

# Systematic review on quality of life outcomes after gastrectomy for gastric carcinoma

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**Background:** Despite advances in chemotherapy and radiotherapy, gastrectomy is the only curative intervention for gastric carcinoma. This study reviews post-operative health-related quality of life (HRQOL) after gastrectomy.

**Methods:** A literature search was conducted on PubMed for all studies published after January 2000 matching strict eligibility criteria. Bibliographies of included studies were also reviewed. Quality appraisal and data tabulation were performed using pre-determined forms. Results were synthesised by narrative review according to PRISMA guidelines with full tabulation of results of all included studies.

**Results:** A total of 21 studies (3,575 patients) were included. Post-operative HRQOL improvements were demonstrated across most or all domains in different HRQOL instruments. Patients experienced declines in HRQOL 1 month after surgery, but reached at least pre-operative levels with recovery by 1 year. The greatest improvements were demonstrated in the emotional health domain with favourable functional benefits. Partial gastrectomy appears to be superior to total gastrectomy in physical, emotional and functional health domains. However, patients remain susceptible to gastrointestinal symptoms following surgery, which negatively impact upon HRQOL. Post-operative complications did not appear to affect HRQOL. Most studies were prospective, but data is heterogeneous.

**Conclusions:** Gastrectomy results in significant HRQOL benefits across a broad range of health domains. This is critical outcome of surgery and an important consideration in pre-operative decision making.

**Keywords:** Gastrectomy; gastric carcinoma; quality of life (QOL)

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## Introduction

### Rationale

Gastric cancer is the fourth leading cause of cancer-related mortality worldwide (1). It is the second most common form of cancer in first world countries (2), with 930,000 new cases and 700,000 deaths reported yearly (3). Since the first successful operation in 1881 (4), partial or total gastrectomy remains the only curative intervention for localised gastric cancer (3,4). Post-operative survival has improved dramatically. The 5-year survival rate of all resections rose from 20.7% before 1970 to 28.4% by 1990, while 5-year

survival rates of curative resections increased from 37.6% to 55.4% during the same period (5). Contemporary studies quote 5-year survival rates of 33-50% (6).

The best treatment for gastric cancer would offer the longest survival, the least toxicity, and the best health-related quality of life (HRQOL) (1). However, survival remains unsatisfactory due to late diagnosis which portends a worse prognosis (7). Treatment-related adverse effects are also difficult to reduce. Therefore, a key goal of surgery is to achieve good symptomatic control and HRQOL (8,9). HRQOL is considered one of the most important parameters in assessing the impact of oncological treatment

on patients (10).

To date, there has been no systematic review on HRQOL after gastrectomy. This is critical in outcome evaluation and allows both patient and clinician to assess whether the procedure will be worthwhile.

The aim of this study was to evaluate HRQOL outcomes in patients after partial or total gastrectomy compared to pre-operative status and age-matched reference populations.

## Methods

The structure of this systematic review followed the PRISMA guidelines (11).

### *Definition and measurement of HRQOL*

HRQOL encapsulates an individual's physical, emotional and psychological health as well as social and functional status. This is important in determining the broad health-related implications of gastric cancer and post-operative HRQOL (12).

Commonly used HRQOL instruments were Gastroenterology Quality of Life Index (GQLI) (13), Gastrointestinal Symptoms Rating Scale (GSRS) (14), Life After Gastric Surgery (LAGS) (15), Eastern Cooperative Oncology Group (ECOG) Performance Rating Scale (16), European Organisation for Research and Treatment of Cancer Quality of Life Questionnaire—cancer specific (EORTC QLQ-C30) (17), European Organisation for Research and Treatment of Cancer Quality of Life Questionnaire—colon specific (EORTC QLQ-STO22) (18), and Medical Outcomes 36-item Short-Form Health Survey (SF-36) (19).

Detailed descriptions of all scoring systems and HRQOL instruments are outlined in the appendix *Table 1*.

