

Review article

# Diabetes Mellitus and Bacterial Infections: a Review of Main Infections in DM Patiens

Reni Yunus<sup>1</sup> , Fitri Wijayati<sup>2</sup> , Askrening Askrening<sup>3</sup> , Dian Yuniar Syanti Rahayu<sup>4</sup> , Fonnie E. Hasan<sup>1</sup> , Trees Tress<sup>1</sup> , Angriani Fusvita<sup>5</sup> 

<sup>1</sup> Department of Medical Technology Laboratory, Poltekkes Kemenkes Kendari, Indonesia

<sup>2</sup> Department of Nursing, Poltekkes Kemenkes Kendari, Indonesia

<sup>3</sup> Department of Midwifery Poltekkes Kemenkes Kendari, Indonesia

<sup>4</sup> Department of Nursing, Poltekkes Kemenkes bandung, Indonesia

<sup>5</sup> Department of Medical Technology Laboratory, Politeknik Bina Husada Kendari, Indonesia

Corresponding author:

**Reni Yunus**

Department of Medical Technology Laboratory, Poltekkes Kemenkes Kendari, Indonesia

Email: reniyunus82@gmail.com

DOI: <https://doi.org/10.36685/phi.v10i1.777>

Copyright: © 2024 the Author(s). This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium provided the original work is properly cited.

## Abstract

**Background:** Patients with diabetes are at a higher risk of bacterial infections, challenging the notion that all diabetes patients are equally prone to such infections. This emphasizes the importance of personalized care for diabetes management. There is also evidence suggesting that antibiotic use in diabetes patients may contribute to antibiotic resistance, posing a potential public health concern. A nuanced approach to understanding the relationship between diabetes mellitus and bacterial infections is essential for effective management.

**Objectives:** The study aimed to review common bacterial infections in patients with diabetes mellitus, focusing on their burden and management.

**Methods:** A systematic literature review was conducted using data from Scopus, to identify relevant articles published between 2019 and 2023 from various countries.

**Results:** Common bacterial infections associated with diabetes mellitus include urinary tract infections, skin and soft tissue infections, respiratory tract infections, and diabetic foot infections which can lead to increased morbidity and mortality rates among individuals with diabetes. Additionally, individuals with poorly controlled blood glucose levels or comorbidities such as obesity or cardiovascular disease face an even higher susceptibility to these types of infection.

**Conclusion:** This review highlights the significant burden of bacterial infections in patients with diabetes mellitus. It underscores the need for proactive management strategies that focus on optimizing glycemic control, promoting good hygiene practices, and early detection and treatment of infections in this vulnerable population.

*Key words:* Diabetes mellitus, bacterial infections

## Article history:

Received 11 January 2024

Revised 15 February 2024

Accepted 9 March 2024

## Background

Diabetes Mellitus is a chronic metabolic disorder characterized by high blood sugar levels resulting from defects in insulin secretion, insulin action, or both. Bacterial infections are known to be a significant concern for individuals with diabetes mellitus, as they can have detrimental effects on their health and complicate disease management. Individuals with diabetes mellitus are at an increased risk of bacterial infections due to the systemic effects of the disease, including immunosuppression and a pro-inflammatory state (Gopi and Seshadri 2023). Bacterial infections such as urinary tract infections and skin manifestations are common in diabetic patients and can lead to complications like acute kidney injury and foot ulcers (Narayanaswamy, S.P, and Kushwaha 2022; Ullah, Ur, et al. 2022; Singh, Junaid, Farooq, S. R. Sharma, et al. 2022). Moreover, diabetes mellitus can predispose individuals to rare but severe infections like mucormycosis and disseminated varicella zoster infection (Rani et al. 2019; Mizu et al. 2022). The impaired immune response in diabetes mellitus can complicate disease management and increase the risk of postoperative infections (Fernández-Ugidos et al. 2019; Kaya et al. 2020). Understanding the relationship between diabetes mellitus and bacterial infections is crucial for effective patient care and management.

The link between diabetes mellitus and bacterial infections is well-established. People with diabetes mellitus have an increased susceptibility to bacterial infections due to several factors. The association between diabetes mellitus and bacterial infections is well-established. Individuals with diabetes mellitus are more susceptible to bacterial infections due to various factors (Ayelign et al. 2019; Graves, Ding, and Yang 2020; Li et al. 2022; Priyadarshini et al. 2022; Ullah, Ur, et al. 2022; Awang et al. 2020; Horiya et al. 2021; Giese et al. 2021; Zhang et al. 2019; Agofure, Eduviere, and Okandjei-Barry 2021; Nkpozi 2019). Diabetes mellitus can lead to immunological impacts that increase susceptibility to infections, including tuberculosis and periodontal diseases (Ayelign et al. 2019; Graves et al. 2020). Moreover, oxidative stress, impaired wound healing, and altered immune responses in diabetic patients can contribute to an increased risk of bacterial infections (Li et al. 2022).

Studies have shown that diabetic foot ulcers are often associated with specific pathogenic bacteria, highlighting the importance of understanding bacterial distribution and drug susceptibility in diabetic patients (Li et al. 2022). Additionally, urinary tract infections in diabetic individuals, especially those caused by multidrug-resistant organisms, can lead to complications like acute kidney injury (Priyadarshini et al. 2022; Ullah, Ur, et al. 2022). Poor glycemic control in diabetes is closely linked to an increased susceptibility to infections, including surgical site infections and pneumonia (Awang et al. 2020; Zhang et al. 2019). Furthermore, chronic hyperglycemia in diabetes can impair lymphocyte function, further compromising the immune response to bacterial infections (Giese et al. 2021). Individuals with diabetes mellitus are more susceptible to bacterial infections due to various factors. Research has shown that diabetes mellitus can lead to immunological impacts that increase susceptibility to infections (Toniolo et al. 2019). Additionally, studies have indicated that diabetic patients may experience alterations in complement pathway activation during bacterial infections, potentially contributing to increased susceptibility (Barkai et al. 2019). Furthermore, diabetic patients are more prone to specific bacterial infections, such as urinary tract infections, highlighting the importance of understanding the prevalence of uropathogens and their antibiotic resistance profiles in diabetic populations (Chand, Rani Goyal, and Singh Naruka 2021). These findings emphasize the significance of addressing the heightened risk of bacterial infections in individuals with diabetes mellitus for effective management and care.

In diabetic patients, the most common bacterial infections are urinary tract infections, skin and soft tissue infections, respiratory tract infections, and foot ulcers. In a study comparing 89,790 matched pairs of patients with and without type 2 diabetes mellitus, it was found that urinary tract infections were more common in diabetic patients compared to non-diabetic patients (Akash et al. 2020). Urinary tract infection is a common infection in type 2 diabetic patients (Salari et al. 2022). Urinary tract infection (UTI) is a prevalent clinical problem among diabetic patients, comprising 1–6% of medical referrals (Tegegne et al. 2023). Most cases of urinary tract infections in diabetic patients are asymptomatic (Kumar, Kumar, Perswani, Taimur, Amit Shah, et al. 2019). Diabetes is a risk factor for urinary tract infections due to weakened immunity, leading to decreased antibacterial activity in urine (Ali 2022). There are clinical and characteristic differences in urinary tract infections between diabetic and non-diabetic patients (Gill and Baidwan 2023). Risk factors for urinary tract infections in diabetic patients include inadequate glycemic control, duration of diabetes, diabetic nephropathy, and anatomical and functional abnormalities of the urinary tract (Burekovic et al. 2021).

Urinary tract infection is one of the most common infections observed in diabetic patients (S, Vennila, and Monica 2021). Urinary tract infections are the most prevalent form of infection among

diabetic patients (Adu-Poku and Addo 2020). Urinary tract infections in diabetic patients can range from asymptomatic infection to severe lower urinary tract infections (Nayaju et al. 2020). Diabetic patients have a higher incidence of urinary tract infections compared to non-diabetic patients, with a higher mortality rate in older diabetic patients (Faraj H Joni 2019). *E. coli* is the most common bacterial pathogen causing urinary infections in diabetic patients, followed by *Klebsiella pneumoniae* and *Proteus mirabilis* (Chand, Goyal, and Naruka 2021).

Urinary tract infections in diabetic patients are characterized by the presence of bacteria and leukocytes in the urine due to the inflammatory response of the urothelium against bacterial infections (Silva, Carnevali, and Ramos 2021). Changes in host defense mechanisms, diabetic cystopathy, and microvascular disease in the kidneys may contribute to the higher rate of urinary tract infections in diabetic patients (Ehmaida, Hemdan, and Aljebaly 2020). To address the practical applications of the link between diabetes mellitus and bacterial infections, it is crucial to emphasize the significance of maintaining good glycemic control in diabetic patients. Proper diabetes management, including regular blood sugar monitoring and adherence to prescribed medications, plays a pivotal role in preventing and managing bacterial infections in individuals with diabetes (Ruissen et al. 2021; Demoz et al. 2019).

Strategies focusing on improving glycemic control through health literacy interventions, dietary modifications, physical activity, and self-management support can significantly impact the prevention of complications associated with diabetes and bacterial infections (Butayeva 2023; Ye 2023; Qin et al. 2021; Masuda et al. 2021). Additionally, addressing factors such as alcohol consumption, vitamin D deficiency, and psychological aspects like diabetes distress and self-efficacy can further enhance glycemic management and overall health outcomes in diabetic patients (Shibeshi et al. 2022; Darraj et al. 2019; Gao et al. 2020).

The literature gap in this study is that there is limited research on the specific mechanisms contributing to the higher rate of urinary tract infections in diabetic patients, such as the impact of diabetic cystopathy and microvascular disease. Further research is needed to explore these mechanisms and their potential implications for better prevention and management strategies. The underlying mechanisms contributing to the higher rate of urinary tract infections in diabetic patients, specifically in relation to diabetic cystopathy and microvascular disease, warrant further investigation to better understand the pathophysiology and develop targeted interventions for prevention and management.

"Furthermore, investigating the association between diabetic cystopathy and microvascular disease in diabetic patients can provide valuable insights into the underlying mechanisms contributing to the higher rate of urinary tract infections. Additionally, understanding how these mechanisms interact with other factors such as glycemic control and immune function will help inform more comprehensive strategies for the prevention and management of urinary tract infections in diabetic patients. The higher rate of urinary tract infections in diabetic patients can be attributed to various factors. Firstly, diabetic cystopathy, characterized by impaired bladder function due to autonomic neuropathy, can lead to incomplete bladder emptying, stasis of urine, and increased susceptibility to infections (Ehmaida et al. 2020). Secondly, microvascular disease in diabetes affects the blood vessels supplying the urinary tract, compromising the immune response and promoting bacterial growth (Ehmaida et al. 2020). Additionally, altered host responses in diabetic patients, such as increased adherence of microorganisms to uroepithelial cells, granulocyte dysfunction, and altered calcium metabolism, contribute to the higher incidence of urinary tract infections (Kumar, Kumar, Perswani, Taimur, Ali Shah, et al. 2019). Understanding these mechanisms is crucial for developing targeted interventions to prevent and manage urinary tract infections in diabetic individuals effectively.

The objective of this study is to review the main bacterial infections in individuals with diabetes mellitus and understand the link between diabetes and bacterial infections. Our understanding of the link between diabetes mellitus and bacterial infections can help guide prevention and management strategies for diabetic patients. The hypothesis of this study is that individuals with diabetes mellitus are at a higher risk of bacterial infections, and there are various mechanisms, such as impaired immune function, altered microbiota, and chronic inflammation, that contribute to this increased susceptibility. Additionally, factors such as poor glycemic control and co-existing complications like peripheral vascular disease and neuropathy may further augment the risk of bacterial infections in diabetic patients.

## Method

### Data Sources and searches

The methodology employed in this study is a Systematic review, adhering to PRISMA standards. PRISMA entails seven key steps: formulating review questions, establishing eligibility criteria, conducting a through search strategy across various information sources, identifying potentially relevant studies, selecting pertinent studies, evaluating the quality of the included studies, and synthesizing the findings from the included studies.

The Systematic process was a comprehensive search to see if any other systematic reviews have been written about subjects connected to the infectious bacteria that cause diabetes mellitus. The following search terms were used to find article locations originating from Data Base Scopus: diabetes mellitus and bacterial infection. There were 3.234 papers published between 2014 and 2023 according to the Scopus database. A set of inclusion and exclusion criteria, such as publication data from 2019 to the present, are used to filter the search results. The conference abstract without a corresponding study subject or design requirement is one of the exclusion criteria, and 2.814 papers were found, of which 166 were published in 2019; 373 articles were published in 2020; 2.223 article were published in 2021; 35 articles were published in 2022; 17 articles were published in 2023. 2.814 papers that are publications of journals, books, theses, generic and subsequent reports that were subsequently screened and found 2.056 documents came from the journal. Article search were limited to publications in English.

Further in the screening articles related to the subject area health sciences and specific to the topic of various infectious diseases in cases of diabetes mellitus and found 512 articles. The final step involves assessing the quality of the selected studies using standardized criteria such as the relevance and rigor of the research design, data collection, methods and analysis technique. After the screening abstract and full reading 512 paper, a total of 77 studies met the inclusion criteria and were included in the synthesis.

