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The impact of the policy-practice gap on costs and benefits of Barrett's esophagus management

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Abstract

Introduction—Clinical guidelines recommend surveillance of Barrett's esophagus (BE) patients. However, the surveillance intervals in practice are shorter than policy recommendations. We aimed to determine how this policy-practice gap affects the costs and benefits of BE surveillance.

Methods—We used The Netherlands as an exemplary Western country and simulated a cohort of 60-year-old BE patients using the MISCAN-EAC microsimulation model. We evaluated surveillance according to the Dutch guideline, as well as more intensive surveillance of non-dysplastic BE (NDBE) and low-grade dysplasia (LGD) patients. For each strategy, we computed the quality-adjusted life years (QALYs) gained and costs compared with no surveillance. We also performed a budget impact analysis to estimate the increased costs of BE management in The Netherlands for 2017.

Results—Compared with no surveillance, the Dutch guideline incurred an additional €5.0 (\$5.7) million per 1,000 BE patients for surveillance and treatment, while 57 esophageal adenocarcinoma (EAC) cases (>T1a) were prevented. With intensive and very intensive surveillance strategies for both NDBE and LGD, the net costs increased by another €2.5–5.6 (\$2.8–6.5) million, while

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Specific author contributions

ILV, MS, CR, AHO, SK, and PJJ contributed in study concept and design. AHO, CR, SN, and SK conducted statistical analyses and all authors interpreted data and analyses results. AHO, CR, and SK drafted the manuscript and all authors critically revised and approved the manuscript. ILV, MS, and SK obtained funding for this study and ILV and SN contributed in study supervision.

Potential competing interests

PJJ, AG and PW have nothing to disclose.

Ethical approval

Approval of the medical ethical committee of the Erasmus MC University Medical Center was obtained for the ProBar study, with as accompanying number of approval MEC-2013-422.

preventing 10–19 more EAC cases and gaining 33–60 more QALYs. On a population level, this amounted to €1–47 (\$24–54) million (+32–70%) higher healthcare costs in 2017.

Conclusions—The policy-practice gap in BE surveillance intervals results in 50–114% higher net costs for BE management for only 10–18% increase in QALYs gained, depending on actual intensity of surveillance. Incentives to eliminate this policy-practice gap should be developed to reduce the burden of BE management on patients and healthcare resources.

Keywords

Surveillance; esophageal cancer; Barrett's esophagus; cost-effectiveness

INTRODUCTION

Barrett's esophagus (BE) is a prevalent condition, with gastro-esophageal reflux disease (GERD) as its most prominent risk factor.(1) It is a precursor lesion of esophageal adenocarcinoma (EAC). The global disease burden because of EAC is growing. In the last three decades, the overall incidence of EAC has increased by six-fold in the western world. (2) The path towards the malignant stage is supposed to proceed by low-grade dysplasia (LGD) and high-grade dysplasia (HGD). Survival rates in patients with symptom-detected EAC are low, which is mainly attributable to the presence of regional or distant metastases at the time of diagnosis.(3) In order to detect neoplastic progression in an earlier stage, surveillance by upper endoscopy with random biopsies is carried out in patients with BE.(4, 5) In case of neoplastic progression towards HGD or early EAC, endoscopic eradication therapy (EET), such as endoscopic mucosal resection (EMR) and radiofrequency ablation (RFA), is available as a minimally invasive treatment strategy.

Due to timely detection of neoplastic progression by surveillance and effective treatment of BE, the burden of EAC on the healthcare system may be reduced. Although BE surveillance also implies an exponential increase of endoscopies, cost-effectiveness analyses have indicated that a strategy of surveillance and EET is beneficial.(6) Recommendations concerning surveillance of BE and EET have been formulated in national and international guidelines.(4, 5, 7)

However, there is a discrepancy between follow-up according to the guidelines and daily practice. Clinicians do not completely adhere to the guidelines. Surveillance intervals are shorter than recommended,(8) and biopsies are not taken according to the Seattle protocol. (9) It is unclear what the influence of this discrepancy between policy and practice is on the burden of BE management.

Therefore, the aim of this study was to determine how current practice in surveillance of patients with BE affects the costs and benefits of the BE management program, compared to practice as recommended by guidelines for BE. We used The Netherlands as an exemplary Western country to evaluate the impact of this policy-practice gap.

