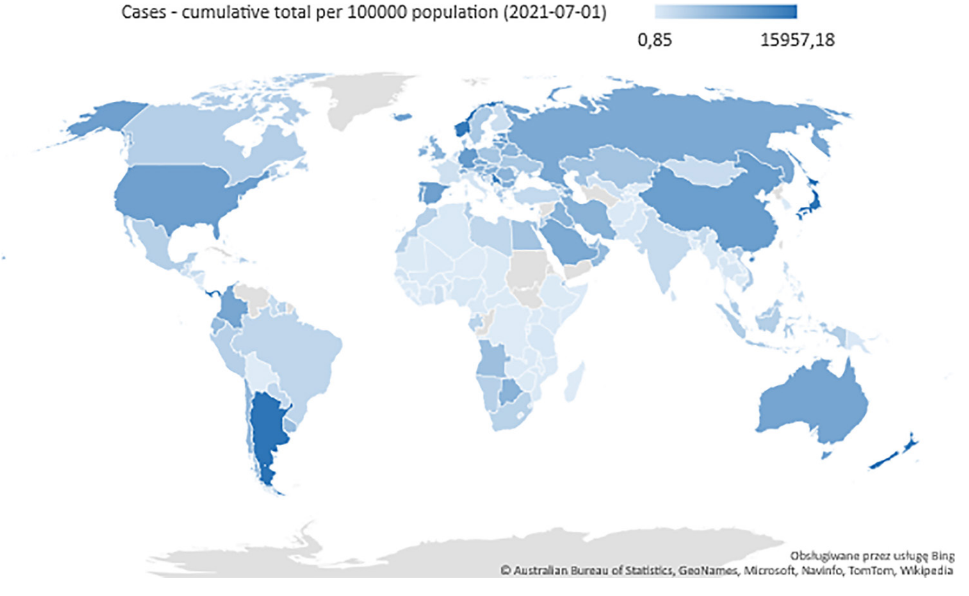

Fig. 1. Number of new cases for COVID-19 by country of residence, cumulative (till the end of June 2021) per 100 thousand population
Source: author’s compilation based on WHO Coronavirus Dashboard data.

On average, the incidence of COVID-19 was around 3 800 new cases per 100 thousand of the population, with a high variation coefficient of 104%. The lowest values are observed in Africa with few countries in other WHO Regions, for

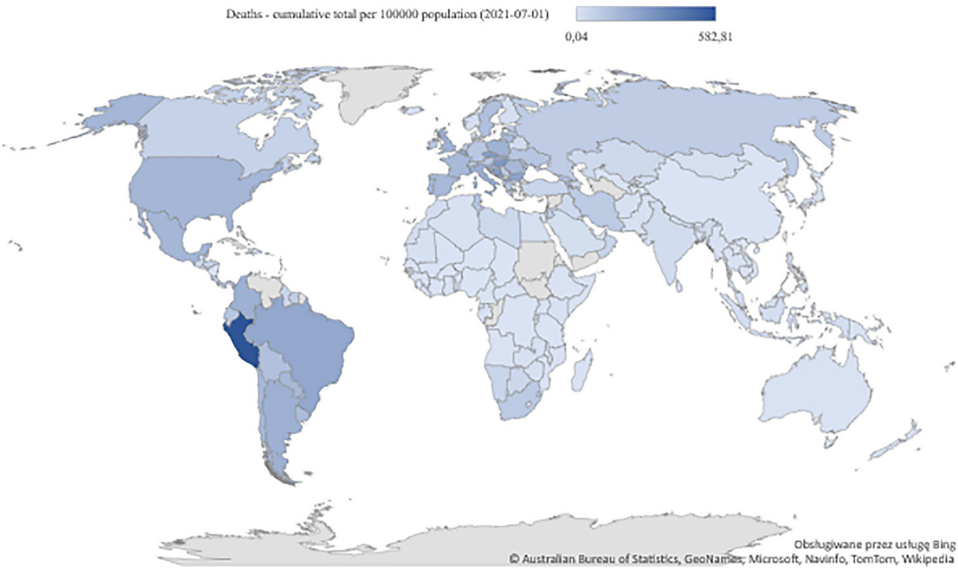

Fig. 2. Number of deaths for COVID-19 by country of residence, cumulative (till the end of June 2021) per 100 thousand population
Source: author's compilation based on WHO Coronavirus Dashboard data.