### Study Selection

The inclusion criteria for this systematic review were defined as follows: (i) type infection at DM patients caused bacteria; (ii) association between diabetes mellitus and bacterial infections; (iii) the clinical characteristics, risk factors for mortality of bacteria with diabetes mellitus (DM). Studies were excluded if they: Literature regarding Diabetes mellitus, but not related to bacterial infections. Conference abstracts were considered only if they furnished all necessary data for the systematic review.

### Data extraction

One investigator extracted essential data from the included articles using a standardized Excel spreadsheet, while a second independent investigator diligently cross-verified the data for accuracy. Each article underwent comprehensive data extraction, capturing details such as author's name, publication year, study objectives, study design, methodology, and main findings.

### Outcomes

The study primarily focused on outcomes such as major bacterial infections affecting individuals with Diabetes Mellitus, prevention of bacterial infections in Diabetes, exploring the relationship between blood sugar control and infection rates, current strategies for reducing risks in Diabetic populations, and clinical insight into bacterial infection.

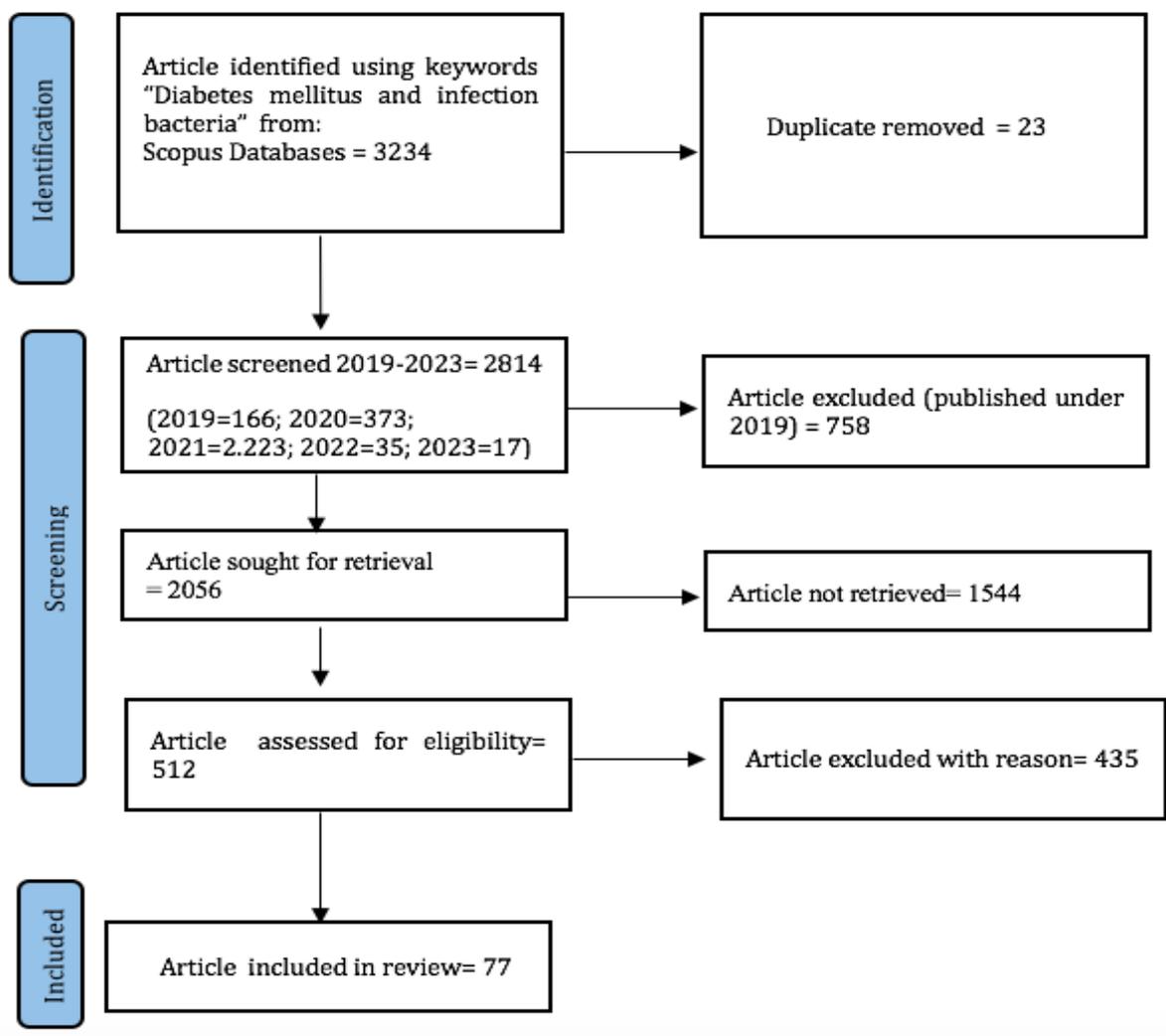
### Data Synthesis

The findings of the systematic review indicate that individuals with diabetes mellitus are more susceptible to bacterial infections. This susceptibility is attributed to factors such as peripheral vascular disease, neuropathy, and impaired immune function.

## Results

The author uses research methods systematically according to the PRISMA stages (Preferred Reporting Items for Systematic Review) which includes identification, screening, inclusion and eligibility the article's findings were then analyzed. Articles that meet the criteria will be reviewed to note the relationship between DM and bacterial infection. Based data extraction on PRISMA guidelines, the review found that common bacterial infections in individuals with diabetes mellitus included urinary tract infections, skin

and soft tissue infections, respiratory tract infections, and diabetic foot infections. The study found that urinary tract infections, skin and soft tissue infections, respiratory tract infections, and diabetic foot infections were the most common bacterial infections in individuals with diabetes mellitus. These infections were found to be more prevalent in individuals with diabetes due to factors such as peripheral vascular disease, neuropathy, and impaired immune function. Additionally, the review identified that individuals with diabetes mellitus are at a higher risk of developing infections caused by multidrug-resistant bacteria, such as extended-spectrum beta-lactamase producing Gram-negative bacteria. Furthermore, the review indicated that appropriate management of diabetes mellitus, including glycemic control and regular foot care, can help reduce the risk of bacterial infections in individuals with diabetes mellitus.



**Figure 1.** Study selection Process

**Table 1** Journal description of DM related bacterial infection

<b>Paper</b>	<b>Study Objectives</b>	<b>Study Design</b>	<b>Methodology</b>	<b>Main findings</b>
Clinical and Microbiological Profile of Urinary Tract Infections in Diabetic versus Non-Diabetic Individuals Ravi Kumar +5 Cureus 2019 16 citations	Compare the incidence, clinical, and microbiological features of UTI between diabetic and non-diabetic patients, assess the risk of UTI in diabetic patients, and evaluate the frequency of asymptomatic UTI in diabetic patients.	Prospective, comparative study; Prospective, observational, cross-sectional, comparative study; Consecutive nonprobability sampling technique; Outpatient department setting	The methodology involved a prospective, observational, cross sectional, comparative study conducted in the outpatient department of a general hospital in Pakistan. Consecutive non-probability sampling technique was used to recruit patients with type II diabetes mellitus, of both genders and age 18 years and above, after obtaining informed consent. All patients were screened for UTI through a midstream 5-ml urinary sample, and urinary culture analysis was performed for infective cases. Patients with recent antibiotic use and certain medical conditions were excluded from the study.	Diabetic patients have twice the risk of UTI compared to non-diabetic patients, with female diabetic patients having a risk almost five times higher than non-diabetic females. In the diabetic group, there is a significantly higher percentage of asymptomatic UTI cases compared to the non-diabetic group. The study concludes that UTIs are more frequent among diabetics, and asymptomatic bacteriuria is a more common entity in diabetic patients and does not require any treatment.
The early use of Antibiotics for At-risk children with Influenza in Primary Care (the ARCHIE programme) Kay Wang +24 Citations unknown	The study objectives include identifying risk factors and assessing prognostic models, understanding GP decision-making, exploring parental experiences, determining antibiotic effectiveness, examining antibiotic resistance and long-term bacterial carriage, developing and validating risk scores, and exploring cost-effectiveness of different potential strategies for early antibiotic use in at-risk children within influenza/ILI.	The study design of this article involved experimental treatment with wound dressings and evaluation of wound healing rates over time	The methodology involves a systematic review, qualitative research via interviews, a randomized clinical trial, a nested sub study, and a pre-trial health economics cost analysis	Premature birth is a new risk factor for clinical deterioration in children with influenza or ILI, and children with underlying risk factors tend to deteriorate quickly and take longer to recover, causing significant disruption and challenges for parents. However, the limited number of clinical deterioration events means that these findings should be interpreted with caution.
New-onset Type 1 Diabetes after COVID-19 mRNA Vaccination Masahiro Yano +8 Internal medicine 2022 33 citations	To report a case of new-onset type 1 diabetes in a Japanese woman after COVID-19 mRNA vaccination, and to suggest that vaccination against SARS-CoV-2 can induce type 1 diabetes in some individuals with a genetic predisposition. The study also emphasizes the need for prospective and large-scale studies to clarify the incidence of new-onset type 1 diabetes associated with COVID-19	To report a case of new-onset type 1 diabetes in a Japanese woman after COVID-19 mRNA vaccination, and to suggest that vaccination against SARS-CoV-2 can induce type 1 diabetes in some individuals with a genetic predisposition. The study also emphasizes the need for prospective and large-scale studies to clarify the incidence of new-onset type 1 diabetes associated with COVID-19 vaccination and the causal relationship between them.	Not applicable (the paper does not have a specific methodology section or describe the methods used in the study)	COVID-19 vaccination can induce type 1 diabetes in some individuals with a genetic predisposition. Limited number of reports are available on cases of new-onset diabetes after COVID-19 vaccination. Prospective and large-scale studies are required to clarify the incidence of new-onset type 1 diabetes associated with COVID-19 vaccination and the causal relationship between them.

<p>Automated Detection of Infection in Diabetic Foot Ulcer Images Using Convolutional Neural Network J Yogapriya +6 Journal of Healthcare Engineering 2022 8 citations</p>	<p>Develop a diabetic foot infection network (DFINET) to assess infection and no infection from diabetic foot ulcer images, achieve promising results in infection recognition, integrate features from parallel convolution layers to efficiently extract discriminative features for classifying infection and non-infection from diabetic foot ulcer images, contribute to the development of a comprehensive computerized diabetic foot ulcer (DFU) evaluation system for remote monitoring.</p>	<p>The study design of the article involves proposing a 22-layer CNN architecture with various components to classify infection and noninfection in diabetic foot ulcer images. The model is designed to extract discriminative features efficiently and improve classification performance</p>	<p>The methodology used in the study includes the development of the DFINET model, application of image augmentation techniques, use of the Adam optimizer, comparison of model performance, and reporting of training time.</p>	<p>The DFINET model achieved a high accuracy of 91.98% and a Matthews correlation coefficient of 0.84 in recognizing diabetic foot infection. The integration of features from parallel convolution layers in the CNN model was crucial for capturing unique and crucial information about foot infection, leading to the high accuracy achieved by the DFINET model.</p>
<p>Isolation and Diagnosis of Bacteria Causing Urinary Tract Infection in Pregnant and Non-Pregnant Females with Diabetes Mellitus Type2 Faraj Hato +1 Non-randomized, non-controlled, observational study. Al-Mustansiriyah Journal of Science 2019 2 citations</p>	<p>to determine the causative organism's susceptibility of urinary tract infection in diabetic patients</p>	<p>The study design of the article involves proposing a 22-layer CNN architecture with various components to classify infection and non-infection in diabetic foot ulcer images. The model is designed to extract discriminative features efficiently and improve classification performance</p>	<p>The methodology involved approaching consecutive female patients with type II DM, regardless of the presence or absence of urinary tract infection, collecting samples from 20-45 years old female diabetic patients, culturing the samples on suitable media, examining pure colonies under a dissecting microscope, and isolating and identifying bacterial cells according to standard bacteriological procedure.</p>	<p>Diabetic patients have a higher risk of urinary tract infection (UTI) and a higher mortality rate from UTI compared to non-diabetic patients, especially in older age. The most common causative agent of UTI in diabetic pregnant females is Escherichia coli. Diabetic women have a higher risk of UTI compared to non-diabetic women, with Escherichia coli being the most common pathogen isolated from the urine of diabetic patients with UTI.</p>
<p>The effect of glycemic control on salivary lipid peroxidation in type II diabetic patients Masoomah Shirzaiy +1 Diabetes &amp; metabolic syndrome 2019 9 citations</p>	<p>The study aims to evaluate the effect of glycemic control on salivary lipid peroxidation in diabetic patients and to assess the correlation between diabetes control levels and products of oxidative stress, specifically salivary lipid peroxidation.</p>	<p>Case-control study</p>	<p>The methodology involved a case-control study with 44 diabetic (type II) patients and 44 healthy subjects, collection of unstimulated saliva for MDA assessment, laboratory tests for FBS and HbA1c, specific instructions for saliva collection, MDA measurement using TBARS, and data analysis using SPSS software.</p>	<p>Diabetic patients had significantly higher levels of MDA and HbA1c compared to the control group. There was a direct correlation between salivary MDA levels and HbA1c, indicating that poor glycemic control leads to an increase in salivary MDA. Salivary MDA levels in diabetic patients were higher than in healthy participants, suggesting that assessment of salivary MDA could be a beneficial procedure for monitoring the effectiveness of diabetes treatment.</p>

