EPIDEMIOLOGICAL FEATURES OF BACTERIAL DYSENTERY

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Abstract

Bacterial dysentery (shigellosis) is a severe intestinal infection caused by the bacteria Shigella spp. This article analyzes the global and regional epidemiological features of bacterial dysentery, such as prevalence, demographic characteristics, seasonality, risk groups, climatic and socio-economic factors, as well as antibiotic resistance. associated with antibiotic resistance. The need to improve research, monitoring and preventive measures, improve sanitary and hygienic conditions and take into account climate change is emphasized.

Keywords: Bacterial dysentery, Shigella spp., epidemiology, seasonality, antimicrobial resistance, climatic and socio-economic factors.

Introduction

Bacterial dysentery is a disease caused by bacteria of the genus Shigella (e.g., S. flexneri, S. sonnei, S. dysenteriae, S. boydii) characterized by blood- or mucus-stained diarrhea, fever, and abdominal pain. The disease is a serious threat to public health globally, especially in developing countries, because it is easily transmitted through water and food and develops at a low infectious dose (10–100 bacterial cells). According to the World Health Organization (WHO), shigellosis in 2016 was the second leading cause of death from diarrheal diseases among all age groups, causing about 164 million cases and 600,000 deaths. Children under 5 years of age bear the greatest burden, with between 28 000 and 81 000 child deaths each year in low- and middle-income countries. According to a study published in The Lancet in 2025, shigellosis is the most common cause of invasive bloody diarrhoea in children under 5 years of age globally and causes the death of approximately 170 children each year, even in high-income countries.

For example, a study published in The Lancet Microbe in 2025 showed the predominance of S. flexneri and S. sonnei species in high-incidence countries by examining the geographical distribution of serotypes and providing data for vaccine development. continent, the dominance of the S. flexneri species and the achievement of antibiotic resistance levels of up to 90%. A systematic review published in 2023 in South Asia showed a prevalence of shigellosis among children under 5 years of age up to 10% (95% CI: 8–11%) and up to 12% (95% CI: 10–14%) in rural areas. 2023 review

in the journal Trends in Microbiology discussed new technologies for modeling shigella infection and the use of animal models to study the mechanisms of pathogenesis. In addition, an article in the Future Journal of Pharmaceutical Sciences (2024) analyzed the role of various Shigella species (S. dysenteriae, S. flexneri, S. boydii, S. sonnei) in the spread of bacterial dysentery, showing the endemicity of the disease in Asia.

In the context of Central Asia and Uzbekistan, the epidemiological features of shigellosis are of particular relevance, as the region belongs to developing countries where water pollution, migration and social factors contribute to the spread of infection. In Uzbekistan, a 2011 study showed that 90% of Shigella strains were resistant to antibiotics (including previously used ones). A 2021 study in the Central Asian Journal of Medical and Natural Science studied the clinical and epidemiological characteristics of shigellosis in adults and noted that fever persists for 3-7 days, and infection often occurs in crowded places. A 2025 article in The Conference Hub analyzed the epidemiological features of shigellosis in Uzbekistan, emphasizing that a sharp decline in the incidence remains one of the most urgent challenges due to a variety of factors (e.g., seasonality and serogroups). A 2006 multicenter study showed that the incidence of shigellosis in Central Asia is 100 times higher than in industrialized countries. According to the CDC (USA), about 450 thousand people are registered annually cases of shigellosis and $93 million in medical costs, but in developing countries these figures are much higher.

All these statistical and scientific data show that the study of the epidemiological features of bacterial dysentery is relevant not only at the global, but also at the local level. The growth of antibiotic resistance, the increased spread of infection against the backdrop of climate change and the need to develop a vaccine make this topic especially important. For countries such as Uzbekistan, new epidemiological studies will help improve disease prevention strategies while contributing to global scientific developments.

Materials and Methods

Scientific articles and dissertations were used as the main sources. Information was searched in the PubMed, Web of Science, Google Scholar databases.

- Analysis of publications over the past 20 years (e.g., 2004–2014 and 2009–2016);
- Epidemiological analysis (incidence, demographic characteristics, seasonality) and risk factors (climate, socio-economic conditions);

- Epidemiological methods were used for the analysis: statistical regression (logistic regression, Bayesian models), seasonality analysis, correlation with climatic indicators, and in some cases, predictive models.

