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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.
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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.

Содержание:

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THE IMPACT OF CLIMATE CHANGE ON INFECTIOUS DISEASES: A COMPREHENSIVE ANALYSIS OF VECTOR-BORNE DISEASES, WATER-BORNE DISEASES, AND PUBLIC HEALTH STRATEGIES

Geetika Patel M[1], Nidhi[2], Karan Ramlal Gupta[3], Manish Kumar Gupta[4], Sudhir Kumar Gupta[5], Krupa S[6].

[1]Associate Professor, Department of Community Medicine, Parul University, PO Limda, Tal.Waghodia, District Vadodara, Gujarat, India.

[2]Assistant Professor, Department of Nursing, IIMT University, Meerut, Uttar Pradesh, India.

[3]Assistant Professor, Department of Ayurveda, Sanskriti University, Mathura, Uttar Pradesh, India.

[4]Professor, Department of Pharmacy, Vivekananda Global University, Jaipur, India.

[5]Professor, Department of Community Medicine, TeerthankerMahaveer University, Moradabad, Uttar Pradesh, India.

[6]Assistant Professor, Department of Chemistry & Biochemistry, School of Sciences, JAIN (Deemed-to-be University), Karnataka, India.

Abstract.

Climate change is long-term modifications to weather patterns and a rise in extreme weather events. It might modify the hazard to human health and exacerbate current problems. The article explores the scientific data in a description of the effects of Infectious diseases in humans and climate change. It identifies scientific advancements and gaps in potential responses from human civilization and how it might prepare for the changes that come with it by adjusting to them. The impact reflects three aspects, such as climate variables, selected infectious diseases, and infectious disease components. This study demonstrates how vulnerable people are to any ill consequences that climate change may have on their health. Humans can actively influence controllable correlated health impacts by taking proactive measures, such as increasing our understanding of the detrimental effects associated with specific diseases and the patterns in climate change. We can also carefully distribute technology and resources, encouraging exercise and public awareness. It is advised to take the following adaption measures: Considering how infectious diseases and climate change are not the only things that science has discovered and create locally efficient early warning systems for those effects to produce more scientific justifications and go beyond scientific reports. Improve prediction of the spatiotemporal processes behind climate change and changes in infectious illnesses connected at different temporal and spatial scales.

Key words. Climate change, impact on pathogens, human infectious diseases, adaptation, and health.

Introduction.

The term "climate change" describes long-term statistical variations in the weather, such as changes to the normal Climate or the pattern of weather surrounding the average (i.e., extreme weather events). Although there have been some disagreements over the underlying causes of climate change, there is general agreement that the world is undergoing continuous climate change. That humanity has played a substantial role in this process. The main issues caused by Climate change are accelerating the loss of biodiversity and altering the distribution of species, which results in fewer agricultural spaces being available and, consequently, food shortages [1]. Public health measures must be strong and flexible to effectively combat the problems caused by infectious illnesses and climate change. Surveillance systems must be improved to track disease trends and spot outbreak early warning indications. Rapid response procedures should be in place to gather resources and carry out effective initiatives in a timely manner. To lessen the burden of infectious diseases that are susceptible to climate change, public health campaigns emphasizing preventive measures, such as vector control, safe water practices, and hygiene promotion, are essential [2].The infections known as the pathogens that cause vector-borne diseases (VBDs) are transferred by arthropods like sand flies and triatomine bugs, ticks, lice, black flies, tsetse flies, mosquitoes, and mosquitoes. Leishmaniasis, lymphatic filariasis (LF), yellow fever, malaria, dengue, changes disease, Japanese encephalitis, and over Eighty percent of the world's population are in danger from these illnesses, which disproportionately harm the poorest people living in tropical and subtropical regions. Over the world's population in its half is thought to reside in areas with two or more VBDs present, as many of these diseases are co-endemic. VBDs account for Seventy percent of the projected worldwide burden of all infectious diseases, making them a significant contributor to the global burden of disease [3].

