

**EVALUATING THE DETERMINANTS OF CHOOSING IN-  
HOUSE VERSUS OUTSOURCED GENETIC SERVICES IN  
THAI HOSPITALS: A CASE STUDY OF BUMRUNGRAD  
INTERNATIONAL HOSPITAL**

The seal of Mahidol University is a circular emblem. It features a central golden figure, likely a deity or a royal figure, set against a blue background. The figure is surrounded by a golden border containing Thai script. The entire seal is rendered in a light, semi-transparent style.

**PROMPRON POONPRASEART**

**A THEMATIC PAPER SUBMITTED IN PARTIAL  
FULFILLMENT OF THE REQUIREMENTS FOR  
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Thematic paper  
entitled  
**EVALUATING THE DETERMINANTS OF CHOOSING IN-  
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HOSPITALS : A CASE STUDY OF BUMRUNGRAD  
INTERNATIONAL HOSPITAL**

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OF BUMRUNGRAD INTERNATIONAL HOSPITAL**

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**ABSTRACT**

This study investigates the key factors influencing the decision between offering in-house genetic services versus outsourcing these services at Bumrungrad International Hospital in Thailand. The hospital, prioritized for its patient-centered approach, faces a critical operational decision that impacts cost management, turnaround time, and overall service quality. The research focuses on exploring the cost-effectiveness, patient preferences, service lead times, and collaboration with specialized laboratories, while also investigating the role of local expertise and technical teams in supporting in-house services. Data were collected through in-depth interviews with healthcare professionals at various levels, revealing that in-house genetic services generally offer faster turnaround times and better integration with existing infrastructure, but require significant initial investment. The study highlights the importance of cost management strategies, patient-centered service development, efficient lead time management, strategic collaborations, and continuous staff training to ensure high standards of genetic services. The findings suggest that a balanced approach combining in-house capabilities with strategic outsourcing can optimize both operational efficiency and patient satisfaction.

**KEY WORDS: IN-HOUSE GENETIC SERVICES/ OUTSOURCED GENETIC  
SERVICES/ PATIENT SATISFACTION/ HOSPITAL OPERATIONS/  
THAILAND**

39 pages

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# CHAPTER I

## INTRODUCTION

### 1.1 Background

The ecosystem of hospital operations has front-end and back-end processes which both play crucial roles in improving patient satisfaction and outcomes. Optimizing workflow by reducing turnaround times affects operational decisions, particularly in genetic testing, where timely results are essential for accurate diagnosis and treatment. The choice between in-house and outsourced genetic services is a significant operational decision that impacts these factors.

Bumrungrad International Hospital, known for its patient-centered approach, serves in this case study for evaluating the factors of choosing in-house versus outsourced genetic services. The hospital assesses the risk level and urgency of genetic testing needs through initial evaluations in the medical clinic department. Based on this evaluation, patient samples are directed to either in-house or outsourced genetic testing laboratories, depending on urgency and necessity for diagnostic or screening purposes. This decision-making process impacts cost management, turnaround time, and the hospital's commitment to high-quality patient care by streamlining workflow operations.

Assessing the cost-effectiveness of in-house diagnostics compared to outsourced services reveals potential control over diagnostic processes and how to integrate seamlessly with existing infrastructure. Evaluating operational and financial implications is crucial for long-term savings by leveraging existing resources that provide faster results, leading to better patient outcomes and timely diagnosis. Improving patient satisfaction and health outcomes through customized diagnostic options strengthens the hospital's market position by ensuring affordability and accessibility for diverse patient segments. Investigating market segmentation leads to customized services to meet specific patient needs as personalized care. The hospital can identify key market segments for targeted marketing by addressing unique requirements and optimizing resource allocation for better operational efficiency. Examining the impact of service lead time



on operations reveals the importance of timely results to support better health outcomes through faster treatment initiation. Enhancing patient satisfaction by reducing wait times and underscoring effective time management in the hospital. Collaborating with outsourced specialized laboratories demonstrates the benefits of accessing advanced diagnostic tools and more reliable testing results. The role of local expertise and technical teams in supporting in-house genetic services highlights the value of leveraging expertise and the importance of training for maintaining high standards of patient care long-term.

By examining all these factors, this study will provide comprehensive insights into the strategic considerations hospitals must make to ensure efficient and effective genetic testing services, ultimately contributing to better patient care and operational excellence.

## **1.2 Research Objectives**

To investigate the key factors influencing Bumrungrad International Hospital's decision to offer in-house genetic services versus outsourced genetic diagnostics.

1. Evaluate the operational and financial implications of in-house genetic services at Bumrungrad International Hospital.
  - Assess the cost-effectiveness of maintaining in-house genetic diagnostics compared to outsourced services.
  - Explore how pricing strategies are developed for genetic testing packages to different segments.
  - Compare the costs associated with outsourced genetic services, including potential higher costs due to global service fees.
2. Investigate the market segmentation and target demographics for Bumrungrad International Hospital's genetic services.
  - Identify key market segments and their specific needs and preferences.
  - Determine the factors contributing to high patient satisfaction and areas for improvement.
3. Examine the impact of service lead time on patient care and hospital operations.

- Compare the turnaround times between in-house and outsourced genetic services.
  - Identify how lead time influences patient satisfaction and hospital workflow.
4. Assess the collaboration between Bumrungrad International Hospital and specialized laboratories or other organizations.
    - Investigate the nature and benefits of these collaborations to enhance service quality and efficiency.
    - Determine how these partnerships enhance the quality and reliability of genetic services.
  5. Study the key role of local expertise and technical teams in supporting in-house genetic services.
    - Analyze the training and development of technical teams.
    - Identify challenges and opportunities in managing specialized teams within the hospital.

### **1.3 Research questions**

1. What are the cost-effectiveness and pricing strategies of in-house genetic services compared to outsourced services at Bumrungrad International Hospital?
2. What are the key market segments and their specific needs and preferences for genetic services at Bumrungrad International Hospital?
3. How does the lead time for in-house versus outsourced genetic services impact patient satisfaction and hospital workflow at Bumrungrad International Hospital?
4. How do collaborations with specialized laboratories and other organizations enhance the quality and reliability of genetic services at Bumrungrad International Hospital?
5. What are the challenges and opportunities in training, developing, and managing technical teams to support in-house genetic services at Bumrungrad International Hospital?

## CHAPTER II

### LITERATURE REVIEW

#### 2.1 Operational and Financial Implications of In-House Genetic Services

The reviewed literature highlights several critical factors influencing the decision for in-house genetic services over outsourced alternatives in healthcare organizations. A recurring concern is the cost-effectiveness of in-house services.

