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BEYOND MEDICINE AVAILABILITY: UNPACKING THE CHALLENGES OF METHADONE MAINTENANCE THERAPY IMPLEMENTATION IN NORTHERN THAI HOSPITALS

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ABSTRACT

Methadone maintenance therapy (MMT) is a harm reduction-based approach that has been part of national policies since 2018. Despite its inception, MMT provision faces challenges, particularly in North Thailand, where opioid use disorders are the most prevalent. This study assessed MMT provisions in terms of system input, performance, and output in all 147 public hospitals under the Ministry of Public Health in Northern Thailand. This cross-sectional study employed an online questionnaire based on the World Health Organization's six building blocks and the Non-adoption, Abandonment, Scale-up, Spread, and Sustainability (NASSS) framework. Northern Thailand data collection spanned from September 1, 2022, to February 1, 2023. The results revealed that ninety-eight hospitals (66.70%) responded. Only 37.76% actively provided MMT, 4.08% discontinued it, and 58.16% did not offer it. In areas where opioid overuse disorder is reported, MMT is available in 70.59% of the hospitals. The strong system governance and value proposition of MMT in hospitals with MMT services helped 78.49% of patients with opioid use disorder access services and maintained a one-year retention rate of 71.35%. Though patients with MMT services had a high retention rate, gaps still existed such as a lack of staff and training, limited data collection, and insufficient collaboration with stakeholders to expand the referral capacity. Inactive and pending hospitals lacked an MMT service policy, hindering service launches. According to the findings, the scaling up of MMT services still faces challenges, including the fact that most hospitals do not offer these services and even those that do often lack staff, training, and resources. Support for MMT services must be tailored to the specific needs and contexts of different hospitals.

Keywords: methadone maintenance, opioid use disorder, complexity, NASSS framework, scale-up

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Introduction

Drug addiction is a major global crisis. The injection of heroin is a significant contributor, with an estimated 58 million users worldwide.[1] Thailand is facing a drug epidemic, particularly with opioids such as opium and heroin,[2] and 70% of opioid patients are in Northern Thailand.[2] Opioid overdoses have led to approximately 110,000 deaths, setting off alarms in the public health sector due to increases in HIV cases as well as a heightened risk of hepatitis B and C due to unsafe injections.[3,4]

Methadone maintenance therapy (MMT) is widely recognized as an effective pharmacotherapy for individuals with opioid use disorder (OUD) to reduce their withdrawal symptoms.[3] In 2018, the government of Thailand integrated MMT into its Drug Abuse Service Plan,[4] a comprehensive government-led initiative that aims to improve healthcare services. This comprehensive framework outlines the roles, responsibilities, and procedures for safe methadone use in the treatment of OUD. The effectiveness of MMT in the country is primarily measured by patient retention rates, with the target rate increasing annually from a one-year retention rate of 55% in fiscal year 2021 to 75% in 2023.[5] While all 13 health regions improved each year, only nine passed the key performance indicator in 2021,[6] reflecting barriers that hinder patient access. The Thanyarak Chiangmai Hospital, a specialized center under the Department of Medical Services, is responsible for expanding MMT services to address opioid overuse in public health hospitals located in Northern Thailand's health regions 1 and 2.

MMT can be considered an innovation by itself, though having it accepted by patients and healthcare providers[7-9] can be quite challenging. Patients may struggle with finances,[10] a lack of understanding of MMT,[10-12] fear side effects,[10,13] are wary of social stigma,[7,10,11] and have concerns about law enforcement.[10,14] Furthermore, limited budgets, a shortage of specialists, and safety concerns can hinder healthcare providers.[15]

Thailand conducted a limited study on the obstacles to implement MMT services.[16] Addressing these complexities is crucial for the successful transfer and sustainability of MMT services.[17] These constraints underscore the significance of effectively managing the components of health systems, as emphasized in the Service Plan for Drug Abuse, which is grounded in the health systems framework of the World Health Organization (WHO).

The Non-adoption, Abandonment, Scale-up, Spread, and Sustainability (NASSS) framework is a model designed to analyze and address the challenges of implementing and scaling new technologies in healthcare environments.[18,19] This framework comprises seven domains: condition, technology, value proposition, adopters, organization(s), wider system, and adaptation.[18,19] In the context of MMT services, these domains could address aspects such as the nature of opioid addiction (condition), the methadone dispensing system (technology), the benefits to patients and society (value proposition), healthcare workers and patients (adopters), clinics and health systems (organizations), drug policies and societal attitudes (wider system), and long-term program sustainability (adaptation). These services take into account the unpredictable interactions among these domains and assist in pinpointing areas where complexity can be reduced.[20,21] Various health programs,[18,22,23] including harm reduction services,[16] have utilized the NASSS framework to identify factors influencing success or failure, demonstrating the interplay between factors and external contexts, and their potential applicability to MMT services.

Nimsakul et al.[16] discovered the intricate process of implementing harm reduction in two community hospitals using the NASSS framework and complexity theory. The success of service implementation efforts are influenced by various factors and social contexts, which could be concerning. Engaging a broader system and preparing for unexpected challenges will support

successful implementation. However, the study was restricted to only one province.