Due to a lack of methods for supplying potable water, many populations in underdeveloped nations have to resort to using water from rivers and streams. Therefore, releasing industrial and municipal wastewater that has not been adequately treated (or has not been treated at all) into streams and receiving rivers places the communities' limited resources at risk of water-borne diseases. Due to inadequate water quality, over 80% of infections in underdeveloped nations are water-borne diseases. Poliomyelitis, cholera, hepatitis A, typhoid fever, and amoebic dysentery are common water-borne diseases that are primarily brought on by poor water quality in impoverished nations. Water-borne diseases like cholera are at a lower risk due to less water contamination [4]. Furthermore, multidisciplinary interactions involving epidemiologists, policymakers, and climate scientists are essential to creating evidence-based plans and policies. To foster resilience and lessen the impact of infectious diseases on climate change, public health planning and policy-making procedures must consider climate change [5].

The scientific evidence for how climate change affects human infectious diseases is examined in detail in the study. The study focuses on the pathogen, host, and transmission of human infectious diseases, as well as the observed and anticipated effects of changes in major climatic variables and extreme weather events.

The article's remaining sections are organized as follows: part two discusses related literature, part three discusses methods, part four discusses findings, and Part Five concludes.

Related works.

The study [6] has policies for dealing with climate change in the ASEAN healthcare systems, with specific emphasis on policies dealing with preventing infectious diseases. AMS and the ASEAN's present climate-related health policies are assessed using the Joanna Briggs Institute (JBI) approach. The study's limitations are the year of the study criteria and the English keywords picked for the paper purpose of the search, which reduced the likelihood of incorporating papers in other languages. The article [7] aims to identify the ticks and tick-borne illnesses (TBDs) that are currently present in or may spread to Canada, outline climate change and other changes in the environment affecting the risk of ticks and TBDs, and describe public wellness and clinical strategies for managing ticks and TBDs. The ability to deal with present and prospective TBDs in Canada is made possible by the obvious connection to climate change.

The objective of research [8] is to assess the recent developments in technology, societal changes, and climate change has raised the danger of infectious disease epidemics. The researchers thoroughly analyzed pertinent research on infectious disease outbreaks and global changes in the literature. These epidemics have had an important effect on morbidity and death; they can quickly traverse international boundaries and affect many nations. Research [9] summarizes the probable effects of climate change on food safety and microbiological deterioration at several points in the food chain. Climate change necessitates multidisciplinary approaches to understand and recognize potential developing threats. The global climate change effects on food items can be direct and indirect.

Study [10] evaluates the temperature and precipitation as the primary climatic factors that directly affect the ecosystems affected by vector-borne illnesses. At all scales, from the global to the local, mitigating measures must be developed. These efforts must be coordinated and should capitalize on the drive to accomplish the Sustainable Development Goals. The study [11] aimed to determine how climate factors and deforestation affect the prevalence of malaria and dengue in Mizoram. The study is subjected to Climate Forecast System Reanalysis (CFSR) analysis. The prevalence of malaria may have been directly influenced by ongoing and considerable deforestation, particularly of dense forests, which also contributes to the local increase in temperature.

Research [12] Climate directly affects healthcare, from extreme weather, air pollution, sea-level rise, and a variety of other factors that impact food production and water supplies. Numerous studies indicate that recent climate change has already affected the pathogen peri-Arctic, arctic regions, and vector-host systems in temperate and higher-altitude tropical zones. Classifying and describing how climate change has impacted infectious diseases with cutaneous signs was the goal of the study [13]. For climate-sensitive illnesses, the internet-based MEDLINE and PubMed databases were searched. Dermatologists should know that Climate change and disease prevalence will affect where infectious diseases are found. Many of these illnesses involve cutaneous signs often seen in clinical practice.

