

A Health Promotion Program for Improving Weights, Body Mass Indexes, and Body Compositions among Individuals with Non-communicable Diseases in Thailand: RE-AIM Model and Financial Feasibility Study

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Abstract

Background: Non-communicable diseases (NCDs) are serious health issues in many countries. This paper aimed to evaluate a wellness center or health promotion program using the reach, effectiveness, adoption, implementation and maintenance (RE-AIM) framework and to investigate financial feasibility of NCDs prevention and promotion program in Thailand. **Methodology:** A retrospective plus interview study was used in this paper. Data were obtained from two wellness centers in public hospitals, Thailand. RE-AIM model was used to evaluate the program. Financial feasibility was performed with the home exercise and fitness center models based on financial and service assumptions. **Results:** A total of 217

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participants were included in this study. After attending the prevention and promotion program for more than two months, the participants' body weights and body mass indexes reduced significantly. Regarding the RE-AIM framework, the wellness centers reached target groups and continued providing services in the public hospitals. In terms of a financial feasibility study, the model could break-even in the first year (0.36 year for home exercise, while a fitness center model was 5.44 years with a fee of 4,500 THB per person). For the internal rate of return (IRR), both models showed positive investment. **Discussion:** RE-AIM model indicated that the wellness centers successfully reached its target groups. The findings provided a positive outcome and positive investment by financial feasibility study despite small sample size. Further studies are recommended to involve more hospitals to improve the generalizability of our findings.

Keywords: health promotion program, body mass index, body compositions, RE-AIM, financial feasibility study

การศึกษาความเป็นไปได้ทางการเงินของโปรแกรมการส่งเสริมสุขภาพของสถานพยาบาลโดยปรับใช้กรอบการประเมิน RE-AIM

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บทคัดย่อ

กลุ่มโรคไม่ติดต่อ (non-communicable diseases, NCDs) นับว่าเป็นปัญหาหลักด้านสุขภาพทั่วโลก การศึกษานี้มีวัตถุประสงค์เพื่อประเมินโปรแกรมการส่งเสริมสุขภาพของสถานพยาบาล (wellness center) โดยปรับใช้กรอบการประเมิน RE-AIM (reach, effectiveness, adoption, implementation and maintenance) และศึกษาความเป็นไปได้ทางการเงินของโปรแกรมการส่งเสริมสุขภาพ โดยใช้วิธีการศึกษาแบบย้อนหลังเสริมด้วยการสัมภาษณ์เพื่อยืนยันข้อมูลที่ได้รับ (retrospective plus interview study) การวิเคราะห์ความเป็นไปได้ทางการเงินนำเสนอในสองรูปแบบการให้บริการอันได้แก่ รูปแบบการออกกำลังกายที่บ้าน (home exercise) และรูปแบบของการใช้ fitness center โดยใช้ข้อมูลสมมติฐานทางการเงินและการจัดบริการต่างๆ ที่เกี่ยวข้อง ผลการศึกษาพบว่า การประเมินโปรแกรมโดยใช้โมเดล RE-AIM แสดงให้เห็นว่า โปรแกรมการส่งเสริมสุขภาพเข้าถึงในทุกกลุ่ม ถึงแม้ว่าตัวอย่างจะน้อยในการศึกษานี้แต่ผลการศึกษาแสดงถึงผลลัพธ์ในเชิงบวก กล่าวคือจากจำนวนผู้ที่เข้ารับการบริการในโปรแกรมทั้งสิ้น 217 ราย มีผลลัพธ์ในเรื่องการลดน้ำหนักและดัชนีมวลกายที่ดีขึ้น ภายหลังจากการเข้าร่วมโปรแกรมการส่งเสริมสุขภาพเกินกว่าสองเดือน ทั้งนี้จากแบบจำลองสามารถนำมาขยายต่อในสถานพยาบาลทั้งภาครัฐและเอกชน นอกจากนี้เมื่อประเมินความเป็นไปได้ทางการเงินของโปรแกรมสองรูปแบบ พบว่า การให้บริการทั้งสองแบบ มีจุดคุ้มทุนในปีแรกของการจัดบริการ โดยรูปแบบ home exercise มีระยะเวลาคืนทุน 0.36 ปี และรูปแบบ fitness center มีระยะเวลาคืนทุน 5.44 ปี สำหรับการคิดอัตราค่าบริการ 4,500 บาทต่อรายสำหรับการรับบริการ 6 เดือน ส่วนผลการวิเคราะห์อัตราคืนทุนภายในโครงการให้ผลบวกซึ่งหมายถึงการลงทุนทั้งสองรูปแบบมีความคุ้มค่า อย่างไรก็ตาม การศึกษานี้มีโปรแกรมการส่งเสริมสุขภาพในสถานพยาบาลเพียงสองแห่งและยังพบความท้าทายในเรื่องระบบข้อมูล ดังนั้นในการศึกษาครั้งต่อไปควรเพิ่มจำนวนสถานพยาบาลที่มีการจัดบริการส่งเสริมสุขภาพเพื่อพัฒนาข้อค้นพบจากการศึกษานี้

