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Published

2023

Version

Version of Record (VoR)

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Document of the World Bank

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An Economic Evaluation of Day Surgery for Non-Acute Hernia Repair in Sri Lanka in 2022

Hansoo Kim, Anuji Gamage, Amala De Silva, Suganya Yogeswaran, Lakshmen Senanayake, Ranjan Dias, Di Dong, Deepika Eranjanie Attygalle, Hideki Higashi

March 2023

WORLD BANK GROUP

Acknowledgments

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The report was reviewed by Jahanzaib Sohail, Health Economist, World Bank, and Iryna Postolovska, Senior Health Economist, World Bank. We would like to express our appreciation for their valuable advice in finalizing this report. We wish to acknowledge the significant support and cooperation of the Sri Lanka Ministry of Health, especially Dr. Asela Gunawardena, Director General of Health Services, and Dr. Sridharan Sathasivam, Deputy Director General Planning.

Financial support for this work was provided by the Government of Japan through the Policy and Human Resources Development (PHRD) Trust Fund.

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Executive Summary

Early discharge of publicly funded non-acute hernia patients after surgery may save health care costs by reducing inpatient bed-days. An economic evaluation was conducted to examine the cost implications of implementing day care surgeries for non-acute hernia cases for publicly funded patients to improve the efficiency of the public health system in Sri Lanka. A linked decision tree model was developed and populated using secondary data to model the pathway probabilities and costs. Cost data were obtained from the Medical Supplies Division, relevant hospitals, and laboratories. Hospital hotel costs per bed-day were calculated based on WHO-CHOICE[1] model estimations with inflation adjusted to the 2022 value. The model assumed that 5 percent of patients would encounter surgical complications. In the current standard of care situation for a cohort of 40,401 patients undergoing non-acute hernia repair, the decision tree model estimated that an average of 4.05 hospital bed-days were utilized for non-acute hernia repair including those experiencing surgical complications. With day surgery, patients without surgical complications spend less than 24 hours before being discharged, and the average length of stay can be reduced to 1.15 bed-days including those with surgical complications. In the standard of care scenario, the total cost for non-acute hernia repair at a public hospital was estimated LKR 164,968 per patient, while the same procedure performed as a day surgery would reduce the cost to LKR 145,622 per patient. The savings from implementing day surgeries for non-acute hernia cases will amount to approximately LKR 781.6 million (approximately USD 2.4 million). Shifting uncomplicated non-acute hernia patients from an inpatient scenario to a day surgery could result in considerable cost saving to the government. More studies on the benefit of expanding day surgery services to other conditions are warranted, which would further inform the government on options to maximize efficiency in the publicly funded health care system of Sri Lanka.

[1] WHO-CHOOSE = World Health Organization's choosing interventions that are cost-effective.

Introduction

The Sri Lankan pluralistic health system has been providing public health care services free of charge since the 1930s, which consists of western-allopathic approach and other systems including Ayurveda, Siddha, Unani, acupuncture, and deshiya chikitsa. Allopathic medical care, which plays a central role in the health care system of Sri Lanka, is provided through both the public and private sectors (Rajapaksa et al. 2021). The first National Health Policy of Sri Lanka was formulated in 1992 that emphasized the decentralization of health administration to the divisional level. The Sri Lanka Ministry of Health (MOH) is responsible for the provision of a comprehensive health care throughout the country that primarily provides allopathic care.

The country has enjoyed a significant economic growth since 2000 over two decades. However, the growth of economy has been slowing down since 2013, with an economic contraction faced in 2020 in the height of COVID-19 pandemic. The current health expenditure (CHE) as a percentage of gross domestic product (GDP) has remained constant at about 4 percent that comprises both government and private contributions. External health expenditure is around 1 percent of GDP, which has remained low at this level over decades. The government health expenditure as a percentage of GDP has been around 1.6–1.9 percent. Compared to health care spendings in other peer countries that typically range between 2.2 percent to 5.5 percent of GDP such as in Thailand, China, Malaysia, and South Africa, Sri Lanka spends less on health. Nonetheless, Sri Lanka's health outcomes have been one of the best in low- and middle-income countries, particularly in maternal and child-related indicators.