<p>Susceptibility for Some Infectious Diseases in Patients With Diabetes: The Key Role of Glycemia Antonio R Villa +9 Frontiers in Public Health 2021 49 citations</p>	<p>The study objectives are to analyze the role of diabetes in the development of bacterial and viral infections, discuss the mechanisms by which hyperglycemia may increase susceptibility to infections, and understand the impact of hyperglycemia on the immune system.</p>	<p>The study design of the article involves proposing a 22-layer CNN architecture with various components to classify infection and noninfection in diabetic foot ulcer images. The model is designed to extract discriminative features efficiently and improve classification performance</p>	<p>The study design of the article involves proposing a 22-layer CNN architecture with various components to classify infection and noninfection in diabetic foot ulcer images. The model is designed to extract discriminative features efficiently and improve classification performance</p>	<p>Uncontrolled diabetes, characterized by hyperglycemia, leads to metabolic alterations and increases susceptibility to bacterial infections, particularly in the respiratory and urinary tracts. Hyperglycemia induces physiological and immunological disorders that may predispose and exacerbate infectious diseases, suggesting that controlling glucose levels could be an alternative tool to contribute to the fight against infections. The potential benefits of controlling hyperglycemia through pharmacological approaches open a new option to improve the outcome of bacterial and viral infections.</p>
<p>Wound Healing in Diabetic Patients Muhammad Bilal +4 Small 2022 24 citations</p>	<p>The study objectives are to identify the risk of wound infection and rate of healing in diabetic patients, and to observe the risk of infection in surgical wounds of operative cases.</p>	<p>Cross-sectional study</p>	<p>The methodology involved a cross-sectional study design, non-probability purposive sampling technique, data collection through face-to-face interviews and review of medical records, and data analysis using SPSS 26 with various statistical measures.</p>	<p>Patients with uncontrolled diabetes had a high incidence of wound complications after operation, emphasizing the need for strict diabetic control and extra vigilance to prevent complications in this group of patients.</p>
<p>Infections in patients with diabetes mellitus: A review of pathogenesis Juliana Casqueiro +2 Indian journal of endocrinology and metabolism 2012 896 citations</p>	<p>The study objective of this article is to review and discuss the increased susceptibility of patients with diabetes mellitus to various infections, highlighting the pathogenesis, complications, and importance of immunization in preventing morbidity and mortality in diabetic patients.</p>	<p>The study design of this article is a literature review. The authors conducted a search of the MEDLINE and LILACS databases for articles published between 1999 and 2011, using specific keywords related to diabetes mellitus, infections, immunization, and vaccines. They included consensus papers, editorials, original articles, and review articles in English, Spanish, and Portuguese for their review</p>	<p>The methodology involved searching the MEDLINE and LILACS databases for articles published between 1999 and 2011 using specific keywords. Consensus papers, editorials, original articles, and review articles written in English, Spanish, and Portuguese were included, and the articles were initially selected based on their titles and abstracts.</p>	<p>The recommendation of compulsory immunization with anti-pneumococcal and influenza vaccines is essential due to their impact on reducing respiratory infections, hospitalizations, and deaths related to respiratory tract diseases.</p>

<p>A Comprehensive Overview of Skin Complications in Diabetes and Their Prevention Pascaline David +2 Cureus 2023 1 citation</p>	<p>To provide a comprehensive overview of skin complications in diabetes, including their epidemiology, pathophysiology, and risk factors; to review current guidelines and protocols for skin care in diabetes, including the role of emollients and other topical treatments; to highlight the implications for clinical practice in managing skin complications in diabetes; to suggest future research directions for developing new prevention and management strategies, potentially utilizing new technologies.</p>	<p>This type of study involves a comprehensive examination and synthesis of existing literature on a specific topic to provide a summary of current</p>	<p>The methodology involved a comprehensive literature search of multiple databases using specific keywords related to diabetes and skin complications, with a focus on literature published from 2012 to 2022. The aim was to provide an overview of skin complications in diabetes, including their epidemiology, pathophysiology, and risk factors.</p>	<p>The main or primary outcome measured in the study is maintaining skin integrity and preventing complications in diabetes through effective skin care.</p>
<p>Clinical and Therapeutic Treatment Approach between Diabetes mellitus and urinary tract infection. Larissa Amoroso Da Silva +2  International Journal for Innovation Education and Research 2021 0 citations</p>	<p>The study objectives are to describe the clinical and therapeutic aspects of diabetes mellitus and urinary tract infection, with guidelines on glucose management in these events. The study aims to discuss pertinent clinical and therapeutic issues, covering the diabetes factors that contribute to the onset of UTI; urinary tract infection complications in patients with diabetes mellitus; asymptomatic bacteriuria, recurrent urinary tract infections, and urinary incontinence in people with diabetes; treatments for diabetes and urinary tract infection; and the relationship between glucose-lowering medications and UTI</p>	<p>Non- systematic review by searching in the virtual health library and published article</p>	<p>The methodology used in the study is a non-systematic review conducted by searching in the Virtual Health Library, PubMed, Scielo, and Google Academic databases using specific descriptors. The most relevant articles were selected.</p>	<p>The main findings include the significant impact of urinary tract infections (UTI) on diabetic patients, the potential for UTI prevention in diabetic patients due to the connection between these diseases, and the higher risk and severe complications of UTIs in diabetic patients, such as pyelonephritis and renal abscess.</p>
<p>Efficacy of phage cocktail AB-SA01 therapy in diabetic mouse wound infections caused by multidrug-resistant Staphylococcus aureus Garedew Legesse +8 BMC Microbiology 2020 40 citations</p>	<p>To determine the efficacy of the cGMP phage product AB-SA01 in treating S. aureus infection in a mouse model with induced diabetes and to assess the effectiveness of phage cocktails in treating diabetic ulcers infected with antibiotic-resistant pathogens.</p>	<p>Experimental study</p>	<p>The methodology involved using a chemically induced diabetic mouse model, random assignment of mice to different treatment groups, data management using Microsoft Excel Spreadsheet, statistical analysis using STATA software, and compliance with ethical guidelines.</p>	<p>.</p>

<p>Distribution and drug sensitivity of pathogenic bacteria in diabetic foot ulcer patients with necrotizing fasciitis at a diabetic foot center in China Xuemei Li +5 BMC Infectious Diseases 2021 11 citations</p>	<p>To investigate the distribution and susceptibility of pathogenic bacteria in DNF patients and provide empirical antibacterial guidance for the clinic.</p>	<p>Retrospective analysis of microbiological data from diabetic foot ulcer patients with osteomyelitis. The study involved analyzing cultures from different specimens, such as soft tissue, swabs, and blood, to assess microbiological concordance in the management of these infections</p>	<p>The methodology involved collecting swab and soft tissue specimens from DNF patients, identifying bacterial isolates using VITEK-MS mass spectrometer and VITEK2-Compact instrument, performing drug susceptibility testing using various methods, and analyzing the data using SPSS 22.0 software.</p>	<p>Gram-positive bacteria were the main bacteria isolated from DNF patients. The proportion of multi-drug resistant bacteria among the pathogens was significant, and there was a high risk for amputation, which should be considered in the initial empirical medication. Broad-spectrum antibacterial are recommended.</p>
<p>Diabetes-associated infections: development of antimicrobial resistance and possible treatment strategies Muhammad Sajid +5 Citations unknown</p>	<p>The study objectives are to investigate the association of diabetes mellitus with various types of bacterial infections, summarize the findings of studies related to the association of DM with infectious diseases and the risk of infection in diabetic patients, analyze the pattern of resistance against antimicrobial agents used for the treatment of diabetes-associated infections, and provide possible treatment strategies against DM-associated infections.</p>	<p>Observational study with some clinical trials included</p>	<p>Not applicable (the paper does not provide a specific methodology or description of methods used in the study)</p>	<p>The paper summarizes the association of diabetes mellitus with various types of bacterial infections and the pattern of resistance against antimicrobial agents used for the treatment of diabetes-associated infections. It also provides possible treatment strategies against these infections.</p>
<p>Bacterial profile of diabetic foot infection in a tertiary care centre Mohd Junaid +5 IP International Journal of Medical Microbiology and Tropical Diseases 2022 0 citations</p>	<p>To find the possible aerobic bacterial pathogens in diabetic foot infection. To observe the antibiogram of isolated microorganisms.</p>	<p>Observational study, single-site design</p>	<p>The methodology involved an observational study design, identification of isolates using standard biochemical tests, antibiotic susceptibility testing using the Kirby-Bauer disc diffusion method, and collection of specimens from diabetic foot infection patients at admission and OPD visits.</p>	<p>Gram negative organisms were more predominant than gram positive organisms in diabetic foot infections, with 55.18% being gram negative and 44.82% being gram positive. Out of 82 samples, 64 showed significant growth, indicating a high rate of positive growth in diabetic foot infection samples. - The study observed a higher prevalence of diabetic foot infections in male patients (60.98%) compared to female patients (39.02%)</p>
<p>Functional hydrogels for diabetic wound management Daqian Gao +4 APL Bioengineering 2021 40 citations</p>	<p>To find the strategies, mechanism of action, performance, and application of functional hydrogels for managing diabetic wounds</p>	<p>The paper discusses the design strategies, mechanisms of action, performance, and application of functional hydrogels for managing diabetic wounds. It reviews recent research progress in managing diabetic wounds with a special focus on how researchers have designed novel hydrogel dressings to solve biofilm-related infections and promote diabetic wound healing.</p>	<p>The methodology involved Literature review about the recent research in managing diabetic wounds with a special focus and promote diabetic wound healing</p>	<p>Diabetic wounds have a slow healing process and are easily infected due to hyperglycemia. The development of multifunctional hydrogels is a promising strategy for diabetic wound management. Hydrogels offer 3D architectures for cell migration and tissue regeneration, making them a potential vehicle for drug delivery and wound dressing.</p>

<p>Multidrug-Resistant Escherichia coli Causing Urinary Tract Infections among Controlled and Uncontrolled Type 2 Diabetic Patients at Laquintinie Hospital in Douala, Cameroon Josiane Claire +6 The Canadian journal of infectious diseases &amp; medical microbiology = Journal canadien des maladies infectieuses et de la microbiologie medicale 2022 5 citations</p>	<p>to assess the resistance profile of Escherichia coli and biochemical abnormalities in diabetic patients with balanced and unbalanced blood glucose levels</p>	<p>Cross-sectional study</p>	<p>The methodology involved a cross-sectional study at a hospital, collection of serum and urine samples, identification of E. coli, in vitro susceptibility testing against antibiotics, and statistical analyses to analyze the data.</p>	<p>The prevalence of urinary tract infections caused by E. coli was significantly higher in diabetic patients with unbalanced blood sugar levels and diabetic patients with balanced blood sugar levels compared to nondiabetics. - Diabetic participants with unbalanced blood sugar levels exhibited significantly higher frequencies of polyuria, proteinuria, leukocyturia, and polyphagia, indicating a higher burden of clinical symptoms associated with UTIs in this group. - These findings suggest that uncontrolled diabetes is associated with an increased risk of UTIs caused by E. coli, as well as a higher frequency of clinical symptoms related to UTIs.</p>
<p>Extra-Gastroduodenal Manifestation and Helicobacter pylori Infection Izaldeen Sowaid +2 Nature Reviews Disease Primers 2023 78 citations</p>	<p>To assess the relationship between H. pylori infection and extra-gastroduodenal manifestations, such as iron deficiency anemia, chronic spontaneous urticarial, diabetes mellitus, and celiac diseases with low ferritin levels</p>	<p>Clinical trial study</p>	<p>The methodology involved a clinical trial study on 235 patients, using upper and lower GI endoscopy, fiberoptic bronchoscopy, stool samples tested with H. pylori Antigen rapid test cassette, and the Heliprobe system for non-invasive 14 C Urea breath test.</p>	<p>- H. pylori infection is more prevalent in females - The urea breath test showed a higher percentage of positive cases in males compared to females, with a highly significant relation between gender and the urea breath test - The frequency of identification of H. pylori using the stool antigen test as the gold standard was 71.8%</p>
<p>Current Diabetes Reviews Afiat Berbudi +3 Citations unknown</p>	<p>The study objectives are to provide an overview of the immunological aspect of T2D, explore the possible mechanisms that result in increased infections in diabetics, understand how immune dysfunctions occur during hyperglycemia, and identify novel treatments and preventions for infectious diseases and T2D comorbidities, with the aim of improving the outcome of infectious disease treatment in T2D patients.</p>	<p>Literature review on immunological aspect of T2D and the mechanism leading to increased infections in diabetic.</p>	<p>The methodology used in the study includes a review of relevant literature on the immunological aspect of T2D and the mechanisms leading to increased infections in diabetics, as well as references to in vitro and animal studies on immune cell activity and function in diabetic subjects.</p>	<p>- Hyperglycemia in diabetes leads to dysfunction of the immune response, resulting in a weakened defense against invading pathogens. - Both innate and adaptive immune responses are affected in diabetic subjects, contributing to their susceptibility to infections. - Understanding the mechanisms of hyperglycemia that impair host defense against pathogens is crucial for developing novel strategies to treat infections in diabetic patients.</p>