The main statistics of the study [14] of infectious diseases are outlined with a special emphasis on the links between food and water-borne illness, environmental variables, and climate change. The unique contribution of WASH to ecological variables related to preventing the spread of infectious diseases in climate change's face. Additionally, improving the health systems' resilience and closing global adaptation gaps would be necessary. Environmental changes impact how water and food-borne diseases spread and are transmitted, according to chapter [15]. The regulation of various elements' cycles, including those of carbon, nitrogen, and oxygen, was greatly influenced by microbes. Climate change would undoubtedly raise temperatures and alter the pattern of precipitation in dry lands around the planet, affecting both their structure and function.

The study [16] presented a thorough analysis of the 2019-nCoV, a new human coronavirus, with an emphasis on the epidemiological trends, biological characteristics, illness preventive and management approaches, and probable routes of transmission. They reviewed the available literature, which included research publications, clinical reports, and public health sources, in order to accomplish our goal. To give a thorough understanding of the subject, they combined data from several sources. A global public health emergency brought on by the development of 2019-nCoV called for quick and diversified research efforts. For the purpose of creating efficient preventive and therapeutic measures, a thorough understanding of the features, modes of transmission, and pathogenic mechanisms of the virus is essential.

Study [17] emphasized the value of point-of-care (POC) diagnostics in the context of managing infectious diseases, especially in the wake of the COVID-19 epidemic. To discuss the topic, the review takes a methodical approach. It starts off by summarizing different POC detection techniques, including magnetic, surface plasmon resonance (SPR), surface-enhanced Raman scattering (SERS), colorimetric, and chemiluminescence biosensors. The development of POC devices, such as lab-on-a-chip (LOC), lab-on-a-disc (LOAD), microfluidic paper-based analytical devices (PADs), lateral flow devices, miniaturized PCR devices, and isothermal nucleic acid amplification (INAA) devices, was then covered in detail. Despite obstacles, POC diagnostics have a bright future, and more study and advancement in this field are vital for efficient disease management and pandemic control.

Study [18] offered thorough recommendations on risk assessment, prevention, diagnosis, and treatment of infections in cardiac implanted electronic devices (CIEDs). Experts in the fields of cardiology, infectious diseases, electrophysiology, and allied disciplines worked together to establish the consensus agreement. The recommendations should be evaluated and put into practice, however, in light of the variable nature of each patient and the dynamic nature of medical research. Optimizing patient outcomes and reducing the effects of CIED infections require ongoing study, collaboration, and adaptation of healthcare procedures.

Study [19] provided therapeutic consensus recommendations for the most effective administration of the polymyxin antibiotics, colistin (polymyxin E) and polymyxin B, to adult patients. An international expert team with members from clinical pharmacy, infectious diseases, pharmacology, critical care, and microbiology was assembled to develop these guidelines. These suggestions are meant to be a useful tool for doctors, researchers, and decision-makers in order to maximize the clinical use of these antibiotics in difficult circumstances where there are few other therapeutic options.

Study [20] verify a next-generation sequencing test that uses microbial cell-free DNA sequencing to identify and quantify a variety of illnesses caused by clinically relevant bacteria, DNA viruses, fungi, and eukaryotic parasites present in plasma samples. The microbial cell-free DNA sequencing assay underwent analytical and clinical confirmation by the researchers. They employed a panel of 13 microorganisms to represent the main elements influencing the effectiveness of the test. The use of this test has the potential to revolutionize non-invasive diagnosis of a variety of infections, but further evaluating its clinical relevance will require continuing validation and field testing.

Materials and Methods.

Pathogen, host, and transmission environment are the three disease components that can be used to evaluate how global climate change affects human infectious diseases. Figure 1 depicts the framework which shows the relationship between climate changes, infectious diseases affecting humans, and human society. Throughout the process, people play a significant and active role. Each of the three types of words used to choose the search phrases for the research study must have at least one item necessary for the data to be returned. The first group of disease components includes the host or vector, disease transmission, and pathogen. The second group covers environmental and meteorological topics, such as climate variables such as temperature, precipitation, and humidity, in addition to frequent extreme weather phenomena like El Nino and meteorological concerns like drought, floods, and heat waves. The third group provides information on the selected infectious diseases, including those that are spread through vectors (like malaria), through water or the air (like cholera), through food (like Campylobacter), or through the immune system of the body.