Over the last three years, Sri Lanka has been grappling with a pandemic and an economic crisis, which have resulted in a reduction of revenue to the government and resources available to the public sector services. In a country where public health expenditure has remained relatively low over decades with relatively high out-of-pocket expenditures that account for around 50 percent of total health spending, the impact of the crises on health care financing can be devastating. Thus, it is critical to revisit the existing resource use in the health care system to examine the sustainability of financing and service delivery.

Sri Lanka is a lower-middle-income country in South Asia. Nevertheless, Sri Lanka's health system has been widely regarded as one of the highest performing models in low- and middle-income countries, having achieved "good health at low cost." Key health indicators show remarkable progress in population health over decades, particularly in improved maternal and child health (MCH) outcomes and elimination of some communicable diseases such as polio, measles, rubella, and mother-to-child transmission of HIV. As a result, overall morbidity and mortality have substantially declined, and the population in Sri Lanka is now aging faster than any other countries in the region. While the health system has performed well in achieving good MCH indicators, it has not been well equipped to address the growing burden of noncommunicable diseases (NCDs) with the aging population that requires significantly more resources.

However, given the rigid nature of the low level of public health spending that can be exacerbated with the ongoing economic crisis, it is crucial to expand the fiscal space for health by improving the efficiency of health system and service delivery. Savings through unspent funds may be retained in an institution to improve service delivery within the same institution, or savings within the health system may be reallocated to strengthen other services such as the primary health care system to cater to the growing demand of elderly care. In identifying potential areas for efficiency gains, another study has explored several modalities within the Sri Lankan health care system through a desk review, focus group discissions, and key informant interviews (World Bank 2023a). One of the key areas that were

recommended as priority is to introduce day care and day surgery for conditions that can be managed by ambulatory care but are typically treated by admitting patients to hospitals. They may include conditions that require either medical care or surgical procedures, and both options were explored in that study. To compile a list of potential conditions amenable to day care and day surgery, multiple criteria were employed for the selection such as the overall prevalence and magnitude of disease burden and the degree of health care utilization (Table 1).

Table 1: Diseases amenable to day surgeries/medical care

Day surgery	Medical care
• Open/laparoscopic inguinal/para-umbilical hernia repair • Epigastric hernia • Laparotomy • Cholecystectomy • Saphenofemoral ligation	• Asthma • Snake bite • Gastroesophageal reflux disease • Chest pain • Diarrhea

Source: World Bank 2023a.

Identification of procedures amenable to day surgery can be based on multiple factors. Key factors that determine if an operation can be performed as day surgery include the degree of tissue damage and pain, the extent of blood and fluid losses, and the extent of postoperative care and complications (Šeparović and Augustin 2017). Considering the service utilization and feasibility of implementation, hernia surgery was selected for this exercise to examine the potential cost implications. Around 40,000 hernia surgeries are conducted in the public hospitals of Sri Lanka annually, one of the most frequently performed surgeries in the country (Medical Statistics Unit 2023). Hernia surgery is a common procedure conducted to repair the weakness in the abdominal wall, which gives rise to protrusion of body tissue. There are three broad categories of hernia: groin, abdominal, and intra-abdominal hernias. Most hernias require surgical repair, although not all cases require immediate operations. Abdominal wall hernia repair is one of the most common types of surgery. There are two surgical options for hernia repair: laparoscopic hernia repair and open hernia surgery. Hernia repair is usually performed using regional anesthesia and is therefore categorized as an intermediate procedure. Umbilical and inguinal hernias are commonly conducted as day surgeries in other countries (Cleveland Clinic 2022; NHS 2022). Most hernia repairs are performed at the tertiary hospitals in Sri Lanka because of the greater number of surgeons available at tertiary care institutions and patients' perception of better quality at this level. The services in the public health sector described above are provided free of charge to the patients in principle. In contrast, the private hospitals charge for any service rendered, and the patients must bear the costs incurred through out-of-pocket payments or private insurance.

