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| **Disease** | **Subject** | **Finding** | **Year** | **Reference** |
| **Colorectal cancer** | Audit implementation | It is feasible to accomplish a nationwide surgical audit program, with national coverage and high case ascertainment, in a relatively short period of time. | 2013 | Van Leersum et al.1 |
|  | National clinical practice | From an international perspective, the use of radiotherapy (RT) for rectal cancer in the Netherlands is currently very high. Considerable hospital variation was observed for RT in stage I and for the proportion of chemoradiotherapy among all RT schemes. | 2013 | Van Leersum et al.2 |
|  | National clinical practice | An increasing percentage of patients undergoing low anterior resection for rectal cancer receive a defunctioning stoma, 70% in current Dutch practice. Clinically relevant anastomotic leakage rates remained similar. Routine use of defunctioning stomas should be questioned. | 2012 | Snijders et al.3 |
|  | National clinical practice | In the treatment of a left-sided malignant colon obstruction, acute resection as first choice treatment seems justified. However, for frail, elderly patients, with mortality rates of over 30% after acute resection, the need for alternative treatment strategies was stressed. | 2015 | Tanis et al.4 |
|  | National clinical practice | After the introduction of the Dutch Surgical Colorectal Audit, a dramatic improvement in circumferential resection margin (CRM) reporting and a major decrease in CRM involvement after rectal cancer surgery occurred. | 2015 | Gietelink et al.5 |
|  | National clinical practice | After a colorectal cancer resection, there is excess mortality among patients aged ≥85 compared to patients aged <85 years, particularly in the first year after surgery. Excess mortality in patients aged ≥85 years in the first year after surgery (expected mortality based on national life tables) was 12.1%. | 2016 | Verweij et al.6 |
|  | National clinical practice | The revised national guideline on colorectal cancer was rapidly implemented with a substantial decrease in RT use for low-risk resectable rectal cancer, and increased specificity of MRI for N-staging. | 2017 | Gietelink et al.7 |
|  | National clinical practice | Since the introduction of the National Bowel Cancer Screening Program in the Netherlands, there has been a clear increase in the number of surgical resections, without affecting waiting times. | 2017 | De Neree tot Babberich et al.8 |
|  | National clinical practice | By benchmarking the results of a population-based study against results of landmark RCTs, it was demonstrated that rectal cancer care in the Netherlands has considerably improved over time. Fewer positive CRMs have been seen since the TME trial and after the COLOR II trial oncologically safe implementation of minimally invasive surgery was achieved. | 2017 | Dutch Snapshot Research Group9 |
|  | National clinical practice | In 2011, after low anterior resection for rectal cancer in the Netherlands (with high use of neoadjuvant RT) one third of anastomotic leakages (AL) were diagnosed beyond 30 days. Almost half of the ALs did not heal and developed into a chronic sinus. | 2017 | Borstlap et al.10 |
|  | National clinical practice | In the Netherlands, the use of laparoscopic colorectal cancer surgery increased to ≥ 80% at national level. Conversion rate decreased and was significantly related to laparoscopic hospital volume. Conversion has only minimal impact on short-term postoperative outcomes. | 2017 | De Neree tot Babberich et al.11 |
|  | Quality indicators | Guideline adherence in processes for patients with colorectal cancer is not associated with a better short-term outcome for the individual patient. However, hospitals with favorable scores on guideline adherence also have better postoperative outcome rates. | 2012 | Kolfschoten et al.12 |
|  | Quality indicators | Hospital variation with regard to anastomotic leakages (ALs) is relatively independent of differences in case-mix. AL rates may therefore be suitable as an outcome indicator for measurement of surgical quality of care. | 2012 | Snijders et al.13 |
|  | Quality indicators | ‘Textbook outcome’ (TO) gives a simple summary of hospital performance, while preventing indicator-driven practice. As a result TO is meaningful for patients, providers, health insurance companies and the healthcare inspectorate. | 2013 | Kolfschoten et al.14 |
