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WASH FIT AS A COMPLEMENTARY TOOL FOR INDUSTRIAL HYGIENE IN PRIMARY HEALTH CARE FACILITIES: CASE STUDY

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Abstrak

Layanan air, sanitasi, higiene, dan pengelolaan limbah yang andal di fasilitas pelayanan kesehatan (Fasyankes) merupakan dasar dari mutu pelayanan, pencegahan dan pengendalian infeksi (PPI), serta pencapaian Tujuan Pembangunan Berkelanjutan (SDGs 3 dan 6). Di Kota Jayapura, Provinsi Papua, terdapat kesenjangan dalam aspek air, sanitasi, higiene (WASH), dan pengelolaan limbah di pusat kesehatan masyarakat (Puskesmas) yang berdampak pada pengendalian infeksi, keselamatan kerja, dan mutu pelayanan. *WASH Facility Improvement Tool* (WASH FIT) yang dikembangkan oleh WHO/UNICEF menawarkan pendekatan terstruktur berbasis risiko untuk menilai dan meningkatkan kondisi tersebut. Penelitian ini bertujuan untuk mengevaluasi efektivitas WASH FIT serta mempromosikan penerapannya guna mengarusutamakan WASH dalam konteks higiene industri untuk meningkatkan standar kesehatan, keselamatan, dan lingkungan. Penilaian menggunakan WASH FIT dilakukan pada 10 Puskesmas di Papua dengan mengombinasikan penilaian indikator utama (air, sanitasi, higiene, energi, limbah, manajemen) melalui observasi terstruktur dan dokumentasi teknis. Hasil penilaian WASH FIT menunjukkan adanya kekurangan signifikan pada indikator-indikator utama WASH. Rata-rata skor berada pada kategori sedang hingga rendah: sanitasi 55%, higiene 66%, pengelolaan limbah 58%, dan kurang dari 60% memiliki sistem pengelolaan limbah medis yang berfungsi dengan baik. WASH FIT terbukti menjadi kerangka kerja yang efektif untuk meningkatkan standar kesehatan kerja di Puskesmas. Integrasi WASH dalam perspektif higiene industri memberikan arah menuju sistem yang tangguh dalam konteks yang lebih luas.

Kata kunci: *Higiene, Higiene Industri, Sanitasi, WASH, Air*

Abstract

Reliable water, sanitation, hygiene and waste services in health-care facilities (HCFs) are foundational to quality of care, infection prevention and control (IPC), and the Sustainable Development Goals (SDGs 3 and 6). In Jayapura, Papua Province, gaps in water, sanitation, hygiene (WASH), waste management in primary health centers (PHCs) compromise infection control, occupational safety, and quality of care. The WASH Facility Improvement Tool (WASH FIT), developed by WHO/UNICEF, offers a structured, risk-based approach to assess and improve these conditions. This study aims to evaluate the effectiveness of WASH FIT and promote the tool to mainstream WASH in the industrial hygiene context to improve health, safety, and environmental standards. An assessment using WASH FIT as a tool was conducted across 10 PHCs in Papua, combining scoring of key indicators (water, sanitation, hygiene, energy, waste, management) with structured observations, and technical documentation. WASH FIT assessment revealed significant shortcomings in key WASH indicators. Average scores were moderate to low: sanitation 55%, hygiene 66%, waste management 58%, and less than 60% had functional medical waste management systems. WASH FIT has proven to be an effective framework to improve occupational health standards in PHCs. Integrating WASH within an industrial hygiene lens offers a pathway to resilient systems in the broader context.

Keywords: *Hygiene, Industrial Hygiene, Sanitation, Wash, Water*

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INTRODUCTION

Reliable access to water, sanitation, and hygiene (WASH) in health care facilities is fundamental for ensuring quality of care, infection prevention and control (IPC), and the achievement of the Sustainable Development Goals (SDGs), particularly SDG 3 (good health and well-being) and SDG 6 (clean water and sanitation) (World Health Organization , 2023). Adequate WASH and medical waste management services in primary health care facilities are essential to protect health workers and patients, prevent healthcare-associated infections, and ensure a safe working environment (Mulogo et al., 2021).