This study examined the current state of MMT in hospitals throughout Northern Thailand, including service system inputs, performance, and outputs. Additionally, it aimed to determine the relationship between access to MMT service and the one-year retention rate among patients. The findings are expected to provide valuable insights for policymakers and healthcare providers to improve and scale up MMT services effectively, leading to better patient outcomes and more efficient resource allocation in the region's drug abuse treatment programs.

Methods

This study is an analytical cross-sectional study. The conceptual framework draws from the WHO's six building blocks of health systems,[24] the NASSS framework,[18,19] and previous research on technology implementation.[16] The framework consists of 3 interconnected domains: system inputs, system performance, and system outputs. System inputs encompass: 1) system governance, including MMT policy, service formalization, resource distribution (financial, workforce, infrastructure), internal system development, monitoring and evaluation system, and stakeholders' engagement; 2) health workforce availability; 3) health information systems application, 4) medicine availability, 5) financial support, 6) service capacity, 7) systems adoption, 8) value proposition, and 9) broader system influence.

System performance contains: 1) patients' access to service, 2) service coverage (e.g. screening, referral center), 3) service adaptation (e.g. workforce, regulations), and 4) continuity in MMT provision. System output refers to: 1) retention rate, 2) safety (methadone overdose and misuse rate), and 3) patient living conditions (ability to return to daily activities).

The online questionnaire, which consists mostly of questions requiring empirical and numerical information, contains three main sections: 1) baseline characteristics, 2) system input, and 3) system performance. The system input section comprises closed-ended questions, including dichotomous questions (e.g., have/do not have policies to support MMT), and open-ended questions requiring numerical responses (e.g., number of health workforce members trained in addiction treatment). Each section also includes additional informational fields. The value proposition is assessed using a 5-point Likert scale (1=strongly disagree, 5=strongly agree). The system performance section includes closed-ended dichotomous questions (e.g., have/do not have adaptations of MMT services) and open-ended questions requiring numerical responses (e.g., average percentage of OUD patients).

For system output, the treatment of OUD patients measures the retention rate, which reflects the effectiveness of the program in maintaining long-term patient engagement. This is calculated by dividing the number of patients who completed treatment and received continuous follow-up care according to individual needs and the Ministry of Public Health standards by the total number of patients who entered and completed treatment, excluding those arrested or deceased.[6] Hospitals not offering MMT were only required to complete the system input section of the survey.

To ensure the validity of the questionnaire, its content validity was evaluated by a panel of six experts, including a psychiatrist and an addiction specialist, pharmacists, staff members involved in MMT services, and a professor in Social and Administrative Pharmacy. The panel assessed the relevance, clarity, and comprehensiveness of the questionnaire items concerning the implementation of MMT services. Based on their feedback, the questionnaire was refined and finalized. Each item had an item-objective congruence (IOC) greater than 0.5.

All Ministry of Public Health (MOPH) hospitals within Northern Thailand's Health Regions 1 and 2 (covering 147 hospitals across 12 provinces) were

included. Invitation letters were distributed via mail, requesting completion by the hospital director or designated MMT personnel (completion time: 30-45 minutes). Data were collected from September 1, 2022 to February 1, 2023. The follow-up procedures by phone at six and 12 weeks ensured adequate response rates. The study was approved by the Research Ethics Committee of the Faculty of Pharmacy, Chiang Mai University.

Descriptive statistics were generated using STATA version 14.0. Spearman's rank correlation assessed the association between access and treatment retention. Qualitative opinions were analyzed using content analysis.

Results

This study enrolled 98 hospitals from Health Regions 1 and 2 in Northern Thailand, with a response rate of 66.67%. The sample group comprised all hospital levels, with most being community hospitals. Among the hospitals enrolled, 37 (37.76%) were actively providing MMT services, four (4.08%) had previously provided the services but discontinued, and 57 (58.16%) had not yet started providing MMT (Table 1).

Although first-level hospitals constituted the largest group of participating hospitals, they had the lowest proportion of active MMT services. The middle-level hospitals had the highest percentage of active MMT services (Figure 1A). The proportion of active MMT services appeared to be slightly correlated with the reported cases of OUD in each hospital level (Figure 1B). Regarding areas with OUD, 70.59% of the hospitals offered MMT services, with 100% of the advanced-level hospitals doing so (Figure 1C). In areas without reported OUD, it is unlikely that MMT services will be provided (Figure 1D).