METHODS

We used the Microsimulation Screening Analysis model of EAC (MISCAN-EAC) from Erasmus MC University Medical Center (Rotterdam, The Netherlands) to simulate a cohort of patients with BE in The Netherlands. Separate model runs were used to determine the costs and benefits of full adherence with the current Dutch guideline, and of non-adherent scenarios with more intensive surveillance as reported in the literature.(10, 11)

Dutch MISCAN-EAC model

The Dutch MISCAN-EAC model simulates the life histories of a population of individuals from birth to death. In this population, EAC develops through BE and the risk of developing BE and EAC in people with GERD symptoms is higher than in those without GERD symptoms.(12) In the model, BE starts in a state with no dysplasia (ND), but may progress to LGD and HGD. However, patients may also regress from LGD to ND and from HGD to LGD (Appendix 1). From HGD, malignant cells can arise and transform to a state of T1a EAC. Subsequently, more advanced stages of EAC can develop. The sequence of BE to EAC can be interrupted by surveillance, which can detect BE with or without dysplasia. Patients with NDBE or LGD enter a surveillance program and patients with persistent LGD, HGD, and early-detected EAC receive treatment, which can change their life histories (e.g. an HGD patient who received EET might not develop EAC anymore). The harms and benefits of surveillance and treatment were incorporated in the model. Comparing all life histories with surveillance and treatment with those without any intervention defines the benefits, harms, and costs of the surveillance and treatment intervention.

The model was calibrated to observed incidence rates of EAC in The Netherlands from 2012–2017.(13) We also used data of an observational multicenter prospective cohort study (ProBar) with currently a median follow-up of 8 years(14) to calibrate the BE progression rates in our model. Additional details on the model structure, assumptions, and calibration are provided in Appendix 1.

Population and BE management strategies

We simulated a Dutch cohort of 60-year-old patients with BE, as other studies have shown that the mean/median age of BE patients at diagnosis is higher than 60 years. (15–17) We followed these patients until death and compared four different management strategies (Figure 1): (1) no surveillance, (2) the Dutch guideline strategy, and strategies where we assumed (3) intensive or (4) very intensive surveillance, in accordance with intervals observed in practice.(10, 11, 18) Strategies differed with respect to the intensity of surveillance for NDBE and LGD patients.

In all strategies, patients with HGD/EAC T1a were treated with EET. In the strategies with surveillance, patients with persisting long-segment LGD in the last three endoscopic surveillance exams, also received EET. Except for strategy 1 without surveillance, surveillance after EET was modeled according to the US guidelines and expert opinion (Appendix Table 1).(5, 19) Any recurrences after EET were followed by touch-up RFA and more intensive surveillance. A maximum number of three touch-up RFAs was assumed for

each patient. Patients with persistent or recurrent NDBE or LGD after the maximum number of touch-ups underwent surveillance, and those with persistent or recurrent HGD/EAC T1a underwent esophagectomy.

Surveillance and treatment assumptions

In the main analysis, we assumed that all patients attended all surveillance endoscopies and treatment sessions. We assumed that surveillance stopped at the age of 80 years. To consider the high interobserver variability in histological diagnosis of BE patients, we used the results of the ProBar study.(14, 20) In the ProBar study, after the first histological diagnosis of BE, a second BE expert pathologist assessed the histological diagnosis. In case of disagreement, another BE expert pathologist evaluated the result to reach consensus. We compared the results of the first and last assessment of the patients in the ProBar study to estimate the validity of the endoscopic surveillance test to grade dysplasia or detect EAC. Table 1 provides the assumed distribution of diagnosed states for patients with a particular true state in the model. We assumed that initial EET took two years and that patients during this two-year period of EET, received an average of 3.55 RFA sessions and four endoscopies (Table 2).(21) The proportion of patients receiving EMR treatments before RFA was assumed to be 55%.(22) The EET success and recurrence rates were assumed based on the initial state of the patients (NDBE, LGD, HGD/EAC T1a).(23)

Costs and utilities

Based on a retrospective chart review at Erasmus MC University Medical Center, we estimated the average utilization of a BE or EAC patient of specific healthcare products, as defined within the Diagnosis and Treatment Combinations (DTC) system in The Netherlands. This was multiplied by the average price of all hospitals in The Netherlands for these services based on the reimbursement (Table 2).(24) A more detailed description of the derivation of cost estimates can be found in Appendix 2.

