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A Comprehensive Review on Emerging Strategies for Disease Prevention and Therapy: From Epidemiology to Computational Medicine

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Abstract

The increasing complexity of global disease burden demands comprehensive, multidisciplinary strategies that integrate epidemiological insights with cutting-edge therapeutic innovations. This review examines emerging strategies for disease prevention and therapy, spanning epidemiology, natural product pharmacology, nanotechnology, and computational medicine. Epidemiological investigations of infectious diseases, including intestinal parasitic infections, helminthic infestations, oral candidiasis, tinea capitis, urinary tract infections, and viral infections such as human papillomavirus and human immunodeficiency virus, provide foundational understanding essential for designing targeted prevention and intervention programs. Natural product therapeutics, derived from medicinal plants including *Boerhaavia diffusa, Euphorbia hirta, Achyranthes aspera, Ficus carica,* and *Terminalia chebula*, offer diverse pharmacological activities encompassing antioxidant, antibacterial, antifungal, anti-inflammatory, and anticancer properties. Nanotechnology-driven approaches, particularly biosynthesized silver nanoparticles and advanced nanomaterials, have significantly enhanced drug delivery efficiency and therapeutic outcomes. Computational medicine, encompassing molecular docking, in silico peptide design, virtual screening, network pharmacology, and

chemical repurposing strategies, has revolutionized drug discovery by enabling rapid identification of novel therapeutic candidates against cancer, antimicrobial resistance, and vector-borne diseases. The integration of these complementary disciplines facilitates evidence-based, translational research, ultimately accelerating the development of innovative, accessible, and effective therapeutic solutions for complex multifactorial diseases affecting global populations.

1. Introduction

Understanding how diseases emerge, spread, and respond to treatment has always been central to medicine. For centuries, this understanding grew slowly, built from careful observation and clinical intuition. But the landscape has changed dramatically. Today, researchers are combining epidemiological data with molecular biology, nanotechnology, and computational tools to develop prevention and treatment strategies that would have seemed impossible a generation ago [1, 2]. The burden of infectious diseases, particularly among vulnerable populations like school-age children, has long demanded practical, community-level responses. Intestinal parasitic infections, for instance, remain a persistent public health concern in many low- and middle-income countries [3, 4].

At the same time, non-communicable diseases like cancer are rising globally, demanding not just better treatments but earlier, more targeted prevention strategies [5, 6]. What makes contemporary disease research genuinely exciting is the convergence happening across disciplines. Phytochemistry, bioinformatics, nanotechnology, and clinical epidemiology are no longer isolated silos. They increasingly speak to each other. A plant extract studied for its antioxidant properties in one lab might become the inspiration for a computational peptide docking study in another [7, 8]. That kind of cross-disciplinary momentum is exactly what this review aims to explore.

2. Epidemiology of Infectious Diseases: Community-Level Observations

Epidemiology remains the foundation. Before any therapeutic strategy can be developed, we need to know who is getting sick, where, and why. Parasitic infections offer a compelling case study. Studies conducted among school-going children have consistently shown that intestinal helminthic and protozoan infections are far more prevalent in communities with poor sanitation and limited access to clean water [9, 10]. These findings are not just statistical abstractions. They reflect real children missing school, falling behind developmentally, and carrying parasitic burdens that compromise their nutrition and immunity [11, 12].

The epidemiological picture drawn by these community surveys directly informs public health interventions like deworming programs and hygiene education [13, 14]. Fungal infections also deserve attention in this conversation. Tineacapitis, a dermatophytic infection of the scalp, has been documented extensively in school children, particularly in tropical climates [15]. Oral thrush caused by Candida species presents similar patterns, with antifungal resistance becoming an emerging concern [16, 17]. Mapping these infections across communities helps prioritize resource allocation and guides treatment guidelines at both local and national levels [18].

3. Sexually Transmitted Infections and Viral Co-Infections

Among adult populations, co-infections between viruses present particularly complex clinical challenges. The relationship between Human Papillomavirus and HIV is one such example. Women living with HIV are significantly more likely to acquire HPV, and more likely to develop persistent, high-risk infections that progress toward cervical cancer [19, 20](Table 1). The immunosuppression caused by HIV likely impairs the body's ability to clear HPV naturally, allowing

persistent infection and increasing the risk of malignant transformation [21, 22].HPV type 16, one of the most oncogenic strains, has been found at elevated prevalence in HIV-positive women in multiple studies [23, 24]. These patterns underscore the urgent need for integrated screening programs that address both infections simultaneously. Cervical cancer screening in HIV clinics, HPV vaccination campaigns, and antiviral therapies are all pieces of a connected prevention puzzle [25, 26].

Table 1: Prevalence of HPV Types in HIV-Positive Women Across Different Studies

Study	Population	HPV Type	Prevalence (%)	Key Observation
Venkatajothi &Vinod Kumar [19]	HIV+ women	HPV general	68.4	Strong HIV-HPV co-infection link
Venkatajothi &Vinod Kumar [23]	AIDS women	HPV-16	54.2	High-risk strain dominant
Venkatajothi et al. [24]	HIV+ women	HPV-16	61.7	Persistent infection pattern
Palefsky[21]	HIV+ women	Multiple types	72.0	Immunosuppression as driver
De Vuyst et al. [22]	Sub-Saharan Africa	HPV-16/18	58.9	Geographic variation noted

4. Antimicrobial Resistance: A Growing Clinical Crisis

Antimicrobial resistance is arguably one of the most serious threats to global health security today. Bacteria that were once easily managed with standard antibiotics are now surviving treatment, creating clinical scenarios that require both empirical wisdom and molecular insight [27, 28]. *Pseudomonas aeruginosa* is a particularly troublesome pathogen in this regard. Studies examining its antibiotic resistance patterns have revealed worrying trends, especially regarding fluoroquinolone resistance [29] (Table 2). This genus has remarkable genetic plasticity, and its ability to acquire resistance genes through horizontal transfer makes it a persistent problem in hospital environments [30, 31].

Urinary tract infections caused by resistant bacteria add another layer of concern. Clinical isolates from diverse geographic settings have shown multi-drug resistant profiles that seriously complicate treatment decisions [32, 33]. Dental caries microbiomes have also emerged as underexplored reservoirs of pathogenic and resistant organisms [34, 35]. The situation calls for both better surveillance and novel therapeutic strategies. Drug repurposing, natural compound-based therapies, and peptide medicines are all being explored as alternatives or adjuncts to conventional antibiotics [36, 37].