<p>Laser-Activatable CuS Nanodots to Treat Multidrug-Resistant Bacteria and Release Copper Ion to Accelerate Healing of Infected Chronic Nonhealing Wounds Yue Qiao +12 ACS Applied Materials and Interfaces 2019 128 citations</p>	<p>Develop a Nano system to cure multidrug-resistant bacteria-infected chronic nonhealing wounds, repurpose CuS-based NPs as antibacterial agents for combating chronic wound infections, and simultaneously exert antibacterial effect and accelerate wound-healing process</p>	<p>In vivo experimental study</p>	<p>The methodology includes in vitro and in vivo antibacterial activity analysis, in vitro cell migration and angiogenesis studies, and in vivo wound healing improvement analysis using diabetic mutant mice.</p>	<p>The development of ultra small copper sulfide (covellite) nanodots (CuS NDs) based dual functional Nano system to cure multidrug-resistant bacteria-infected chronic nonhealing wound. The nanosystem could eradicate multidrug-resistant bacteria and expedite wound healing simultaneously owing to the photothermal effect and remote control of copper-ion release. The combination of ultra-small CuS NDs with photothermal therapy displayed enhanced therapeutic efficacy for chronic nonhealing wound in multidrug-resistant bacterial infections, which may represent a promising class of antibacterial strategy for clinical translation.</p>
<p>Urinary Tract Infection due to Extended-Spectrum Beta-Lactamase Producing Organisms is a risk Factor for Acute Kidney Injury among Patients diagnosed with Diabetes Mellitus Type 2 Naimat Ullah +5 Pakistan Journal of Medical &amp; Health Sciences 2022 0 citations</p>	<p>The study objective is to investigate whether the UTI caused by Extended-Spectrum Beta-Lactamase Producing Organisms is a risk factor for Acute Kidney Injury among Patients diagnosed with Diabetes Mellitus Type 2.</p>	<p>Case-control study</p>	<p>The methodology involved a case-control study at a specific medical college and hospital, including 98 patients with diabetes mellitus and culture-proven UTI. The study also involved analyzing the colony and culture characteristics of the bacteria, measuring antibiotic sensitivity, and using SPSS software for statistical analysis.</p>	<p>UTI caused by ESBL-producing organisms like E. coli and K. pneumonia is a higher risk factor for acute kidney injury in patients with diabetes mellitus type II. Diabetes mellitus increases the severity and complication associated with infections, including UTIs. ESBL-positive organisms have natural resistance to penicillin, which complicates the treatment of UTIs in diabetic patients.</p>

<p>Bacterial Profiles and Their Associated Factors of Urinary Tract Infection and Detection of Extended Spectrum Beta-Lactamase Producing Gram-Negative Uropathogens Among Patients with Diabetes Mellitus at Dessie Referral Hospital, Northeastern Ethiopia Mekuanent Alemu +4 Diabetes, Metabolic Syndrome and Obesity: Targets and Therapy 2020 11 citations</p>	<p>To determine the bacterial profile and associated risk factors among diabetic patients and to identify extended spectrum beta-lactamase producing Gram-negative bacterial uropathogens.</p>	<p>Hospital-based cross-sectional study</p>	<p>The methodology involved a hospital-based cross-sectional study, simple random sampling, a structured questionnaire for data collection, urine specimen collection for culture and antimicrobial susceptibility testing, and adherence to CLSI criteria for testing.</p>	<p>The overall prevalence of significant bacteriuria was 11.6% - The majority of the isolates were Gram-negative bacteria, with E. coli and K. pneumoniae identified as the two dominant isolates - Moderately higher rates of resistance to commonly used antimicrobial agents were observed for both Gram-negative and Gram-positive bacterial isolates.</p>
<p>Meta Analysis: Correlation between Diabetes Mellitus and Surgical Wound Infection Chattrin Fahrezi +2 Indonesian Journal of Medicine 2022 0 citations</p>	<p>The study objectives are to examine the effect of diabetes mellitus on the incidence of surgical wound infection and to conduct a meta-analysis on the topic.</p>	<p>Systematic review and meta-analysis</p>	<p>The methodology used in the study includes a systematic review design and meta-analysis, with article selection from multiple databases, analysis using RevMan 5.3 software, and adherence to PRISMA guidelines.</p>	<p>Diabetes mellitus significantly increases the incidence of surgical wound infections, with patients having a 2.54 times higher risk compared to those without diabetes mellitus (OR= 2.54; 95% CI= 1.93 to 3.34; p&lt;0.001).</p>
<p>Immunological Mechanisms of Sickness Behavior in Viral Infection Mia Krapić +5 Viruses 2021 13 citations</p>	<p>To revisit recent literature that elucidates both the benefits and the negative aspects of sickness behavior in the context of viral infection. To revisit recent literature on the molecular mechanisms underlying the impact of the activated immune system on sickness behavior following infection with a particular focus on</p>	<p>Literature review that elucidates both the benefits and the negative aspects of sickness behaviour in the context of viral infection</p>	<p>Not applicable (the paper is a review article and does not present original research with a specific methodology)</p>	<p>The paper revisits recent literature to elucidate the benefits and negative aspects of sickness behavior in the context of viral infection. Sickness behavior in response to viral infection is not a pathology but a carefully orchestrated response mediated by the immune system. This behavior optimizes the immune response against the invading pathogen while minimizing</p>

	viral infection			viral replication in infected cells.
Diabetes and periodontal diseases: consensus report of the Joint EFP/AAP Workshop on Periodontitis and Systemic Diseases Iain L C Chapple +1 Citations unknown	The study objectives are to report epidemiological evidence for the impact of periodontal disease on diabetes incidence, control, and complications; identify potential underpinning mechanisms for the relationship between periodontal disease and diabetes; critically examine the current evidence base for the periodontal disease-diabetes paradigm and establish pragmatic guidelines for patient care.	Systematic review	The methodology used in the study involved a critical examination of the current evidence base for the periodontal disease-diabetes paradigm, including systematic reviews and the establishment of pragmatic guidelines for patient care. The scientific rationale for the study was to systematically review the impact of periodontitis and its treatment on diabetes control, complications, and incidence	reduction in HbA1C at 3 months
Angiographic profile of coronary artery disease in patients with acute coronary syndrome in correlation to their glycaemic status Matin Parkar +4 2021 0 citations	To study the relationship between glycemic control and the presence of coronary artery disease on clinical presentation with acute coronary syndrome (ACS)	Cohort study, non-randomized, non-blinded, non-controlled, multi-site, retrospective, observational	The methodology involved a retrospective cohort study with 1200 patients, including a subset of 200 subjects, and utilized statistical methods such as mean and standard deviation calculations, Pearson's correlation coefficient, chi-square test, and ANOVA tests using SPSS software.	Poor correlation between diabetes indicators (HbA1c, fasting blood sugar, post prandial blood sugar, random blood sugar) and Gensini score - When diabetes is under control, the severity of cardiac disease is low
Methicillin-resistant Staphylococcus aureus pneumonia in diabetics: a single-center, retrospective analysis Qiu-Rui Zhang +4 Chinese Medical Journal 2019 6 citations	To explore the clinical characteristics, antimicrobial resistance, and risk factors for mortality of S. aureus pneumonia in patients with diabetes mellitus (DM) and non-diabetics mellitus (non-DM)	Retrospective cohort study	Retrospective study design; assessment of patient characteristics including demographics, comorbidities, and clinical outcomes; antimicrobial susceptibility testing; univariate and multivariate logistic regression analysis; statistical analyses using SPSS.	Patients with diabetes mellitus (DM) are more susceptible to MRSA infection, with higher antimicrobial resistance, co-infection rate, and more severe pneumonia compared to non-DM patients. Independent risk factors for pneumonia-related mortality were MRSA and CURB-65. Higher HbA1c levels were associated with increased MRSA infection and co-infection rates, as well as more severe pneumonia, leading to higher mortality.
The prevalence of urinary tract infections in type 2 diabetic	The study objectives are to determine the prevalence of urinary tract infections in type 2	Systematic review, Meta-analysis, Observational study, Cross-sectional study	The methodology involved conducting a systematic review and meta-analysis using specific	The overall prevalence of urinary tract infection in patients with type 2 diabetes was 11.5%. with a higher prevalence in

<p>patients: a systematic review and meta-analysis Nader Salari +6 European Journal of Medical Research 2020 19 citations</p>	<p>diabetic patients through a systematic review and meta-analysis, to develop interventions to reduce the incidence of urinary tract infections in type 2 diabetic patients, and to provide a better understanding for the development of more detailed programs to reduce the effects of urinary tract infections and improve people's health.</p>		<p>keywords in multiple databases from 1993 to 2020. Criteria for entering studies were clearly defined, and the STROBE checklist was used to evaluate methodological quality.</p>	<p>women compared to men. The prevalence of urinary tract infections in diabetic Iranian patients was observed to increase with the number of years of research and the age of participants, but decrease with increasing sample size. Subgroup analysis revealed a higher prevalence of urinary tract infections in women with diabetes compared to men.</p>
<p>Poor Glycemic Control: Prevalence and Risk Factors Among Patients with Type 2 Diabetes Mellitus in Northeast State of Peninsular Malaysia +9 International Journal of Human and Health Sciences 2020 5 citations</p>	<p>To determine the prevalence of poor glycemic control and its associated factors among T2DM patients in Pasir Puteh district, Kelantan</p>	<p>comparative cross-sectional study</p>	<p>The methodology used in the study involved a comparative cross-sectional study among T2DM patients, employing descriptive statistics, simple and multiple logistic regressions for data analysis, calculating sample size, using simple random sampling for subject recruitment, and utilizing SPSS Statistics for data entry and analysis.</p>	<p>The prevalence of patients with poor glycemic control in Pasir Puteh district was high at 79.6%, and significant factors associated with poor glycemic control included age, duration of diabetes, cigarette smoking, presence of hypertension, and presence of dyslipidemia. The study provided important criteria for clinicians to improve the management of diabetes mellitus and optimize glycemic control based on the pinpointed significant risk factors.</p>
<p>Prevalence of urinary tract infections and risk factors among diabetic patients in Ethiopia, a systematic review and meta-analysis Kirubel Dagnaw +5 PLoS ONE 2023 5 citations</p>	<p>The study objectives are to estimate the prevalence of urinary tract infection and its associated factors in Ethiopia, and to provide a better understanding of the condition to develop more detailed programs to reduce the effects of urinary tract infections and improve people's health.</p>	<p>Systematic review and meta-analysis</p>	<p>The methodology used in the study includes data extraction and analysis using Microsoft Excel and STATA statistical software, computation of I<sup>2</sup> for heterogeneity assessment, subgroup analysis by region and publication year, meta-regression analysis using study-level covariates, quality appraisal using the Joanna Briggs Institute (JBI) standardized checklist, assessment of risk of bias using the tool developed by Hoy et al., checking for publication bias using funnel plot, Begg's and Egger's</p>	<p>The prevalence of urinary tract infection in diabetic patients in Ethiopia was estimated to be 15.97%, with the highest prevalence observed in the SNNP region (19.21%) and in studies conducted in and after 2018 (17.98%). Being female, being illiterate, and having a prior history of urinary tract infection were identified as predictors of urinary tract infection in diabetic patients.</p>

			regression tests, sensitivity analysis to examine the effect of a single study on the overall prevalence, and meta-regression to identify potential sources of heterogeneity.	
Proteus mirabilis thoracic vertebral osteomyelitis: a case report Ming-Hsiu Chiang +3	To report a case of an older adult woman with recurrent fevers and chronic back pain, ultimately diagnosed with P. mirabilis vertebral osteomyelitis; to describe the clinical process for identifying the infection source and causative pathogen in the reported case; to discuss conservative treatment plans for P. mirabilis vertebral osteomyelitis; to review previous reports of similar cases and their respective diagnostic approaches.	Literature review that elucidates both the benefits and the negative aspects of sickness behaviour in the context of viral infection	The methodology used in the study involved clinical process for identifying the infection source and causative pathogen, describing conservative treatment plans, and reviewing previous reports of similar cases and their diagnostic approaches. The authors initially suspected a UTI but reconsidered based on atypical clinical presentation and further investigated using inflammation scans and MRI images to detect vertebral osteomyelitis.	Proteus mirabilis may disseminate to the vertebrae through the Batson plexus; vertebral osteomyelitis caused by Proteus mirabilis is rare; long-term antibiotic treatment can be effective for this condition.
Determination of microbiological characteristics and risk factors associated with bacteriuria and symptomatic urinary tract infection in patients with retained ureteral stents: an observational study Jae Yoon Kim +6 Translational Andrology and Urology 2021 1 citation	To identify microbiological characteristics and factors associated with bacteriuria and symptomatic UTI in patients with retained ureteral stents	observational cross-sectional study	The methodology used in the study is an observational study	Infections related to ureteral stents showed a specific microorganism profile and resistance pattern compared to community-acquired UTIs. - ESBL-producing bacteria were found in a significant proportion of patients with ureteral stents, particularly in those with E. coli and K. pneumoniae. - Symptomatic UTI developed in a small but significant percentage of patients, and this was associated with dependent functional capacity, impaired renal function, and longer ureteral stenting duration
The assessment of prophylactic and therapeutic methods for nail infections in	To evaluate the level of knowledge among diabetic patients about preventing nail infections and the impact of these infections on their	The study design is an observational study involving a combination of methods including a questionnaire, interview, physical examination.	The methodology included the use of the DLQI questionnaire, interview, physical examination, mycological tests, and a survey with multiple	High prevalence of nail plate infection, with dermatophytes being the most common fungus and a high prevalence of bacteria also being discovered. - Almost