คำสำคัญ: โปรแกรมการส่งเสริมสุขภาพ, ดัชนีมวลกาย, องค์ประกอบของร่างกาย, RE-AIM, ความเป็นไปได้ทางการเงิน

Background and Rationale

Non-communicable diseases (NCDs) are serious health issues globally. Approximately 71% of all deaths worldwide were attributable to NCDs, and 77% of NCDs deaths happened in low- and middle-income countries.⁽¹⁾ In Thailand, of 75% of all deaths in 2009 were related to NCDs. The Thai population aged 15 years and over living with NCDs increased from 6.9% in 2009 to 8.9% in 2013 with more males living with disability than females. The top three NCDs among the Thai population in 2014 were stroke, diabetes, and ischemic heart disease.⁽²⁾ Hypertension causing stroke increased from 21.4% to 24.5%, approximately 600,000 persons.⁽³⁾

The growing prevalence and incidence of NCDs represent a significant disease burden and have a substantial impact on not only population health and healthcare system but also the country economy and wealth. As Thailand is facing an increasing trend of NCDs, subsequent economic loss from NCDs will significantly rise. Previous research estimated that the cost of NCDs was about THB 280 billion in 2013.⁽⁴⁾ In the absence of adequate health policy to combat or impede the NCDs, they would have eventually a far-reaching impact on population health, and their costs would be too much to handle.

In 2011, the Thai cabinet introduced the Thailand Healthy Lifestyle Strategic Plan for 2011-2020⁽⁵⁾ to encourage related ministries to collaborate in managing NCDs. Following this plan, the Ministry of Public Health (MoPH) later introduced the NCD Clinic Plus 2017 program in healthcare facilities

across the country. The goal of this program was to encourage healthcare providers to provide high-quality NCD care based on the six elements: 1) formation of commitment to set policies and strategies, 2) information system, 3) service management arrangement, 4) self-care promotion, 5) decision-making support, and 6) connecting services to the communities. The target population was patients with four major NCDs: diabetes, hypertension, cardiovascular disease, and chronic kidney disease. The NCD Clinic Plus 2017 program incorporated annual screening, risk behaviors modifications, and knowledge exhibition. In addition, an intensive individualized plan for people who were at risk of cardiovascular disease was implemented for a month.

However, effectively encouraging patients to change their health behaviors is a critical skill of primary care physicians. The NCD Clinic Plus program was considered a remarkable health promotion policy direction for Thailand, but this intervention targeted only the NCD patients, not people at risk of NCDs. Further, the key performance indicators (KPIs) of the program were focusing on the pre- and post-reporting weights, body mass indexes (BMI), and body compositions of the NCD patients to monitor their improvements. These three indicators were important among patients with chronic conditions because they were associated with several NCDs. The NCD Clinic also established a set of performance indicators to measure the effectiveness of health facilities in achieving a common goal of the

program. Some health facilities chose their own proactive health promotion programs to meet the KPIs, as they believed that failure to address factors such as weight, BMI, and body composition would limit the success of the program in combatting NCDs.

As the health facilities in Thailand had different ways to establish their health promotion programs aiming at improving weight, BMI, and body compositions for individuals at high risk of NCDs, this study aimed to evaluate the wellness center models using RE-AIM (reach, effectiveness, adoption, implementation and maintenance) framework^(6,7) and investigated a financial feasibility of NCDs prevention and promotion program. The RE-AIM framework provides a holistic approach to evaluate the translation of scientific advances into practice and public health impact.⁽⁸⁾ By using RE-AIM framework, all health promotion program facilitators can gain a deeper understanding of the factors that contribute to the program's success or failure and make informed decisions about program design, dissemination, and implementation.