instance in Grenada and Bolivia in the Americas (2nd and 3rd lowest values in the world), Lao People's Democratic Republic and the Republic of Korea in the Western Pacific (5th and 9th lowest values, respectively), as well as San Marino with lowest prevalence in Europe and 10th lowest in the world. The highest number of new cases have been recorded in Argentina and Panama in the Region of the Americas. Among the top 50 states, 54% are European, with Norway (around 15 000 new cases; 5th highest value in the world), Serbia (6th), Cyprus (7th), Luxembourg (8th), and Germany (over 10 500 new cases; 10th). Notably, the 11th and 12th highest prevalence have occurred in China (also the 3rd highest in the region of Western Pacific after New Zealand and Japan – 3rd and 4th in the world, respectively) and the United States of America. Estonia has placed 14th in the world and first among Central-Eastern European (CEE) states, with Poland in the 62nd position. With few exceptions, European countries have suffered from high numbers of new COVID-19 cases, indicating a high-prevalence cluster. However, the Central and Eastern region was distinguished by a lower level of the disease.

It should be noted, however, that the number of cases relies strongly on the number of tests, hence, the values recorded worldwide are underestimated as a considerable share of people with the infection are undetected either because they are asymptomatic or have mild symptoms, according to state guidelines, to be eligible for testing (WHO 2020 Estimating mortality…).

Low mortality rates for COVID-19 are observed in African, Western Pacific and Southeast Asian states. The highest death rates have been recorded in Europe (70% of the top 50 countries) and the Americas. Among the top death rates in Europe, a few are located in Central and Easter states, including Hungary (first after Peru), Czechia (3rd in Europe and 4th in the world) as well as Bulgaria, Slovenia and Slovakia, closing the top 10, with Poland in 17th place worldwide. The highest value outside Europe belongs to Brazil (9th in the world). Unusually high mortality has been recorded in Peru (583 deaths per 100 thousand inhabitants), which is double the second-highest value observed in Hungary (306). Thus, there was a need to exclude Peru from the econometric analysis. The average death rate for the remaining 177 states is 66 per 100 thousand, with high diversity among states (115% of the mean value) (see Table 1 and Fig. 2)

Methodology

We attempt to quantify the net effect of prosperity on the prevalence of COVID-19, namely, new cases and mortality. A dedicated analytical tool based on the econometric approach and counterfactual analysis is to serve this purpose. This tool was developed to assess the net effect of affluence and health economic threshold for the mortality of NCDs in European regions (see Olejnik, Żółtaszek 2023). In this paper, we expand the scope of the study by analysing both the number of cases and mortality of COVID-19 across the world.

We use the idea of a joinpoint model to construct a specification that models the dependence of the epidemiological measure of prevalence on the level of wealth (see Hinkley 1971, Dyvesether et al. 2018, Olejnik, Żółtaszek 2023). This tool allows for a change in the monotonicity and strength of the relationship. The point at which the direction of the function changes can be interpreted as the health economic threshold. Evaluation of the individual patterns of each epidemiological measure, together with extrapolation methods, made it possible to calculate the value of the net effect of wealth. This net effect is assessed for each measure in each country. It is defined as the difference between the actual prevalence and the assumed level – as if the country had different levels of wealth (see Olejnik, Żółtaszek 2023).

In our study, the model describes Epidemiological Measures (EM), namely incidence and mortality rates of COVID-19

$$EM_i\,(GDP_i; \alpha_0, \alpha_1, \alpha_2, GDP^*) = \alpha_0 + \alpha_1(GDP^* - GDP_i)^+ + \alpha_2(GDP_i - GDP^*)^+ + \varepsilon_i \quad (1)$$

with the notation $a^+ = \max\{a, 0\}$, for any $a \in \mathbb{R}$. The change point – GDP^* is the level at which potential change in regression line of Epidemiological Measure occurs. This is our proxy for the health economic threshold. The variable GDP_i is the gross domestic product per capita.