### *Eligibility criteria*

Studies considered for review had the following characteristics: (I) all patients over 18 years of age; (II) gastric carcinoma as the primary indication for surgery; (III) complete or partial gastrectomy as a primary procedure; and (IV) HRQOL data recorded. These studies were restricted according to the following report characteristics: (I) published after January 2000; (II) English language; and (III) original research only.

### *Information sources and search strategy*

On November 2013, a literature search was conducted

using MeSH keyword search on PubMed (MEDLINE) for all studies which matched the eligibility criteria above (*Figure 1*). An additional manual search of OVID (MEDLINE) and EBSCOhost (EMBASE) as well as bibliographies of each included study was conducted to identify studies not covered by the initial MeSH keyword search. All identified articles were retrieved from the aforementioned databases.

### *Study selection*

Following the search, two reviewers independently performed screening of titles and abstracts after MeSH keyword and manual searches. Studies were excluded if they did not meet eligibility criteria. Consensus for studies included for review was achieved by discussion between reviewers based on the pre-determined eligibility criteria.

### *Data items and extraction*

All data items for assessment of study quality (*Table 1*) and study results (*Table 2*) were pre-determined. Data extraction was then performed by two reviewers using standardised pilot forms.

### *Synthesis of results*

Results were synthesised by a narrative analysis through the use of pre-determined items, as outlined above. HRQOL was categorised into a number of health domains, including global health, physical health, emotional health, functional health and social health. Subsequently, results of individual studies were amalgamated according to these health domains.

### *Risk of bias*

The risk of bias in individual studies was assessed by a qualitative analysis based on study quality and data tabulated in *Table 1*. Overall level of evidence of each study was also assessed (40).

## Results

### *Study selection*

Twenty-one studies were included for review (*Figure 1*) (15,20-39). Heterogeneous data precluded meta-analysis.

**Table 1** Quality appraisal

Author, year (years of CRS)	Patients	Study design	Generic HRQOL instrument	Disease specific measures	Methodological quality		Precision	
					Patient demographics	Follow-up and assessment methods	Follow-up consistency	Overall level of evidence
Hokschi (20), 2002 [1995-1999]	48	P	NO	YES; EORTC QLQ-C30	Age: 58.3; male: 49%; BMI: NR; GC: 100%; tumour stage: 0-5%, 1A-15%, 1B-24%, 2-32%, 3A-15%, 3B-7%, 4-2%; lymph node metastasis: NR; DOI: NR; total gastrectomy: 100%; location: Germany	Baseline R; follow-up: NR	100% PR; 85% RR	II
Shiraishi (21), 2002 [1993-1999]	51	P	NO	YES; ECOG	Age: 63.1; male: 73%; BMI: 23.3; GC: 100%; tumour stage: 1-86%, 2-14%; lymph node metastasis: 84%; DOI: mucosa-61%, submucosa-39%; total gastrectomy: 39%; location: Japan	Baseline NR; follow-up: by mail	100% PR; 94% RR	II
Spector (15), 2002 [1990-1998]	94	R	NO	YES; GQLI, LAGS	Age: 69.7; male: 93%; BMI: NR; GC: 100%; tumour stage: NR; lymph node metastasis: NR; DOI: NR; total gastrectomy: 41%; location: USA	Baseline NR; follow-up: by mail and phone	34% PR; 84% RR	III
Díaz De Liaño (22), 2003 [1992-1999]	157	P	NO	YES; EORTC QLQ-C30	Age: 67; male: 67%; BMI: NR; GC: ; tumour stage: 1-61%, 2-15%, 3-22%, 4-2%; lymph node metastasis: NR; DOI: NR; total gastrectomy: 44%; location: Spain	Baseline R; follow-up: clinical examination	43% PR; 79% RR	II
Kono (23), 2003	50	P	NO	YES; GSRS	Age: 66.0; male: 68%; BMI: NR; GC: 100%; tumour stage: NR; lymph node metastasis: 6%; DOI: mucosa-23%, submucosa-77%; total gastrectomy: 100%; location: Japan	Baseline NR; follow-up: NR	94% PR; 100% RR	II
Kahlke (24), 2004 [1992-2001]	492	R	NO	YES; EORTC QLQ-C30	Age: 64.5; male: 38%; BMI: NR; GC: 100%; tumour stage: 1-1%, 2-20%, 3-37%, 4-42%; lymph node metastasis: 27%; DOI: NR; total gastrectomy: 55%; location: Germany	Baseline R; follow-up: NR	34% PR; 30% RR	III
Hjermstad (25), 2006 [1990-1999]	120	P	NO	YES; EORTC QLQ-C30, EORTC QLQ-STO22	Age: 63; male: 44%; BMI: NR; GC: 100%; tumour stage: 1-42%, 2-11%, 3-3%, 4-44%, lymph node metastasis: NR; DOI: NR; total gastrectomy: 28%; location: Norway	Baseline NR; follow-up: by mail and clinical examination	33% PR; 90% RR	II
Ikenaga (26), 2006 [1999-2003]	84	P	NO	YES; QOL survey	Age: 65.2; male: 51%; BMI: 23.0; GC: 100%; tumour stage: 1A-94%, 1B-6%; lymph node metastasis: 6%; DOI: mucosa-65%, submucosa-35%; total gastrectomy: NR; location: Japan	Baseline NR; follow-up: by mail	100% PR; 95% RR	II

