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ЕЖЕМЕСЯЧНЫЙ НАУЧНЫЙ ЖУРНАЛ

Медицинские новости Грузии

საქართველოს სამედიცინო სიახლენი

GEORGIAN MEDICAL NEWS

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GMN: Georgian Medical News is peer-reviewed, published monthly journal committed to promoting the science and art of medicine and the betterment of public health, published by the GMN Editorial Board since 1994. GMN carries original scientific articles on medicine, biology and pharmacy, which are of experimental, theoretical and practical character; publishes original research, reviews, commentaries, editorials, essays, medical news, and correspondence in English and Russian.

GMN is indexed in MEDLINE, SCOPUS, PubMed and VINITI Russian Academy of Sciences. The full text content is available through EBSCO databases.

GMN: Медицинские новости Грузии - ежемесячный рецензируемый научный журнал, издаётся Редакционной коллегией с 1994 года на русском и английском языках в целях поддержки медицинской науки и улучшения здравоохранения. В журнале публикуются оригинальные научные статьи в области медицины, биологии и фармации, статьи обзорного характера, научные сообщения, новости медицины и здравоохранения. Журнал индексируется в MEDLINE, отражён в базе данных SCOPUS, PubMed и ВИНИТИ РАН. Полнотекстовые статьи журнала доступны через БД EBSCO.

GMN: Georgian Medical News – საქართველოს სამედიცინო სიახლენი – არის ყოველთვიური სამეცნიერო სამედიცინო რეცენზირებადი ჟურნალი, გამოიცემა 1994 წლიდან, წარმოადგენს სარედაქციო კოლეგიისა და აშშ-ის მეცნიერების, განათლების, ინდუსტრიის, ხელოვნებისა და ბუნებისმეტყველების საერთაშორისო აკადემიის ერთობლივ გამოცემას. GMN-ში რუსულ და ინგლისურ ენებზე ქვეყნდება ექსპერიმენტული, თეორიული და პრაქტიკული ხასიათის ორიგინალური სამეცნიერო სტატიები მედიცინის, ბიოლოგიისა და ფარმაციის სფეროში, მიმოხილვითი ხასიათის სტატიები.

ჟურნალი ინდექსირებულია MEDLINE-ის საერთაშორისო სისტემაში, ასახულია SCOPUS-ის, PubMed-ის და ВИНИТИ РАН-ის მონაცემთა ბაზებში. სტატიების სრული ტექსტი ხელმისაწვდომია EBSCO-ს მონაცემთა ბაზებიდან.

WEBSITE

www.geomednews.com

К СВЕДЕНИЮ АВТОРОВ!

При направлении статьи в редакцию необходимо соблюдать следующие правила:

1. Статья должна быть представлена в двух экземплярах, на русском или английском языках, напечатанная через **полтора интервала на одной стороне стандартного листа с шириной левого поля в три сантиметра**. Используемый компьютерный шрифт для текста на русском и английском языках - **Times New Roman** (**Кириллица**), для текста на грузинском языке следует использовать **AcadNusx.** Размер шрифта - **12**. К рукописи, напечатанной на компьютере, должен быть приложен CD со статьей.

2. Размер статьи должен быть не менее десяти и не более двадцати страниц машинописи, включая указатель литературы и резюме на английском, русском и грузинском языках.

3. В статье должны быть освещены актуальность данного материала, методы и результаты исследования и их обсуждение.

При представлении в печать научных экспериментальных работ авторы должны указывать вид и количество экспериментальных животных, применявшиеся методы обезболивания и усыпления (в ходе острых опытов).

4. К статье должны быть приложены краткое (на полстраницы) резюме на английском, русском и грузинском языках (включающее следующие разделы: цель исследования, материал и методы, результаты и заключение) и список ключевых слов (key words).

5. Таблицы необходимо представлять в печатной форме. Фотокопии не принимаются. **Все цифровые, итоговые и процентные данные в таблицах должны соответствовать таковым в тексте статьи**. Таблицы и графики должны быть озаглавлены.

6. Фотографии должны быть контрастными, фотокопии с рентгенограмм - в позитивном изображении. Рисунки, чертежи и диаграммы следует озаглавить, пронумеровать и вставить в соответствующее место текста **в tiff формате**.

В подписях к микрофотографиям следует указывать степень увеличения через окуляр или объектив и метод окраски или импрегнации срезов.

7. Фамилии отечественных авторов приводятся в оригинальной транскрипции.

8. При оформлении и направлении статей в журнал МНГ просим авторов соблюдать правила, изложенные в «Единых требованиях к рукописям, представляемым в биомедицинские журналы», принятых Международным комитетом редакторов медицинских журналов - http://www.spinesurgery.ru/files/publish.pdf и http://www.nlm.nih.gov/bsd/uniform_requirements.html
В конце каждой оригинальной статьи приводится библиографический список. В список литературы включаются все материалы, на которые имеются ссылки в тексте. Список составляется в алфавитном порядке и нумеруется. Литературный источник приводится на языке оригинала. В списке литературы сначала приводятся работы, написанные знаками грузинского алфавита, затем кириллицей и латиницей. Ссылки на цитируемые работы в тексте статьи даются в квадратных скобках в виде номера, соответствующего номеру данной работы в списке литературы. Большинство цитированных источников должны быть за последние 5-7 лет.

9. Для получения права на публикацию статья должна иметь от руководителя работы или учреждения визу и сопроводительное отношение, написанные или напечатанные на бланке и заверенные подписью и печатью.

10. В конце статьи должны быть подписи всех авторов, полностью приведены их фамилии, имена и отчества, указаны служебный и домашний номера телефонов и адреса или иные координаты. Количество авторов (соавторов) не должно превышать пяти человек.

11. Редакция оставляет за собой право сокращать и исправлять статьи. Корректура авторам не высылается, вся работа и сверка проводится по авторскому оригиналу.