|  | Quality indicators | Hospital type and annual hospital volume are not independently associated with failure to rescue (FTR) rates in colorectal cancer surgery. | 2013 | Henneman et al.15 |
|  | Quality indicators | In quality improvement projects, feedback to hospitals of failure to rescue (FTR) rates, along with complication rates, may illustrate shortcomings (prevention or management of complications) per hospital, which may be an important step in reducing mortality. | 2013 | Henneman et al.16 |
|  | Quality indicators | Individual quality indicators are not suitable as a surrogate measure for the complete evaluation of hospital performance on quality of colorectal cancer care. | 2013 | Gooiker et al.17 |
|  | Quality indicators | An ‘unplanned reoperation after elective colorectal cancer surgery’ quality indicator seems suitable as benchmark information to hospitals but less suitable for identifying poor performers. | 2014 | Henneman et al.18 |
|  | Quality indicators | A combined measure of volume and outcome can be used as an indicator to identify hospitals that provide adequate quality and is associated with better outcomes in the subsequent year. | 2014 | Kolfschoten et al.19 |
|  | Quality indicators | To compare outcomes between hospitals it is crucial to consider noise due to low hospital case volume with a random effects model. | 2015 | Fischer et al.20 |
|  | Risk prediction | The incidence of severe postoperative complications is lower after colon cancer than rectal cancer resection; however, the risk of dying from a severe complication (failure to rescue: FTR) is twice as high after colon cancer resection, even after case-mix adjustment. | 2014 | Henneman et al.21 |
|  | Risk prediction | For elderly patients with two or more additional risk factors, a non-elective resection for colon cancer should be considered a high-risk procedure with a mortality risk of up to 41%. | 2012 | Kolfschoten et al.22 |
|  | Risk prediction | Elderly patients and those with co-morbidity have a higher mortality risk after anastomotic leakage (AL) following a resection for colon carcinoma. Mortality was significantly higher for patients with AL than those without. | 2014 | Bakker et al.23 |
|  | Risk prediction | Synchronous colorectal carcinomas (CRCs) require different surgical treatment than solitary CRCs. Postoperative outcomes for synchronous CRC are unfavorable, most likely because of the extent of the resection. | 2014 | Van Leersum et al.24 |
|  | Risk prediction | Non-elective colon cancer resection is associated with high mortality compared to elective resections. Particularly at risk are patients with tumor perforation or right-sided resections. | 2014 | Bakker et al.25 |
|  | Risk prediction | Anastomotic leakage (AL) after a low anterior resection (LAR) for rectal cancer is a frequently observed complication. Differences in clinical outcomes suggest that grade C (requiring reoperation) and B (requiring drainage) leakage should be considered as separate entities.  | 2017 | Frouws et al.26 |
|  | Risk prediction | No significant impact of annual hospital volume on rectal cancer surgery outcomes could be demonstrated among 71 Dutch hospitals. The majority of patients were treated at medium-volume (20-50 rectal cancer resections) hospitals. | 2017 | Jonker et al.27 |
|  | Risk prediction | Based on nationwide data, a number of previously reported clinical predictors of pathologic complete response (pCR) after chemoradiotherapy for rectal cancer were confirmed: clinical tumor, nodal and metastasis stage, signs of obstruction, differentiation and histologic subtype. | 2018 | van der Sluis et al.28 |
|  | Risk prediction | There is a significant association between the level of digitalization in hospitals and the length of stay after colorectal cancer surgery, suggesting that advanced electronic medical records support healthcare providers in achieving desired quality outcomes. | 2017 | Van Poelgeest et al.29 |
|  | Hospital variation | There is no even distribution of high-risk patients among hospitals providing surgical treatment to patients with colorectal cancer in the Netherlands. This underlines the need for risk adjustment when comparing hospital performances. | 2011 | Kolfschoten et al.30 |
|  | Hospital variation | Caution is needed when interpreting hospital rankings on the basis of postoperative mortality, since hospital variation is largely due to chance. | 2014 | Henneman et al.31 |
