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THE ASSESSMENT OF SOCIAL RETURN ON INVESTMENT FROM STUDYING THE URINATION PATTERNS OF PATIENTS WITH LOWER URINARY TRACT SYMPTOMS USING A HOME-BASED UROFLOWMETRY DEVICE

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ABSTRACT

This study assesses the Social Return on Investment (SROI) of investigating the urination patterns for patients with lower urinary tract symptoms (LUTS) using a home-based urinary flow rate measurement device. The primary aim is to evaluate the financial and social value of the project, with a focus on the outcomes for stakeholders, including patients, healthcare personnel, and local communities. The methodology follows a six-step SROI analysis process, involving defining project scope, identifying stakeholders, collecting data, and calculating SROI. The results indicate that for every 1 Thai Baht invested, a social benefit of 1.79 Baht is generated, reflecting the positive impact of the project. The total investment amounted to 17,019,409.87 THB, with the primary beneficiaries receiving 72% of the total outcome value. Key impact areas include skills and innovation (38%), economic and financial outcomes (37%), and health improvements (18%). The study concludes with recommendations for expanding the scope to include other patient groups, conducting long-term impact evaluations, improving accessibility to technology, and considering environmental impact in future healthcare innovations. This research highlights the potential of digital healthcare technologies to improve outcomes, reduce healthcare system burdens, and provide long-term social and economic benefits.

KEYWORDS: Social Return on Investment, Lower Urinary Tract Symptoms, Home-based Uroflowmetry, Telehealth.

1. INTRODUCTION

Uroflowmetry, a standard diagnostic tool for evaluating lower urinary tract symptoms (LUTS), is widely employed in urology to assess conditions that impair normal urinary function. These conditions, which affect up to 30% of men over the age of 65, become increasingly prevalent with age (National Clinical Guideline Centre (UK), 2010). Among the most impactful of these is nocturia, a condition characterized by the need to awaken one or more times at night to urinate. The International Continence Society (2002) defines nocturia as waking at night to void, with each voiding episode preceded and followed by sleep. Epidemiological studies conducted across Europe and Asia including regions such as China, Taiwan, Japan, Korea, Hong Kong, and Singapore report a high prevalence of nocturia among the elderly. In individuals over the age of 70, nocturia is reported in 69–93% of cases at least once per night, with 28–62% experiencing it twice or more (Wein *et al.*, 2016). Despite its high prevalence and significant impact on quality of life, nocturia remains underdiagnosed and underreported, particularly in Thailand, where local data are lacking. Many patients consider nocturia to be a natural consequence of aging rather than a treatable condition, which delays intervention and worsens health outcomes. Nocturia negatively affects sleep quality, contributes to daytime fatigue, and increases the risk of falls and associated comorbidities in older adults. Diagnostic evaluation is further challenged by the variability in urinary flow throughout the day, often resulting in inaccurate assessments when conducted in clinical settings (Hiromitsu *et al.*, 2023). Traditional hospital-based uroflowmetry devices, while effective, are expensive, difficult to operate, and not widely accessible especially in community or rural healthcare settings. In larger hospitals, the number of uroflowmetry units is typically limited to one to three devices, contributing to long wait times and testing delays. Furthermore, the unfamiliar and often stressful hospital environment can lead to compromised test results, as patients may struggle to urinate under pressure. To address these challenges, this study proposes the development and application of a home-based urinary flow rate measurement device. The device, which operates using a novel weight-based principle, is designed to be affordable, user-friendly, and non-invasive, enabling patients to conduct uroflowmetry tests conveniently in the

comfort of their homes. Preliminary research indicates that patients demonstrate stronger urinary flow and improved comfort when tested at home, with statistically significant differences in flow parameters compared to hospital-based assessments. By capturing real-time data on urination volume, peak flow rate (Q_{max}), voided volume, voiding time, and time to peak flow (TQ_{max}), the home-based device offers valuable clinical insights into nocturia and other LUTS-related conditions such as benign prostatic hyperplasia (BPH). This study also incorporates fluid intake and output tracking, providing comprehensive insight into patients' urinary behaviors and aiding in tailored medical management. Importantly, these data can be securely shared with healthcare providers at community hospitals or primary care facilities, enabling continuous monitoring and timely intervention even in the absence of on-site urologists. In parallel with the clinical objectives, the study aims to evaluate the **Social Return on Investment (SROI)** of implementing this home-based diagnostic solution. SROI is a framework for measuring and accounting for the broader value created by social projects, beyond traditional financial metrics (Scholten *et al.*, 2006). It captures social, economic, and environmental outcomes that matter to stakeholders, offering a structured approach to assess the effectiveness and sustainability of health-related interventions. Through this lens, the introduction of a home-based uroflowmetry device addresses several public health and social challenges, such as reducing healthcare disparities, improving access to diagnostics in underserved communities both urban and rural areas and lowering long-term healthcare costs associated with untreated LUTS. Quantifying the SROI of this project involves identifying key stakeholders (patients, caregivers, community healthcare providers), mapping inputs (equipment, training, time), and evaluating outputs and outcomes (improved health, reduced hospital visits, enhanced quality of life). By assigning monetary values to these outcomes and comparing them against the costs, the SROI framework provides a compelling narrative for investment in community-driven health innovation. Additionally, the evaluation encourages stakeholder engagement, informs strategic decision-making, and ensures alignment with public health goals and societal needs.

In summary, this research not only contributes to the clinical understanding and management of

nocturia and lower urinary tract symptoms but also demonstrates the value of health technology innovation through rigorous SROI assessment. The insights gained may guide healthcare policy, promote equitable access to diagnostic tools, and support sustainable healthcare development in both urban and rural settings.

2. OBJECTIVES

This study aims to assess the outcomes and return on investment from investigating the nighttime urination patterns of patients with lower urinary tract symptoms using a home-based urine flow rate measurement device.

3. LITERATURE REVIEW

1. Social Impact Assessment (SIA) is a study of the social value or social changes resulting from the implementation of a project. It is a crucial tool for fostering learning between project implementers and stakeholders by jointly monitoring and assessing the outcomes of a project in terms of its economic, social, or environmental impact on the community. In addition to being a strategy for understanding the effects of a project, SIA serves as an important decision-making tool for evaluating ongoing or planned projects (Joyce & MacFarlane, 2002; Vanclay, 2003).

2. Social Return on Investment (SROI) is a tool used to measure and compare the social success of any project, activity, or business investment. In addition to evaluating direct financial outcomes, SROI considers indirect values, which must be converted into monetary terms. Direct values include clear financial metrics such as costs and revenues, while indirect values may involve factors like time costs, learning and training expenses, and the value of managing waste materials, among others. These indirect values vary based on population demographics, societal conditions, and other related factors. According to Joyce & MacFarlane (2001), the SROI approach follows a Result-Oriented model, incorporating input factors, processes, outputs, and impacts. SROI focuses on translating social impacts into measurable financial values. Social impact is a composite of economic, political, governance, attitude, knowledge, and other elements that directly affect stakeholders. Evaluating the social return on investment enables stakeholders to recognize the overall social value and use the results to make improvements for the future. This is aligned with

Systems Theory, which allows managers to see the organization as a whole and analyze its relationships with the environment. The theory helps in the analysis and problem-solving of the organization through its components, 1) Inputs: Resources such as human, physical, financial, and data needed for production. 2) Transformation Process: Management techniques, production methods, and relevant technologies. 3) Outputs: Products, services, profits, losses, and other expected results such as employee potential development. 3) Feedback: Information on the outcomes of the organization's activities, which can be used for improving efficiency at various stages. According to Systems Theory, an organization uses its transformation process to convert inputs into outputs, while feedback mechanisms help analyze outcomes and adjust inputs for continual improvement.