12. Недопустимо направление в редакцию работ, представленных к печати в иных издательствах или опубликованных в других изданиях.

При нарушении указанных правил статьи не рассматриваются.

REQUIREMENTS

Please note, materials submitted to the Editorial Office Staff are supposed to meet the following requirements:

1. Articles must be provided with a double copy, in English or Russian languages and typed or compu-ter-printed on a single side of standard typing paper, with the left margin of **3** centimeters width, and **1.5** spacing between the lines, typeface - **Times New Roman** (**Cyrillic**), print size - **12** (referring to Georgian and Russian materials). With computer-printed texts please enclose a CD carrying the same file titled with Latin symbols.

2. Size of the article, including index and resume in English, Russian and Georgian languages must be at least 10 pages and not exceed the limit of 20 pages of typed or computer-printed text.

3. Submitted material must include a coverage of a topical subject, research methods, results, and review.

Authors of the scientific-research works must indicate the number of experimental biological species drawn in, list the employed methods of anesthetization and soporific means used during acute tests.

4. Articles must have a short (half page) abstract in English, Russian and Georgian (including the following sections: aim of study, material and methods, results and conclusions) and a list of key words.

5. Tables must be presented in an original typed or computer-printed form, instead of a photocopied version. **Numbers, totals, percentile data on the tables must coincide with those in the texts of the articles.** Tables and graphs must be headed.

6. Photographs are required to be contrasted and must be submitted with doubles. Please number each photograph with a pencil on its back, indicate author's name, title of the article (short version), and mark out its top and bottom parts. Drawings must be accurate, drafts and diagrams drawn in Indian ink (or black ink). Photocopies of the X-ray photographs must be presented in a positive image in **tiff format**.

Accurately numbered subtitles for each illustration must be listed on a separate sheet of paper. In the subtitles for the microphotographs please indicate the ocular and objective lens magnification power, method of coloring or impregnation of the microscopic sections (preparations).

7. Please indicate last names, first and middle initials of the native authors, present names and initials of the foreign authors in the transcription of the original language, enclose in parenthesis corresponding number under which the author is listed in the reference materials.

8. Please follow guidance offered to authors by The International Committee of Medical Journal Editors guidance in its Uniform Requirements for Manuscripts Submitted to Biomedical Journals publication available online at: http://www.nlm.nih.gov/bsd/uniform_requirements.html
http://www.icmje.org/urm_full.pdf
In GMN style for each work cited in the text, a bibliographic reference is given, and this is located at the end of the article under the title "References". All references cited in the text must be listed. The list of references should be arranged alphabetically and then numbered. References are numbered in the text [numbers in square brackets] and in the reference list and numbers are repeated throughout the text as needed. The bibliographic description is given in the language of publication (citations in Georgian script are followed by Cyrillic and Latin).

9. To obtain the rights of publication articles must be accompanied by a visa from the project instructor or the establishment, where the work has been performed, and a reference letter, both written or typed on a special signed form, certified by a stamp or a seal.

10. Articles must be signed by all of the authors at the end, and they must be provided with a list of full names, office and home phone numbers and addresses or other non-office locations where the authors could be reached. The number of the authors (co-authors) must not exceed the limit of 5 people.

11. Editorial Staff reserves the rights to cut down in size and correct the articles. Proof-sheets are not sent out to the authors. The entire editorial and collation work is performed according to the author's original text.

12. Sending in the works that have already been assigned to the press by other Editorial Staffs or have been printed by other publishers is not permissible.

Articles that Fail to Meet the Aforementioned Requirements are not Assigned to be Reviewed.

ავტორთა საყურადღებოდ!

რედაქციაში სტატიის წარმოდგენისას საჭიროა დავიცვათ შემდეგი წესები:

1. სტატია უნდა წარმოადგინოთ 2 ცალად, რუსულ ან ინგლისურ ენებზე,დაბეჭდილი სტანდარტული ფურცლის 1 გვერდზე, 3 სმ სიგანის მარცხენა ველისა და სტრიქონებს შორის 1,5 ინტერვალის დაცვით. გამოყენებული კომპიუტერული შრიფტი რუსულ და ინგლისურენოვან ტექსტებში - **Times New Roman (Кириллица)**, ხოლო ქართულენოვან ტექსტში საჭიროა გამოვიყენოთ **AcadNusx.** შრიფტის ზომა – 12. სტატიას თან უნდა ახლდეს CD სტატიით.

2. სტატიის მოცულობა არ უნდა შეადგენდეს 10 გვერდზე ნაკლებს და 20 გვერდზე მეტს ლიტერატურის სიის და რეზიუმეების (ინგლისურ, რუსულ და ქართულ ენებზე) ჩათვლით.

3. სტატიაში საჭიროა გაშუქდეს: საკითხის აქტუალობა; კვლევის მიზანი; საკვლევი მასალა და გამოყენებული მეთოდები; მიღებული შედეგები და მათი განსჯა. ექსპერიმენტული ხასიათის სტატიების წარმოდგენისას ავტორებმა უნდა მიუთითონ საექსპერიმენტო ცხოველების სახეობა და რაოდენობა; გაუტკივარებისა და დაძინების მეთოდები (მწვავე ცდების პირობებში).

4. სტატიას თან უნდა ახლდეს რეზიუმე ინგლისურ, რუსულ და ქართულ ენებზე არანაკლებ ნახევარი გვერდის მოცულობისა (სათაურის, ავტორების, დაწესებულების მითითებით და უნდა შეიცავდეს შემდეგ განყოფილებებს: მიზანი, მასალა და მეთოდები, შედეგები და დასკვნები; ტექსტუალური ნაწილი არ უნდა იყოს 15 სტრიქონზე ნაკლები) და საკვანძო სიტყვების ჩამონათვალი (key words).