Methodology

Data

This was a retrospective study that utilized data obtained from two wellness centers located in Taptan Hospital and Banglen Hospital - during the fiscal year 2019. These hospitals were selected through purposive sampling based on two inclusion criteria: the availability of prevention and promotion services, and the presence of data

to be used for evaluating and studying financial feasibility of prevention and promotion program. A retrospective study plus interview study was used for the purposes of this study. For quantitative analysis, we collected general information, BMI, body composition, and weight before and after attending the program. Semi-structured interviews to hospital and project administrators were carried out to understand the providers' characteristics, service activities related to NCDs prevention and promotion, and organization structure.

Measures

Demographic information consisted of age, sex, type of participants and chronic conditions.

The body mass index (BMI) was calculated from weight (kg)/height² (m²). BMI is classified as underweight (<18.5 kg/m²), normal (between 18.5 and 22.9 kg/m²), overweight between 23.0 and 24.9 kg/m², obesity level 1 25.0-29.9 kg/m², and obesity level 2 > 30 kg/m², respectively.

Body compositions were measured by the bioelectrical impedance analysis. Taptan Hospital participants' body compositions were measured by the Inbody Thailand InBody-270 and Tanita InnerScan Build-Pack. Banglen Hospital participants' body compositions were measured by TANITA RD-953. Each model was a standard automatic body composition machine.

Data analysis

Descriptive statistics of demographic data were analyzed as standard deviation (SD), number (n), and percentage (%) as appropriate. Paired

samples T test was used to analyze weight, BMI, and body composition before and after the programs. All statistical tests were two sided and the significance level was set at $p < 0.05$. Data analysis was performed with SPSS, version 19 (SPSS, Chicago, IL, USA).

Program evaluation

We used the RE-AIM framework and definitions to evaluate the program.^(9,10) 1) Reach refers to the number of willing participants in a given program. 2) Effectiveness refers to the results of an intervention on participating individuals. 3) Adoption refers to the number of settings/sectors involved. 4) Implementation refers to the initiative activities required for successful program. And 5) maintenance is defined as the long-term effects and outcomes of a completed program.

A financial feasibility of NCDs prevention and promotion program

Data on services provision from two hospitals as well as financial assumptions regarding capital investment, utilization rate, revenue and expenditure were required. For a financial feasibility study, steps taken were: 1) created a model of NCDs prevention and promotion program using information from two hospitals. 2) study of financial feasibility using financial indicators included net present value, break-even point, payback period, and return on investment. Assumptions of a financial feasibility study were capital investment, utilization rate, revenue, and expenditure

without taxation. This is because there is no tax income in the public sector. Financial feasibility was performed into two models including home exercise and fitness center.

Ethical considerations

In this study, only the hospital's administrative information which contained anonymous individual information was used, therefore, research ethical review was not required.

Results

Data of 217 participants from two wellness centers in public hospitals were analyzed. Their ages were from 14 to 67 years old, with an average age of 43 years old. Most participants were female (71.4%). Most of them were from general populations. Over 50% of the participants had a body mass index (BMI) of at least 25. And 72 participants had hypertension, diabetes and dyslipidemia. A total of 118 participants attended NCD programs for more than two months (Table 1).

Overall, the results showed that weight and BMI of participants changed significantly. Comparing between the 2 hospitals, participants from hospital B had higher weight change (5.77) after attending a program than participants from hospital A (1.89). For BMI, participants from hospital B had higher BMI change (2.4) after attending a program than its counterpart. There was no BMI change among participants from hospital A (Table 2).

Table 1 Demographic characteristics of participants

	Hospital A		Hospital B		Total	
	N=165	%	N=52	%	N=217	%
Sex						
Male	51	30.9	11	21.2	62	28.6
Female	114	69.1	41	78.8	155	71.4
Age (years)						
> 15	1	0.6	0	0	1	0.5
15-59	145	87.9	49	94.2	194	89.4
60 and above	19	11.5	3	5.8	22	10.1
BMI (before attending program)						
< 18.5	2	1.2	0	0	2	0.9
18.5-22.9	45	27.3	1	1.9	46	21.2
23.0-24.9	16	9.7	1	1.9	17	7.8
25.0-29.9	68	41.2	20	38.5	88	40.6
≥ 30	34	20.6	30	57.7	64	29.5
Living with chronic illness						
Hypertension	7	4.2	13	25	20	9.2
Diabetes	6	3.6	2	3.8	8	3.7
Dyslipidemia	44	26.7	0	0	44	20.3
No diseases	108	65.5	37	71.2	145	66.8
Attending program						
Discontinued after 2 months	94	57.0	5	9.6	99	45.6
Continued after 2 months	71	43.0	47	90.4	118	54.4

