Chapter 3.6.

Gastric cancer prevention programme in Bhutan

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Summary

- Gastric cancer is the leading cause of cancer in Bhutan, with a high mortality rate. Therefore, the Ministry of Health implemented a nationwide population-based *H. pylori* screening and endoscopic screening programme from 2020 to 2023 as part of the Health Flagship Programme.
- The programme screened 90.2% of the target population, providing 14-day triple therapy to individuals who tested positive for *H. pylori*, followed by eradication confirmation after 3 months.
- The cancer detection rate in the screening programme was 3.08 per 1000 people screened for *H. pylori*, with a positive predictive value for gastric cancer of 2.15% in individuals who underwent upper gastrointestinal endoscopy because of a positive *H. pylori* test result or other risk factors for gastric cancer.
- The programme used a multifaceted approach to raise awareness, including nationwide broadcasts, local sensitization programmes, leveraging schools to disseminate information, and a special high-level advocacy campaign in the most remote areas.
- Bhutan's experience in implementing a nationwide population-based cancer screening programme provides valuable insights into the effective implementation of public health interventions in resource-limited settings, highlighting several key lessons and strategies to address various challenges.

3.6.1 Rationale and the Health Flagship Programme

Bhutan is a small, mountainous country in the eastern Himalayas, with altitudes ranging from about 100 m to 7500 m above sea level. Almost 45% of the country lies at altitudes

of 3000 m and higher, and only about 5.3% lies at altitudes of lower than 600 m. Bhutan is a lower-middle-income country. It has a population of about 0.7 million, and 62.2% of the population resides in rural areas [1]. Some human settlement areas are still not connected with roads that are usable by motor vehicles, and places such as Lunana are officially 8 days' walking distance from the nearest road. Despite these challenges, Bhutan has made substantial progress in primary health care, including the implementation of successful initiatives in childhood immunization and improved maternal health. The crude childhood immunization coverage is about 97% [1, 2].

Bhutan's approach to education, health care, and the environment is guided by the Gross National Happiness principle. The constitution mandates free basic primary health care, which provides citizens with free health care from primary care to tertiary care, including referrals abroad when health-care services are unavailable in the country. Health-care services are provided through various levels of health-care facilities distributed across the 20 districts of the country. Bhutan has 54 hospitals, 186 primary health-care centres, 51 subposts, and 554 outreach clinics nationwide [2]. Only three hospitals in the country provide a certain level of tertiary health-care services, and these are designated as referral hospitals for three different regions of the country. Apart from a few selective private diagnostic centres, Bhutan does not have a single private hospital. The establishment of these selective private diagnostic centres was approved by the government in 2012 to provide diagnostic tests for health screenings for foreign workers, for immigration purposes, and to complement the workload of the diagnostic services in the public health facilities. Most of these diagnostic centres are located in the towns near the border with India in the southern districts, and their service fees are regulated by the Ministry of Health.

Until very recently, Bhutan had no health insurance system. The Royal Insurance Corporation of Bhutan Limited, the state-owned insurance company, recently launched a health insurance policy, which covers only medical treatment received abroad (in India).

Although Bhutan has made substantial strides in implementing public health initiatives, such as the expanded immunization programme and maternal health services across widely distributed health facilities, it faces substantial challenges in providing curative health care, because of the limited number of tertiary care hospitals.

For example, advanced cancer diagnosis and treatment facilities are available only at the National Referral Hospital, and some complex cancer cases need to be referred abroad for further treatment. The limited availability of and access to cancer care services in the country often result in advanced-stage cancer diagnoses, leading to poor health outcomes, high mortality rates, and substantial socioeconomic impacts. Cancer has been the third most common cause of death in Bhutan for the past 5 years. According to data from the Bhutan Cancer Registry for 2014–2018, cancer mortality rates were 30.7 per 100 000 people for males and 31.5 per 100 000 people for females [3]. The most common cancer types are gastric cancer in males and cervical cancer in females.

The analysis of lifestyle and dietary habits in the past two World Health Organization (WHO) STEPwise approach to noncommunicable disease risk factor surveillance (STEPS) surveys, in 2014 and 2019, has indicated some poor or deteriorating habits in the Bhutanese population [4–6]. Among adults in Bhutan, the prevalence of current tobacco use was 24.8% in 2014 and 23.9% in 2019, the prevalence of current alcohol consumption was 42.4% in 2014 and 42.9% in 2019, and the prevalence of insufficient intake of fruits and vegetables increased from 66.9% in 2014 to 86.4% in 2019. The mean population salt intake was 9 g per day in 2014 and 8.3 g per day in 2019. In addition, studies have shown a high prevalence of *H. pylori* infection in the population and have suggested that the high incidence of gastric cancer in the country could be attributed to a virulent strain of *H. pylori* [7, 8].

