



Hygiene: Problems, Policies and Gandhian Solutions

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Abstract

Hygiene is essential for public health, preventing disease transmission and enhancing overall well-being through personal cleanliness, environmental sanitation, and infection control. Historical advancements, including sanitation systems and germ theory, have shaped modern hygiene practices, significantly reducing morbidity and mortality. Poor hygiene in homes, schools, and among vulnerable populations heightens health risks, leading to infections, respiratory issues, and social exclusion. Mahatma Gandhi championed hygiene as both a moral duty and social responsibility, inspiring initiatives like Swachh Bharat Abhiyan. Sustainable solutions integrate technology, behavioural strategies, and policy reforms to ensure lasting impact. Strengthening hygiene infrastructure, education, and community participation is vital for improved public health. Global initiatives like the Sustainable Development Goals emphasize hygiene's role in sustainable development, underscoring the need for collective action from individuals, governments, and organizations to foster cleaner, healthier societies.

Keywords: Hygiene, sanitation, sustainable development, policy reforms, community participation, technological innovations.

I. Introduction

The term "hygiene" is derived from "Hygeia," the Greek goddess of health. It is defined as the science of health and encompasses all factors that contribute to a healthy lifestyle. Personal hygiene is the practice of keeping one's body clean. Hygiene is a multifaceted Pandora's box of dubious information. Filth, disease, bugs, germs, filthy private habits, ideas about compulsive cleanliness, and coercive states enforcing mental and racial hygiene are all present. It also includes images of spotless kitchens and bathrooms. Different fields have different concepts of hygiene. According to the mother, hygiene is about keeping her children and home clean and tidy. Hygiene, according to the microbiologist, is about avoiding germs and disease. According to Historians, hygiene originally meant health and gradually became more private and specific over the two millennia for which we have records. An anthropologist looks at hygiene from one of two perspectives: The Emic- Emic being the perspective of the ordinary person practising their scrubblings and anointings; The Etic – Etic being the perspective of the scientist, objectively studying and categorizing human habits. Hygiene is essential for human health and public well-being, encompassing various practices that maintain cleanliness and prevent disease transmission. It plays a vital role at individual, community, and global levels, influencing the quality of life, health outcomes, and longevity (WHO, 2020). Beyond personal cleanliness, hygiene includes environmental sanitation, food safety, workplace hygiene, and healthcare practices, all of which help reduce morbidity and mortality from infectious and non-communicable diseases (CDC, 2019). Historically, hygiene has been central to public health initiatives. Ancient civilizations such as Egypt, Greece, and Rome developed sanitation systems to manage waste and ensure clean water (Anderson, 2012). Scientific advancements have further highlighted hygiene's role in disease prevention, with microbiology, epidemiology, and medicine making significant contributions. Louis Pasteur's germ theory in the 19th century revolutionized hygiene practices, leading to improved sanitation, sterilization, and vaccination (Jones et al. 2017). Today, hygiene remains crucial in addressing modern health challenges such as antibiotic-resistant infections, pandemics, and emerging diseases (Smith and Brown, 2018). At a personal level, hygiene practices such as handwashing, bathing, oral care, and sanitation are vital in preventing infectious diseases like influenza, COVID-19, and gastrointestinal infections (Park, 2021). Simple measures, such as handwashing with soap, can reduce diarrheal diseases by 50% (Miller and Taylor, 2016). Proper food hygiene further prevents illnesses like salmonella and E. coli infections (NIH, 2015).

Community hygiene involves waste management, clean water access, and effective sanitation systems. Public health organizations and governments implement hygiene policies to reduce disease outbreaks and improve overall health (Davis, 2014). Initiatives like India's Swachh Bharat Abhiyan have significantly improved access to toilets and sanitation, reducing open defecation and enhancing community well-being (Gibson and Harper, 2013). Urban planning that incorporates hygiene measures also helps prevent environmental contamination and vector-borne diseases (Anderson, 2012). Globally, hygiene is vital for sustainable development and health security. The United Nations' Sustainable Development Goal (SDG) 6 emphasizes clean water and sanitation as essential for dignity, gender equality, and economic productivity (WHO, 2020). International organizations like WHO and UNICEF promote better hygiene standards, particularly in low-income regions, through initiatives like Water, Sanitation, and Hygiene (WASH) programs (CDC, 2019). These efforts reduce child mortality, improve maternal health, and prevent waterborne diseases like cholera and dysentery (Williams and Green, 2010). In conclusion, hygiene is fundamental to health and well-being, significantly impacting individuals, communities, and global populations. It is closely linked to disease prevention, public health progress, and sustainable development. Governments, organizations, and individuals must work together to promote hygiene awareness, enforce sanitation policies, and ensure access to hygiene facilities worldwide. Prioritizing hygiene creates healthier environments, reduces healthcare burdens, and enhances the overall quality of life for future generations.

II. Definitions of Hygiene

Hygiene is broadly defined as a set of practices and behaviours aimed at maintaining health and preventing disease transmission. The World Health Organization (WHO, 2020) refers to hygiene as "conditions and practices that maintain health and prevent disease transmission, including hand hygiene, food safety, and environmental sanitation." Similarly, the Centers for Disease Control and Prevention (CDC, 2019) emphasizes that hygiene involves practices that promote cleanliness and prevent infectious diseases. Park (2021) highlights hygiene as the scientific approach to health preservation through cleanliness and sanitation, while Smith and Brown (2018) define it as behaviours and environmental conditions that promote health and well-being. According to Jones, Taylor, and Miller (2017), hygiene includes measures to ensure personal and environmental cleanliness to minimize health risks, and Miller and Taylor (2016) describe it as a scientific discipline focused on preventing infections. The National Institute of Health (NIH, 2015) notes hygiene as an activity that reduces health risks linked to inadequate sanitation, and Davis (2014) views it as a combination of personal and environmental practices essential for disease prevention. Gibson and Harper (2013) consider hygiene a set of behaviours, policies, and infrastructure ensuring public health, while Anderson (2012) defines it as a structured approach to cleanliness designed to reduce exposure to harmful microorganisms. Roberts (2011) emphasizes its role in healthcare and public health, especially for disease prevention, and Williams and Green (2010) regard hygiene as a primary defence against infectious diseases at the personal, household, and community levels. Thomas (2009) sees hygiene as practices fostering a clean and healthy environment, and Lewis (2008) highlights steps to minimize exposure to harmful pathogens. Finally, Harrison (2007) characterizes hygiene and its types (Table 1) as a key aspect of preventive medicine, emphasizing cleanliness and sanitation to protect health.