However, in Papua Province, particularly in Jayapura City, significant gaps remain in implementing WASH standards in primary health centers (PHCs). Several facilities lack reliable water systems, adequate sanitation infrastructure, and proper medical waste management. These shortcomings directly affect infection control, occupational safety, and the overall quality of care (Washanga & Kaliba, 2024).

To address these systemic challenges, the World Health Organization (WHO) and UNICEF developed the Water and Sanitation for Health Facility Improvement Tool (WASH FIT) a structured, risk-based approach that enables primary and some secondary health care facilities to assess and improve WASH and environmental health services across six domains: water, sanitation, hygiene, waste management, energy, and facility management (WHO, 2023).

Evidence from several low- and middle-income countries demonstrates that the implementation of WASH FIT effectively enhances compliance with hygiene practices, reduces infection transmission risks, and improves facility management systems (Arowosegbe et al., 2021; Riswold et al., 2024). In the context of Papua, WASH FIT implementation could further strengthen health system resilience through an industrial hygiene approach that emphasizes occupational safety and environmental sustainability.

Therefore, evaluating the implementation of WASH FIT in primary health centers across Jayapura City is essential to identify its effectiveness, the challenges encountered, and opportunities to improve health, occupational safety, and environmental standards in primary health care settings.

METHODE

This study adopted a descriptive cross-sectional design utilizing the WASH FIT 2.0 framework to evaluate environmental health conditions across three domains closely related to occupational hygiene: sanitation, hygiene and environmental cleaning, and health care waste management. The purpose was not to assess longitudinal changes but to explore the potential of WASH FIT as a proxy or complementary tool for identifying occupational health risks and guiding improvement efforts consistent with industrial hygiene (IH) principles. The research was conducted in ten primary health centers (PHCs) within Jayapura District, Papua Province, Indonesia. Facilities were purposively selected to represent varying contexts urban and rural settings, different service levels, and sizes reflecting the region's geographic and infrastructural challenges that hinder consistent WASH service provision.

WASH FIT 2.0 served as the primary assessment tool, with emphasis on three domains directly associated with occupational health: sanitation (availability and adequacy of toilets, gender-segregated access, disability inclusion, and menstrual hygiene management), environmental cleaning (hand hygiene facilities, cleaning materials, staff training, and standard operating procedures), and waste management (segregation practices, temporary storage, PPE use, and final disposal methods). Data were collected through structured facility observations, interviews with staff, and document review, and subsequently analyzed descriptively. Interpretation followed the industrial hygiene frameworks of the AREC model Anticipation, Recognition, Evaluation, and Control and the Hierarchy of Controls (elimination, substitution, engineering, administrative, and PPE) to contextualize WASH FIT indicators within occupational hygiene practice(AIHA, 2018).

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RESULT AND DISCUSSION

Facility Overview and Scoring Method

WASH FIT was applied to 10 PHCs. Each facility's performance in the three domains was scored and converted into a percentage for comparison. Key findings across domains revealed systemic WASH-related occupational hazards.

Domain 1: Sanitation

Scores ranged from 40% to 90%:

- Top performers: Sentani (90%), Demta (83%), Harapan (80%)
- Lowest scores: Namblong (40%), Depapre (42%)

Common issues:

- Inconsistent hand hygiene at points of care
- Irregular availability of soap and towels
- Weak enforcement of cleaning protocols and staff supervision

These reflect gaps in administrative and engineering controls, with potential consequences for infection control and staff safety .

Domain 2: Environmental Cleaning

Scores ranged from 40% to 90%:

- Top performers: Sentani (90%), Demta (83%), Harapan (80%)
- Lowest scores: Namblong (40%), Depapre (42%)

Common issues:

- Inconsistent hand hygiene at points of care
- Irregular availability of soap and towels
- Weak enforcement of cleaning protocols and staff supervision

These reflect gaps in administrative and engineering controls, with potential consequences for infection control and staff safety (AIHA, 2018).