Given the limited cancer diagnosis and treatment services, the poor dietary and lifestyle habits in the population, and the high prevalence of *H. pylori* infection and gastric cancer, gastric cancer has become a substantial public health concern. In response, despite the absence of evidence on cost–effectiveness, the Royal Government of Bhutan has demonstrated a strong political commitment to addressing gastric cancer, along with two other preventable cancer types, cervical cancer and breast cancer, by implementing a rigorous population-based cancer screening programme, known as the Health Flagship Programme [9, 10]. The government allocated a budget of Nu 1109.572 million (US$ 13.095 million) to the Ministry of Health for the implementation of the Health Flagship Programme [9, 10].

3.6.2 Health Flagship Programme strategies

The Ministry of Health implemented the Health Flagship Programme from 2020 to 2023, based on the programme blueprint established by the Ministry of Health and the screening programme guideline [11]. The Health Flagship Programme Management Unit developed the guideline in consultation with the Technical Working Group for the Health Flagship Programme, which was made up of clinicians with relevant expertise, such as gastroenterologists, surgeons, oncosurgeons, pathologists, gynaecological oncologists, microbiologists, radiologists, and health communication specialists. The Technical Working Group was responsible for providing the necessary guidance for the effective implementation of the programme and reviewing its effectiveness. Because of the COVID-19 pandemic, the actual screening activities were implemented from 2021, and the primary implementing partners of the programme were the district health sectors in all districts and municipalities, mainly through primary health-care centres, subposts, and hospital community health departments. Primary health-care centres and subposts are the lowest level of health facilities, and these facilities do not have physicians. Primary health-care centres are staffed by at least one health assistant and a nurse, who takes care of public health interventions and minor clinical ailments. The screening strategy was issued as part of the national screening guideline, and the programme was rigorously monitored by the Prime Minister's Office.

The main strategies of the gastric cancer programme included:

- Expanding the *H. pylori* testing and endoscopy services in the country by
    - introducing the stool antigen test (SAT) for *H. pylori* infection to primary health-care centres;
    - expanding endoscopy services to the lower levels of health-care facilities.
- Enhancing advocacy and awareness of gastric cancer by
    - advocacy and capacity-building of health workers;
    - public awareness programmes designed to raise public awareness of the issue, persuade people to modify their risk factors, and encourage them to participate in screening programmes.
- Mass eradication of *H. pylori* infection in the Bhutanese population by

- using the SAT for *H. pylori* infection in people aged 18–75 years;
- an *H. pylori* eradication therapy programme (triple therapy and quadruple therapy) for people with positive SAT results.

- Endoscopic screening for gastric cancer by
  - upper gastrointestinal endoscopy (UGIE) for individuals aged 40–75 years with risk factors such as a history of atrophic gastritis, history of *H. pylori* infection, family history of gastric cancer, or history of dyspepsia with alarm features, and for individuals who use tobacco products and consume alcohol.

3.6.3 Implementation of the Health Flagship Programme

Expansion of H. pylori *testing, endoscopy, and histopathology services*

Before the Health Flagship Programme, *H. pylori* testing was performed on endoscopic biopsy samples using the rapid urease test (RUT). Later, the urea breath test (UBT) service was piloted in the three referral hospitals as an alternative method for *H. pylori* testing. The RUT could be used only on endoscopic biopsy samples, and the UBT was expensive and time-consuming. In addition to the requirement for an analyser, the cost per UBT was about 3–6 times the cost per SAT. Given the limitations of the RUT and the UBT for mass screening, the Health Flagship Programme adopted the SAT for mass population-based *H. pylori* screening [9, 10]. The SATs used for *H. pylori* testing included the H. PYLORI CHEK [12] and the H. PYLORI QUIK CHEK [13]. SAT kits were distributed to hospitals, primary health-care centres, and subposts.

Before the Health Flagship Programme, endoscopy services in Bhutan were limited to four centres: three referral hospitals and a military hospital in the capital city. Although outreach camps occasionally provided endoscopy services to other districts, permanent endoscopy services were available only in these four centres. In addition, the endoscopy equipment used was basic and lacked advanced features such as narrow-band imaging or i-scan. In 2021, the Health Flagship Programme established 12 endoscopy centres in 11 districts, covering all regions of Bhutan [9, 10]. This expansion improved the accessibility of routine endoscopy services at hospitals from 7.4% (4 of 54 hospitals) before the Health Flagship Programme to 22.2% (12 of 54 hospitals). This allowed 94.2% of the target population to be reached with UGIE [9]. All 12 centres have

advanced endoscopy equipment with narrow-band imaging and i-scan capabilities, enabling the early diagnosis of gastric cancer.

Before the Health Flagship Programme, histopathology laboratory services, which are essential for cancer diagnosis, were available in only two referral hospitals. The biopsy report turnaround time, calculated from the date of receipt of the sample to the dispatch of the report, ranged from 21 days to 47 days. As part of the Health Flagship Programme, a histopathology laboratory was established in another referral hospital, the Central Regional Referral Hospital, to improve the overall availability of histopathology services in the country; this has substantially reduced the biopsy report turnaround time [9, 10].