|  | Hospital variation | There is large variation in the use of defunctioning stomas for patients with rectal cancer and a lack of uniformity of selection criteria for defunctioning stomas between surgeons. | 2015 | Snijders et al.32 |
|  | Hospital variation | Low hospital volume in rectal cancer surgery is independently associated with a higher risk of circumferential resection margin (CRM) involvement, even after adjustment for relevant confounders. This supports minimal volume standards in rectal cancer surgery. | 2016 | Gietelink et al.33 |
|  | Hospital variation | For cT4 rectal cancer, high-volume hospitals may offer better multimodality treatment while for cT1-3 rectal cancer, centralization appears to have no advantages. | 2017 | Jonker et al.34 |
|  | Hospital variation | In colon cancer surgery, it seems possible to deliver excellent care regardless of the hospital teaching status. Best performers are found in all hospital teaching types. | 2018 | van Groningen et al.35 |
|  | Treatment evaluation | Use of laparoscopic techniques in colorectal cancer surgery in the Netherlands is safe and results are better in terms of short-term outcome than those for open surgery. | 2013 | Kolfschoten et al.36 |
|  | Treatment evaluation | Delaying surgery for rectal cancer until the 15th or 16th week after the start of neoadjuvant chemoradiotherapy (CRT) (10–11 weeks from the end of CRT) seems to result in the highest chance of a pathologic complete response. | 2013 | Sloothaak et al.37 |
|  | Treatment evaluation | Laparoscopic re-intervention following laparoscopic surgery for colorectal cancer is accompanied by lower mortality and faster recovery compared to open re-interventions. Though laparoscopic re-interventions seem feasible, future research is needed to define their exact benefits. | 2014 | Vennix et al.38 |
|  | Treatment evaluation | Although creation of a defunctioning stoma in patients undergoing an oncologic resection for mid or high rectal cancer results in lower anastomotic leakages, it is also associated with more postoperative complications, mortality and a longer hospital stay, even after case-mix adjustment. | 2014 | Bakker et al.39 |
|  | Treatment evaluation | The technique of abdominoperineal excision (APE) for non-advanced rectal cancer is not inferior to the low anterior resection (LAR) with respect to resection margin involvement. | 2014 | Van Leersum et al.40 |
|  | Treatment evaluation | A pronounced tendency towards defunctioning stoma construction in rectal cancer surgery does not result in lower overall anastomotic leakage or mortality rates. It seems that hospitals with low stoma rates are better at selecting high-risk patients. | 2015 | Snijders et al.41 |
|  | Treatment evaluation | Laparoscopic resection reduces the risk of postoperative mortality compared with open resection in an elective setting in patients with non-locally advanced, non-metastasized colorectal cancer. Frail, elderly patients in particular seem to benefit. | 2016 | Gietelink et al.42 |
|  | Treatment evaluation | LHP and LA with DI were associated withfewer infective complications and reoperations than LAalone. The rate of any complication was less after LHRthan LA with or without DILHP and LA with DI were associated withfewer infective complications and reoperations than LAalone. The rate of any complication was less after LHRthan LA with or without DIIn patients undergoing a Hartmann procedure for rectal cancer, neoadjuvant radiotherapy (RT) is independently associated with an increased risk of postoperative intra-abdominal abscess requiring re-intervention. RT did not affect overall re-interventions and mortality. | 2015 | Jonker et al.43 |
|  | Treatment evaluation | LHP and LA with DI were associated withfewer infective complications and reoperations than LAalone. The rate of any complication was less after LHRthan LA with or without DILHP and LA with DI were associated withfewer infective complications and reoperations than LAalone. The rate of any complication was less after LHRthan LA with or without DIIn the surgical treatment of rectal cancer after RT, a low Hartmann’s procedure (LHP) was found to be associated with a lower risk of complications and reoperation than LAR without a defunctioning ileostomy (DI) and was in this respect similar to a LAR with a DI. | 2016 | Jonker et al.44 |
