

## ORIGINAL ARTICLE

# The Mediating Role of Universal Health Coverage Between International Health Regulations Core Capacities and Mortality from Communicable Diseases

## Uluslararası Sağlık Tüzüğü Temel Kapasitesi ile Bulaşıcı Hastalıklara Bağlı Ölüm Oranları Arasında Evrensel Sağlık Kapsamının Aracılık Rolü

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## ABSTRACT

**Aim:** Communicable diseases continue to pose a significant threat to public health and sustainable development efforts. To address this challenge, targets under the Sustainable Development Goals focus on enhancing healthcare capacity and achieving Universal Health Coverage (UHC). Improving the physical and technical capacity of healthcare services and ensuring access aim to support the fight against communicable diseases. This study aims to determine the mediating role of Universal Health Coverage (UHC) service coverage in the relationship between International Health Regulations (IHR) core capacities and mortality rates due to communicable diseases.

**Methods:** The study utilized 2021 data from 183 World Health Organization member states that are party to the IHR, without sample selection. A simple mediation model was developed, and assumptions of mediation effect analysis were tested through regression analyses to evaluate relationships between variables.

**Results:** A significant negative effect was observed between IHR core capacities and mortality rates due to communicable diseases. Additionally, a significant positive effect was identified between IHR core capacities and UHC service coverage. In the model incorporating both IHR and UHC, a significant negative effect was observed between UHC service coverage and mortality rates due to communicable diseases. Mediation analysis revealed that UHC service coverage fully mediates the effect of IHR core capacities on mortality rates due to communicable diseases.

**Conclusions:** The findings suggest that IHR core capacities alone have a limited effect on reducing mortality rates without adequate healthcare access. Supporting IHR core capacities with improved access to healthcare is essential. Countries should continue efforts to enhance IHR core capacities and integrate these efforts with UHC policies to effectively combat communicable diseases.

**Keywords:** Communicable disease, International health regulations, Public health, Sustainable development, Universal health coverage

## ÖZ

**Amaç:** Bulaşıcı hastalıklar toplum sağlığı ve sürdürülebilir kalkınma çabaları üzerinde önemli bir tehdit olmaya devam etmektedir. Bulaşıcı hastalıklarla mücadele amacıyla sürdürülebilir kalkınma hedefleri kapsamında sağlık hizmeti kapasitesinin oluşturulması ve evrensel sağlık kapsamının sağlanması için hedefler belirlenmiştir. Sağlık hizmetinin fiziki ve teknik kapasitesinin iyileşmesi ve hizmete erişimin sağlanmasıyla bulaşıcı hastalıklarla mücadele edilmesi amaçlanmaktadır. Çalışmanın temel amacı Uluslararası Sağlık Tüzüğü (IHR) temel kapasiteleri ile bulaşıcı hastalıklara bağlı ölüm oranları arasındaki ilişkide Evrensel Sağlık Kapsamı (UHC) hizmet kapsamının aracılık rolünün belirlenmesidir.

**Gereç ve Yöntemler:** Çalışma kapsamında örneklem seçimi yapılmayıp IHR'ye taraf olan Dünya Sağlık Örgütüne üye 183 ülkenin 2021 yılına ait verileri kullanılmıştır. Çalışmanın amacı doğrultusunda basit aracılık modeli oluşturulmuştur. Değişkenler arasındaki ilişkiyi test eden aracılık etkisi analizi varsayımları regresyon analizleriyle test edilmiştir.

**Bulgular:** IHR temel kapasitesi ile bulaşıcı hastalıklara bağlı ölüm oranı arasında anlamlı negatif etki tespit edilmiştir. IHR temel kapasitesi ile UHC hizmet kapsamı arasında ise anlamlı pozitif etki olduğu belirlenmiştir. IHR ve UHC'nin birlikte dahil edildiği modelde UHC hizmet kapsamı ile bulaşıcı hastalıklara bağlı ölüm oranı arasında anlamlı negatif etki tespit edilmiştir. Aracılık etkisi analizi sonucunda ise IHR temel kapasitesinin bulaşıcı hastalıklara bağlı ölüm oranı üzerindeki etkisinde UHC hizmet kapsamının tam aracı rolü oynadığı belirlenmiştir.

**Sonuçlar:** Belirlenen bulgulara göre IHR temel kapasitesinin sağlık hizmetlerine erişim olmadan bulaşıcı hastalıklara bağlı ölüm oranı üzerinde sınırlı etkisinin olduğu söylenebilir. IHR temel kapasitelerinin toplumun sağlık hizmetine erişimiyle desteklenmesi gerekmektedir. Ülkelerin bulaşıcı hastalıklarla mücadelede IHR temel kapasitelerini arttırmaya yönelik çabalara devam etmesi ve bu çabaların UHC politikalarıyla entegre edilmesi önerilmektedir.