5. ცხრილები საჭიროა წარმოადგინოთ ნაბეჭდი სახით. ყველა ციფრული, შემაჯამებელი და პროცენტული მონაცემები უნდა შეესაბამებოდეს ტექსტში მოყვანილს.

6. ფოტოსურათები უნდა იყოს კონტრასტული; სურათები, ნახაზები, დიაგრამები - დასათაურებული, დანომრილი და სათანადო ადგილას ჩასმული. რენტგენოგრამების ფოტოასლები წარმოადგინეთ პოზიტიური გამოსახულებით **tiff** ფორმატში. მიკროფოტოსურათების წარწერებში საჭიროა მიუთითოთ ოკულარის ან ობიექტივის საშუალებით გადიდების ხარისხი, ანათალების შეღებვის ან იმპრეგნაციის მეთოდი და აღნიშნოთ სურათის ზედა და ქვედა ნაწილები.

7. სამამულო ავტორების გვარები სტატიაში აღინიშნება ინიციალების თანდართვით, უცხოურისა – უცხოური ტრანსკრიპციით.

8. სტატიას თან უნდა ახლდეს ავტორის მიერ გამოყენებული სამამულო და უცხოური შრომების ბიბლიოგრაფიული სია (ბოლო 5-8 წლის სიღრმით). ანბანური წყობით წარმოდგენილ ბიბლიოგრაფიულ სიაში მიუთითეთ ჯერ სამამულო, შემდეგ უცხოელი ავტორები (გვარი, ინიციალები, სტატიის სათაური, ჟურნალის დასახელება, გამოცემის ადგილი, წელი, ჟურნალის №, პირველი და ბოლო გვერდები). მონოგრაფიის შემთხვევაში მიუთითეთ გამოცემის წელი, ადგილი და გვერდების საერთო რაოდენობა. ტექსტში კვადრატულ ფჩხილებში უნდა მიუთითოთ ავტორის შესაბამისი N ლიტერატურის სიის მიხედვით. მიზანშეწონილია, რომ ციტირებული წყაროების უმეტესი ნაწილი იყოს 5-6 წლის სიღრმის.

9. სტატიას თან უნდა ახლდეს: ა) დაწესებულების ან სამეცნიერო ხელმძღვანელის წარდგინება, დამოწმებული ხელმოწერითა და ბეჭდით; ბ) დარგის სპეციალისტის დამოწმებული რეცენზია, რომელშიც მითითებული იქნება საკითხის აქტუალობა, მასალის საკმაობა, მეთოდის სანდოობა, შედეგების სამეცნიერო-პრაქტიკული მნიშვნელობა.

10. სტატიის ბოლოს საჭიროა ყველა ავტორის ხელმოწერა, რომელთა რაოდენობა არ უნდა აღემატებოდეს 5-ს.

11. რედაქცია იტოვებს უფლებას შეასწოროს სტატია. ტექსტზე მუშაობა და შეჯერება ხდება საავტორო ორიგინალის მიხედვით.

12. დაუშვებელია რედაქციაში ისეთი სტატიის წარდგენა, რომელიც დასაბეჭდად წარდგენილი იყო სხვა რედაქციაში ან გამოქვეყნებული იყო სხვა გამოცემებში.

აღნიშნული წესების დარღვევის შემთხვევაში სტატიები არ განიხილება.

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THE PATTERN OF COVID-19 DISTRIBUTION AMONG CONTINENTS: AN EXAMINATION AFTER THIRTY-FOUR MONTHS

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Abstract.

It has been more than 34 months since the severe acute respiratory syndrome coronavirus 2 that causes the COVID-19 pandemic emerged. However, understanding of COVID-19 is still evolving, and COVID-19 statistics are dynamic. The purpose of this study was to investigate the pattern of distribution of COVID-19 in the six continents by the end of October 2022 and compare it to the end of 2020 and 2021. Online data of distribution was successfully recruited from the "Worldometer" website. By the end of October 2022, nearly 6.8 billion COVID-19 tests have been performed, resulting in around 636 million cases detected, while about 6.6 million deaths were registered. The year 2021 was worse than 2020, while the first 10 months of 2022 witnessed the largest number of detected cases (55% of all cases recorded). The distribution of deaths and cases has not been consistent between continents. The number of cases/deaths is proportional to the number of tests performed. The largest share of tests was carried out in Europe (41%), while fewer tests were conducted in Africa (1.6%), and therefore, fewer cases and deaths were recorded. In conclusion, between countries, as well as across continents, the number of COVID-19 cases/deaths/tests and the case-fatality rate vary significantly, and over time, which suggest considerable uncertainty over the exact COVID-19 statistics worldwide. The definition of suspected cases should be clear, appropriate, and internationally standardized. Only when an international standard is agreed upon will we be able to make fair comparisons.

Key words. COVID-19, coronavirus, continent, case-fatality, tests.

Introduction.

Coronaviruses co-exist with humans and animals worldwide, and these viruses continuously undergo genetic mutation (as other viruses) so that countless variants are generated [1]. In general, coronaviruses are responsible for 10–20% of respiratory infections and generate symptoms of the common cold [1]. Many infected individuals remain asymptomatic [2]. Others experience mild symptoms such as cough and sore throat whilst some additionally develop fever and joint pains [1]. Severe illness occurs mainly in the elderly and can take a fatal course, particularly in patients with pre-existing illnesses [1]. Thus, even cold coronaviruses (such as Human Coronavirus OC43) can be associated with case-fatality rates (CFR) of 8% when circulating within nursing homes [3].

The severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) that causes "coronavirus disease 2019" (COVID-19) was first isolated from biological samples in Wuhan, China, in December 2019 [4]. The virus was identified as a member of the genus beta-coronavirus, grouping it with severe acute respiratory syndrome (SARS) and Middle East Respiratory Syndrome (MERS) [4]. The virus spread internationally within 2 months of first being identified, and it was found to be transmitted via close human-to-human contact [5]. On March 11, 2020, the World Health Organization (WHO) declared the SARS-CoV-2 outbreak a global pandemic [6].