Disutilities of initial, continuous, and terminal care of EAC patients as well as endoscopy, EET, esophagectomy, and the complications due to surveillance or treatment were estimated from the literature or based on expert opinion (Table 2).

Outcomes

The health outcomes estimated for each strategy included: number of EAC cases (>T1a), mortality due to EAC, treatment complications (*i.e.* perforation, stricture, and bleeding), life years gained, and quality-adjusted life years (QALYs) gained. For each strategy, we also estimated the total costs, including the costs of endoscopy, EET treatment, EET touch-ups, esophagectomy, complications, and cancer care.

Analyses

We compared the results of the more intensive strategies with the Dutch guideline strategy. We calculated incremental costs and benefits, to assess the efficiency of the more intensive surveillance strategies. We also computed the incremental costs per QALY gained for the more intensive strategies compared with the Dutch guideline strategy. We used the common Dutch willingness-to-pay (WTP) threshold of €20,000 (\$22,853) per QALY

gained to determine if these more intensive strategies are cost-effective.(25) Both costs and QALYs were discounted by 3% annually, as recommended by the Second Panel on Cost-Effectiveness in Health and Medicine.(26)

Budget impact analysis

We performed a budget impact analysis to estimate the costs for management of BE patients in The Netherlands for 2017. We replicated the Dutch BE population aged 20–80 in 2017. We estimated total annual costs, the numbers of endoscopies, endoscopic therapies, and esophagectomies for the Dutch guideline strategy, and the intensive and very intensive surveillance strategies (strategies 2, 3 and 4).

Sensitivity analyses

We performed the following one-way sensitivity analyses to test the robustness of our results.

- We simulated cohorts of 50-year-old, 55-year-old and 70-year-old BE patients;
- We assumed 20% lower and higher progression rate of BE to EAC;
- We assumed lower patients participation rates for surveillance (80%) and EET (95%);
- We applied discounting rates of 1.5% for effects and 4% for costs to all the strategies, according to the Dutch guideline for economic evaluations in healthcare; (27)
- We used the costs in the US setting for surveillance, EET, treatment of complications, and cancer care (Appendix Table 2).

RESULTS

Main analysis

Without surveillance (strategy 1), 121 EAC cases (>T1a) were diagnosed per 1,000 60-year-old BE patients during lifetime follow-up. The Dutch surveillance guideline (strategy 2) prevented 57 of these EAC cases and gained 333 additional QALYs, while the costs increased by €5.0 (\$5.7) million (Figure 2, Appendix Table 3).

Intensive and very intensive surveillance practice in The Netherlands for NDBE and LGD patients (strategy 3 and 4), resulted in 50–114% higher net costs (+€2.5–5.6 million, \$2.8–6.5) compared to the Dutch guideline, while 10–19 more EAC cases (+18–34%) were prevented and 33–60 more QALYs (+10–18%) were gained, respectively. In other words, intensive and very intensive surveillance of both NDBE and LGD patients led to an incremental cost of more than €76,400 (\$87,300) per QALY gained which was more than the commonly accepted Dutch WTP threshold of €20,000 (\$22,853) per QALY gained.(25) The incremental cost per QALY gained was worst (€85,835, \$1,126,476) for intensifying surveillance in LGD patients (strategy 3a).

Budget impact analysis

On a national level, management of BE patients with full adherence to the Dutch guideline, required an estimated 54,706 endoscopies, 1,163 initial EETs, 1,052 EET touch-ups, and 137 esophagectomies in 2017. The costs of the program were estimated to be €67.0 (\$76.6) million. Intensive surveillance of both NDBE and LGD patients (strategy 3) resulted in an estimated 23,585 more endoscopies, 333 more initial EETs, 284 more EET touch-ups, and 7 more esophagectomies in 2017 (Table 3). Very intensive surveillance strategy for NDBE and LGD (strategy 4) was estimated to require even more endoscopies and treatments. The non-adherence to the Dutch guideline increased the costs of BE management in The Netherlands by €21.2–47.0 (\$24.2–53.7) million (32–70%) in 2017.