The standard care for hernia repair in Sri Lanka requires a minimum of three inpatient bed-days. However, evidence from other countries suggest that non-acute hernia repair can be performed as a day surgery (Dietz 2019; The HerniaSurge Group 2018). Early discharge of non-acute hernia repair patients may save medical costs by reducing patients' time in hospitals and enables more efficient use of hospital beds in the public system. In Sri Lanka, a patient with non-acute hernia will typically make two or more visits before being admitted for surgery. For surgery without complications, the length of stay can be approximately four days including one day for pre-operation assessment. Patients experiencing complications will typically need to stay in the hospital for five days including one day for pre-operation assessment. The extended length of stays in hospitals will add to the burden to the health system as well as the patients.

To assess the implications of early discharge of a non-acute uncomplicated hernia patient, this study presents an analysis of implementing day surgeries to improve the health system efficiency for publicly funded patients undergoing non-acute hernia repair in Sri Lanka.

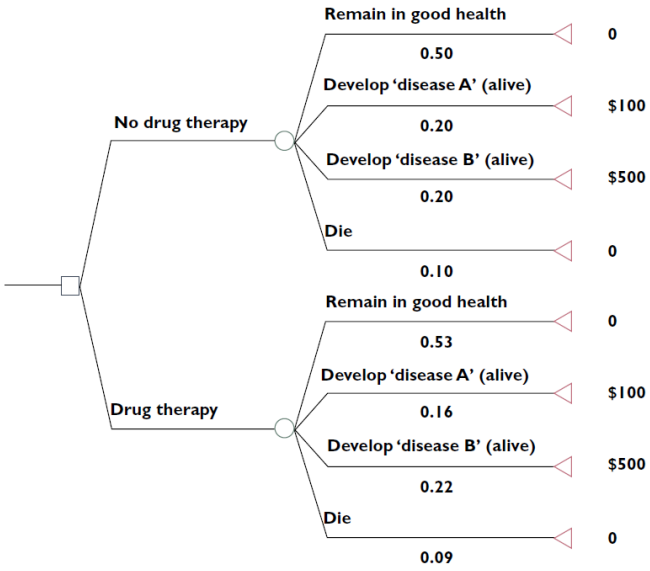
Methods

We conducted an economic evaluation to examine the potential cost implications of introducing a day surgery for non-acute hernia cases in public hospitals of Sri Lanka.

The economic evaluation was performed using a cost minimization analysis (CMA) framework (Drummond et al. 2015). CMA is performed when improvements in health outcomes are not expected from a new intervention compared to standard of care. In this situation, the aim of the evaluation is to identify the least costly alternative. A decision tree was used to conceptualize and assess the new approach versus the current standard of care.

Figure 1 presents a hypothetical example of a decision tree with respect to initiating therapy or not. Therapy is associated with both potential benefit (decrease in the risk of 'disease A') and harm (increase in the risk of 'disease B').