3. Development and Testing of Home Urine Flow Rate Measurement Device: Key aspects include, 1) Home Urine Flow Rate Measurement Device: Development of a device for patients to use at home, despite limited widespread use. For instance, Sonke, G. S. found that reliable Qmax data should be collected about 25 times per patient. 2) Device Comparison Testing: Jørgensen J.B. tested the Da Capo™ device against the Urodyn 1000™, finding that both devices were similarly accurate, with Da Capo being more convenient for home use. 3) NB-IoT Technology: This is a low-power, long-range communication technology suitable for household devices such as urine flow meters due to its low cost and wide coverage across Thailand. 4) Prototype Device: Prototype testing using NB-IoT for signal transmission showed good efficiency and reduced development costs, with potential use for telehealth and 5) Data Recording: The home device records data on frequency, strength, and volume of urine, which can be used to assess urinary conditions such as overactive bladder, nocturia and frequency of urination.

From a review of the literature and related concepts, it can be concluded that Social Impact Assessment (SIA) and Social Return on Investment (SROI) are important tools for assessing the social value and impacts of projects. They foster collaboration between project implementers and stakeholders, particularly in projects that monitor the economic, social, and environmental impacts on communities. In Social Impact Assessment, both input factors (resources), processes (activities),

outputs (results), and impacts (outcomes) are measured to provide clear insights for project decision-making. Meanwhile, SROI focuses on measuring both direct value (e.g., costs, sales) and indirect value (e.g., time costs, waste management) to assess overall social value. The outcomes can guide future improvements, in line with Systems Theory, which focuses on viewing an organization holistically for continuous improvement. The project on the Home Urine Flow Rate Measurement Device illustrates the potential for using SIA and SROI to assess the impact of the device in monitoring and tracking urinary conditions in patients with lower urinary tract symptoms, particularly during the night. This could help caregivers and medical professionals plan more appropriate treatments, monitor symptoms more effectively, reduce unnecessary hospitalizations, and foster better cooperation between patients and healthcare teams in managing their health.

4. METHODOLOGY

This study aims to calculate the **Social Return on Investment (SROI)** as a financial value, assessing it through insights into the changes experienced by stakeholders. The key areas of focus are: 1) analyzing SROI, and 2) exploring the concept of **Social Impact Assessment (SIA)** (Joyce & MacFarlane, 2002). The process includes six steps:

- 1) Define the project's scope and identify stakeholders.
- 2) Develop a results framework.
- 3) Collect outcome data and assess its value in financial terms.
- 4) Gather impact data and evaluate its value.
- 5) Calculate SROI using the formula:

$$\text{SROI} = \frac{\text{Financial value of outcomes} - \text{Outcome Value not Attributable to the Project}}{\text{Project costs}}$$

The research project utilizes two types of data, **1) Primary data**: Collected through in-depth interviews with project managers, healthcare personnel, companies involved in data trials, patients' family members, and the target patients themselves, including semi-structured interviews with the community. **2) Secondary data**: Includes academic documents, articles, reports, books, and information from websites, alongside performance data from the research project.

The research is conducted in three steps, **Step 1: Planning**, this involves understanding the project's

goals, analyzing social impact assessment (SIA), and calculating the SROI. The objective is to align the evaluation with the mission and strategy of the organization and understand the changes induced by the research project. It also includes identifying stakeholders, setting boundaries for the analysis, creating the result chain (IVC), and selecting social impact indicators. **Step 2: Implementation**, this step includes designing surveys that align with the chosen indicators from Step 1. A field survey will be conducted from May 1, 2025, to August 31, 2025, with 120 participants. Interviews will be conducted with the sample group and stakeholders involved in the project. The data collected will be linked to the specified indicators, which for this study include investment costs, increased income, reduced costs, reduced illness, community involvement, government welfare benefits, and future economic benefits and **Step 3: Data Analysis and Interpretation**, involves converting the outcome indicators into financial values, obtained from stakeholders. This will be done by applying economic methods, such as cost-benefit analysis, revenue and expenditure analysis, and using these to calculate the social return on investment (SROI).

The population and sample groups targeted for this study are divided into two categories, 1)

Patients with lower urinary tract disorders who require the use of a urine flow rate meter. The sample consists of patients with lower urinary tract disorders who seek treatment at the Faculty of Medicine Vajira Hospital in Bangkok and its surrounding areas from May 1, 2025, to August 31, 2025, will be 120 people will be included. 2) Public and private sector organizations involved, including doctors, nurses, and healthcare personnel (10 individuals), a company providing trial data (1 company), family members of patients with lower urinary tract disorders being treated at the Faculty of Medicine Vajira Hospital (30 individuals), and the academic institution and hospital participating in the project (1 institution). The sample selection process will follow a non-probability sampling method, starting with a quota system and using purposive sampling based on area and convenience. Participants must voluntarily agree to provide data, ensuring the study reflects the need to promote, support, and study the social return on investment in assessing the nighttime urination patterns of patients with lower urinary tract disorders using a home-based urine flow rate meter.

Measurement Tools, the tool used in this project is a semi-structured interview, which was employed to collect data for the study. The questions used to measure the variables and content were derived from a literature review to ensure relevance and alignment with the study's objectives. The social return on investment (SROI) assessment has several limitations, such as the need for proficiency in using the SROI CALCULATOR software (National Innovation Agency, Thailand, 2020), as well as basic financial and accounting skills to perform the SROI evaluation. Additionally, creating financial proxies for value conversion, calculating present value, determining the rate of return, and establishing the value of capital and outcomes requires forming assumptions, which must be handled with caution. Standard values for costs and revenues, such as minimum wage rates from the Ministry of Labor, salaries, and employee benefits from the Civil Service Commission, and other government agencies, were used in this process. For the numerical data analysis, a discount rate of 3.50% was applied to the calculations to interpret the results of the SROI.

Data Collection, Compilation, and Analysis, **Data** was collected and analyzed using semi-structured interviews, which were part of the research process to assess the social return on investment (SROI) for a project evaluating the urination patterns of patients with lower urinary tract symptoms using home-based urine flow measurement devices. This study is a part of the research and development process to create an evaluation framework, with the following steps, 1) Workshop for Data Collection: A workshop was conducted to collect data for the project evaluation based on the developed evaluation framework. 2) Group Discussions: Group discussions were organized with 5 participants per group. Participants were grouped according to their roles in the project. The research team acted as moderators, setting the discussion topics, while assistants recorded the discussions and contributed additional questions. In-depth interviews were conducted in a semi-structured format, with the research team creating the interview topics according to the evaluation framework based on the three pillars of sustainability: economic, social, and environmental outcomes. Research assistants conducted individual interviews with participants. 3) Analysis of Social Impact Results: The analysis involved summarizing results into a "results map," which includes input

factors, process activities, outputs, and the outcomes generated by the project and 4) Social Return on Investment (SROI) Calculation: The SROI was analyzed by calculating the ratio of social return on investment compared to the project's financial budget. This calculation allowed the research team to assess the impact of every 1 baht spent on the project. The data obtained from in-depth interviews were checked for completeness to ensure that all objectives were covered. Then, the accuracy of the data was verified through cross-referencing documents, interviews, and participatory observation to ensure consistency. The data was then analyzed based on the study objectives and synthesized to provide an overall understanding of the project under the relevant theoretical framework. The study results were summarized and presented through descriptive analysis, with the SROI being calculated as a financial value based on the SROI analysis process.

