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Mitigating Infectious Disease Risks in Correctional Facilities: The Combined Impact of Pahurat's BathTub Approach (PBA) and One Health Strategy

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ABSTRACT

Introduction: Incarcerated populations are disproportionately affected by infectious diseases due to factors such as overcrowding, limited access to healthcare, and pre-existing health conditions. Diseases like tuberculosis (TB), hepatitis, and sexually transmitted infections (STIs) present significant public health challenges within correctional facilities, which often have inadequate sanitation and health management practices. This study examines the combined impact of Pahurat's BathTub Approach (PBA) and the One Health Strategy in mitigating these infectious disease risks.

Methods: This documentary study analyzes data from the Department of Corrections and the Department of Disease Control, spanning from October 1, 2021, to September 30, 2024. The PBA categorizes water usage into three types—cold for healthy inmates, warm for those undergoing treatment, and hot for individuals who may be unaware of their infections. This method complements the One Health Strategy, which recognizes the interconnections between human, animal, and environmental health. By implementing these approaches, the study focuses on the prevention and control of TB, HIV/AIDS, syphilis, and hepatitis C among inmates.

Results: Significant declines in key infectious diseases were observed from 2021 to 2024. Over 1.2 million inmates were screened for TB, resulting in confirmation rates of 1.06%, 0.91%, 0.89%, and 0.90%. For STIs, including HIV/AIDS, 348,464 individuals were screened, with confirmation rates of 1.17%, 1.36%, 1.39%, and 1.01%. The integration of PBA and One Health principles led to improved sanitation practices, enhanced healthcare access, and increased awareness of health issues among inmates.

Conclusion: The combined application of Pahurat's BathTub Approach and the One Health Strategy offers a robust framework for addressing infectious disease risks in correctional facilities. This integrated approach not only improves health outcomes for incarcerated individuals but also supports public health at large by facilitating safe reintegration into communities. By addressing social determinants of health and promoting humane treatment, this initiative contributes to the global goal of "Ending TB and STIs by 2030," ultimately enhancing the overall well-being of both inmates and the surrounding population.

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Abbreviations

TB: Tuberculosis**STIs:** Sexual Transmission Infections**HIV-AIDS:** Human immunodeficiency virus - acquired immunodeficiency syndrome**SYP:** Syphilis**PBA:** Pahurat's BathTub Approach**DOC:** Department of Corrections**DJOP:** Department of Juvenile Observation and Protection**DDC:** Department of Disease Control**MOJ:** Ministry of Justices**MOPH:** Ministry of Public Health**NHSO:** National Health Security Office

Introduction

Background

Incarcerated populations are particularly vulnerable to infectious diseases due to factors such as overcrowding, limited healthcare access, and high rates of pre-existing health conditions. The prevalence of infectious diseases like respiratory infections, tuberculosis (TB), hepatitis, and sexually transmitted infections (STIs) is significantly higher in correctional facilities than in the general population [1]. These health disparities are further exacerbated by inadequate sanitation, poor health management practices, and adverse social determinants of health, including socioeconomic status, education, and community support [1]. The risk of disease transmission increases when inmates are not properly screened, monitored, or treated, potentially leading to outbreaks that can impact both the inmate population and the surrounding community upon their release [2].

Contact: Pahurat Kongmuang Taisuwan, Department of Disease Control, Ministry of Public Health, Thailand.© 2026 The Authors. This is an open access article under the terms of the Creative Commons Attribution NonCommercial ShareAlike 4.0 (<https://creativecommons.org/licenses/by-nc-sa/4.0/>).

The One Health concept emphasizes the interconnectedness of human, animal, and environmental health, recognizing that health outcomes are influenced by various factors across these domains [3]. In the context of correctional facilities, applying a One Health approach can enhance infectious disease management by considering not just the health of inmates but also the broader environmental and community factors that contribute to disease transmission [4]. This holistic perspective is crucial for developing effective interventions that address the root causes of health disparities.