As the result of the estimation process, we obtain the numerical value of the GDP^* parameter, two slope coefficients of mutually exclusive surplus and deficit of GDP with respect to the health economic threshold and one common constant. In other words, we can look at equation (1) as a spline combination of two linear functions: first (f_1) described on the set of lower GDP countries R_1 (for which

$GDP_i \leq GDP^*$, $i \in R_1$) and second (f_2) described on the set of upper GDP countries R_2 (for which $GDP_i \geq GDP^*$, $i \in R_2$). For the value of the health economic threshold, we have $f_1(GDP^*) = f_2(GDP^*)$. This methodology allows us to obtain two types of net effect values: the net effect of poverty (*NE_P*) and affluence (*NE_A*).

To describe the number of people (per 100 thousand inhabitants) who died/fell ill because the *i*-th country is poor, or alternatively, the number of people that could have been saved if the country *i* had been more prosperous and, therefore, benefited from better healthcare quality we employ a negative effect of poverty

$$NE\_PN_i = \max\{EM_i^d - f_2(GDP_i), 0\}, \; i \in R_1. \tag{2}$$

The number of people that survived/did not fall ill because they live in the poorer region is described by the positive impact of poverty on regional health

$$NE\_PP_i = \max\{f_2(GDP_i) - EM_i, 0\}, \; i \in R_1. \tag{3}$$

The number of people that died/fell ill because of living in a wealthy region is described by an explicate (true) negative effect of affluence

$$NE\_AN_i = \max\{EM_i - f_1(GDP_i), 0\}, \; i \in R_2. \tag{4}$$

The direct positive effect of affluence represents the number of people that survived/did not fall ill thanks to the region's prosperity

$$NE\_AP_i = \max\{f_1(GDP_i) - EM_i^d, 0\}, \; i \in R_2. \tag{5}$$

Results and discussion

Based on the preliminary study of the spatial distribution of incidence and mortality across countries, it can be hypothesised that COVID-19 statistically resembles a disease of affluence rather than poverty, as high prevalence rates have been recorded in highly developed countries while low in poorer ones. To investigate the relationship between affluence and COVID-19, we utilise the net effect and health economic threshold methodology based on the joinpoint regression, independently for the incidence and mortality.

As displayed in Table 2 and Fig. 3, the relationship between GDP and COVID-19 prevalence does not exhibit constant monotonicity across the states. As estimated, among poorer regions (subset R_1 with GDP below 17 308 USD per capita), the higher the region's GDP, the higher the number of cases per 100 thousand inhabitants. After crossing the health economic threshold, the number of cases stabilises at a high level of 6 653.1 per 100 thousand inhabitants, as the slope parameter α_2 does not significantly differ from zero (p=0.703). It is worth mentioning that 57% of countries are classified as poorer (or below the threshold). Most are from Africa, and only a few are European (in increasing GDP order): the Republic of Moldova, Ukraine, Armenia, Albania, Azerbaijan, Georgia, Bosnia and Herzegovina, and North Macedonia.

Table 2. Results of joinpoint regression with an estimated change point – *GDP** for COVID-19 incidence, 2019–2021

COVID-19	Parameter	p-value	GDP*
			17 308 USD
α_1	0.448	<0.001	
α_0	6653.1	<0.001	
α_2	−0.008	0.703	

Source: author's compilation.

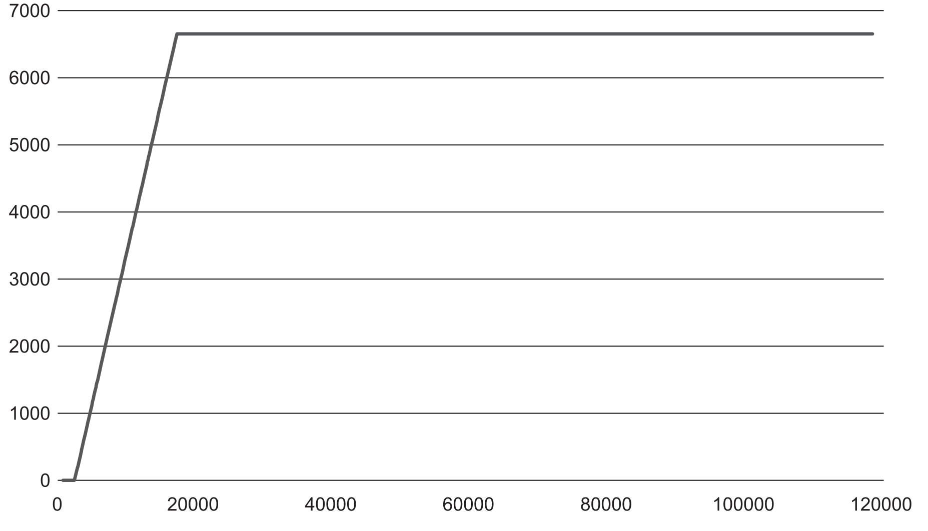

Fig. 3. Plot for joinpoint regression with an estimated change point for COVID-19 incidence 2019–2021
Source: author's compilation.