The decision to insource or outsource services, as examined over 25 years in the public sector, should be strategically aligned with organizational goals. In-house services often offer better control, integration, and improved cost management and service quality (Haugen & Klungseth, 2017).

For instance, in-house genetic services are significantly important for hereditary cancer detection using strategies like Lynch syndrome detection, providing significant cost savings and improved health outcomes through streamlined processes and better integration with existing healthcare infrastructure (Morrow et al., 2020). In-house genetic testing for endocrine tumors is also more cost-efficient due to lower operational costs and faster turnaround times, enhancing both cost management and patient outcomes (Patócs et al., 2024).

In-house whole genome-wide association studies can be more cost-effective in the long run, leveraging existing infrastructure and expertise, with initial setup costs being offset by operational savings (Krissaane et al., 2020). Similarly, integrating whole genome sequencing (WGS) into healthcare, particularly at institutions like Karolinska University Hospital, demonstrates significant benefits such as reduced turnaround times and enhanced diagnostic accuracy due to the proximity of resources and expertise (Stranneheim et al., 2021).

Although in-house genetic services have initial setup costs, these costs are offset by savings in operational and data management expenses over time. For example, in the case of pediatric patients, in-house WGS and whole-exome sequencing (WES) are particularly cost-effective, reducing costs compared to external service fees and

improving diagnostic yields, which in turn leads to better health outcomes and long-term savings (Wildin, 2024).

Moreover, in-house genetic services can lead to long-term financial advantages by supporting innovations and exploring research opportunities. By maintaining control over genetic testing processes, healthcare providers as hospitals can participate in advancement research and develop proprietary technologies and methodologies which lead to secure grants and funding from internal operation improvement. These activities not only contribute to the hospital's reputation but also open new revenue streams and reduce dependence on laboratories from the outside country due to the high cost of fees and high turnaround time of testing results. (Garrison & Towse, 2017).

Overall, the literature underscores that in-house genetic services can substantially reduce diagnostic times, improve cost-effectiveness by leveraging in-house expertise and integrated resources, and offer better control over service quality and cost management. These findings suggest that, when feasible, in-house genetic services can provide significant operational and financial advantages for healthcare institutions.

## **2.2 Market Segmentation and Target Demographics for Genetic Services**

Understanding customer needs and preferences is crucial in healthcare, and effective target marketing involves identifying specific segments based on various criteria to improve patient satisfaction and outcomes.

Health consumers can be segmented based on different factors. Demographic, psychographic, and behavioral criteria are key for target marketing (Elrod, J. K., & Fortenberry, J. L., 2018). Psychological determinants and socio-demographic variables influence health behaviors and preferences (Bloem, S., 2020). Medical knowledge and self-management ability highlight the need to customize service production processes (Brommels, M., 2020). Healthcare needs and service utilization provide a detailed analysis of patient demographics and chronic disease prevalence (Low, L. L., 2017).

These segmentation strategies help meet individual needs and preferences more effectively. By tailoring marketing and services to demographic, psychographic, and behavioral segments enhances satisfaction and loyalty (Elrod, J. K., & Fortenberry,

J. L., 2018). Furthermore, designing health programs around psychological and socio-demographic factors improves patient satisfaction (Bloem, S., 2020). Also customizing services based on medical knowledge and self-management abilities optimizes resource use and outcomes (Brommels, M., 2020).

In conclusion, segmenting based on healthcare needs and utilization leads to efficient resource allocation and better outcomes (Low, 2017). By understanding each segment's characteristics, providers can create more effective and personalized health coaching, leading to better overall patient satisfaction.

### **2.3 The Impact of Service Lead Time on Patient Care and Hospital Operations**

Efficient management of service lead time is a crucial role in healthcare organization into different aspects and its effects for maintaining high standards of care. Several studies provide insights into how various aspects of lead time management affect patient satisfaction, and hospital operation

Higher workloads of the healthcare team and longer service times are associated with increased patient wait times and potential declines in patient safety. So, efficient management of service times is critical for maintaining high standards of care in healthcare organizations and maintaining patient satisfaction (Brossard, Minvielle, & Sicotte, 2022).

The integration of genetic services into primary care faces barriers that require addressing lead time issues to enhance patient satisfaction and streamline operations (Kam et al., 2021). By utilizing big data analytics in hospital operations can enhance service delivery by reducing lead times and improving patient flow, leading to better resource management and increased patient satisfaction (Brossard, Minvielle, & Sicotte, 2022c).

Moreover, timely genetic testing and reporting are crucial for optimal patient management. Studies indicate that reducing lead time in genetic services leads to higher patient satisfaction due to quicker diagnosis and treatment initiation. Quick turnaround times for test results can lead to better patient experiences and improved

satisfaction rates, underscoring the importance of efficient lead time management in healthcare and also maintaining patient loyalty.(Olsson, Hellström, & Vakulenko, 2022).

In addition to improving patient satisfaction and hospital workflow, efficient lead time management can also enhance clinical decision-making and reduce healthcare costs. Shorter lead times allow healthcare providers to make quicker and more informed decisions, which can lead to timely diagnosis and better health outcomes. Furthermore, reducing lead times can minimize the need for repeat visits and unnecessary hospital stays, thereby lowering overall healthcare operation costs and increasing the efficiency of resource utilization (Vezyridis & Timmons, 2019).

In summary, the literature consistently highlights that efficient lead time management is crucial for improving patient safety, satisfaction, and overall hospital efficiency. Addressing lead time issues in various healthcare settings, particularly genetic services, can significantly enhance patient outcomes and streamline hospital operations.

## **2.4 The Collaboration between Hospitals and Local Specialized Laboratories**

The collaboration between healthcare providers and local specialized laboratories is essential for enhancing service quality and diagnostic accuracy. As highlighted in the study of Alderwick et al. it can enhance by leveraging the strengths of different organizations. Partnering with specialized laboratories enhances diagnostic accuracy, reduces turnaround times, and improves patient satisfaction to improve health outcomes and service quality. (Alderwick et al., 2021; Kam et al., 2021).

Some healthcare providers emphasize collaboration by providing a shared platform for data exchange among experts. This also improves the coordination between hospitals and specialized laboratories, leading to better-integrated care and more reliable genetic testing results (Vos et al., 2020; Kam et al., 2021).