Table 1 Demographics of surveyed hospitals and respondents

Hospital	**MMT service provision, n (%)**			**Total (n=98)**
	Active (n=37)	**Inactive (n=4)**	**Pending (n=57)**	
Health region				
Region 1	31 (43.06)	3 (4.17)	38 (52.77)	72 (100.00)
Region 2	6 (23.08)	1 (3.85)	19 (73.07)	26 (100.00)
Hospital level				
Advanced (A) level	5 (55.56)	0 (0.00)	4 (44.44)	9 (100.00)
Standard (S) level	1 (33.33)	2 (66.67)	0 (0.00)	3 (100.00)
Middle (M) level	7 (63.64)	1 (9.09)	3 (27.27)	11 (100.00)
First (F) level	24 (32.00)	1 (1.33)	50 (66.67)	75 (100.00)
Healthcare accreditation (n=97)				
Re-accredited	25 (38.46)	3 (4.62)	37 (56.92)	65 (100.00)
Accredited	3 (30.00)	1 (10.00)	6 (60.00)	10 (100.00)
Under review or not accredited	8 (36.36)	0 (0.00)	14 (63.64)	22 (100.00)
Narcotic healthcare accreditation (n=97)				
Re-accredited	22 (36.66)	4 (6.67)	34 (56.67)	60 (100.00)
Accredited	11 (47.83)	0 (0.00)	12 (52.17)	23 (100.00)
Not accredited	2 (15.38)	0 (0.00)	11 (84.62)	13 (100.00)
Surveyor	1 (100.00)	0 (0.00)	0 (0.00)	1 (100.00)
OUD reported in the area	36 (70.59)	2 (3.92)	13 (25.49)	51 (100.00)

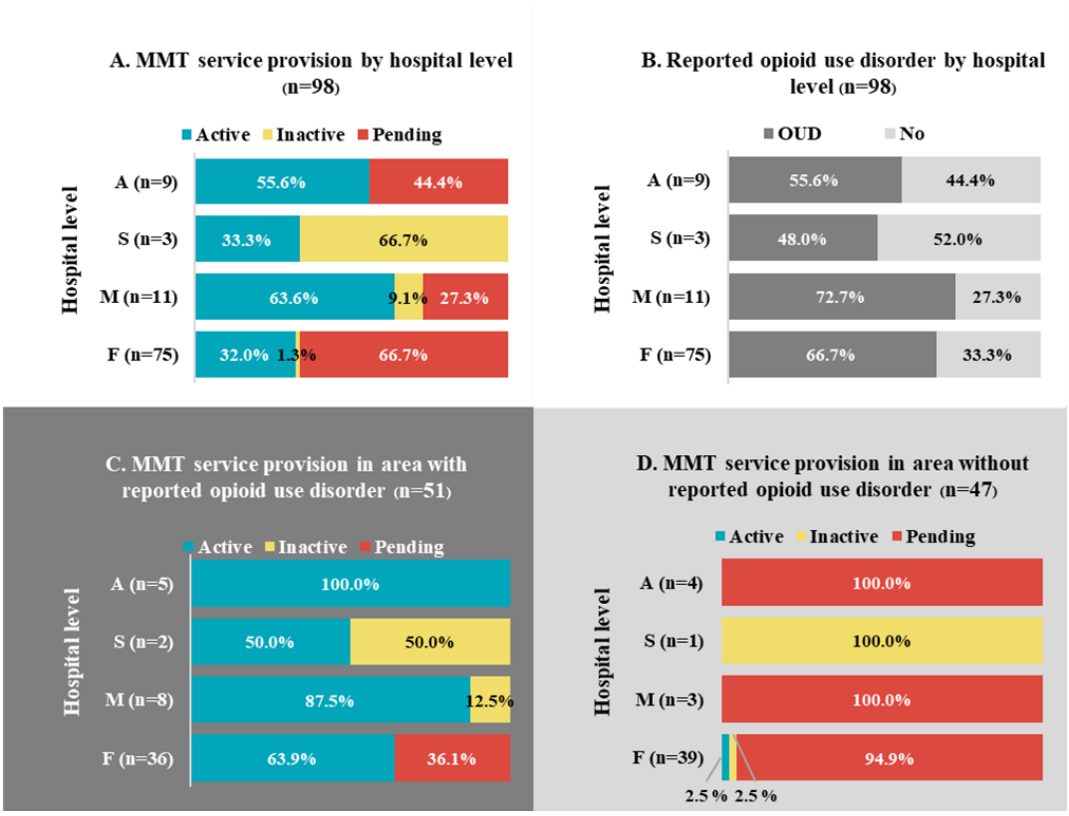

Figure 1 MMT services provision and OUD by hospital level

System input

MMT hospitals were assessed for systems governance, health workforce, health information systems, essential medicines, financing, capacity, adoption of systems, value proposition, and the broader system.

System governance

The findings of this research indicated that hospitals possessing MMT services exhibited robust governance due to the presence of mechanisms related to policy formulation, oversight, collaboration, regulation, system design, and accountability to prevent isolation among system components (Table 2).

Health workforce

MMT is typically managed by a team of healthcare professionals, including nurses, physicians, and pharmacists. In some hospitals, additional staff, such as data entry and laboratory officers, as well as community partners, may also be involved. However, the distribution of MMT staff varies across professions, and a shortage of key professionals was reported in all hospital groups, including MMT active hospitals (Figure 2). Only 44.44% of those in the active hospitals felt that they had sufficient staff. Additionally, a lack of training in addiction treatment among staff members was observed, with only 43.6% of nurses and fewer than 20% of physicians and pharmacists in MMT active hospitals receiving adequate training (Figure 3).