Advocacy and capacity-building of public service providers and health workers

For the effective implementation of the Health Flagship Programme, advocating for institutions and individuals, such as health service providers, health administrators, and local administrators, was treated as extremely important. Several rounds of sensitization programmes, including workshops and meetings on cancer screening initiatives, were conducted for these stakeholders. During the sensitization sessions, the stakeholders were informed about their roles and their accountability as crucial parties involved in the national initiative.

The primary focus was on building capacity among health workers through a wide range of training sessions covering prevention, early detection, protocols, skill enhancement, and data management. Knowledge gaps were identified and addressed through comprehensive training programmes [9]. All relevant health professionals, including health assistants at community health departments, primary health-care centres, and subposts, were trained to screen for *H. pylori* infection using the SAT kit. Nearly all of the 15 surgeons in the country and a gastroenterologist received basic training in UGIE, and some received advanced training in UGIE and early gastric cancer diagnosis. The endoscopy training was provided by the Khesar Gyalpo University of Medical Sciences in collaboration with Fukuoka University, Japan. This collaboration ensured that the training was of high quality and incorporated the latest advances and best practices in cancer screening and early detection.

Multifaceted public advocacy and awareness initiative

Public advocacy and awareness programmes were crucial components of the cancer screening initiatives, to ensure seamless implementation and the achievement of the objectives and outcomes. A multifaceted approach was adopted for the awareness initiative, to reach various target groups in the population (Table 3.6.1). The official launch of the programme, attended by the Honourable Health Minister, was broadcast nationwide on the Bhutan Broadcasting Service and was followed by an extensive panel discussion on the national television news channel.

Table 3.6.1. Public advocacy and awareness approaches used during the Health Flagship Programme in Bhutan[a]

Objective	Target groups	Methods
General awareness of the programme	General public, service providers	• Official launch of the programme • Panel discussion on a national television programme
Effective implementation of the programme	Management, local government, health service providers	• Sensitization programme • Screening guidelines • Official notifications • Executive orders
Enhanced awareness of cancer and the screening programme	General population	• Videos, narratives, infographics, pamphlets, posters • Public announcements and notifications • Panel discussions, talk shows • Health talks during the outreach camps
Improved programme coverage	General population, service providers	• High-level advocacy initiative in the most remote areas for unreached populations • Sensitization of students in schools

[a] The Health Flagship Programme is a nationwide population-based cancer screening programme initiated by the Ministry of Health from 2020 to 2023.

In addition to a series of talk shows and panel discussions about cancer and the related initiatives, which aired on national television and in social media, the awareness programme included short video clips, infographics, public notifications, and announcements about the screening schedules through various media channels. Announcing the screening schedules helped the public to plan their work in advance and enabled them to participate in the screening programme. In addition, before the

screening camps started, health professionals provided the necessary health education on gastric cancer to the public.

In rural areas, the resident populations are largely permanent, and health information can be effectively disseminated through the local administration's information-sharing mechanisms. However, in urban areas, the resident population is more mobile, which makes it challenging for the designated health facilities to trace their catchment populations and use the local administration's information-sharing mechanisms. In addition, health advocacy often failed to reach certain sections of the urban population because of the nature of their work, the presence of illiteracy, and the limited access to news and social media by some of the population. These challenges made it difficult to implement the screening programme effectively.

To address these challenges, a unique approach was taken that involved schools and schoolchildren in urban areas. Although students in schools are generally younger than the screening target age of 18 years, they played a crucial role in disseminating information about the screening programme to the target population, particularly their parents, family members, relatives, and neighbours. Sensitizing and educating students in urban areas about cancer and the cancer screening initiative substantially boosted coverage and helped to overcome the challenges in reaching the urban population.

High-level advocacy initiative

The high-level advocacy initiative for the residents of Lunana was led by one of Her Majesties the Queen Mothers. This initiative focused on reaching the most remote and underserved populations in the country. Lunana is a *gewog* (group of villages) with a population of about 700 and is located at an altitude of 3400 m above sea level, officially 8 days' walking distance from the nearest road. Her Majesty the Queen Mother and her entourage, including a complete team of health workers for advocacy and cancer screening, were flown to Lunana by helicopter for the event.

Lunana was chosen for the high-level advocacy initiative not because of its cancer prevalence or its population size but to emphasize the importance of the message about cancer care that needed to be conveyed to the entire Bhutanese population.

Before the event, health-care workers at the primary health-care centres in Lunana conducted extensive screening tests for *H. pylori* infection and assessed gastric cancer

risk factors, covering about 70% of the target resident population. Among those tested, 13% were found to be positive for *H. pylori* and were promptly started on eradication therapy.

During the event, UGIE services were offered to individuals who had been pre-identified and registered by the local primary health-care centres. A total of 113 people underwent UGIE, and 12 histopathology biopsies were collected for further analysis. Upon review, none of the biopsies indicated cancer or precancerous conditions.