**Anahtar Kelimeler:** Bulaşıcı hastalık, Evrensel sağlık kapsamı, Halk sağlığı, Sürdürülebilir kalkınma, Uluslararası sağlık tüzüğü

## Introduction

Despite advancements in medical science diseases hinder social and economic development and developments in public health practices, and, as demonstrated by the COVID-19 pandemic, communicable diseases remain a significant threat pose significant threats to international health security to public health today (1-3). In addition to causing (1,4). Due to the burden of communicable diseases, substantial mortality and suffering, communicable the United Nations Sustainable Development Goals

(SDGs) have set targets to end epidemics such as AIDS, tuberculosis, and malaria and to combat hepatitis and other communicable diseases (4).

The third of the 17 global goals for sustainable development has been identified as “ensuring healthy lives and promoting well-being for all at all ages.” Within this global goal, Target 3.8 is defined as “achieving universal health coverage (UHC), including financial risk protection, access to quality essential healthcare services, and access to safe, effective, quality, and affordable essential medicines and vaccines for all” (5). One of the indicators developed to monitor this target, Indicator 3.8.1, measures healthcare service coverage. Known as the UHC Service Coverage Index, Indicator 3.8.1 is defined as the average coverage of essential health services, including reproductive, maternal, newborn, and child health; communicable diseases; non-communicable diseases; and health service capacity and access, among both the general and the most disadvantaged populations (5,6). Studies in the literature indicate that countries striving to achieve UHC experience declines in mortality rates due to communicable diseases, improvements in key health indicators, and reductions in disease burden (7-12). These findings suggest that efforts to ensure UHC significantly contribute to achieving public health goals and promoting sustainable development (13).

Another goal related to public health within the SDGs is Target 3.d: “Strengthen the capacity of all countries, particularly developing countries, for early warning, risk reduction, and management of national and global health risks.” To monitor this target, Indicator 3.d.1 was established as “International Health Regulations (IHR) capacity and health emergency preparedness” (5). States Parties to the IHR are required to regularly assess and report their existing capacities for public health surveillance and practices to the World Health Organization (WHO) using the IHR States Parties Self-Assessment Annual Reporting Tool (SPAR). Studies in the literature indicate that as IHR core capacity scores improve, better control of communicable diseases and reduced mortality rates are observed (14-18). Strengthening IHR core capacities is expected to support countries’ efforts to prevent public health threats and promote sustainable development (19,20).

Although significant progress has been made in improving public health capacities within the scope of IHR core capacities, recent responses to outbreaks such as the COVID-19 pandemic have raised concerns about the adequacy of IHR implementation alone

(21,22). For instance, despite high IHR core capacity scores and the expectation of better communicable disease control, some high-income countries such as the United States and the United Kingdom experienced devastating impacts from COVID-19 (23). These outcomes highlight the necessity of evaluating not only the adequacy of IHR core capacities but also the accessibility of essential healthcare services within communities. While achieving high IHR core capacity scores are thought to be effective in controlling communicable diseases, access to related healthcare services is considered critically important for successful disease control (24-26).

Literature reviews reveal studies examining the relationship between UHC service coverage and communicable disease control and burden, as well as studies investigating the relationship between IHR core capacities and communicable disease control (7-12,14-18). Furthermore, a limited number of studies have evaluated the relationship between the previous version of the 13 IHR core capacities and UHC (26). However, no recent studies using updated data have assessed the role of UHC service coverage in the relationship between IHR core capacities and mortality rates due to communicable diseases. Therefore, this study aims to determine the mediating role of UHC service coverage in the relationship between IHR core capacities and mortality rates due to communicable diseases. The findings aim to contribute to the literature on UHC service coverage and IHR core capacities and to provide policymakers with an approach to support decision-making in controlling communicable diseases.

## Materials and Methods

### Research Model

In this explanatory cross-sectional study, the research model developed in line with the main objective is presented in Figure 1. According to this model, the independent variable, IHR core capacities, is expected to influence the dependent variable, mortality rates due to communicable diseases, through the mediating variable, UHC service coverage.

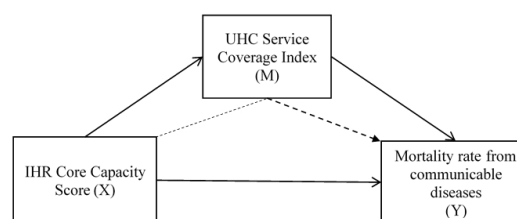


Figure 1. Research model

## Population and Sampling

In this study, no sample selection was made, and efforts were made to obtain data from 194 of the 196 member states of WHO that are parties to the IHR between October 2024 and November 2024. Twelve countries for which IHR core capacity scores were unavailable and one country for which UHC service coverage index and mortality rates due to communicable diseases were inaccessible were excluded from the analysis. Accordingly, the study was conducted using data on IHR core capacity scores, UHC service coverage index, and mortality rates due to communicable diseases from 183 countries.