Table 2 Changes in weight and body mass index (BMI) of participants

Hospital	n	Mean ± SD		Mean difference	Sig.	Mean ± SD		Mean difference	Sig.
		Weight before	Weight after			BMI before	BMI after		
A	71	68.80 ± 15.98	66.91 ± 15.25	1.89	0.000*	26.26 ± 4.75	25.93 ± 5.07	0.32	0.455

For body composition, only hospital A had available data for analysis. Results showed that

only body fat mass changed significantly after attending the program (Table 3).

Table 3 Body composition of participants

Body composition	n	Mean $\pm$ SD		Mean difference	sig
		Before	After		
Total body water	71	33.62 $\pm$ 7.78	33.61 $\pm$ 7.71	0.01	0.926
Protein	71	9.05 $\pm$ 2.14	9.03 $\pm$ 2.11	0.01	0.669
Minerals	71	3.17 $\pm$ 0.68	3.17 $\pm$ 0.69	0.00	0.985
Body fat mass	71	22.96 $\pm$ 9.05	21.17 $\pm$ 8.89	1.84	0.000*
Fat free mass	71	45.84 $\pm$ 10.59	45.82 $\pm$ 10.50	0.02	0.900
Skeletal muscle mass	71	25.26 $\pm$ 6.43	25.25 $\pm$ 6.36	0.01	0.935
Percent body fat	71	32.92 $\pm$ 8.53	30.99 $\pm$ 9.22	1.92	0.000*

A financial feasibility of NCDs prevention and promotion program

A financial feasibility was performed in the two models, consisting of home exercise and fitness center using financial and services assumptions. The financial assumptions were capital investment, service utilization rate, revenue and expenditure without tax (Supplementary).

The services assumption was that everyone would receive services one time per month for 6 months. There were 4 main services program including assessment, empowerment, coaching and fitness program.

1. Assessment services including biometric assessment, psychometric assessment, health risk assessment, and medical history assessment of participants.

2. Empowerment services including counseling, goal setting, and motivating patients to

continue their program.

3. Coaching including diet coaching using food models, and workshops for participants.

4. Fitness program was planned activities for individuals based on their conditions.

Revenue and expenditure estimations included both the home exercise model and the fitness center model. For the home exercise model, the expenditure increased every year. If the service fees were 2,500 THB per person, it would make revenue lower than expenditure starting from year 5. However, the service fees of 3,500 THB per person made a profit from year 1 to year 10. For the fitness center model, the expenditure also increased every year. If the service fees were 4,000 THB per person, the revenue was less than expenditure (a loss) started from year 8. However, if the service fees were 4,500 THB per person, program would make a profit over the period from

year 1 to year 10.

Moreover, the two models had a break-even point in the first year, suggesting that revenue would equal to expenditure. Besides, there was net profit from two models in the first year. However, it was estimated that expenditure increased every year while revenue remains constant.

In addition, a payback period for home exercise was 0.36 years with a fee of 3,500 THB

per person while, a payback period for fitness center model was 5.44 years with a fee of 4,500 THB per person.

For the internal rate of return (IRR), it was 31% from the home exercise model with service fees 2,500 THB per person. IRR was 268% for home exercise (if service fees were 3,500 THB per person) model which encourages people to do more physical exercise at home or at other

Table 4 The wellness center evaluation using RE-AIM model

RE-AIM framework	Wellness center	Notes
Reach (individual)	There were 3 target groups. 1. People at risk of NCDs who attended annual health checks at hospital. 2. People who were willing to attend the program. 3. Patients from NCDs clinics	Target groups covered healthy people and people at risk of NCDs in accordance with the wellness center policy.
Effectiveness (individual)	An average of weight and body mass index (BMI) were reduced significantly after participants attending wellness center program.	Motivation process played a crucial role in behavior change.
Adoption (setting level)	1. A pilot study in 16 public hospitals in 2018 but only 2 public hospitals had enough data to evaluate the program. 2. A total of 217 participants from 2 public hospitals attended the program (using 2019 data)	
Implementation (mainly at setting/sector level)	1. The services provided at the wellness center in hospitals included: assessments (e.g., biometric, psychometrics, health risk, medical history assessments), empowerment (i.e., counseling, goal setting, and motivation), and coaching (i.e., diet and physical activity coaching) 2. Only 118 from 217 participants attended programs for more than two months.	
Maintenance (individual and setting/sector level)	1. This program continued providing services in hospitals and expanded to other public hospitals. It benefits individuals who would like to continue the program. 2. It was the collaboration between Department of Disease Control, Department of NCDs, and Department of Health, Ministry of Public Health.	Required funding support from government agencies.