COVID-19 was described as a distinct new disease [6]. However, from the start, there were no distinctive symptoms. COVID-19 can often present as a common cold-like illness [6]. The spectrum of symptomatic infection ranges from mild to critical; most infections are mild [7]. Among patients with symptomatic COVID-19, cough, myalgias, and headache are the most commonly reported symptoms [7]. Other features, including diarrhea, sore throat, runny nose, and smell or taste abnormalities, are also well documented [7]. Pneumonia is considered the most frequent serious manifestation of infection, characterized primarily by fever, cough, dyspnea and bilateral infiltrates on chest imaging [7,8].

Asymptomatic infections with SARS-CoV-2 have been well documented [7,9,10]. One meta-analysis found that 40.5% of SARS-CoV-2-infected individuals were asymptomatic [10]. For this reason, the reported case counts underestimate the overall burden of COVID-19, as only a fraction of acute infections are diagnosed and reported. Seroprevalence surveys in the United States (US) and Europe have suggested that the rate of prior exposure to SARS-CoV-2 exceeds the incidence of reported cases by about ten-fold or more [11].

Since the first reports of cases from Wuhan, cases have been reported on all continents. Globally, over 630 million confirmed cases of COVID-19 have been reported. By the end of 2020, the epidemic reached every country in the world (except North Korea and Turkmenistan), as the "Worldometer" website indicates [12]. Worldometer is a reference website that provides counters and real-time statistics for diverse topics [13]. In 2020, the website attained greater popularity due to hosting statistics relating to the COVID-19 pandemic.

Understanding of COVID-19 is still evolving [7], and COVID-19 statistics are dynamic and could change dramatically. The purpose of this study was to use COVID-19 data to examine the distribution of COVID-19 among the continents (excluding Antarctica) by the end of October 2022 and compare it to the end of 2020 and 2021.

Methods.

All data were taken from the "Worldometer" website [12] unless otherwise specified. We copied the data at the end of each period (2020, 2021, and October 2022), and then we stored the data in Excel files. The data used in this analysis consists of the cumulative incidence (confirmed cases) of COVID-19, the cumulative number of deaths, and the total number of tests performed.

In addition, other important statistics were sought. The CFR is the ratio of deaths from a specific disease to the total number of people diagnosed with the disease during a given period [14]. The CFR is calculated by dividing the number of COVID-19 deaths by the total number of confirmed cases. A CFR is generally expressed as a percentage. Similarly, the "infection-fatality rate" is used for the CFR in outbreaks of infectious diseases; it represents the proportion of deaths among all people diagnosed with infection regardless of their health status. In this study, we used CFR rather than the infection-fatality rate in line with general practice.

The mortality rate is another parameter, but in contrast to CFR, it measures the relative number of deaths from a specific cause within the general population at a given time. In pandemics, the number of specific deaths per million population (the whole population) is usually used [12,15]. Thus, in addition to the absolute numbers, the "Worldometer" website presents the statistics per million population: the number of cases per million population, the number of deaths per million population (D/M), and the number of tests per million population. This helped us when comparing countries/continents because they differ greatly in terms of population.

Statistical analysis was carried out using Statistical Package for Social Sciences (SPSS, version 26). The Spearman correlation coefficient was used to determine the association between different variables. Ethical approval from an Institutional Review Board was not required due to the secondary analysis of publicly available data.

Results.

By the end of 2020, the detected COVID-19 cases globally amounted to around 84 million, and the deaths were about 1.8 million. While more than 1.2 billion COVID-19 tests were performed, some countries have performed many tests, for example, the United Kingdom (UK) tested the equivalent of 81% of its population. Based on the number of COVID-19 deaths, we found that four countries (US, Brazil, India, and Mexico) combined accounted for nearly half of cases (47.5%) and half of the deaths (45%) worldwide. Also, by expanding the circle, we found that 82% of deaths accumulated in 15 countries, see Table 1. Based on the number of deaths per million, Belgium was the second worst country in the world (after San Marino); it has 1,674 deaths per million. Table 2 shows the CFRs of COVID-19 in France in 5 different time frames. The CFR was high initially, but it decreased to 0.43% later. Regarding the six continents, more than one million deaths occurred in Europe and North America (including Mexico and Caribbean countries); see Table 3.

At the end of 2021, the number of cases/deaths/tests almost tripled worldwide. Compared to 2020, there was not much change in the proportions of distribution of COVID-19 deaths and cases between continents, a relative increase in the proportions of deaths and cases in Asia. Also, there was no significant change in the list of the fifteen countries most affected by COVID-19 based on the number of deaths at the end of 2021 compared to the end of 2020, except for the entry of Indonesia and exit of Spain; see Tables 4-5. Based on the number of deaths

Table 1. *COVID-19 statistics for the fifteen countries most affected globally based on the number of deaths by the end of 2020.*

	No. of cases	No. of deaths	CFR*	D/M*	No. of tests	Population#
US*	20,399,752	353,429	1.73%	1,065	253,330,973	331,002,651
Brazil	7,675,973	194,949	2.54%	914	28,600,000	212,559,417
India	10,286,329	149,018	1.45%	107	172,049,274	1,379,400,000
Mexico	1,413,935	124,897	8.83%	964	3,596,935	128,932,753
Italy	2,107,166	74,159	3.52%	1,227	26,598,607	60,461,826
UK*	2,488,780	73,512	2.95%	1,080	54,892,984	67,886,011
France	2,620,425	64,632	2.47%	989	35,025,374	65,273,511
Russia	3,159,297	57,019	1.80%	391	90,648,889	145,934,462
Iran	1,225,142	55,223	4.51%	653	7,566,946	83,992,949
Spain	1,936,718	50,837	2.62%	1,087	27,016,086	46,754,778
Colombia	1,642,775	43,213	2.63%	845	8,134,396	50,882,891
Argentina	1,613,928	43,163	2.67%	951	4,811,498	45,195,774
Peru	1,012,614	37,621	3.72%	1,133	5,502,884	32,971,854
Germany	1,743,478	34,104	1.96%	406	34,801,593	83,783,942
Poland	1,294,878	28,554	2.21%	755	7,203,973	37,846,611

* CFR: Case-fatality rate, D/M: The number of deaths per million, US: United States, UK: United Kingdom.