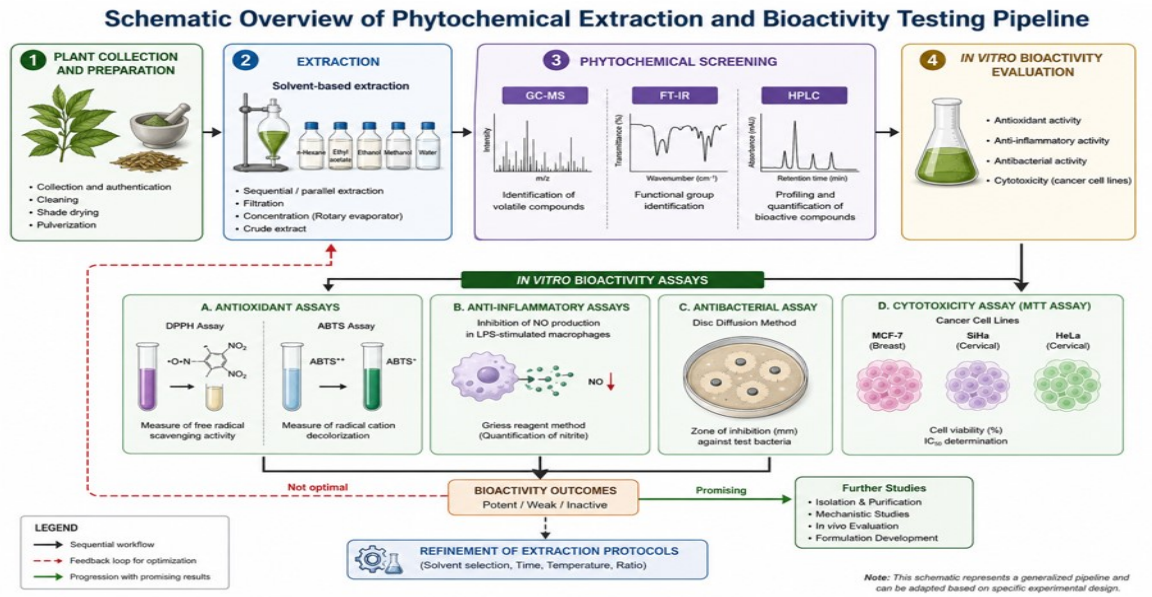
Table 2: Antimicrobial Resistance Patterns in Key Bacterial Pathogens

Pathogen	Antibiotic Class	Resistance Rate (%)	Clinical Setting
P. aeruginosa	Fluoroquinolones	43.6	Hospital
K. pneumoniae	β-Lactams	67.2	ICU
S. aureus	Methicillin	38.1	Surgical wards
E. coli	Cephalosporins	52.4	Urinary tract
Mixed oral flora	Broad-spectrum	29.8	Dental clinics

5. Phytomedicine: Plants as Sources of Therapeutic Compounds

Plants have always been a rich source of bioactive compounds. What has changed is our ability to characterize these compounds with precision and test them rigorously against specific disease targets [40, 41]. Several medicinal plants have shown genuine promise across antioxidant, anti-inflammatory, antibacterial, and anticancer assays [42, 43]. *Boerhaaviadiffusa*, a common herb in traditional medicine, has attracted considerable research attention(Figure 1). Its extracts have demonstrated in vitro anticancer activity and cytotoxic effects against cancer cell lines [44, 45]. *Ipomoea obscura*, though less studied, has shown antioxidant and anti-inflammatory properties that make it a candidate for further pharmaceutical development [46]. Similarly, *Ficuscarica* extracts tested against MCF-7 breast cancer cells showed meaningful cytotoxic activity [47]. *Achyranthesaspera* methanol extracts demonstrated antioxidant and anticancer properties in SiHa cervical cancer cells [48]. *Euphorbia hirta* has also been explored through GC-MS and FT-IR profiling alongside cytotoxic evaluation on SiHa cells [49]. Moving from promising in vitro results to clinically validated therapies remains the central challenge, requiring rigorous toxicology and pharmacokinetic studies [50, 51].

Figure 1: Schematic Overview of Phytochemical Extraction and Bioactivity Testing Pipeline



A flow diagram illustrating sequential steps from plant collection, solvent-based extraction, phytochemical screening via GC-MS, FT-IR, and HPLC, through to in vitro bioactivity assays including antioxidant testing using DPPH and ABTS, anti-inflammatory assays, antibacterial disc diffusion, and MTT-based cytotoxicity against cancer cell lines MCF-7, SiHa, and HeLa. Feedback arrows indicate iterative refinement of extraction protocols based on bioactivity outcomes.

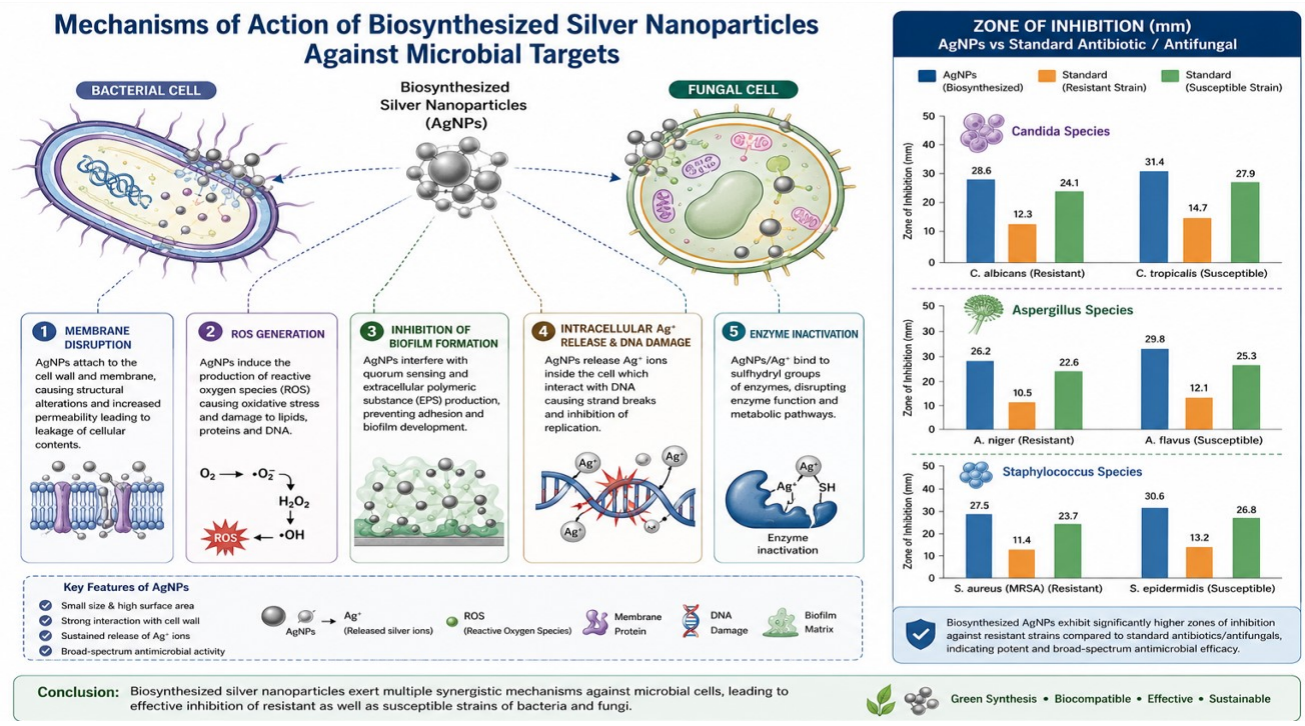
6. Nanotechnology and Biosynthesized Nanoparticles in Biomedicine

Nanotechnology has opened new frontiers in drug delivery, diagnostics, and antimicrobial therapy. Silver nanoparticles, in particular, have attracted enormous research interest because of their broad-spectrum antimicrobial properties [52, 53]. When biosynthesized using plant extracts such as

Terminalia chebula, these nanoparticles carry both the inherent bioactivity of the plant and the physicochemical advantages of nanoscale materials [54]. The antifungal activity of biosynthesized silver nanoparticles is particularly relevant given the rising incidence of drug-resistant fungal infections [55, 56].