Domain 3: Waste Management

Scores ranged from 42% to 76%:

- Best performers: Sentani (76%), Genyem (68%), Nimbokrang (68%)
- Lowest scores: Waibhu (42%), Depapre (47%)

Deficiencies included:

- Lack of color-coded bins
- Improper storage of hazardous waste
- No onsite waste disposal capacity
- Limited PPE use and waste handler training
- These factors elevate biological and chemical exposure risks, particularly for cleaning staff (AIHA, 2018).

This domain reflects major deficiencies in applying hazard control measures in line with the Hierarchy of Controls, particularly at the levels of engineering and administrative safeguards (AIHA, 2018).

Aggregated Domain Scores per PHC

Table 1. Aggregated Domain Scores per PHC

Public Health Care	Sanitation	Gygiene & Cleaning	Waste Management
Harapan	58%	80%	59%
Genyem	77%	70%	68%
Sawoy	33%	60%	61%
Depapre	23%	42%	47%
Namblong	20%	40%	55%
Dosay	70%	70%	66%
Demta	72%	83%	66%
Waibhu	70%	70%	42%
Sentani	68%	90%	76%
Nimbokrang	63%	58%	68%

Alignment with Industrial Hygiene

WASH FIT assessments demonstrated strong alignment with IH principles:

- Anticipation & Recognition: e.g., lack of soap, unsafe waste handling
- Evaluation: e.g., gaps in infrastructure, poor SOP adherence
- Control Measures: WASH FIT action items mirror engineering, administrative, and PPE controls

This alignment shows that WASH FIT can support risk-based occupational health improvements, particularly in settings with limited IH capacity (AIHA, 2018; WHO. ,2022)

Discussion

Interpreting WASH FIT Findings Through an Industrial Hygiene Lens

The findings from ten primary health centers (PHCs) in Jayapura District indicate that the WASH FIT 2.0 framework is effective in identifying occupational and environmental health risks within healthcare settings, despite being originally developed as a public health quality improvement tool. The structured assessment of sanitation, hygiene, and healthcare waste management provided a clear facility-level risk profile that directly impacts worker safety, patient protection, and service quality. Similar to industrial hygiene audits, the WASH FIT tool enables systematic anticipation, recognition, evaluation, and control of hazards within healthcare environments (WHO & UNICEF, 2023).

Across the assessed facilities, sanitation and waste management received low to moderate ratings, revealing persistent risks such as inadequate toilet infrastructure, unsafe waste segregation, and insufficient protective measures for cleaning staff. These deficiencies not only threaten public health but also reflect occupational hazards often highlighted in industrial hygiene practice, including biological exposure and environmental contamination (Kmentt et al., 2021). For instance, the lack of gender-segregated and accessible toilets observed in PHCs at Namblong, Depapre, and Sawoy demonstrates ergonomic and equity shortcomings in workplace design (Bartram et al., 2019). Similarly, unsafe temporary waste storage in Waibhu and Depapre indicates potential chemical and infectious exposures, particularly for janitorial staff (Anderson et al., 2021).

Limited hand hygiene infrastructure and poor adherence to cleaning protocols also indicate weak administrative and engineering controls—two key tiers within the industrial hygiene "Hierarchy of Controls." Such deficiencies can elevate the risk of cross-contamination and healthcare-associated infections (HAIs), underscoring the importance of aligning WASH FIT implementation with occupational hygiene principles (AIHA, 2018; WHO, 2022). The integration of personal protective equipment (PPE) management and worker training into

WASH FIT assessment frameworks can further strengthen this linkage by addressing gaps in behavior-based safety practices (Chaitkin et al., 2022).

By interpreting WASH FIT outcomes through an industrial hygiene (IH) perspective, it becomes evident that the framework captures many of the same workplace hazards typically assessed in IH audits. Using the AREC model—Anticipation, Recognition, Evaluation, and Control—WASH FIT can support evidence-based risk prioritization and intervention planning in healthcare facilities with limited resources (Kmentt et al., 2021; WHO, 2022). This connection positions WASH FIT as not only a tool for infection prevention and control (IPC) but also a bridge toward institutionalizing IH standards in low- and middle-income countries (LMICs).