**Table 1** (continued)

Table 1 (continued)

Author, year (years of CRS)	Patients	Study design	Generic HRQOL instrument	Disease specific measures	Methodological quality		Precision	
					Patient demographics	Follow-up and assessment methods	Follow-up consistency	Overall level of evidence
Samarasam (27), 2006 [1999-2003]	151	R	NO	YES; QOL survey	Age: 51; male: 80%; BMI: NR; GC: 100%; tumour stage: 1-3%, 2-5%, 3-15%, 4-77%; lymph node metastasis: NR; DOI: NR; total gastrectomy: 26%; location: India	Baseline NR; follow-up: by mail	91% PR; 72% RR	III
Huang (28), 2007 [2002-2003]	51	R	NO	YES; EORTC QLQ-C30, EORTC, QLQ-STO22	Age: 65; male: 49%; BMI: 24.2; GC: NR; tumour stage: 1-29%, 2-24%, 3-33%, 4-14%; lymph node metastasis: NR; DOI: NR; total gastrectomy: 28%; location: Taiwan	Baseline NR; follow-up: NR	NR PR; NR RR	III
Kim (29), 2008 [2003-2005]	183	P	NO	EORTC QLQ-C30	Age: 55.6; male: 60%; BMI: 24.4; GC: 100%; tumour stage: 1A-84%, 1B-12%, 2A-3%, 3B-1%; lymph node metastasis: NR; DOI: NR, total gastrectomy: 0%; location: Korea	Baseline R; follow-up: clinical examination	90% PR; 100% RR	II
Tyrväinen (30), 2008 [1987- 1999]	172	P	YES; SF-36, 15D	NO	Age: 64; male: 36%; BMI: 25.8; GC: 100%; tumour stage: 1-72%, 2-28%; lymph node metastasis: NR; DOI: NR; total gastrectomy: 100%; location: Finland	Baseline R; follow-up: by mail and clinical examination	30% PR; 83% RR	II
Wu (31), 2008 [1993-1999]	221	P	NO	YES; Spitzer QOL Index	Age: 63.9; male: 76%; BMI: NR; GC: 100%; tumour stage: NR; lymph node metastasis: NR; DOI: NR; total gastrectomy: 24%; location: Taiwan	Baseline R; follow-up: by research nurse	100% PR; 97% RR	I
Tokunaga (32), 2009 [1996-2005]	123	R	NO	YES; QOL survey	Age: 62.7; male: 75%; BMI: NR; GC: 100%; tumour stage: NR; lymph node metastasis: NR; DOI: NR; total gastrectomy: 0%; location: Japan	Baseline NR; follow-up: by mail	87% PR; 78% RR	II
Avery (33), 2010 [2000-2004]	58	P	NO	YES; EORTC QLQ-C30, EORTC, QLQ-STO22	Age: 71.0; male: 72%; BMI: 25; GC: 100%; tumour stage: 1A-10%, 1B-14%, 2-31%, 3A-26%, 3B-7%, 4-12%; lymph node metastasis: 14%, DOI: NR; total gastrectomy: 60%; location: UK	Baseline R; follow-up: by mail	100% PR; 100% RR	II
Kobayashi (34), 2011 [2005-2007]	110	P	NO	YES; EORTC QLQ-C30, EORTC, QLQ-STO22	Age: 61.1; male: 56%; BMI: NR; GC: 100%; tumour stage: 1-71%, 2-21%, 3-9%, 4-3%; lymph node metastasis: 33%; DOI: T1-64%, T2-26%, T3-9%, T4-0%; total gastrectomy: 10%; location: Japan	Baseline R; follow-up: by mail	89% PR; 78% RR	II
Jakstaite (35), 2012 [2008-2009]	87	R	NO	YES; EORTC QLQ-C30	Age: 64; male: 59%; BMI: NR; GC: 100%; tumour stage: 1-15%, 2-35%, 3-50%; lymph node metastasis: NR; DOI: NR; total gastrectomy: 100%; location: Lithuania	Baseline NR; follow-up: NR	79% PR; 49% RR	III