As of July 1, 2020.

Table 2. COVID-19 statistics in France in 5 different time frames.

	12 July 2020	end of 2020	July 1, 2021	End of 2021	Nov. 1, 2022
No. of cases	170,752	2,620,425	5,775,301	9,972,800	36,842,910
No. of deaths	30,004	64,632	111,082	123,741	157,047
CFR*	17.50%	2.47%	1.92%	1.24%	0.43%
No. of tests	1,384,633	35,000,000	93,089,184	188,795,159	271,490,188
D/M*	462	989	1,698	1,889	2,395

**CFR: Case-fatality rate, D/M: The number of deaths per million.*

Table 3. COVID-19 statistics among the six continents by the end of 2020(sorted according to the number of deaths per million).

	No. of cases	No. of deaths	CFR*	D/M*	No. of tests	Tests/pop.	Population#
N. America	23,444,633	513,531	2.19%	867	267,000,000	0.45	592,072,212
S. America	13,189,414	362,534	2.75%	842	58,431,015	0.14	430,759,766
Europe	23,650,100	543,626	2.30%	727	363,602,953	0.49	747,636,026
Asia	20,681,909	337,354	1.63%	73	489,193,136	0.11	4,641,054,775
Africa	2,769,841	65,491	2.36%	49	24,543,548	0.02	1,340,598,147
Oceania	47,418	1,048	2.21%	25	12,689,156	0.30	42,677,813
All	**83,783,315**	**1,823,584**	**2.18%**	**234**	**1,215,459,808**	**0.16**	**7,794,798,739**

**CFR: Case-fatality rate, D/M: The number of deaths per million. # As of July 1, 2020.*

Table 4. COVID-19 statistics for the fifteen countries most affected globallybased on the number of deaths by the end of 2021.

	No. of cases	No. of deaths	CFR*	D/M*	No. of tests	Population
US*	55,432,239	846,711	1.53%	2,536	812,410,441	333,903,023
Brazil	22,287,521	619,056	2.78%	2,882	63,776,166	214,817,033
India	34,838,804	481,080	1.38%	344	677,878,255	1,400,272,592
Russia	10,499,982	308,860	2.94%	2,115	240,400,000	146,027,994
Mexico	3,969,686	299,285	7.54%	2,285	12,358,387	130,956,264
Peru	2,292,254	202,653	8.84%	6,021	21,725,629	33,657,752
UK*	12,937,886	148,624	1.15%	2,172	404,382,130	68,418,899
Indonesia	4,262,720	144,094	3.38%	519	63,166,543	277,844,119
Italy	6,125,683	137,402	2.24%	2,278	140,137,606	60,328,929
Iran	6,194,401	131,606	2.12%	1,537	41,982,912	85,598,564
Colombia	5,147,039	129,901	2.52%	2,513	29,565,827	51,693,023
France	9,972,800	123,741	1.24%	1,889	188,795,159	65,489,381
Argentina	5,606,745	117,146	2.09%	2,557	27,954,322	45,815,350
Germany	7,176,448	112,756	1.57%	1,339	89,622,218	84,184,322
Poland	4,108,215	97,054	2.36%	2,569	27,197,479	37,784,650

**CFR: Case-fatality rate, D/M: The number of deaths per million, US: United States, UK: United Kingdom.*

Table 5. *COVID-19 statistics among the six continents by the end of 2021 (sorted according to the number of deaths per million).*

	No. of cases	No. of deaths	CFR*	D/M*	No. of tests	Tests/pop.	Population
S. America	39,742,349	1,191,891	3.00%	2,744	186,030,074	0.43	434,293,623
N. America	65,679,773	1,244,905	1.90%	2,097	911,003,920	1.53	593,698,920
Europe	87,629,455	1,526,741	1.74%	2,041	1,724,887,833	2.31	748,080,258
Asia	84,640,304	1,254,351	1.48%	270	1,698,052,243	0.37	4,643,241,629
Africa	9,798,653	228,968	2.34%	167	87,428,393	0.06	1,372,380,171
Oceania	558,856	4,505	0.81%	105	61,345,825	1.43	42,789,204
All	**288,049,390**	**5,451,361**	**1.89%**	**696**	**4,668,748,288**	**0.60**	**7,834,483,805**

* CFR: Case-fatality rate, D/M: The number of deaths per million.

per million, Peru, a country in South America, became the most affected country followed by ten countries; most are in Europe (Bulgaria, Bosnia and Herzegovina, Hungary, Montenegro, North Macedonia, Georgia, Czechia, Romania, Croatia, and Slovakia), their number of deaths per million ranged from 4,496 in Bulgaria to 3,045 in Slovakia.

As of November 1, 2022, there was no significant change in the list of the fifteen countries most affected by COVID-19 compared to 2021; see Table 6. The mean of CFRs across the world was 1.32%, ranging from zero to 18.08%. Africa was the least continent affected by COVID-19 based on the number of deaths per million, followed by Asia, as shown in Table 7. In the first 10 months of 2022, nearly 348 million cases were recorded, which represents 54.7% of all cases recorded since the beginning of the pandemic. Despite the noticeable increase in the number of cases, fortunately, it was not accompanied by a relative rise in the number of deaths, as only 1.1 million deaths were recorded in the first 10 months of 2022, while about 3.6 million deaths were recorded in 2021. Based on the number of deaths per million, Peru remains the worst country, followed by the same 10 countries which were most affected at the end of 2021 (Bulgaria, Bosnia, Hungary… Slovakia).