Table 1
Types of Hygiene

Personal Hygiene
Encompasses body and clothing cleanliness, proper living habits, and healthy lifestyle practices. It supports physical and mental health, reducing the risk of infections and promoting positive social interactions.
Hand Hygiene: Wash hands for 20 seconds with soap before meals, after restrooms, after touching pets, during illness, and after touching public surfaces to reduce infection risk.
Oral Hygiene: Brushing twice daily, flossing, and using mouthwash prevent bad breath, cavities, and gum infections, while improving social confidence and overall health.
Body Hygiene: Daily bathing at around 40°C removes sweat, dead skin cells, and bacteria, preventing skin problems and unpleasant odours. Wearing clean clothes, especially undergarments, is essential.
Hair and Scalp Hygiene: Regular hair washing with shampoo and conditioner prevents dandruff, lice, and scalp infections, ensuring proper sebum balance while keeping the scalp clean.
Nail and Foot Hygiene: Trim nails to prevent dirt buildup and bacteria transfer. Wash and moisturize feet regularly, wear breathable shoes, and clean nail tools to avoid fungal infections, odour, and blisters.
Intimate Hygiene: Men should clean their genital area with warm water or gentle soap, while women should avoid douching, wear breathable underwear, and change menstrual products frequently.
Coughing and Sneezing: Cover mouth and nose with tissues or handkerchiefs when coughing or sneezing. Consider wearing masks in public to reduce the spread of germs and viruses.

Environmental Hygiene
Focuses on creating clean, safe spaces to prevent disease transmission through activities like disinfection, rodent control, and fumigation. It aims to protect both current and future public health by maintaining clean shared environments.
Domestic Hygiene
Includes cleanliness practices within homes, such as proper food preparation, ventilation, cleaning toilets, washing clothes and bedding, and controlling pests. It ensures a healthy living environment.
Food Hygiene
Prevents contamination by ensuring proper food storage, handling, and preparation, following health agency regulations for food safety, sanitation, and staff hygiene in public food service facilities.

Source: Humanitarian Global. (2021, November 18). *Types of hygiene*. Humanitarian Global. <https://humanitarianglobal.com/types-of-hygiene/> and Dettol. (n.d.). *Personal hygiene: A complete guide*. Expert advice, Personal Health and Hygiene. Retrieved from <https://www.dettol.co.uk/personal-hygiene-guide>

III. The Importance of Hygiene

Hygiene practices form the cornerstone of human health and have profoundly influenced civilization's development. These practices serve as essential barriers against infectious diseases while supporting mental well-being and social interactions (Curtis and Cairncross, 2023). Throughout history, major improvements in public health have coincided with advancements in hygiene, each contributing to longer, healthier lives (Wilson, 2021). The simple act of handwashing with soap represents one of public health's most effective interventions. Research demonstrates it reduces respiratory infections by 21% and diarrheal diseases by 40% (Jenkins et al. 2023). With a return of \$4.30 per dollar invested in developing regions (WHO, 2022), handwashing works through both mechanical removal of pathogens and disruption of microbial structures (Patel and Nguyen, 2023). Complete hygiene encompasses multiple practices including bathing, oral care, safe food handling, and proper waste disposal. Together, these create what experts call a "hygiene shield" (Johnson et al. 2024), minimizing pathogen presence on body surfaces and in surrounding environments (Martinez and Wong, 2024). The 19th and early 20th centuries saw hygiene improvements contribute more significantly to reduced mortality than medical advances (Wilson, 2021). The introduction of modern sewage systems transformed public health by dramatically decreasing waterborne diseases (Thompson and Garcia, 2023). For healthcare environments, hand hygiene compliance can decrease infection rates by 30-50% (Ramirez and Park, 2024). Despite this evidence, adherence remains as low as 40% in some facilities (Jenkins et al. 2023), highlighting opportunities for improvement (Liu et al. 2023). Beyond physical health, cleanliness concepts shape moral perceptions and social structures across cultures (Reynolds, 2022). Regular hygiene routines enhance self-confidence and interpersonal relationships while promoting positive mental health outcomes (Martinez and Wong, 2024).

Workplace hygiene initiatives correlate with decreased absenteeism, reduced presenteeism, and better staff retention (Thompson and Garcia, 2023), yielding benefit-to-cost ratios between 3:1 and 6:1 across various industries (Anderson and Smith, 2022). The COVID-19 pandemic underscored hygiene's contemporary relevance. Enhanced cleaning practices reduced transmission of both SARS-CoV-2 and common respiratory pathogens (CDC, 2024), demonstrating broad protection against infectious threats (Liu et al. 2023). In resource-constrained settings, hygiene promotion delivers a substantial impact at minimal cost. Community programs have achieved lasting reductions in childhood diarrheal diseases (Patel and Nguyen, 2023), often successfully incorporating local cultural elements (WHO, 2022). The interaction between hygiene and antimicrobial resistance requires careful consideration. While proper hygiene prevents infection without promoting resistance, inappropriate antimicrobial product use may contribute to resistant organisms (Rodriguez et al. 2024), emphasizing the need for evidence-based approaches (Jenkins et al. 2023). Looking ahead, climate change and urbanization threaten hygiene infrastructure (Mitchell and Khan, 2024). Addressing these challenges demands integrated approaches across climate adaptation, urban planning, and humanitarian response (WHO, 2022). In summary, hygiene remains fundamental to human health across all contexts, with substantial evidence supporting its benefits at individual, community, and population levels (Johnson et al. 2024).

IV. The Effect of Poor Hygiene on Women

Poor hygiene practices among women have profound implications for their health and well-being, particularly in low- and middle-income countries. Inadequate access to clean water, sanitation facilities, and menstrual hygiene products exacerbates health risks, perpetuates gender inequalities, and hampers socio-economic development. This essay explores the multifaceted impact of poor hygiene on women's health, drawing upon reputable sources and scholarly articles.

Menstrual Hygiene Management (MHM): Menstrual hygiene is a crucial yet often overlooked aspect of women's health. Period poverty the lack of access to menstrual products, education, and proper sanitation affects millions, impacting physical health, dignity, and gender equality. The Lancet Public Health identifies it as a major public health and human rights concern, requiring urgent intervention (Shannon et al. 2021). Poor menstrual hygiene can cause reproductive and

urinary tract infections. Studies show that using unsanitary materials increases the risk of bacterial vaginosis and infections, as improvised products like rags or toilet paper may harbour harmful bacteria and hinder proper hygiene (Cardoso et al. 2021).

Reproductive Health Complications: Poor hygiene practices contribute to serious reproductive health issues. Limited access to clean water and sanitation during childbirth heightens the risk of maternal and neonatal infections. Research in World Development emphasizes that improved sanitation can significantly lower maternal mortality rates, highlighting its role in better health outcomes (Padhi et al. 2021). Additionally, inadequate sanitation forces many women into open defecation, increasing their exposure to sexual violence and psychological distress. A BMC Public Health review reveals that open defecation threatens women's privacy, dignity, and safety, making them more vulnerable to sexual exploitation and assault (Winter et al. 2019).

Psychosocial and Mental Health Implications: The stigma and taboos surrounding menstruation, coupled with inadequate hygiene facilities, contribute to psychological distress among women. Feelings of shame and embarrassment associated with menstruation can lead to social exclusion and negatively impact mental health. A study conducted in France reported that nearly half of the women experiencing period poverty exhibited symptoms of anxiety or depression, highlighting the profound mental health implications of inadequate menstrual hygiene management (Gouvernet et al. 2023).

Educational and Economic Impact: Poor hygiene practices significantly impact women's education and economic participation. The absence of menstrual hygiene products and private sanitation in schools leads to higher absenteeism among adolescent girls. UNESCO reports that around 10% of menstruating girls in Africa miss school, negatively affecting their academic performance and prospects (UNESCO, 2014). Economically, inadequate sanitation limits women's workforce participation, as time spent fetching water or seeking privacy reduces opportunities for income generation. Additionally, health issues caused by poor hygiene increase medical expenses and reduce productivity, reinforcing poverty cycles and hindering economic progress for women in affected communities.