Outcomes

An analysis of the conducted scientific studies and official statistics shows that bacterial dysentery (shigellosis) is still a serious epidemiological problem on a global scale. According to the Global Burden of Disease (GBD), in 2016 the number of deaths associated with this infection amounted to about 212 thousand cases under 5 years old. The GEMS project and many other multicenter studies confirm that Shigella spp. is one of the leading causes of severe diarrhea in children.

Regional observations, for example, in China, showed that in the period 2004-2014, more than 3.3 million cases of dysentery were registered, while the incidence rate decreased from 38.03 to 11.24 per 100 thousand population. At the same time, the mortality rate decreased from 0.028% to 0.003%, which indicates an increase in the effectiveness of diagnosis and treatment. However, despite the overall decline, high pressure persists among young children and in areas with poor sanitation infrastructure.

Age plays an important role in the demographic distribution: children under 1 year of age and in the group of 1-4 years are the main risk group. In addition, a higher incidence rate is observed among the rural population, low-income segments of society and residents of areas with unsatisfactory sanitary and hygienic conditions. In some developed countries, the infection is more common in special risk groups, for example, in conditions of high population density or among certain social groups.

Epidemiological observations show a pronounced seasonality of bacterial dysentery. The greatest increase in the incidence occurs in the summer and autumn months, when high temperatures and humidity are observed. Meteorological analyses confirm that rising temperatures, heavy precipitation and high humidity directly affect the increase in the incidence of dysentery. In addition, in a number of regions, there is a statistical increase in the number of cases within a few weeks of extreme climatic events such as floods.

The species composition of Shigella also has regional features: in developing countries, S. flexneri dominates, while in developed regions the proportion of S. sonnei increases. In recent years, there has been a significant increase in the prevalence of S. sonnei, which reflects a change in the global epidemiological profile. Large-scale observations have shown that the resistance of Shigella isolates to traditionally used antibiotics is extremely high: more than 89% to nalidixic acid, 88%

to ampicillin, 88% to tetracycline, and up to 82% to sulfamethoxazole. In recent years, resistance to ciprofloxacin, azithromycin and third-generation cephalosporins has been increasingly recorded. drug-resistant strains seriously complicate global treatment strategies.

Analysis of the data obtained shows that, despite the overall decrease in the epidemiological burden of bacterial dysentery, the disease remains a serious health problem both at the global and regional levels. The main risk factors are related to young children, areas with inadequate water supply and sanitation systems, and increasing antibiotic resistance. In addition, climate change and extreme weather events can further complicate the epidemiology of dysentery.

Key indicators (summarized):

• Global mortality (2016, GBD): ~212,000 cases.

• China (2004–2014): 3.3 million cases; the incidence decreased from 38.03 to 11.24 per 100 thousand; CFR from 0.028% to 0.003%.

• Antibiotic resistance: nalidixic acid ~89%, ampicillin ~89%, tetracycline ~88%, sulfamethoxazole ~83%.

Despite effective preventive measures, the epidemiological features of bacterial dysentery remain closely related to socio-economic, climatic and clinical factors. Thus, the results highlight the need for a comprehensive approach to disease control in the future – strengthening sanitary and hygienic measures, regular monitoring of antibiotic resistance and taking into account climatic risk factors.

Discussion

The results of the study represent a number of important findings about the global and regional epidemiological burden of bacterial dysentery. According to GBD data, morbidity and mortality associated with Shigella are still significant (i.e., it is too early to say that "the problem has been solved"). therapeutic measures on this group.

Regional examples (e.g., observations in China for 2004–2014) show a marked decrease in morbidity and mortality; This has been attributed to improvements in sanitation, the health system and diagnostic capabilities. However, the decline does not eliminate regional disparities: in rural and socio-economically disadvantaged areas, in places of high population density, as well as in certain vulnerable groups, the pressure remains high, and improvements are unevenly distributed. This indicates the need for targeted distribution of resources, taking into account spatio-temporal clusters and territorial imbalances.