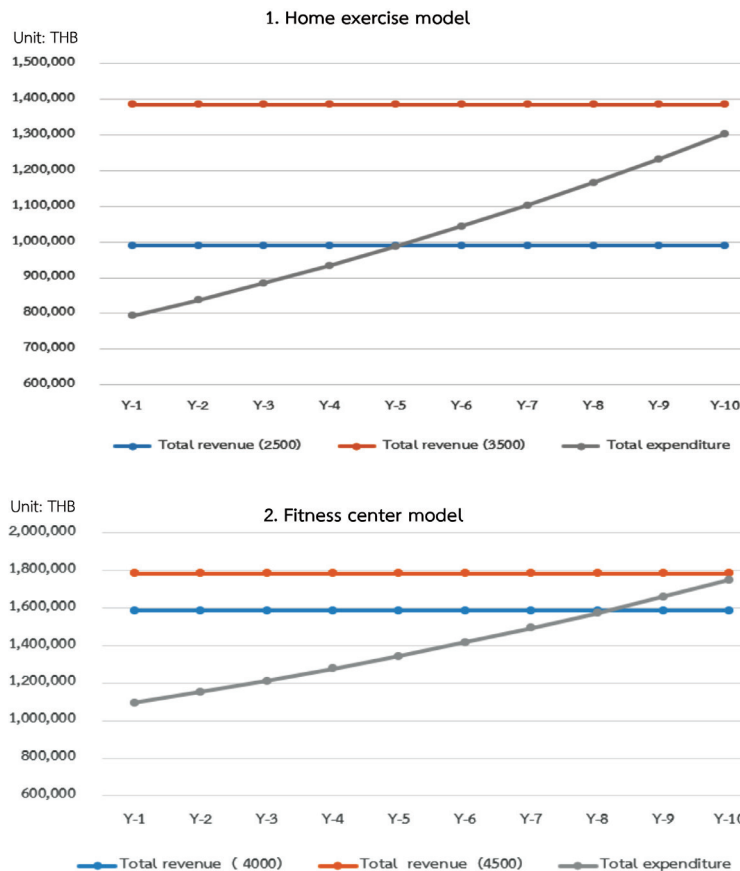


Figure 1 Revenue and expenditure estimation of home exercise and fitness center models

convenient places. On the other hand, the fitness center model with service fees 4,000 and 4,500 THB per person had IRR $\leq 1\%$ which means a financial feasibility of this model was low. However, if add 4 providers team in the fitness center model with service fees 4,500 THB per person, IRR would become 73% with payback period of 1.22 years.

Discussion

This study evaluated the wellness centers in two public hospitals using RE-AIM model, and studied financial feasibility of NCDs prevention and promotion program.

There were four processes in this program, including assessment, empowerment, coaching

and fitness program. Each participant received services once a month for six months. The results showed that the average weight and body mass index (BMI) had reduced significantly after participants attended the prevention and promotion program. Previous studies indicated that lifestyle change intervention, weight reduction could reduce the incidence of persons at high risk of diabetes^(11,12) and also improve CVD risk factors.⁽¹³⁾

From participants' perspectives, most of them reported that willingness was the main factor of the key success. One observation was participants from NCD clinics and participants from a screening program of NCDs were not willing to attend the program. As a result, there was no change

in weights and BMI in this group. Therefore, empowerment process should be more promoted to increase participants' motivation and willingness. Body composition analyzer is often employed in research to study obesity.⁽¹⁴⁾ In this study, only body fat mass changed significantly after attending the program. However, there were some recommendations from experts for using that tool reducing error value such as urination before measurement or do not use cosmetics before measurement.

Program evaluation using RE-AIM model demonstrated that the wellness centers successfully reached its target groups needed both healthy people and people who were at risk for non-communicable diseases (NCDs) which contributed to strengthening public health. In addition, the result showed positive outcome in terms of weight and BMI. However, there are some challenges from program that needs to improve including information system, financial sustainability and standard guideline.