Despite various laws and organizations aimed at addressing inmates' health issues, significant challenges persist. The Mandela Rules, or the United Nations Standard Minimum Rules for the Treatment of Prisoners, provide an internationally recognized framework for prison management [5]. These rules outline essential conditions for maintaining safety, security, and human dignity for all prisoners, based on five key principles: respecting prisoners' inherent dignity, prohibiting torture and ill-treatment, addressing prisoners' needs without discrimination, ensuring safety for all, and emphasizing the role of prisons in protecting society and reducing recidivism [6]. These guidelines are critical

for ensuring that inmates receive adequate healthcare while effectively managing limited resources [7].

Additionally, the Constitution of the Kingdom of Thailand B.E. 2560, Chapter 3: Rights and Freedoms of the Thai People, Section 47, ensures individuals have the right to receive public health services from the state [8]. Those in poverty are entitled to these services without charge, and individuals have the right to the prevention and eradication of dangerous communicable diseases at no cost. However, social determinants such as a lack of education about health issues and the stigma surrounding incarceration can hinder access to these rights [2,9].

Pahurat's BathTub Approach (Figure 1) complements the Mandela Rules by systematically providing health services based on inmates' health statuses [10]. This framework categorizes water usage into three types: cold for healthy inmates, warm for those receiving treatment for TB or STIs, and hot for individuals who may be ill or unaware of their health status. This structured approach supports comprehensive health management and addresses the social determinants that impact health outcomes, ensuring that all inmates receive appropriate care based on their specific needs.

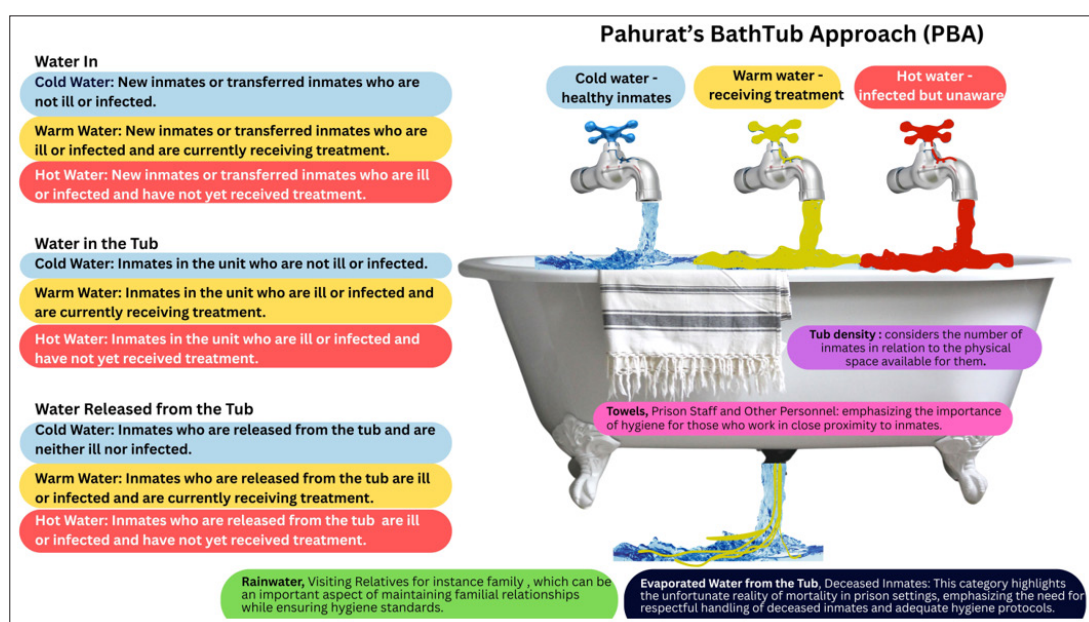


Figure 1: Pahurat's BathTub Approach

Monitoring health outcomes through both the Mandela Rules and the BathTub Framework is essential for evaluating the effectiveness of health interventions and ensuring timely care for inmates. Training personnel to implement health management practices according to legal standards and best public health practices is crucial [6]. This article will explore how these frameworks contribute to broader public health goals, such as reducing the incidence of infectious diseases in the community. By highlighting successful case studies and data, we aim to provide concrete evidence of the positive impact of these integrated approaches.