## Data Collection

In this study, IHR core capacity scores were obtained from the World Health Organization's e-SPAR tool (27). Data for the UHC service coverage index were retrieved from the "Global Health Observatory" database of the World Health Organization (28). Age-standardized mortality rates per 100,000 population due to communicable diseases (including neglected tropical diseases and malaria, HIV/AIDS and sexually transmitted infections, respiratory infections and tuberculosis, intestinal infections, intestinal nematode infections, and other infectious diseases) were obtained from the results of the 2021 Global Burden of Disease study conducted by the Institute for Health Metrics and Evaluation (IHME) (29).

In this study, the Universal Health Coverage (UHC) Service Coverage Index, identified as the mediating variable, is calculated as a standardized index ranging from 0 to 100 for each country. This index is derived from four main health service domains: 1-reproductive, maternal, newborn, and child health; 2-infectious diseases; 3-non-communicable diseases; and 4-service capacity and access, assessed through 14 different sub-indicators. The UHC Service Coverage Index score is obtained by calculating the geometric mean of the scores from these sub-indicators. This index is monitored and calculated by WHO and the World Bank, based on health service indicators reported by countries (5, 6).

The IHR core capacity scores, identified as the independent variable in this study, are managed by WHO and developed under the framework of the International Health Regulations (IHR). The IHR core capacity score consists of 15 core capacity areas, including 1-policy, legal, and normative instruments to implement IHR; 2-IHR coordination, national IHR

focal point functions, and advocacy; 3-financing; 4-laboratory; 5-surveillance; 6-human resources; 7-health emergency management; 8-health services provision; 9-infection prevention and control; 10-risk communication and community engagement; 11-points of entry and border health; 12-zoonotic diseases; 13-food safety; 14-chemical events; and 15-radiation emergencies. These capacities are evaluated using 35 related indicators. Countries that are signatories to the IHR use the State Party Annual Reporting (SPAR) tool each year to assess these indicators. Through this process, the scores for each of the 15 capacities and the overall IHR core capacity score are determined (30). For this study, the IHR core capacity scores for 183 countries were obtained from the previously mentioned databases and used as the independent variable, while the UHC service coverage index was employed as the mediating variable.

During the period when the study was conducted, data for IHR core capacity scores were accessible up to 2023, while data for UHC service coverage and mortality rates due to communicable diseases were available up to 2021. To ensure consistency with the data on the UHC service coverage index and mortality rates due to communicable diseases, IHR core capacity scores for 2021 were included in the study.

## Data Analysis

In the study, skewness and kurtosis coefficients were examined to determine whether the data followed a normal distribution. The skewness value for IHR core capacity was calculated as 0.096, and its kurtosis value was -0.852. For UHC service coverage, the skewness value was -0.393, and the kurtosis value was -1.067. For mortality rates due to communicable diseases, the skewness value was 4.939, and the kurtosis value was 1.974. It is assumed that data are normally distributed when skewness and kurtosis coefficients fall within the range of -2 to +2 (31). Accordingly, the IHR core capacity scores and UHC service coverage index data were assumed to follow a normal distribution. However, it was found that mortality rates due to communicable diseases did not follow a normal distribution. For datasets not exhibiting a normal distribution, various transformation methods can be applied depending on the degree of skewness to approximate a normal distribution. Based on the skewness and kurtosis values and the distribution of mortality rates due to communicable diseases on the histogram, severe positive skewness was identified. Therefore, a logarithmic transformation was applied to

the mortality rates due to communicable diseases to align with their distribution (32). After the logarithmic transformation, the skewness value of mortality rates due to communicable diseases was determined to be -0.343, and the kurtosis value was -0.101. Following this transformation, the mortality rate data were assumed to follow a normal distribution.

In line with the study's objective, IHR core capacity scores were identified as the independent variable, mortality rates due to communicable diseases as the dependent variable, and the UHC service coverage index as the mediating variable. Accordingly, a simple mediation model, as shown in Figure 1, was developed (33). The mediation effect methodology is frequently used in social and health sciences. These research models are based on the assumption that instead of a direct relationship between the independent and dependent variables, the dependent variable is first influenced by the mediating variable, subsequently affecting the dependent variable. Thus, a chain of relationships defining the interaction between the independent and dependent variables is formed. In other words, mediation analysis examines whether the independent variable exerts an indirect effect on the dependent variable through the mediating variable (34,35).

The approach proposed by Baron & Kenny (36) was used to construct the mediation model specified in the study. According to this approach, the mediation model can be developed in four stages (assumptions). First, the independent variable (X) must significantly influence the dependent variable (Y). Second, the independent variable (X) must significantly influence the mediating variable (M). Third, when both the independent (X) and mediating (M) variables are

(34, 36). To develop the research model specified for the study and analyze the mediation effect, regression analyses were performed using the PROCESS V4.2 macro in IBM SPSS Statistics 21 software. To evaluate the mediation effect, Model 4, as proposed by Hayes (33), aligning with this study's research model, was selected and utilized for the analyses.