Figure 1: Example of decision tree

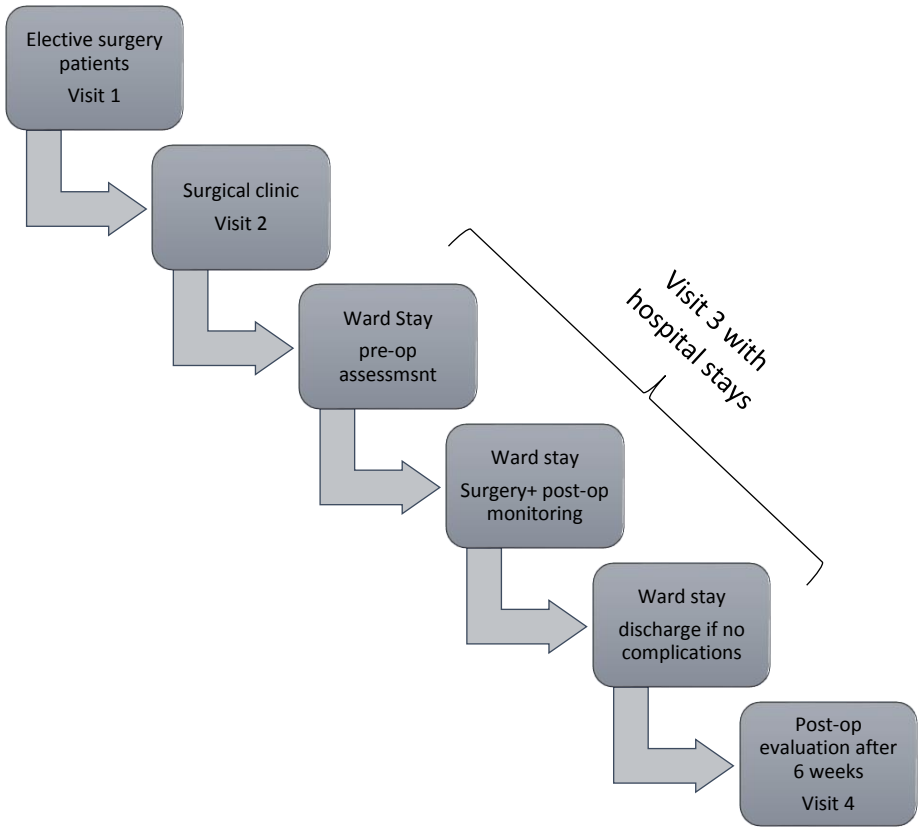


The square is the decision node, the point where alternative treatment options are defined. In this example, two choices are defined: 'No therapy' and 'Therapy'. The circles represent chance nodes, from which emanate the possible consequences of each choice. Both options in the example have the same four possible transition states: Remain in good health, Develop 'disease A' (but stay alive), Develop 'disease B' (but stay alive), and 'Die' (from any cause). The underlying likelihoods of their occurring are indicated below the relevant sub-branches and are called transition probabilities. The sum of all transition probabilities emanating from a chance node is always one. In the example, compared with 'no therapy', therapy reduces the likelihood of developing non-fatal 'disease A' by 20 percent (from 20 percent to 16 percent) and of dying by 10 percent (from 10 percent to 9 percent) but increases the likelihood of developing non-fatal 'disease B' by 10 percent (from 20 percent to 22 percent). The triangles are terminal nodes, where the health impact of each consequence, called a payoff, is quantified. In the example, as is often the case in health economic analyses, consequences of an option can also be quantified in terms of the costs of 'disease A' and 'disease B'. The costs for

'disease B' are assumed higher because this condition is more disabling. The expected values of each branch are calculated in the same way: the sum of all cost × transition probability. Analysis of the tree reveals the expected dollar values of 'no therapy' and 'therapy' to be USD 120 (0.50 × USD 0 + 0.20 × USD 100 + 0.20 × USD 500 + 0.10 × USD 0) and USD 126 (0.53 × USD 0 + 0.16 × USD 100 + 0.22 × USD 500 + 0.09 × USD 0), respectively. On average, therapy would lead to greater downstream cost, even though it is associated with improved health outcomes. So far, the expected dollar value of the therapy has not considered the cost of the therapy itself. If this is assumed to be a one-off cost of USD 300, then the net cost of therapy would be USD 300 + (USD 126 − USD 120) = USD 306. The net costs of health interventions always consider downstream-related costs.

The study subjects included all non-acute hernia patients who undergo surgical operations in Sri Lanka. The patient pathway for non-acute hernia cases in the standard of care is described in Figure 2.