Sensitivity analyses

Our results were robust for assumptions regarding the age of the simulated BE cohort, progression rate to BE, and lower participation rates of patients for surveillance or EET with similar increases in costs and QALYs as in main analysis, and incremental costs per QALY gained were around or above 40,000 for all strategies (Table 4 and Appendix Table 4). Assuming US costs resulted in an incremental costs per QALY gained below \$60,000 for most scenarios which is considered cost-effective in a US setting (Appendix Table 5).

DISCUSSION

Our findings indicate that more intensive surveillance for BE patients leads to 50–114% higher costs for an almost 10–18% increase in QALYs gained compared to the Dutch guideline, depending on actual intensity of surveillance. Shorter surveillance intervals than recommended can increase the likelihood of preventing EAC diagnosis or EAC death, therefore more QALYs might be gained. However, with a slight increase in QALYs gained versus the considerable increase in costs, we found that more intensive surveillance of BE patients than recommended is unlikely to be cost effective using the WTP threshold of €20,000 (\$22,853) per QALY gained in The Netherlands. The policy-practice gap in surveillance of BE patients increased the annual costs of the surveillance program by €21–47 (\$24–54) million at a national level in The Netherlands in 2017, as more endoscopic and treatment procedures were required.

Interestingly, we found that the impact of more intensive surveillance for both NDBE and LGD patients is larger than the combined impact of intensified surveillance for each of these patient groups separately. In our model, NDBE patients can progress to LGD, and LGD patients can regress to NDBE. Therefore, in a more intensive strategy for both NDBE and LGD, BE patients would have more intensified surveillance in case of progression or regression, while in a more intensive strategy for either NDBE or LGD, in case of progression or regression, these patients would not have intensified surveillance. Furthermore, in an intensified surveillance strategy for both NDBE and LGD patients, NDBE patients undergo surveillance more frequently and we detect more LGD patients who would also undergo surveillance more frequently. Consequently, the number of endoscopies, costs and benefits increase more when there is concurrent intensified surveillance for

both NDBE and LGD patients compared to the combined impact of separate intensified surveillance.

Results were quite sensitive to the Dutch cost setting. Using US costs, cost-effectiveness ratios were slightly more favorable because of the higher savings from prevented EAC treatment in that setting. Estimated costs per QALY gained of very intensive surveillance (\$60,550) would still not be considered cost-effective using Dutch WTP thresholds, but would be when assuming the commonly used US-based WTP threshold of \$100,000 per QALY gained. Furthermore, it is worth mentioning that we have performed a conservative analysis. If we had considered indirect costs, such as patient-time and transportation costs, the increase in costs would have been even larger. In addition, the policy-practice gap in BE management is probably larger, due to low adherence of clinicians to the biopsy protocol, which can result in a lower detection rate of dysplasia.(28) Therefore, the beneficial effect of intensified surveillance may be even lower than what we have estimated.

This is the first study that used budget impact analysis to evaluate the impact of the policy-practice gap in management of BE patients in The Netherlands. In addition, We used a precise method to calculate all BE management program related costs in The Netherlands by estimating the average utilization of a BE or EAC patient of specific healthcare products and the average price of these products in all hospitals in The Netherlands (Appendix 2). Other strong points of our study are that our model fits the Dutch EAC incidence data and we have used the outcomes of an observational multicenter prospective cohort (ProBar) study in The Netherlands to calibrate our model.(14) The baseline characteristics and the incidence rate of HGD/EAC of ProBar study have been shown to be comparable to other international cohorts.(29, 30) Therefore, the findings of this study are generalizable to other Western populations.

Our study also has some limitations. First, for the effectiveness of EET, only short-term outcomes were available from the literature.(23) We therefore extrapolated those outcomes to estimate the long-term effectiveness of EET. Second, the exact progression rate from BE to EAC is unknown. However, we optimized the progression parameters using ProBar data, and we conducted sensitivity analyses with higher and lower progression rates to evaluate the robustness of our findings. Finally, the Dutch guidelines do not provide any recommendations for surveillance after EET. Therefore, we used other guidelines and expert opinion to define the post-treatment strategies.