The aim of this study is to assess the effectiveness of health interventions in reducing the incidence of infectious diseases—specifically tuberculosis (TB), HIV-AIDS, syphilis, and hepatitis C—among incarcerated populations while also considering the influence of social determinants of health on these outcomes.

Methods

Design

The study utilizes a documentary design, analyzing data collected from relevant organizations, including the Department of Corrections and the Department of Disease Control. The setting encompasses various correctional facilities and health departments over the period from October 1, 2021, to September 30, 2024, as part of a quality improvement initiative.

The study examines data from a diverse group of inmates in correctional facilities, including both new arrivals and existing inmates. The materials include health screening records and treatment protocols documented by the relevant departments.

Methods and Analysis

The study involves systematic health screenings for tuberculosis (TB), HIV/AIDS, syphilis (SYP), and hepatitis C (Hep C), conducted using standardized protocols. Interventions may include the implementation of Pahurat's BathTub Approach, which categorizes water usage for health management: cold water for healthy inmates, warm water for those receiving treatment, and hot water for individuals who are ill.

Comparisons will be made between the incidence rates of these infections before and after the implementation of these interventions. Generic names for medications and treatments will be utilized, with proprietary brands included in parentheses where applicable.

The statistical analysis will employ descriptive statistics to summarize the data in percentage form.

Results

Thailand operates a total of 143 prisons under the Department of Corrections, Ministry of Justice, with a capacity to house 200,000 prisoners. From 2021 to 2024, the quarterly prisoner numbers and densities in these facilities were as follows: 358,369 (179.18%), 285,182 (142.59%), 261,401 (130.70%), and 270,879 (135.44%), as shown in Table 1.

Table 1: Number of Prisoners and Prisoner Density from 2021 to 2024

Years	2021	2022	2023	2024
Prisoner number	358,369	285,182	261,401	270,879
Prisoner density (%)	179.18	142.59	130.70	135.44

Between October 1, 2021, and September 30, 2024, there was a significant reduction in key infectious diseases among inmates. During this period, over 1.2 million new and existing inmates were screened for tuberculosis, with the following numbers screened each year: 351,737 in 2021, 259,278 in 2022, 280,921 in 2023, and 363,825 in 2024. The confirmation rates for tuberculosis were 1.06% in 2021, 0.91% in 2022, 0.89% in 2023, and 0.90% in 2024, indicating a notable decline in TB confirmations (see Figure 2).

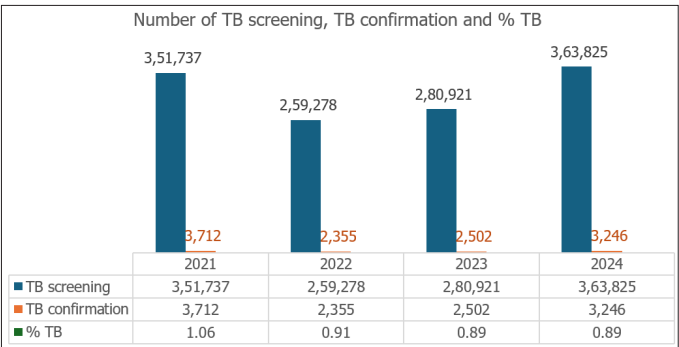


Figure 2: Screening of New Arrivals and Existing Inmates for Tuberculosis, Including the Number Screened and the Corresponding Confirmation Rates

Over a four-year period of HIV screening, more than 348,000 new arrivals were tested, with the following numbers screened each year: 19,448 in 2021, 100,800 in 2022, 89,337 in 2023, and 138,679 in 2024. The confirmation rates for HIV were 1.17% in 2021, 1.36% in 2022, 1.39% in 2023, and 1.01% in 2024 (see Figure 3).