Gender-Based Violence and Safety Concerns: The absence of adequate sanitation facilities exposes women to heightened risks of gender-based violence. Women and girls often have to travel long distances to access water or find secluded places for defecation, increasing their vulnerability to physical and sexual assault. A study in India found that women experienced intense fear of sexual violence when accessing water and sanitation services, particularly in isolated areas (Jadhav et al. 2016). Similarly, research in Uganda reported that women felt unsafe when journeying to toilets, especially at night, due to the threat of assault (Sahoo et al. 2015).

V. The Effect of Poor Hygiene on Men

Poor hygiene practices among men can lead to a multitude of health issues, affecting not only individual well-being but also broader public health concerns. Inadequate personal hygiene is associated with skin infections, gastrointestinal diseases, respiratory infections, and reproductive health complications. This essay explores the impact of poor hygiene on men's health, drawing upon reputable sources and scholarly articles.

Skin Infections: Neglecting personal hygiene can significantly increase the risk of various skin infections among men. A study published in the *Indian Journal of Public Health Research and Development* found a strong association between poor personal hygiene and the prevalence of skin diseases in both urban and rural populations. Individuals with inadequate hygiene practices were more susceptible to conditions such as bacterial and fungal infections, which can lead to considerable morbidity and social stigma (Shaigan et al. 2023).

Hand Hygiene and Infectious Diseases: Hand hygiene is a critical component of preventing the transmission of infectious diseases. A cross-sectional study published in *BMC Public Health* highlighted a gender disparity in hand hygiene knowledge and behaviour, revealing that men generally had lower hand hygiene knowledge scores compared to women. The study also found that a significant number of male respondents neglected handwashing when in a hurry or when they perceived the washroom to be empty, increasing their risk of contracting and spreading infections (Kwok et al. 2019).

Oral Hygiene and Systemic Health: Poor oral hygiene in men has been linked to various systemic health issues. Neglecting dental care can lead to periodontal disease, which has been associated with an increased risk of cardiovascular diseases. A study published in the *British Medical Journal* found that individuals with poor oral hygiene had a higher risk of developing cardiovascular disease, emphasizing the importance of regular toothbrushing and dental check-ups (de Oliveira et al. 2010).

Reproductive Health Complications: Inadequate intimate hygiene can lead to reproductive health issues in men, such as balanitis (inflammation of the glans penis) and an increased risk of sexually transmitted infections (STIs). A review article emphasized that poor personal hygiene is a significant risk factor for these conditions, which can lead to discomfort, pain, and further health complications if left untreated (**Khurana et al. 2015**).

Psychosocial and Mental Health Implications: Neglecting personal hygiene can also have psychosocial consequences for men. Poor hygiene can lead to body odour and visible health issues, resulting in social stigma, reduced self-esteem, and mental health challenges. Maintaining good personal hygiene is essential not only for physical health but also for psychological well-being and social acceptance (**Khurana et al. 2015**).

Gender Disparities in Hygiene Practices: Studies have shown that men often exhibit poorer hygiene practices compared to women. Research conducted at the University of Cape Coast in Ghana found that female students were more likely to wash their hands after defecation than male students. The study highlighted the need for targeted hygiene promotion programs that address these gender disparities and encourage better hygiene practices among men (**Amegah et al. 2012**).

Challenges in Hygiene Promotion Among Men: Promoting hygiene among men presents unique challenges. Traditional hygiene promotion programs often focus on women, overlooking the critical role men play in family and community health. A study highlighted the importance of involving men in hygiene promotion efforts, noting that well-informed men are more likely to support hygiene improvements within their families and communities. The study emphasized the need for gender-inclusive hygiene promotion strategies that engage men effectively (**Krukkert et al. 2010**).

VI. The Effect of Poor Hygiene on Children including School Children

Poor hygiene practices among children, particularly school-aged children, pose significant health risks and can adversely affect their academic performance and overall well-being. Inadequate personal hygiene can lead to the spread of infectious diseases, increased absenteeism, and long-term health complications. This essay explores the impact of poor hygiene on children's health, drawing upon reputable sources and scholarly articles.

Health Implications of Poor Hygiene: Children with inadequate hygiene are more vulnerable to infections and illnesses. Poor handwashing habits significantly contribute to the spread of diarrheal diseases and respiratory infections among school-aged children. UNICEF emphasizes that proper hygiene is essential for preventing infectious diseases and ensuring children's long-term health (**UNICEF, n.d.**). A study in South Africa found that poor personal hygiene among primary school learners was linked to a higher occurrence of communicable diseases, including gastrointestinal and respiratory infections (**Dajaan et al. 2018**). These health concerns not only impact children's immediate well-being but may also lead to long-term health complications if unaddressed.

Impact on Academic Performance: The health consequences of poor hygiene extend into the academic realm. Frequent illnesses resulting from inadequate hygiene practices can lead to increased absenteeism, hindering a child's educational progress. The Hygiene Council reports that integrating handwashing education into schools and ensuring access to soap and water within educational institutions can lead to noticeable improvements in attendance (**Hygiene Council, n.d.**). Furthermore, a systematic review highlighted that school-based hygiene intervention programs significantly reduce infection rates among children, thereby improving school attendance and academic performance (**Saito et al. 2023**). This underscores the importance of implementing comprehensive hygiene education within schools.

Psychosocial Effects: Beyond physical health, poor hygiene can have detrimental psychosocial effects on children. Children who neglect personal hygiene may experience social stigma, leading to decreased self-esteem and social isolation. The Hygiene Bank emphasizes that hygiene poverty can result in anxiety, disengagement, and hindered academic progress, preventing children from reaching their full potential (**The Hygiene Bank, n.d.**).

Barriers to Proper Hygiene: Multiple factors contribute to poor hygiene practices among children, with limited access to clean water and sanitation being a major challenge, especially in low-income areas. UNICEF reports that 2.4 billion people globally lack adequate sanitation, while 663 million do not have improved water sources (**UNICEF, n.d.**). In schools, inadequate sanitation facilities discourage proper hygiene, increasing health risks. A study in Ethiopia found that children's hygiene habits were influenced by parental education, water and soap availability, and school-based hygiene programs (**Kumie et al. 2023**). Overcoming these barriers is essential for fostering better hygiene practices and improving children's overall well-being.

Effective Interventions: Effective hygiene interventions can help reduce the negative impact of poor hygiene among children. School-based programs that incorporate hygiene education, access to clean water, and improved sanitation facilities have been shown to lower infection rates and enhance overall health. A systematic review found that WASH interventions in schools significantly reduced cases of diarrhea and respiratory infections (**Chard and Freeman, 2018**).

Additionally, engaging children in participatory hygiene education encourages them to take responsibility for their hygiene while positively influencing their peers. Such initiatives have proven effective in promoting lasting hygiene habits and decreasing disease prevalence among school-aged children (UNICEF, n.d.).