By determining to enhance the reliability of genetic services, these partnerships enhance reliability through better resource allocation, access to advanced diagnostic tools, and comprehensive genetic counseling and testing services which lead more lead more accurate diagnostics, reduced turnaround times, and improved patient outcomes (Alderwick et al., 2021b; Kam et al., 2021).

Moreover to improve diagnostic accuracy and reduce turnaround times, partnerships between hospitals and specialized outsourced laboratories facilitate continuous education and training for healthcare professionals. These collaborations ensure that healthcare teams stay updated with the latest advancements in genetic testing and diagnostics knowledge, which is crucial for maintaining high standards of care. Continuous professional development through joint training programs and workshops can lead to more accurate interpretations of genetic tests and better patient counseling. Moreover, these partnerships can support innovation by enabling joint research initiatives, leading to the development of new diagnostic techniques and personalized treatment plans (Hou & Michaud, 2020).

In conclusion, leveraging the strength among healthcare providers and local expertise laboratories leads to better-integrated care and ensures more reliable genetic testing results, ultimately contributing to better healthcare outcomes and patient satisfaction

## **2.5 The key role of local expertise and technical teams in supporting in-house genetic services**

Various studies have examined different aspects of the role of local expertise and technical teams in supporting in-house genetic services. It is critical in enhancing the quality and efficiency of healthcare, including the evaluation and effectiveness of technical assistance, the integration of genetic service, and transforming teams into expert teams.

The literature emphasizes the importance of transforming teams of experts into cohesive expert teams. This study highlights developing expert teams through targeted interventions and continuous training among various teams aimed at improving teamwork and the overall performance of technical teams in healthcare. It is shown to significantly enhance the performance and efficiency of in-house genetic services. (Bisbey et al., 2021).

Another key message is the necessity of initiating effective structured training and development programs. The study initiates the importance of structured training and development for technical teams in healthcare organizations. They emphasize that these programs are crucial for sustainable improvements in service delivery through continuous learning, skill enhancement, and the application of best practices to support

high standards of care (Scott et al., 2022). Another study showed that collaborative environments and specialized training programs also enhance diagnostic capabilities and overall service quality as well. (Stranneheim, H., 2021)

Continuous training and development of specialized teams are essential for managing transformational changes in healthcare services. This approach ensures that specialized teams remain competent and capable of delivering high-quality care in healthcare organizations (Taylor et al., 2022). In addition to continuous training and structured development programs, creating opportunities for specialized teams within hospitals to participate in collaborations and leadership roles can significantly enhance their effectiveness. Encouraging specialized teams to engage not only broadens their skills but also supports the culture of innovation and sharing confidently. This is the way to approach and lead to improved problem-solving capabilities, higher job satisfaction, and better retention rates among healthcare professionals. Additionally, providing platforms for specialized teams to contribute to hospital-wide decision-making processes ensures that their expertise is leveraged in strategic planning and policy formulation of the hospital, further enhancing the overall quality of care (Salas et al., 2008).

To conclude studies collectively underscore the critical role of local expertise and technical teams in supporting in-house genetic services. Well structured training programs and collaborative efforts support continuous development to maintain high standards of healthcare delivery which relate to better patient outcomes.



## **CHAPTER III**

### **RESEARCH METHODOLOGY**

#### **3.1 Research Design**

This section presents exploration of the perspectives and experiences of the research design that can be employed to comprehensively evaluate the determinants of choosing in-house versus outsourced genetic services at Bumrungrad International Hospital.

#### **3.2 Population and Sample**

This study population consists of all healthcare professional teams involved in genetic services at Bumrungrad International Hospital. This study targets three specific levels of personnel: heads of professions, senior professionals, and operational staff. Representatives from these levels will be selected from clinical administrators, healthcare professionals, and lab technicians. The sample selection process is as follows:

1. Heads of Professions: Two top-level professionals from the clinical and laboratory departments who oversee and make decisions for genetic services in both front-end and back-end processes.
2. Senior professionals: Four experienced professionals with significant expertise and responsibilities in genetic services.
3. Operational staff: Two frontline staff members directly involved in the day-to-day operations of genetic services, covering both front-end and back-end processes.

### **3.3 Data Collection Methodology**

This study aims to provide comprehensive insights into the strategic considerations and operational impacts of choosing in-house versus outsourced genetic services, ultimately contributing to better patient care and operational excellence at Bumrungrad International Hospital. By understanding the healthcare professions' perspective.

Data collection will be conducted using in-depth interviews with clinical administrators, healthcare professionals, and lab technicians of three different levels (heads of professions, senior professionals, and operational staff). These interviews will discuss highlighting areas for improvement and the factors contributing to patient satisfaction. These sessions will further an open interview on the experiences and insights of healthcare professionals about operation management, market segmentation strategies, and the rationale behind choosing in-house or outsourced services.

### **3.4 The research question for an in-depth case study**

#### **3.4.1 Heads of Professions**

1. How do you assess the cost-effectiveness of maintaining in-house genetic diagnostics compared to outsourced services? (Aims to understand the top-level evaluation of cost efficiency from decision-makers.)
2. What are the key market segments for Bumrungrad's genetic services, and what are their specific needs and preferences? (Aims to identify key market segments and their requirements from a strategic viewpoint.)
3. What is the impact of lead times on patient care and hospital operations compared to the turnaround times between in-house and outsourced genetic services from a management perspective? (Aims to seek a comparative analysis of turnaround times on operations and care from a management perspective.)
4. How do the collaborations with specialized laboratories or other organizations enhance the quality and reliability of genetic services? (Aims to understand the impact of collaborations on service quality.)
5. What are the challenges and opportunities in managing specialized teams within the hospital? (Aims to identify both challenges and opportunities in team management.)

### **3.4.2 Senior Professionals**

1. Could you provide specific examples of cost differences you have observed between in-house and outsourced genetic services which may impact genetic testing packages? (Aims to explore the effectiveness of current pricing strategies highlight practical cost differences )

2. How do you evaluate and identify patient segments for genetic services? (Aims to explore methods for demographic identification and targeting.)

3. What measures are in place to prioritize patient cases and evaluate service lead times for genetic diagnostics? (Aims to explore existing measures to improve lead times.)

4. Can you describe any significant outcomes which impact service quality and efficiency from these collaborations? (Aims to examine the operational impact of partnerships with specific outcomes.)

e. How does the expertise of local teams impact the effectiveness of genetic services? (Aims to examine the contribution of local expertise to service effectiveness.)

### **3.4.3 Operational staff**

1. What challenges do you face dealing with the price offered associated with patients for genetic services? (Aims to identify specific pricing strategy challenges faced by operational staff.)