This high-level advocacy initiative was a historic event for Lunana, because it was the first time that the community had experienced a specialized outreach medical camp that offered advanced services, such as endoscopy. This high-level event, held for a remote and unreached population, emphasized that every life matters and encouraged everyone to join the fight against this preventable cancer. The event also highlighted the potential for ongoing specialized health-care access in remote areas.

3.6.4 Community-based outreach camps

H. pylori screening, eradication therapy, and endoscopic screening were provided in both facility-based and camp-based settings. Most of the population (> 90%) were covered in outreach screening camps.

Registration of the target population and distribution of sample containers

The first task of the screening process was to list the target population by health facility catchment area. This task was assigned to the primary health-care centres, subposts, and hospital community health departments. After the district health office had scheduled the screening date for each catchment area, voluntary village health workers and *desuups* (volunteers) were mobilized to distribute sample containers. This ensured that individuals could bring their samples to the screening camp venue on the designated camp screening date. People who did not receive a sample container in advance could obtain one at the camp venue on the screening date or from nearby health facilities during official business hours.

People were advised to collect their samples so that they would be as fresh as possible on the scheduled screening date or within 2 days of this date. Individuals who could not attend the scheduled screening camp could visit their local health facilities during routine hours for *H. pylori* testing. This approach ensured maximum participation

and convenience for the community and enhanced the overall effectiveness of the screening programme.

H. pylori *testing*

Stool samples were collected from the screening camps or health facilities, and the demographic information and risk factor details for each individual were entered into the online cancer reporting system. A system-generated unique identity number was given to each sample. The reporting system, hosted on the DHIS2 software platform, includes features specifically for reporting cancer screening data. Every health facility (including primary health-care centres, subposts, and hospital community health departments) can access the system using their unique login credentials to enter, view, edit, and print data and reports. Laboratory, gynaecology, endoscopy, and pharmacy departments also have access to enter or view data on their reporting pages. The SAT results were uploaded to the system and were issued to individuals on the same day; this allowed people to collect the triple-therapy regimen if applicable. The district health office has access to the data for its district, and the Ministry of Health has access to nationwide data.

Before the online system was fully operational, data management was done using Excel; the data were later uploaded to the system. *H. pylori* tests were performed on the same day or within the recommended time limit using either the H. PYLORI CHEK or the H. PYLORI QUIK CHEK test. The H. PYLORI CHEK kit can be used to perform 94 tests (excluding positive and negative controls) and was used for the mass screening; this test was performed only by certified laboratory professionals. The H. PYLORI QUIK CHEK test was used for walk-in patients and for tests in distant places; this test can be performed by trained health assistants.

The H. PYLORI CHEK test uses an enzyme-linked immunosorbent assay (ELISA). The kit contains immobilized capture antibodies against *H. pylori* antigen. The conjugate consists of *H. pylori* antigen-specific antibodies coupled to horseradish peroxidase. If the antigen is present in the specimen, it binds to the conjugate and the immobilized capture antibody during incubation. After the addition of the substrate, a colour change is detected because of the formation of enzyme–antibody–antigen complexes. The results can be read using an ELISA reader or visually if an ELISA reader is unavailable. The main equipment required for the test is a centrifuge and a water bath. Test results can

be obtained in about 60 minutes. The sensitivity of this test was 91%, and the specificity was 100% [14].

The H. PYLORI QUIK CHEK test contains *H. pylori* antigen-specific antibodies (test line; “T”) and antibodies to horseradish peroxidase (control line; “C”). After the addition of the conjugate, *H. pylori* antigen in the sample binds to the antibody–peroxidase conjugate. The antigen–antibody–peroxidase complexes then migrate through a filter pad to a membrane, where they are captured by immobilized anti-*H. pylori* antibodies at the test line. The reaction window is visually examined for the appearance of vertical blue lines on the “C” and “T” sides after the addition of the substrate. Test results can be obtained in about 30 minutes. The sensitivity of this test was 92%, and the specificity was 91% [14].

The test kits require storage at 2–8 °C and must be brought to room temperature before testing. After use, the test kits should be returned to the storage temperature. Samples can be processed within 36 hours of collection if stored at room temperature. Fresh unpreserved samples can be stored at 2–8 °C for up to 96 hours, and frozen unpreserved samples can be stored at ≤ −10 °C for up to 14 days before they are tested [12].

Most of the tests were performed on the same day. When the public turnout for the mass screening exceeded expectations, especially in urban areas, tests were completed within 2 days on samples stored at 2–8 °C. The results were then uploaded to the online cancer reporting system, and individuals were informed via a text message alert on their mobile phones or via a telephone call to collect the triple-therapy medications from the screening camp or a pharmacy counter at any nearby health facility. Pharmacists or health assistants educated patients about the use of the triple-therapy medicines, the need for a follow-up test (3 months after completion of the treatment), and the importance of reporting any adverse drug reactions. Pharmacists were deployed to dispense medications to people who tested positive for *H. pylori* during the mass screening camps.