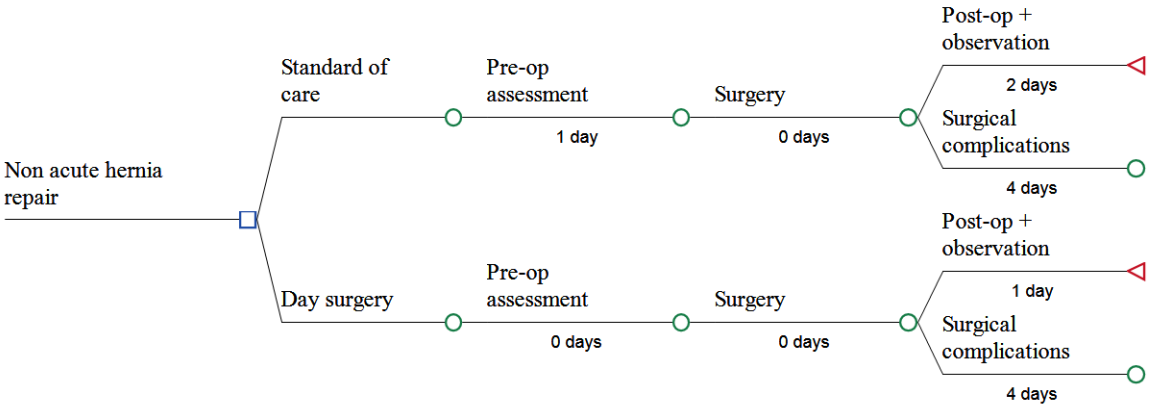
Figure 2: Current practice of hernia repair for non-acute hernia cases



As shown Figure 2, patients with potential non-acute hernia will present to a health care institution. A patient diagnosed with non-acute hernia will then visit a surgical clinic followed by admission to a hospital for surgery. The patient typically spends four days in the hospital (including pre-operation, surgery, and post-operation) if no surgical complications occur.

A day surgery will reduce the hospital stay of a patient to one day for non-acute hernia repair. In a day surgery, the patient is assumed to be admitted to the hospital in the morning, undergoes the surgery on the same day, and stays in the day surgery ward for four to six hours for post-operation observation before being discharged. Hence, it is assumed that the patient will spend 24 hours or less in the hospital. Figure 3 illustrates the different paths the patients will follow in standard of care and day surgery in a decision tree that will be used for this analysis.

Figure 3: Decision tree model to assess the potential cost savings of establishing day surgery for non-acute hernia surgery



Based on a local study (Rajapaksha et al. 2019) and expert opinion,[2] it was assumed that 5 percent of non-acute hernia repairs will result in surgical complications. An alternative scenario with 10 percent of hernia repairs resulting in surgical complications was also examined.

The primary outcome of this analysis is the total costs of non-acute hernia repair from a health system perspective, expressed in LKR. The secondary outcome is the number of hospital days required for the same. Microsoft Excel software was used for data analysis, and the model can be found in the Online Appendix.

Data Input

The data for the direct medical costs were obtained from public and private hospitals as well as expert opinion. The hospital bed cost per day was based on the WHO-CHOICE model (WHO 2021). The model provides the unit cost estimates per outpatient visit and inpatient bed-day for over 190 countries and territories, including Sri Lanka. The estimated unit costs represent the 'hotel' component of hospital costs (Stenberg et al. 2018). The unit cost per bed-day for hospitals in Sri Lanka in 2022 was estimated from the WHO-CHOICE model with the following steps:

- Converted the WHO-CHOICE unit cost estimate (expressed in 2010 international dollar) to 2010 LKR by means of purchasing power parity in 2010 (IMF 2022)
- Adjusted the LKR unit cost in 2010 to the 2022 value by means of GDP deflators in Sri Lanka between the two years (IMF 2022).

The estimated values are provided in Table 2.

Table 2: Hospital unit costs used in the model.

Level of health care	2010			2022	
	International dollar	LKR	USD[a]	LKR	USD [a]
Secondary care	56.6	2,183	19.3	5,545	17.2
Tertiary care	73.2	2,823	25.0	7,171	22.2

Note: a. The values in USD are provided for ease of reference only, which are based on the exchange rates in 2010 and 2022 (USD 1 = LKR 113.05 and USD 1 = LKR 323.34, respectively) (IMF 2022).

[2] Dissanayake D., personal communication, June 2022; Senanayake L., personal communication, July 2022.

The average of unit costs per bed-day in secondary and tertiary care hospitals was used for the analysis, which was weighted based on the proportion of hernia repairs performed in each level of health care in each year. Data for the nonmedical costs were obtained from the Medical Supplies Division (2022) and expert opinion.[3] Duration of the clinical course (from the onset of the first diagnosis/presentation to a health care institution until discharge from the hospital) was obtained from a local study (World Bank 2023b) and expert opinion.[4] The cost data used to populate the model are given in Table 3.