2. What feedback do you receive from different patient segments about our genetic services? (Aims to explore insight from direct patient's feedback as reported by front-line staff.)

3. What steps do you take to manage patient expectations regarding turnaround times for the service? (Aims to investigate methods used to manage patient expectations.)

4. How does working with external laboratories affect your daily operations and service delivery? (Aims to investigate the direct impact of collaborations on daily work.)

5. What training have you received to support in-house genetic services? Any challenges do you face in your role? (Aims to investigate the challenges faced by operational staff and understand the training.)

## CHAPTER IV

### FINDINGS

#### 4.1 Interview results

1. Interview result from Heads of Professions - Laboratory departments; H1

“...In terms of service sustainability, we primarily consider the needs of the doctors, focusing on the speed of test results while keeping the test costs the same and reducing overall costs. We also ensure quality according to standards. For example, a test that doesn't significantly increase in price but reduces the time to get results or increases the utilization of existing lab equipment would encourage more in-house testing.

When diverse test samples are sent in, we select only one test from one organization to prevent confusion among doctors. If a test is required by large hospitals according to Thai regulations, the nurses must make it available.

The direction for service quality improvement involves increased automation and AI integration for decision support. For instance, analyzing digital images with AI helps group cell characteristics more quickly and accurately, reducing human error since humans rely on judgment and intuition.

To evaluate the team's and specialists' quality, we use a system of quality training and HR competency evaluation. When a new testing system is introduced, everyone in the lab must be able to perform the test. Employees are sent for training and tested to assess their competence...”

2. Interview result from Heads of Professions - Clinical departments; H1

“... To ensure smooth coordination and good relationships between departments, we hold monthly meetings where doctors and staff can regularly update each other and strengthen their working relationships. If policies are announced, all employees can access the information through the hospital's application.

Regarding collaboration with external organizations to improve service quality standards, the volume of tests significantly impacts cost reduction through shared costs.

If every organization in the country conducts its own tests, each one bears the cost until it becomes profitable.

Collaboration with external organizations within the country increases resource sharing and knowledge among local professionals. Sending samples abroad only utilizes services, but collaborating within the country fosters technological and knowledge development.

In managing cost uncertainties, the hospital's strength lies in strict procurement practices, emphasizing bulk deals with external organizations to lower costs. However, tests with low volumes carry the risk of price instability.

The hospital adjusts test prices annually based on the costs of test reagents and equipment from suppliers. Each year, we forecast the number of tests for each type to help plan costs. For example, some tests spike during specific seasons, like health check-ups at the beginning of the year.

When new technology is introduced, we assess its impact before adoption. If we are confident that it can be used for patient sample analysis or diagnosis at 100%, we will decide to adopt it. However, if the technology is still under development, we will not use it for patient samples ...”

### 3. Interview result from Senior professionals - Laboratory departments; S1

“... We don't decide to run tests in-house or outsource them all at once. We look at things like the facility, the costs involved such as reagents or buying new facilities, and the volume of tests. From there, we can determine the monetary value. Turnaround time is considered based on the break-even point, and typically, in-house testing has a faster turnaround time than sending it out to an external lab.

If a department has expertise in certain tests to support diagnosis, our lab will study and incorporate those new tests to support new patient treatment methods. However, if the test cases are still low, we'll send those tests to an external lab instead.

If there's a trend showing an increase in test volumes, the committee will evaluate and come to a consensus to consider a new business unit. Most of the test evaluations are based on the doctors' needs, looking at whether the lab already has a guideline marker for the tests they want. If the number of tests is still low, it's more cost-effective to send them to an external lab rather than increasing the validation costs ... ”

#### 4. Interview result from Senior professionals - Laboratory departments; S2

“...The decision to perform tests in-house comes from the doctors' expectations for quick results. Our team's quality control includes several aspects: 1) Training 2) Knowledge Sharing 3) Quality control documents 4) Card files 5) Competency documents 6) Work instructions 7) IQC/IQA 8) Preventive maintenance.

The challenges we face include the development gap between our HIS database and the sequencing testing record database, making some systems incompatible. Implementing these systems is difficult and requires purchasing additional storage systems, increasing the cost for each test. Another challenge is that the hospital has established a documentation system, ensuring that we can provide world-class quality service. Therefore, our team needs to adhere strictly to the documents and standards set by the hospital ...”

#### 5. Interview result from Senior professionals - Clinical departments; S3

“... Most of the time, it's the doctors who choose for the patients, rather than the patients making their own decisions. The patients who come for testing are usually referred by the Genetic Center, NIPT department, Obstetrics department, Cancer department, or Pediatrics department. When it comes to team management, we expect everyone in the team to be able to perform the assigned tests.

Choosing a vendor for collaboration with the hospital is quite crucial. We don't consider contracts with external organizations unless they pass our quality control system or have certificates equivalent to or higher than our hospital's standards. When we select a vendor, we evaluate the accuracy of their lab results and the time it takes to complete the tests. Sometimes, if one lab can cover multiple types of tests, it's more cost-effective than sending samples to a lab that can only handle one type of test.

Following the hospital's protocols is critical because we're dealing with patients, and there should be no errors. This can be quite challenging for new employees ...”

#### 6. Interview result from Senior professionals - Clinical departments; S4

“... When a doctor requests a new test, we hold monthly meetings to discuss how to interpret the test results. We conduct research to evaluate new testing methods and seek approval from the senior director while also considering the cost-effectiveness of the tests.

Communication between the wet lab team and the analysis team is key. We have morning briefs to discuss the day's tasks, and we hold subunit meetings each month. If there are any credential-related matters, we communicate through Microsoft Teams. For policy-related issues, we send emails or pop-up alerts through the PeopleSoft program.

One of the challenges we face is the rapid advancement of technology. Doctors have high expectations for the accuracy of genetic testing results, so our team needs to constantly update their knowledge and keep up with technological advancements ...”

#### 7. Interview result from Operational staff - Laboratory departments; O1

“... As an Operational staff member in the Laboratory Department, my primary responsibility is to perform assigned tests efficiently and contribute to our team's overall improvement. When new employees join us, they are trained by experienced team members, ensuring they gain the necessary skills and knowledge. After the training, their performance is evaluated by our quality assessment team and supervisors using a standardized checklist. One challenge we face is finding experienced personnel since our testing techniques are relatively new to the market. Therefore, we focus on recruiting quick learners who are open to continuous education.