Health information system

The majority of active MMT hospitals were equipped with the necessary health information systems as mandated by the Drug Abuse Service Plan, which included treatment registration and updated information input by designed staff, as well as patient follow-up. However, when it came to proactive surveillance, only around half of the hospitals documented drug abuse risk factors in the community (Table 2).

Table 2 Systems input for MMT service

System input for MMT services	MMT service provision, n (%)			Total
	Active	Inactive	Pending	
Systems governance	**(n=37)**	**(n=4)**	**(n=57)**	**(n=98)**
Undertake plans or policies to provide support to MMT	33 (91.67)	2 (50.00)	3 (5.26)	38 (38.78)
Formalize MMT services by specifying roles and duties	34 (94.44)	1 (25.00)	2 (3.51)	37 (37.76)
Distribute financial, people, and infrastructure resources to support MMT operations efficiently	34 (94.44)	2 (50.00)	1 (1.75)	37 (37.76)
Develop internal systems to streamline MMT delivery	33 (91.67)	2 (50.00)	4 (7.02)	39 (39.80)
Develop M&E systems and utilize data-driven decision-making to enhance future MMT planning	30 (83.33)	1 (25.00)	1 (1.75)	32 (32.65)
Engage stakeholders across and outside the hospital in planning, monitoring, and information access	25 (69.44)	1 (25.00)	3 (5.26)	29 (29.59)
Effective coverage of MMT staff	**(n=37)**	**(n=4)**	**(n=57**	**(n=98)**
MMT staff is sufficient	16 (44.44)	1 (25.00)	7 (12.50)	24 (25.00)
MMT staff are competent to provide MMT services	21 (58.33)	1 (25.00)	5 (8.93)	27 (28.13)
Availability of health information system	**(n=36)**	**(n=4)**	**(n=57)**	**(n=97)**
Assign a staff to enter, update, validate, and oversee MOPH standard dataset data reporting	34 (94.44)	2 (50.00)	26 (45.61)	62 (63.92)
Assign a staff to enter, update, and validate MMT service information into the National Drug Treatment and Rehabilitation Data Reporting System	35 (97.22)	2 (50.00)	29 (50.88)	66 (68.04)
Processes for registration, reporting drug user screening findings, treatment and rehabilitation, follow-up care	36 (100.00)	2 (50.00)	26 (45.61)	64 (65.98)
Gather information about community drug epidemic risk factors	18 (50.00)	1 (25.00)	18 (31.58)	37 (38.14)
Track symptoms and treatment outcomes from patients, families, and the community	25 (71.43)	1 (25.00)	22 (40.74)	48 (51.61)
Analyse service data to improve quality	24 (70.59)	1 (25.00)	1 (1.82)	26 (27.96)
Availability of drug and medical supplies	**(n=36)**	**(n=4)**	**(n=57)**	**(n=97)**
Methadone	36 (100.00)	1 (25.00)	4 (7.02)	41 (42.27)
Naloxone	35 (97.22)	2 (50.00)	28 (49.12)	65 (67.01)
Non-drug medical supplies	36 (100.00)	3 (75.00)	46 (80.70)	85 (87.63)
Supporting equipment	32 (88.89)	1 (25.00)	8 (14.04)	41 (42.27)
SOPs for methadone management	35 (97.22)	3 (75.00)	29 (50.88)	67 (69.07)
Self-assessment	34 (94.44)	3 (75.00)	27 (47.37)	64 (65.98)
External audit of drug management systems	30 (83.33)	3 (75.00)	35 (61.40)	68 (70.10)
Financial support	**(n=36)**	**(n=4)**	**(n=57)**	**(n=97)**
Continuous	25 (69.44)	1 (25.00)	0 (0.00)	26 (26.80)
Uneven	9 (25.00)	0 (0.00)	1 (1.75)	10 (10.31)
None	2 (5.56)	3 (75.00)	56 (98.25)	61 (62.89)
Service capacity	**(n=36)**	**(n=4)**	**(n=57)**	**(n=97)**
Capable to receive, refer, or monitor patients	35 (97.22)	2 (50.00)	34 (59.65)	71 (73.20)
Incapable	1 (2.78)	2 (50.00)	23 (40.35)	26 (26.80)