The problem of antimicrobial resistance (AMR) is central to the discussion: data from laboratory surveillance and large-scale studies show a high level of resistance of Shigella isolates to traditional drugs (nalidixic acid, ampicillin, tetracycline, sulfamethoxazole, etc.). In recent years, an increase in resistance to ciprofloxacin, azithromycin, and in some cases to third-generation cephalosporins has been recorded. This AMR profile significantly limits empirical therapy strategies, increases the length of hospitalization, and increases the burden on the health care system. Therefore, at the clinical level, it is necessary to move towards treatment based on the results of susceptibility tests, strengthen antibiotic rational use programmes and national monitoring systems.

Climatic factors and extreme weather events (e.g., increased rainfall and flooding) have been shown to influence the incidence of Shigella in empirical and modelling studies. The mechanism is obvious: contamination of drinking water sources, damage to sanitary infrastructure and forced migration increase the risk; As a result, small episodes can develop into large epidemics in vulnerable regions. Therefore, climate-adapted public health strategies are extremely important – rapid sanitation measures after floods, water quality monitoring and preventive action in at-risk areas.

From the pathogenetic point of view, S. flexneri dominates in a number of regions, while with the growth of the level of economic development, the share of S. sonnei increases; This affects the epidemiological profile, diagnostic priorities and potential vaccine strategies. The rapid change of serotypes or clones in certain areas makes the task of developing vaccines and targeted public health measures even more urgent. In this regard, molecular surveillance and regular serotyping are of strategic importance. In the local context, in particular Central Asia and Uzbekistan, the available data are very limited. Most publications and indicators are based on research from China and other regions, so their direct transfer ("we will have the same thing") requires caution. Therefore, national laboratories need to be modernized, AMR monitoring needs to be expanded, and data must be integrated into national registries – otherwise policies and practices risk being based on insufficient information.

Action-based recommendations based on results should include: first, prevention aimed at children (especially <5 years old) – expansion of WASH (water, sanitation, hygiene) programmes, as well as educational initiatives in schools on nutrition and hygiene; second, the introduction of continuous laboratory surveillance of Shigella and the management of AMR at the national level; third, updating empirical therapy protocols and moving to approaches based on sensitivity tests; fourth, the development of climate-adapted contingency plans – preparedness for rapid flood

response in the field of water supply and sanitation. Vaccine development and trials should also be part of the strategy, especially to reduce the burden among children.

Overall, while the results show a reduction in disease burden and improvements in the health system, antibiotic resistance, climate impacts, and regional disparities continue to complicate Shigella control. A more integrated, evidence-based and climate-adaptive approach is therefore required in public health policy. In other words, the problem has not yet been "defeated" – but with strategic and targeted actions, its severe consequences can be significantly reduced.

Conclusion

Based on the results and discussion, it can be emphasized that bacterial dysentery (shigellosis) remains an urgent public health problem both globally and regionally. Despite the decline in morbidity and mortality rates in a number of countries in recent years, it has not yet been possible to completely reduce the epidemiological burden. This is especially due to the high prevalence of the disease among children under five years of age.

The geographical and temporal distribution of Shigella species, as well as the epidemiological changes associated with their different serotypes, require new approaches to disease control. In developing countries, **S. flexneri predominates, while** S. sonnei **is increasingly found in developed regions**, changing the global epidemiological dynamic.

In addition, climate change and extreme weather events (e.g., heavy rainfall and flooding) have been shown to increase the incidence of bacterial dysentery. This further complicates the epidemiological process and increases the risk of epidemic outbreaks in areas with weak sanitation infrastructure. Therefore, preventive measures should include not only sanitation and hygiene programmes, but also contingency plans adapted to climatic conditions.

In general, the epidemiological features of bacterial dysentery show that:

1. The disease continues to be a serious threat to global health, especially among children.

2. WASH **(water, sanitation, hygiene) programmes, educational interventions and vaccination strategies** play a key role in reducing the epidemiological burden.

3. Monitoring of antibiotic resistance and rational use of drugs remain the main factors in maintaining the effectiveness of treatment.

4. Climatic factors complicate the spread of the disease, so weather and environmental conditions must be taken into account during epidemiological control.

Thus, effective control of bacterial dysentery requires a comprehensive approach. Improved sanitation, rational use of antibiotics, vaccine development and rollout, and climate-smart health strategies can significantly reduce the epidemiological burden. Consistent epidemiological research and the strengthening of integrated national and international responses therefore remain a priority.

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