Overall, for all countries, the correlation was significantly positive (the correlation coefficient=0.856) between the number of cases and the number of tests, as well as between the number of deaths and the number of tests (0.788). Additionally, the number of deaths per million was positively correlated with other variables except for the CFRs. In contrast, the correlation was significantly negative between CFRs and the number of cases and the number of tests per million (see Table 8).

Table 6. *The fifteen countries most affected by COVID-19 globally based on the number of deaths by the end of October 2022.*

	No. of cases	No. of deaths	CFR*	D/M*	No. of tests	Population
US*	99,400,959	1,095,646	1.10%	3,272	1,128,575,628	334,805,269
Brazil	34,878,665	688,270	1.97%	3,196	63,776,166	215,353,593
India	44,655,828	529,077	1.18%	376	901,093,208	1,406,631,776
Russia	21,434,758	390,247	1.82%	2,676	273,400,000	145,805,947
Mexico	7,111,119	330,393	4.65%	2,511	18,600,671	131,562,772
Peru	4,156,924	217,012	5.22%	6,443	35,746,266	33,684,208
UK*	23,898,489	193,673	0.81%	2,827	522,526,476	68,497,907
Italy	23,531,023	179,101	0.76%	2,972	252,677,943	60,262,770
Indonesia	6,497,786	158,663	2.44%	568	110,536,735	279,134,505
France	36,842,910	157,047	0.43%	2,395	271,490,188	65,584,518
Germany	35,649,648	153,814	0.43%	1,834	122,332,384	83,883,596
Iran	7,557,805	144,580	1.91%	1,681	54,358,591	86,022,837
Colombia	6,309,716	141,837	2.25%	2,753	36,724,183	51,512,762
Argentina	9,718,875	129,991	1.34%	2,825	35,716,069	46,010,234
Poland	6,341,296	118,131	1.86%	3,130	37,641,363	37,739,785

** CFR: Case-fatality rate, D/M: The number of deaths per million, US: United States, UK: United Kingdom.*

Table 7. *COVID-19 statistics among the six continents by the end of October 2022 (sorted according to the number of deaths per million).*

	No. of cases	No. of deaths	CFR*	D/M*	No. of tests	Tests/pop.	Population
S. America	64,447,745	1,332,969	2.07%	3,045	237,653,983	0.54	437,694,443
Europe	234,475,143	1,942,549	0.83%	2,599	2,778,426,689	3.72	747,543,837
N. America	117,850,921	1,552,847	1.32%	2,596	1,262,347,121	2.11	598,140,916
Oceania	12,620,052	21,586	0.17%	497	88,291,944	2.03	43,469,030
Asia	193,886,632	1,487,935	0.77%	316	2,310,875,850	0.49	4,711,356,783
Africa	12,673,817	257,854	2.03%	183	108,756,579	0.08	1,406,728,744
All	**635,954,310**	**6,595,740**	**1.04%**	**830**	**6,786,352,166**	**0.85**	**7,944,933,753**

** CFR: Case-fatality rate, D/M: The number of deaths per million.*

Table 8. *The correlation test between the different variables.*

Correlations								
		No. of deaths	CFR#	Deaths/ million	No. of cases	Cases/ million	No. of tests	Tests/ million
No. of deaths	Pearson Correlation	1	.061	.284**	.887**	.021	.788**	-.005-
	Sig. (2-tailed)		.367	.000	.000	.754	.000	.945
	N	223	223	223	223	223	213	213
CFR#	Pearson Correlation	.061	1	.007	-.053-	-.397-**	-.051-	-.267-**
	Sig. (2-tailed)	.367		.923	.429	.000	.460	.000
	N	223	228	223	228	228	214	214
Deaths/ million	Pearson Correlation	.284**	.007	1	.211**	.468**	.156*	.215**
	Sig. (2-tailed)	.000	.923		.002	.000	.022	.002
	N	223	223	223	223	223	213	213
No. of cases	Pearson Correlation	.887**	-.053-	.211**	1	.149*	.856**	.056
	Sig. (2-tailed)	.000	.429	.002		.025	.000	.417
	N	223	228	223	228	228	214	214
Cases/ million	Pearson Correlation	.021	-.397-**	.468**	.149*	1	.091	.560**
	Sig. (2-tailed)	.754	.000	.000	.025		.185	.000
	N	223	228	223	228	228	214	214
No. of tests	Pearson Correlation	.788**	-.051-	.156*	.856**	.091	1	.206**
	Sig. (2-tailed)	.000	.460	.022	.000	.185		.002
	N	213	214	213	214	214	214	214
Tests/ million	Pearson Correlation	-.005-	-.267-**	.215**	.056	.560**	.206**	1
	Sig. (2-tailed)	.945	.000	.002	.417	.000	.002	
	N	213	214	213	214	214	214	214

*** Correlation is significant at the 0.01 level (2-tailed).*

** Correlation is significant at the 0.05 level (2-tailed).*

 # CFR: Case-fatality rate.

Discussion.

At the beginning of the pandemic, most people -including experts- feared that the continent of Africa would suffer more from the recently discovered virus. Certainly, their expectations seemed logical for several reasons, including extreme poverty, widespread hunger, overcrowding in some countries, their lack of infrastructure, and the presence of a number of endemic diseases such as malaria and AIDS [16].