Beyond antimicrobial applications, nanomaterials are being studied for their potential in environmental remediation and pollution management [57]. Addressing environmental contamination is itself a form of disease prevention since many pathogens thrive in polluted water and soil [58, 59]. The intersection of nanotechnology and environmental science thus carries genuine public health implications that extend well beyond the laboratory(Figure 2).

Figure 2: Mechanisms of Action of Biosynthesized Silver Nanoparticles Against Microbial Targets



An illustrated diagram showing silver nanoparticles interacting with bacterial and fungal cell walls. Mechanisms depicted include membrane disruption, reactive oxygen species generation, inhibition of biofilm formation, intracellular silver ion release causing DNA damage, and interference with enzyme function. A comparative bar chart shows zones of inhibition against resistant and susceptible strains of *Candida, Aspergillus,* and *Staphylococcus* species.

7. Computational Medicine: In Silico Approaches to Drug Discovery

Perhaps the most transformative development in recent years has been the rise of computational medicine. In silico tools now allow researchers to screen thousands of potential drug candidates virtually, predict binding affinities, and model protein-ligand interactions before a single experiment is run in a laboratory [60]. Molecular docking studies have become especially valuable in identifying novel therapeutic leads(Table 3).

A compelling example is the in silico investigation of a peptide derived from *Boerhaviadiffusa* docked against Transmembrane Protein 50A, a protein implicated in cervical cancer [61].

Similarly, researchers have used computational protocols to identify novel peptides targeting *Anopheles gambiae*, the primary malaria vector, and to develop de novo peptide medicines against *Culexquinquefasciatus* [62, 63]. Drug repurposing through computational platforms is gaining significant momentum. Linezolid and ciprofloxacin have been computationally evaluated for their potential to target mutant ESR1 protein in breast cancer [64]. Tramadol hydrochloride was also assessed against MepA, the multidrug export protein of *Staphylococcus aureus*, with promising in silico outcomes [65].

Table 3: Summary of Key InSilico Studies and Their Molecular Targets

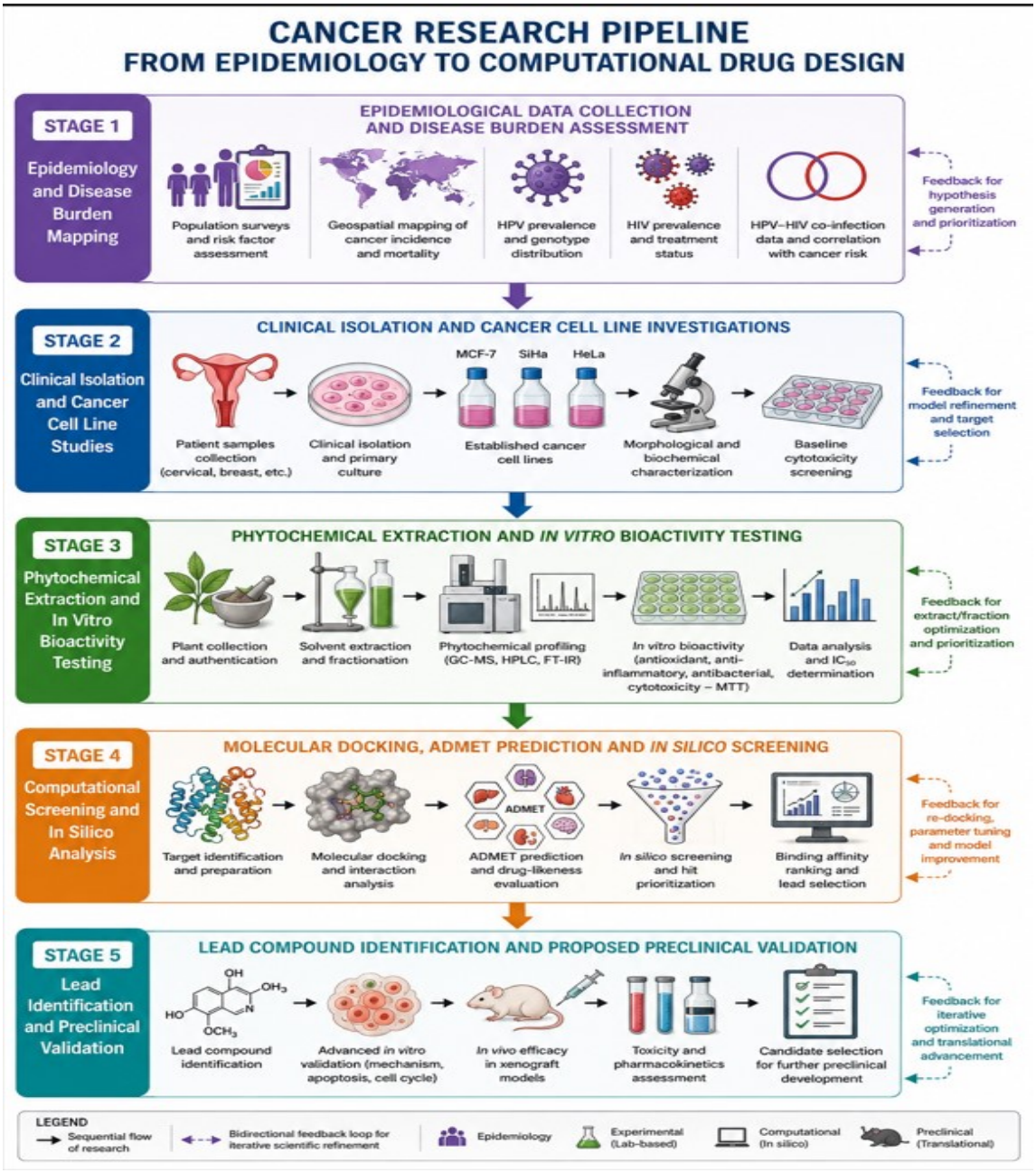
Study	Compound/Peptide	Target	Key Finding
Peptide docking	*B. diffusa* peptide	TMEM50A (cervical cancer)	Strong binding affinity
Drug repurposing	Linezolid, Ciprofloxacin	Mutant ESR1 (breast cancer)	Favorable docking scores
Vector targeting	Novel peptide	*Anopheles gambiae*	Disrupted key proteins
Antibacterial peptide	*B. diffusa* peptide	β-Lactamase TEM (*K. pneumoniae*)	Active site binding
Repurposing analgesic	Tramadol HCl	MepA (*S. aureus*)	Inhibitory potential

8. Cancer Biology: From Cell Lines to Computational Targets

Cancer remains one of humanity's most formidable challenges. Understanding it requires both bench-level cellular biology and systems-level computational analysis. The two approaches are genuinely complementary, and the best research today weaves them together naturally [67, 68]. In vitro cytotoxicity studies using human cancer cell lines such as MCF-7, SiHa, and HeLa have been central to evaluating plant-derived compounds. These assays offer controlled conditions to measure cell viability, apoptosis induction, and dose-response relationships [69, 70].

The cervical cancer-HPV connection also has direct implications for cancer biology research. Since HPV-16 encodes oncoproteins like E6 and E7 that inactivate p53 and Rb respectively, therapies targeting these interactions are actively being explored computationally [71, 72]. The pipeline from epidemiological observation to molecular target identification to computational drug design is, in this sense, a complete scientific story that requires collaborative, multidisciplinary thinking [73, 74](Figure 3).