In the case of mortality, the relationship between GDP and death rate is also not constant across all states (see Table 3 and Fig. 4). As the result of estimation, we've established that in poorer countries (65% of 177 countries), the richer the country, the higher the death rate, but with a slower increase than for new cases. However, the tendency reverses after crossing the change point, where for more prosperous countries, the slope becomes negative. The *GDP** is almost 23 thousand USD, which makes it noticeably higher than for COVID-19 prevalence but slightly lower than for the NCDs (see Olejnik, Żółtaszek 2023). As a result, two more Eastern European states are classified as poorer than in incidences: Belarus and Montenegro. Overall, while the level of prosperity needed to reduce

COVID-19 mortality is not as high as that of most NCDs, it still exceeds the current economic status of most countries.

Table 3. Results of joinpoint regression with an estimated change point – *GDP** for COVID-19 mortality, 2019–2021

COVID-19	Parameter	p-value	GDP*
			22 793 USD
α_1	0.0059	<0.001	
α_0	126.99	<0.001	
α_2	−0.0009	0.009	

Source: author's compilation.

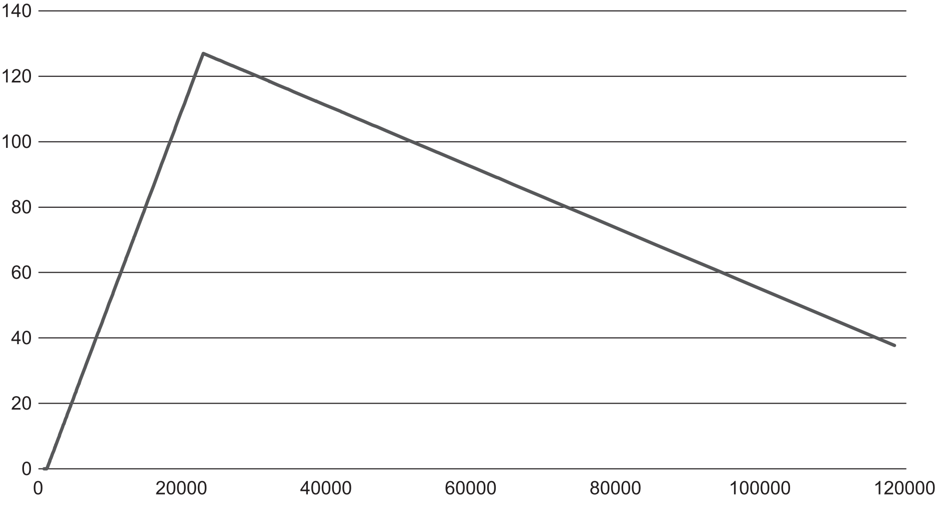

Fig. 4. Plot for joinpoint regression with an estimated change point for COVID-19 mortality 2019–2021
Source: author's compilation.

The pattern of COVID-19 prevalence, with a steep rise for poorer countries and a plateau for more affluent regions, resembles one of the mental and neurological disorders (see Olejnik, Żółtaszek 2023), therefore analogically, the most insightful is to calculate the positive effect of poverty (*NE_PP*). The number of people who did not test positive for COVID-19 because they were living in a less affluent country is presented in Fig. 5. The highest number of non-infected was estimated for African states as they constitute 60% of the top 10, 70% of the top 30 and 64% of the top 50 countries. Among them, Guinea ranked 1st in the world with 6652 non-infected, and Niger was 4th with 6630 per 100 thousand inhabitants not falling ill. From other WHO Regions, top values were achieved in Grenada and Bolivia from the Americas (2nd and 3rd, respectively), Lao People's Democratic Republic (5th, Western Pacific) and Timor-Leste (10th, Southeast Asia). Since most European states are considered affluent, based on the estimated value of the threshold, a positive effect of poverty is not observed there. Among the exceptions, the highest number of non-infected in Europe was in North Macedonia, which ranked 19th in the world (6 509).