The district health office, through the primary health-care centres and hospitals, conducted a second round of testing 3 months after completion of the triple-therapy medication. Individuals who still tested positive for *H. pylori* on the second test were prescribed quadruple therapy. Because of metronidazole resistance in the community

[8], this drug was replaced by tinidazole in the quadruple-therapy regimen. The screening algorithm is shown in Fig. 3.6.1.

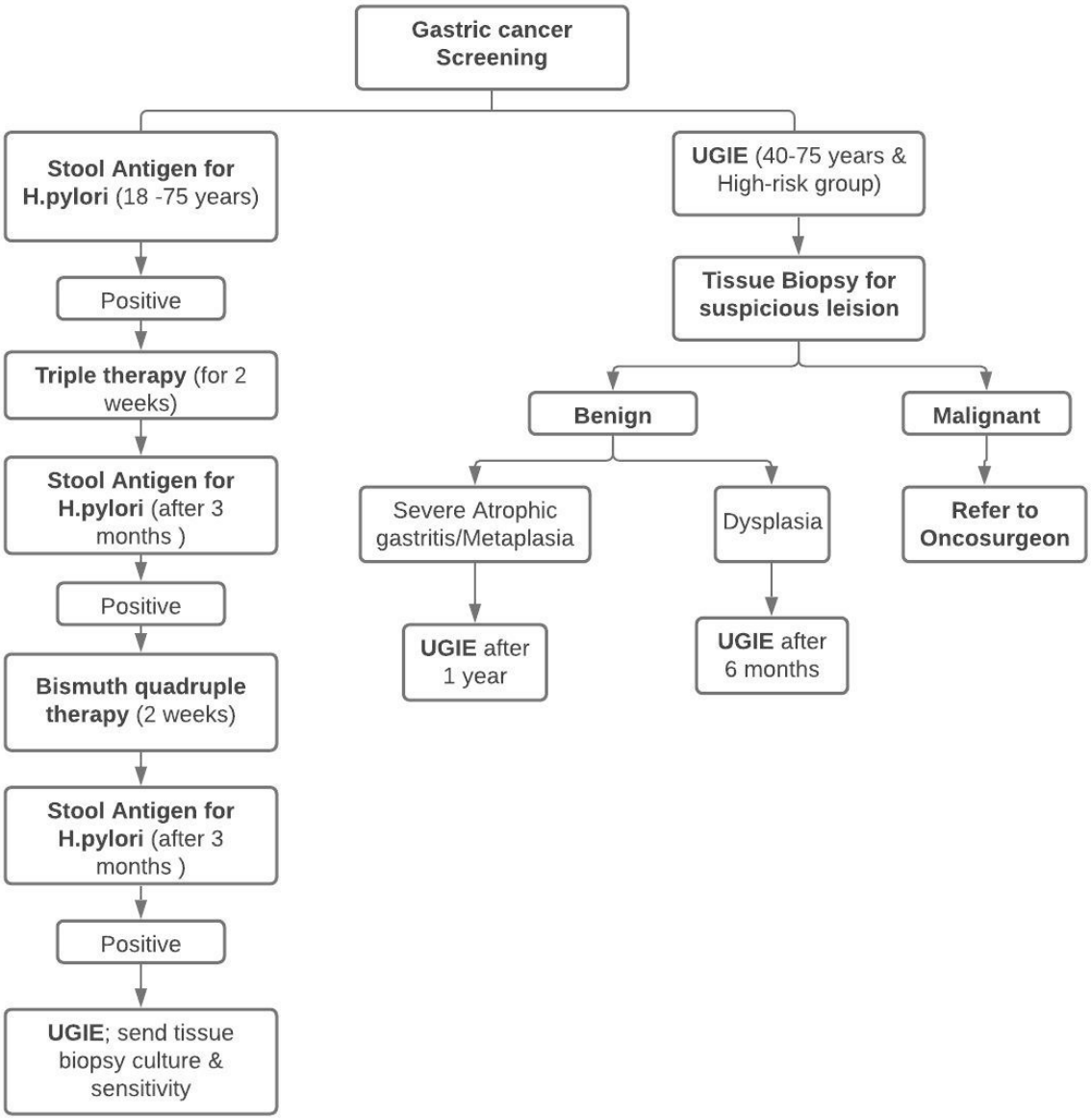

Fig. 3.6.1. Screening algorithm for *H. pylori* and gastric cancer used in Bhutan for the Health Flagship Programme. UGIE, upper gastrointestinal endoscopy.

Treatment for H. pylori *infection*

For the effective treatment of *H. pylori* infection, patients received triple therapy as a first-line treatment. This regimen includes clarithromycin (500 mg, twice a day), amoxicillin (1000 mg, twice a day), and pantoprazole (40 mg, twice a day). This regimen is administered for 14 days. Before starting treatment, patients were screened for any

penicillin allergy. For individuals with a confirmed allergy to penicillin, tinidazole (500 mg, twice a day) was prescribed as a substitute for amoxicillin. Patients were also advised to call the medical emergency hotline for assistance if they experienced any signs of a drug allergy.