Data Analysis, the measurement of Social Return on Investment (SROI) is expressed as a financial value and assessed through the six-step SROI analysis process, 1) Stakeholders in the Research Project 2) Investment in the Research Project 3) Outcomes of the Changes 4) Calculation of Outcome Values 5) Adjustment of Outcome Values and 6) Project Reporting (National Innovation Agency, Thailand, 2020)

The interpretation of the SROI values is as follows, 1) An SROI greater than 1 indicates that the social value is greater than the investment, making the activity worthwhile. 2) An SROI equal to 1 means that the activity produces neither benefits nor returns. 3) An SROI less than 1 indicates that the activity does not generate a return. (Cambero, C. & Sowlati, T., 2014)

For this research project, the analysis of the SROI includes the following steps, 1) Analysis of Outcomes: The study analyzes the outcomes of the urination pattern of patients with lower urinary tract symptoms using home-based urine flow measurement devices from stakeholders. 2) Impact Chain Analysis: This involves analyzing the impact chain of the urination pattern of patients with lower urinary tract symptoms using the urine flow measurement devices at home. 3) Financial Proxy Analysis: This step analyzes the financial proxies for the urination pattern of patients with lower urinary tract symptoms using the home-based urine flow measurement device. 4) Impact Analysis:

The impact analysis focuses on the outcomes of the

urination pattern of patients with lower urinary tract symptoms using home-based urine flow

measurement devices. The detailed tables 1 to 4 are as follows:

Table 1: Analysis Of Outcomes for The Urination Pattern of Patients with Lower Urinary Tract Symptoms Using Home-Based Urine Flow Measurement Devices from Stakeholders.

Stakeholders	Details	Outputs	Outcomes
1. Patients with Lower Urinary Tract Symptoms	Patients with lower urinary tract symptoms receiving treatment at the Faculty of Medicine, Vajira Hospital, in the Bangkok metropolitan area from May 1, 2025 to August 31, 2025, totaling 30 participants or 120 participants.	<ol style="list-style-type: none"> Care and prevention of lower urinary tract symptoms in patients receiving treatment. Ability to self-manage the treatment of lower urinary tract symptoms. Reduction in hospital healthcare costs. Reduction in travel expenses and time lost from work. 	<ol style="list-style-type: none"> Knowledge, skills, and experience in the medical field related to lower urinary tract conditions using a home urinary flow rate meter. Safety behaviors and care systems for managing the urination patterns in patients with lower urinary tract symptoms using a home urinary flow rate meter. Development of training capabilities and skills in techniques using a home urinary flow rate meter. Feeling of safety when family members are knowledgeable about the urination patterns in patients with lower urinary tract symptoms using a home urinary flow rate meter. Receiving assessment of urinary flow rate at home.
2. Healthcare Professionals	Healthcare professionals from the Department of Surgery, Faculty of Medicine, Vajira Hospital, Navamindradhiraj University, totaling 10 participants.	<ol style="list-style-type: none"> Has the skills and knowledge to teach medical management related to lower urinary tract conditions using a home urinary flow rate meter. Has received training to develop the capacity to teach, train skills, and techniques in educational management using a home urinary flow rate meter. 	Has received training to develop the capacity to teach, train skills, and techniques in educational management using a home urinary flow rate meter.
3. Hospitals	Vajira Hospital, Faculty of Medicine, Vajira Hospital, Navamindradhiraj University.	Improved teaching management and increased capacity to accommodate more patients, along with a reduction in healthcare testing and treatment costs.	<ol style="list-style-type: none"> Teaching management on the use of home urine flow rate meters and increased capacity to accommodate more patients, along with a reduction in healthcare testing and treatment costs. The tool has been practically implemented, enabling the distribution of tests to smaller service units or to patients' homes, and allowing for closer monitoring of their treatment.
4. Patients' Relatives	Relatives of patients caring for individuals with lower urinary tract symptoms receiving treatment at the Faculty of Medicine, Vajira Hospital, in the Bangkok metropolitan area from May 1, 2025 to August 31, 2025, totaling 30 participants.	<ol style="list-style-type: none"> Can assist patients in the treatment of lower urinary tract diseases, being diagnosed and treated. Reduces healthcare costs for the hospital. Reduces travel costs and time lost from work. 	<ol style="list-style-type: none"> Safety behaviors and care systems associated with the use of home-based urine flow rate measurement for patients with lower urinary tract symptoms during nighttime urination. Development of training capacity, skill-building, and techniques using home-based urine flow rate measurement

			<p>tools.</p> <p>3. Feeling of safety related to having knowledge about the urination patterns of patients with lower urinary tract symptoms using home-based urine flow rate measurement.</p> <p>4. Reducing healthcare costs and decreasing expenses related to travel and lost work time.</p>
5. Community and Government Sectors	<ol style="list-style-type: none"> Public Health Office of the province. Hospitals in the Bangkok metropolitan area. Community members from the research project's sample group. 	Healthcare prevention and care network for patients with lower urinary tract symptoms using home-based urine flow rate measurement devices.	<ol style="list-style-type: none"> Increase the export value of medical equipment products and reduce the import of foreign products. Patients have better access to healthcare services, with more comprehensive and convenient examinations. Hospitals can accommodate more patients with reduced testing costs. Urine flow rate measurements are accurate, with a low failure rate. Doctors can more closely and comprehensively monitor the treatment of lower urinary tract patients.

Table 2: Analysis Of the Impact Chain for The Urination Pattern of Patients with Lower Urinary Tract Symptoms Using a Home-Based Urine Flow Rate Measurement Device.

Input	Activities	Output	User	Outcome	Impact
1. Development of the urination pattern for patients with lower urinary tract symptoms using a home-based urine flow rate measurement device.	Implementation of learning management for the urination pattern of patients with lower urinary tract symptoms using a home-based urine flow rate measurement device, including recording, measuring, and monitoring the frequency, force, volume, and duration of urination related to nocturia.	Knowledge, skills, experience, and safety behaviors in the healthcare system for managing lower urinary tract diseases with a home-based urine flow rate measurement device.	<ol style="list-style-type: none"> Patients with lower urinary tract symptoms Healthcare professionals Hospitals Patients' relatives Community and government agencies	<ol style="list-style-type: none"> Knowledge, skills, experience, and safety behaviors related to the healthcare system and lower urinary tract disorders using home-based urine flow rate measurement devices. Development of training potential, skill-building, and techniques for using home-based urine flow rate measurement devices. Sense of security when a patient's relatives have knowledge of the urination patterns of patients with lower urinary tract symptoms using home-based urine flow rate measurement 	<ol style="list-style-type: none"> Prototype of the urination patterns in patients with lower urinary tract symptoms using home-based urine flow rate measurement devices. Safety behaviors and care systems received with the urination patterns in patients with lower urinary tract symptoms using home-based urine flow rate measurement devices. Development of training potential, skill-building, and techniques using home-based urine flow rate measurement devices. Sense of security associated with

				<p>devices.</p> <p>4. Receiving home-based urine flow rate assessments.</p>	<p>knowledge of urination patterns in patients with lower urinary tract symptoms using home-based urine flow rate measurement devices.</p> <p>5. Reduced healthcare costs, as well as reduced travel expenses and time lost during work.</p> <p>6. Increased export value of medical instrument products and reduced imports of foreign products.</p> <p>7. Patients have greater access to healthcare services, more comprehensive evaluations, and enhanced convenience.</p>
<p>2. Participants trained on the urination patterns in patients with lower urinary tract symptoms using a home-based urinary flow rate measurement device include:</p> <ol style="list-style-type: none"> 1. Patients with lower urinary tract symptoms 2. Healthcare professionals 3. Hospitals 4. Patient relatives 5. Community members and Government agencies 	<p>The project activity focuses on the urination patterns of patients with lower urinary tract symptoms, using a home-based urinary flow rate measurement device. The research project duration is 1 year.</p>	<ol style="list-style-type: none"> 1. Care and prevention of lower urinary tract diseases in patients undergoing treatment. 2. Self-management of lower urinary tract diseases during treatment. 3. Reducing hospital healthcare costs. 4. Reducing travel expenses and time lost during work. 5. Assisting patients in managing lower urinary tract diseases during treatment. 6. Reducing hospital healthcare costs. 7. Reducing travel expenses and time lost during work. 	<ol style="list-style-type: none"> 1. Patients with lower urinary tract symptoms 2. Healthcare professionals 3. Hospitals 4. Patients' relatives <p>community and government agencies</p>	<ol style="list-style-type: none"> 1. Knowledge, skills, experience, safety behaviors, and the care system related to lower urinary tract diseases using home-based urine flow rate measurement devices. 2. Development of training capacity, skill building, and techniques using urine flow rate measurement devices at home. 3. Enhanced sense of safety when patient relatives are knowledgeable about the urination patterns for patients with lower urinary tract symptoms using home-based urine flow rate measurement devices. 4. Undergoing home-based urine flow rate assessments. 	<ol style="list-style-type: none"> 1. Prototype for urination patterns in patients with lower urinary tract symptoms using home-based urine flow rate measurement devices. 2. Safety behaviors and care systems provided using home-based urine flow rate measurement devices. 3. Development of training capacity and skill-building techniques using home-based urine flow rate measurement devices. 4. Sense of safety and understanding of the urination patterns for patients with lower urinary tract symptoms using home-based urine flow rate measurement devices.