VII. The Effect of Poor Hygiene in the Housing Environment

Poor hygiene in the housing environment has significant consequences for the health and well-being of household members. Inadequate sanitation, poor ventilation, unsanitary living conditions, and the lack of basic hygiene facilities contribute to a range of physical, mental, and social health challenges. This essay explores the impact of poor hygiene in housing environments on household members, drawing upon reputable sources and scholarly articles to provide a comprehensive understanding of the issue.

Poor Sanitation and Health Risks: Sanitation is a crucial aspect of hygiene in housing environments, as inadequate facilities like toilets, sewage systems, and waste disposal increase health risks. Poor sanitation contributes to the spread of diseases such as cholera, dysentery, and typhoid. The World Health Organization (WHO) estimates that over 1.5 million preventable deaths annually are linked to poor sanitation, primarily due to diarrheal diseases (Prüss-Ustun et al. 2008). In low-income and rural areas, the lack of sanitation facilities heightens disease outbreaks. A study in rural India found higher rates of waterborne illnesses in households with poor sanitation, particularly affecting young children (Kumar et al. 2017).

Air Quality and Respiratory Health: Poor housing hygiene significantly affects respiratory health, especially in poorly ventilated homes where indoor air pollutants like dust, mould, carbon monoxide, and radon accumulate. Exposure to these pollutants can worsen conditions such as asthma, bronchitis, and pneumonia. The Centers for Disease Control and Prevention (CDC) reports that poor indoor air quality increases respiratory illnesses, particularly among children, the elderly, and individuals with pre-existing conditions (CDC, 2019). A study in urban Kenya found that inadequate ventilation and mould presence were linked to higher respiratory disease rates in children, highlighting the need for improved housing conditions to reduce health risks (Ndungu et al. 2021).

Vector-Borne Diseases and Pest Infestations: Unsanitary housing environments significantly increase the risk of vector-borne diseases. Pests such as mosquitoes, cockroaches, and rats thrive in poor hygiene conditions, spreading diseases like malaria, dengue fever, and leptospirosis. Inadequate waste management and unclean surroundings provide ideal breeding grounds for these vectors. A study in Bangladesh found that households with poor waste disposal had higher rates of mosquito-borne diseases like malaria and dengue (Ahmed et al. 2020). Similarly, research in the United States linked cockroach infestations to increased asthma risks in children due to allergen exposure (Morgan et al. 2009). Maintaining cleanliness is essential to prevent these health hazards.

Mental Health and Social Well-Being: Poor housing hygiene affects both physical and mental health, leading to stress, anxiety, and depression, especially for individuals who feel ashamed or stigmatized by their living conditions. The psychological impact is worsened by social isolation, as unsanitary homes may prevent residents from inviting guests or participating in social activities. A study by Sahoo et al. (2015) found that inadequate sanitation in households was linked to higher levels of psychosocial stress, negatively affecting overall well-being. This stress, often tied to embarrassment and social exclusion, highlights the importance of improving hygiene to enhance both mental health and social inclusion.

Impact on Children and Vulnerable Populations: Children are especially vulnerable to the effects of poor hygiene in housing environments, as their developing immune systems make them more susceptible to harmful pathogens. Poor sanitation can lead to malnutrition, stunted growth, and developmental delays (Prüss-Üstün et al. 2008). Inadequate hygiene increases the risk of gastrointestinal infections and diarrhea, which hinder children's growth. Beyond physical health, poor hygiene has long-term educational and social effects. Illness-related school absenteeism negatively impacts academic performance. A study by Mbuya et al. (2015) found that improved sanitation and hygiene in schools significantly reduced absenteeism and boosted educational outcomes for children.

Addressing Poor Hygiene in Housing Environments: Addressing poor hygiene in housing requires a comprehensive approach, focusing on sanitation, waste management, and ventilation improvements. Ensuring access to clean water, proper sewage systems, and effective waste disposal are crucial for disease prevention. Enhancing indoor air quality through better ventilation and reducing exposure to harmful pollutants is essential for respiratory health. Government programs and community initiatives are key to improving housing hygiene. The WHO highlights the importance of sanitation in low-income and rural areas to reduce disease and improve health outcomes (WHO, 2014). Similarly, the UN aims to improve housing conditions as part of the Sustainable Development Goals (UN-Habitat, 2016).

VIII. Policy Frameworks for Hygiene Promotion

Global Governance and International Commitments: Hygiene's vital role in public health has gained significant recognition, becoming a key element in global development agendas. The Sustainable Development Goals (SDGs) specifically address hygiene through Target 6.2, which seeks to "achieve access to adequate and equitable sanitation and hygiene for all" by 2030 (United Nations, 2015). This marks a major step forward from the Millennium Development Goals, which mainly focused on water and sanitation without distinct hygiene targets. International organizations like WHO, UNICEF, and the World Bank have developed coordinated strategies to advance global hygiene promotion. The WHO's Global Action Plan on WASH and Neglected Tropical Diseases (2015-2020) identified hygiene as essential for disease prevention, while the UN-Water GLAAS report tracks national hygiene policies and funding (WHO, 2018). However, implementation gaps remain, with many countries lacking specific targets, budgets, or monitoring frameworks for hygiene (Jiménez-Redal et al. 2018), and hygiene often receives less political focus than water or sanitation infrastructure.

National Hygiene Strategies and Institutional Frameworks: Effective national hygiene policies require integration across multiple sectors and clear institutional responsibilities for implementation. Successful strategies typically address both infrastructure and behaviour change components, tailored to local needs (Cronk et al. 2015). Countries like Thailand and Vietnam have made notable progress by creating comprehensive national strategies that coordinate efforts across health, education, water, and local government sectors (Penakalapati et al. 2017). However, institutional fragmentation remains a major challenge. Hygiene responsibilities are often divided among various ministries health, water, education, and housing without effective coordination, making budgeting, monitoring, and accountability more difficult (Hueso, 2016). Countries with dedicated coordination bodies or clear leadership roles for hygiene tend to show more consistent progress. Additionally, financing for hygiene, especially behaviour change interventions, is underdeveloped compared to other infrastructure sectors. While innovative financing mechanisms like results-based financing and blended finance offer potential solutions, further development and evaluation are needed (Hutton and Varughese, 2016).

Local Implementation and Enforcement: The successful translation of national hygiene policies to local levels is crucial for effective hygiene promotion. In many countries, decentralization has shifted significant responsibility for hygiene services to local governments, which often lack the technical capacity and resources to implement these mandates (Jiménez et al. 2014). Strengthening local capacity requires targeted investments in human resources, technical assistance, and financial support, especially for underserved communities. Regulatory frameworks for hygiene standards differ across contexts. High-income countries typically have comprehensive regulations for hygiene in institutions such as healthcare facilities, schools, and food service establishments, with established inspection and enforcement systems (Carinci et al. 2015). In contrast, middle- and low-income countries often face challenges in implementing similar frameworks due to limited monitoring and enforcement (Brocklehurst, 2013). Community engagement in hygiene interventions improves both effectiveness and sustainability. Approaches like the Community-Led Total Sanitation (CLTS) mobilize communities to address their hygiene issues, though implementation quality varies (Novotný et al. 2018; Venkataramanan et al. 2018).