Table 3: Medical cost data used to populate the model (excluding hospital stay)

Item	Cost (LKR)
Surgery evaluation	1,225
Anesthesia evaluation	24,500
Operation	56,000
Other hospital charges	55,000
Post-operation evaluation	1,225
Total	137,950

Source: MSD 2022; expert opinion.[5]

The number of patients entering the model was obtained from the number of hernia repairs performed in Sri Lanka between 2018 and 2020 reported by the Medical Statistics Unit (2023). The average annual number of hernia repair reported in the period was 36,936. Only 32,060 were performed in 2020 compared to 40,401 in 2019 (Table 4). The smaller number of hernia repairs in 2020 is likely due to the impact of COVID-19, which may not reflect the actual annual needs for surgery in the country.

Table 4: Hernia repair by care year and care setting

Year	Secondary	Tertiary	Total
2018	11,647 (30.37%)	26,700 (69.63%)	38,347
2019	12,430 (30.77%)	27,971 (69.23%)	40,401
2020	10,564 (32.95%)	21,496 (67.05%)	32,060
Average	11,547 (31.36%)	25,389 (68.64%)	36,936

Source: Medical Statistics Unit 2023.

Therefore, the number of hernia repairs performed at secondary and tertiary care settings in 2019 was used as the base case for this analysis. An alternative scenario with the average number of hernia repairs over the three-year period was also examined.

Results

The results of the analysis as well as the alternative scenarios are provided in Table 5. The cost per patient for the standard of care is LKR 164,968 and is estimated to be LKR 145,622 for a day surgery. An average of 2.9 hospital days will be saved per patient, which is equivalent to a saving of LKR 19,346 per patient. The overall saving to the health care system in Sri Lanka is estimated at 117,163 bed-days with a cost saving of LKR 781,600,477 (approximately USD 2.4 million).

Under the assumption that 10 percent of patients will experience surgical complications (alternative scenario 1), the cost for standard of care increases slightly to LKR 165,301 and LKR 146,622 for day

[3] Dissanayake D., personal communication, June 2022; Senanayake L., personal communication, July 2022.
[4] Ibid.
[5] Ibid.

surgery. A saving of LKR 18,679 per patient leads to an overall cost saving of LKR 754,648,736 (approximately USD 2.3 million), which is 3.45 percent smaller than the base case mentioned above.

In alternative scenario 2, the patient numbers are varied. Using the average patient numbers between 2018 and 2020, the overall cost saving is LKR 713,526,818 (approximately USD 2.2 million), which is 8.71 percent lower than the base case.

Table 5: Results of the base case

Strategy	Average number of hospital bed-days per patient[a]	Medical cost per patient (LKR)	Number of hospital bed-days saved per patient	Savings on medical cost per patient (LKR)	Number of hospital bed-days saved per year for Sri Lanka	Savings on medical cost per year for Sri Lanka (LKR)
Standard care	4.05	164,968	2.90	19,346	117,163	781,600,477 (USD 2,417,240)[b]
Day surgery	1.15	145,622				
Alternative scenario: 1–10% of patients experiencing surgical complications						
Standard care	4.10	165,301	2.80	18,679	113,123	754,648,736 (USD 2,333,887)[b]
Day surgery	1.30	146,622				
Alternative scenario 2:average patient numbers from 2018 to 2020						
Standard care	4.05	164,928	2.90	14,179	107,114	713,526,818 (USD 2,206,710)[b]

Note: a. The average bed-days account for surgical complications that have longer hospital stays.
b. USD 1 = LKR 323.34 (IMF 2022).

Discussion

This study examined the potential cost implication of implementing day surgeries for non-acute hernia cases in Sri Lanka.

In Sri Lanka, patients who require surgical repair are usually admitted to a ward where they spend four days in total for surgery. Day surgery is suggested as an alternative to the current standard of care. The primary benefit of a day surgery is the shorter hospital stay; patients will experience less disruptions of their daily routines, and a greater number of patients can be treated in a given time that can shorten the waiting lists. Further, more resources can be allocated to cater to complications and emergency cases that could contribute to the overall improvement of quality of services.