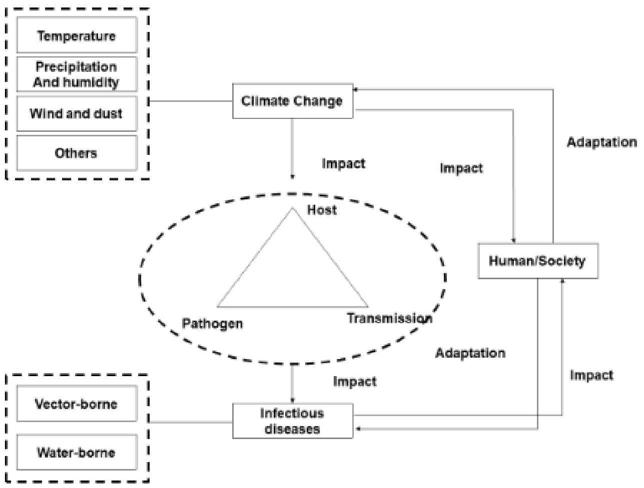

Figure 1. *Framework of climate change on infection diseases.*

The direct effects of global climate change on food systems include altered growth conditions, lower crop yields, shifted harvest dates, and increased pest pressure. Indirectly, it worsens global food insecurity by upsetting supply systems, driving up food costs, impacting nutrition, especially for vulnerable populations.

Human infectious diseases and climate change

Climate variables that change over time include precipitation, wind, sunshine, and temperature. These modifications may impact the environment's accessibility, potential disease transmission methods, persistence, reproduction, or spread of hosts and disease pathogens. Changes in human infectious disease outbreak frequency and severity, as well as in their geographic and seasonal patterns, are typical indicators of the health effects of these factors. The literature on the complex and anticipated effects of climate change covers a wide range of infectious diseases in considerable depth, including water-borne, vector-borne, food-borne, and air-borne infections. The systematic literature review in this section of the article examines how climate change affects the three components of disease: the host, the transmission, and the pathogen.

Pathogens and climate change

Bacteria, parasitic organisms, viruses, fungi, and many other disease-causing agents are examples of pathogens. Climate change can have an immediate impact on a disease's ability to survive, reproduce, and complete its life cycle. It can also have an indirect effect by altering a disease's habitat, surroundings, or rivals. The amount, location, and time of year of pathogen distributions may change. The temperature may affect the life cycle of infections and may involve a disease. A pathogen first requires a specific range of temperatures to survive and develop. For instance, the ecology of the two thresholds of 22–23 in degrees Celsius for a mosquito's optimum growth and 25–26 9 in degrees Celsius for human transmission is critical for the Japanese encephalitis virus (JEV). The second point is that the extrinsic incubation time (EIP) and pathogen growth may both be impacted by a rise in temperature. When P. falciparum is involved, the EIP drops from Twenty-six days at twenty degrees Celsius and thirteen days at twenty-five degrees Celsius. Conversely, Since EIP is more likely to be prolonged at lower ambient temperatures; fewer mosquitoes can endure long enough to spread infections such as dengue. Third, extended heat exposure may cause food and water supplies to become warmer than usual, which may foster algal blooms and the growth of microorganisms.