					<p>5. Reduced healthcare costs and travel expenses, as well as reduced time lost from work.</p> <p>6. Increased export value of medical instrument products and reduced import dependency.</p> <p>7. Greater patient access to healthcare services, more comprehensive testing, and enhanced convenience.</p> <p>8. Hospitals can treat more patients with reduced diagnostic costs.</p> <p>9. Urine flow rate measurements are more accurate with low failure rates.</p> <p>10. Doctors can follow up with patients in the lower urinary tract group more closely and comprehensively.</p>
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Table 3: Financial Proxy Analysis for The Urination Patterns in Patients with Lower Urinary Tract Symptoms Using a Home-Based Urinary Flow Rate Measurement Device.

Stakeholders	Specific Outcomes	Indicators	Financial Proxies	Data Sources
1. Patients with lower urinary tract symptoms	Knowledge and skills related to using a home-based urinary flow rate measurement device, along with medical travel expenses	Cost per person for training in research-related skills and medical travel expenses (in Thai Baht)	<ul style="list-style-type: none"> -Financial valuation of knowledge gained from skill training on the use of a home-based urinary flow rate measurement device -Financial valuation of applying the acquired knowledge -Travel expenses, opportunity costs of work disruption, food and beverage costs, and other expenses associated with receiving medical care 	<ul style="list-style-type: none"> -Results of cost conversion from implementing the use of a home-based urinary flow rate measurement device, including the average training investment per person -Recording and calculating travel expenses, opportunity costs of work disruption, food and beverage costs, and other medical care expenses, based on the sample group average
2. Healthcare professionals	<ul style="list-style-type: none"> -Prototype model for analyzing the urination patterns in patients with lower urinary tract symptoms using a home-based urinary flow rate measurement device. -Development of training 	<ul style="list-style-type: none"> -Prototype model for analyzing the urination patterns in patients with lower urinary tract symptoms using a home-based urinary flow rate measurement device. 	<ul style="list-style-type: none"> -Financial valuation of knowledge gained from skill training on the use of a home-based urinary flow rate measurement device. -Financial valuation of the 	<ul style="list-style-type: none"> -Results of cost conversion from the operation of the home-based urinary flow rate measurement device and

	<p>capacity, skill-building, and techniques with the use of the device.</p> <ul style="list-style-type: none"> -Reduction in healthcare costs through improved operational practices. -Accurate urinary flow measurement with a low failure rate. -Enhanced ability for physicians to closely and comprehensively monitor and treat lower urinary tract conditions. 	<ul style="list-style-type: none"> -Decrease in data values when patients do not receive treatment at the hospital. -Knowledge, skills, and techniques related to using a home-based urinary flow rate measurement device. -Accurate urinary flow rate measurement with a low failure rate. -Physicians are able to more closely and comprehensively monitor and treat patients in the lower urinary tract group. 	<p>application of knowledge from the project budget.</p> <ul style="list-style-type: none"> -Operational costs of healthcare personnel and other medical treatment expenses. 	<p>opportunity costs in the research project, along with the project research budget.</p> <ul style="list-style-type: none"> -Average minimum daily wage for healthcare personnel.
3. Hospitals	<ul style="list-style-type: none"> - Prototype model for analyzing the urination patterns in patients with lower urinary tract symptoms using a home-based urinary flow rate measurement device. -Development of training capacity, skill-building, and techniques for using the device. -Reduction in healthcare costs, travel expenses, and time lost from work. -Increased export value of medical equipment products and reduced reliance on imports. -Patients have greater access to healthcare services, receive more comprehensive screenings, and experience more convenience. -Hospitals can accommodate more patients while reducing the cost of testing. -Physicians are able to more closely and comprehensively monitor and treat patients with lower urinary tract symptoms. 	<p>The reduced healthcare costs for the group of patients with the urination and lower urinary tract symptoms, which is the sample group.</p>	<ul style="list-style-type: none"> -Calculation of the financial conversion for reduced healthcare costs in the sample group. -Financial conversion of knowledge gained from skill training on using a home-based urinary flow rate measurement device. -Financial conversion of the application of knowledge from the project budget. 	<p>Report on expenses from recording and comparing healthcare costs of the sample group.</p>
4. Patient relatives, communities, and government agencies	<ul style="list-style-type: none"> -Providing care and prevention for patients with lower urinary tract disorders who undergo diagnosis and treatment. -Enabling self-care for patients with lower urinary tract disorders who receive diagnosis and treatment. -Reducing healthcare costs for hospitals. -Reducing travel expenses and time lost from work. -Acquiring the skills and knowledge to teach medical topics related to lower urinary tract disorders using a home-based urinary flow rate measurement device. -Expanding the ability to 	<p>The cost of training individuals in skills related to the research project, along with travel expenses for patient care and medical treatment (in Baht).</p>	<ul style="list-style-type: none"> -Financial conversion of the knowledge gained from skill training on using a home-based urinary flow rate measurement device. -Financial conversion of the application of knowledge from the project budget. 	<ul style="list-style-type: none"> -Results of cost conversion from the operation of the home-based urinary flow rate measurement device and opportunity costs in the research project, along with the project research budget. -Average minimum daily wage of patient caregivers for hospital visits, based on the sample group.

	provide care and support more patients. -Reducing healthcare costs for hospitals. -Reducing travel expenses and time lost from work. -Establishing a healthcare network to prevent and care for patients with lower urinary tract symptoms using a home-based urinary flow rate measurement device.			
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Table 4: Impact Analysis of The Urination Patterns in Patients with Lower Urinary Tract Symptoms Using a Home-Based Urinary Flow Rate Measurement Device's.

Stakeholders	Attribution	Deadweight	Drop-off	Displacement
1. Patients with lower urinary tract symptoms	50%	20-30%	20%	0%
2. Healthcare professionals	50%	10-20%	10%	0%
3. Hospitals	30%	40-50%	20%	0%
4. Patient relatives	50%	30%	20%	0%
5. Communities and government agencies	50%	30%	10%	0%

Data analysis will be conducted upon receiving complete data. This study evaluates the Social Return on Investment (SROI) using the program analysis model developed by the National Innovation Agency, Thailand, 2020. The model calculates the impact and the social return, yielding results such as Present Value (PV) for each year, Total Present Value, Net Present Value (NPV), and Social Return. The calculation of outcomes follows the formulas outlined below: Impact = Quantity X Value in currency X (1-deadweight) X (1-displacement) x (1-Attribution)

Calculating Social Return = if (duration > year, AF... O) X (1x drop off)
 Present Value = sum (Calculating Social Return)
 Total Present Value (PV) = total year (5) ÷ (1+Discount rate)
 Net Present Value = (Total Present Value (PV)) - (total inputs in currency)
 Social Return = Total Present Value (PV) ÷ (total inputs in currency)
 Investment in Project Implementation (Input) can be broken down as shown in Table 5.

Table 5: Investment In Project Implementation (Input).