In spite of these limitations, our results provide strong evidence for clinicians that non-adherence to the guidelines substantially increases the costs of BE management while the benefits are small. The Results seem to suggest that at least some of the more intensive strategies are cost-effective compared to current guidelines in countries like US with higher common accepted WTP threshold than the Netherlands. However, the number of BE patients that will actually benefit from this intensification is very small and harms of intensified surveillance may outweigh its health benefits. We recommend rather than more intensive surveillance for all BE patients to target those at highest risk.

Current guidelines mainly distinguish risk of patients by dysplasia status, but our model results in Appendix 1 suggest substantial differences in EAC risk by gender and BE length. Using gender, BE length and potentially biomarkers such as P53 to identify those BE patients at the highest risk for developing EAC and target those for more intensive surveillance, could very well be a cost-effective strategy. Such a stratification could also reassure clinicians that they can safely extend the interval in other low-risk patients. In such a setting, risk-stratified management of BE patients based on the risk of progression of BE towards HGD/EAC would reduce the burden of unnecessary surveillance endoscopies and treatments and decreases healthcare cost at a national level, while at the same time maintaining benefits.

In conclusion, our findings indicate that the policy-practice gap in BE surveillance intervals results in more than 100% higher costs for only up to 18% more QALYs gained. It is important to develop incentives to eliminate this policy-practice gap so that the burden of BE management on patients and healthcare resources can be reduced.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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What is known?

- Clinical guidelines recommend surveillance of Barrett's esophagus (BE) patients.
- An important gap exists between policy-recommendations and observed practice for BE surveillance.
- Surveillance intervals are shorter than recommended.

What is new here?

- This gap resulted in 50–114% higher costs for BE surveillance for 10–18% increase in QALYs gained.
- On a population level, this amounted to €21–47 (\$24–54) million (+32–70%) higher healthcare costs per year.

Strategy	Surveillance interval		
	non-dysplastic short segment BE	non-dysplastic long segment BE	low-grade dysplasia BE ¹
1. No surveillance	not applicable	not applicable	not applicable
2. Dutch guideline	5 years	3 years	6 months & 1 year
3. Intensive NDBE & LGD	3.5 years	2 years	3 months & 6 months
3a. Intensive NDBE	3.5 years	2 years	6 months & 1 year
3b. Intensive LGD	5 years	3 years	3 months & 6 months
4. Very intensive NDBE & LGD	2 years	1 years	3 months & 6 months
4a. Very intensive NDBE	2 years	1 years	6 months & 1 year

Recommendation by Dutch guideline
Intensive surveillance intervals
Very intensive surveillance intervals

Figure 1.

Simulated Barrett's esophagus management strategies

BE: Barrett's esophagus; LGD: low-grade dysplasia; NDBE: non-dysplastic BE

1 The first interval in this column indicates the first interval for surveillance after diagnosis, and the second interval indicates the interval for following surveillance endoscopies thereafter.

Figure 2.

Impact of more intensive surveillance of Barrett's esophagus on (A) prevented EAC cases, (B) QALYs gained, (C) number of endoscopies, and (D) net costs per 1,000 BE patients. EAC: esophageal adenocarcinoma; NDBE: non-dysplastic Barrett's esophagus; LGD: low-grade dysplasia; QALY: quality-adjusted life year.

1. The Net costs in US\$ for strategies 3, 3a, 3b, 4 and 4a are 3.0, 1.9, 0.8, 6.9 and 5.4 million \$, respectively.

Table 1.

The validity of endoscopic surveillance test to grade dysplasia and detect EAC

		True state			
		NDBE	LGD	HGD/EAC T1a	EAC
Diagnosed state *	NDBE	94.7%	34.0%	2.7%	0.0%
	LGD	5.3%	63.2%	15.8%	2.5%
	HGD/EAC T1a	0.0%	2.9%	72.9%	20.5%
	EAC	0.0%	0.0%	8.6%	77.0%

EAC: esophageal adenocarcinoma, HGD: high-grade dysplasia, LGD: low-grade dysplasia, LY: life years, NDBE: non-dysplastic Barrett's esophagus

* 94.7% of NDBE patients, 63.2% of LGD patients, 72.9% of HGD/EAC T1a patients and 77.0% of EAC patients are assumed to be correctly diagnosed by endoscopic surveillance.