On average, 2.9 hospital days would be saved per patient through implementation of a day surgery procedure. It was estimated that approximately LKR 781.6 million (approximately USD 2.4 million) could be saved by implementing day surgeries for non-acute hernia repairs. This figure can vary by 3.45 percent (LKR 754.6 million ≈ USD 2.3 million) to 8.71 percent (LKR 713.5 million ≈ USD 2.2 million) depending on the proportion of patients experiencing surgical complications and the number of patients, respectively.

As is the case with any modelled analysis, this analysis employed multiple assumptions. First, it is assumed that the health outcomes of hernia repair as a day surgery is equivalent to the outcomes of hernia repair in the standard of care. Given the lack of evidence on the difference in outcomes of hernia repairs between the two, we were not able to quantify and compare the health outcomes and hence were not able to perform a full cost-effectiveness analysis.

Our study is in line with findings from day surgery studies in the region. Azari, Abutorabi, and Zare (2022) studied clinical reports of 494 (251 in inpatient wards and 243 in the daily surgery ward) patients for selected surgeries such as removal of deep screw or pin, closed metacarpal fracture

treatment, treatment of nasal fracture, placement of external fixation device, removal of plaque or rod inside the canal, adjustment of external fixation system, maxillofacial fixation, and treatment of open mandibular complex fracture. Similar to our findings, a cost saving in favor of the day care department was observed. Moreover, Nepali et al. (2022) performed a retrospective study of 59 patients who underwent day care tonsillectomy surgery at the Pokhara ENT Center in Nepal from February 2018 to January 2019. The study demonstrated that day surgery for a simple non-acute procedure was safe and cost-effective. Lastly, Dorairajan et al. (2010) reported a single-center single-unit study of 157 patients for day care hernia surgery where patients were admitted and discharged the same day or evening. Patients had a favorable impression of the day care procedure compared to the inpatient care. This gives us confidence that a day surgery program would be welcomed by patients.

A limitation of the study is that the analysis employed a health system perspective without accounting for the patient costs. We have not considered the effect of a day surgery on social insurance claims or days saved from loss of work, which could well affect the patients' costs and health care seeking behavior. Another limitation is that the input data may not be completely reflective of the intended study subjects. For example, the number of patients is estimated from all hernia repairs which include acute hernia cases. Exact data on the levels of health care settings where hernia repairs were performed were also not available as such details were not available from the Medical Statistics Unit. Finally, the unit costs of hospital stay were based on the 2010 WHO-CHOICE model with data adjusted for currency and inflation to 2022 LKR. The accuracy of the data warrants further validation with a more recent accounting-based cost study. Also, the cost of a hernia surgery was primarily based on expert opinion and the current charges in the private sector. Hence, a hernia costing study would provide more accurate data which would strengthen the evidence.

In this analysis, the number of hernia patients used for the analysis was obtained from hospital records that reflect the patients coded as 'hernia'. However, some patients may have been admitted and coded as 'abdominal lump'. In such cases, the numbers obtained may be an under-reporting of the actual number of hernia surgeries conducted in a given year. Further, data pertaining to the proportion of admitted cases for whom herniorrhaphy was performed were not available. Thus, we assumed that all patients who were admitted underwent herniorrhaphy.

Conclusion

Cost saving can be expected by providing day surgeries for non-acute hernia cases alone, although the amount may not appear very large. However, hernia repair is just one option for day surgery and day care. This analysis will make a case to explore other conditions that are potentially amenable to day surgery and day care, which could collectively result in substantial cost saving. Further, given the ongoing economic crisis, all options for efficiency gains must be accounted for. In the context of input-based budgeting for public hospitals in Sri Lanka, the freed-up beds and other resources could be utilized in other priority health services to reduce wait time and cater to the growing demand for long-term care. More research would be warranted to examine the potential cost savings from other conditions for which day care and day surgery could be provided and can replace the standard of care with longer hospital stays.

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Appendices

Online Appendix: Hernia model.xlsx