Stakeholders	Input Factors/Resources	Value (THB/Year of Project Implementation)
(S1 Beneficiaries) Medical Personnel	1. Participation in capacity development, knowledge acquisition, research outcomes, and standard certification 2. Participation in management and coordination activities 3. Professional compensation 4. Participation in project activities 5. Reduction in patient care costs 6. Participation in project operation activities	Total 560,726.67 THB Breakdown of Costs: 1. Knowledge, skills, and experience development = 100,000.00 THB 2. Capacity-building training, skill enhancement, and techniques = 100,000.00 THB 3. Reduction in urinary flow rate assessment costs = 28,000.00 THB 4. Reduction in patient care costs = 28,000.00 THB 5. Salaries for doctors and nurses = 299,760.00 THB 6. Number of patient treatments = 4,966.67 THB

Hospital	<ol style="list-style-type: none"> 1. Participation in capacity building, knowledge development, research outcomes, and accreditation 2. Involvement in management and coordination 3. Professional fees 4. Participation in project activities 5. Reduction in patient treatment costs 6. Involvement in project operations 	<p>Total 2,488,989.20 THB</p> <p>This includes:</p> <ol style="list-style-type: none"> 1. Knowledge, skills, and experience = 28,000.00 THB 2. Reduction in urine flow rate assessment costs = 28,000.00 THB 3. Reduction in patient treatment costs = 478,890.00 THB 4. Income from management fees = 1,954,099.20 THB
Community, Public Sector	<ol style="list-style-type: none"> 1. Participation in capacity building, knowledge development, research outcomes, and accreditation 2. Involvement in project activities 3. Reduction in patient treatment costs 4. Involvement in project operations 	<p>Total 5,280,000.00 THB</p> <p>This includes:</p> <ol style="list-style-type: none"> 1. Knowledge, skills, and experience = 840,000.00 THB 2. Capacity building through training, skill development, and techniques = 2,400,000.00 THB 3. Increased sense of security = 840,000.00 THB 4. Increased urine flow rate assessment = 1,200,000.00 THB
Patients with Lower Urinary Tract Symptoms	<ol style="list-style-type: none"> 1. Participation in capacity building, knowledge development, research outcomes, and accreditation 2. Involvement in project activities 3. Reduction in patient treatment costs 4. Involvement in project operations 	<p>Total 3,871,932.00 THB</p> <p>This includes:</p> <ol style="list-style-type: none"> 1. Ultrasound = 96,000.00 THB 2. Urine test = 7,200.00 THB 3. Urine flow measurement using the device (urine strength measurement) = 120,000.00 THB 4. Cystoscopy = 240,000.00 THB 5. Kidney function tests = 9,600.00 THB 6. Medications = 6,690 THB 7. Opportunity cost (work) = 9,634.80 THB 8. Food expenses = 6,301.20 THB 9. Transportation costs for medical appointments = 17,106.00 THB 10. Knowledge, skills, and experience = 840,000.00 THB 11. Capacity building through training, skill development, and techniques = 840,000.00 THB 12. Increased sense of security = 840,000.00 THB 13. Reduction in urine flow rate assessment = 840,000.00 THB
(S2 Main Project Implementers) Main Project Implementers (Research Team)	<ol style="list-style-type: none"> 1. Participation in capacity building, knowledge development, research outcomes, and accreditation 2. Involvement in project activities 3. Participation in project operations 	<p>Total 2,250,000 THB</p> <p>This includes tools, equipment, and materials related to the home urine flow rate measurement device, as well as planning and executing project operations.</p>
(S3 Individuals/Groups Providing Direct Funding ssSupport) Faculty of Medicine, Vajira Hospital, Navamindradhiraj University, and Faculty of Engineering, Mahidol University.	<ol style="list-style-type: none"> 1. Participation in capacity building, knowledge development, research outcomes, and accreditation 2. Involvement in project activities 3. Participation in project operations 	<p>Total 750,000 THB</p> <p>This includes the execution plan related to the home urine flow rate measurement device project, as well as providing data collection and service preparation information to the research team and project stakeholders.</p>
The total investment in project implementation (Input)		17,019,409.87 THB

The outcome changes can be categorized as shown in Table 6.

Table 6: Outcome Changes.

Stakeholders	Outcome Dimensions	Outcome Changes	Outcome Indicator
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<p>(S1: Primary Beneficiaries) Medical Personnel</p>	<p>Innovation and Skills Dimension Economic/Financial Outcomes Well-being (Physical and Mental) Dimension</p>	<ol style="list-style-type: none"> 1. Improvement in operational and production processes leading to enhanced efficiency and effectiveness 2. Changes in expenses, costs, and resources associated with management and operational activities 3. Increased sense of self-reliance and professional autonomy 4. Process development contributing to greater organizational performance and impact 	<ol style="list-style-type: none"> 1. Reduced personal expenses for medical personnel due to project implementation 2. Changes in the value of expenditures, costs, and resources associated with operational management 3. Degree of improvement in perceived self-reliance and psychological well-being 4. Changes in the level of personal debt or financial burden
<p>Hospital</p>	<p>Innovation and Skills Dimension Economic/Financial Outcomes</p>	<ol style="list-style-type: none"> 1. Development of operational and production processes leading to increased efficiency and effectiveness 2. Changes in costs, expenditures, and resource allocation for management and activity implementation 3. Process innovation resulting in enhanced organizational performance 4. Acquisition of new skills and knowledge contributing to innovation development and scalability of project outcomes 5. Variations in revenue, budgeting, and resource management for activities and services 6. Expansion of treatment opportunities, networks, and collaborations with other institutions 7. Enhanced organizational unity and cohesion 	<ol style="list-style-type: none"> 1. Reduced personnel-related expenses due to project implementation 2. Changes in the value of expenses, costs, and resource use in service operations 3. Changes in levels of organizational or departmental debt 4. Changes in budget allocation and external support received 5. Degree of improvement in team or organizational unity 6. Degree of expansion in partnerships and opportunities related to the project
<p>Community and Government Sector</p>	<p>Innovation and Skills Dimension Economic/Financial Dimension Well-being (Physical and Mental) Dimension</p>	<ol style="list-style-type: none"> 1. Development of operational and production processes that lead to improved efficiency and effectiveness 2. Changes in expenditures, costs, and resource utilization for project management and implementation 3. Increased sense of self-reliance and empowerment within the community 4. Process innovation contributing to enhanced community service delivery 	<ol style="list-style-type: none"> 1. Reduction in personnel-related expenditures resulting from project implementation 2. Changes in the monetary value of costs, expenditures, and resources used in operational management 3. Degree of change in perceived self-reliance among community members 4. Change in levels of personal or household debt within the community
<p>Patients with Lower Urinary Tract Symptoms (LUTS)</p>	<p>Innovation and Skills Dimension Economic/Financial Dimension Well-being (Physical and Mental) Dimension</p>	<ol style="list-style-type: none"> 1. Improved operational or treatment processes leading to enhanced efficiency and effectiveness 2. Changes in patient-related costs, treatment expenditures, and resource utilization 3. Increased sense of self-reliance in managing personal health 4. Process innovation contributing to more effective and efficient care pathways 5. Adjustments in income, budgeting, and resource 	<ol style="list-style-type: none"> 1. Reduction in individual medical expenses resulting from project implementation 2. Changes in the monetary value of healthcare costs, treatment-related expenses, and resource allocation 3. Degree of improvement in self-reliance in managing symptoms and daily life 4. Changes in levels of personal or household debt due to improved management of health conditions