Table 2.**Model inputs and sources**

Parameter/Definition	Value	Source
EET and touch-ups assumptions		
Maximum number of EET touch-ups	3	(21)
Duration of initial EET (years)	2	(21)
Number of endoscopies during initial EET	4	(21)
Number of treatments during initial EET	3.55	(21)
Proportion of patients receiving EMR treatments before RFA	0.55	(22)
Complication rates		
Perforation due to surveillance endoscopy	0.00024	(31–34)
Bleeding due to surveillance endoscopy	0.00026	(31–33, 35)
Perforation due to EET (per procedure)	0.002	(36)
Bleeding due to EET (per procedure)	0.004	(23, 36)
Stricture rate due to EET (per procedure)	0.019	(23, 36)
Perforation rate resulting from stricture	0.0009	(37)
Bleeding rate resulting from stricture	0.0009	(37)
Success probabilities of treatment		
Success of therapy in pre-treatment HGD /EAC T1a patients		
CE-IM and CE-D	68%	(23)
Non-CE-IM, CE-D	17%	(23)
Non-CE-IM and Non-CE-D	15%	(23)
Success of therapy in pre-treatment LGD patients		
CE-IM and CE-D	72%	(23)
Non-CE-IM, CE-D	19%	(23)
Non-CE-IM and Non-CE-D	8%	(23)
Success of therapy in pre-treatment NDBE patients		
CE-IM	81%	(23)
Non-CE-IM	19%	(23)
Recurrence rates by baseline histologic grade and grade of recurrence		
Annual recurrence rates after CE-IM		
Pre-treatment NDBE	7%	(38–40)
Pre-treatment LGD	8%	(38–40)
Pre-treatment HGD	14%	(38–40)
Recurrence histology distribution pre-treatment NDBE		
NDBE	92%	(38–40)
LGD	6%	(38–40)
HGD/EAC T1a	2%	(38–40)
EAC	0%	(38–40)
Recurrence histology distribution pre-treatment LGD		
NDBE	82%	(38–40)
LGD	14%	(38–40)

Parameter/Definition		Value	Source
HGD/EAC T1a		2%	(38–40)
EAC		2%	(38–40)
Recurrence histology distribution pre-treatment HGD			
NDBE		69%	(38–40)
IND/LGD		15%	(38–40)
HGD/ EAC T1a		10%	(38–40)
EAC		6%	(38–40)
Dutch costs			
Endoscopy		€807 (\$922)	Appendix 2
Initial EET treatment (EMR & RFA)		€11,662 (\$13,326)	Appendix 2
RFA Touch-Up		€2462 (\$2,813)	Appendix 2
EET complication	Stricture	€5,863 (\$6,699)	Appendix 2
	Bleeding	€2,345 (\$2,680)	Appendix 2
	Perforation	€2,345 (\$2,680)	Appendix 2
Esophagectomy		€29,280 (\$33,457)	Appendix 2
Annual outpatient visit after esophagectomy		€190 (\$217)	Appendix 2
EAC stage 1 care		€31,602 (\$36,110)	Appendix 2
EAC stage 2 care		€42,806 (\$48,913)	Appendix 2
EAC stage 3 care		€43,127 (\$49,280)	Appendix 2
EAC stage 4 care		€9,332 (\$10,663)	Appendix 2
Utilities			
<i>Short terms</i>			
Endoscopy with or without EET (1 day)		0.70	(41)
After EET Treatment (1 week) *		0.70	(21)
After RFA Touch-Up (1 week)		0.70	(21)
Stricture (1 week)		0.70	(21)
Perforation (1 week)		0.70	Expert opinion
Bleeding (1 week)		0.70	(21)
After esophagectomy (4 weeks)		0.86	(14)
<i>Long terms (until death)</i>			
Esophagectomy (yearly)		0.90	(14)
EAC stage 1 care (initial year)		0.84	(42, 43)
EAC stage 1 care (yearly after the first year)		0.96	(42, 43)
EAC stage 2 and 3 care (yearly)		0.65	(42, 43)
EAC stage 4 care (yearly)		0.40	(42, 43)

BE: Barrett's esophagus, CE: complete eradication, D: dysplasia, EAC: esophageal adenocarcinoma, EET: endoscopic eradication therapy, EMR: endoscopic mucosal resection, HGD: high-grade dysplasia, IM: intestinal metaplasia, IND: indefinite dysplasia, NDBE: non-dysplastic Barrett's esophagus, LGD: low-grade dysplasia, RFA: radiofrequency ablation.