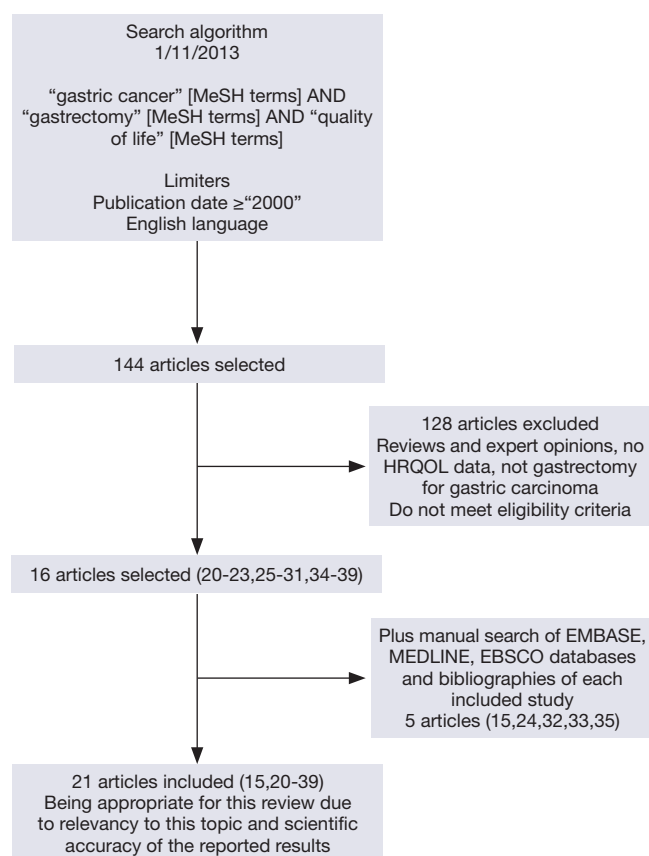
Table 1 (continued)

Table 1 (continued)