		management due to care and self-monitoring improvements	
(S2 Project Leaders) Project Leaders (Research Team)	Innovation Skills Economy/Finance Health and Well-being (Physical and Mental) Society, Community, and Relationships	<ol style="list-style-type: none"> 1. The development of processes leading to enhanced efficiency and effectiveness. 2. Income, budget, and resources for management and the execution of activities have changed. 3. Unity within the group and related organizations. 4. Expansion of opportunities for treatment, networks, and collaborative activities or projects with other organizations. 5. Unity within the group/organizations that have emerged. 	<ol style="list-style-type: none"> 1. Value of costs, expenses, and resources in the management of activities that have changed. 2. Changes in the level of self-reliance and the development of training, skills, techniques, and instructional management through the home-based urinary flow rate measurement device. 3. The level of income, budget, and resources for management that has developed through training, skill development, and instructional techniques related to the home-based urinary flow rate measurement device. 4. Changes in the level of unity within the group or organization. 5. Changes in the level of partnerships and related opportunities linked to the project.
(S3 Direct Funders/Supporters) Faculty of Medicine Vajira Hospital, Navamindradhiraj University, and Faculty of Engineering, Mahidol University.	Innovation Skills Economy/Finance Society, Community, and Relationships	<ol style="list-style-type: none"> 1. The development of processes leading to enhanced efficiency and effectiveness. 2. Income, budget, and resources for management and the execution of activities that have changed. 3. Unity within the group and related organizations. 4. Expansion of opportunities for treatment, networks, and collaborative activities or projects with other organizations. 5. Unity within the group/organizations that have emerged. 	<ol style="list-style-type: none"> 1. Value of costs, expenses, and resources in the management of activities that have changed. 2. Changes in the level of self-reliance and the development of training, skills, techniques, and instructional management through the home-based urinary flow rate measurement device. 3. The level of income, budget, and resources for management that have developed through training, skill development, and instructional techniques related to the home-based urinary flow rate measurement device. 4. Changes in the level of unity within the group or organization. 5. Changes in the level of partnerships and related opportunities linked to the project.

The calculation of the value of outcomes assessment, as shown in Table 7. (Valuation) results in the following valuation

Table 7: Valuation Of the Project's Outcomes.

Stakeholders of the Project	*Outcome of Chang	Importance	Value of Outcome (THB/Year of Project Implementation)
S1 - Beneficiaries			
Healthcare Personnel	The project has led to the development of operational and production processes, resulting in enhanced efficiency and effectiveness.	Has financial value	64.33
	Changes in the costs, expenses, resources, and management structures related to operations, production, and activity implementation have been observed.	Has financial value	17.83
	A sense of self-reliance has been achieved among healthcare personnel as a result of the improvements in skills and processes.	Has financial value	17.83

Total Value				560,726.67
Hospital	Development of management processes leading to increased efficiency and effectiveness.	Has financial value	50.00	750,000.00
	Creation of a sense of self-reliance.	Has financial value	50.00	750,000.00
Total Value				1,500,000.00
Community / Government	Acquisition of new skills and knowledge, leading to the development and expansion of innovative outputs in new forms.	Has financial value	62.12	3,280,00.00
	Acquisition of new skills and knowledge, leading to the development and expansion of innovative outputs in new forms.	Has financial value	18.94	1,000,000.00
	Creation of a sense of self-reliance.	Has financial value	18.94	1,000,000.00
Total Value				5,280,000.00
Family Members of Patients	Creation of a sense of self-reliance.	Has financial value	44.99	817,762.00
	Development of processes in operations/ production, leading to increased efficiency and effectiveness.	Has financial value	27.51	500,000.00
	Acquisition of new skills and knowledge, leading to the development and expansion of innovative outputs in new forms.	Has financial value	27.51	500,000.00
Total Value				1,817,762.00
Patients with Lower Urinary Tract Symptoms (LUTS)	Development of processes in operations/ production, leading to increased efficiency and effectiveness.	Has financial value	14.54	1,871,932.00
	Project activities impact mental and emotional health.	Has financial value	7.77	1,000,000.00
	Changes in income/budget/ resources for management, production, and activity implementation.	Has financial value	77.69	10,000,000.00
Total Value				1,817,762.00
Total Value for S1 Beneficiaries				22,030,420.67
S2 Project Implementers				
Project Leaders (Research Team)	Development of processes in operations/ production, leading to increased efficiency and effectiveness.	Has financial value	33.33	500,000.00
	Changes in income/budget/ resources for management, production, and activity implementation.	Has financial value	33.33	500,000.00
	Creation of unity within the group/ organization.	Has financial value	33.33	500,000.00
Total Value				1,500,000.00
Total Value for S2 Project Implementers				1,500,000.00
S3 Direct Funders/Supporters				
Faculty of Medicine Vajira Hospital, Navamindradhiraj	Expansion of business opportunities/ expansion of partnerships and networks/ collaborative activities or projects with other organizations.	Has financial value	50.00	750,000.00

University, and the Graduate School of Mahidol University	Development of operational/processes leading to enhanced efficiency and effectiveness.	Has financial value	50.00	750,000.00
Total Value				1,500,000.00
Research Team	Development of operational/processes leading to enhanced efficiency and effectiveness.	Has financial value	100.00	1,500,000.00
Total Value				1,500,000.00
Total Value for S3 Stakeholders/Direct Funders				3,000,000.00
S4 Other Related Individuals/Groups				
Patient's Family	Development of operational processes leading to enhanced efficiency and effectiveness.	Has financial value	50.00	250,000.00
	A sense of self-reliance.	Has financial value	50.00	250,000.00
Total Value				500,000
Hospital	Building relationships between individuals/groups/communities/organizations.	Has financial value	40.00	500,00.00
	Changes in costs/expenses/resources for management/production/execution of activities.	Has financial value	20.00	250,000.00
	Creation of unity within the group/organization that has emerged.	Has financial value	40.00	500,000.00
Total Value				1,250,000.00
Community and Government	Building relationships between individuals/groups/communities/organizations.	Has financial value	14.29	100,000.00
	Development of management processes leading to enhanced efficiency and effectiveness.	Has financial value	14.29	100,000.00
	A sense of self-reliance.	Has financial value	71.43	500,000.00
Total Value				700,000.00
Faculty of Medicine Vajira Hospital, Navamindradhiraj University, and Faculty of Engineering, Mahidol University.	Expansion of business opportunities/expansion of partnerships and networks/collaborative activities or projects with other organizations.	Has financial value	25.00	2500,000.00
	Development of management processes leading to enhanced efficiency and effectiveness.	Has financial value	25.00	2500,000.00
	Changes in costs/expenses/resources for management/production/execution of activities.	Has financial value	25.00	2500,000.00
	Promotion of image/raising awareness and recognition.	Has financial value	25.00	2500,000.00
Total Value				1,000,000.00
Medical Personnel	Expansion of business opportunities/expansion of partnerships and networks/collaborative activities or projects with other organizations.	Has financial value	46.50	260,726.62
	A sense of self-reliance.	Has financial value	17.83	260,762.62

	Development of operational processes leading to enhanced efficiency and effectiveness.	Has financial value	8.92	50,000.00
	Building relationships between individuals/groups/communities/organizations	Has financial value	8.92	50,000.00
	Changes in income/budget/resources for management/ production/ execution of activities.	Has financial value	17.83	100,000.00
Total Value				560,726.62
Total Value for S4 Other Relevant Individuals/Groups				4,010,726.62
Project Outcome Valuation				30,541,147.29

Note: Outcome Changes*

1. The calculation of outcome value requires a financial proxy estimation set at 3.50%, in order to evaluate cost-effectiveness. For outcomes that do not have a direct monetary value, market-equivalent estimations must be made using a choice modeling approach to calculate the social return on investment (SROI).
2. The research team analyzed and considered only those outcome values that resulted from specific project-related activities within the defined time frame.

Type**

1. With Financial Value: Refers to outcome changes that have a measurable financial value, such as increased income or reduced costs.
2. Without Financial Value: Refers to outcome changes that do not have a measurable financial value or cannot be directly quantified in monetary terms.

5. RESULTS

Social Return on Investment (SROI) Evaluation Results of the Study on Urination Patterns Among Patients with Lower Urinary Tract Symptoms Using a Home-Based Urinary Flow Rate Measurement Device. Two key discussion points have emerged from the results of the Social Return on Investment (SROI) evaluation for the project investigating nocturnal urination patterns in patients with lower urinary tract symptoms (LUTS) using a home-based urinary flow rate monitoring device.