If the triple therapy does not achieve eradication (confirmed by a follow-up test 3 months after completion of the treatment), quadruple therapy is recommended as the second-line treatment. This regimen includes tetracycline (500 mg, 4 times a day), bismuth subsalicylate (520 mg, 4 times a day) or bismuth subcitrate (120 mg, 4 times a day), pantoprazole (40 mg, twice a day), and tinidazole (500 mg, twice a day). Quadruple therapy is prescribed for an additional 14 days.

To improve compliance with the treatment regimen, several strategies were put in place, although further enhancements might have been beneficial. The focal pharmacists conducted random follow-ups with patients to ensure adherence to the prescribed regimen. At the 3-month confirmatory test, patients who tested positive were asked specific questions to verify compliance. The decision to proceed with quadruple therapy was contingent upon verification of treatment completion.

Only patients who were confirmed to have completed the treatment regimen in full were eligible for second-line treatment. For those who tested positive but had not completed the initial treatment as directed, a referral was made to the Hospital Therapeutic Committee. This committee reviewed each case individually and decided whether to repeat the first-line treatment or initiate the second-line treatment based on the patient's compliance and clinical response.

Endoscopic screening

Based on the risk factor assessment during the *H. pylori* screening and on the *H. pylori* test results, individuals aged 40–75 years with identified risk factors for gastric cancer were actively enrolled for UGIE screening [9, 10]. In addition, the screening guideline recommends UGIE for any patient irrespective of age and sex if clinically indicated, and for patients who are resistant to quadruple therapy (opportunistic diagnoses). UGIE outreach camps were scheduled for each community to screen all listed individuals. Endoscopy teams, along with the necessary equipment, were mobilized from the nearest established endoscopy centres.

All endoscopic findings were recorded in the online cancer reporting system and the health facility register book for each patient. Endoscopic biopsies obtained from suspicious lesions in the stomach and duodenum were sent to the nearest histopathology laboratory for laboratory confirmation. The histopathology biopsy reports were also entered directly into the system, allowing the referring endoscopist or the focal health worker to view the report and to follow up with the patient to arrange the necessary treatment or management. The screening algorithm is shown in Fig. 3.6.1.

3.6.5 Outcomes of the Health Flagship Programme

The Health Flagship Programme was implemented with sufficient resources to achieve the long-term goal of reducing gastric cancer incidence and mortality.

Key measurement metrics

Using the strategies outlined earlier, the Health Flagship Programme aimed to assess its outcomes by the end of the implementation period using the following key measurement metrics.

- Primary prevention programme:
    - ***H. pylori* screening coverage:** The proportion of individuals screened for *H. pylori* infection relative to the total population aged 18–75 years.
    - ***H. pylori* treatment coverage:** The proportion of individuals diagnosed with *H. pylori* infection who received triple therapy, compared with the total number of individuals who tested positive for *H. pylori* in the initial screening.
- Secondary prevention programme:
    - **Screening coverage:** The percentage of individuals who underwent UGIE compared with the total target population for gastric cancer screening.
    - **Cancer detection rate:** The proportion of cancers detected relative to the total number of individuals screened for gastric cancer.
    - **Positive predictive value:** The proportion of cancers detected among individuals aged > 40 years with a positive *H. pylori* test result or other identified risk factors for gastric cancer.

- **Proportion of advanced-stage cancers:** The percentage of advanced-stage cancers identified relative to the total number of cancers detected.

Screening results

A total of 410 546 individuals aged 18–75 years were registered for the gastric cancer screening programme across all 20 districts of the country. Of this target population, 370 225 individuals participated in *H. pylori* screening using the SAT, achieving a programme coverage rate of 90.2%. Among those tested, 119 854 individuals were found to be positive for *H. pylori* and subsequently received triple therapy, resulting in a national *H. pylori* positivity rate of 32.4%. The positivity rate varied across districts, ranging from 21.9% in Samtse District to 49.8% in Zhemgang District. A breakdown of *H. pylori* prevalence by district is shown in Fig. 3.6.2.