Precipitation patterns may alter as a result of climate change, which could have an impact on how water-borne viruses spread. Rainfall is essential for the development of germs that cause water-borne diseases. The rainy season is linked to a rise in water fragments, which invokes fecal bacteria since excessive rainfall can bring up fecal germs. However, unusual precipitation during a lengthy drought may cause pathogens to increase, causing a disease outbreak. Pathogens are concentrated in effluent water due to inadequate river flows brought on by droughts and little rainfall. The viruses that cause water-borne diseases are also affected by changes in humidity. For instance, surface water's drying effect reduces the ability of water-borne viruses to survive near the water's surface. Changes in humidity may also alter the virus of diseases transmitted by vectors. The growth of the malaria parasite in Anopheline mosquitoes was discovered to be affected by moisture. During the rainy season, the high humidity and temperature in Yangon and Singapore encourage mosquitoes to spread the dengue virus, contributing to dengue hemorrhagic fever outbreaks in these areas. Another significant climate factor that might impact infectious disease pathogens is sunshine. For instance, during cholera outbreaks, temperature and daylight hours work together to create a favorable environment. Figure 2 shows the graphical representation of various water-borne diseases. Numerous microorganisms pose dangers to human health, making waterborne infections a serious public health concern. The fact that diarrhea makes up 23.8% of these ailments highlights how widely felt it is throughout society. Even while cholera is somewhat less common (2.04%), it nevertheless poses a serious hazard because of its propensity for sudden breakouts. Skin conditions, which account for 5.44% of all waterborne illnesses and frequently result from tainted water sources, highlight the variety of these conditions. 10.37% of cases are of hepatitis and its variants, highlighting the vital importance of water hygiene in preventing viral infections. With a notable 35.71%, dysentery stands out and highlights the urgent need for better sanitation and water treatment. Together, typhoid (9.69%) and fever (9.52%) highlight the enduring nature of aquatic bacteria that cause systemic diseases. Malaria, with a 3.4% prevalence, serves as another reminder of the wide range of illnesses impacted by water sources. In order to battle the wide range of waterborne infections and protect public health, clean water and appropriate sanitation measures are essential.

Vectors/hosts and climate change

Pathogens that cause disease can exist on or in hosts, such as living things like plants or animals. Vectors are intermediary hosts, transferring and disseminating infection to living creatures that become hosts. Animal hosts, especially insects, are the article's main topic. Insect vector population patterns and geographic distribution are closely tied to climatic trends and changes. Geographic distribution, start, and breadth of infectious diseases may differ due to climate change's influence on disease vectors.

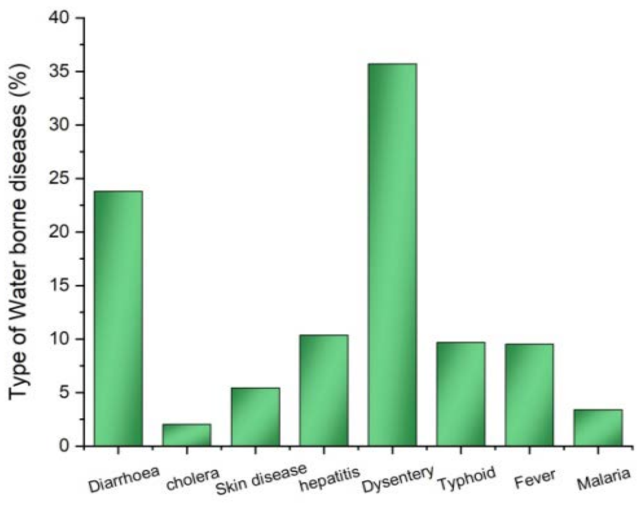

Figure 2. *Various water-Borne diseases.*

Geographically and temporally, temperature influences how disease vectors spread. As temperatures rise, low-latitude insects may establish novel environments in high-altitude and mid or high-latitude regions, which could facilitate the transmission of illnesses worldwide. Some human vector-borne diseases, including the plague, African trypanosomiasis, dengue, yellow fever, Lyme disease, Lyme disease, malaria, and tick-borne encephalitis, have been discovered to have expanded to newer areas. Due to the expansion of ticks, midge habitats, and mosquitoes, most of these diseases have moved to regions with higher latitudes. However, the migration of disease vectors may be constrained by temperature changes. As global warming continues, pathogen hosts like A. aegypti may become extinct in regions where temperatures exceed their limits. Variations in precipitation may also impact the hosts and vectors of illness. It has been found that rainfall correlates well with several infectious diseases spread by vectors. The growth of some mosquito vector larvae accelerates in response to rising temperatures and precipitation. The quantity and quality of these mosquitoes' hatching sites may be limited by droughts, which would reduce the number of vectors and the spread of disease. The malaria vector, adult Anopheline, breeds in tiny, clean-water ponds that naturally occur.