|  | Treatment evaluation | LHP and LA with DI were associated withfewer infective complications and reoperations than LAalone. The rate of any complication was less after LHRthan LA with or without DILHP and LA with DI were associated withfewer infective complications and reoperations than LAalone. The rate of any complication was less after LHRthan LA with or without DIIn high-risk patients with a malignant obstruction of the proximal colon, a bridging strategy (stent or stoma) may be a valid alternative to an acute resection, since it is accompanied by significantly lower postoperative mortality. | 2016 | Amelung et al.45 |
|  | Treatment evaluation | LHP and LA with DI were associated withfewer infective complications and reoperations than LAalone. The rate of any complication was less after LHRthan LA with or without DILHP and LA with DI were associated withfewer infective complications and reoperations than LAalone. The rate of any complication was less after LHRthan LA with or without DIIn contrast to previous assumptions, omentoplasty after abdominoperineal resection with primary perineal closure for non-locally advanced rectal cancer appeared not to improve perineal wound healing and seemed to increase the occurrence of perineal hernia. | 2018 | Blok et al.46 |
|  | Treatment evaluation | Elective surgery for rectal cancer <4 days after preoperative short-course radiotherapy resulted in an increase in anastomotic leakages. Optimal intervals should be assessed. | 2018 | Sparreboom et al.47 |
|  | Treatment evaluation | In elective right-sided colectomy for cancer, an open approach seems to have a higher risk of complications and mortality compared to laparoscopic, even after adjusting for confounders. | 2018 | Bosker et al.48 |
|  | Health care costs | Complications after colorectal cancer surgery are associated with a substantial increase in costs. Although not all surgical complications can be prevented, reducing complications will result in considerable cost savings. | 2015 | Goveart et al.49 |
|  | Health care costs | Obesity in colorectal cancer surgery is associated with a significant increase in hospital costs, compared to normal-weight patients. This may be explained by the significantly higher severe complication rate in obese patients. | 2016 | Govaert et al.50 |
|  | Health care costs | There is evidence for simultaneous quality improvement and cost reduction in colorectal cancer surgery. Improving quality will potentially catalyze cost savings as well. | 2016 | Govaert et al.51 |
|  | Health care costs | In elective colon cancer surgery, laparoscopic resection was significantly less expensive than open resection. The largest cost reduction was seen in patients aged ≥ 75 years with ASA I-II. Elective rectal cancer surgery was significantly more expensive when performed laparoscopically. | 2017 | Govaert et al.52 |
| **Gastric / esophageal cancer** | Audit implementation | Nationwide implementation of an audit of the surgical treatment of upper GI cancer in the Netherlands has been successful, showing improvements on various process and outcome indicators. | 2016 | Busweiler et al.53 |
|  | National clinical practice | In esophageal cancer surgery, the number of lymph nodes (LNs) retrieved increased between 2011 and 2016. Retrieval of ≥15 LNs was not associated with increased postoperative morbidity/mortality. | 2018 | van der Werf et al.54 |
|  | Quality indicators | A composite measure defined as ‘textbook outcome’ (TO), to assess quality of care was defined. There was wide variation between hospitals in achieving textbook outcome. | 2017 | Busweiler et al.55 |
|  | Quality indicators | Patients with gastric cancer are more likely to die if a (major) postoperative complication occurs (failure to rescue – FTR). Next to morbidity and mortality, FTR should be considered as an important outcome measure after esophagogastric cancer resections. | 2017 | Busweiler et al.56 |
|  | Risk prediction | In gastrectomy for gastric cancer, ASA grade, neoadjuvant chemotherapy and type of resection are independent predictors of morbidity and death, irrespective of age. | 2017 | Nelen et al.57 |
|  | Treatment evaluation | Laparoscopic techniques in gastric cancer surgery have been safely introduced in the Netherlands with overall morbidity and mortality comparable to open surgery and with shorter hospitalization. | 2017 | Brenkman et al.58 |
|  | Treatment evaluation | In the Netherlands, there is an increasing trend towards minimally invasive esophagectomy (MIE) compared to open esophagectomy (OE) for cancer. There are no relevant differences in mortality and pulmonary complications between OE and MIE. Anastomotic leaks and re-interventions were more frequently observed in patients after MIE. MIE was associated with a shorter hospital stay. | 2017 | Seesing et al.59 |