## Results

The findings of the regression analysis conducted to determine the effect of the IHR core capacity score on mortality rates from communicable diseases are presented in Table 1. According to the results of the analysis, the IHR core capacity score was found to have a significant and negative effect on mortality rates from communicable diseases ( $B=-0.013$ ;  $F=87.20$ ;  $p<0.001$ ). In the established regression model, the IHR core capacity score explains 32% of the total variability in mortality rates from communicable diseases ( $R^2=0.325$ ). Accordingly, it can be stated that an increase in the IHR core capacity score statistically reduces mortality rates from communicable diseases. Based on the findings obtained, the first assumption for mediation analysis proposed by Baron & Kenny (36) has been satisfied.

The findings of the regression analysis conducted to determine the effect of the IHR core capacity score on UHC service coverage are presented in Table 2. According to the analysis results, the IHR core capacity score was found to have a significant and positive effect on the UHC service coverage index ( $B=0.645$ ;  $F=175.16$ ;  $p<0.001$ ). In the established regression model, the IHR core capacity score explains 49% of the total variability in UHC service coverage ( $R^2=0.491$ ). Accordingly, it can be stated that an increase in the

**Table 1.** The effect of IHR Core Capacities on mortality rates from communicable diseases

| Variable                | Beta   | SE    | $\beta$ | t-value | p-value | R     | R <sup>2</sup> | LLCI   | ULCI   |
|-------------------------|--------|-------|---------|---------|---------|-------|----------------|--------|--------|
| Constant                | 3.179  | 0.098 |         | 32.156  | 0.000   |       |                | 2.983  | 3.374  |
| IHR Core Capacity Score | -0.013 | 0.001 | -0.570  | -9.338  | 0.000   | 0.570 | 0.325          | -0.016 | -0.011 |

Constant: Mortality rate from communicable diseases, Beta: Unstandardized regression coefficient, SE: Standard error,  $\beta$ : Standardized Beta, R: Correlation coefficient, R<sup>2</sup>: Coefficient of determination, LLCI: Lower level confidence interval, ULCI: Upper level confidence interval

included in the model, the mediating variable (M) must have a significant effect on the dependent variable (Y). Finally, when the mediating variable (M) is included in the model, the previously significant relationship between the independent (X) and dependent variable (Y) becomes insignificant, indicating full mediation, or weakens, indicating partial mediation

IHR core capacity score statistically increases the UHC service coverage index. Based on the identified findings, the second assumption for mediation analysis proposed by Baron & Kenny (36) has been satisfied.

The findings of the regression analysis conducted to determine the effect of the IHR core capacity score

and the UHC service coverage index on mortality rates from communicable diseases are presented in Table 3. According to the analysis results, the UHC service coverage index was found to have a significant and negative effect on mortality rates from communicable diseases ( $B=-0.017$ ;  $F=113.40$ ;  $p<0.001$ ). The regression model, in which the IHR core capacity score and

direct and indirect effects, was found to be significant and negative ( $B=-0.013$ ;  $p<0.001$ ).

When examining the findings, it was observed that the lower (LLCI) and upper (ULCI) bounds of the bootstrap confidence interval at a 95% confidence level were negative ( $-0.014$ ;  $-0.009$ ). Additionally, the inclusion of both the IHR core capacity score and UHC service

**Table 2.** The effect of IHR Core Capacities on UHC Service Coverage

| Variable                | Beta   | SE    | $\beta$ | t-value | p-value | R     | R <sup>2</sup> | LLCI   | ULCI   |
|-------------------------|--------|-------|---------|---------|---------|-------|----------------|--------|--------|
| Constant                | 23.951 | 3.239 |         | 7.393   | 0.000   |       |                | 17.559 | 30.343 |
| IHR Core Capacity Score | 0.645  | 0.048 | 0.701   | 13.235  | 0.000   | 0.701 | 0.491          | 0.548  | 0.741  |

Constant: UHC Service Coverage Index, Beta: Unstandardized regression coefficient, SE: Standard error,  $\beta$ : Standardized Beta, R: Correlation coefficient, R<sup>2</sup>: Coefficient of determination, LLCI: Lower level confidence interval, ULCI: Upper level confidence interval

the UHC service coverage index are included as independent variables, explains 55% of the total variability in mortality rates from communicable diseases ( $R^2=0.557$ ). Additionally, as previously indicated in Table 2, the significant and negative effect of the IHR core capacity score on mortality rates from communicable diseases was found to be insignificant ( $p=0.169$ ). Based on the findings obtained, the third and fourth assumptions for mediation analysis proposed by Baron & Kenny (36) have been satisfied.