When urgent test results are needed, we offer a fast-track option to prioritize these cases and provide doctors with estimated result delivery dates. For some tests, outsourcing to external labs is an option we consider, evaluating choices based on turnaround times—like one-day processing in Singapore versus possible delays with local government labs during weekends. Selecting vendors for outsourcing involves thorough assessments of the lab’s technical staff, quality control systems, certifications, and equipment usage.

Sending samples to external labs comes with challenges such as maintaining appropriate temperatures during transport to prevent sample degradation, potential customs delays, and ensuring packaging integrity. Urgent cases, especially those involving critical patients, are often unsuitable for government labs due to their limited operating hours and frequent holidays. Within our team, we hold regular knowledge-sharing sessions where specialists share their expertise, enhancing the overall competency of the team ...”

#### 8. Interview result from Operational staff - Clinical departments; O2

“... Patients have the flexibility to select specific packages that meet their needs, such as screening, annual health check-ups, or additional tests for pre-existing conditions. Once a package is chosen, doctors assign the necessary tests, although patients can opt out of any recommended tests. The lab primarily focuses on conducting diagnostic tests as advised by doctors. For external test samples, it is crucial to inform all relevant hospital departments about the estimated testing time to ensure each department can plan their work accordingly.

In terms of team management, there is an expectation that every team member should be capable of performing the assigned tests. We have a structured training system where experienced staff train new employees. These new employees are then evaluated by a quality assessment team and their supervisor, using a checklist to ensure they meet the required standards and are proficient with the necessary documentation. One of the significant challenges we face is finding experienced personnel, as the testing techniques are relatively new to the market. Therefore, it is essential to build a team of individuals who are quick learners and adaptable to new knowledge and techniques ...”

## 4.2 Data Analysis

In the rapidly evolving landscape of healthcare, data analysis plays a crucial role in understanding and improving various aspects of clinical and laboratory operations. This analysis is informed by insights gathered from interviews with senior professionals and operational staff across different departments. The key factors influencing decisions and challenges in these settings include cost differences and pricing challenges, market segments based on patient feedback, service lead times and patient expectations, the impact of external specialized collaborations, and training and challenges faced by staff.



**Table 4.1 Groups of answer for in-depth interview**

Finding from Interviews	Key Factors
<p>“...focusing on the speed of test results while keeping the test costs the same and reducing overall costs.”, H1</p> <p>“...a test that doesn't significantly increase in price but reduces the time to get results or increases the utilization of existing lab equipment would encourage more in-house testing.”, H1</p> <p>“...the volume of tests significantly impacts cost reduction through shared costs. If every organization in the country conducts its own tests, each one bears the cost until it becomes profitable.”, H2</p> <p>“In managing cost uncertainties, the hospital's strength lies in strict procurement practices, emphasizing bulk deals with external organizations to lower costs. However, tests with low volumes carry the risk of price instability.”, H2</p> <p>“The hospital adjusts test prices annually based on the costs of test reagents and equipment from suppliers. Each year, we forecast the number of tests for each type to help plan costs.”, H2</p> <p>“... We don't decide to run tests in-house or outsource them all at once. We look at things like the facility, the costs involved such as reagents or buying new facilities, and the volume of tests. From there, we can determine the monetary value.”, S1</p> <p>“Turnaround time is considered based on the break-even point, and typically, in-house testing has a faster turnaround time than sending it out to an external lab.”, S1</p>	<p><b>Cost differences &amp; Pricing Challenges</b></p>

**Table 4.1 Groups of answer for in-depth interview (cont.)**

Finding from Interviews	Key Factors
<p>“If the number of tests is still low, it's more cost-effective to send them to an external lab rather than increasing the validation costs.”, S1</p> <p>“Implementing these systems is difficult and requires purchasing additional storage systems, increasing the cost for each test.”, S2</p> <p>“Sometimes, if one lab can cover multiple types of tests, it's more cost-effective than sending samples to a lab that can only handle one type of test.”, S3</p> <p>“We conduct research to evaluate new testing methods and seek approval from the senior director while also considering the cost-effectiveness of the tests.”, S4</p> <p>“For some tests, outsourcing to external labs is an option we consider, evaluating choices based on turnaround times—like one-day processing in Singapore versus possible delays with local government labs during weekends.”, O1</p> <p>“Selecting vendors for outsourcing involves thorough assessments of the lab’s technical staff, quality control systems, certifications, and equipment usage.”, O1</p>	
<p>“When diverse test samples are sent in, we select only one test from one organization to prevent confusion among doctors.”, H1</p>	<p><b>Market Segments based on Patient Feedback</b></p>

**Table 4.1 Groups of answer for in-depth interview (cont.)**

<b>Finding from Interviews</b>	<b>Key Factors</b>
<p>“Most of the time, it's the doctors who choose for the patients, rather than the patients making their own decisions. The patients who come for testing are usually referred by the Genetic Center, NIPT department, Obstetrics department, Cancer department, or Pediatrics department.”, S3</p> <p>“Patients have the flexibility to select specific packages that meet their needs, such as screening, annual health check-ups, or additional tests for pre-existing conditions.”, O2</p> <p>“Once a package is chosen, doctors assign the necessary tests, although patients can opt out of any recommended tests.”, O2</p>	
<p>“...focusing on the speed of test results...”, H1</p> <p>“...a test that doesn't significantly increase in price but reduces the time to get results...”, H1</p> <p>“For example, some tests spike during specific seasons, like health check-ups at the beginning of the year.”, H2</p> <p>“To ensure smooth coordination and good relationships between departments, we hold monthly meetings where doctors and staff can regularly update each other and strengthen their working relationships.”, H2</p> <p>“Turnaround time is considered based on the break-even point, and typically, in-house testing has a faster turnaround time than sending it out to an external lab.”, S1</p>	<p><b>Service Lead Times and Patient Expectations</b></p>

**Table 4.1 Groups of answer for in-depth interview (cont.)**

Finding from Interviews	Key Factors
<p>“The decision to perform tests in-house comes from the doctors' expectations for quick results.”, S2</p> <p>“When we select a vendor, we evaluate the accuracy of their lab results and the time it takes to complete the tests.”, S3</p> <p>“When a doctor requests a new test, we hold monthly meetings to discuss how to interpret the test results.”, S4</p> <p>“Doctors have high expectations for the accuracy of genetic testing results.”, S4</p> <p>“When urgent test results are needed, we offer a fast-track option to prioritize these cases and provide doctors with estimated result delivery dates.”, O1</p> <p>“Urgent cases, especially those involving critical patients, are often unsuitable for government labs due to their limited operating hours and frequent holidays.”, O1</p> <p>“For external test samples, it is crucial to inform all relevant hospital departments about the estimated testing time to ensure each department can plan their work accordingly.”, O2</p>	
<p>“If a test is required by large hospitals according to Thai regulations, the nurses must make it available.”, H1</p> <p>“Regarding collaboration with external organizations to improve service quality standards, the volume of tests significantly impacts cost reduction through shared costs.”, H2</p>	<p><b>Impact of External Specialized Collaborations</b></p>