|  | Treatment evaluation | An interval of ≥12 weeks between end of neoadjuvant chemoradiotherapy and esophagectomy for cancer is associated with higher pathologic complete response (pCR), but not with increased intra- or post-operative complications.  | 2018 | van der Werf et al.60 |
|  | Treatment evaluation | In esophagectomy for cancer, intrathoracic anastomosis (compared to cervical) was associated with lower anastomotic leak rate, lower rate of recurrent nerve paresis and a shorter hospital stay. Risk factors for anastomotic leak were co-morbidities and proximal tumors. | 2018 | Gooszen et al.61 |
|  | Hospital variation | Considerable hospital variation in the probability of receiving adjuvant chemo(radio)therapy after gastric cancer resection was observed. Its omission was strongly associated with postoperative complications, underlining the need to further reduce perioperative morbidity. | 2018 | Schouwenburg et al.62 |
|  | Hospital variation | There is considerable hospital variation in the use of perioperative therapy in patients with gastric cancer. Besides known case-mix factors, use of perioperative therapy was associated with the level of involvement of multidisciplinary care. | 2018 | Beck et al.63 |
|  | Health care costs | Complications after esophagectomy for cancer are associated with a substantial increase in hospital costs. Anastomotic and chyle leakage resulted in the largest additional costs. | 2017 | Goense et al.64 |
| **Pancreatic cancer** | Audit implementation | In the first few years after establishment, the Dutch Pancreatic Cancer Audit was implemented at national level, has high-quality data and reports good outcomes of pancreatic surgery at national level. | 2017 | van Rijssen et al.65 |
|  | Hospital variation | In pancreatoduodenectomy, between-hospital variations in mortality were explained mainly by differences in failure to rescue (FTR), rather than the incidence of major complications. | 2018 | van Rijssen et al.66 |
| **Breast cancer** | National clinical practice | There is a trend towards less extensive axillary surgery in Dutch cT1-T4N0M0 breast cancer patients. Variations in patterns of care in axillary surgery are present. | 2017 | Poodt et al.67 |
|  | Hospital variation | Hospital organizational factors affect the use of immediate breast reconstruction (IBR) in the Netherlands. Optimization of these factors could lead to less variation in IBR rates. | 2017 | Schreuder et al.68 |
|  | Hospital variation | A large degree of hospital variation was found in post-mastectomy immediate breast reconstruction rates in the Netherlands for both invasive breast cancer and ductal carcinoma in situ, even after adjustment for patient and tumor factors. | 2017 | Van Bommel et al.69 |
|  | Hospital variation | In stage III breast cancer, nationwide use of neoadjuvant chemotherapy (NAC) was 79%. Considerable between-hospital variation in use of NAC was observed, even after adjustment for patient, tumor, clinical management and hospital factors. | 2017 | Spronk et al.70 |
|  | Outcome improvement | Nationwide implementation of an audit of breast cancer treatment in the Netherlands has been successful. Data show that overall quality of breast cancer care in all hospitals is high. Improvement on most quality indicators has been seen over time. | 2017 | Van Bommel et al.71 |
| **Lung cancer** | Audit implementation | The Dutch Lung Surgery Audit provides reliable benchmarked information for caregivers and hospital management with potential to start local, regional or national improvement initiatives. | 2018 | Ten Berge et al.72 |
|  | Audit implementation | The Dutch Lung Cancer Audit (DLCA) is a unique registry to evaluate the quality of multidisciplinary lung cancer care. It has been accepted and implemented nationwide, enabling participating healthcare providers to obtain insight into their performance. | 2018 | Beck et al.73 |
|  | Audit implementation | Data quality in a nationwide audit can be promoted in various ways. Useful tools are: on-site data verification processes and a completeness indicator. Both methods are used in the DLCA. | 2018 | Hoeijmakers et al.74 |
|  | National clinical practice | Accuracy of NSCLC staging in the Netherlands is low. Accurate nodal staging remains particularly challenging. | 2016 | Heineman et al.75 |