The results of the analysis conducted to examine the mediating role of the UHC service coverage index in the relationship between the IHR core capacity score and mortality rates from communicable diseases are presented in Table 4. According to the analysis, the IHR core capacity score was found to have a significant and negative indirect effect on mortality rates from communicable diseases ( $B=-0.011$ ;  $\text{BootLLCI}=-0.014$ ;  $\text{BootULCI}=-0.009$ ). The direct effect of the IHR core capacity score on mortality rates from communicable diseases was determined to be statistically insignificant and negative ( $B=-0.002$ ;  $p=0.169$ ). The total effect of the IHR core capacity score on mortality rates from communicable diseases, expressed as the sum of the

coverage index in the model rendered the effect of the IHR core capacity score on mortality rates from communicable diseases statistically insignificant ( $p=0.169$ ). These results indicate that the established mediation model demonstrates a significant and complete mediation relationship (34,36). Accordingly, it was concluded that the UHC service coverage index plays a full mediating role in the effect of the IHR core capacity score on mortality rates from communicable diseases.

## Discussion

Acute public health emergencies have the potential to cause devastating impacts in terms of lives lost, mortality, and economic development. Moreover, they severely test countries' healthcare systems and can further deepen existing weaknesses (37). Tools such as IHR core capacities and UHC service coverage indices have been developed in line with the Sustainable Development Goals to combat communicable diseases, a significant public health concern. These tools aim to enhance countries' capacities to combat communicable diseases (3,10-12,15,17). Within this context, the study aimed to

**Table 3.** The effect of IHR Core Capacities and UHC Service Coverage on mortality rates from communicable diseases

| Variable                   | Beta   | SE    | $\beta$ | t-value | p-value | R     | R <sup>2</sup> | LLCI   | ULCI   |
|----------------------------|--------|-------|---------|---------|---------|-------|----------------|--------|--------|
| Constant                   | 3.607  | 0.091 |         | 39.391  | 0.000   |       |                | 3.427  | 3.788  |
| IHR Core Capacity Score    | -0.002 | 0.001 | -0.096  | -1.379  | 0.169   |       |                | -0.005 | 0.001  |
| UHC Service Coverage Index | -0.017 | 0.001 | -0.676  | -9.723  | 0.000   | 0.746 | 0.557          | -0.021 | -0.014 |

Constant: Mortality rate from communicable diseases, Beta: Unstandardized regression coefficient, SE: Standard error,  $\beta$ : Standardized Beta, R: Correlation coefficient, R<sup>2</sup>: Coefficient of determination, LLCI: Lower level confidence interval, ULCI: Upper level confidence interval

**Table 4.** Mediation analysis

| Relationship           | Total Effect        | Direct Effect       | Indirect Effect | Confidence Interval |          | Conclusion            |
|------------------------|---------------------|---------------------|-----------------|---------------------|----------|-----------------------|
|                        |                     |                     |                 | BootLLCI            | BootULCI |                       |
| <b>X &gt; M &gt; Y</b> | -0.013<br>(p=0.000) | -0.002<br>(p=0.169) | -0.011          | -0.014              | -0.009   | Full Mediation Effect |

X: IHR Core Capacity Score, M: UHC Service Coverage Index, Y: Mortality rate from communicable diseases, BootLLCI: Bootstrap lower level confidence interval, BootULCI: Bootstrap upper level confidence interval

determine the mediating role of UHC service coverage in the relationship between IHR core capacities and mortality rates from communicable diseases.

The study found that the IHR core capacity score significantly and negatively affects mortality rates from communicable diseases. A review of the literature reveals studies supporting these findings. In a study conducted by Tsai & Tipayamongkhogul (14), it was noted that IHR core capacity scores play a critical role in the spread of communicable diseases. Furthermore, countries with low IHR core capacity scores were found to have an 11 times higher likelihood of experiencing poor health outcomes compared to countries with high IHR core capacities. Wong et al. (16) reported that during the COVID-19 pandemic, countries with higher IHR core capacity scores were significantly more likely to have lower incidence rates. Another study found that countries with high IHR core capacities experienced lower case and mortality rates during the first 12 weeks of the COVID-19 pandemic (18). As evident, as IHR core capacity scores improve, mortality rates from communicable diseases decrease. They are expected to play an essential role in the early detection, reporting, and control of public health threats (17). However, the devastating outcomes observed even in countries with high IHR core capacities during the COVID-19 pandemic have led to the understanding that, while effective, IHR core capacities alone are not sufficient to combat communicable diseases (21-23). In this context, it is thought that to fully realize the benefits expected from IHR core capacities, they need to be supported by improved access to healthcare services (16).

The analyses revealed that the IHR core capacity score significantly and positively affects the UHC service coverage index. Although the number of studies evaluating the relationship between these variables is limited, a study conducted by Lee et al. (26) identified a significant positive relationship between the IHR core capacity score and UHC. The study determined that the IHR core capacity explains 82.3% of the variance in UHC service coverage. Efforts and investments aimed

at strengthening IHR core capacities contribute to the enhancement of healthcare systems. In this regard, it is understood that efforts to improve IHR core capacities for preparedness against public health threats will also contribute to the achievement of UHC service coverage (22,24).