The alignment between WASH FIT indicators and occupational hygiene dimensions is particularly relevant for advancing Sustainable Development Goals (SDGs) 3 (good health and well-being), 6 (clean water and sanitation), and 8 (decent work and economic growth). Integrating WASH FIT within industrial hygiene frameworks can promote safer work environments, reduce occupational exposure risks, and enhance healthcare system resilience (Bartram et al., 2019; WHO & UNICEF, 2023). Moreover, this integration supports the development of context-specific control strategies in geographically challenging areas like Papua, where infrastructural and logistical constraints hinder consistent WASH service delivery (Anderson et al., 2021).

In conclusion, interpreting WASH FIT through an industrial hygiene lens broadens its utility beyond infection control to encompass worker safety, facility management, and environmental sustainability. Embedding IH-based thinking into WASH FIT implementation promotes a culture of proactive risk management, ensuring safer, more efficient, and equitable healthcare environments in resource-limited regions such as Jayapura. Continued cross-disciplinary collaboration among public health, engineering, and occupational safety professionals is essential to translate these frameworks into actionable and sustainable improvements.

Positioning WASH FIT Within Industrial Hygiene Frameworks

The Water and Sanitation for Health Facility Improvement Tool (WASH FIT) does not replace formal industrial hygiene (IH) assessments such as chemical sampling, noise monitoring, or exposure modelling but it offers essential environmental health data that are often missing in low- and middle-income country (LMIC) health systems where IH is rarely institutionalised (WHO, 2022). This gap positions WASH FIT as a pragmatic tool able to fill an urgent need: mapping workplace health risks in healthcare facilities, especially in settings lacking dedicated IH personnel or budgets.

In this sense, WASH FIT may serve multiple roles. First, as a baseline risk-mapping tool, it can identify environmental and procedural hazards at the facility level (Purwandari, Daniel, & Hafidz, 2024). Second, as a participatory planning instrument, it encourages worker involvement in hygiene and waste-management practices (Elevating the Role of Cleaners in Healthcare Facilities: A Guidance Note, 2021). Third, as a framework for gradual integration, it allows infection prevention and control (IPC) and WASH teams to engage with IH concepts through a familiar tool.

The structured domains of WASH FIT align well with the Hierarchy of Controls used in IH, providing clear opportunities to promote engineering solutions (for example, toilet retrofitting, improved drainage systems), strengthen administrative policies (such as SOPs for cleaning and waste segregation), and standardise personal protective equipment (PPE) use and training (Cronk et al., 2021). By framing interventions in these tiers, WASH FIT supports implementation of control measures in the logic of elimination, substitution, engineering, administrative, and PPE control.

While WASH FIT was developed primarily for IPC and quality-of-care improvement, its alignment with IH frameworks underlines its potential to act as a gateway to more advanced industrial hygiene practices, particularly in low-resource healthcare facilities that lack formal IH systems (Bartram et al., 2019). By using WASH FIT assessments to identify and rank hazards, facility managers can begin applying IH thinking anticipating hazards, recognising exposures, evaluating controls, and implementing improvements.

In LMIC health-care environments where dedicated IH professionals and budgets may be absent, WASH FIT offers a step-wise approach to embed IH-type hazard assessment into routine facility management. For example, the tool's use in Indonesia (Purwandari et al., 2024) demonstrates that WASH FIT can deliver data on waste-management, hand-hygiene, and environmental cleaning domains that overlap with traditional IH audits. Thus, WASH FIT can act as both a bridging mechanism and capacity-building platform for occupational health and safety in health-care facilities.

In conclusion, WASH FIT's structured assessment framework provides critical insight into workplace hazards within healthcare settings and offers a practical path toward integrating industrial hygiene principles into WASH programmes. By linking sanitation, hygiene, waste-management assessments to the Hierarchy

of Controls and the AREC (Anticipation, Recognition, Evaluation, Control) model, facility managers in resource-limited settings can prioritize interventions that protect both workers and patients. The use of WASH FIT as a gateway to IH may thus strengthen resilience, safety, and quality of care in health-care facilities globally.