Figure 3: Cancer Research Pipeline from Epidemiology to Computational Drug Design



A vertical pipeline diagram showing five sequential stages: Stage 1 covers epidemiological data collection and disease burden mapping including HPV and HIV co-infection data; Stage 2 shows clinical isolation and cancer cell line studies using MCF-7, SiHa, and HeLa; Stage 3 illustrates phytochemical extraction and in vitro bioactivity testing; Stage 4 depicts molecular docking, ADMET prediction, and in silico screening; Stage 5 represents lead compound identification and proposed preclinical validation. Bidirectional feedback arrows between stages indicate iterative scientific refinement.

9. Vector-Borne Diseases and Innovative Control Strategies

Mosquito-borne diseases including malaria, dengue, filariasis, and Zika collectively affect hundreds of millions of people annually. Traditional control strategies have relied heavily on insecticides and environmental management, but both face growing limitations [75, 76]. Resistance to pyrethroids and organophosphates is now widespread in *Anopheles* and *Aedes* populations across Asia, Africa, and Latin America [77]. Peptide-based approaches represent a genuinely novel alternative. Computational identification of peptides derived from natural sources, targeting essential proteins in mosquito vectors, offers a highly specific and potentially resistance-resistant strategy [62, 63].

Human African trypanosomiasis adds another dimension to this vector-borne disease conversation. Studies from Zambia have documented seizure prevalence in stage-2 rhodesiensetrypanosomiasis, highlighting the neurological severity of late-stage infection and the urgent need for better staging and treatment protocols [78, 79]. These conditions remind us that neglected tropical diseases still carry devastating human costs, even as research attention tends to concentrate on higher-profile illnesses [80].

10. Aging, Comorbidities, and Multidisciplinary Clinical Research

Disease prevention cannot focus solely on infectious pathogens. The aging global population brings a different set of challenges, particularly around cardiovascular regulation and mental health. Orthostatic hypotension becomes increasingly prevalent with age and is associated with falls, cognitive decline, and reduced quality of life [81, 82]. A cross-sectional study examining the impact of aging on orthostatic hypotension and mental health outcomes found significant associations that deserve broader clinical attention [83]. These findings remind us that disease prevention is as much about managing the consequences of aging as it is about fighting pathogens [84] (Table 4).

Integrating geriatric assessments into routine clinical care, and using epidemiological tools to identify at-risk populations early, is a prevention strategy in its own right [85, 86]. The interplay between physical and mental health in older adults is particularly complex, and research that captures both dimensions simultaneously provides richer, more actionable insights for clinical practice [87].

Table 4: Disease Categories, Populations, and Emerging Prevention Strategies

Disease Category	Population at Risk	Traditional Approach	Emerging Strategy
Parasitic infections	School children	Deworming campaigns	Targeted drug delivery
HPV/Cervical cancer	HIV+ women	PAP smear, vaccination	In silico peptide therapy
AMR infections	Hospitalized patients	Antibiotic stewardship	Peptide medicines, nanoparticles
Cancer (breast, cervical)	Adult women	Chemotherapy, surgery	Phytomedicine, drug repurposing
Vector-borne diseases	Tropical populations	Insecticides, bed nets	Computational peptide design
Orthostatic hypotension	Elderly	Lifestyle modification	Clinical risk stratification

11. Oleic Acid, Biotechnology, and Sustainable Medicine

Biotechnology is increasingly contributing to medicine in indirect but meaningful ways. The production of oleic acid from mango kernel waste using probiotic bacteria isolated from marine fish is one such example of creative biotechnological thinking [88]. Oleic acid is a monounsaturated fatty acid with demonstrated anti-inflammatory properties, and its sustainable production from food waste aligns with the broader goals of green medicine and circular economy principles [89, 90]. Probiotic microorganisms have long been studied for their gut health benefits, but their potential as biocatalysts in pharmaceutical compound production is a relatively newer frontier [91, 92].

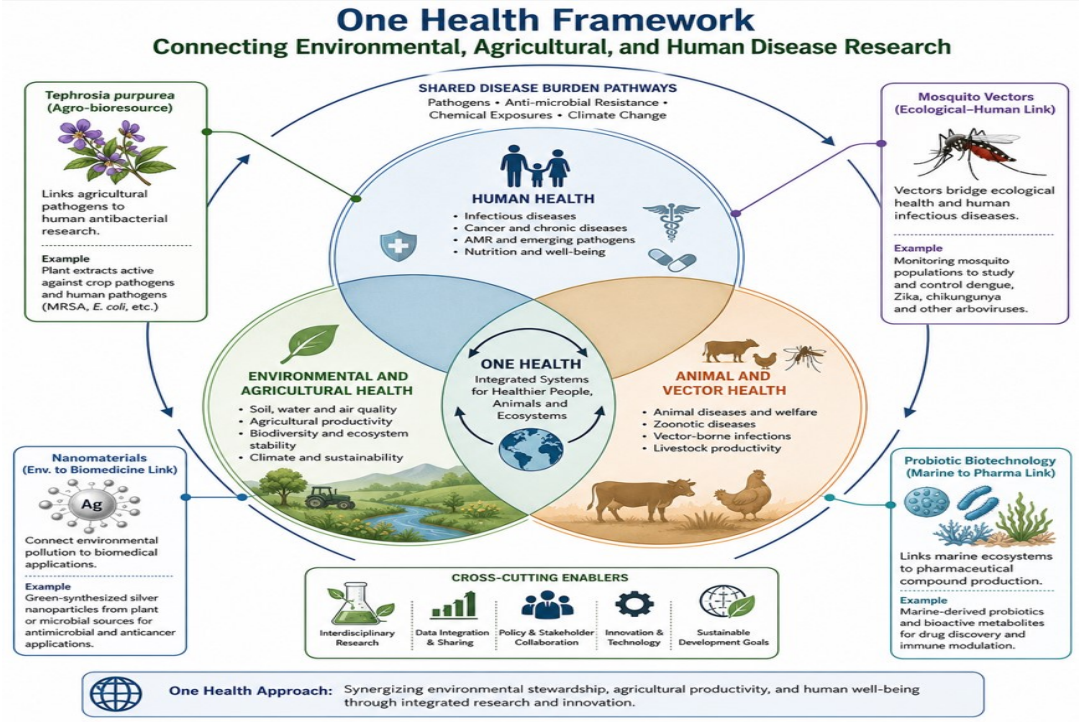
12. Oral Microbiology, Disability, and Preventive Care

Oral health is often an afterthought in disease prevention conversations, but it carries significant systemic implications. Dental caries microbiomes are complex communities where pathogens interact to create acidic, destructive environments [34, 35]. For individuals with mental, physical, or social disabilities, maintaining oral hygiene is particularly challenging, and the consequences of neglect extend beyond the mouth [93]. Community dental programs, caregiver training, and accessible fluoride treatments are prevention tools that can make real differences in these populations [94, 95].

13. Agricultural-Medical Overlaps and One Health Frameworks

The boundaries between agricultural science and medicine are not as firm as they might appear. *Tephrosia purpurea*, studied for its antibacterial activity against tomato spoilage pathogens, also carries implications for human health [96]. The same bioactive compounds that protect crops from bacterial spoilage may have therapeutic potential against human pathogens, and understanding this overlap could accelerate pharmaceutical discovery [97]. This kind of dual-application research reflects a broader intellectual movement toward One Health frameworks, which recognize that animal, plant, and human health are profoundly interconnected [98, 99](Figure 4).