|  | National clinical practice | Concordance between clinical and pathologic staging in the Netherlands is low. In patients with clinical stage I Non-Small Cell Lung Carcinoma (NSCLC), 22.6% are upstaged to pathologic stage II or higher. Improvement in accuracy of staging is needed. | 2016 | Heineman et al.76 |
|  | National clinical practice | In patients with a stage III NSCLC, a large treatment variation in the use of chemoradiotherapy (sequential vs. concurrent) was observed between and within the Netherlands and Belgium. Higher age and N-stage were significantly associated with choice of therapy. | 2017 | Walraven et al.77 |
|  | Risk prediction | The between-hospital variation in case mix of patients undergoing surgery for NSCLC emphasizes the importance of proper adjustment when comparing hospitals on outcome indicators. | 2018 | Beck et al.78 |
|  | Risk prediction | Operative mortality was significantly higher among octogenarians than among younger patients, whereas the incidence of complications was similar in all age groups. | 2018 | Detillion and Veen79 |
| **Melanoma** | National clinical practice | Nationwide implementation of a unique comprehensive population-based registry in advanced melanoma treatment in the Netherlands has been successful and has led to the safe introduction of new therapeutic options for advanced melanoma in the Netherlands. | 2017 | Jochems et al.80 |
|  | National clinical practice | This nation-wide study provides valuable insights into the healthcare costs of advanced cutaneous melanoma patients who were treated with ipilimumab in clinical practice. Most of the costs were attributable to ipilimumab, but the costs and its distribution varied considerably across subgroups. | 2018 | Franken et al.81 |
|  | National clinical practice | Real-world outcomes of ipilimumab in the Netherlands slightly differ from outcomes in phase III trials. Although phase III trials are crucial for establishing efficacy, real-world data are of great added value enhancing the generalizability of outcomes of ipilimumab in clinical practice. | 2018 | Jochems et al.82 |
|  | Risk prediction | The clinical outcomes of vemurafenib in BRAF-mutant metastatic melanoma patients with a favorable risk profile are comparable with the pivotal trials. However, as the majority of patients have a less favorable risk profile, trial results cannot be generalized to a more heterogeneous patient population in daily practice. | 2018 | Schouwenburg et al.83 |
| **Vascular disease** | Quality indicators | Risk-adjusted mortality (in accordance with V(p)-POSSUM score) for elective abdominal aortic aneurysm (AAA) surgery has limited capability for hospital comparison quality assessment.  | 2017 | Lijftogt et al.84 |
|  | Quality indicators | The composite measure ‘textbook outcome’ (TO) generates additional information to evaluate overall quality of care in elective aneurysm surgery. | 2017 | Karthaus et al.85 |
|  | Treatment evaluation | Based on nationwide Dutch registry data, the intervention threshold for elective endovascular AAA repair is 55 mm in men and 52mm in women. The almost doubled mortality risk for elective open repair in women argues for a conservative approach when considering open repair.  | 2017 | Tomee et al.86 |
| **Obesity surgery** | Audit implementation | The Dutch Audit for Treatment of Obesity has rapidly matured. Essential in this process were: a well-organized national structure, cooperation with DICA, government funding and most important, the support and dedication of the bariatric surgeons themselves. | 2017 | Poelemeijer et al.87 |

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**Supplemental Table 2.** Abbreviation list of DICA audits

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| DACI | Dutch Audit for Carotid Interventions |
| DAPA | Dutch Audit for Peripheral Artery Disease |
| DASA | Dutch Acute Stroke Audit |
| DATO | Dutch Audit for Treatment of Obesity |
| DBIR | Dutch Breast Implant Registry |
| DCRA | Dutch ColoRectal Audit |
| DGEA | Dutch Gastroinestinal Endoscopy Audit |
| DGOA | Dutch Gynaecological Oncology Audit |
| DHBA | Dutch Hepato Biliary Audit |
| DHFA | Dutch Hip Fracture Audit |
| DHNA | Dutch Head and Neck Audit |
| DLCA | Dutch Lung Cancer Audit |
| DMTR | Dutch Melanoma Treatment Registry |
| DPCA | Dutch Pancreatic Cancer Audit |
| DPIA | Dutch Parkinson’s Insight Audit |
| DRCE | Dutch Registration of Complications in Endoscopy |
| DSAA | Dutch Surgical Aneurysm Audit |
| DSSR | Dutch Spine Surgery Registry |
| DUCA | Dutch Upper GI Cancer Audit |
| EPSA | European Pediatric Surgery Audit |
| NBCA | Nabon Breast Cancer Audit |