In the regression model including both the IHR core capacity score and the UHC service coverage index, it was determined that the UHC service coverage index significantly and negatively affects mortality rates from communicable diseases. A study conducted by Saengtabtim et al. (38) found that countries with higher UHC service coverage scores demonstrated better performance in combating the COVID-19 pandemic. Kruk et al. (10) indicated in their study that achieving UHC service coverage can lead to improvements in health outcomes. Hogan et al. (39) identified a relationship between UHC service coverage and life expectancy. Their study revealed that achieving UHC service coverage facilitates effective healthcare delivery and improves health outcomes. Another study found a significant relationship between UHC service coverage and global health security, with the UHC service coverage index explaining 43% of the variance in the global health security index. These findings highlight the critical role of UHC service coverage in improving health outcomes (25). Based on the findings, it is understood that achieving UHC service coverage enhances access to essential healthcare services, thereby improving public health (12,40).

The mediation analysis conducted in this study revealed that the UHC service coverage index plays a full mediating role in the effect of IHR core capacity scores on mortality rates from communicable diseases. In line with the identified full mediation role, it is understood that IHR core capacity has a limited effect on mortality rates from communicable diseases in the absence of access to healthcare services. While IHR core capacities are recognized as a critical tool for controlling communicable diseases, it is evident that these capacities must be supported by access to healthcare services. Efforts by countries to strengthen

their healthcare systems in line with IHR core capacities will enhance their capacities for prevention, detection, and response to combat communicable diseases (19,20). Achieving UHC service coverage will increase access to healthcare services and reduce inequalities (24,41,42). Considering the relationship between IHR core capacities and UHC service coverage, it is understood that these tools should not be addressed in isolation as they are mutually interdependent (16). A systematic review conducted by Shoman et al. (43) found that adequate and efficient health human resources, a robust healthcare system, sufficient service delivery, health financing, service accessibility, leadership, and governance influenced countries' performance in combating the Ebola outbreak. In light of the findings that were presented, it is understood that ensuring both IHR core capacity and UHC service coverage together would enable societies to benefit more from existing healthcare services and contribute to a reduction in mortality rates from communicable diseases.

Human capital is considered an important factor for economic growth. The loss of labor due to communicable diseases and the inability to accumulate human capital emerge as barriers to the economic growth of countries (44). In this context, the combined consideration of IHR core capacities and UHC service coverage can be associated with economic growth in line with sustainable development efforts. While healthcare services are a significant means of combating poverty, they can become an impoverishing factor when effective healthcare coverage and financial protection for all in society are not provided. Therefore, the potential benefits of universal health coverage (UHC) in protecting communities from financial risk and ensuring access to quality healthcare are substantial (41). Achieving universal health coverage is expected to reduce out-of-pocket expenses, thereby mitigating the devastating effects of communicable diseases on society. UHC service coverage, aimed at improving access to healthcare services and reducing inequalities, is closely linked to public health expenditures and social health insurance systems. Although the increase in public health expenditures required to achieve UHC has been criticized, there is a correlation between UHC coverage and countries' GDPs (45). Achieving universal health coverage is anticipated to contribute to the economic growth of countries. In countries such as the Netherlands, France, Italy, and South Korea,

an increase in per capita GDP has been observed following the establishment of universal health coverage. In this regard, public health expenditures required to achieve UHC are expected to contribute to national economies in the long term rather than impose a burden (46). Therefore, it is believed that enhancing IHR capacities supported by universal health coverage will prevent the devastating impacts of communicable diseases, reduce labor force losses, and lead to significant progress toward sustainable development.

### Conclusion

The study demonstrated that the UHC service coverage index plays a full mediating role in the effect of IHR core capacity scores on mortality rates from communicable diseases. The findings indicate that combating communicable diseases requires not only enhancing the physical and technical capacities of healthcare systems but also developing policies to ensure the effective delivery of these capacities to communities. In order to strengthen the resilience of healthcare systems against communicable diseases and reduce mortality rates, UHC policies need to be expanded and supported by IHR core capacities. Accordingly, it is recommended that countries continue their efforts to enhance IHR core capacities in combating communicable diseases and integrate these efforts with UHC policies.

Public health is widely recognized as a fundamental component of economic prosperity, and there is a need for regulations that ensure equal access to healthcare for every individual. In this context, it is recommended to implement regulations aimed at increasing the proportion of public health expenditures within total health expenditures to achieve universal health coverage. Access to healthcare services can be improved through public health expenditures and social insurance systems. Particularly in low- and middle-income countries, the catastrophic effects of out-of-pocket health expenditures on households and the workforce can be mitigated. Finally, it is recommended that developments under IHR and UHC be regularly monitored and transparently reported to ensure that policymakers take these into account during decision-making processes.

The study evaluating the mediating effect of UHC service coverage in the relationship between IHR core capacities and mortality rates from communicable diseases has several limitations. The findings present a

general relationship without considering the economic, social, and cultural characteristics of countries. Given the differences in IHR capacities and UHC policies between low-income and high-income countries, the results cannot be assumed to apply universally to all countries. Future studies could evaluate the relationship between IHR capacities and UHC service coverage for countries with varying income levels. Considering the importance of combating communicable diseases, it is recommended that future research focuses on identifying the challenges encountered in the implementation of IHR and UHC policies. The quality of healthcare services provided was not included in the analysis presented in this study. Even if service capacity is advanced, the quality of the services provided can also significantly influence health outcomes. Therefore, it is suggested that future studies on universal health coverage and service coverage include an evaluation of service quality.