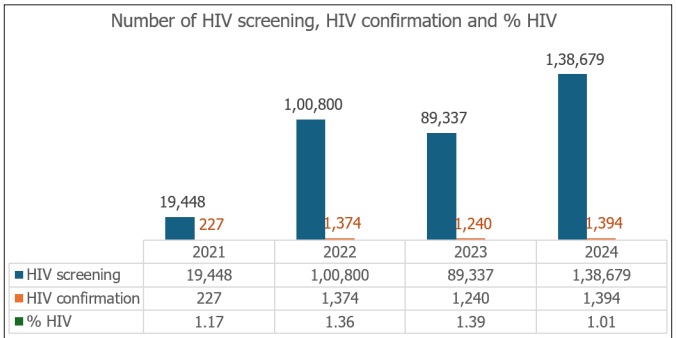


Figure 3: Screening of New Arrivals Prisoners for HIV, Including the Number Screened and the Corresponding Confirmation Rates

During a four-year period of SYP screening, over 322,000 new arrivals were tested, with the following annual totals: 10,650 in 2021, 91,068 in 2022, 83,271 in 2023, and 137,551 in 2024. The confirmation rates for SYP were 1.62% in 2021, 2.02% in 2022, 2.56% in 2023, and 2.40% in 2024, indicating an increase in SYP confirmations (see Figure 4).

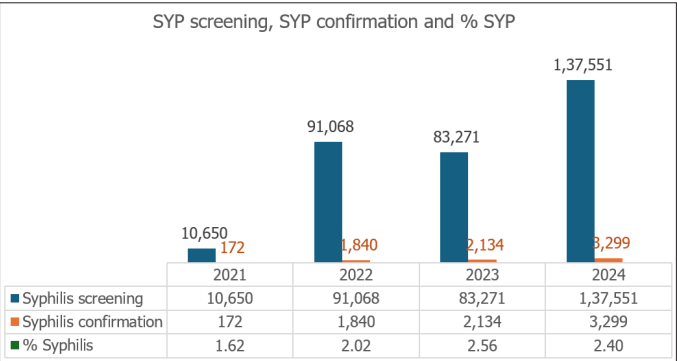


Figure 4: Screening of New Arrivals Prisoners for SYP, Including the Number Screened and the Corresponding Confirmation Rates

Over a four-year period of Hep C screening, more than 322,000 new arrivals were tested, with the following annual totals: 12,098 in 2021, 86,185 in 2022, 81,185 in 2023, and 139,906 in 2024. The confirmation rates for Hep C were 2.17% in 2021, 2.00% in 2022, 1.92% in 2023, and 0.85% in 2024, indicating a decrease in Hep C confirmations (see Figure 5).

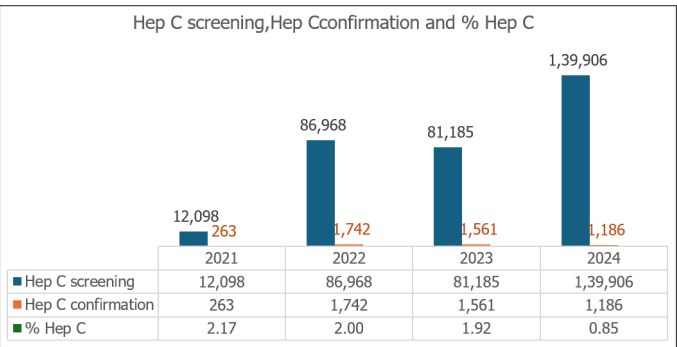


Figure 5: Screening of New Arrivals Prisoners for Hep C, Including the Number Screened and the Corresponding Confirmation Rates

When comparing the screening numbers for TB, HIV, SYP, and Hep C among new arrivals and existing inmates, we observed a significant increase in TB screenings over the four-year period, particularly among existing inmates. Similarly, there was an upward trend in HIV, SYP, and Hep C screenings among new arrivals (see Figure 6).