Author, year (years of CRS)	Patients	Study design	Generic HRQOL instrument	Methodological quality		Precision	
				Disease specific measures	Patient demographics	Follow-up and assessment methods	Overall level of evidence
Kim (36), 2012, [2005- 2007]	547	P	NO	YES; EORTC QLQ-C30, EORTC QLQ- STO22	Age: 54; male: 71%; BMI: NR; GC: 100%; tumour stage: 1A-66%, 1B-23%, 2-7%, 3A-5%; lymph node metastasis: NR; DOI: 1-83%, 2-12%, 3-5%; lymph node metastasis: NR; DOI: NR; total gastrectomy: 19%; location: Korea	Baseline R; follow-up: NR	92% PR; 93% RR
Kunisaki (37), 2012 [2002-2008]	623	P	NO	QOL Survey	Age: 65.1; male: 66%; BMI: 23.0; GC: 100%; tumour stage: 1A-66%, 1B-23%, 2-7%, 3A-5%; lymph node metastasis: 19%; DOI: T1-78%, T2A-11%, T2B-6%, T3-5%; total gastrectomy: 27%; location: Japan	Baseline NR; follow-up: NR	86% PR; 36% RR
Lee (38), 2012 [2010-2010]	109	R	NO	YES; EORTC QLQ-C30, EORTC QLQ-STO22	Age: 55.9; male: 55%; BMI: 24.1; GC: 100%; tumour stage: 1-100%; lymph node metastasis: 6%; DOI: T1-89%, T2-11%; total gastrectomy: 0%; location: Japan	Baseline R; follow-up: NR	73% PR; 100% RR
Namikawa (39), 2012 [2004-2010]	44	R	NO	YES; EORTC QLQ-C30, EORTC QLQ-STO22	Age: 64; male: 75%; BMI: NR; GC: 100%; tumour stage: NR; lymph node metastasis: NR; DOI: NR; total gastrectomy: 50%; location: Japan	Baseline NR; follow-up: NR	100% PR; 100% RR

HRQOL, health related quality of life; NA, not applicable; NR, not recorded; P, prospective; PR, participation rate; HRQOL, quality of life; R, retrospective; RR, response rate; DOI, depth of invasion; GC, gastric cancer; GQLI, gastroenterology quality of life index; GSRS, gastrointestinal symptom rating scale; LAGS, life after gastric surgery; SF-36, medical outcomes survey short form 36 questions; BP, bodily pain; GH, general health; MCS, mental component summary score; MH, mental health; PCS, physical component summary score; PF, physical functioning; RE, role emotional; RP, role physical; SF, social functioning; VT, vitality; ECOG, eastern cooperative oncology group performance status rating; EORTC QLQ-C30, European organisation for research and treatment of cancer quality of life questionnaire-cancer specific; AL, appetite loss; C, constipation; CF, cognitive function; Di, diarrhoea; Dy, dyspnoea; EF, emotional function; F, fatigue; FP, financial problems; GHS, global health status; I, insomnia; N/V, nausea/vomiting; P, pain; PF, physical function; RF, role function; SF, social function; EORTC QLQ-STO22, European organisation for research and treatment of cancer quality of life questionnaire-colon specific.





**Figure 1** Summary of search algorithm (15,20-39).

Key factors were statistical (no pre-operative data, data not expressed as mean  $\pm$  standard deviation) and methodological (follow-up time point not reported, heterogeneous HRQOL scoring systems that could not be amalgamated) heterogeneity. Full details and results of the reviewed articles are provided in *Tables 1,2*.

### Study characteristics and risk of bias

The strength of evidence was analysed systematically in this review (*Table 1*). We aimed to minimise reporting bias with a comprehensive search of the literature for all studies that meet our eligibility criteria. Most studies were conducted in Europe and Asia. The average age at surgery was 51-71 years. Males accounted for 36-93% of patients. The sample size ranged from 44 to 623. Nine studies had less than 100 patients (15,20,21,23,26,28,33,35,39).

Follow-up was conducted by mail, telephone and clinical examination over a period of 2 weeks to 8.9 years. According to previous guidelines, a response rate of >85%

(loss to follow-up <15%) is considered ideal for treatment received analyses (41). This was not achieved in ten studies (15,22,24,27,28,30,32,34,35,37). Patients who failed to respond may be more likely to be unwilling or unable to due to illness or being deceased, which may skew HRQOL positively.

There were 13 prospective studies and 8 retrospective studies. This is an important source of bias in the reviewed studies. Retrospective collection of data may be inconsistent, with selection bias and lack of pre-operative data as key factors (42). The overall level of evidence of each study was analysed. A total of 13 studies had a level of evidence I or II (20-23,25,26,29-31,33,34,36,37) and 8 studies had a level of evidence III or IV (15,24,27,28,32,35,38,39).