A financial feasibility model, including home exercise program and fitness center program, showed positive results, suggesting that both programs made profits. Findings also showed that the programs could be operated by private sector not limited to public sector. For the home exercise program, the results suggested investing this service with a fee of 3,500 THB per person, which would yield an internal return rate (IRR) of 268%, a net present value (NPV) of THB 2,248,170 and a payback period was 0.36 years. To track participants' performances, fitness tracker or

fitness watch was recommended to be used during attending program. For fitness center program, the findings suggested investing this service with a fee of 4,500 THB per person, which would yield an IRR of 73%, a net present value (NPV) of THB 9,021,479.48 and a payback period was 1.22 years. One study investigated the business financial feasibility of a fitness center, which provided exercise equipment, yoga class, and sauna, in Thailand showed an NPV of THB 1,298,609, an IRR of 63%, and the payback period was 1.6 years with the initial investment of THB1,799,970⁽¹⁵⁾. Another study investigated the business financial feasibility of a sports club showed an NPV of THB 44,654,917, an IRR of 31.44%, and the 4-year payback period with an investment of THB 31,670,000.⁽¹⁶⁾ Comparing our results with the two studies, our two fitness models had higher IRR shorter payback periods, and break-even point in the first year of the investment plan.

This study had several limitations. First, the study was a retrospective study. To make a better prediction, future studies are recommended to use a prospective design. Second, there were only two public hospitals, which had a very different number of participants in this study. Third, there was only one hospital that had adequate data on the participants' body composition for change analysis, before and after attending a prevention and promotion program. Fourth, dropout rate was high. Fifth, a financial feasibility model did not consider willingness to pay for membership fee. Lastly, the feasibility study was based on assumptions, some of which were baseless. However, the

result of this study highlighted the usefulness of health promotion program and the benefits of health behavior modification for NCD patients which could be reduced future healthcare expenditure. Also, a financial feasibility model for both models reported positive cash flow for 10 years. Further studies are recommended to involve more hospitals to improve the generalizability of our findings.

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Data Availability Statement: The data presented in this study are available on request from the corresponding author.

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Supplementary

Financial and service assumptions

Assumption 1 Capital investment

Table 1 Equipment and building

No.	Home exercise model	Fitness center model
1	Body composition analyzer	Treadmill
2	Fitness trackers or fitness watches	Dumbbells and shelves
3		Fitness air bike
4		Upright bike
5		Recumbent bike
6		Elliptical
7		Machine weights
8		Flat weight bench
9		Bench press
10		Body composition analyzer
11		12 doors lockers (19.4 × 45.8 × 183 cm)
12		Water dispenser
13		40-inch TV
14		Air conditioner
15		Building (area 152.5 sq m.)

Note: Building has a useful life of 25 years, fitness trackers or fitness watches and body composition analyzer have a useful life of 3 years. Other equipment has a useful life of 5 years.

Assumption 2 Service utilization rate

Table 2 Estimation of service utilization

No	Model	Service utilization per day	Service utilization per month	Service utilization per year	Customers per year (persons)	A number of team
1	Home exercise model	9	198	2,376	396	1
2	Fitness center model	9	198	2,376	396	1

Assumption 3 Revenue and Expenditure

Table 3 Revenue

No.	Details	Home exercise model	Fitness center model
1	Number of customers per year (persons)	396	396
2	Service fees per person (THB)	3,500	4,500
3	Total revenue (THB)	1,386,000	1,782,000

Table 4 Human resource

No.	Details	Home exercise model	Fitness center model
1	Assessment and empowerment	1	1
2	Nutritionist	1	1
3	Sports science	1	1

Table 5 Labor cost per year

No.	Details	Home exercise model	Fitness center model
1	Assessment and empowerment	240,000	240,000
2	Nutritionist	240,000	240,000
3	Sports science	240,000	372,000

Noted: Labor costs increase by 6% each year in financial feasibility model.

Table 6 Utilities, maintenance and others

No.	Expenditure	Expenditure rate
1.	Material supplies - Home exercise model - Fitness center model	2.5% of labor cost 7.5% of labor cost
2.	Utilities - Home exercise model - Fitness center model	20% of labor cost 20% of labor cost
3.	Maintenance - Home exercise model - Fitness center model	10% of depreciation 10% of depreciation
4.	Others	3% labor cost
5.	Electricity	Estimated by (Watt * price per watt * 22 days * 12 months)
6.	Water	Estimated by (unit * price per unit * 22 days * 12 months)