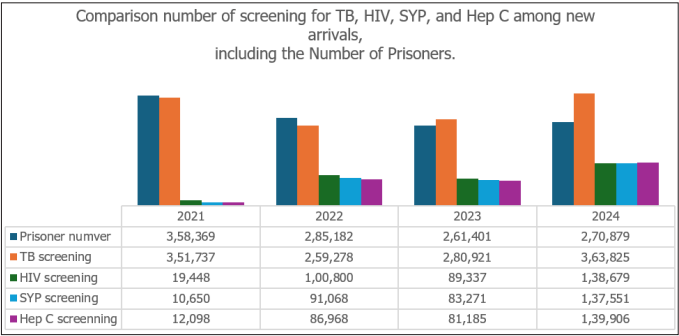


Figure 6: Comparison Number of Screening for TB, HIV, SYP, and Hep C Among New Arrivals, Including the Number of Prisoners

However, when comparing the confirmation rates for TB, HIV, SYP, and Hep C among new arrivals and existing inmates, we noted a significant decline in TB confirmations over the four-year period, especially among existing inmates. Likewise, HIV, SYP, and Hep C also exhibited a decreasing trend among new arrivals (see Figure 7).

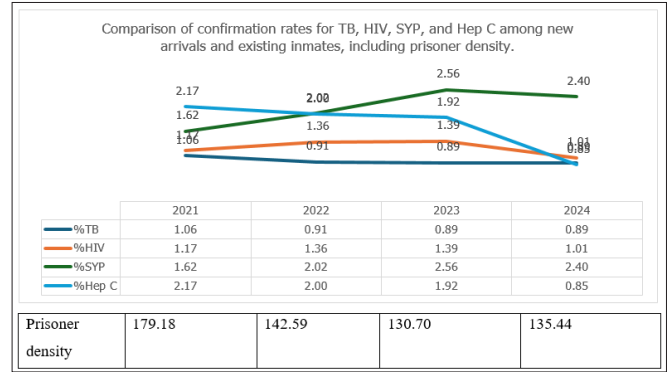


Figure 7: Comparison of Confirmation Rates for TB, HIV, SYP, and Hep C Among New Arrivals and Existing Inmates, Including Prisoner Density

Discussion

The findings from our analysis of infectious disease screening in Thailand’s correctional facilities highlight critical trends and challenges in managing health among incarcerated populations. Over the four-year period from 2021 to 2024, the screening data reveal significant fluctuations in both the number of prisoners and the prevalence of key infectious diseases, underscoring the complex interplay of overcrowding, healthcare accessibility, and disease management [1,11].

Despite the concerning prisoner densities—ranging from 130.70% to 179.18% of capacity—there was a notable reduction in tuberculosis (TB) confirmations among inmates. This decline, particularly among existing inmates, suggests that recent health interventions have effectively addressed TB transmission within these facilities [6]. The increased number of annual screenings indicates a concerted effort to monitor and manage TB. This improvement may be attributed to enhanced health management practices and the implementation of frameworks such as the Mandela Rules and Pahurat’s BathTub Approach, both of which emphasize the importance of systematic health services tailored to inmates’ health statuses [4,10].

Pahurat’s BathTub Approach is particularly relevant in this context, as it categorizes new arrivals and inmates based on their health needs using different water designations: cold water for healthy individuals, warm water for those undergoing treatment, and hot water for those who may be ill or unaware

of their health status. This structured approach enables targeted healthcare interventions that cater to the diverse needs of the inmate population. Additionally, it is essential to maintain health by effectively transitioning individuals in warm and hot water back to cold water through appropriate healthcare services. By integrating this framework with the One Health strategy, which recognizes the interconnectedness of human, animal, and environmental health, we can develop a comprehensive health management system that prioritizes individual health outcomes while also addressing the broader environmental and community factors influencing disease transmission [1].