Note: 1 = lack of system input, 5 = rich of system input

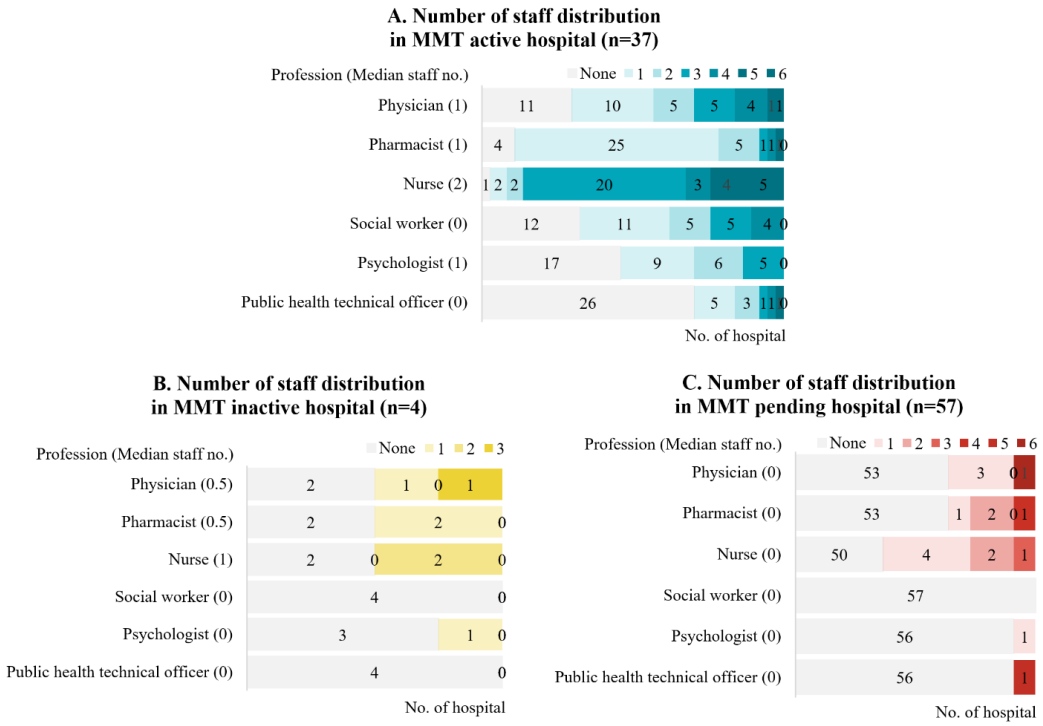

Figure 2 Number of MMT staff distribution in each profession (A. MMT active hospital, B. Inactive hospital, and C. Pending hospital)

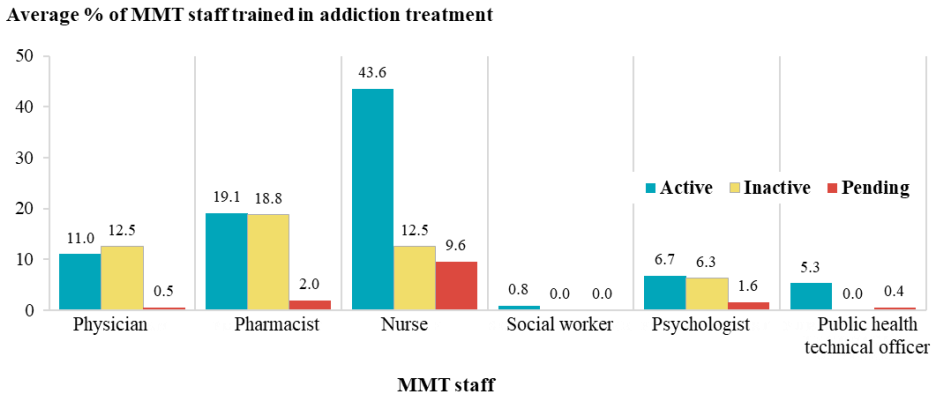

Figure 3 Average percentage of MMT staff in each profession trained in addiction treatment, by provision of MMT services

Drug and related supplies

Active MMT hospitals are equipped with the necessary medical supplies, including methadone and an antidote (naloxone). They have established standard operating procedures as well as self-assessment and external audits. However, methadone and supporting equipment were not available in most non-MMT hospitals (Table 2). The open questions showed that opioid methadone formulations differed across hospitals, causing medication errors. This can affect MMT patient retention because they may travel to hospitals that offer better treatment.

Financing

Many active MMT hospitals have the financial resources to establish the program and provide staff training. Inactive and MMT-pending hospitals face difficulties owing to insufficient funding (Table 2). The open-ended questions indicated that hospitals face financial challenges, mainly due to the cost of high-dose methadone and the need for additional funding for services.

Service capacity

Of the hospitals that offered MMT services, 97.22% were equipped to receive referred cases, refer patients to higher-level hospitals, and monitor them according to the requirements of the plan. On the other hand, about half of the inactive and pending MMT service hospitals were unable to refer and monitor patients (Table 2).

Value proposition and wider system

The value proposition assessment evaluates stakeholders' viewpoints responding to 5-point Likert scale questions. The calculation of the reliability coefficient for items of 0.86 indicates internal consistency.

Although MMT is typically well-regarded by stakeholders, healthcare providers in hospitals offering the treatment tend to have more favourable views. In contrast, hospitals that had previously provided MMT were less likely to value it. Staff members in MMT active hospitals find the treatment effective but they also have concerns about misuse and safety. Nevertheless, patients are generally satisfied, and the community views the treatment positively. Community concerns about social stigma and misuse, as well as inequities in MMT access among different populations, are less likely to be viewed as problems. In MMT-pending hospitals, staff members recognize the benefits of treatment but have assigned lower ratings, which may be due to barriers such as knowledge and safety concerns (Table 3).