1. Stakeholder Investment and Outcome Distribution, The total investment across stakeholder groups amounted to 17,019,409.87 THB. Among this, the primary beneficiaries (S1), including healthcare personnel, hospitals, local communities, government agencies, caregivers, and patients with LUTS,

accounted for 82% of the total investment. The principal implementers of the project (S2), i.e., the research team, represented 9% of the investment, while the funding bodies (S3), including the Faculty of Medicine Vajira Hospital, Navamindradhiraj University, Faculty of Engineering, Mahidol University and the research team, also contributed 9%. In terms of the total value of outcomes across all stakeholders, this was calculated at 30,541,147.29 THB. The distribution of this value indicated that the primary beneficiaries (S1) received 72% of the total outcomes. The research team (S2) received 5%, while the funding institutions (S3) received 10%. Other involved individuals or groups (S4), such as faculty members and medical personnel affiliated with the aforementioned institutions, received 13% of the total outcome value. The outcome dimensions were analyzed as follows, Social and Relational Capital (SR): 7%, Skills and Innovation (SI): 38%, Physical and Mental Health (HE): 18%, Economic and Financial (EC): 37%, Environmental Impact (EN): No measurable impact was observed in this dimension. These findings are illustrated in Figure 1.

2. The net social outcome value amounts to 13,521,737.42 THB. This indicates that for every 1 THB invested in the project, a social benefit of 1.79 THB was generated. An SROI ratio equal to or greater than 1 is considered a benchmark of project quality, signifying that the implementation successfully achieved its objectives and delivered effective outcomes. Furthermore, the rate of return on investment may vary depending on the number of participants involved and the duration over which the project is implemented. This suggests that the social benefits and financial value to society are likely to increase over time.

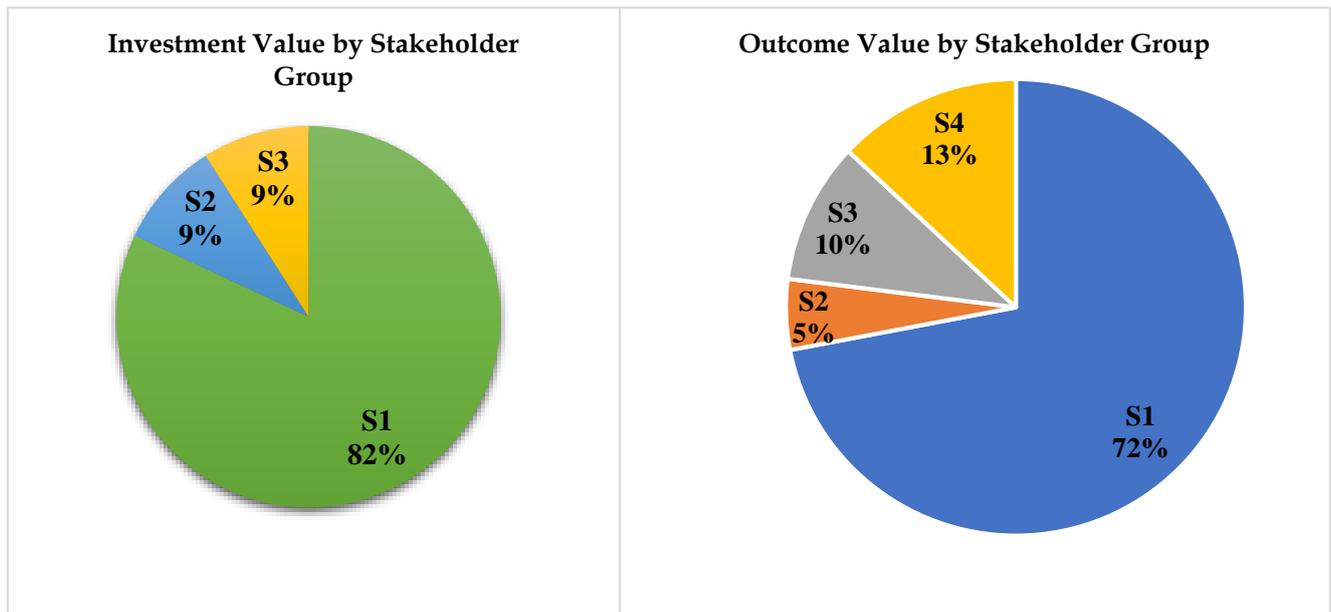


Figure 1: Investment Value, Outcome Value, And Impact Dimensions by Stakeholder Group. Source: National Innovation Agency: Sroi Calculator

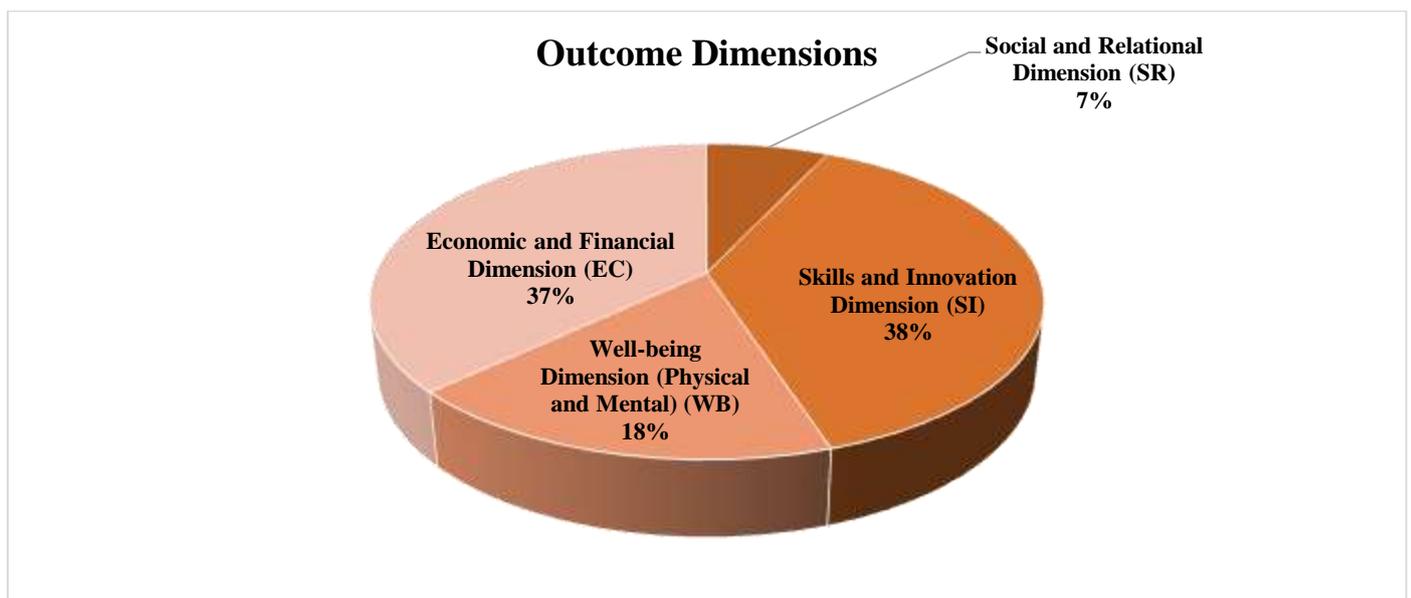


Figure 1: Investment Value, Outcome Value, And Impact Dimensions by Stakeholder Group. Source: National Innovation Agency: Sroi Calculator