**Table 4.1 Groups of answer for in-depth interview (cont.)**

Finding from Interviews	Key Factors
<p>“Collaboration with external organizations within the country increases resource sharing and knowledge among local professionals. Sending samples abroad only utilizes services, but collaborating within the country fosters technological and knowledge development.”, H2</p> <p>“If there's a trend showing an increase in test volumes, the committee will evaluate and come to a consensus to consider a new business unit.”, S1</p> <p>“Most of the test evaluations are based on the doctors' needs, looking at whether the lab already has a guideline marker for the tests they want.”, S1</p> <p>“The challenges we face include the development gap between our HIS database and the sequencing testing record database, making some systems incompatible.”, S2</p> <p>“Choosing a vendor for collaboration with the hospital is quite crucial. We don't consider contracts with external organizations unless they pass our quality control system or have certificates equivalent to or higher than our hospital's standards.”, S3</p> <p>“Communication between the wet lab team and the analysis team is key. We have morning briefs to discuss the day's tasks, and we hold subunit meetings each month.”, S4</p> <p>“If there are any credential-related matters, we communicate through Microsoft Teams. For policy-related issues, we send emails or pop-up alerts through the PeopleSoft program.”, S4</p>	

**Table 4.1 Groups of answer for in-depth interview (cont.)**

Finding from Interviews	Key Factors
<p>“Sending samples to external labs comes with challenges such as maintaining appropriate temperatures during transport to prevent sample degradation, potential customs delays, and ensuring packaging integrity.”, O1</p>	
<p>“The direction for service quality improvement involves increased automation and AI integration for decision support. For instance, analyzing digital images with AI helps group cell characteristics more quickly and accurately, reducing human error since humans rely on judgment and intuition.”, H1</p> <p>“To evaluate the team's and specialists' quality, we use a system of quality training and HR competency evaluation.”</p> <p>“When a new testing system is introduced, everyone in the lab must be able to perform the test. Employees are sent for training and tested to assess their competence.”, H1</p> <p>“If policies are announced, all employees can access the information through the hospital's application.”, H2</p> <p>“When new technology is introduced, we assess its impact before adoption. If we are confident that it can be used for patient sample analysis or diagnosis at 100%, we will decide to adopt it. However, if the technology is still under development, we will not use it for patient samples.”, H2</p> <p>“If a department has expertise in certain tests to support diagnosis, our lab will study and incorporate those new tests to support new patient treatment methods. However, if the test cases are still low, we'll send those tests to an external lab instead.”, S1</p>	<p><b>Training and Challenges</b></p>

**Table 4.1 Groups of answer for in-depth interview (cont.)**

Finding from Interviews	Key Factors
<p>“Our team's quality control includes several aspects: 1) Training 2) Knowledge Sharing 3) Quality control documents 4) Card files 5) Competency documents 6) Work instructions 7) IQC/IQA 8) Preventive maintenance.”, S2</p> <p>“Another challenge is that the hospital has established a documentation system, ensuring that we can provide world-class quality service. Therefore, our team needs to adhere strictly to the documents and standards set by the hospital.”, S2</p> <p>“When it comes to team management, we expect everyone in the team to be able to perform the assigned tests.”, S3</p> <p>“Following the hospital's protocols is critical because we're dealing with patients, and there should be no errors. This can be quite challenging for new employees.”, S3</p> <p>“One of the challenges we face is the rapid advancement of technology. Doctors have high expectations for the accuracy of genetic testing results, so our team needs to constantly update their knowledge and keep up with technological advancements.”,S4</p> <p>“When new employees join us, they are trained by experienced team members, ensuring they gain the necessary skills and knowledge.”, O1</p> <p>“After the training, their performance is evaluated by our quality assessment team and supervisors using a standardized checklist.”, O1</p>	

**Table 4.1 Groups of answer for in-depth interview (cont.)**

Finding from Interviews	Key Factors
<p>“One challenge we face is finding experienced personnel since our testing techniques are relatively new to the market. Therefore, we focus on recruiting quick learners who are open to continuous education.”, O1</p> <p>“Within our team, we hold regular knowledge-sharing sessions where specialists share their expertise, enhancing the overall competency of the team.”, O1</p> <p>“In terms of team management, there is an expectation that every team member should be capable of performing the assigned tests.”</p> <p>“We have a structured training system where experienced staff train new employees.”, O2</p> <p>“These new employees are then evaluated by a quality assessment team and their supervisor, using a checklist to ensure they meet the required standards and are proficient with the necessary documentation.”, O2</p> <p>“One of the significant challenges we face is finding experienced personnel, as the testing techniques are relatively new to the market. Therefore, it is essential to build a team of individuals who are quick learners and adaptable to new knowledge and techniques.”, O2</p>	

#### 4.2.1 Key Factors

- **Cost differences & Pricing Challenges:** One of the critical aspects of laboratory and clinical operations is managing costs effectively while maintaining high-quality service. Insights from interviews highlight the importance of evaluating cost-effectiveness, whether in-house or outsourced testing. This involves considering the costs of reagents, equipment, and additional storage systems, as well as negotiating bulk



deals to reduce costs. The annual adjustment of test prices based on supplier costs and the strategic decision-making around outsourcing tests are pivotal in controlling pricing challenges.

- **Market Segments based on Patient Feedback:** Understanding patient needs and preferences is essential for tailoring healthcare services. The flexibility for patients to select specific testing packages and the influence of doctor referrals on patient choices are significant factors. This segmentation helps in designing services that meet patient expectations and improve satisfaction.

- **Service Lead Times and Patient Expectations:** Speed and accuracy of test results are paramount in healthcare. The decision to perform tests in-house or outsource them is often driven by the need for quick turnaround times to meet doctors' and patients' expectations. Fast-track options for urgent cases and clear communication about estimated testing times ensure that departments can plan their workflows efficiently, thus enhancing overall service delivery.