System performance

MMT hospitals were assessed for access, coverage, adaptation, and continuity. Most hospitals offer patient classification and referral services. Most hospitals have been continuously operating MMT services for more than 5 years and even adapted their services during the COVID-19 pandemic. These adaptations led to a high percentage of OUD patients entering MMT services in fiscal year 2021 at 78.49 (Table 4).

System output

Of the patients with OUD who entered treatment, 71.35% stayed for a year, with differing results among hospitals. The patients were able to resume their normal lives by 90.52%. However, some hospitals reported that more than half of the patients experienced methadone overdose and misuse (Table 5). A positive correlation was found between access to MMT and a one-year retention rate, although this was not statistically significant (Spearman's rank correlation coefficient 0.25, p-value = 0.207).

Discussion

The research assessed the situation of MMT provisions including system input, performance, and output in hospitals located in Northern Thailand. It included 66.67% of the 147 hospitals in the region. This high response rate could be attributed to the hospitals' strong interest in reflecting their situation on relevant issues, as well as the results of two rounds of follow-up for questionnaire return, thus, enhancing the representativeness of the findings in the broader Thai context. Hospital representatives with an average of 10 years of experience in hospitals and 5 years in MMT services responded to the survey contributing to the study's reliability. Given that the surveyed area accounted for almost 70% of OUD in Thailand [2], the results can represent the situation of MMT treatment in Thailand. In 2023, only 37.76% of hospitals offered MMT, 4.08% discontinued the service, and the remaining 58.16% had not yet initiated the service.

Table 3 Value proposition of MMT and the influence of wider systems

Agreement with the statement	MMT service provision, Mean ± SD			Total
	Active	Inactive	Pending	
Overall adoption of MMT				
Staff value and accept MMT	4.51 ± 0.61	2.75 ± 1.26	3.83 ± 0.98	4.09 ± 0.95
Patients value and accept MMT	4.26 ± 0.70	3.33 ± 1.15	3.96 ± 0.88	4.09 ± 0.82
The patient's family values and accepts MMT	4.11 ± 0.68	3.33 ± 1.15	4.00 ± 0.68	4.03 ± 0.71
Community values and accepts MMT	3.80 ± 0.96	3.00 ± 1.00	4.00 ± 0.77	3.85 ± 0.90
From MMT staff point of view				
MMT can be adapted to hospital context	4.40 ± 0.65	3.25 ± 0.96	3.88 ± 0.91	4.10 ± 0.85
MMT improves patient's and community's wellbeing	4.26 ± 0.78	4.00 ± 0.00	4.12 ± 0.93	4.18 ± 0.83
MMT improves staff skills with complex patient cases	4.09 ± 0.74	3.75 ± 0.96	3.97 ± 0.97	4.01 ± 0.85
MMT enhances service standards and continuous improvement	4.03 ± 0.89	3.25 ± 0.96	3.84 ± 0.81	3.90 ± 0.86
MMT can generate income for the hospital	3.71 ± 1.14	2.75 ± 0.96	3.39 ± 1.12	3.51 ± 1.13
Staff worried about ethical issues such as unregulated methadone use*	3.31 ± 1.05	3.50 ± 1.91	3.42 ± 1.00	3.38 ± 1.07
Staff safety concerns while offering services *	3.14 ± 1.09	3.75 ± 0.96	3.15 ± 1.08	3.18 ± 1.07
Staff worries about insufficient skills *	2.77 ± 1.00	3.50 ± 1.29	3.49 ± 1.12	3.15 ± 1.12
Coordination between hospital departments and outside agencies makes MMT difficult *	2.63 ± 1.09	3.25 ± 1.26	2.97 ± 1.14	2.81 ± 1.12
From patients' points of view				
Patients like MMT at a local hospital	4.49 ± 0.61	3.67 ± 1.53	4.15 ± 0.88	4.31 ± 0.79
Resuming normal life helps patients support their families and society	4.37 ± 0.60	3.67 ± 1.53	4.11 ± 0.85	4.23 ± 0.77
MMT can reduce family expenses	4.31 ± 0.72	4.00 ± 1.73	4.12 ± 0.82	4.22 ± 0.81
MMT reduces withdrawal symptoms	4.23 ± 0.69	4.00 ± 1.73	4.30 ± 0.95	4.25 ± 0.85
MMT relieves family concerns about the patient's drug addiction symptoms	4.14 ± 0.37	3.67 ± 1.53	3.74 ± 0.86	3.95 ± 0.84
Self-identified withdrawal or overdose symptoms satisfy patients	4.09 ± 0.61	3.67 ± 1.53	4.04 ± 0.77	4.05 ± 0.72
Patients like MMT because it improves society's view of drug addicts	4.03 ± 0.82	3.67 ± 1.53	3.79 ± 0.92	3.91 ± 0.89
Methadone users fear social stigma *	2.71 ± 1.07	2.00 ± 0.00	2.75 ± 1.17	2.70 ± 1.10
From community and society points of view				
MMT service helps patients, family, and society obtain treatment, which is crucial to rehabilitation	4.06 ± 0.76	3.67 ± 1.53	3.79 ± 0.99	3.92 ± 0.91
Treatment costs are not reimbursed for all patients *	3.26 ± 1.08	2.33 ± 0.58	3.45 ± 0.89	3.31 ± 1.06
Social laws and practices hinder MMT effectiveness *	3.06 ± 1.21	3.33 ± 1.15	3.26 ± 0.96	3.16 ± 1.09
When officials visit homes, communities often stigmatize drug users*	2.80 ± 1.08	2.67 ± 0.58	2.28 ± 1.03	2.57 ± 1.06
The community fears MMT promotes mingling and misuse in their community *	2.42 ± 1.32	2.00 ± 1.00	2.14 ± 1.22	2.28 ± 1.26