### Ethical Considerations

Ethical approval was not required as the data included in the study and analyzed were obtained from open data sources.

### Conflict of Interest

The author declared no potential conflicts of interest concerning the research, authorship, and/or publication of this article.

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### References

1. Jones KE, Patel NG, Levy MA, et al. Global trends in emerging infectious diseases. *Nature*. 2008;451:990-993.
2. Tulchinsky TH, Varavikova EA. Communicable diseases. *The New Public Health*. 2014;149-236.
3. Anser MK, Islam T, Khan MA, Zaman K, Nassani AA, Askar SE, et al. Identifying the potential causes, consequences, and prevention of communicable diseases (including COVID-19). *Biomed Res Int*. 2020;2020:1-13.
4. World Health Organization (WHO). Communicable and noncommunicable diseases, and mental health. Accessed October 7, 2024. <https://www.who.int/our-work/communicable-and-noncommunicable-diseases-and-mental-health>
5. United Nations. Sustainable development. Accessed November 8, 2024. [https://sdgs.un.org/goals/goal3#targets\\_and\\_indicators](https://sdgs.un.org/goals/goal3#targets_and_indicators)
6. World Health Organization (WHO). UHC service coverage index (3.8.1). Accessed November 9, 2024. <https://www.who.int/data/gho/indicator-metadata-registry/imr-details/4834>
7. Ikeda N, Saito E, Kondo N, Inoue M, Ikeda S, Satoh T, et al. What has made the population of Japan healthy? *Lancet*. 2011;378(9796):1094-1105.
8. Moreno-Serra R, Smith PC. Does progress towards universal health coverage improve population health? *Lancet*. 2012;380(9845):917-923.
9. Hajjar K, Lillo L, Martinez DA, Hermosilla M, Risko N. Association between universal health coverage and the disease burden of acute illness and injury at the global level. *BMC Public Health*. 2023;23:735.
10. Kruk ME, Gage DA, Joseph NT, Danaei G, Garcia-Saiso S, Salomon JA. Mortality due to low-quality health systems in the universal health coverage era: a systematic analysis of amenable deaths in 137 countries. *Lancet*. 2018;382(10160):2203-2212.
11. Konca M. The effect of universal health coverage on health outcomes: the case of Türkiye. *Alanya Academic Review-Journal*. 2024;8(2):490-502.
12. Moon D, Jeon J, Park J, Choi MH, Kim MH, Choi H. Universal health coverage saves more lives among severely ill COVID-19 patients: a difference-in-differences analysis of individual patient data South Korea. *Health Res Policy Sys*. 2024;22:1-12.
13. Kieny MP, Bekedam H, Dovlo D, Fitzgerald J, Habicht J, Harrison G, et al. Strengthening health systems for universal health coverage and sustainable development. *Bull World Health Organ*. 2017;85(7):537-539.
14. Tsai FJ, Tipayamongkhogul M. Are countries' self-reported assessments of their capacity for infectious disease control reliable? Associations among countries' self-reported international health regulations 2005 capacity assessments and infectious disease control outcomes. *BMC Public Health*. 2020;20(282):1-9.
15. Tsai FJ, Lin CP, Turbat B. Exploring association between countries' self-reported international health regulations core capacity and COVID-19 control outcomes. *J Glob Health Rep*. 2021;5:e2021017.