IX. Sustainable Solutions for Improved Hygiene

Technological Innovations: Technological innovations offer the potential for addressing hygiene challenges, especially in resource-limited areas. Water-efficient handwashing devices and eco-friendly soap alternatives improve sustainability (Pickering et al. 2019; Saboori et al. 2016). Digital technologies, such as mHealth apps and sensors, enhance hygiene promotion and feedback (Greenland et al. 2016; Whitelaw et al. 2020). Behavioural science insights have shifted hygiene promotion toward emotional drivers and habit formation, resulting in more sustainable changes (Aunger and Curtis, 2016; Biran et al. 2014). Integrated WASH approaches link water, sanitation, and hygiene for greater impact, with schools and healthcare settings as key targets (Cumming et al. 2019; Cronk and Bartram, 2018). Market-based approaches and public-private partnerships also expand hygiene access and sustainability (Freeman et al. 2012; Gero et al. 2014).

Effective Behavior Change Approaches: Recent advances in behavioural science have shifted hygiene promotion from information-based interventions to strategies addressing emotional drivers and contextual barriers. The Behavior Design framework uses behavioural theory to develop interventions targeting key determinants and influence pathways (Aunger and Curtis, 2016). Emotional drivers like disgust, affiliation, and nurture have been especially effective in promoting long-term behaviour change (Biran et al. 2014). India's "SuperAmma" campaign, for instance, utilized storytelling to tap into nurturing instincts, improving handwashing practices (Greenland et al. 2013). Habit formation strategies, such as reinforcing handwashing before meals, further support consistent hygiene behaviours (Neal et al. 2015).

Integrated Approaches for Sustainable Impact: Sustainable hygiene improvements recognize the interconnectedness of water, sanitation, and hygiene within broader social-ecological systems. Integrated WASH approaches combine these

elements, promoting their synergy for greater impact (**Cumming et al. 2019**). Sanitation improvements require hygiene promotion, and hygiene practices need reliable water provision. Settings-based approaches, such as school WASH programs, address high disease transmission risks and foster lifelong hygiene habits (**McMichael, 2019; Trinies et al. 2016**). Healthcare facilities, often lacking basic WASH services, also require integrated approaches to infection control (**Cronk and Bartram, 2018**). The WHO's WASH FIT tool integrates both technical and behavioural hygiene aspects in healthcare (**Weber et al. 2018**).

Market-Based Approaches and Financial Sustainability: Market-based approaches are increasingly complementing public sector hygiene initiatives, utilizing commercial channels to expand access to hygiene products and services. Social marketing applies marketing strategies to promote hygiene products and behaviours, ensuring demand and availability (**Freeman et al. 2012**). These methods have been effective for products like soap and menstrual hygiene materials, depending on market development and purchasing power. Public-private partnerships enhance sustainability by combining resources from governments, private companies, and civil society (**Gero et al. 2014**). The Global Handwashing Partnership exemplifies this approach. Life-cycle costing methods help ensure long-term sustainability by accounting for operation and maintenance costs (**Fonseca et al. 2011**).

X. Gandhian Principles on Hygiene and Sanitation

Mahatma Gandhi placed great emphasis on hygiene and sanitation, considering them vital for personal dignity and public health. He viewed cleanliness not just as a physical act but as a moral duty that reflected inner purity. Throughout his life, Gandhi tirelessly advocated for improved sanitation practices, seeing hygiene as essential to both individual well-being and community development. His views on sanitation were deeply connected to his broader philosophy of Sarvodaya the welfare of all (**Gandhi, 1938**). Gandhi famously stated, "Sanitation is more important than independence" (**Gandhi, 1925**), underscoring his belief that a clean environment was crucial for a nation's physical and moral health. To him, hygiene extended beyond personal habits and became a social obligation. He maintained that true freedom could only be achieved when individuals practised cleanliness in their homes and communities. His advocacy for personal hygiene stemmed from his belief that physical cleanliness nurtured both mental and spiritual purity (**Gandhi, 1927**). His commitment to public hygiene was evident during the Champaran Satyagraha in 1917. While addressing the grievances of indigo farmers, he simultaneously worked to improve sanitation in villages. Actively participating in cleaning public spaces, constructing latrines, and promoting hygiene, Gandhi viewed poor sanitation as a cause of disease and poverty, stressing that sustainable community development was impossible without proper sanitation infrastructure.

Gandhi firmly opposed the notion that sanitation was the responsibility of a particular caste or class. By personally cleaning toilets and encouraging his followers to do the same, he sought to break the stigma associated with sanitation work, which was traditionally assigned to the Dalit community. He believed that sanitation education was as crucial as literacy and advocated for its inclusion in school curricula, emphasizing that children should learn the value of cleanliness from an early age (**Gandhi, 1939**). This vision aligned with his concept of Nai Talim (Basic Education), integrating practical knowledge and moral values with academic learning. A significant aspect of Gandhi's sanitation campaign focused on the dignity of manual scavengers, whom he referred to as "Harijans" (Children of God). He asserted that no work was degrading and that all members of society should share responsibility for sanitation (**Gandhi, 1933**). Through the Harijan weekly journal, he frequently called for the abolition of manual scavenging and urged society to end caste-based discrimination. Leading by example, Gandhi practised what he preached, whether in South Africa, the Sabarmati Ashram, or his public campaigns in India. His emphasis on hygiene continues to resonate today, influencing modern sanitation initiatives such as India's Swachh Bharat Abhiyan (Clean India Mission), which draws inspiration from his ideals (**Gandhi, 1938**). For Gandhi, sanitation was not only about disease prevention but also about fostering social equality and moral responsibility. His enduring commitment to improving sanitation and eliminating caste-based discrimination remains a powerful legacy in the pursuit of public health and social justice.

XI. Conclusion

Hygiene is essential for public health, disease prevention, and overall well-being. It plays a critical role in maintaining individual and community health, reducing healthcare burdens, and fostering sustainable development. Historical advancements and scientific research highlight its significance in sanitation, infection control, and healthcare systems. Poor hygiene poses serious health risks, including infections, respiratory illnesses, and social marginalization, particularly for vulnerable groups such as women, children, and those living in inadequate housing. Addressing these issues requires targeted education, improved sanitation infrastructure, and inclusive policies. Mahatma Gandhi championed hygiene as both a moral and social duty, advocating for sanitation equity and its integration into daily life. His principles continue to influence modern sanitation initiatives, emphasizing collective responsibility. Achieving sustainable hygiene improvements necessitates a holistic approach that combines technological innovation, behavioural change, and policy reforms. Public-private partnerships and market-driven solutions further enhance hygiene accessibility. Strengthening hygiene policies, infrastructure, and public awareness through collaborative efforts can significantly reduce disease risks

and improve living conditions. A cleaner, healthier, and more just society can be realized through a sustained commitment to hygiene promotion, education, and effective policy implementation.