<p>patients with diabetes Marianna Majchrzycka +2 Advances in Dermatology and Allergology 2022 0 citations</p>	<p>lives. Also, to analyze differences between type 1 and type 2 diabetes patients, as well as between males and females.</p>	<p>mycological tests, and a survey containing multiple choice questions. The study involved a sample of 120 patients and was approved by an ethical committee.</p>	<p>choice questions on a sample of 120 patients. The examination took place at the Department of Dermatology in Heliodor Świącicki Clinical Hospital in Poznan, and the study was conducted according to modern ethical standards and approved by the appropriate ethical committee.</p>	<p>all study participants tested positive for onychomycosis, indicating a high prevalence of this condition among diabetic patients. - The paper presents two case reports with descriptions of treatment management and photographs of its effects, providing practical insights into managing nail infections in diabetic patients.</p>
<p>Xi Sinonasal diffuse large B-cell lymphoma in a patient with Wiskott-Aldrich syndrome: A case report and literature review wen Sun +15 Citations unknown</p>	<p>The study objectives include reporting a unique case of WAS associated with DLBCL in paranasal sinuses, reviewing major publications of WAS-related lymphomas in the head and neck area, extending available therapies for WAS-related lymphomas, emphasizing the significance of recognizing sinonasal lymphomas in WAS patients presenting with sinusitis, and discussing the effects of mutations in the WAS gene on the level of WASP and their correlation with the diversity of the disease.</p>	<p>The study design of this study is case report about WAS associated with DLBCL in paranasal sinuses.</p>	<p>Case report, review of major publications, genetic testing, treatment with chemotherapy, CAR-T therapy, and HSCT, declaration of absence of conflict of interest</p>	<p>Diffuse large B-cell lymphoma (DLBCL) is a rare but significant form of malignancy in patients with Wiskott-Aldrich syndrome (WAS), especially when it occurs in paranasal sinuses and leads to visual impairment. - Prompt recognition of sinonasal malignancy from WAS in patients presenting with sinusitis symptoms is crucial to avoid unnecessary surgical intervention, and optic nerve sheath fenestration (ONSF) is urgent when the tumor has caused visual loss. - The prognosis for lymphoma in WAS patients is still poor due to their immunodeficiency, and allogeneic hematopoietic stem-cell transplantation (HSCT) remains the most curative therapy for WAS, with chemotherapy being the most common treatment for DLBCL in WAS.</p>
<p>The Association Between Gender and Complications of Type 2 Diabetes Mellitus Among Patients in Almarj City-Libya Fatma Kh Ali Ehmaida +2</p>	<p>The study objectives were to provide new data on patients with type 2 diabetes mellitus and make suggestions for the prevention of this disorder, as well as to focus on the relationship between genders and complications of diabetes mellitus</p>	<p>Descriptive statistical study, observational</p>	<p>The methodology used in the study involved a descriptive statistical analysis of data collected from 473 diabetic mellitus patients in Almarj city, Libya. Data analysis was conducted using SPSS statistical package version 19 and results were tabulated and represented</p>	<p>- The study focused on the relationship between genders and complications of diabetes mellitus, finding that males had a higher risk of complications compared to females in Almarj city. - The conclusion of the study was that men with type 2 diabetes mellitus are more likely to have serious complications</p>

<p>Risk factors for bacterial infection following replantation of zone 1 amputation Dong Chul Lee +5 Archives of Hand and Microsurgery 2023 0 citations</p>	<p>The study objectives are to identify risk factors for bacterial infection following zone 1 replantation, explore the relationship between the number of vein anastomoses and the occurrence of bacterial infection, and investigate the impact of salvage therapy on the risk of bacterial infection after zone 1 replantation.</p>	<p>Retrospective chart review</p>	<p>The methodology involved a retrospective chart review to collect data on patients who underwent zone 1 replantation, followed by detailed data collection on potential risk factors for bacterial infection. Statistical analysis was conducted using the Mann-Whitney test and the chi-square test, with a significance level set at <math>p &lt; 0.05</math>.</p>	<p>Occurrence of bacterial infection following zone 1 replantation</p>
<p>Barriers and Strategies to Lifestyle and Dietary Pattern Interventions for Prevention and Management of TYPE-2 Diabetes in Africa, Systematic Review Hirut Bekele +3 Journal of Diabetes Research 2020 45 citations</p>	<p>To review published articles investigating lifestyle and dietary pattern interventions for diabetes prevention and management in Africa, and to review barriers to lifestyle interventions and strategies to overcome these barriers.</p>	<p>The study design is not explicitly mentioned in the paper. However, the methods section indicates that extensive electronic database searches were conducted, and the levels of evidence and quality guides of articles and research papers were evaluated based on the Johns Hopkins Method of Research Evidence Appraisal Tool. The inclusion and exclusion criteria for this review were determined via the PICOS guidance for conducting literature reviews. Although specific details about the study design (e.g., randomized, double-blind, controlled, observational, etc.) are not provided, it can be inferred that the study design involved a systematic review or literature review based on the methods described</p>	<p>The methodology involved conducting an electronic database search, applying inclusion and exclusion criteria based on PICOS guidance, evaluating levels of evidence and quality guides using the Johns Hopkins Method, and selecting articles based on a thorough examination of titles, abstracts, and full articles.</p>	<p>Diabetes mellitus is a major challenging public health problem in Africa. - Lifestyle interventions, such as regular physical exercise, weight management, and adherence to health care professionals' recommendations on a healthy diet, are crucial for the prevention and management of diabetes in Africa. - The main barriers to adherence are both systemic and personal in nature, and the strategies for overcoming these barriers include health education programs, advocacy, and capacity building</p>

## Discussion

Diabetes mellitus significantly increases susceptibility to bacterial infections due to factors such as hyperglycemia, immune dysfunction, impaired wound healing, and co-existing complications. Peripheral vascular disease and neuropathy further elevate the risk of bacterial infections in diabetic patients (Chávez-Reyes et al. 2021; Huang et al. 2023). Hyperglycemia plays a crucial role in this increased susceptibility by affecting immune cell function, promoting inflammation, and influencing the virulence of bacterial pathogens (Krapić, Kavazović, and Wensveen 2021; Huang et al. 2023). Additionally, hyperglycemia hinders inflammation from subsiding, leading to persistent bacterial infections and chronic inflammation in diabetic wounds (Huang et al. 2023; Wang et al. 2024). Overall, the impact of diabetes on bacterial infections is multifaceted, involving various mechanisms related to hyperglycemia and immune responses. Factors such as hyperglycemia, immune dysfunction, impaired wound healing, and co-existing complications contribute to this increased susceptibility. Peripheral vascular disease and neuropathy are additional factors that can further augment the risk of bacterial infections in diabetic patients. In diabetic patients, factors like peripheral vascular disease and neuropathy further augment the risk of bacterial infections, emphasizing the multifaceted nature of how diabetes impacts susceptibility to such infections. Additionally, the association of diabetes with lower back pain can lead to functional limitations due to increased load on weight-bearing joints, which is a common mechanical complication (Rani et al. 2019).

Furthermore, the cardiovascular risks associated with medications used for diabetic neuropathy, such as gabapentin and pregabalin, also play a role in the susceptibility to infections in diabetic patients (Kim et al. 2023). The references collectively highlight the intricate interplay between diabetes mellitus and susceptibility to bacterial infections, underscoring the importance of considering various factors such as immune dysfunction, neuropathy, and impaired wound healing in diabetic individuals. Understanding these complexities is crucial for effective management and prevention strategies to mitigate the risk of bacterial infections in diabetic patients.

Major bacterial infections commonly affecting individuals with diabetes mellitus encompass a spectrum of conditions that pose significant challenges. Among these, diabetic foot infections are prevalent and can lead to severe complications, including limb amputations (Singh, Junaid, Farooq, S. Sharma, et al. 2022). Urinary tract infections (UTIs) are also common in diabetic patients, with *Escherichia coli* being a predominant pathogen (Faraj Hatto Joni 2019). Furthermore, skin infections, such as *Staphylococcal* infections, are notably more severe in individuals with uncontrolled diabetes (David, Singh, and Ankar 2023).

In addition to these infections, diabetic patients are at an increased risk of developing mucormycotic, a rare fungal infection with high mortality rates, especially in immunocompromised individuals (Rani et al. 2019; Sowaid, Ali, and Hussian 2022; Akash et al. 2020). Moreover, diabetic foot ulcers can serve as portals for bacterial invasion, with *Staphylococcus aureus* being a common pathogen causing infections in diabetic wound. Furthermore, the impaired immune function in diabetic individuals can lead to a higher susceptibility to bacterial infections, including pyogenic infections such as pyomyositis (Berbudi et al. 2019). Additionally, diabetic patients are more prone to developing complications such as surgical site infections, which can further exacerbate their health outcomes (Fahrezi, Murti, and Tamtomo 2022).

Overall, individuals with diabetes mellitus face a heightened risk of various bacterial infections, ranging from common skin and urinary tract infections to more severe conditions like mucormycotic and pyogenic infections. Managing these infections in diabetic patients requires a comprehensive approach that addresses both the underlying diabetes-related factors and the specific characteristics of each infection to prevent complications and improve outcomes.

Preventing and managing bacterial infections in individuals with diabetes mellitus requires a multifaceted approach. This includes maintaining good glycemic control to optimize immune function and prevent the development of complications. Regular monitoring of blood sugar levels, adhering to a healthy diet and exercise regimen, and taking prescribed medications as directed by healthcare professionals are crucial in managing diabetes and reducing the risk of bacterial infections. To prevent and manage bacterial infections in individuals with diabetes mellitus, a comprehensive approach is essential. Maintaining good glycemic control is paramount to optimize immune function and reduce the risk of complications (Tomic, Shaw, and Magliano 2022).

Regular monitoring of blood sugar levels, adherence to a healthy diet, exercise regimen, and proper medication management as prescribed by healthcare professionals are crucial components in managing diabetes and lowering the susceptibility to bacterial infections (Tomic et al. 2022). In addition to glycemic control, understanding the burden and risks of emerging complications in diabetes is vital for effective prevention strategies (Tomic et al. 2022). Addressing lifestyle and dietary patterns, as well as identifying predictors of glycemic control, can further aid in managing diabetes and reducing the risk of infections (Bekele et al. 2020). Moreover, recognizing the association between diabetes mellitus and the development of infectious complications, such as urinary tract infections, can guide interventions to mitigate risks and improve outcomes (Ullah, Ali, et al. 2022). Furthermore, the use of advanced technologies, such as automated detection systems using convolutional neural networks, can assist in the early identification of infections, particularly in diabetic foot ulcers, enhancing treatment outcomes (Yogapriya et al. 2022). Multidisciplinary management approaches, as seen in cases like Fournier gangrene in patients with type 2 diabetes mellitus, underscore the importance of collaborative care in addressing complex infections in diabetic individuals (Christanti, Prajitno, and Christanto 2022). Overall, a holistic approach that encompasses glycemic control,

lifestyle modifications, early detection through advanced technologies, and multidisciplinary management is crucial in preventing and managing bacterial infections in individuals with diabetes mellitus.