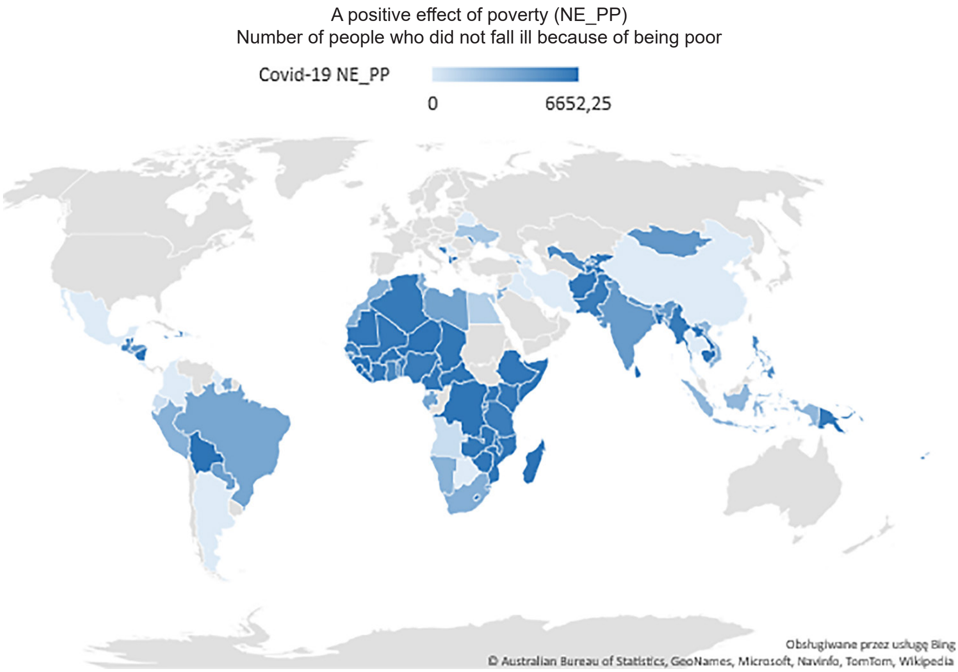

Fig. 5. Net effect of GDP for COVID-19 incidence 2019–2021
Source: author's compilation.

Since the pattern obtained by the joinpoint regression for COVID-19 deaths mirrors that for respiratory system diseases (see Olejnik, Żółtaszek 2023), and positive consequences of wealth seem to be more relevant in this case, we calculated the net effect *NE_AP* (positive effect of affluence). The distribution of people who survived due to the countries' prosperity is presented in Fig. 6. Saint Kitts and Nevis (WHO Region of Americas) achieved the highest number of prevented deaths – almost 120 per 100 thousand inhabitants. Subsequently, a group of Western Pacific states (in increasing order: Australia, Japan, the Republic of Korea, New Zealand and Malaysia) facilitated lowering the mortality by 96 to 106 people per 100 thousand inhabitants. Some eastern Mediterranean states such as Saudi Arabia (82), the United Arab Emirates (65), Kuwait (54) and Qatar (44) also experienced affluence-based gains. In the WHO European Region, the highest net effect of affluence (70–88 per 100 thousand inhabitants) is increasingly observed in Cyprus, Norway, Kazakhstan, Finland and Iceland. For most CEE countries, the positive effect of affluence is small or non-existent, which suggests they did not manage to benefit from their "wealthy state" status.