- **Impact of External Specialized Collaborations:** Collaborations with external organizations are crucial for resource sharing and knowledge exchange. These collaborations help in reducing costs and improving service quality through shared expertise and technology. The selection of external vendors based on stringent quality control measures and certifications ensures that the collaborations are beneficial and maintain high standards of service.

- **Training and Challenges:** The continuous advancement of medical technology necessitates regular training and upskilling of staff. Structured training systems, performance evaluations, and knowledge-sharing sessions are essential for maintaining competency and adapting to new techniques. Recruiting quick learners who can adapt to new knowledge and overcoming the challenges of integrating new technologies are critical for sustaining high-quality service.

This data analysis aims to delve deeper into these key factors, providing valuable insights that can guide strategic decision-making and operational improvements in clinical and laboratory settings. By leveraging these insights, healthcare organizations can enhance their service quality, efficiency, and patient satisfaction.

### 4.3 Common Themes and Points

Based on the insights gathered from interviews with senior professionals and operational staff across laboratory and clinical departments, several common themes and points emerge. These themes highlight shared opinions and challenges across different roles and departments within the healthcare setting.

#### 1. Cost differences & Pricing Challenges

- **Laboratory Departments:** Both senior professionals and operational staff emphasized the importance of evaluating the cost-effectiveness of in-house versus outsourced testing. Senior professionals discussed the need for strict procurement practices and the annual adjustment of test prices. Operational staff also noted the significance of selecting vendors based on cost and turnaround times, highlighting the evaluation of cost-effectiveness in outsourcing decisions.

- **Clinical Departments:** Senior professionals in clinical departments similarly stressed the consideration of cost-effectiveness when evaluating new testing methods and the importance of vendor selection based on cost and quality control systems.

#### 2. Market Segments based on Patient Feedback

- **Laboratory Departments:** There was no direct mention of patient feedback influencing market segments, indicating that this factor is more relevant to clinical departments.

- **Clinical Departments:** Operational staff noted that patients have the flexibility to choose specific testing packages, and doctors often influence these choices. This reflects a shared understanding of patient needs and preferences influencing service offerings.

#### 3. Service Lead Times and Patient Expectations

- **Laboratory Departments:** Both senior professionals and operational staff highlighted the need for quick turnaround times. Senior professionals discussed the decision to perform tests in-house to meet doctors' expectations for quick results, while operational staff emphasized the importance of fast-track options and clear communication about estimated testing times.

- **Clinical Departments:** Senior professionals mentioned holding meetings to discuss new test results and the importance of timely communication between teams to manage expectations effectively.

#### 4. Impact of External Specialized Collaborations

- **Laboratory Departments:** Senior professionals emphasized the benefits of collaboration with external organizations for cost reduction and knowledge sharing. They also discussed the challenges of maintaining quality control when working with external labs. Operational staff noted the logistical challenges of sending samples to external labs and the importance of selecting reliable vendors.

- **Clinical Departments:** Senior professionals discussed the critical nature of vendor selection for collaborations and the necessity of thorough assessments to ensure quality and timely results.

#### 5. Training and Challenges

- **Laboratory Departments:** Training and competency evaluation were common themes among both senior professionals and operational staff. Senior professionals outlined comprehensive training and quality control measures, while operational staff discussed the structured training system for new employees and the challenges of finding experienced personnel.

- **Clinical Departments:** Senior professionals mentioned the need for continuous education to keep up with technological advancements and the structured training system for new employees, highlighting similar challenges in maintaining competency and adapting to new techniques.

### **4.4 Difference in Perspectives**

Based on the insights gathered from interviews with senior professionals and operational staff across laboratory and clinical departments, there are several perspectives and additional pieces of information mentioned that fall outside the predefined factors. These differences in perspectives provide a broader understanding of the unique challenges and considerations within each role and department.

#### **4.4.1 Laboratory Departments**

##### **4.4.1.1 Senior Professionals:**

- **Quality Control and Documentation:** Senior professionals in laboratory departments emphasized the importance of quality control and adherence to documentation standards set by the hospital. This includes comprehensive quality training, HR competency evaluations, and strict adherence to protocols to ensure world-class service. This focus on quality control and documentation was not explicitly covered under the predefined factors but is critical to laboratory operations.

- **Integration of AI and Automation:** The emphasis on increasing automation and AI integration for decision support in laboratory departments highlights a forward-looking approach to improving service quality and reducing human error. This aspect was not directly mentioned in the factors but is significant for the future of laboratory testing.

##### **4.4.1.2 Operational Staff:**

- **Team Management and Competency:** Operational staff discussed the structured training system and the evaluation of new employees by quality assessment teams and supervisors. They also highlighted the challenge of finding experienced personnel and the need to recruit quick learners. This detailed focus on team management and competency evaluation goes beyond the predefined training and challenges factor.

- **Logistics and Sample Transport:** The operational staff mentioned specific logistical challenges related to sending samples to external labs, such as maintaining appropriate temperatures during transport, potential customs delays, and ensuring packaging integrity. These logistical concerns are additional considerations not covered under the predefined factors but are crucial for laboratory operations.

#### **4.4.2 Clinical Departments**

##### **4.4.2.1 Senior Professionals:**

- **Communication and Coordination:** Senior professionals in clinical departments discussed the importance of communication and coordination between the wet lab team and the analysis team, as well as the use of tools like Microsoft Teams and PeopleSoft for credential-related and policy-related communications. These details

on internal communication mechanisms provide additional context to the operations that are not explicitly covered by the predefined factors.

- **Monthly Meetings and Research Evaluation:** The emphasis on monthly meetings to discuss new test requests and the research conducted to evaluate new testing methods before seeking approval indicates a structured approach to decision-making and innovation. This approach to internal review and approval processes provides additional insights beyond the predefined factors.

#### 4.4.2.2 Operational Staff:

- **Flexibility in Patient Choices:** Operational staff highlighted that patients have the flexibility to select specific packages that meet their needs and that doctors assign necessary tests based on these choices. This patient-centered approach adds another layer of consideration to the market segments based on patient feedback factor but also extends beyond it to emphasize patient autonomy and choice.

The differences in perspectives highlight several additional considerations that are important for understanding the complete picture of clinical and laboratory operations. These include quality control and documentation, AI and automation, team management and competency, logistical challenges, internal communication mechanisms, structured decision-making processes, and patient-centered approaches. Recognizing these additional perspectives provides a more comprehensive understanding of the unique challenges and operational nuances within each role and department.