But was this the case? Since the beginning of the pandemic, COVID-19 statistics indicate that the continent of Africa, which constitutes approximately 17% of the world's population, is less affected by this virus compared to others. By the end of 2020, Africa had recorded about 3.3% of all COVID-19 cases and only 3.5% of all deaths. Africa was better than many high-income countries. For example, the UK, with a population of 68 million people, recorded by the end of 2020 nearly 2.5 million cases, and about 73.5 thousand deaths, ahead of the entire continent of Africa. The scenario in 2021 and the first 10 months of 2022 was almost the same. In 2021, COVID-19 deaths in Africa represented about 4.2% of all deaths. Moreover, only two countries, South Africa and Tunisia accounted for more than half of the deaths (51%), considering that their population represents only 5% of the continent's population [17].

To find out the possible reason for such a large difference in the numbers across continents, we should focus on the number of COVID-19 tests performed. There is inequality between continents in terms of the number of tests performed. In Africa, by the end of October 2022, only 108 million tests (1.6%) have been conducted despite the large continent's population. The largest number of tests were conducted in Europe, where 2.78 billion (41%) tests were performed, and the population of Europe represents only 9% of the world's population. Moreover, more than 1.1 billion tests have been performed only in the US, more than three times its population, and this represents about 16.6% of the tests performed worldwide. Additionally, France, Spain, the UK, and Italy have performed tests more than the number of their population. For example, Spain has performed ten times more tests (471 million) than its population. In short, Europe has tested the equivalent of nearly four times more than its population while Africa has tested the equivalent of 8% only of its population, as shown in Table 7.

Statistically, the number of COVID-19 cases is proportional to the number of tests performed. This could lead to the finding of many cases as a function of the number of PCR tests conducted. For example, if 10% of a particular population is PCR positive, the number of PCR positives will depend on the size of the sample. This means that the more PCR test is carried out, as in the US, the larger the fraction of the population that is confirmed. With fewer tests, as in Africa, fewer cases will be discovered. Ultimately, this means that the number of confirmed cases (PCR positives) cannot be used to tell if the pandemic is advancing, as seen in 2022 when 348 million cases (55% of all cases recorded) were recorded but without a similar increase in the number of deaths. As the end of 2021 approached, specifically in December (a season of colds in the north hemisphere), COVID-19 cases began to increase significantly worldwide, and the number of daily cases increased until it reached its peak on January 21, when 3,840,468 cases were recorded—the highest number ever since the beginning of the pandemic. Unlike the years 2020 and 2021, when it was being recorded less than 800,000 cases per day, the number of daily cases increased to more than one million, reaching two and three million.

The US was the worst country based on the absolute numbers, with the most cases, deaths, and tests. However, as a proportion of the population, Peru was the worst country as it registered 6,443 deaths per million: almost double that of the US (3,272). Therefore, the deaths per million is a better parameter for the pandemic as it takes into account the population size. Among continents, South America was the most affected.

Likewise, the CFRs don't reflect the true burden of disease/infection. There was a negative correlation between CFRs and the number of cases per million and the number of tests per million. This is probably because the more testing is done, the more cases are discovered, leading to more cases with mild disease and thus lowering the CFRs. In France, which was used as an example of the change in CFR over time (Table 2), during the first four months of declaring the pandemic, by July 12, 1,384,633 tests were performed, and there were 170,000 cases and 30,004 deaths. Therefore, the CFR was high, not because the disease was serious, but because the tests were limited to the severe cases—i.e., mild cases were ignored (selection bias). Later, the cases increased in France, due to the great increase in the number of tests carried out, almost as in many other countries, thus, the CFR decreased. On November 7, 2020, France recorded 83,324 new cases, and this number was the largest up to the end of November 2021.

It is clear that the current COVID pandemic follows previous epidemics: initial CFRs start high and trend downwards [18]. CFRs across countries vary widely depending on the number of tests, who is tested, and for what reasons. There is no consistency across the world [17,18]. On the other hand, COVID-19 has caused a marked increase in deaths across the world, but there is significant variation between countries. Some of this variation can be accounted for by differences in the way countries attribute the cause of death (often done by a medical examiner but can be subjective) [14].

Definitions of important diseases are often surprisingly loose, perhaps embarrassingly so. Diseases are usually identified by their signs and symptoms, but a number of diseases, especially infectious diseases, are associated with the same symptoms. Specifically, the spectrum of COVID-19 symptoms is wide. Symptoms include almost every respiratory symptom, and almost every general symptom, such as fever, malaise, as well as some gastrointestinal symptoms. However, as with other viruses, none of these findings definitively establish the diagnosis of COVID-19 without microbiologic testing [19].

The most important difference between COVID-19 and SARS is the case definition. The WHO has issued updated case definitions for SARS during the outbreak [20]. In contrast to the definition for SARS, a confirmed case of COVID-19 does not require the criteria for a suspect case to be met, but simply a positive PCR test [21]. Furthermore, laboratory diagnostic tests for SARS and MERS require the detection of viruses by an assay for viral RNA present in two separate samples [22,23]. Moreover, the laboratory diagnosis of COVID-19 is a problem, especially if not correlated with the clinical condition, because of the absence of a definitive reference standard to diagnose

or rule out COVID-19 infection [24]. Evidence is rapidly emerging on the effectiveness of tests for COVID-19 diagnosis, but important uncertainties about their effectiveness and most appropriate application remain [24].

As of November 1, 2022, the number of COVID-19 tests performed had reached nearly 6.8 billion resulting in approximately 635 million detected cases. It is increasingly clear that current testing strategies are not capturing everybody suffering from symptoms suggestive of COVID or has an epidemiologic link, as well as a subclinical infection problem. So, the number of detected cases represents a small percentage of the actual number of COVID-19 [7,11], simply multiply the number by ten to find the actual minimum number, i.e., at least 6.5 billion infections have already occurred. One study that used multiple data sources, estimated that by November 2021, over 3 billion individuals, or 44% of the world's population, had been infected with SARS-CoV-2 at least once [11].