Research has shown a clear relationship between blood sugar control and infection rates in individuals with diabetes mellitus. Poor glycemic control, characterized by high blood sugar levels, can weaken the immune system and impair the body's ability to fight off bacterial infections. Several research offer important insights into the association between blood sugar control and infection rates in diabetes individuals (Shirzaiy and Dalirsani 2019). Investigates the relationship between patients with type 2 diabetes's ability to control their blood sugar and their salivary levels of interleukin-8. The study examines the potential link between HbA1c levels and inflammatory markers, shedding light on how blood sugar control may influence immune responses and susceptibility to infections (Lambou et al. 2022). Explores the role of multidrug-resistant *Escherichia coli* in diabetic patients with deglycation-related urinary tract infections. The research underscores the significant association between poor blood sugar control and increased frequencies of urinary symptoms, highlighting the importance of glycemic management in reducing infection risks (Bilal et al. 2022). Emphasizes the value of well managed blood sugar levels in improving wound healing and lowering the risk of serious infections in those with diabetes. The study highlights how important glycemic management is for controlling complications and infection rates in people with diabetes by underscores the significance of well-controlled blood sugar levels in enhancing wound healing and decreasing the risk of severe infections in diabetic patients. The study emphasizes the critical role of glycemic control in managing complications and infection rates in individuals with diabetes (Parker et al. 2021). Assess the glycemic state of individuals with acute coronary syndrome by analyzing their angiographic profile of coronary artery disease. By analyzing blood sugar levels and disease severity, this study offers insights into the impact of blood sugar control on cardiovascular health and infection risks in diabetic individuals. These references collectively highlight the intricate relationship between blood sugar control and infection rates in diabetic patients. Understanding this connection is crucial for optimizing diabetes management strategies to mitigate infection risks and improve overall health outcomes.

Diabetes mellitus has been associated with immunodeficiency, making individuals with diabetes more susceptible to bacterial infections. Diabetes mellitus is associated with immunodeficiency, predisposing individuals to an increased risk of bacterial infections. Genetic predisposition plays a crucial role in the development of type 1 diabetes, as evidenced by the onset of new-onset type 1 diabetes following COVID-19 mRNA vaccination in individuals with a genetic predisposition to the disease (Yano et al. 2022). Moreover, the presence of the type 1 diabetes risk gene *IFIH1* has been linked to enterovirus infections, suggesting a potential association between genetic predisposition, viral infections, and type 1 diabetes (Sioofy-Khojine et al. 2022). Immunodeficiency disorders, such as Wiskott-Aldrich syndrome (WAS), are characterized by a predisposition to autoimmunity and lymphoproliferative diseases, highlighting the link between immunodeficiency and disease susceptibility (Sun et al. 2023). Additionally, *GATA2* deficiency is associated with cellular immunodeficiencies and a predisposition to recurrent or atypical infections, emphasizing the impact of genetic factors on immunological phenotypes and infection susceptibility (Kotmayer et al. 2022). Diabetic individuals are more susceptible to bacterial infections due to factors such as neuropathy, peripheral artery disease, and immunodeficiency, which facilitate bacterial superinfections leading to severe complications like cellulitis, osteomyelitis, and sepsis (Korpowska, Majchrzycka, and Adamski 2022).

Furthermore, the presence of drug-resistant bacteria in diabetic foot ulcers poses a significant challenge during treatment, underscoring the importance of understanding the immunodeficiency aspects in diabetic patients. In conclusion, the interplay between genetic predisposition, immunodeficiency, and diabetes mellitus underscores the complex relationship between diabetes-related immunodeficiency and the predisposition to bacterial diseases. Understanding these factors is crucial for effective management and prevention strategies in diabetic individuals.

In diabetic patients, bacterial infections are a common complication that can significantly impact their health and well-being. These infections can occur in various parts of the body, including the urinary tract, skin, respiratory tract, and even in surgical wounds. Diabetic patients are particularly susceptible to bacterial infections due to factors such as immunodeficiency and impaired wound healing. Research has shown that diabetic foot ulcers can harbor drug-resistant bacteria, complicating treatment and necessitating effective antimicrobial strategies (Bruyn et al. 2022). Moreover, the utilization of light-activatable synergistic therapy has proven effective in treating drug-resistant bacteria-infected chronic wounds in diabetic mice, showcasing the potential for innovative treatment modalities (Qiao et al. 2019). Laser-activatable CuS nanodots have exhibited promise in treating multidrug-resistant bacteria and expediting the healing of infected chronic nonhealing wounds, addressing the challenges posed by chronic nonhealing wounds in diabetic patients (Qiao et al. 2019). Additionally, a dual layered adhesive film cored with a microsphere-loaded hydrogel composite dressing has been discovered to accelerate the healing of infected diabetic wounds, offering a promising clinical translation strategy for managing diabetic foot ulcers (Qin et al. 2021). Bacterial infection-related glomerulonephritis in diabetic patients emphasizes the significance of understanding the clinical features, infection profiles, and outcomes in diabetic individuals with kidney biopsy-proven bacterial infections (John et al. 2023). In conclusion, these clinical insights shed light on the challenges and potential strategies for managing bacterial infections in diabetic patients. By leveraging innovative treatments, optimizing wound care, and addressing infection-related complications, healthcare providers can enhance outcomes and quality of life for individuals with diabetes.

Advancements in treatment protocols for diabetics with bacterial infections have shown promising results in improving outcomes and quality of life for these patients. Diabetic patients with bacterial infections present a unique challenge that requires innovative treatment protocols. Recent research has explored novel therapeutic approaches utilizing advanced materials and technologies to enhance wound healing and combat infections in diabetic

individuals. One promising advancement is the development of tailored hydrogels delivering niobium carbide, which enhances reactive oxygen species (ROS)-scavenging and antimicrobial activities for diabetic wound healing (Zhang et al. 2019). Functional hydrogels have also shown potential in diabetic wound management, offering solutions such as wound autografts, dressings, and tissue engineering scaffolds to address the complexities of diabetic wounds (Gao et al. 2021). Moreover, polymer some wound dressing sprays capable of bacterial inhibition and hydrogen sulfide (H<sub>2</sub>S) generation have emerged as a convenient and efficient treatment approach for diabetic patients. Phage therapy has shown efficacy in treating diabetic mouse wound infections caused by multidrug-resistant *Staphylococcus aureus*, offering a promising alternative to traditional antibiotic treatments (Kifelew et al. 2020).

Additionally, nanohybrid double network hydrogels based on a platinum nanozyme composite have demonstrated antimicrobial and diabetic wound healing properties, providing a multifunctional approach to infection management (Lee et al. 2023). These advancements in treatment protocols for diabetics with bacterial infections highlight the importance of leveraging cutting-edge technologies and materials to improve wound healing outcomes and combat infections effectively. By incorporating these innovative approaches into clinical practice, healthcare providers can enhance the quality of care and outcomes for diabetic patients with bacterial infections.

## Conclusion

Based on a literature review involved Impact DM on susceptibility to bacterial infections, Major bacterial infections affecting individuals with DM, prevention of bacterial infections in Diabetes, exploring the relationship between blood sugar control and infection rates, current strategies for reducing Risks in Diabetic populations, and clinical insight into bacterial infection, it can be concluded that diabetic patients are at a higher risk of bacterial infections and that effective management and prevention strategies are crucial. These strategies include proper glycemic control, regular dental and periodontal care, timely treatment of diabetic foot ulcers, and the use of innovative approaches such as polymer some wound dressing sprays, phage therapy, nanohybrid double network hydrogels, and sonocatalytic hydrogen/hole-combined therapy. By implementing these strategies, healthcare providers can improve outcomes for diabetic patients by reducing the incidence and severity of bacterial infections, promoting better wound healing, and ultimately enhancing overall patient well-being and quality of life. This review highlights the significant burden of bacterial infections in patients with diabetes mellitus. It underscores the need for proactive management strategies to prevent and treat these infections to reduce the morbidity and mortality associated with diabetes.

### Declaration Conflicting Interest

The authors declared no competing interest.

### Funding

None.

### Acknowledgment

The authors acknowledge to all participants that participated in this study. The author would like to thank Library of Poltekkes Kemenkes Kendari, for supporting us to use reputable reference facilities.

### Author Contribution

Conceptualization and formal analysis: RY; data curation: FW; Funding acquisition and investigation: AS and DYSR; Methodology and Supervision: FEH and TR; Software and writing draft: AF; Validation and revising: all authors.

### Author Biography

*Reni Yunus* is a Lecturer at Poltekkes Kemenkes Kendari, Department of Medical Technology Laboratory and a member of Association Institution Medical Technology Laboratory Indonesia.

*Fitri Wijayati* is a Lecturer at Poltekkes Kemenkes Kendari, Department of Nursing.

*Askrening Askrening* is a Lecturer at Poltekkes Kemenkes Kendari, Department of Midwifery.

*Dian Yuniar Syanti Rahayu* is a Lecturer at Poltekkes Kemenkes Bandung, Department of Nursing.

*Fonnie E. Hasan* is a Lecturer at Poltekkes Kemenkes Kendari at Medical Technology Laboratory Department.

*Trees Trees* is a Lecturer at Poltekkes Kemenkes Kendari at Medical Technology Laboratory Department.

*Angriani Fusvita* is a Lecturer at Polytechnic Bina Husada Kendari, Department of Medical Technology Laboratory.

### References

- Adu-Poku, Maxwell, and Matthew G. Addo. 2020. "Antimicrobial Susceptibility Profile of Urinary Tract Pathogenic Infections in Diabetic Patients Attending a Health Facility in Kumasi, Ghana." *International Journal of Pathogen Research*. doi: 10.9734/ijpr/2020/v4i230109.
- Agofure, Otovwe, Anthony Taghohgho Eduviere, and Oghenenioborue Rume Okandeji-Barry. 2021. "Coronavirus Disease-19 and Diabetes Mellitus: Implications for Diabetes Management in Nigeria." *International Journal of Community Medicine And Public Health* 8(2):969. doi: 10.18203/2394-6040.ijcmph20210251.
- Akash, Muhammad Sajid Hamid, Kanwal Rehman, Fareeha Fiayyaz, Shakila Sabir, and Mohsin Khurshid. 2020. "Diabetes-Associated Infections: Development of Antimicrobial Resistance and Possible Treatment Strategies." *Archives of Microbiology* 202(5):953–65. doi: 10.1007/s00203-020-01818-x.
- Ali, Alaa J. 2022. "Role of IL-6 in Urinary Tract Infection Among Diabetic and Non- Diabetic Patients." *Tikrit Journal of*

*Pure Science*. doi: 10.25130/tjps.v27i5.11.