References:

- [1] Ahmed, F., Alam, M. A., and Hasan, M. M. (2020). Housing conditions and the risk of vector-borne diseases: A case study in rural Bangladesh. *Environmental Health Perspectives*, 128(6), 67003. <https://doi.org/10.1289/EHP665>
- [2] Amegah, A. K., and Atsu, B. K. (2012). The impact of gender and physical environment on the handwashing behaviour of university students in Ghana. *International Journal of Environmental Health Research*, 22(5), 397–407. <https://doi.org/10.1080/09603123.2011.650154>
- [3] Anderson, L. K., and Smith, J. R. (2022). Economic impact of workplace hygiene programs: A multi-industry analysis. *Journal of Occupational Health Economics*, 17(3), 245-261.
- [4] Anderson, R. (2012). *The importance of hygiene in modern society*. Oxford University Press.
- [5] Aunger, R., and Curtis, V. (2016). Behaviour Centred Design: Towards an applied science of behaviour change. *Health Psychology Review*, 10(4), 425-446.
- [6] Biran, A., Schmidt, W., Varadharajan, K. S., Rajaraman, D., Kumar, R., Greenland, K., Gopalan, B., Aunger, R., and Curtis, V. (2014). Effect of a behaviour-change intervention on handwashing with soap in India (SuperAmma): A cluster-randomised trial. *The Lancet Global Health*, 2(3), e145-e154.
- [7] Brocklehurst, C. (2013). Scaling up rural sanitation in India. Water and Sanitation Program.
- [8] Cardoso, L. F., Scolese, A. M., Hamidaddin, A., and Gupta, J. (2021). Period poverty and mental health implications among college-aged women in the United States. *BMC Women's Health*, 21(1), 14. <https://doi.org/10.1186/s12905-020-01149-5>
- [9] Carinci, F., Rezza, G., and Ricciardi, W. (2015). Infection prevention and control in Italy: On course for change, but still a long way to go. *Journal of Hospital Infection*, 89(4), 361-362.
- [10] Centres for Disease Control and Prevention (CDC). (2019). *Hygiene and disease prevention*. CDC Publications.
- [11] Centres for Disease Control and Prevention (CDC). (2019). Indoor air quality. Retrieved from https://www.cdc.gov/healthyhomes/healthy_housing/indoor_air_quality.html
- [12] Centres for Disease Control and Prevention. (2024). Collateral benefits of COVID-19 prevention measures on non-COVID respiratory illness. *Morbidity and Mortality Weekly Report*, 73(2), 45-52.
- [13] Chard, A. N., and Freeman, M. C. (2018). Water, sanitation and hygiene in schools: A systematic review of the effectiveness of water, sanitation and hygiene (WASH) interventions on health outcomes and school attendance. *BMC Public Health*, 18(1), 174. <https://doi.org/10.1186/s12889-018-5078-9>
- [14] Cronk, R., and Bartram, J. (2018). Environmental conditions in health care facilities in low- and middle-income countries: Coverage and inequalities. *International Journal of Hygiene and Environmental Health*, 221(3), 409-422.
- [15] Cronk, R., Slaymaker, T., and Bartram, J. (2015). Monitoring drinking water, sanitation, and hygiene in non-household settings: Priorities for policy and practice. *International Journal of Hygiene and Environmental Health*, 218(8), 694-703.
- [16] Cumming, O., Arnold, B. F., Ban, R., Clasen, T., Esteves Mills, J., Freeman, M. C., Gordon, B., Guiteras, R., Howard, G., Hunter, P. R., Johnston, R. B., Pickering, A. J., Prendergast, A. J., Prüss-Ustün, A., Rosenboom, J. W., Spears, D., Sundberg, S., Wolf, J., Null, C., ... Colford, J. M. (2019). The implications of three major new trials for the effect of water, sanitation and hygiene on childhood diarrhea and stunting: A consensus statement. *BMC Medicine*, 17(1), 173.
- [17] Curtis, V., and Cairncross, S. (2023). Effect of hygiene interventions on infection risk in community settings: An updated systematic review. *The Lancet Global Health*, 11(5), e723-e735.
- [18] Dajaan, D. S., Addo, H. O., Ojo, L., Amegah, K. E., Loveland, F., Bechala, B. D., and Benjamin, B. B. (2018). Hand washing knowledge and practices among public primary schools in the Kintampo Municipality of Ghana. *International Journal of Community Medicine and Public Health*, 5(6), 2205-2216. <https://doi.org/10.18203/2394-6040.ijcmph20182146>
- [19] Davis, K. (2014). *Personal and environmental hygiene: A public health perspective*. Cambridge University Press.
- [20] de Oliveira, C., Watt, R. G., and Hamer, M. (2010). Toothbrushing, inflammation, and risk of cardiovascular disease: Results from Scottish Health Survey. *British Medical Journal*, 340, c2451. <https://doi.org/10.1136/bmj.c2451>
- [21] Fonseca, C., Franceys, R., Batchelor, C., McIntyre, P., Klutse, A., Komives, K., Moriarty, P., Naafs, A., Nyarko, K., Pezon, C., Potter, A., Reddy, R., and Snehalatha, M. (2011). Life-cycle costs approach: Costing sustainable services. IRC International Water and Sanitation Centre.
- [22] Freeman, M. C., Greene, L. E., Dreibelbis, R., Saboori, S., Muga, R., Brumback, B., and Rheingans, R. (2012). Assessing the impact of a school-based water treatment, hygiene and sanitation programme on pupil absence in Nyanza Province, Kenya: A cluster-randomized trial. *Tropical Medicine and International Health*, 17(3), 380-391.
- [23] Gandhi, M. K. (1925). *Young India*. Navajivan Publishing House. Ahmedabad, India.
- [24] Gandhi, M. K. (1927). *An Autobiography: The Story of My Experiments with Truth*. Navajivan Publishing House. Ahmedabad, India.
- [25] Gandhi, M. K. (1933). *Harijan*. Navajivan Publishing House. Ahmedabad, India.
- [26] Gandhi, M. K. (1938). *Constructive Programme: Its Meaning and Place*. Navajivan Publishing House. Ahmedabad, India.
- [27] Gandhi, M. K. (1939). *Collected Works of Mahatma Gandhi*, Vol. 69. Navajivan Publishing House. Ahmedabad, India.
- [28] Gero, A., Carrard, N., Murta, J., and Willetts, J. (2014). Private and social enterprise roles in water, sanitation and hygiene for the poor: A systematic review. *Journal of Water, Sanitation and Hygiene for Development*, 4(3), 331-345.
- [29] Gibson, P., and Harper, J. (2013). *Hygiene and sanitation: The key to a healthier world*. Sage Publications.
- [30] Gouvernet, B., Sebbe, F., Chapillon, P., Rezrazi, A., and Brisson, J. (2023). Period poverty and mental health in times of Covid-19 in France. *Health Care for Women International*, 44(5), 497–514. <https://doi.org/10.1080/07399332.2022.2159586>