Disease Transmission and Climate Change

According to the mechanism employed, the transmission of a disease can be either direct or indirect. Physical interaction directly, indirect physical contact, droplet contact, fecal-oral transmission, and air-borne transmission are the most common methods of disease transfer from one person to another. The transmission of a disease from a single organism, a vector, or an intermediate host to humans is called "indirect transmission."

Despite considerable confusion regarding the precise mechanisms, the study has demonstrated that climatic factors and weather patterns may influence disease transmission. Instead of concentrating on the workings of disease transmission, this section investigates climate change's possible effects on the news of infectious diseases that affect humans. Since Climate changes may affect an infection's ability to survive, they may immediately impact how quickly diseases spread. Indirectly, the response to climate change by people and vectors/hosts led to a change in the transmission channels. Climate changes alone or combined with other factors, such as rainfall, may affect how diseases spread. By changing the patterns of contact between humans and pathogens, vectors, or hosts, climate change may impact the spread of infectious illnesses. It has been found that during seasons of heavy rainfall and flooding, rat-transmitted diseases can occasionally become more common due to changing patterns of human-pathogen-rodent contact. The way of those people's and other hosts' behaviors, the effects of climate change can be seen in seasonal employment, migration, summer and winter lifestyles, and physical activity. These patterns can significantly impact the way that diseases spread. Climate change may affect disease transmission since it makes people more susceptible to illness and less resistant to infection. The information supplied shows how temperatures have changed and how many mosquitoes have gathered in a positive pool over the four years from 2019 to 2022. The summer and winter seasons show distinct temperature differences across these years. With 480 positive mosquito pools, the summer and winter temperatures in 2019 were 580 and 430 units, respectively. The next year, 2020, had a modest drop in summer and winter temperatures to 460 and 380 units, respectively, along with 400 positive mosquito pools. Temperatures increased substantially in 2021, with summer and winter values reaching 720 and 565 units, respectively, and the positive mosquito pools rising to 510. Temperatures fluctuated in 2022, with summertime lows of 655 units and substantial wintertime lows of 325 units, both having 520 positive mosquito pools. These results illustrate the possible impact of climatic conditions on mosquito populations by indicating a relationship between temperature variations and mosquito pool counts. Figure 3 depicts the positive mosquito pools.

Infectious Diseases and extreme weather

When a meteorological or climatic variable rises above a certain point at the upper (or lower) edge of its measured range, it is considered extreme weather. They consist of meteorological risks on an area or local scale and severe occurrences on a global scale. These events are uncommon, occurring fewer than 5% of the time, but their intensity and frequency have been rising, making them a significant indicator of planetary climate change. The dynamics of human infectious illnesses may alter due to their effects on pathogens, vectors/hosts, or transmission pathways, often accompanied by sudden variations in a few climate variables. But human knowledge differs tremendously when it comes to other extreme weather events. The uncertainty in calculating the spatial and (sometimes) temporal ranges of an extreme weather event limits science's capacity to forecast the effects of infectious illnesses on human health.

Human Aspect and society reaction

It is crucial to understand that social and economic aspects are critical in anticipating how the risk for infectious diseases may vary due to climate change. Due to their inability to successfully handle stresses and challenges, some populations and regions are more susceptible to the increased hazards. The effectiveness of common public health measures, including programs to promote sanitation and access to clean water, as well as biosecurity measures and surveillance efforts to identify and treat infectious diseases, contribute to the levels of vulnerability in a variety of ways, including to the actions taken to lower the costs associated with climate-sensitive health issues and consequences include policies and practices. However, a report on post-hurricane contagious infections in affluent countries revealed no rise. The inability of developing nations to foresee and address health difficulties brought on by climate change results from a lack of proper financial and medical resources, as well as ineffective communication and public health education.