- Awang, Hafizuddin, Siti Mariam Ja'afar, Nurul Adhiyah Wan Ishak, Muhamad YusofZainal, Abdul Mukmin Mohamed Aminuddin, and Zawiyah Dollah. 2020. "Poor Glycemic Control: Prevalence and Risk Factors Among Patients with Type 2 Diabetes Mellitus in Northeast State of Peninsular Malaysia." *International Journal of Human and Health Sciences (IJHHS)* 4(3):206. doi: 10.31344/ijhhs.v4i3.202.
- Ayelnig, Birhanu, Markos Negash, Meaza Genetu, Tadelo Wondmagegn, and Tewodros Shibabaw. 2019. "Immunological Impacts of Diabetes on the Susceptibility of Mycobacterium Tuberculosis." *Journal of Immunology Research* 2019. doi: 10.1155/2019/6196532.
- Barkai, László József, Emese Sipter, Dorottya Csuka, Zoltán Prohászka, Katrine Pilely, Peter Garred, and Nóra Hosszúfalusi. 2019. "Decreased Ficolin-3-Mediated Complement Lectin Pathway Activation and Alternative Pathway Amplification during Bacterial Infections in Patients with Type 2 Diabetes Mellitus." *Frontiers in Immunology* 10(MAR):1–10. doi: 10.3389/fimmu.2019.00509.
- Bekele, Hirut, Adisu Asefa, Bekalu Getachew, and Abebe Muche Belete. 2020. "Barriers and Strategies to Lifestyle and Dietary Pattern Interventions for Prevention and Management of TYPE-2 Diabetes in Africa, Systematic Review." *Journal of Diabetes Research* 2020. doi: 10.1155/2020/7948712.
- Berbudi, Afiat, Nofri Rahmadika, Adi Imam Tjahjadi, and Rovina Ruslami. 2019. "Type 2 Diabetes and Its Impact on the Immune System." *Current Diabetes Reviews* 16(5):442–49. doi: 10.2174/1573399815666191024085838.
- Bilal, Muhammad, Abdul Hanan, Muhammad Saleem Bashir, Muhammad Shakeel Basit, and Muhammad Adeel Abbas. 2022. "Wound Healing in Diabetic Patients." *Pakistan Journal of Medical and Health Sciences* 16(12):360–64. doi: 10.53350/pjmhs20221612360.
- Bruyn, Astrid D., Stijn Verellen, Liesbeth Bruckers, Laurien Geebelen, Ina Callebaut, Ilse D. Pauw, Björn Stessel, and Jasperina Dubois. 2022. "Secondary Infection in COVID-19 Critically Ill Patients: A Retrospective Single-Center Evaluation." *BMC Infectious Diseases*. doi: 10.1186/s12879-022-07192-x.
- Burekovic, Azra, Edhem Hasković, Faruk Ceric, and Dzenana Halilovic. 2021. "Correlation Between Inflammatory and Biochemical Parameters in Patients With Diabetes and Urinary Tract Infection." *Materia Socio Medica*. doi: 10.5455/msm.2021.33.240-243.
- Butayeva, Jamila. 2023. "The Impact of Health Literacy Interventions on Glycemic Control and Self-management Outcomes Among Type 2 Diabetes Mellitus: A Systematic Review." *Journal of Diabetes*. doi: 10.1111/1753-0407.13436.
- Chand, Anita E., Sarita R. Goyal, and Harshad S. Naruka. 2021. "Prevalence of Uropathogens Among Diabetic Patients and Their Antibiogram at Government Medical College, Kota." *Ip International Journal of Medical Microbiology and Tropical Diseases*. doi: 10.18231/j.ijmmt.2021.006.
- Chand, Anita E., Sarita Rani Goyal, and Harshad Singh Naruka. 2021. "Prevalence of Uropathogens among Diabetic Patients and Their Antibiogram at Government Medical College, Kota." *IP International Journal of Medical Microbiology and Tropical Diseases* 7(1):24–27. doi: 10.18231/j.ijmmt.2021.006.
- Chávez-Reyes, Jesús, Carlos E. Escárcega-González, Erika Chavira-Suárez, Angel León-Buitimea, Priscila Vázquez-León, José R. Morones-Ramírez, Carlos M. Villalón, Andrés Quintanar-Stephano, and Bruno A. Marichal-Cancino. 2021. "Susceptibility for Some Infectious Diseases in Patients With Diabetes: The Key Role of Glycemia." *Frontiers in Public Health* 9(February):1–18. doi: 10.3389/fpubh.2021.559595.
- Christanti, Mike, Jongky Hendro Prajitno, and Rio Yudistira Christanto. 2022. "A Patient with Type 2 Diabetes Mellitus (T2DM) with Fournier Gangrene: A Case Report." *Bali Medical Journal* 11(1):61–66. doi: 10.15562/bmj.v11i1.2957.
- Darraj, Hussain, Mohammed Badedi, Kirsten R. Poore, Abdulrahman Hummadi, Abdullah Khawaji, Yahia Solan, Ibrahim Zakri, Abdullah Sabai, Majid Darraj, Dhayf A. Mutawwam, Mohammed Daghreeri, Safaa Sayed, Wael Alaallah, Abdulaziz F. Alfadhly, and Abdullah Alsabaani. 2019. "Vitamin D Deficiency and Glycemic Control Among Patients With Type 2 Diabetes Mellitus in Jazan City, Saudi Arabia." *Diabetes Metabolic Syndrome and Obesity Targets and Therapy*. doi: 10.2147/dmso.s203700.
- David, Pascaline, Seema Singh, and Ruchira Ankar. 2023. "A Comprehensive Overview of Skin Complications in Diabetes and Their Prevention." *Cureus* 15(5). doi: 10.7759/cureus.38961.
- Demoz, Gebre T., Abebe Gebremariam, Helen Yifter, Minyahil Alebachew, Yirga L. Niriayo, Gebremicheal Gebreslassie, Minyahil A. Woldu, Degena Bahrey, and Workineh Shibeshi. 2019. "Predictors of Poor Glycemic Control Among Patients With Type 2 Diabetes on Follow-Up Care at a Tertiary Healthcare Setting in Ethiopia." *BMC Research Notes*. doi: 10.1186/s13104-019-4248-6.
- Ehmaida, Fatma K. A., Sokaina S. Hemdan, and Asmaa M. Aljebaly. 2020. "The Association Between Gender and Complications of Type 2 Diabetes Mellitus Among Patients in Almarj City-Libya." *Al-Mukhtar Journal of Sciences*. doi: 10.54172/mjsc.v35i2.306.
- Fahrezi, Chattrin, Bhisma Murti, and Didik Tamtomo. 2022. "Meta Analysis: Correlation between Diabetes Mellitus and Surgical Wound Infection." *Indonesian Journal of Medicine* 7(2):122–30. doi: 10.26911/theijmed.2022.07.02.01.
- Fernández-Ugidos, Paula, Eduardo Barge-Caballero, Rocío Gómez-López, María J. Paniagua-Martin, Gonzalo Barge-Caballero, David Couto-Mallón, Miguel Solla-Buceta, Carmen Iglesias-Gil, Vanesa Aller-Fernández, Miguel González-Barbeito, Jose Manuel Vázquez-Rodríguez, and María G. Crespo-Leiro. 2019. "In-Hospital Postoperative Infection after Heart Transplantation: Risk Factors and Development of a Novel Predictive Score." *Transplant Infectious Disease* 21(4):0–1. doi: 10.1111/tid.13104.

- Gao, Daqian, Yidan Zhang, Daniel T. Bowers, Wanjun Liu, and Minglin Ma. 2021. "Functional Hydrogels for Diabetic Wound Management." *APL Bioengineering* 5(3):1-21. doi: 10.1063/5.0046682.
- Gao, Yuxia, Yarong Han, Xin Zou, Judy Xu, Dean G. Mawen, Yaqing Zhong, qingyun Lun, Minjie Chu, Qiang Ma, Xun Zhuang, and Jing Xiao. 2020. "Diabetes Distress, Depressive Symptoms and Type 2 Diabetes Management and Glycemic Control: The Mediating Role of Self-Efficacy." doi: 10.21203/rs.3.rs-97220/v1.
- Giese, Isabella Maria, Marie Christin Schilloks, Roxane L. Degroote, Maria Weigand, Simone Renner, Eckhard Wolf, Stefanie M. Hauck, and Cornelia A. Deeg. 2021. "Chronic Hyperglycemia Drives Functional Impairment of Lymphocytes in Diabetic INSC94Y Transgenic Pigs." *Frontiers in Immunology* 11(January):1-11. doi: 10.3389/fimmu.2020.607473.
- Gill, Anureet, and Sukhinder Baidwan. 2023. "A Comparative Study to Assess Clinical and Characteristic Differences of Urinary Tract Infections Between Diabetic and Non-Diabetic Patients." *International Journal of Advanced Research in Medicine*. doi: 10.22271/27069567.2023.v5.i1b.461.
- Gopi, Manigandan, and M. S. Seshadri. 2023. "Diabetes Mellitus-a True Immunosuppression." *International Journal Of Community Medicine And Public Health* 10(2):842-44. doi: 10.18203/2394-6040.ijcmph20230007.
- Graves, Dana T., Zhenjiang Ding, and Yingming Yang. 2020. "The Impact of Diabetes on Periodontal Diseases." *Periodontology 2000* 82(1):214-24. doi: 10.1111/prd.12318.
- Horiya, Megumi, Takatoshi Anno, Mayuko Kawada, Haruki Yamada, Kaiou Takahashi, Haruka Takenouchi, Hideyuki Iwamoto, Fumiko Kawasaki, Katsumi Kurokawa, Hideaki Kaneto, Kohei Kaku, and Koichi Tomoda. 2021. "Pyogenic Psoas Abscess on the Dorsal Side, and Bacterial Meningitis and Spinal Epidural Abscess on the Ventral Side, Both of Which Were Induced by Spontaneous Discitis in a Patient with Diabetes Mellitus: A Case Report." *Journal of Diabetes Investigation* 12(7):1301-5. doi: 10.1111/jdi.13461.
- Huang, Fang, Xiangyu Lu, Yan Yang, Yushan Yang, Yongyong Li, Le Kuai, Bin Li, Haiqing Dong, and Jianlin Shi. 2023. "Microenvironment-Based Diabetic Foot Ulcer Nanomedicine." *Advanced Science* 10(2):1-24. doi: 10.1002/advs.202203308.
- John, Elenjickal E., Sanjeet Roy, Jeethu J. Eapen, Reka Karuppusami, Nisha Jose, Selvin S. R. Mani, Joseph Johny, Rizwan Alam, Salim Yusuf, Abi M. Thomas, Anna T. Valson, Vinoi G. David, Santosh Varughese, and Alexander Schmeißer. 2023. "Bacterial Infection-related Glomerulonephritis in Patients With Diabetes." *Nephrology*. doi: 10.1111/nep.14222.
- Joni, Faraj H. 2019. "Isolation and Diagnosis of Bacteria Causing Urinary Tract Infection in Pregnant and Non Pregnant Females With Diabetes Mellitus Type2." *Al-Mustansiriyah Journal of Science*. doi: 10.23851/mjs.v29i4.465.
- Joni, Faraj Hatto. 2019. "Isolation and Diagnosis of Bacteria Causing Urinary Tract Infection in Pregnant and Non Pregnant Females with Diabetes Mellitus Type2." *Al-Mustansiriyah Journal of Science* 29(4):23-26. doi: 10.23851/mjs.v29i4.465.
- Kaya, Elif, Johannes Siebermair, Nadine Vonderlin, Nino Hadjamu, Obayda Azizy, Tienush Rassaf, and Reza Wakili. 2020. "Impact of Diabetes as a Risk Factor in Patients Undergoing Subcutaneous Implantable Cardioverter Defibrillator Implantation: A Single-Centre Study." *Diabetes and Vascular Disease Research* 17(2). doi: 10.1177/1479164120911560.
- Kifelew, Legesse Garedeew, Morgyn S. Warner, Sandra Morales, Lewis Vaughan, Richard Woodman, Robert Fitridge, James G. Mitchell, and Peter Speck. 2020. "Efficacy of Phage Cocktail AB-SA01 Therapy in Diabetic Mouse Wound Infections Caused by Multidrug-Resistant Staphylococcus Aureus." *BMC Microbiology* 20(1):1-10. doi: 10.1186/s12866-020-01891-8.
- Kim, Jae Yoon, Jeong Kyun Yeo, Min Gu Park, Luck Hee Sung, Dae Yeon Cho, and Ji Hyeong Yu. 2023. "Determination of Microbiological Characteristics and Risk Factors Associated with Bacteriuria and Symptomatic Urinary Tract Infection in Patients with Retained Ureteral Stents: An Observational Study." *Translational Andrology and Urology* 12(1):19-32. doi: 10.21037/tau-22-331.
- Korpowska, Kamila, Marianna Majchrzycka, and Zygmunt Adamski. 2022. "The Assessment of Prophylactic and Therapeutic Methods for Nail Infections in Patients with Diabetes." *Postepy Dermatologii i Alergologii* 39(6):1048-52. doi: 10.5114/ada.2022.113585.
- Kotmayer, Lili, Damia Romero-Moya, Oskar Marin-Bejar, Emilia Kozyra, Albert Català, Anna Bigas, Marcin W. Wlodarski, Csaba Bödör, and Alessandra Giorgetti. 2022. "GATA2 Deficiency and MDS/AML: Experimental Strategies for Disease Modelling and Future Therapeutic Prospects." *British Journal of Haematology* 199(4):482-95. doi: 10.1111/bjh.18330.
- Krapić, Mia, Inga Kavazović, and Felix M. Wensveen. 2021. "Immunological Mechanisms of Sickness Behavior in Viral Infection." *Viruses* 13(11). doi: 10.3390/v13112245.
- Kumar, Ravi, Rajesh Kumar, Prinka Perswani, Muhammad Taimur, Ali Shah, and Faizan Shaukat. 2019. "Clinical and Microbiological Profile of Urinary Tract Infections in Diabetic versus Non-Diabetic Individuals." *Cureus* 11(8):8-15. doi: 10.7759/cureus.5464.
- Kumar, Ravi, Rajesh Kumar, Prinka Perswani, Muhammad Taimur, Amit Shah, and Faizan Shaukat. 2019. "Clinical and Microbiological Profile of Urinary Tract Infections in Diabetic Versus Non-Diabetic Individuals." *Cureus*. doi: 10.7759/cureus.5464.
- Lambou, Josiane Claire Soukoue, Michel Noubom, Boris Emmanuel Djoumsie Gomseu, Wiliane Jean Takougoum Marbou, Jean De Dieu Tamokou, and Donatien Gatsing. 2022. "Multidrug-Resistant Escherichia Coli Causing Urinary Tract Infections among Controlled and Uncontrolled Type 2 Diabetic Patients at Laquintinie Hospital in Douala, Cameroon." *Genetics Research* 2022. doi: 10.1155/2022/1250264.