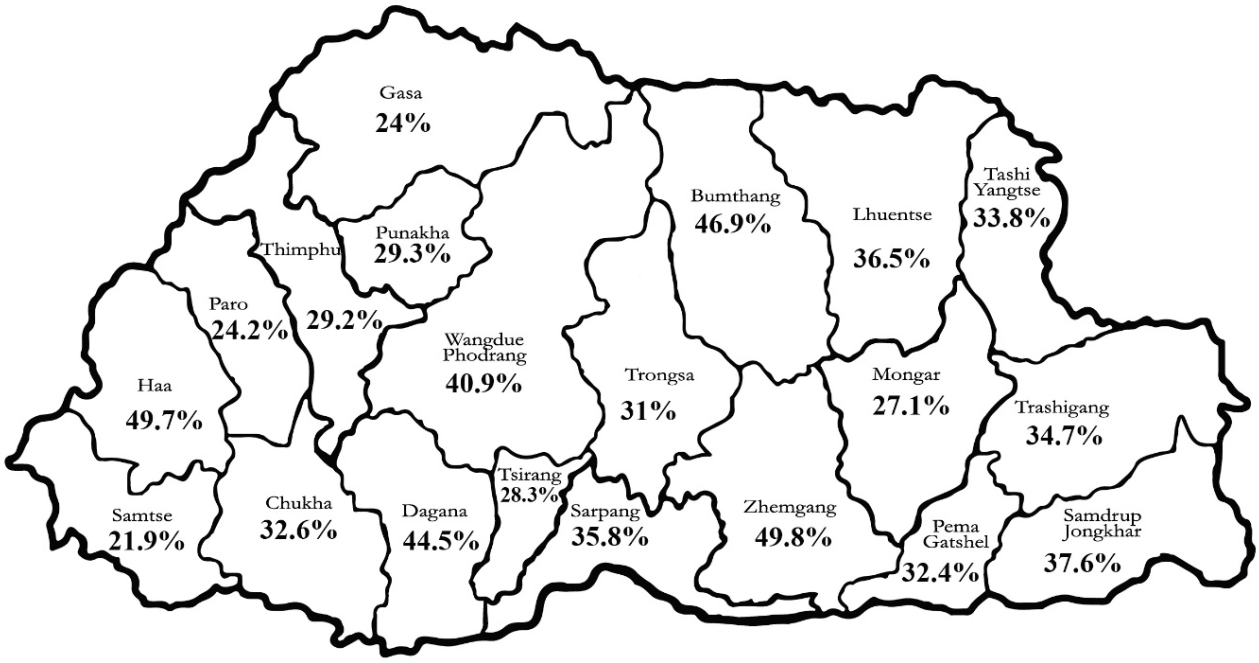

Fig. 3.6.2. *H. pylori* prevalence in districts in Bhutan measured using the stool antigen test during the Health Flagship Programme.

A confirmatory test was conducted for 32 262 individuals, representing 27% of those who tested positive for *H. pylori* and received eradication therapy. Of these, 7.92% still tested positive for *H. pylori*. The resistance to triple therapy varied between districts, with rates ranging from 2.16% to 22.13%. However, it is challenging to draw definitive conclusions about drug resistance, because these figures include all cases who tested positive on the repeat test regardless of treatment compliance (timely completion of the entire course of treatment).

After *H. pylori* screening and risk factor assessment for gastric cancer, 53 182 people aged 40–75 years underwent UGIE screening nationwide in 2021–2023. During this period, 11 637 endoscopic biopsies were taken from suspicious lesions for histopathological confirmation. Biopsies were performed on about 22% of individuals who underwent UGIE, and the biopsy rate varied between endoscopists. The guidelines recommended biopsies for any suspicious lesions, leading to a wide range in the biopsy rate, from 0.56% to 95.75%.

In 2021–2023, a total of 1142 cases of gastric cancer were identified nationwide, resulting in a cancer detection rate of 3.08 per 1000 people screened for *H. pylori* (Table 3.6.2). In comparison, according to data from the Bhutan Cancer Registry for 2019–2022, the overall age-adjusted incidence rate of gastric cancer was 25.1 per 100 000 people in males and 18.9 per 100 000 people in females. In addition, histopathological examination of the 11 637 biopsies identified 206 cases of low-grade dysplasia (1.77%), 42 cases of high-grade dysplasia (0.36%), and 40 cases of intramucosal carcinoma (0.34%). These conditions were found more commonly in districts with high biopsy rates, such as Lhuentse District and Mongar District.

Table 3.6.2. Gastric cancer detection rate by districts of Bhutan (per 1000 people screened for *H. pylori*) during the Health Flagship Programme[a]

District	Gastric cancer detection rate per 1000 people screened for *H. pylori* (2021–2023)
Bumthang	5.24
Dagana	3.35
Haa	14.12
Sarpang	2.28
Samdrup Jongkhar	2.27
Mongar	3.13
Chukha	1.20
Paro	6.57
Pema Gatshel	1.48
Punakha	7.60
Gasa	7.43
Lhuentse	8.47
Samtse	1.46
Trashigang	2.85
Thimphu	0.65
Trashiyangtse	9.16
Trongsa	6.63
Tsirang	2.01
Wangdue Phodrang	6.60
Zhemgang	5.21
National	**3.08**

[a] The Health Flagship Programme is a nationwide population-based cancer screening programme initiated by the Ministry of Health from 2020 to 2023.

From the number of cancers detected in individuals who underwent UGIE because of a positive *H. pylori* test result or other identified risk factors for gastric cancer, the positive predictive value for gastric cancer was found to be 2.15%.