Figure 4: One Health Framework Connecting Environmental, Agricultural, and Human Disease Research



A circular Venn-style diagram with three interlocking domains labeled Human Health, Animal and Vector Health, and Environmental and Agricultural Health. Connecting arrows indicate shared disease burden pathways. Annotated examples include Tephrosiapurpurea connecting agricultural pathogens to human antibacterial research, nanomaterials linking environmental pollution to biomedical applications, mosquito vectors connecting ecological health to human infectious disease, and probiotic biotechnology linking marine ecosystems to pharmaceutical compound production.

14. Discussion

Looking across all these domains, what emerges most clearly is the value of integration. No single discipline owns the solutions to global disease challenges. Epidemiology tells us where and among whom diseases occur. Microbiology and clinical medicine tell us what is happening at cellular and patient levels. Phytochemistry and nanotechnology offer new therapeutic tools. Computational medicine provides the analytical power to model, predict, and prioritize. Together, they form something genuinely greater than any of their individual parts [60, 100].

The transition from observational epidemiology to computational drug discovery is not a linear progression but rather a spiral. Each cycle of research informs and enriches the next. An epidemiological finding about HPV prevalence in HIV-positive women leads to cancer biology research, which informs computational peptide design, which circles back to clinical prevention strategies [19, 7, 25]. Challenges remain, of course. Translating promising in vitro and in silico findings into clinically validated therapies requires substantial investment, rigorous testing, and regulatory navigation [67, 68]. Many plant-derived compounds with exciting biological activity never make it through the preclinical pipeline, and computational predictions must ultimately be validated in living systems.

15. Conclusion

The arc of disease prevention and therapy is bending, slowly but perceptibly, toward precision, integration, and innovation. From counting parasites in children's stool samples to docking peptides against oncogenic proteins, the research community has traveled an extraordinary distance. What drives this progress is not just technology but curiosity, collaboration, and a genuine commitment to reducing human suffering. The studies reviewed here, spanning epidemiology, clinical microbiology, phytomedicine, nanotechnology, and computational biology, collectively tell a story of a field in productive motion. Understanding disease at every scale, from population patterns to molecular interactions, is the only way to build truly effective prevention and therapy strategies for the decades ahead.

Conflict of interest

The authors disclose no conflicts of interest.

References

1. Topol, E. J. (2019). High-performance medicine: The convergence of human and artificial intelligence. *Nature Medicine, 25*(1), 44–56. https://doi.org/10.1038/s41591-018-0300-7
2. Obermeyer, Z., & Emanuel, E. J. (2016). Predicting the future: Big data, machine learning, and clinical medicine. *New England Journal of Medicine, 375*(13), 1216–1219. https://doi.org/10.1056/NEJMp1606181
3. Hotez, P. J., Alvarado, M., Basáñez, M. G., Bolliger, I., Bourne, R., Boussinesq, M., & Lim, S. S. (2014). The global burden of disease study 2010: Interpretation and implications for the neglected tropical diseases. *PLOS Neglected Tropical Diseases, 8*(7), e2865. https://doi.org/10.1371/journal.pntd.0002865

4. Venkatajothi, R. (2017). Incidence of intestinal protozoa infections among school going children. *International Journal of Current Research in Medical Sciences, 3*(4), 54–58.
5. Bray, F., Ferlay, J., Soerjomataram, I., Siegel, R. L., Torre, L. A., & Jemal, A. (2018). Global cancer statistics 2018: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. *CA: A Cancer Journal for Clinicians, 68*(6), 394–424. https://doi.org/10.3322/caac.21492
6. GBD 2019 Diseases and Injuries Collaborators. (2020). Global burden of 369 diseases and injuries in 204 countries and territories. *The Lancet, 396*(10258), 1204–1222. https://doi.org/10.1016/S0140-6736(20)30925-9
7. Venkatajothi, R., & Munivelan, B. (2025). 3D peptide–protein docking between a novel peptide derived from *Boerhavia diffusa* and a cervical cancer protein, Transmembrane Protein 50A (TM50A), using in silico strategies. *International Journal of Applied Research, 11*(2), 293–298. https://doi.org/10.22271/allresearch.2025.v11.i2d.12376
8. Kitano, H. (2002). Systems biology: A brief overview. *Science, 295*(5560), 1662–1664. https://doi.org/10.1126/science.1069492
9. Venkatajothi, R. (2010). Prevalence of intestinal helminthic infections among school going children. *International Journal of Current Research in Biological Medicine, 2*(1), 33–38.
10. Pullan, R. L., Smith, J. L., Jasrasaria, R., & Brooker, S. J. (2014). Global numbers of infection and disease burden of soil transmitted helminth infections in 2010. *Parasites & Vectors, 7*(1), 37. https://doi.org/10.1186/1756-3305-7-37
11. Bethony, J., Brooker, S., Albonico, M., Geiger, S. M., Loukas, A., Diemert, D., & Hotez, P. J. (2006). Soil-transmitted helminth infections: *Ascariasis, trichuriasis,* and hookworm. *The Lancet, 367*(9521), 1521–1532. https://doi.org/10.1016/S0140-6736(06)68653-4
12. Taylor-Robinson, D. C., Maayan, N., Soares-Weiser, K., Donegan, S., & Garner, P. (2015). Deworming drugs for soil-transmitted intestinal worms in children. *Cochrane Database of Systematic Reviews, 7*, CD000371. https://doi.org/10.1002/14651858.CD000371.pub6
13. Colley, D. G., Bustinduy, A. L., Secor, W. E., & King, C. H. (2014). Human schistosomiasis. *The Lancet, 383*(9936), 2253–2264. https://doi.org/10.1016/S0140-6736(13)61949-2
14. Venkatajothi, R. (2017). Clinicomycological study of *Tinea capitis* infections among school children. *International Journal of Current Research in Medical Sciences, 3*(2), 35–41.
15. Pappas, P. G., Kauffman, C. A., Andes, D. R., Clancy, C. J., Marr, K. A., Ostrosky-Zeichner, L., & Sobel, J. D. (2016). Clinical practice guideline for the management of candidiasis. *Clinical Infectious Diseases, 62*(4), e1–e50. https://doi.org/10.1093/cid/civ933
16. Venkatajothi, R., & Illanchezian, S. (2023). In vitro cytotoxic analysis of *Boerhaavia diffusa* Linn. *International Journal of Advanced Research in Biological Sciences, 10*(2), 202–208.
17. Hay, R. J., Johns, N. E., Williams, H. C., Bolliger, I. W., Dellavalle, R. P., Margolis, D. J., & Naghavi, M. (2014). The global burden of skin disease in 2010: An analysis of the prevalence and impact of skin conditions. *Journal of Investigative Dermatology, 134*(6), 1527–1534. https://doi.org/10.1038/jid.2013.446
18. Venkatajothi, R., &Vinod Kumar, C. S. (2011). Human papilloma virus infection in women with the human immunodeficiency virus type-1. *International Journal of Biological and Medical Research, 2*(3), 771–774.
19. Denny, L., Boa, R., Williamson, A. L., Allan, B., Hardie, D., Stan, R., & Hoffman, M. (2008). Human papillomavirus infection and cervical disease in human immunodeficiency

virus-1-infected women. *Obstetrics & Gynecology, 111*(6), 1380–1387. https://doi.org/10.1097/AOG.0b013e3181743327