16. Wong MCS, Huang J, Wong SH, Teoh JYC. The potential effectiveness of the WHO international health regulations capacity requirements on control of the COVID-19 pandemic: a cross-sectional study of 114 countries. *J R Soc Med*. 2021;114(3):121-131.
17. Satria FB, Tsai FJ, Turbat B. Analyzing self-evaluation capacity scores related to infectious disease control in international health regulations during the first year of the COVID-19 pandemic. *Sci Rep*. 2022;12:1-8.
18. Duong DB, King AJ, Grépin KA, Hsu LY, Lim JF, Phillips C, et al. Strengthening national capacities for pandemic preparedness: a cross-country analysis of COVID-19 cases and deaths. *Health Policy Plan*. 2022;37(1):55-64.
19. Wamala JF, Okot C, Makumbi I, Natseri N, Kisakye A, Nanyunja M, et al. Assessment of core capacities for the International Health Regulations (IHR[2005]) – Uganda, 2009. *BMC Public Health*. 2010;10(Suppl 1):1-9.
20. Liu B, Sun Y, Dong Q, Zhang Z, Zhang L. Strengthening core public health capacity based on the implementation of the international health regulations (IHR) (2005): Chinese lessons. *Int J Health Policy*. 2015;4(6):381-386.
21. Kandel N, Chungong S, Omaar A, Xing J. Health security capacities in the context of COVID-19 outbreak: an analysis of international health regulations annual report data from 182 countries. *Lancet*. 2020;395(10229):1047-1053.
22. Gostin LO, Katz R. The international health regulations: the governing framework for global health security. *Milbank Q*. 2016;94(2):264-313.
23. Fukuda-Parr S. When indicators fail: SPAR, the invisible measure of pandemic preparedness. *Policy and Society*. 2022;41(4):528-540. doi:10.1093/polsoc/puac024
24. Kluge H, Martin-Moreno JM, Emiroglu N, Rodier G, Kelley E, Vujnovic M, et al. Strengthening global health security by embedding the international health regulations requirements into national health systems. *BMJ Glob Health*. 2018;3(1):1-7.
25. Assefa Y, Hill PS, Gilks CF, Damme WV, van de Pas R, Woldeyohannes S, et al. Global health security and universal health coverage: understanding convergences and divergences for a synergistic response. *PLoS One*. 2020;15(12):1-16.
26. Lee Y, Kim S, Oh J, Lee S. An ecological study on the association between international health regulations (IHR) core capacity scores and the universal health coverage (UHC) service coverage index. *Global Health*. 2022;18:1-13.
27. World Health Organization (WHO). IHR Score per capacity. Accessed September 3, 2024. <https://extranet.who.int/e-spar/Home/CapacityScoreDetails>
28. World Health Organization (WHO). The Global Health Observatory. Accessed September 3, 2024. <https://www.who.int/data/gho/data/indicators/indicator-details/GHO/uhc-index-of-service-coverage>
29. Institute for Health Metrics and Evaluation (IHME). Global burden of disease (GBD) results. Accessed September 3, 2024. <https://vizhub.healthdata.org/gbd-results/>
30. World Health Organization (WHO). Electronic IHR states parties self-assessment annual reporting tool. Accessed March 20, 2025. <https://extranet.who.int/e-spar/#background>
31. George D, Mallery M. SPSS for Windows Step by Step: A Simple Guide and Reference. 17.0 update. Boston, MA: Pearson; 2010.
32. Tabachnick BG, Fidell LS. Using Multivariate Statistics. 7th ed. New York, NY: Pearson; 2019.
33. Hayes AF. Introduction to Mediation, Moderation, and Conditional Process Analysis: A Regression-Based Approach. 2nd ed. New York, NY: The Guilford Press; 2018.
34. Wu AD, Zumbo BD. Understanding and using mediators and moderators. *Soc Indic Res*. 2008;87:367-392.
35. Chan M, Hu P, Mak MKF. Mediation analysis and warranted inferences in media and communication research: examining research design in communication journals from 1996 to 2017. *Journal Mass Commun Q*. 2022;99(2):463-486.
36. Baron RM, Kenny DA. The moderator-mediator variable distinction in social psychological research: conceptual, strategic, and statistical considerations. *J Pers Soc Psychol*. 1986;51(6):1173-1182.
37. Doble A, Sheridan Z, Razavi A, Wilson A, Okereke E. The role of international support programs in global health security capacity building: a scoping review. *PLOS Glob Public Health*. 2023;3(4):1-21.
38. Saengtabtim K, Tang J, Leelawat N, Egawa S, Suppasri A, Imamura F. Universal health coverage

- mitigated COVID-19 health-related consequences in Asia Oceania. *Int J Disaster Risk Reduct.* 2023;92:1-15.
39. Hogan DR, Stevens GA, Hosseinpour AR, Boerma T. Monitoring universal health coverage within the sustainable development goals: development and baseline data for an index of essential health services. *Lancet Glob Health.* 2018;6(2):e152-e168.
40. Gaffney AE, Hawks L, Bor DH, Wollhandler S, Himmelstein DU, McCormick D. 18.2 million individuals at increased risk of severe COVID-19 illness are un- or underinsured. *J Gen Intern Med.* 2020;35:2487-2489.
41. Frenk J, de Ferranti D. Universal health coverage: good health, good economics. *Lancet.* 2012;330(9845):862-864.
42. O'Connell T, Rasanathan K, Chopra M. What does universal health coverage mean? *Lancet.* 2014;383(9913):277-279.
43. Shoman H, Karafillakis E, Rawaf S. The link between the West African Ebola outbreak and health systems in Guinea, Liberia, and Sierra Leone: a systematic review. *Global Health.* 2017;13(1):1-22.
44. Goenka A, Liu L. Infectious diseases, human capital and economic growth. *Econ Theory.* 2020;70:1-47.
45. Wagstaff A, Neelsen S. A comprehensive assessment of universal health coverage in 111 countries: a retrospective observational study. *Lancet Glob Health.* 2020;8(1):39-49.
46. Agustina R, Dartanto T, Sitompul R, Susiloretni KA, Suparmi MKM, Achadi EL, et al. Universal health coverage in Indonesia: concept, progress, and challenges. *Lancet.* 2019;393(10166):75-102