- Lee, Dong Chul, Chan Ju Park, Jin Soo Kim, Sung Hoon Koh, Si Young Roh, and Kyung Jin Lee. 2023. "Risk Factors for Bacterial Infection Following Replantation of Zone 1 Amputation." *Archives of Hand and Microsurgery* 28(3):158–65. doi: 10.12790/ahm.23.0023.
- Li, Xuemei, Zhipeng Du, Ziwei Tang, Qin Wen, Qingfeng Cheng, and Yunhua Cui. 2022. "Distribution and Drug Sensitivity of Pathogenic Bacteria in Diabetic Foot Ulcer Patients with Necrotizing Fasciitis at a Diabetic Foot Center in China." *BMC Infectious Diseases* 22(1):1–10. doi: 10.1186/s12879-022-07382-7.
- Masuda, Hiroaki, Daisuke Ishiyama, Minoru Yamada, Fumiko Iwashima, Yosuke Kimura, Yuhei Ootobe, Naoki Tani, Mizue Suzuki, and Hideki Nakajima. 2021. "Relationship Between Long-Term Objectively Measured Physical Activity and Glycemic Control in Type 2 Diabetes Mellitus Patients: A Prospective Cohort Study." *Diabetes Metabolic Syndrome and Obesity Targets and Therapy*. doi: 10.2147/dmsos.307070.
- Mizu, Daisuke, Haruka Nishida, Yoshinori Matsuoka, and Koichi Ariyoshi. 2022. "Visceral Disseminated Varicella Zoster Infection: A Rare Cause of Acute Abdomen in a Patient with Well-Controlled Diabetes Mellitus—a Case Report." *BMC Infectious Diseases* 22(1):1–4. doi: 10.1186/s12879-022-07183-y.
- Narayanaswamy, Girish, Reenu S.P, and Ramesh Kumar Kushwaha. 2022. "Bacterial Urinary Tract Infection in Diabetes Patients and Evaluation for Multidrug Resistant Organisms." *IP International Journal of Medical Microbiology and Tropical Diseases* 8(4):317–23. doi: 10.18231/j.ijmmt.2022.062.
- Nayaju, Tulsi, Milan K. Upreti, Alina Ghimire, Basudha Shrestha, Basanta Maharjan, Rajesh Joshi, Binod Lekhak, and Upendra T. Shrestha. 2020. "Higher Prevalence of ESBL Producing Uropathogenic Escherichia Coli Among Diabetic Patients From a Tertiary Care Hospital of Kathmandu." doi: 10.21203/rs.3.rs-31876/v1.
- Nkpozi, Dr MO. 2019. "Bacterial Infections in Unusual Sites in the Setting of Poor Glycaemic Control - Case Reports." *Journal of Medical Science And Clinical Research* 7(4):299–303. doi: 10.18535/jmscr/v7i4.52.
- Parkar, Matin, Chandrakant Chavan, Shubhadarshini Pawar, and Yugandhara Chavan. 2021. "Angiographic Profile of Coronary Artery Disease in Patients with Acute Coronary Syndrome in Correlation to Their Glycaemic Status." *International Journal of Advances in Medicine* 8(6):781. doi: 10.18203/2349-3933.ijam20212099.
- Priyadarshini, Ankita, Janvi Shah, Hemantkumar Patadia, and Ajit K. Gangawane. 2022. "Prevalence and Antibiotic Sensitivity of Uropathogens Isolated from Type-II Diabetic Patients Having Urinary Tract Infection (UTI): A Retrospective Study from a Rural Tertiary Care Hospital." *International Journal of Health Sciences* 6(June):2511–23. doi: 10.53730/ijhs.v6ns6.9798.
- Qiao, Yue, Yuan Ping, Hongbo Zhang, Bo Zhou, Fengyong Liu, Yinhui Yu, Tingting Xie, Wanli Li, Danni Zhong, Yuezhou Zhang, Ke Yao, Hélder A. Santos, and Min Zhou. 2019. "Laser-Activatable CuS Nanodots to Treat Multidrug-Resistant Bacteria and Release Copper Ion to Accelerate Healing of Infected Chronic Nonhealing Wounds." *ACS Applied Materials and Interfaces* 11(4):3809–22. doi: 10.1021/acsami.8b21766.
- Qin, Yue, Marah Aqeel, Fengqing Zhu, Edward J. Delp, and Heather A. Eicher-Miller. 2021. "Dietary Aspects to Incorporate in the Creation of a Mobile Image-Based Dietary Assessment Tool to Manage and Improve Diabetes." *Nutrients*. doi: 10.3390/nu13041179.
- Rani, Sanda U., Sivaranjani Yeluri, Manchikatla P. Kumar, and Venkateswara R. Guttikonda. 2019. "Rhinocerebral Mucormycosis Associated With Actinomycosis in a Diabetic Patient: A Rare Presentation." *Journal of Oral and Maxillofacial Pathology*. doi: 10.4103/jomfp.jomfp\_77\_18.
- Rani, Sanda Usha, Yeluri Sivaranjani, Manchikatla Praven Kumar, and Guttikonda Venkateswara Rao. 2017. "Alteration of Cellular Metabolism in Cancer Cells and Its Therapeutic." *Journal of Oral and Maxillofacial Pathology* 21(3):244–51. doi: 10.4103/jomfp.JOMFP.
- Ruissen, Merel M., Hannah Regeer, Cyril P. Landstra, Marielle A. Schroijen, Ingrid M. Jazet, Michiel F. Nijhoff, Hanno Pijl, Bart E. Ballieux, Olaf M. Dekkers, Sasja D. Huisman, and Eelco J. d. Koning. 2021. "Increased Stress, Weight Gain and Less Exercise in Relation to Glycemic Control in People With Type 1 and Type 2 Diabetes During the COVID-19 Pandemic." *BMJ Open Diabetes Research & Care*. doi: 10.1136/bmjdr-2020-002035.
- S, Harikrishnan, Rosy Vennila, and R. Monica. 2021. "Isolation and Characterisation of Anti-Bacterial Resistance Patterns of Bacterial Isolates From Urinary Tract Infection in Diabetics." *International Journal of Current Pharmaceutical Research*. doi: 10.22159/ijcpr.2021v13i1.40816.
- Salari, Nader, Mohammad M. Karami, Shadi Bokaei, Maryam Chaleshgar, Shamarina Shohaimi, Hakimeh Akbari, and Masoud Mohammadi. 2022. "The Prevalence of Urinary Tract Infections in Type 2 Diabetic Patients: A Systematic Review and Meta-Analysis." *European Journal of Medical Research*. doi: 10.1186/s40001-022-00644-9.
- Shibeshi, Mulugeta S., Alemneh K. Daba, Kebede M. Meiso, and Birkneh T. Tadesse. 2022. "Glycemic Control Among Children and Adolescents With Diabetes in Southern Ethiopia: A Cross-Sectional Study." *BMC Endocrine Disorders*. doi: 10.1186/s12902-022-01070-y.
- Shirzaiy, Masoomah, and Zohreh Dalirsani. 2019. "The Effect of Glycemic Control on Salivary Lipid Peroxidation in Type II Diabetic Patients." *Diabetes and Metabolic Syndrome: Clinical Research and Reviews* 13(3):1991–94. doi: 10.1016/j.dsx.2019.04.004.
- Silva, Larissa Amoroso da, Bianca Pereira Carnevali, and Rogério Rodrigo Ramos. 2021. "Clinical and Therapeutic Treatment Approach Between Diabetes Mellitus and Urinary Tract Infection." *International Journal for Innovation Education and Research* 9(9):288–98. doi: 10.31686/ijer.vol9.iss9.3339.
- Singh, Sudhir, Mohd Junaid, Umar Farooq, Shweta R. Sharma, Vasundhara Sharma, and Imran Ahmad. 2022. "Bacterial Profile of Diabetic Foot Infection in a Tertiary Care Centre." *IP International Journal of Medical Microbiology and Tropical Diseases* 8(1):51–54. doi: 10.18231/j.ijmmt.2022.011.

- Singh, Sudhir, Mohd Junaid, Umar Farooq, Shweta Sharma, Vasundhara Sharma, and Imran Ahmad. 2022. "Bacterial Profile of Diabetic Foot Infection in a Tertiary Care Centre." *Ip International Journal of Medical Microbiology and Tropical Diseases*. doi: 10.18231/j.ijmmt.2022.011.
- Sioofy-Khojine, Amir Babak, Sarah J. Richardson, Jonathan M. Locke, Sami Oikarinen, Noora Nurminen, Antti Pekka Laine, Kate Downes, Johanna Lempainen, John A. Todd, Riitta Veijola, Jorma Ilonen, Mikael Knip, Noel G. Morgan, Heikki Hyöty, Mark Peakman, and Martin Eichmann. 2022. "Detection of Enterovirus RNA in Peripheral Blood Mononuclear Cells Correlates with the Presence of the Predisposing Allele of the Type 1 Diabetes Risk Gene IFIH1 and with Disease Stage." *Diabetologia* 1701–9. doi: 10.1007/s00125-022-05753-y.
- Sowaid, Izaldeen Y., Omer M. K. Ali, and Saad Abul S. Hussian. 2022. "Extra-Gastrointestinal Manifestation and Helicobacter Pylori Infection." *Archives of Razi Institute* 77(3):1017–26. doi: 10.22092/ARI.2022.357387.2027.
- Sun, Xiwen, Chunyu Luo, Ru Tang, Song Mao, Ying Zhu, Chonghui Fei, Mengyu Wang, Shaolin Tan, Shiyao Zhang, Jiayao Zhou, Hai Lin, Zhipeng Li, and Weitian Zhang. 2023. "Sinonasal Diffuse Large B-Cell Lymphoma in a Patient with Wiskott–Aldrich Syndrome: A Case Report and Literature Review." *Frontiers in Immunology* 13(January):1–7. doi: 10.3389/fimmu.2022.1062261.
- Tegegne, Kirubel D., Gebeyaw Biset, Natnael A. Gebeyehu, Lehulu T. Yirdaw, Nathan E. Shewangashaw, and Mesfin W. Kassaw. 2023. "Prevalence of Urinary Tract Infections and Risk Factors Among Diabetic Patients in Ethiopia, a Systematic Review and Meta-Analysis." *Plos One*. doi: 10.1371/journal.pone.0278028.
- Tomic, Dunya, Jonathan E. Shaw, and Dianna J. Magliano. 2022. "The Burden and Risks of Emerging Complications of Diabetes Mellitus." *Nature Reviews Endocrinology* 18(9):525–39. doi: 10.1038/s41574-022-00690-7.
- Toniolo, Antonio, Gianluca Cassani, Anna Puggioni, Agostino Rossi, Alberto Colombo, Takashi Onodera, and Ele Ferrannini. 2019. "The Diabetes Pandemic and Associated Infections: Suggestions for Clinical Microbiology." *Reviews and Research in Medical Microbiology* 30(1):1–17. doi: 10.1097/MRM.0000000000000155.
- Ullah, Naimat, Talal Ali, Obaid U. Rahman, Sheeraz Ahmed, Muhammad Hamza, and Muhammad Z. Noorani. 2022. "Urinary Tract Infection Due to Extended-Spectrum Beta-Lactamase Producing Organisms Is a Risk Factor for Acute Kidney Injury Among Patients Diagnosed With Diabetes Mellitus Type 2." *PJMHS*. doi: 10.53350/pjmhs22169956.
- Ullah, Naimat, Talal Ali, Rahman. Obaid Ur, Shreeraz Ahmed, Muhammad Hamza, and Muhammad Zain Noorani. 2022. "Urinary Tract Infection Due to Extended-Spectrum Beta-Lactamase Producing Organisms Is a Risk Factor for Acute Kidney Injury among Patients with Type 2 Diabetes Mellitus." *PJMHS* 19(1):956–68. doi: <https://doi.org/10.53350/pjmhs22169956>.
- Wang, Feng, Qinghe Wu, Chunfu Zhang, Lingchi Kong, Rongtai Zuo, Kai Feng, Guoping Jia, Mengfei Hou, Jianhua Zou, Yimin Chai, Jia Xu, Xiaoyuan Chen, and Qinglin Kang. 2024. "Ultrasmall MnOx Nanodots Catalyze Glucose for Reactive Oxygen Species-Dependent Sequential Anti-Infection and Regeneration Therapy." *Small Structures* 5(1):1–17. doi: 10.1002/ssr.202300198.
- Yano, Masahiro, Tomoaki Morioka, Yuka Natsuki, Keyaki Sasaki, Yoshinori Kakutani, Akinobu Ochi, Yuko Yamazaki, Tetsuo Shoji, and Masanori Emoto. 2022. "New-Onset Type 1 Diabetes after COVID-19 mRNA Vaccination." *Internal Medicine* 61(8):1197–1200. doi: 10.2169/internalmedicine.9004-21.
- Ye, Qing. 2023. "The Association Between Alcohol Drinking and Glycemic Management Among People With Type 2 Diabetes in China." *Journal of Diabetes Investigation*. doi: 10.1111/jdi.14108.
- Yogapriya, J., Venkatesh Chandran, M. Sumithra, B. Elakkiya, A. Shamil. Ebenezer, and C. Sures. Gnana Dha. 2022. "Automated Detection of Diabetic Foot Ulcer Using Convolutional Neural Network." *Journal of Healthcare Engineering* 980 LNEE:565–76. doi: <https://doi.org/10.1155/2022/2349849>.
- Zhang, Qiu Rui, Hong Chen, Bing Liu, and Min Zhou. 2019. "Methicillin-Resistant Staphylococcus Aureus Pneumonia in Diabetics: A Single-Center, Retrospective Analysis." *Chinese Medical Journal* 132(12):1429–34. doi: 10.1097/CM9.0000000000000270.

**Cite this article as:** Yunus, R; Wijayanti, F; Askrening, A; Rahayu, D. Y. S; Hasan, F. E; Trees, T; Fusvita, A. (2024). Diabetes Mellitus and Bacterial Infections: A Review of Main Infections in DM Patients. *Public Health of Indonesia*, 10(1), 73-97. <https://doi.org/10.36685/phi.v10i1.777>