Poor sanitation, hygiene, and waste management systems in health-care facilities are not only occupational health risks but also systems-level stressors that undermine health-system resilience. The international community recognises that resilient health systems must maintain core functions during shocks such as disease outbreaks, natural disasters, or large-scale service disruptions. In this context, inadequate WASH (water, sanitation and hygiene) services become vulnerability multipliers by increasing infection risks, interrupting service delivery, and potentially leading to facility failures (WHO, 2022). The integration of the Water and Sanitation for Health Facility Improvement Tool (WASH FIT) into facility assessments can therefore contribute to strengthening health-system resilience at the same time as improving worker protection.

The WASH FIT tool enables health-care facility managers and stakeholders to prioritise basic infrastructure and procedural improvements that directly contribute to major global development goals. For example, by reducing health-careassociated infections through improved sanitation and hygiene, WASH FIT supports SDG 3 (Good Health and Well-being). By improving access to safe water and functional sanitation, it advances SDG 6 (Clean Water and Sanitation) (UN SDG Partnerships: WASH Systems for Health, 2023). Additionally, by protecting frontline health-care workers from preventable hazards in the workplace, WASH FIT contributes to SDG 8 (Decent Work and Economic Growth) emphasising safer work environments as a component of sustainable growth.

In more detail, the tool can serve as a baseline risk-mapping platform: identifying environmental and procedural hazards at the facility level such as broken toilets, improper waste segregation, and limited hand-hygiene infrastructure. It also functions as a participatory planning instrument, engaging workers and cleaning-staff in surveillance of hygiene and waste-management practices. Finally, WASH FIT can act as a framework for gradual integration of industrial hygiene (IH) concepts, enabling IPC and WASH teams to engage more deeply with worker-safety agendas by using familiar assessment structures (World Health Organization & UNICEF, 2023).

The alignment of WASH FIT's structure with the Hierarchy of Controls further enhances its value. Engineering controls (e.g., toilet retrofitting, improved drainage) can be prioritised, followed by administrative policies (e.g., SOPs for cleaning and waste segregation), and standardised PPE use and training for health-care and support staff. In this way, WASH FIT supports both traditional public-health and occupational-health strategies in a coherent framework.

In low- and middle-income countries where formal IH assessments (such as chemical sampling or noise monitoring) are seldom institutionalised the pragmatic use of WASH FIT creates a strategic entry point for embedding worker safety in health-care facility management (Wash Matters, 2025). This integration ensures that the protection of health-care workers is mainstreamed alongside patient-safety and service-quality goals.

In conclusion, framing WASH FIT through an industrial hygiene lens strengthens its contribution to health-system resilience and progress toward the SDGs. It helps facilities prioritise essential infrastructure and workforce protection, and it aligns public-health, occupational-health, and development-agenda objectives. Institutions that adopt this integrated approach will likely enhance both the safety of their workforce and the reliability of their service delivery critical for achieving health-system sustainability in challenging settings.

CONCLUSION

The Water and Sanitation for Health Facility Improvement Tool (WASH FIT), developed by the World Health Organization (WHO) and UNICEF, serves as a structured and practical framework for improving water, sanitation, and hygiene (WASH) services in health care facilities. It demonstrates a strong alignment with core principles of industrial hygiene through its participatory, context-sensitive, and action-oriented design, enabling facilities particularly in low-resource settings such as Papua to systematically assess and enhance environmental conditions that impact both patient safety and worker health. Findings from the application of WASH FIT in ten primary health care facilities in Jayapura District highlight its effectiveness in identifying significant gaps in sanitation, hygiene practices, and health care waste management areas that are often overlooked in conventional occupational health assessments but represent tangible and preventable risks to frontline health workers. Although WASH FIT does not directly evaluate physical, chemical, or ergonomic hazards typically addressed in industrial hygiene, it effectively complements existing IH frameworks by enabling environmental hazard mapping for biological

exposures, supporting the implementation of engineering and administrative controls, and promoting staff awareness and behavioral change through participatory processes. Consequently, WASH FIT can function as a gateway tool for expanding the scope of occupational health and safety practices in the health sector, especially in regions where industrial hygiene systems remain limited or underdeveloped

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