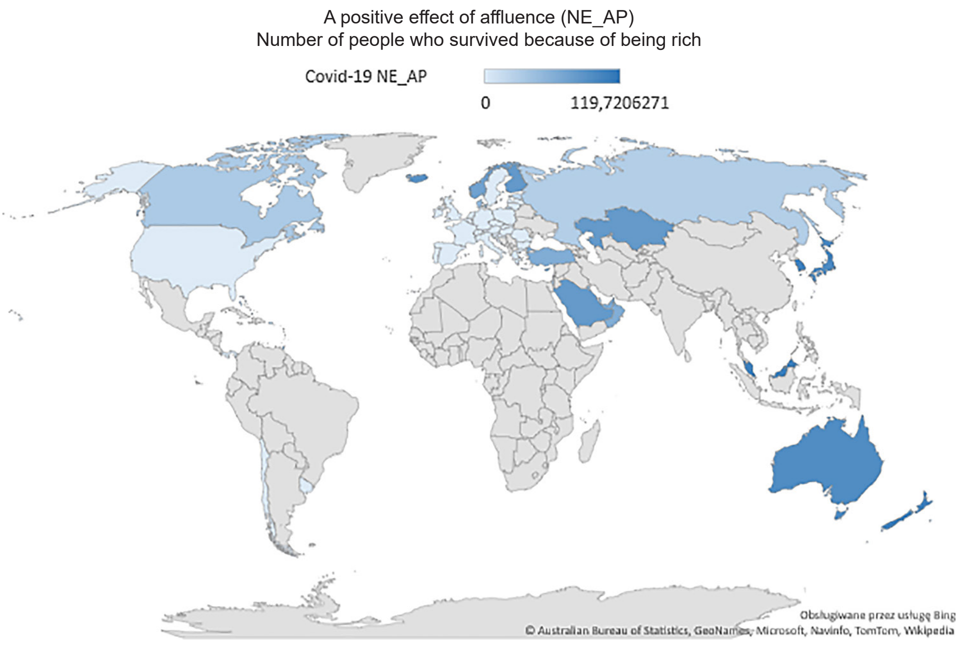

Fig. 6. Net effect of GDP for COVID-19 mortality 2019–2021
Source: author's compilation.

The results show that the spatial patterns of COVID-19 mortality and new cases differed. For both, up to the respective health economic threshold, the wealthier the country, the greater the prevalence. However, above GDP*, the number of incidences stabilises at a very high level, where the death rates decline with states' prosperity. Subsequently, the positive effect of poverty is the most relevant for the number of new cases, while the positive effect of wealth is appropriate for mortality.

We have found that the estimated health economic threshold for mortality was more than 30% higher than the one for the incidence rate. This indicates that smaller resources are needed to block COVID-19 transmission than for critical care. Lockdowns, social distancing, masks and disinfection are relatively inexpensive but effective preventive measures compared to costly, high-tech ICU treatment. Still, the trends couldn't be reversed for new cases, and the best-case scenario for richer countries is a high plateau. Notably, more than half of the countries are below *GDP**, with a positive correlation between prosperity and prevalence. This means that even relatively cheap preventive measures were beyond the reach of most of the world.

Overall, Europe is a cluster of high COVID-19 prevalence, measured by incidence and mortality. As expected, we do not observe any positive effect of poverty for new cases, as most European countries are considered affluent. However, many Western and Northern European countries used their wealth efficiently, significantly reducing mortality. Unfortunately, in the CEE, the net effect was negligible. Therefore, even with relatively high levels of prosperity, compared to the rest of the world, governments and health systems have not stood up to the challenge.

Conclusions

The COVID-19 pandemic has proven to be the ultimate test of the world's readiness for a global health challenge. Although the most difficult period has passed, it is vital to learn as much as possible from our successes and failures in the fight against the virus. This study aimed to assess the expanded correlation between key epidemiological measures and countries' wealth as an aggregated proxy for socioeconomic development.

The methodology used in this paper proved effective in the assessment of prevalence-development relations. It turns out that not only is the association statistically significant, but its monotonicity changes. The monotonicity change point has been obtained utilising econometric estimation. It's worth noting that resources required to block or reduce the prevalence of COVID-19 are in the same range as that for some NDCs (see Olejnik, Żółtaszek 2023). This suggests that the health economic threshold (around 20 000 USD per capita) represents the breakpoint at which the wholesome healthcare system's effectiveness counteracts affluence's detrimental effect.

In terms of the type of net effect, we found that the positive effect of poverty is observed for the number of new cases, while the positive effect of wealth is found for mortality. As expected, the scale of incidence was disproportionately larger than for mortality. For incidences, the net effect clusters, while for mortality, the values are more dispersed. These differences in patterns and scale for various prevalence aspects prove that evaluating alternative epidemiological measures, such as morbidity, mortality, and hospitalisations, is essential to obtain complete information about the disease.