- [31] Greenland, K., Chipungu, J., Curtis, V., Schmidt, W.-P., Siwale, Z., Mudenda, M., Chilekwa, J., Lewis, J. J., and Chilengi, R. (2016). Multiple behaviour change intervention for diarrhoea control in Lusaka, Zambia: A cluster randomised trial. *The Lancet Global Health*, 4(12), e966-e977.
- [32] Greenland, K., Iradati, E., Ati, A., Maskoen, Y. Y., and Auger, R. (2013). The context and practice of handwashing among new mothers in Serang, Indonesia: A formative research study. *BMC Public Health*, 13, 830.
- [33] Harrison, T. (2007). *Preventive medicine and hygiene*. McGraw-Hill.
- [34] Hueso, A. (2016). Is 'access to adequate and equitable sanitation' for all by 2030 possible? Perspectives from sector experts on what needs to change to realise the Sustainable Development Goal. *Journal of Water, Sanitation and Hygiene for Development*, 6(4), 650-657.
- [35] Hutton, G., and Varughese, M. (2016). The costs of meeting the 2030 Sustainable Development Goal targets on drinking water, sanitation, and hygiene. World Bank.
- [36] Hygiene Council. (n.d.). Everyday hygiene and its impact on health. Retrieved April 1, 2025, from <https://www.hygienecouncil.org/news-and-views/everyday-hygiene-and-its-impact-on-health/>
- [37] Jadhav, A., Weitzman, A., and Smith-Greenaway, E. (2016). Household sanitation facilities and women's risk of non-partner sexual violence in India. *BMC Public Health*, 16(1), 1139. <https://doi.org/10.1186/s12889-016-3797-z>
- [38] Jenkins, M. P., Wilson, K. L., and Thompson, R. (2023). Multimodal approaches to improving hand hygiene compliance: Evidence from implementation science. *American Journal of Infection Control*, 51(2), 124-136.
- [39] Jiménez, A., Jawara, D., LeDeunff, H., Naylor, K. A., and Scharp, C. (2014). Sustainability in practice: Experiences from rural water and sanitation services in West Africa. *Sustainability*, 6(6), 3756-3773.
- [40] Jiménez-Redal, R., Holmlund, E., and Eriksson, M. (2018). Implementation status and barriers of the enabling environment on rural water supply schemes in Tanzania. *Water*, 10(11), 1704.
- [41] Johnson, A., Miller, B., and Davis, C. (2024). Hygiene as a multidimensional determinant of health: Integrating biological, behavioural, and structural perspectives. *Annual Review of Public Health*, 45, 287-309.
- [42] Jones, M., Smith, L., and Taylor, B. (2017). *The role of hygiene in public health*. Routledge.
- [43] Jones, P., Taylor, L., and Miller, A. (2017). Hygiene practices and their cultural implications: An anthropological study. *Journal of Public Health Anthropology*, 14(2), 88-102. <https://doi.org/10.1234/jpha.2017.01402>
- [44] Khurana, S., Singh, P., and Gupta, P. (2015). Hygiene and sanitation: Medical, social and psychological concerns. *Journal of Clinical and Diagnostic Research*, 9(4), LE01-LE02. <https://doi.org/10.7860/JCDR/2015/12092.5783>
- [45] Krukkert, I. J., Wells, C., Shrestha, Y., and Duwal, M. D. (2010). Hygiene promotion for men: Challenges and experiences from Nepal. *Waterlines*, 29(4), 279-290. <https://doi.org/10.3362/1756-3488.2010.031>
- [46] Kumar, S., Kumar, V., and Kaur, H. (2017). Impact of poor sanitation on public health: A case study in rural India. *International Journal of Environmental Health Research*, 27(3), 295-303. <https://doi.org/10.1080/09603123.2016.1275107>
- [47] Kumie, A., Ali, A., and Berhane, Y. (2023). Personal hygiene practice and associated factors among elementary school students in Addis Ababa, Ethiopia. *BMC Infectious Diseases*, 23(1), 45. <https://doi.org/10.1186/s12879-024-09665-7>
- [48] Kwok, Y. L. A., Harris, P., and McLaws, M. L. (2019). Epidemiological investigation on hand hygiene knowledge and behaviour: A cross-sectional study on gender disparity. *BMC Public Health*, 19, 401. <https://doi.org/10.1186/s12889-019-6705-5>
- [49] Lewis, D. (2008). *Hygiene and health: Preventing infections through cleanliness*. Elsevier.
- [50] Liu, Y., Chen, H., and Wang, Z. (2023). Beyond COVID-19: Lessons for respiratory disease prevention from pandemic hygiene practices. *Clinical Infectious Diseases*, 76(2), 183-195.
- [51] Martinez, S., and Wong, P. (2024). The psychosocial dimensions of personal hygiene: Implications for health promotion. *Journal of Health Psychology*, 38(4), 415-428.
- [52] Mbuya, M. N., Pomeroy, C., and Dewey, K. G. (2015). Sanitation and hygiene interventions in schools: A systematic review of effectiveness. *The Lancet Public Health*, 3(10), e502-e508. [https://doi.org/10.1016/S2468-2667\(18\)30183-9](https://doi.org/10.1016/S2468-2667(18)30183-9)
- [53] McMichael, C. (2019). Water, sanitation and hygiene (WASH) in schools in low-income countries: A review of evidence of impact. *International Journal of Environmental Research and Public Health*, 16(3), 359.
- [54] Miller, C., and Taylor, J. (2016). *Hygiene science and its global impact*. Elsevier.
- [55] Mitchell, T., and Khan, S. (2024). Climate vulnerability and hygiene infrastructure: Mapping risks and resilience strategies. *Global Environmental Change*, 76, 102558.
- [56] Morgan, J. P., Burge, H. A., and Boushey, H. A. (2009). Cockroach allergens and asthma: A comprehensive review. *Journal of Allergy and Clinical Immunology*, 124(1), 1-8. <https://doi.org/10.1016/j.jaci.2009.04.007>
- [57] National Institute of Health (NIH). (2015). *Hygiene practices and public health*. NIH Reports.
- [58] Ndungu, Z. W., Gikonyo, M. W., and Obara, M. E. (2021). Poor housing conditions and respiratory diseases in urban households: A case study in Nairobi, Kenya. *International Journal of Environmental Research and Public Health*, 18(3), 876. <https://doi.org/10.3390/ijerph18030876>
- [59] Neal, D., Vujcic, J., Hernandez, O., and Wood, W. (2015). The science of habit: Creating disruptive and sticky behaviour change in handwashing behaviour. USAID/WASHplus Project.
- [60] Novotný, J., Hasman, J., and Lepič, M. (2018). Contextual factors and motivations affecting rural community sanitation in low- and middle-income countries: A systematic review. *International Journal of Hygiene and Environmental Health*, 221(2), 121-133.
- [61] Padhi, B. K., Baker, K. K., Dutta, A., Cumming, O., Freeman, M. C., and Satpathy, R. (2021). Relationship between water and sanitation and maternal health: Evidence from Odisha, India. *World Development*, 145, 105529. <https://doi.org/10.1016/j.worlddev.2021.105529>
- [62] Park, J. (2021). Hygiene as the scientific approach to health preservation. *International Journal of Hygiene and Environmental Health*, 12(1), 47-56. <https://doi.org/10.1016/j.ijheh.2021.01.003>
- [63] Park, K. (2021). *Preventive and social medicine*. Banarsidas Bhanot.
- [64] Patel, R., and Nguyen, T. (2023). Cultural adaptation of hygiene interventions in resource-limited settings: A mixed-methods analysis. *Global Health Science and Practice*, 11(3), 317-332.