6. CONCLUSIONS

This study aims to evaluate the Social Return on Investment (SROI) of a project that studies urination patterns in patients with lower urinary tract symptoms using a home-based urinary flow rate measurement device. The results show that the total investment value is 17,019,409.87 THB, while the value of the project's outcomes is 30,541,147.29 THB. The distribution of benefits is significantly seen

among key stakeholders, which can be categorized into four main areas as follows, **1) Impact on Key Beneficiaries (S1)**: The key beneficiaries include medical personnel, hospitals, communities, government sectors, patients' relatives, and patients with lower urinary tract symptoms, who account for 82% of the benefits from the investment. The distribution of outcomes in this group reflects the project's importance to the healthcare system,

especially in reducing clinical burdens, shortening waiting times for treatment, and improving home-based symptom monitoring efficiency. This is in line with the World Health Organization's (WHO) 2021 approach, which emphasizes using digital health technology to enhance medical service access. The impact on the research team (S2) and funders (S3) is also notable, with the research team benefiting from 9% of the outcomes, largely related to knowledge development and future research potential. Funders, including the Faculty of Medicine Vajira Hospital, Navamindradhiraj University, the Faculty of Engineering, Mahidol University, and the research team, receive 9% of the outcomes, indicating that the project offers value in academic investment and health innovation. The analysis of skill and innovation (SI) accounted for 38%, highlighting the promotion of knowledge development and the application of technology in monitoring urinary health, in line with digital health research trends (Topol, 2019). The economic and financial impact (EC) was 37%, showing the economic effects of reducing public health costs and alleviating patients' burdens from traveling to medical facilities. The health and well-being impact (HW) at 18% demonstrates the improvement in patients' quality of life and reduction in concerns about urinary symptoms affecting their mental health. The social and relationship impact (SR) was 7%, reflecting the creation of social networks and community involvement in healthcare, as seen in the research by Greenhalgh et al. (2020), which emphasized the role of home-based health monitoring technology in reducing clinical burdens and improving healthcare efficiency. However, an important consideration is the accessibility of technology for elderly groups and the readiness of digital infrastructure, which warrants further study. **2) Value of Outcomes and Distribution of Outcomes:** The total value of outcomes amounts to 30,541,147.29 THB. The key beneficiaries (S1) received 72% of the outcomes, the research team (S2) received 5%, the funders (S3) received 10%, and other relevant individuals or groups (S4: healthcare personnel and related agencies) received 13%. The distribution of these benefits reflects the social and economic value of the project, particularly its systemic impact on related sectors. The high proportion of benefits (72%) received by key beneficiaries demonstrates the project's effectiveness in reducing medical and public health burdens through home-based health

technology, which reduces the need for in-person hospital visits, lowers costs, and improves patients' quality of life. This aligns with Greenhalgh et al.'s (2020) research showing that home-based health monitoring technology helps reduce healthcare system burdens and improves chronic disease management. The research team's 5% share reflects the knowledge development and potential for future research. This outcome is in the form of academic publications, innovation creation, and the enhancement of researchers' capabilities, which are crucial factors for advancing healthcare systems and health technology (Topol, 2019). The funders, including Faculty of Medicine, Vajira hospital, Navamindradhiraj University, the Faculty of Engineering, Mahidol University, and the research team, benefit from 10%, showcasing the value derived from investing in medical research and health innovation. This is consistent with Brynjolfsson and McAfee's (2014) research, which highlights that investing in medical innovations can reduce long-term costs and improve healthcare service efficiency.

Healthcare personnel and relevant agencies received 13%, which reflects the systemic changes in infrastructure and healthcare service delivery. The use of technology for home health monitoring could alleviate hospital burdens, enhance public health policy effectiveness, and promote the use of modern medical technologies. **3) Analysis of Social Impacts:** The project has an impact on five main dimensions: Skill & Innovation (SI), Economic & Financial (EC), Health & Well-being (HW), Social & Relationship (SR), and Environmental (EN). The proportion of impacts in each dimension reflects the social value of the project from various perspectives, which can be analyzed in detail as follows. **3.1) Skill & Innovation (SI):** 38% - This project plays a crucial role in the development of health knowledge and medical technology, particularly through the use of home-based urinary flow rate measurement devices. It allows healthcare personnel and researchers to obtain accurate data and apply it to the development of future health innovations, supporting the global trend of home-based health monitoring (Topol, 2019). Previous studies have shown that using technology for home health monitoring can reduce healthcare system burdens and enhance patient access to quality care (Greenhalgh et al., 2020). **3.2) Economic & Financial (EC):** 37% - The economic impact of this project results from reduced public

health costs and patient expenses, including travel costs to medical appointments, hospital testing fees, and related treatment costs. Related studies show that home-based health technology can reduce healthcare facility costs by 30-40%, particularly for patients with chronic diseases (Deloitte, 2021). Furthermore, investments in health innovations can create long-term economic returns by reducing hospital congestion and improving healthcare resource allocation. Brynjolfsson & McAfee (2014) also state that digital technologies can enhance economic efficiency by lowering costs and increasing labor productivity in the healthcare system. **3.3) Health & Well-being (HW):** 18% - The project enhances patients' quality of life by reducing stress from traveling to see doctors, minimizing inconvenience in accessing tests, and allowing for continuous self-monitoring. Previous studies show that home health monitoring can reduce anxiety levels and increase patient satisfaction (Greenhalgh et al., 2020). Additionally, using technology for home healthcare helps improve patients' independence, enabling them to manage their health more effectively, a practice supported by the WHO (2021). **3.4) Social & Relationship (SR):** 7% - This project contributes to building healthcare networks in the community by promoting the involvement of patients' relatives, healthcare personnel, and related agencies. Holistic healthcare, relying on social networks, plays a vital role in promoting mental health and the overall quality of life for patients (Topol, 2019). Greenhalgh et al. (2020) found that community and family involvement in healthcare enhances cooperation in treatment, reduces recurrence rates, and improves the overall healthcare system. **3.5) Environmental (EN):** 0% - The study found no direct environmental impacts. However, in the future, considerations regarding the environmental impact of medical devices used at home and the disposal of waste generated by these devices may be necessary. Research on sustainable healthcare suggests that home-based health technologies can reduce hospital energy consumption and medical waste (Deloitte, 2021). While no immediate environmental impact is evident, further long-term studies should address this issue. **4) Net Results and Social Return on Investment:** The net outcome value of the project is 13,521,737.42 THB, which results from subtracting the total investment value (17,019,409.87 THB) from the total value of outcomes (30,541,147.29 THB). The

SROI is 1.79, indicating that the project significantly generates social value. Relevant studies show that health projects focused on using technology to reduce costs and improve patient care efficiency tend to have high social returns (McDaid et al., 2019), which is consistent with this study's results. The use of home-based urinary flow rate measurement devices reduces patient expenses, eases hospital burdens, and improves patient quality of life. An SROI of 1.79 demonstrates that the project not only delivers substantial value currently but also has the potential to generate further value in the future if it can expand to include more patients. Additionally, the SROI could increase if the project is improved or expanded, such as by increasing participant numbers or extending the project duration, as greater technology adoption helps lower the per-unit cost of investment (Brouwer et al., 2021). This aligns with Fujiwara's (2015) research, which suggests that health projects using technology to monitor patient symptoms tend to produce higher social returns as data is used to further develop health systems. Expanding the project should be considered for further evaluation.

7. RECOMMENDATIONS

The study on Social Return on Investment (SROI) for the home-based urinary flow rate measurement device in patients with lower urinary tract symptoms emphasizes the use of digital technology to improve home healthcare and reduce the burden on the healthcare system. The study suggests the following recommendations for development, 1) Expansion of the Study Scope: The study could be expanded to include other patient groups, such as the elderly or individuals with chronic diseases, to enhance outcomes and provide broader insights into the social and economic impacts. 2) Long-term Impact Analysis: A long-term impact evaluation should be conducted to assess the sustainability of the outcomes after the project's completion, evaluating how lasting the benefits of the technology are. 3) Access to Technology: Research should focus on the accessibility of technology for elderly individuals or those with digital limitations to create an appropriate support system for these groups. 4) Technology Development and Improvement: Further development of the technology to make it more user-friendly and efficient will help increase the future returns on investment, improving both functionality and ease of use. 5) Environmental Impact

Considerations: There should be an assessment of the resource usage and waste management from home medical devices, including efforts to reduce energy consumption within the healthcare system.

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