The detected differences in incidence and mortality patterns result from various accompanying conditions. The availability and accessibility of healthcare heavily influenced mortality rates. Therefore, in wealthier regions, qualitative and quantitative aspects of medical goods and services have proven to be sufficient to minimise morality. On the other hand, the number of new cases was probably determined by factors unrelated to healthcare. In wealthier countries, higher urbanisation and population density levels, combined with high mobility and firmly established values of individual rights and independence, limited the effects of states' distancing policies. In addition, the proportion of older people, disproportionately more affected by COVID-19 than other age groups, is much higher in wealthier countries due to ageing populations than in less developed countries.

It should be noted that the results of this study are based on officially recorded COVID-19 positive test results and causes of death. These rates are highly dependent on countries' ability to test patients. We are aware that the reliability of data varies over time and countries. Poorer states likely had lower testing availability so the prevalence may be underestimated. It is suspected that mortality data may be more accurate than those for new cases. However, the statistics for less wealthy regions are also likely to be more biased than those for more prosperous regions. The credibility of the data cannot be verified at this time. Therefore, the issue should be re-examined when more reliable data becomes available.

Overall, it can be concluded that the world was not fully prepared for the challenges of a global pandemic. Neither the poorer nor the wealthier states were successful enough in their efforts to battle COVID-19. However, western European countries used their wealth more effectively than CEE. All governments lacked the scope and timing of relevant policies. Healthcare did not have adequate resources and logistics to satisfy the rising needs. The societies were unprepared economically, culturally and socially and, in many cases, not disciplined enough to fully implement the restrictions. The question remains whether we can take the sub-optimal approach to COVID-19 as a lesson or continue to repeat the same mistakes in the upcoming pandemics.

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Wpływ netto bogactwa na zdrowie w przypadku COVID-19 – porównanie stanu na całym świecie

Zarys treści: Związek dobrobytu i zdrowia nie jest jednoznaczny i stały. Rzeczywiście wyższy poziom zamożności wpływa na zdrowie jednostek i populacji na dwa przeciwstawne sposoby. Wzrost czynników ryzyka zwiększa prawdopodobieństwo wystąpienia niektórych chorób. I odwrotnie, lepsza opieka zdrowotna i świadomość zmniejszają ryzyko rozwoju tych chorób lub zwiększają prawdopodobieństwo leczenia i wyleczenia. Dlatego ogólny wpływ na zdrowie lub „efekt netto" bogactwa (pozytywny lub negatywny) może być trudny do określenia. Co więcej, efekt ten może nie być stały dla różnych grup dochodowych. Stawiamy więc tezę, że może istnieć „punkt zamożności" zmieniający dominujący wpływ bogactwa (pozytywny/negatywny), który będziemy nazywać „progiem ekonomicznym zdrowia".

Celem artykułu jest ocena i ilościowe określenie trudnego do uchwycenia ogólnego wpływu dobrobytu na występowanie i śmiertelność COVID-19. W szczególności staramy się oszacować zarówno efekt netto zamożności, jak i próg ekonomiczny zdrowia, stosując dedykowane narzędzie analityczne oparte na regresji punktowej i metodach prognozowania. Wykorzystujemy istniejącą ideę regresji punktu łączenia, aby stworzyć specyfikację, która modeluje związek między PKB a rozpowszechnieniem lub śmiertelnością i która może wykazywać niestałą monotoniczność. Następnie obliczamy wartość liczbową efektu netto zamożności poprzez ekstrapolację.

Nasze wyniki pokazują, że zachorowalność i śmiertelność z powodu COVID-19 rosną wraz z dobrobytem. Do pewnego poziomu PKB, im bogatszy kraj, tym większa częstość występowania. Po przekroczeniu tego progu liczba zachorowań stabilizuje się na bardzo wysokim poziomie, a śmiertelność spada wraz z zamożnością krajów. Okazało się, że kraje Europy Zachodniej i Północnej efektywnie wykorzystywały swoje bogactwo, znacznie zmniejszając śmiertelność. Niestety w krajach Europy Środkowej i Wschodniej efekt netto bogactwa był znikomy. Dlatego nawet przy stosunkowo wysokim poziomie dobrobytu w porównaniu z resztą świata rządy i systemy opieki zdrowotnej nie sprostały wyzwaniu.

Słowa kluczowe: ekonomika zdrowia, próg ekonomiczny zdrowia, COVID-19, regresja punktu połączenia, efekt netto zamożności, studia regionalne

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