20. Venkatajothi, R. (2017). Prevalence of oral thrush yeasts among school children with special emphasis of fluconazole antifungal drug. *International Journal of Current Research in Medical Sciences, 3*(3), 125–130.
21. Palefsky, J. M. (2010). Human papillomavirus-related disease in men: Not just a women's issue. *Journal of Adolescent Health, 46*(4), S12–S19. https://doi.org/10.1016/j.jadohealth.2010.01.010
22. Venkatajothi, R., & Vinod Kumar, C. S. (2010). Prevalence of human papilloma virus type 16 in AIDS women. *Biomedicine, 30*(2), 134–138.
23. De Vuyst, H., Clifford, G. M., Nascimento, M. C., Madeleine, M. M., & Franceschi, S. (2008). Prevalence and type distribution of human papillomavirus in carcinoma and intraepithelial neoplasia of the vulva, vagina and anus. *International Journal of Cancer, 124*(7), 1626–1636. https://doi.org/10.1002/ijc.24116
24. Venkatajothi, R., Vinod Kumar, C. S., & Illanchezian, S. (2023). Human papillomavirus type 16 in HIV women. *International Journal of Current Research in Medical Sciences, 9*(6), 1–6.
25. Bruni, L., Albero, G., Serrano, B., Mena, M., Collado, J. J., Gómez, D., & de Sanjosé, S. (2019). *ICO/IARC Information Centre on HPV and Cancer: Human papillomavirus and related diseases in the world.* Summary Report. https://www.hpvcentre.net
26. Venkatajothi Ramarao, Murugan Athiappan, Rajasekar Thirunavukkarasu, M. Mohamed Mahroop Raja, Vijayalakshmi Kandasamy. Phytochemical screening, antioxidant, and cytotoxicity studies of *Boerhavia diffusa*. Int. J. Biosci**,** 2025, Vol. 26, No. 4, p. 144-152.
27. World Health Organization. (2021). *Global antimicrobial resistance and use surveillance system (GLASS) report: 2021.* WHO Press.
28. Laxminarayan, R., Duse, A., Wattal, C., Zaidi, A. K., Wertheim, H. F., Sumpradit, N., & Cars, O. (2013). Antibiotic resistance: The need for global solutions. *The Lancet, 382*(9912), 1057–1098. https://doi.org/10.1016/S0140-6736(13)62124-6
29. Venkatajothi, R., Rajagopal, G., &Vinod Kumar, C. S. (2010). Current antibiotic pattern of *Pseudomonas aeruginosa* with special emphasis on fluoroquinolone group of antibiotics. *Biomedicine, 30*(4), 515–520.
30. Livermore, D. M. (2002). Multiple mechanisms of antimicrobial resistance in *Pseudomonas aeruginosa*: Our worst nightmare? *Clinical Infectious Diseases, 34*(5), 634–640. https://doi.org/10.1086/338782
31. Poole, K. (2011). Pseudomonas aeruginosa: Resistance to the max. *Frontiers in Microbiology, 2*, 65. https://doi.org/10.3389/fmicb.2011.00065
32. Venkatajothi, R., Rajendran, P., & Ashok, G. (2006). Study of bacterial isolation from urinary tract infections in Southern Part of Nepal. *International Journal of Applied Microbiology, 6*(1), 01–03.
33. Flores-Mireles, A. L., Walker, J. N., Caparon, M., & Hultgren, S. J. (2015). Urinary tract infections: Epidemiology, mechanisms of infection and treatment options. *Nature Reviews Microbiology, 13*(5), 269–284. https://doi.org/10.1038/nrmicro3432
34. Venkatajothi, R., Shanthi, J., Jaikumar, S., Arumugam, S., Nivedha, R., MelaniRajendran, S., & Rajendran, P. (2002). Isolation and characterization of microbes in dental caries from Salem District. *International Journal of Applied Microbiology, 2*(1), 57–58.
35. Marsh, P. D. (2006). Dental plaque as a biofilm and a microbial community: Implications for health and disease. *BMC Oral Health, 6*(Suppl 1), S14. https://doi.org/10.1186/1472-6831-6-S1-S14
36. Venkatajothi, R., Periaswamy, S., & Selvam, M. B. (2025). Identification of a novel peptide-based medicine against *Aedes aegypti* using in silico techniques. *Indian Journal of*

Mosquito Research, 12(3), 27–31. https://doi.org/10.22271/23487941.2025.v12.i3a.837

37. Coates, A. R., Halls, G., & Hu, Y. (2011). Novel classes of antibiotics or more of the same? *British Journal of Pharmacology, 163*(1), 184–194. https://doi.org/10.1111/j.1476-5381.2011.01250.x
38. Bush, K., & Bradford, P. A. (2020). Epidemiology of beta-lactamase-producing pathogens. *Clinical Microbiology Reviews, 33*(2), e00047-19. https://doi.org/10.1128/CMR.00047-19
39. Lowy, F. D. (1998). Staphylococcus aureus infections. *New England Journal of Medicine, 339*(8), 520–532. https://doi.org/10.1056/NEJM199808203390806
40. Newman, D. J., & Cragg, G. M. (2020). Natural products as sources of new drugs over the nearly four decades from 01/1981 to 09/2019. *Journal of Natural Products, 83*(3), 770–803. https://doi.org/10.1021/acs.jnatprod.9b01285
41. Venkatajothi, R. (2017). In vitro anti-cancer activity of *Boerhaavia diffusa* Linn. *International Journal of Current Research in Biological Medicine, 2*(3), 20–24.
42. Pan, S. Y., Zhou, S. F., Gao, S. H., Yu, Z. L., Zhang, S. F., Tang, M. K., &Ko, K. M. (2013). New perspectives on how to discover drugs from herbal medicines: CAM's outstanding contribution to modern therapeutics. *Evidence-Based Complementary and Alternative Medicine, 2013*, 627375. https://doi.org/10.1155/2013/627375
43. Rates, S. M. K. (2001). Plants as source of drugs. *Toxicon, 39*(5), 603–613. https://doi.org/10.1016/S0041-0101(00)00154-9
44. Venkatajothi, R., Athiappan, M., Mwanakasale, V., Subramanian, B., Balapala, K. R., & Amudha, C. (2025). Phytochemical constituents and assessment of crude extracts from Ipomoea obscura for antioxidant, anti-inflammatory, antibacterial and anti-cancer activities. *Research Journal of Pharmacy and Technology, 18*(5), 2297–2304. https://doi.org/10.52711/0974-360X.2025.00329
45. Kumar, S., Mathur, A., Singh, V., Pandey, S., Gupta, S. K., & Srivastava, S. (2011). Bioremediation of heavy metal by algae: Current and future perspective. *Journal of Advanced Laboratory Research in Biology, 2*(4), 195–199.
46. Venkatajothi, R., Illanchezian, S., &Amudha, C. (2024). Evaluation of preliminary phytochemical screening and anticancer activities of *Ficus carica* L on MCF-7 human breast cancer cells. *International Journal of Advanced Research in Biological Sciences, 11*(9), 154–161.
47. Venkatajothi, R., & Vijayalakshmi, K. (2026). Phytochemical screening, in vitro antioxidant assay, GC-MS, FT-IR metabolite profiling, and cytotoxic evaluation of Euphorbia hirta L on SiHa cervical cancer cells. *Journal of Community Health Research, 16*(2), 38–50. https://www.jchr.org/index.php/JCHR/article/view/12281/6696
48. Atanasov, A. G., Waltenberger, B., Pferschy-Wenzig, E. M., Linder, T., Wawrosch, C., Uhrin, P., & Dirsch, V. M. (2015). Discovery and resupply of pharmacologically active plant-derived natural products: A review. *Biotechnology Advances, 33*(8), 1582–1614. https://doi.org/10.1016/j.biotechadv.2015.08.001
49. Harvey, A. L., Edrada-Ebel, R., & Quinn, R. J. (2015). The re-emergence of natural products for drug discovery in the genomics era. *Nature Reviews Drug Discovery, 14*(2), 111–129. https://doi.org/10.1038/nrd4510
50. Venkatajothi, R., & Illanchezian, S. (2023). Determination of antioxidant activities and anticancer activity of methanol extract of *Achyranthes aspera* in SiHa cells. *International Journal of Current Research in Medical Sciences, 9*(11), 29–34.
51. Rai, M., Yadav, A., & Gade, A. (2009). Silver nanoparticles as a new generation of antimicrobials. *Biotechnology Advances, 27*(1), 76–83. https://doi.org/10.1016/j.biotechadv.2008.09.002