Note: 1 = strongly disagree, 5 = strongly agree; * the mean score of the negative response is reported without converting the scale.

Table 4 System performance of MMT active hospitals

Service coverage (n=36)	**n**	**%**
Screening and classification of patients	33	89.19
Patient referral center	32	86.49
Referral of other medical treatments	28	75.68
Integration with harm reduction	27	72.97
Social welfare services	13	35.14
Other services (e.g., family therapy)	4	10.81
Adaptations of MMT services (n=36)	**n**	**%**
Workforce adaptation	28	75.68
Regulations adaptation	26	70.27
Facilities and equipment adaptation	24	64.86
Financial adaptation	17	45.95
Others (e.g., opening drop-in center)	9	24.32
Access to MMT (n=29): Average percentage of OUD patients entering into MMT service per year, Mean ± SD (Min, Max)	78.49 ± 28.53 (7.54, 100)	
< 50%	4	13.79
≥ 50%	25	86.21
Continuity in MMT provision (n=28): Median (IQR, Min-Max)	8 years (7.5, 0.5-30)	
≤ 5 years	8	28.57
> 5 years	20	71.43

Table 5 System output of hospitals with active MMT services

System output of the MMT services	
One-year retention rate of treatment phase, Mean ± SD (Min, Max)	71.35 ± 27.23 (0, 100)
Percentage of methadone overdose, Median (IQR, Min-Max)	0 (0, 0-53.33)
Percentage of methadone misuse, Median (IQR, Min-Max)	0 (2.01, 0-50.00)
Percentage of patients who can return to their daily, Mean ± SD (Min, Max)	90.52 ± 20.20 (0, 100)

Situation of MMT service provision

Hospitals that implement MMT demonstrate commitment to person-centered care[25,26] through adaptations, such as increasing take-home methadone doses for patients facing transportation challenges.[13,27-29] These modifications improve patient retention and quality of life.[30] Research supports the importance of adapting service delivery models to overcome access barriers and that good system governance is also essential because it drives other critical inputs and fosters resilience, as was observed even during the COVID-19 pandemic.[29,31-33] This pandemic prompted adjustments to drug-dispensing regulations.[34-36] However, careful policy development is necessary to balance benefits and misuse.[37] The Substance Abuse and Mental Health Services Administration (SAMHSA) is concerned with patients in the conditional stable phase of the disease who receive take-home methadone.[38]

Less than half of the staff received addiction treatment training (Figure 3), highlighting the critical need for upskilling. Inadequate OUD treatment training impedes MMT service provision.[11] Addressing these issues, addiction treatment training

can enhance MMT service efficiency.[15,39] Additionally, high turnover post-training results in a skilled worker shortage,[40,41] necessitating more training options. Studies show trained staff exhibit less stigma and better knowledge and attitudes toward drug treatment.[42-46] Effective service provisions require enhanced pharmacist support via targeted training and better system integration.[15,47,48] Training should also begin at the undergraduate level, emphasizing patient experiences, therapeutic knowledge, and the regulatory environment surrounding OUD treatment.[49]

Hospitals interested in providing MMT services must first evaluate their readiness and contact the Provincial Public Health Office (PPHO), which will then inform the responsible Thanyarak Institute to supervise the hospital during the establishment process. The PPHO will also provide funding for the service and monitor the hospital's performance using reports and key performance indicators. Consequently, hospitals that have not yet started the service may lack the necessary resources (Table 2). On the other hand, the lower level of system input reported in inactive MMT service hospitals may be attributed to factors such as the absence of OUD cases (Figure 1) or insufficient staff (Figure 2-3), which may have led to the discontinuation of the service and the omission of PPHO support. Additionally, inconsistent support from the PPHO may hinder a hospital's ability to provide services. Therefore, further research is needed to examine these factors in greater depth.

While the financial support provided by PPHO to hospitals for system input is undoubtedly linked to the availability of most inputs, system governance and value proposition depend more on each hospital's context. WHO defines governance as a process involving policy development, oversight, collaboration, regulation, system design, and accountability to prevent isolation among system components.[24] MMT active hospitals differ in governance. They plan, manage, monitor, resource, and engage stakeholders beyond their walls (Table 2). Prioritizing good system governance is essential because it drives other critical inputs, fosters resilience, and adaptation, even during the COVID-19 pandemic.[29,50,51]

A robust health information system and risk factor data are essential for good governance. Evidence-based decision-making, ongoing performance monitoring, and proactive risk management optimize patient outcomes and system efficiency by informing policy, resource allocation, and quality improvement.[24] However, Table 2 reveals a gap in collecting community drug addiction risk factors, possibly due to insufficient hospital and external stakeholder engagement in planning, monitoring, and information sharing. This implies that proactive surveillance for improved MMT sustainability governance necessitates greater stakeholder participation.