## **CHAPTER V**

### **CONCLUSION AND RECOMMENDATION**

#### **5.1 Conclusion**

The study's research objectives at Bumrungrad International Hospital aimed to investigate critical aspects of their genetic services, focusing on cost-effectiveness, market segmentation, service lead times, external collaborations, and training challenges. The interview results provided significant insights aligning with these objectives, highlighting the importance of cost differences and pricing challenges, market segments based on patient feedback, service lead times and patient expectations, the impact of external specialized collaborations, and training and challenges.

From the interviews, it became clear that cost efficiency is very important in the hospital's decision-making process regarding whether to conduct tests in-house or outsource them. Maintaining high-quality service while managing costs involves various considerations, such as the prices of reagents and the expenses related to facilities. The interviewees, including heads of professions and senior professionals, emphasized that in-house testing generally offers faster turnaround times, which is crucial for timely diagnosis and treatment. However, it requires a significant initial investment in equipment and staff training. The hospital's pricing strategies are carefully adjusted annually based on the costs of test reagents and equipment, with careful forecasting to manage these expenses effectively.

Patient preferences and feedback play a crucial role in guiding the hospital's genetic services. Operational staff emphasized the flexibility in test package selection, accommodating routine screenings, annual health check-ups, and specific condition-related tests. Feedback from departments such as the Genetic Center, NIPT, Obstetrics, Cancer, and Pediatrics is important in customizing services to meet diverse patient needs, ensuring alignment with different market segments.

The speed of test results became a critical factor impacting patient satisfaction. Both laboratory and clinical departments focus on minimizing lead times

to enhance patient care. In-house testing is generally preferred due to its faster results compared to outsourced services, meeting the high expectations of doctors and patients.

Collaborations with external organizations play an important role in maintaining high-quality standards and managing costs through resource sharing. The heads of professions emphasized the benefits of partnering with local groups, which promotes technological and knowledge development within the country. Such collaborations are preferred over sending samples abroad, as they enhance service quality and reduce costs by leveraging shared resources and expertise among local professionals. This strategic approach helps the hospital manage cost uncertainties and improve overall service efficiency

Ensuring the competence of healthcare professionals during rapid advancements in genetic testing technologies is a continuous challenge. The hospital's comprehensive training programs and strict quality control measures are designed to keep staff updated with the latest techniques and standards. However, the development gap between the hospital's HIS database and the sequencing testing record database presents a significant challenge, requiring additional investments in compatible systems and storage solutions. Moreover, recruiting and training experienced personnel in relatively new testing techniques remains a persistent issue, emphasizing the need for ongoing education and adaptation to new knowledge and technologies.

In summary, Bumrungrad International Hospital's approach to genetic services involves a careful balance of cost management, patient-centered care, efficient service delivery, strategic collaborations, and continuous staff development. Addressing these key factors effectively contributes to the hospital's goal of providing high-quality, reliable, and timely genetic services, ultimately enhancing patient satisfaction and operational efficiency. The insights gained from the interviews highlight the critical areas that need attention to ensure the sustained success and improvement of the hospital's genetic services.

## **5.2 Recommendation**

### **5.2.1 Enhance Cost Management and Pricing Strategies**

To maintain cost-effectiveness, it is recommended that Bumrungrad International Hospital continues to regularly review and adjust their pricing strategies based on the latest costs of test reagents and equipment. Implementing advanced cost forecasting methods can help better predict expenses and manage resources efficiently. Additionally, the hospital should consider buying in bulk and forming strategic partnerships with suppliers to further reduce costs. This approach can serve as a model for other hospitals aiming to optimize their financial management, ensuring sustainability while maintaining high-quality services.

### **5.2.2 Focus on Patient-Centered Service Development**

Incorporating patient feedback into the development of genetic services is crucial. The hospital should establish regular channels for collecting and analyzing patient feedback, ensuring that the services offered meet the specific needs and preferences of different market segments. Personalized test packages and flexible options should be expanded to serve more patients, enhancing patient satisfaction and engagement. Other hospitals can adopt similar strategies to better align their services with patient needs, improving overall patient experience and satisfaction.

### **5.2.3 Optimize Service Lead Times**

Minimizing lead times for test results is essential for improving patient care and satisfaction. Bumrungrad International Hospital should regularly review and optimize workflows to identify and eliminate bottlenecks, ensuring that in-house testing remains faster than external options. By adopting these practices, other hospitals can enhance their operational efficiency and provide more timely care to patients.

### **5.2.4 Strengthen Collaborations with External Organizations**

The research highlights the important role of collaborations with local and international organizations in maintaining high-quality standards and reducing costs through shared resources. Bumrungrad International Hospital should continue to



support these partnerships, which provide access to shared expertise and technological advancements. Establishing clear guidelines and regular evaluations of these collaborations will ensure they contribute effectively to the hospital's goals. Other healthcare organizations can replicate this model of strategic partnerships to enhance service quality and operational efficiency while lowering costs.

#### **5.2.5 Invest in Training and Development:**

Continuous training and development of healthcare professionals are essential for maintaining high standards in genetic services. The hospital should expand its training programs, incorporating the latest advancements in genetic testing technologies. Creating a structured career development path for staff can help retain talent and ensure that the team remains competent and motivated. Additionally, addressing the development gap between the HIS database and sequencing testing records should be a priority, requiring investment in compatible systems and infrastructure. Other hospitals can adopt similar strategies to enhance their workforce's capabilities, ensuring they are prepared to handle advanced diagnostic technologies.

#### **5.2.6 Encourage National Collaboration in Healthcare:**

The research highlights the importance of internal collaborations within the country, showing how these partnerships can lead to shared benefits rather than competition for individual gains. By working together, healthcare organizations in Thailand can pool resources, share knowledge, and leverage each other's strengths to improve service quality and operational efficiency. This collaborative approach can help reduce costs, enhance technological development, and ultimately provide better patient care. Other hospitals can benefit from adopting a similar collaborative mindset, focusing on shared benefits rather than competing for market share.

By focusing on these key areas, Bumrungrad International Hospital can enhance the efficiency, quality, and patient satisfaction of their genetic services. Additionally, other hospitals can use these strategies to improve their management of costs, processes, and human resources, promoting a more collaborative and efficient healthcare ecosystem in Thailand.

### 5.3 Limitation

- Generalizability

The findings from this study are specific to Bumrungrad International Hospital and may not apply directly to other hospitals or healthcare settings. Different hospitals may have varying operational structures, resources, and patient demographics that could influence how relevant these results are. Further research is needed to test these findings in different contexts to assess their broader relevance.



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