The stage distribution of gastric cancer cases recorded by the oncology department at the National Referral Hospital indicated that 47% of the cases are classified as early stage (stage I–IIB), 43% as locally advanced (stage III), and 10% as advanced stage (stage IV) (Table 3.6.3).

Table 3.6.3. Proportions of gastric cancers by stage in Bhutan

Stage	Classification	Proportion (%)
Early	I	21
	IIA	20
	IIB	6
Locally advanced	III	43
Advanced	IV	10

3.6.6 Lessons learned from implementing a population-based cancer screening programme in Bhutan

Bhutan's population-based gastric cancer screening programme (2020–2023), implemented as part of the Health Flagship Programme, provided valuable insights into the effective implementation of public health interventions in resource-limited settings, highlighting several key lessons and strategies to address various challenges. Some of the main lessons learned and challenges addressed are as follows.

Lessons learned

Strong political commitment

Bhutan's nationwide gastric cancer screening initiative reflects a powerful political commitment to health. The Royal Government of Bhutan prioritized this programme, despite limited local cost–effectiveness evidence, by approving a substantial budget that enabled critical health infrastructure development and the widespread implementation of screening services.

Comprehensive strategy and collaboration

The programme's success was grounded in a comprehensive strategy and close collaboration with central and local government, health-care facilities, schools, and community leaders. These partnerships were essential for maximizing participation across diverse regions, including reaching remote populations.

Public awareness and education

Public engagement was substantially bolstered by a multifaceted advocacy campaign, which used television, social media, schools, and high-level outreach in

remote areas. The high-level advocacy initiative emphasized the importance of collective effort in fighting preventable cancers. Leveraging school students as information channels in urban areas was particularly effective for reaching mobile populations.

Trust between health-care providers and the public

The strong bond between health-care providers and the public in Bhutan was a key factor in the programme's success. Public trust in health-care workers made it easier to mobilize communities for screening, demonstrating the critical role of trust in successful public health interventions.

Infrastructure and resources

Expanding endoscopy centres and enhancing diagnostic equipment greatly increased the programme's reach. Bhutan's cold-chain storage capacity, complete with high-volume walk-in refrigerators and refrigerated vans, was essential for maintaining the quality of *H. pylori* test kits and ensuring the programme's effectiveness.

Data and technology integration

The implementation of an online cancer reporting system streamlined data management, enabling real-time updates. This system supported patient tracking, treatment management, and data-driven decision-making for optimizing screening strategies.

Challenges addressed

Logistics and cold-chain management

The SAT kits required a strict temperature range of 2–8 °C. This was tackled by storing kits in regional walk-in refrigerators and distributing them to health facilities based on their cold-chain capacity, using refrigerated vans. This approach was effective, although maintaining the cold chain was challenging in remote areas with limited road access.

Equipment transportation and infrastructure

Transporting sensitive endoscopy equipment and accessories to rural and remote areas required smart planning because of Bhutan's rugged terrain and lack of road connectivity in certain regions. Careful logistic coordination was essential for safely reaching these areas and setting up temporary screening facilities.

Human resource constraints

The limited health-care workforce in Bhutan is already stretched thin because of multiple public health initiatives. To expand capacity, nearly all surgeons were given basic training in UGIE, and some received advanced training in early gastric cancer detection. These trained surgeons were efficiently used through efficient mobilization and planning. In addition, primary health-care staff received specialized training to conduct rapid SAT screenings. These efforts helped expand service availability with a limited health workforce while managing the increased workload.

Community and cultural sensitivities

Bhutanese cultural practices, especially the preference for spiritual healing, posed a unique challenge, because individuals often delay seeking medical care. Recognizing the popular belief that medication and spiritual healing must go hand in hand, the programme included public sensitization efforts to encourage the integration of medical treatment with spiritual practices. This culturally sensitive approach helped reduce late-stage diagnoses by fostering trust and encouraging timely medical follow-up.

3.6.7 Future directions

Drawing on insights from Professor Prawase Wasi's "triangle that moves the mountain" [15], commitment to the continuation of such gastric cancer prevention efforts will be highly dependent on relevant high-quality evidence and strong political commitment. Insights from the recent programme will guide Bhutan to adopt the most efficient, cost-effective, and sustainable strategies for routine screening.

Enhancing national capacity and infrastructure for early gastric cancer diagnosis and treatment is Bhutan's foremost priority. Without this, population-based screening efforts will have a limited impact. In addition, although Bhutan's central clinical laboratory

currently monitors antibiotic resistance for commonly used antibiotics, developing and maintaining an antibiogram specific to the antibiotics used in *H. pylori* eradication therapy will help guide future treatment protocols.

With the data from the Health Flagship Programme and the National Health Survey, Bhutan plans to focus on evaluating the effectiveness of the programme, building evidence for cost-effective cancer screening, and refining its strategies in collaboration with the relevant national and international research agencies, such as IARC. This approach will not only support evidence-based decision-making in Bhutan but also contribute to the global understanding of gastric cancer.

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