One amazing thing about 2021 is that some countries suddenly recorded a rapid increase in the number of COVID-19. For example, at the end of 2020, Vietnam recorded only 35 deaths from COVID-19, but by the end of 2021 the number became 32,394; the number has multiplied 925 times, Thailand as well (61 deaths in 2020 *vs.* 21,698 deaths in 2021) [12]. There is no logical justification for this rise, but it is clearly backed by the large and sudden increase in the number of tests. For example, in Vietnam, about 1.4 million tests were performed in 2020, but the number became 75 million at the end of 2021. North Korea did not record any cases of COVID-19 until May 2022, and in just two months it recorded approximately 4.7 million cases with 74 deaths [25]. North Korean health authorities have relied on the presence of fever to diagnose COVID-19 since their discovery of the first case on May 12 [25]. Such an example causes confusion about how the disease is diagnosed around the world.

Regarding the rate of positive COVID-19 tests (number of confirmed cases/number of tests in a given period), there is a big difference across countries. For example, at the end of October 2022, the rate of positive tests in the US was 8.8%, while it was 54.7% and 38.2% in Brazil and Mexico, respectively. It is important to point out that Brazil and Mexico did less testing than the US as shown in Table 6; this is probably due to their less capacity. Similarly, the rate of positive tests in Asia and Europe was about 8.4% while it was around 9.3% and 27.2 in North America and South America, respectively. In South Korea, which adopted a strategy of wide testing for SARS-CoV-2 from the start [15], the positivity rate was 162% [12], this possibly means that South Korea has adopted clinical diagnostic methods or has not updated the data as it should.

Furthermore, studies have shown that prolonged shedding or sporadic detection of SARS-CoV-2 RNA can occur long after symptom resolution [26,27]. Adding to these clinical complexities is the demand for testing for SARS-CoV-2 at all stages of diseases, frequently driven by the screening of asymptomatic persons, something that traditionally has not happened with other viral respiratory diseases [28]. This can lead to positive results from PCR tests, with high cycle threshold (Ct) values near the test's limit of detection [28]. Ct plays an important role in COVID-19 testing. The Ct refers to the number of cycles in an RT-PCR assay needed to amplify viral RNA to reach a detectable level. The Ct value can thus indicate the relative viral RNA level in a specimen (with lower Ct values reflective of higher viral levels). The laboratories generally do not provide the Ct value with the qualitative PCR result [29]. Furthermore, Ct values are not standardized across labs.

Given the relatively high rate of asymptomatic COVID-19 and long-term RNA positivity in some persons, an unexpected positive result can raise questions about the epidemiological significance or contagiousness [28]. Different Ct settings may influence COVID-19 diagnosis. Several investigators have examined the correlation between PCR Ct values and the ability to isolate the virus in cell culture [30,31]. La Scola et al. were unable to isolate the virus from any specimens with CT values ≥34, the authors suggest that patients with Ct above 33-34 are not contagious and thus can be discharged from hospital care [30]. Other researchers were unable to isolate the virus from specimens with Ct values >24 [31]. Therefore, the way the test is performed and interpreted may influence the results of COVID-19 testing; if a high Ct is chosen, it will lead to the detection of many cases that do not usually present a public health risk, taking into account the high analytic sensitivity of PCR tests in ideal settings (i.e., they are able to detect low levels of viral RNA in test samples known to contain viral RNA) [29]. Therefore, the PCR positive indicates the presence of a fragment of viral RNA, but that does not necessarily mean infectivity, especially with high Ct. This could justify the big difference in the percentages of positive COVID-19 tests worldwide.

Moreover, the rate of positive COVID-19 tests might significantly change over time in the same country. For example, the percentage of positive tests in France in the first 6 months of 2020 was about 12%, but it declined in 2021 (4.8%). What is striking, however, is that the percentage of positive tests in the first half of 2022 rose to 25%. The significant rise in the number of cases seen in 2022 may be due to a higher proportion of positive tests (due to the selection of a high Ct and/or examining more sick persons) as well as the increased number of tests. So, standardized criteria for who should be tested and standardized criteria for when a result is considered positive should be internationally agreed upon. Since pneumonia is considered the most frequent serious manifestation of infection with SARS-CoV-2 [7], it might be appropriate that the case definition criteria include lower respiratory symptoms, such as dyspnea, with abnormal vital signs and chest x-ray abnormalities suggestive of pneumonia with a history of contact with a confirmed case of COVID-19, as with the case definition of SARS [20], not only upper respiratory tract symptoms.

Finally, there are limitations to this study. Some of these limitations include that the criteria used to identify suspected cases, diagnose COVID-19, determine deaths, and report the numbers vary somewhat from country to country and usually change over time. The lack of standardization has complicated efforts to track the pandemic in near real-time [32]. Moreover, the current study did not take into account the effect of demographic data and vaccination coverage. On the other hand, this study provides an updated overview of COVID-19 statistics around the world and enables the reader to understand the changes in statistics over time.

Conclusions.

The COVID-19 pandemic began at the end of 2019, the year 2020 witnessed 1.8 million deaths, but the number of cases and deaths tripled in the following year. The distribution of deaths and cases has not been consistent between continents. The reason for this is that there were no standardized criteria for who should be tested nor standardized criteria for when a result is considered positive. What is certain is that the number of cases/deaths is proportional to the number of tests performed. The largest share of tests was carried out in Europe (41%), while fewer tests were conducted in Africa (1.6%).

Between countries, as well as across continents, the CFRs vary significantly, and over time, which suggests considerable uncertainty over the exact CFRs. The definition of suspected cases should be clear and fixed over time. This is, however, discarded when it comes to a confirmatory diagnosis of COVID-19 and replaced by a single PCR test result. Only when an international standard is agreed upon will we be able to make fair comparisons.

Conflict of interest statement.

The author declares no conflict of interest. Also, he did not receive any funds.

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