However, a report on post-hurricane contagious infections in affluent countries revealed no rise. The inability of developing nations to foresee and address health difficulties brought on by climate change results from a lack of proper financial and medical resources, as well as ineffective communication and public health education. The extended time that hurricane victims spent in substandard shelters, with contaminated food and water sources, inadequate sanitary facilities, and low immunization rates, was thought to be a contributing factor to the delay. The danger of diarrheal and vector-borne diseases was successfully reduced by implementing public education and awareness programs as one of the intervention measures in response to the warning.

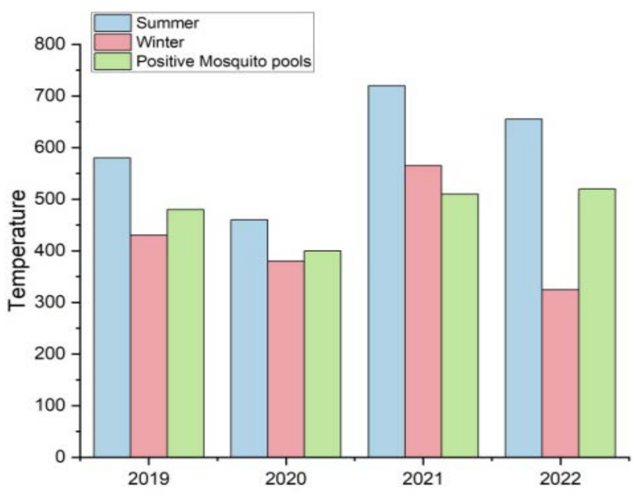

Figure 3. *Positive Mosquito pools.*

Discussion.

Extreme weather events and altering weather patterns are both caused by climate change. Pathogens are impacted by how the environment affects human infectious diseases, hosts/vectors, and disease transmission, particularly regarding climatic variability and extreme weather events. Climate factors initially set boundaries for a group of contagious illnesses geographically and temporally. Changes in the geographical and temporal Climate will affect the growth, survival, reproduction, and interactions between disease pathogens, their hosts, and their interactions with humans. Due to severe weather conditions and meteorological dangers, a lot of infectious are significantly impacted by abrupt and drastic changes in weather. We need help correctly forecasting the patterns and consequences of some of these catastrophic weather phenomena. Finally, because extreme weather usually involves linked shifts of numerous climate variables, it can be difficult to predict the impact of severe weather, particularly large-scale extreme weather occurrences and meteorological risks.

Climate change's harmful effects on people's health do not just affect them passively. We can significantly and proactively assist in reducing and managing the harmful effects of climate change on human health by utilizing proactive adaptation measures. First, there are varied degrees of climate change occurring throughout the world, which produces problems and difficulties for different groups. The precise health effects of climate change on infectious diseases must be understood in each region. Second, despite similar levels of climate change, some areas and population segments are more vulnerable to escalating dangers because they lack resources and cannot cope with the demands and challenges. To reduce the risk to their health posed by climate change, industrialized and advanced societies should work with developing nations and less advanced countries. This is because infections do not limit themself to members of at-risk groups. Thirdly, human susceptibility by using the right adaptation tactics, infectious disease risks can be adjusted to change.

One such example is the timely (re-)allocation of financial and healthcare resources in response to professional evaluations of changes in the spatial and temporal pattern of the risk for human infectious diseases. With these projections, early warning systems that have effectively assisted societies in reducing or mitigating probable health repercussions have been created. Through this overview of the literature, it has become evident to us that there are two sets of scientific investigations on how climate change may affect human infectious illnesses and how such consequences may affect human health. One group looks at the issue through the lens of climate change and makes predictions about what aspects of the Climate may change and lead to increased health hazards. The other category determines the range of climatic factors or meteorological circumstances that are advantageous to or suited for a particular disease's active hosts/vectors or transmission and pathogens.