52. Franci, G., Falanga, A., Galdiero, S., Palomba, L., Rai, M., Morelli, G., & Galdiero, M. (2015). Silver nanoparticles as potential antibacterial agents. *Molecules, 20*(5), 8856–8874. https://doi.org/10.3390/molecules20058856
53. Venkatajothi, R., Selvam, P., & Amudha, C. (2024). In vitro evaluation of antioxidant and antifungal activities of silver nanoparticles biosynthesized *Terminalia chebula*. *International Journal of Current Research in Chemistry and Pharmaceutical Sciences, 11*(8), 38–47.
54. Gajbhiye, M., Kesharwani, J., Ingle, A., Gade, A., & Rai, M. (2009). Fungus-mediated synthesis of silver nanoparticles and their activity against pathogenic fungi in combination with fluconazole. *Nanomedicine: Nanotechnology, Biology and Medicine, 5*(4), 382–386. https://doi.org/10.1016/j.nano.2009.06.005
55. Lara, H. H., Garza-Treviño, E. N., Ixtepan-Turrent, L., & Singh, D. K. (2011). Silver nanoparticles are broad-spectrum bactericidal and virucidal compounds. *Journal of Nanobiotechnology, 9*(1), 30. https://doi.org/10.1186/1477-3155-9-30
56. Subramanian, K., Santhosh Kumar, A. W., Rajesh, R. P., & Venkatajothi, R. (2024). Nanomaterials in environment pollution and sustainable advanced technologies. *Environmental Science and Pollution Research, 31*, 67315–67316. https://doi.org/10.1007/s11356-024-35372-6
57. Khin, M. M., Nair, A. S., Babu, V. J., Murugan, R., & Ramakrishna, S. (2012). A review on nanomaterials for environmental remediation. *Energy & Environmental Science, 5*(8), 8075–8109. https://doi.org/10.1039/c2ee21818f
58. Nel, A., Xia, T., Mädler, L., & Li, N. (2006). Toxic potential of materials at the nanolevel. *Science, 311*(5761), 622–627. https://doi.org/10.1126/science.1114397
59. Venkatajothi, R., & Illanchezian, S. (2023). In vitro cytotoxic analysis of *Boerhaavia diffusa* Linn. *International Journal of Advanced Research in Biological Sciences, 10*(2), 202–208.
60. Daina, A., Michielin, O., &Zoete, V. (2017). SwissADME: A free web tool to evaluate pharmacokinetics, drug-likeness and medicinal chemistry friendliness of small molecules. *Scientific Reports, 7*, 42717. https://doi.org/10.1038/srep42717
61. Trott, O., & Olson, A. J. (2010). AutoDockVina: Improving the speed and accuracy of docking with a new scoring function, efficient optimization, and multithreading. *Journal of Computational Chemistry, 31*(2), 455–461. https://doi.org/10.1002/jcc.21334
62. Venkatajothi, R., Sudhalakshmi, Y., Athiappan, M., Kandasamy, V., &Yavanika, V. (2025). Impact of the anti-inflammatory medication tramadol hydrochloride on *Staphylococcus aureus* multidrug export protein MepA using in silico chemical repurposing methods. *Journal of Zoological Investigations, 11*(1), 610–619. https://doi.org/10.33745/ijzi.2025.v11i01.064
63. Hanahan, D., & Weinberg, R. A. (2011). Hallmarks of cancer: The next generation. *Cell, 144*(5), 646–674. https://doi.org/10.1016/j.cell.2011.02.013
64. Vogelstein, B., Papadopoulos, N., Velculescu, V. E., Zhou, S., Diaz, L. A., &Kinzler, K. W. (2013). Cancer genome landscapes. *Science, 339*(6127), 1546–1558. https://doi.org/10.1126/science.1235122
65. Mosmann, T. (1983). Rapid colorimetric assay for cellular growth and survival: Application to proliferation and cytotoxicity assays. *Journal of Immunological Methods, 65*(1–2), 55–63. https://doi.org/10.1016/0022-1759(83)90303-4
66. Freshney, R. I. (2010). *Culture of animal cells: A manual of basic technique and specialized applications* (6th ed.). Wiley-Blackwell.
67. Venkatajothi, R., & Illanchezian, S. (2023). In vitro cytotoxic analysis of *Boerhaavia diffusa* Linn. *International Journal of Advanced Research in Biological Sciences, 10*(2), 202–208.