* During initial EET, patients were assumed to receive on average 3.55 RFA sessions and 0.55 EMR treatments, therefore 28.7 days utility of 0.7 was assumed per initial two-year EET.

Table 3.

The impact of the policy-practice gap in management of Barrett's esophagus in The Netherlands in 2017

Strategy	Dutch guideline	Intensive for NDBE and LGD		Very intensive for NDBE and LGD	
Endoscopies	54,706	78,290	+23,586 (43%)	108,135	+53,429 (98%)
Initial EET	1,163	1,496	+333 (29%)	1,776	+613 (53%)
EET touch-ups	1,052	1,336	+284 (27%)	1,604	+552 (52%)
Esophagectomies	137	144	+7 (5%)	150	+13 (9%)
Costs (million €)	67.0	88.2	+21.2 (32%)	114.0	+ 47.0 (70%)
(million \$)	76.6	100.8	+24.2	130.3	+53.7

EET: endoscopic eradication therapy, NDBE: non-dysplastic Barrett's esophagus, LGD: low-grade dysplasia, RFA: radiofrequency ablation

Results of the main analysis and sensitivity analyses of more intensive strategies versus Dutch guideline per 1,000 Barrett's esophagus patients

Table 4.

Strategy	Intensive for NDBe and LGD (Strategy 3) ¹				Intensive for LGD (Strategy 3b) ¹				Very intensive for NDBe and LGD (Strategy 4) ¹				Very intensive for NDBe (Strategy 4a) ¹			
	QALY gained ²	Net costs ² (€m)	Incremental costs (€) per QALY ²	QALY gained ²	Net costs ² (€m)	Incremental cost (€) per QALY ²	QALY gained ²	Net costs ² (€m)	Incremental cost (€) per QALY ²	QALY gained ²	Net costs ² (€m)	Incremental cost (€) per QALY ²	QALY gained ²	Net costs ² (€m)	Incremental cost (€) per QALY ²	QALY gained ²
Main analysis	32.5	2.5	76,415	28.0	1.6	57,188	0.6	0.6	985,980	59.8	5.6	94,872	50.6	4.4	87,844	
Cohort of 50-year-old	52.7	3.2	60,953	45.5	2.1	46,822	2.7	0.8	288,285	97.8	7.2	73,942	82.2	5.8	70,205	
Cohort of 55-year-old	42.4	2.9	68,228	36.7	1.9	51,352	1.3	0.7	545,274	78.8	6.5	82,859	66.8	5.1	76,965	
Cohort of 70-year-old	16.1	1.5	90,400	15.0	0.9	59,817	-0.3	0.4	N.A.	30.1	3.4	114,531	26.4	2.6	98,665	
Higher progression rate	44.7	2.5	55,056	39.3	1.6	40,749	0.6	0.6	1,036,215	83.4	5.6	67,165	71.6	4.4	61,204	
Lower progression rate	24.0	2.5	103,615	20.7	1.6	77,140	0.6	0.6	1,091,515	43.8	5.7	130,244	36.9	4.5	121,408	
Lower participation rate	23.9	2.0	83,361	20.7	1.3	62,007	0.1	0.5	4,309,423	43.7	4.5	103,723	37.1	3.6	95,844	
Different discount rates ³	44.6	2.3	51,663	37.8	1.5	39,196	1.4	0.6	408,403	81.7	5.3	64,467	68.4	4.1	60,139	
US cost setting ⁴	32.5	1.5	45,731	28.0	1.0	35,097	0.6	0.4	578,634	59.8	3.6	60,550	50.6	2.9	58,323	

BE: Barrett's esophagus, EAC: esophageal adenocarcinoma, LGD: low-grade dysplasia, LY: life years, m: million, NDBe: non-dysplastic Barrett's esophagus, QALY: quality-adjusted life year

¹ Difference of the results of these strategies and Dutch guideline strategy are presented.

² Costs and QALYs were discounted at an annual rate of 3%, unless specified otherwise.

³ Costs discounted by 4% annually and QALYs by 1.5% annually.

⁴ US costs are presented in \$US. Other costs presented in € in this table are presented in \$US in Appendix Tables 3 and 4 as well.