The worth of a value proposition in achieving success cannot be underscored. Active and pending MMT hospitals recognize the benefits of MMT for themselves, patients, their families, and the community, and strongly agree that the MMT service has high staff value compared to patients, their families, and the community. However, the inactive MMT hospitals were less in agreement with the overall value of MMT (Table 3). It is possible that inactive hospitals have a more practical view and were facing challenges during their previous service provision.[15,16,46] The previous study conducted by Nimsakul et al. found the value proposition dimension of harm reduction services to be a simple straightforward component due to the clear advantages observed from the patients' perspective.[16] However, in our study, we discovered that the value proposition for MMT is a more complicated component as various hospitals assign different values to MMT.

High adoption of MMT services, combined with a clear value proposition (e.g., reduced opioid use, improved outcomes, cost savings), enhances MMT's sustainability and integration into healthcare

systems. This can lead to consistent funding, supportive policies, and standardized protocols. Understanding diverse stakeholders' value propositions is crucial, as it helps tailor the service to meet varied needs, thereby increasing overall support and long-term viability of MMT programs.[11,42,52]

A connection was established between MMT service access and one-year retention rates, albeit not statistically significant. Various factors, such as methadone dosage, age, perceived clinic accessibility, and the client's trust in the program, may impact retention rates.[53] Significant barriers to access include polydrug use, legal system referrals, residency in group homes, financial constraints, and homelessness.[54] Government of Canada data indicates that factors such as accessibility, affordability, and convenient operating hours are likely to improve retention rates.[55] Additional research exploring the relationship between these issues and patient outcomes may shed light on critical factors that can be adjusted.

Contextual variations in MMT-active, inactive, and pending hospitals

MMT-active hospitals have shown strength in developing policies for services. Engaging more stakeholders can strengthen system governance[56] and serve as a valuable mechanism for linking community information in monitoring patients.[57] Studies have highlighted the benefits of community networks and district health strategies, such as the Committee for the Improvement of the Quality of Life (CIQ), in implementing community health activities, promoting health prevention and early detection,[58] and addressing non-communicable and emerging diseases.[58-60]

Inactive hospitals had difficulties presenting the compelling value proposition of MMT. However, the reinstatement of services at an inactive hospital does not necessarily mean starting from scratch, as they already possess basic resources. It is essential to prioritize reviving this group so that they can increase access to treatment for patients in the area and alleviate the burden on current MMT provision hospitals.

The MMT-pending hospitals lack inputs as they have not established a policy to initiate the service; thus, no financial support has been allocated. Nonetheless, these hospitals appeared to be receptive to MMT. Strengthening policy support and implementing monitoring and evaluation mechanisms could stimulate hospitals to initiate their plans, which could catalyze further support. To achieve these objectives, adopting a comprehensive approach to problem-solving and engaging patients may lead to improved goal attainment, considering the transitory nature of goals and the stage of treatment.[38]

The researchers formulated a framework by integrating WHO's health systems framework[24] and the NASSS framework.[18,19] The six building blocks of the WHO serve as a comprehensive framework for examining the dynamic interactions among system components, resulting in improved performance and output.[24] The NASSS framework complements this approach by recognizing the varying levels of complexity within MMT and its surrounding environment, beyond the health service system itself.[18,19]

This study provides valuable insight into the national landscape of MMT services. The results revealed that MMT availability in Thailand remains uneven, and hospitals face numerous challenges. This highlights the need for a contextualized approach to policy implementation and evaluation, as a one-size-fits-all approach may not effectively promote success in diverse hospital settings.

Limitations

The study's self-reported survey had limitations, including the possibility of underreporting by hospital representatives with socially undesirable attitudes and behaviors despite the researchers' clear communication. Future studies can enhance the representation of inactive MMT groups and use qualitative research to explore their

perspectives. Understanding MMT service situations at each hospital level is crucial for efficient referral support, so future studies should separately study each level. This would include perspectives of patients and the community, as well as triangulating data from other sources to provide more comprehensive information. Finally, future research may benefit from examining individual health regions to identify inputs and contextual factors that affect performance.

Conclusion

The scaling up of MMT in hospitals throughout Northern Thailand still faces challenges, including the fact that most hospitals do not offer these services and even those that do often lack the necessary staff, training, and resources. The support for successful implementation of MMT services must be tailored to the specific needs and contexts of each hospital.

Recommendations

MMT programs require flexible strategies at national, provincial, and local levels. The MOPH should bolster hospitals with staff, training, and program revitalization. Public education and district-level collaboration can reduce the active hospital workload and improve patient follow-up. Thanyarak Institutes should optimize MMT by tailoring protocols regionally and incorporating outcome measures beyond the one-year patient retention rate.

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