68. Münger, K., Baldwin, A., Edwards, K. M., Hayakawa, H., Nguyen, C. L., Owens, M., & Yeo-Cruz, S. (2004). Mechanisms of human papillomavirus-induced oncogenesis. *Journal of Virology, 78*(21), 11451–11460. https://doi.org/10.1128/JVI.78.21.11451-11460.2004
69. Venkatajothi, R., & Illanchezian, S. (2023). In vitro cytotoxic analysis of *Boerhaavia diffusa* Linn. *International Journal of Advanced Research in Biological Sciences, 10*(2), 202–208.
70. Burd, E. M. (2003). Human papillomavirus and cervical cancer. *Clinical Microbiology Reviews, 16*(1), 1–17. https://doi.org/10.1128/CMR.16.1.1-17.2003
71. Venkatajothi, R., Vinod Kumar, C. S., & Rajendran, P. (2011). Screening of high risk human papilloma virus type 16 in AIDS women. *Biomedicine, 31*(3), 302–306.
72. zurHausen, H. (2009). Papillomaviruses in the causation of human cancers: A brief historical account. *Virology, 384*(2), 260–265. https://doi.org/10.1016/j.virol.2008.11.046
73. World Health Organization. (2022). *World malaria report 2022.* WHO Press.
74. Bhatt, S., Gething, P. W., Brady, O. J., Messina, J. P., Farlow, A. W., Moyes, C. L., & Hay, S. I. (2013). The global distribution and burden of dengue. *Nature, 496*(7446), 504–507. https://doi.org/10.1038/nature12060
75. Ranson, H., & Lissenden, N. (2016). Insecticide resistance in African Anopheles mosquitoes: A worsening situation that needs urgent action to maintain malaria control. *Trends in Parasitology, 32*(3), 187–196. https://doi.org/10.1016/j.pt.2015.11.010
76. Mwanakasale, V., Venkatajothi, R., & Mwansa, M. (2023). Prevalence and risk factors for seizures in stage-2 of rhodesiense human African trypanosomiasis in Zambia from January 2013 to July 2022. *International Journal of Current and Innovative Advanced Research, 5*(4), 1–4.
77. Kennedy, P. G. E. (2013). Clinical features, diagnosis, and treatment of human African trypanosomiasis (sleeping sickness). *The Lancet Neurology, 12*(2), 186–194. https://doi.org/10.1016/S1474-4422(12)70296-X
78. Hotez, P. J., Fenwick, A., Savioli, L., & Molyneux, D. H. (2009). Rescuing the bottom billion through control of neglected tropical diseases. *The Lancet, 373*(9674), 1570–1575. https://doi.org/10.1016/S0140-6736(09)60233-6
79. Venkatajothi, R., & Illanchezian, S. (2023). In vitro cytotoxic analysis of *Boerhaavia diffusa* Linn. *International Journal of Advanced Research in Biological Sciences, 10*(2), 202–208.
80. Lahrmann, H., Cortelli, P., Hilz, M., Mathias, C. J., Struhal, W., & Tassinari, M. (2006). EFNS guidelines on the diagnosis and management of orthostatic hypotension. *European Journal of Neurology, 13*(9), 930–936. https://doi.org/10.1111/j.1468-1331.2006.01512.x
81. Shibao, C., Lipsitz, L. A., & Biaggioni, I. (2013). ASH position paper: Evaluation and treatment of orthostatic hypotension. *Journal of Clinical Hypertension, 15*(3), 147–153. https://doi.org/10.1111/jch.12062
82. Balapala, K. R., Mwanakasale, V., Mukanga, B., Venkatajothi, R., Silitongo, M. S., Sayana, S. B., & Mushabati, F. (2025). Impact of ageing on orthostatic hypotension and mental health: A cross-sectional study. *Romanian Medical Journal, 72*(1). https://doi.org/10.37897/RMJ.2025.1.7
83. Tinetti, M. E., Fried, T. R., & Boyd, C. M. (2012). Designing health care for the most common chronic condition: Multimorbidity. *JAMA, 307*(23), 2493–2494. https://doi.org/10.1001/jama.2012.5265
84. Inouye, S. K., Studenski, S., Tinetti, M. E., & Kuchel, G. A. (2007). Geriatric syndromes: Clinical, research, and policy implications of a core geriatric concept. *Journal of the American Geriatrics Society, 55*(5), 780–791. https://doi.org/10.1111/j.1532-5415.2007.01156.x
85. Fried, L. P., Tangen, C. M., Walston, J., Newman, A. B., Hirsch, C., Gottdiener, J., &McBurnie, M. A. (2001). Frailty in older adults: Evidence for a phenotype. *Journals of*

Gerontology Series A: Biological Sciences and Medical Sciences, 56(3), M146–M157. https://doi.org/10.1093/gerona/56.3.M146

86. Prince, M., Wimo, A., Guerchet, M., Ali, G., Wu, Y., & Prina, M. (2015). *World Alzheimer report 2015: The global impact of dementia.* Alzheimer's Disease International.
87. Anandan, R., Kannan, V., Sivakumar, L., Venkatajothi, R., &Athiappan, M. (2024). Production of oleic acid from mango kernels waste using probiotic bacteria isolated from marine fishes. *Asian Journal of Chemistry, 36*(7), 1511–1517. https://doi.org/10.14233/ajchem.2024.31515
88. Tripoli, E., Giammanco, M., Tabacchi, G., Di Majo, D., Giammanco, S., & La Guardia, M. (2005). The phenolic compounds of olive oil: Structure, biological activity and beneficial effects on human health. *Nutrition Research Reviews, 18*(1), 98–112. https://doi.org/10.1079/NRR200495
89. Teres, S., Barceló-Coblijn, G., Benet, M., Álvarez, R., Bressani, R., Halver, J. E., & Escribá, P. V. (2008). Oleic acid content is responsible for the reduction in blood pressure induced by olive oil. *Proceedings of the National Academy of Sciences, 105*(37), 13811–13816. https://doi.org/10.1073/pnas.0807500105
90. Venkatajothi, R., & Illanchezian, S. (2023). In vitro cytotoxic analysis of *Boerhaavia diffusa Linn*. *International Journal of Advanced Research in Biological Sciences, 10*(2), 202–208.
91. Gibson, G. R., Hutkins, R., Sanders, M. E., Prescott, S. L., Reimer, R. A., Salminen, S. J., & Reid, G. (2017). Expert consensus document: The International Scientific Association for Probiotics and Prebiotics (ISAPP) consensus statement on the definition and scope of prebiotics. *Nature Reviews Gastroenterology &Hepatology, 14*(8), 491–502. https://doi.org/10.1038/nrgastro.2017.75
92. Marco, M. L., Heeney, D., Binda, S., Cifelli, C. J., Cotter, P. D., Foligné, B., &Hutkins, R. (2017). Health benefits of fermented foods: Microbiota and beyond. *Current Opinion in Biotechnology, 44*, 94–102. https://doi.org/10.1016/j.copbio.2016.11.010
93. Venkatajothi, R., Rajendran, P., Vinod Kumar, C. S., Nivedha, R., &MelaniRajendran. (2011). Oral microbial diseases and care for people with mental, physical and social disability. *International Journal of Applied Microbiology, 14*(1), 1–8.
94. Petersen, P. E. (2003). The world oral health report 2003: Continuous improvement of oral health in the 21st century. *Community Dentistry and Oral Epidemiology, 31*(Suppl 1), 3–24. https://doi.org/10.1046/j..2003.com122.x
95. Sheiham, A. (2005). Oral health, general health and quality of life. *Bulletin of the World Health Organization, 83*(9), 644–644.
96. Vijayalakshmi, K., Mohamed Mahroop Raja, M., Venkatajothi, R., Sivamanikandan, P., PriyaDharsini, P., Winny Fred Crossia, A., Sivaprakasam, S., & Varadharajan, S. (2025). Exploring the antibacterial potential of Tephrosiapurpurea extracts against tomato spoilage pathogens. *Journal of Community Health Research, 15*(3), 1052–1061. https://www.jchr.org/index.php/JCHR/article/view/8391/4793
97. Dayan, F. E., Cantrell, C. L., & Duke, S. O. (2009). Natural products in crop protection. *Bioorganic & Medicinal Chemistry, 17*(12), 4022–4034. https://doi.org/10.1016/j.bmc.2009.01.046
98. Zinsstag, J., Schelling, E., Waltner-Toews, D., & Tanner, M. (2011). From "one medicine" to "one health" and systemic approaches to health and well-being. *Preventive Veterinary Medicine, 101*(3–4), 148–156. https://doi.org/10.1016/j.prevetmed.2010.07.003

99. Gibbs, E. P. J. (2014). The evolution of one health: A decade of progress and challenges for the future. *Veterinary Record, 174*(4), 85–91. https://doi.org/10.1136/vr.g143
100. Terstappen, G. C., & Reggiani, A. (2001). In silico research in drug discovery. *Trends in Pharmacological Sciences, 22*(1), 23–26. https://doi.org/10.1016/S0165-6147(00)01584-4

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