Conversely, the trends for sexually transmitted infections (STIs) such as syphilis (SYP) and hepatitis C (Hep C) present a more concerning picture. The increase in SYP confirmations, alongside fluctuating but generally high rates for Hep C, indicates potential gaps in prevention and treatment strategies [3]. While the total screenings for these infections rose, the rising confirmation rates suggest that the interventions may not be fully effective or that the risk factors leading to these infections remain prevalent within the prison environment. Addressing these diseases requires a multifaceted approach that not only enhances screening and treatment but also tackles the underlying social determinants of health contributing to higher infection rates among incarcerated individuals [2].

The trends in HIV screenings demonstrate a mixed outcome, where confirmation rates fluctuated but ultimately decreased. This decline could reflect improved awareness and treatment options; yet, the overall prevalence remains a concern (Joint United Nations Programme on HIV/AIDS [UNAIDS], 2022) [12]. The current health interventions may need further refinement to ensure they effectively reach and educate the inmate population, particularly among new arrivals who are at higher risk.

Moreover, the data reveal a critical need for ongoing monitoring and evaluation of health interventions. By applying the One Health concept in correctional settings, we can facilitate a more holistic approach to health management, integrating environmental and community factors that influence disease transmission [11]. This interconnectedness allows stakeholders to design more effective interventions that address both the immediate health needs of inmates and the broader societal influences affecting their health outcomes.

The constitutional rights outlined in the Thai legal framework emphasize the obligation of the state to provide adequate healthcare to incarcerated individuals [7]. However, barriers such as stigma, lack of education, and inadequate resources can hinder access to these rights [1]. Therefore, it is essential for correctional management to prioritize educational programs and resources that empower inmates to understand and advocate for their health needs. By integrating Pahurat’s BathTub Approach with the One Health strategy, correctional facilities can enhance their health management frameworks, ultimately improving health outcomes for inmates and reducing the transmission of infectious diseases both within and beyond prison walls.

Authors, along with colleagues from related organizations such as the Department of Corrections and the Permanent Secretariat Office of the Ministry of Public Health, applied for budget support from the National Health Security Office (NHSO) to establish a fee schedule for the prevention and promotion of screenings for TB, HIV, SYP, and Hep C among new arrivals, exiting inmates, and those preparing for release back into the community [6]. The NHSO approved this support in August 2024, which means that screening for these diseases will be more comprehensive and will enhance prevention and control efforts for incarcerated individuals in the future.

Conclusions

In conclusion, while the data indicate positive trends in TB management. (World Health Organization, 2022), the increases in SYP and Hep C confirmations raise important questions about the adequacy of current health interventions [13,14]. To effectively address these challenges, it is crucial to integrate health management frameworks such as Pahurat's BathTub Approach and the One Health strategy while also considering the social determinants of health that significantly impact incarcerated populations [15]. By categorizing inmates based on their health needs and recognizing the interconnectedness of human, environmental, and community health, we can create a more comprehensive and effective health management system.

Furthermore, addressing social determinants—such as education, economic stability, and access to healthcare—will be vital in enhancing health outcomes for inmates. Fostering community connections and integrating these frameworks will not only improve individual health but also mitigate the risk of infectious disease transmission within correctional facilities and the surrounding communities. Future studies should focus on longitudinal assessments of these integrated health interventions and their long-term impacts on disease prevalence, ultimately contributing to public health goals that benefit both the incarcerated population and the broader community [9,16].

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Data Availability

The datasets used and/or analyzed during the current study are not publicly available.

Declarations

Ethics approval and consent to participate were not required for this study, as it is documentary research.

Competing Interests

No competing interests were identified in this study.

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