There is a gap between these two groups' understanding of the patterns of climate change and their capacity to forecast how the environment will change in terms of the health risks provided by infectious illnesses. These two groups frequently need to collaborate or communicate more effectively. These are the causes of infectious diseases affecting human beings into contagious diseases. The public can be aware of this type of infectious disease. The rankings given to various illnesses represent how important treatment and prevention measures are to each condition. Diseases like human granulocytic anaplasmosis and babesiosis place more of an emphasis on prevention than treatment (scoring at 2), indicating that due to the lack of effective treatments, preventative measures are more important. A balanced approach to handling these illnesses is suggested by the fact that West Nile virus, snowshoe hare encephalitis, Lyme disease, Jamestown Canyon, and Cache Valley virus are given equal weight for both treatment and prevention (rated at 2). Last but not least, tularemia receives a slightly lesser emphasis on both prevention and therapy (scoring at 1), suggesting a relatively modest level of worry about both elements of the condition. Based on the various diseases' individual risks and accessible methods, these values collectively serve as a decision-making framework for allocating resources and efforts to combat the various diseases in an effective manner. Figure 4 discover the treatment and prevention of infectious diseases.

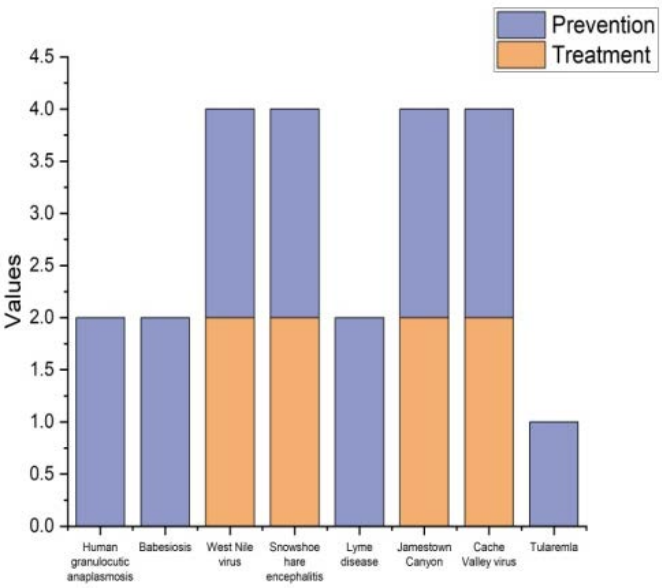

Figure 4. *Treatment and prevention of infection diseases.*

Conclusion.

The advancement of this field's research has yielded important insights into the relationship between climatic factors and particular infectious diseases. It is generally known that human society is susceptible to the negative changes in Climate's impact on health. However, the association between infectious diseases and climate change must be explained scientifically, going beyond empirical evidence. This necessitates a deeper comprehension of the intricate relationships between climate variables and disease dynamics. Another important suggestion is to improve the ability to predict the spatial-temporal dynamics of climate change and how it will affect the spread of infectious illnesses. This entails creating tools and models that can precisely forecast the differences in disease patterns at various scales, enabling more efficient resource allocation and planning.

Additionally, developing regionally suitable early warning systems for the projected negative consequences of climate change on human health is essential. These systems can aid in proactive planning and prompt response to lessen the impact of infectious diseases linked to climate change. The study has indicated some limitations; the most recent developments in the field might need to be covered. It is crucial to consider recent studies and develop research to stay current with our understanding of infectious diseases and climate change. Future studies in this field should concentrate on filling in the gaps and following the suggestions. More thorough research is required to clarify the underlying mechanisms between infectious diseases and climate change. Reducing health hazards can aid in developing targeted initiatives and policies.

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Conflict of interest statement.

The author declares no conflict of interest.

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