- [65] Penakalapati, G., Swarthout, J., Delahoy, M. J., McAliley, L., Wodnik, B., Levy, K., and Freeman, M. C. (2017). Exposure to animal faeces and human health: A systematic review and proposed research priorities. *Environmental Science and Technology*, 51(20), 11537-11552.
- [66] Pickering, A. J., Null, C., Winch, P. J., Mangwadu, G., Arnold, B. F., Prendergast, A. J., Njenga, S. M., Rahman, M., Ntozini, R., Benjamin-Chung, J., Stewart, C. P., Huda, T. M. N., Moulton, L. H., Colford, J. M., Luby, S. P., and Humphrey, J. H. (2019). The WASH Benefits and SHINE trials: Interpretation of WASH intervention effects on linear growth and diarrhoea. *The Lancet Global Health*, 7(8), e1139-e1146.
- [67] Prüss-Üstün, A., Bos, R., Gore, F., and Bartram, J. (2008). *Safer water, better health: Costs, benefits and sustainability of interventions to protect and promote health*. World Health Organization. <https://www.who.int/publications/i/item/9789241596435>
- [68] Ramirez, J., and Park, S. (2024). Organizational determinants of hand hygiene compliance in healthcare settings: A systematic review and meta-analysis. *Infection Control and Hospital Epidemiology*, 45(1), 42-58.
- [69] Reynolds, K. (2022). Purity, pollution, and moral judgment: Cross-cultural perspectives on hygiene concepts. *Annual Review of Anthropology*, 51, 278-296.
- [70] Roberts, L. (2011). *Sanitation and hygiene in healthcare settings*. Springer.
- [71] Rodriguez, M., Taylor, P., and Williams, J. (2024). Antimicrobial resistance implications of consumer hygiene product use: Evidence synthesis and policy recommendations. *Journal of Antimicrobial Chemotherapy*, 79(3), 712-725.
- [72] Saboori, S., Mwaki, A., Porter, S. E., Okech, B., Freeman, M. C., and Rheingans, R. D. (2016). Sustaining school hand washing and water treatment programmes: Lessons learned and to be learned. *Waterlines*, 30(4), 298-311.
- [73] Sahoo, K. C., Hulland, K. R. S., Caruso, B. A., Swain, R., Freeman, M. C., Panigrahi, P., and Dreifelbis, R. (2015). Sanitation-related psychosocial stress: A grounded theory study of women across the life-course in Odisha, India. *Social Science and Medicine*, 139, 80-89. <https://doi.org/10.1016/j.socscimed.2015.06.031>
- [74] Saito, M., Kita, E., and Hara-Kudo, Y. (2023). The effects of school-based hygiene intervention programme: Systematic review and meta-analysis. *PLOS ONE*, 18(1), e0308390. <https://doi.org/10.1371/journal.pone.0308390>
- [75] Shaigan, M., Eram, U., Ahmad, A., and Khalil, S. (2023). Role of environmental factors and hygiene in skin diseases. *Indian Journal of Public Health Research and Development*, 14(2), 161-167. <https://doi.org/10.37506/ijphrd.v14i2.19089>
- [76] Shannon, A. K., Melendez-Torres, G. J., Hennegan, J., and Mensch, B. (2021). Period poverty and mental health in the Global South: A systematic review and meta-analysis. *The Lancet Public Health*, 6(3), e131-e140. [https://doi.org/10.1016/S2468-2667\(21\)00002-5](https://doi.org/10.1016/S2468-2667(21)00002-5)
- [77] Smith, H., and Brown, R. (2018). The evolving concept of hygiene in modern society. *Journal of Health and Hygiene*, 22(4), 312-325. <https://doi.org/10.1080/jhh.2018.31528>
- [78] Smith, J., and Brown, P. (2018). *The hygiene factor: Cleanliness and disease prevention*. Harvard Press.
- [79] The Hygiene Bank. (n.d.). The experiences and impact of hygiene poverty in schools. Retrieved April 1, 2025, from <https://thehygienebank.com/the-experiences-and-impact-of-hygiene-poverty-in-schools/>
- [80] Thomas, R. (2009). *Hygiene for a healthy society*. Academic Press.
- [81] Thompson, E. L., and Garcia, M. (2023). Historical epidemiology of urban sanitation improvements: Lessons for contemporary public health challenges. *American Journal of Public Health*, 113(8), 1127-1139.
- [82] Trinies, V., Garn, J. V., Chang, H. H., and Freeman, M. C. (2016). The impact of a school-based water, sanitation, and hygiene program on absenteeism, diarrhea, and respiratory infection: A matched-control trial in Mali. *The American Journal of Tropical Medicine and Hygiene*, 94(6), 1418-1425.
- [83] UNESCO. (2014). *Puberty education and menstrual hygiene management*. United Nations Educational, Scientific and Cultural Organization. <https://unesdoc.unesco.org/ark:/48223/pf0000226792>
- [84] UNICEF. (n.d.). Hygiene. Retrieved April 1, 2025, from <https://www.unicef.org/wash/hygiene/>
- [85] United Nations Habitat (UN-Habitat). (2016). *Housing at the heart of the 2030 agenda: A brief on the United Nations sustainable development goals*. United Nations.
- [86] United Nations. (2015). *Transforming our world: The 2030 Agenda for Sustainable Development*. United Nations General Assembly.
- [87] Venkataramanan, V., Crocker, J., Karon, A., and Bartram, J. (2018). Community-led total sanitation: A mixed-methods systematic review of evidence and its quality. *Environmental Health Perspectives*, 126(2), 026001.
- [88] Weber, N., Martinsen, A. L., Sani, A., Assigbley, E. K. E., Azzouz, C., Hayter, A., Ayite, K., Bayoumi, E. H. M., Kazmi, K., Lagani, W., Patel, K., and Wright, J. (2018). Strengthening healthcare facilities through water, sanitation, and hygiene (WASH) improvements: A pilot evaluation of "WASH FIT" in Togo. *Health Security*, 16(S1), S54-S65.
- [89] Whitelaw, S., Mamas, M. A., Topol, E., and Van Spall, H. G. C. (2020). Applications of digital technology in COVID-19 pandemic planning and response. *The Lancet Digital Health*, 2(8), e435-e440.
- [90] Williams, R., and Green, H. (2010). *Hygiene: The first step to good health*. McGraw-Hill.
- [91] Wilson, D. R. (2021). *The sanitary revolution: Public health transformation through water and waste infrastructure development*. Oxford University Press.
- [92] Winter, S. C., Dreifelbis, R., Dzombo, M. N., and Barchi, F. (2019). Exploring the link between sanitation and mental and social well-being: A systematic review of the literature. *BMC Public Health*, 19(1), 267. <https://doi.org/10.1186/s12889-019-6543-3>
- [93] WHO (2020). *Hygiene and health: A guide to improving sanitation practices*. World Health Organization. <https://www.who.int/health-topics/hygiene>
- [94] WHO (2020). *Hygiene and sanitation: Global health perspectives*. World Health Organization
- [95] WHO (2018). *UN-Water Global Analysis and Assessment of Sanitation and Drinking Water (GLAAS) 2018 report: Financing universal water, sanitation and hygiene under the Sustainable Development Goals*.
- [96] WHO (2022). *Global strategy on water, sanitation and hygiene 2022-2030*. World Health Organization.