### Mortality and morbidity in included studies

Studies included for review reported early mortality, 1- and 5-year survival of 4% (20), 80-99% (20,27,29), and 15-20% (27) respectively.

Complications specific to gastrectomy were assessed in 10 studies (23,26,29-31,33-35,37,38). There was no statistically significant correlation between post-operative complications and HRQOL found in studies included for review (22,27,39,40).

### HRQOL results

Complete results of qualitative analysis are provided in *Table 2* with data at latest follow-up tabulated.

### Overall health domains

Overall HRQOL and global health status at 1 year is equal to or better compared to pre-operatively (20,24,33,34,36). Global health status in the EORTC QLQ-C30 declines immediately post-operatively, but improvement occurs with recovery at 1-3 months, before reaching or surpassing pre-operative levels by 1 year (24,34,36). Faster recovery may occur with global health status reaching baseline levels by 3 or 6 months (24,33).

HRQOL varies between different surgical operations. When comparing total gastrectomy against partial gastrectomy, most studies reported no statistically significant differences between global health status scores (15,21,22,28). Two studies reported total gastrectomy patients scored lower in the global health status dimension of the EORTC QLQ-C30 at 1 year compared to partial gastrectomy, but these differences did not exceed 10 points and by 5 years there was no difference between the two groups (25,39). Data on the difference between laparoscopic and open

**Table 2** Results of studies reviewed

Author, year	Objective		Comparison group	Follow-up interval	Conclusions
	HRQOL system	Results			
Hoksch (20), 2002	To evaluate the HRQOL during the first post-operative year comparing Longmire's reconstruction without a pouch and Longmire's reconstruction with two pouch sizes  Disease specific measures: ORTC QLQ-C30 (post-operative vs. pre-operative without pouch): GHS (55.8±1.4 vs. 66.1±2.2), PF (88.0±2.6 vs. 88.1±2.8), RF (62.5±5.2 vs. 93.8±2.2), EF (65.8±4.1 vs. 75.5±3.1), CF (7.9±3.9 vs. 84.4±3.2), SF (63.3±3.6 vs. 93.8±1.7), F (47.7±3.7 vs. 18.7±2.7), NV (16.7±4.4 vs. 13.5±1.5), P (25.0±4.7 vs. 22.9±3.9), Dy (26.7±6.3 vs. 24.9±5.5), I (26.7±3.8 vs. 31.2±5.6), AL (16.7±3.8 vs. 27.1±5.2), C (6.7±3.9 vs. 10.4±3.1), DI (37.3±7.2 vs. 4.2±2.6), FP (26.7±5.9 vs. 4.2±1.8)  Generic instruments: –	Post-operative vs. pre-operative; IPP vs. IPP 7 vs. IPP 15	2-weeks, 3-, 6-, 12- months	Both preservation of the duodenal passage and the added pouch reconstruction are essential for improving the HRQOL of a patient with a gastrectomy; no difference was found between the two pouch sizes	
Shiraishi (21), 2002	To compare surgical results, hospital charges and HRQOL of three operative procedures: proximal gastrectomy reconstructed by gastric tube, proximal gastrectomy reconstructed by jejunum, and total gastrectomy  Disease specific measures: QOL questionnaire (total gastrectomy vs. partial gastrectomy): meals per day (1.71±0.69 vs. 1.22±0.44), body weight (2.29±0.85 vs. 2.22±0.97), appetite (1.71±0.59 vs. 1.78±0.67), diarrhoea (1.71±0.47 vs. 1.56±0.73), vomiting (1.18±0.39 vs. 1.110.33), fatigue (1.82±0.39 vs. 1.67±0.71): for detailed results see original paper  Generic instruments: –	Total gastrectomy vs. proximal gastrectomy	Mean: 49.8 months	Operating time, hospital stay and hospital charges for proximal gastrectomy were less than those for total gastrectomy; total HRQOL scores were not significantly different between the two procedures	
Spector (15), 2002	To provide a preliminary description of the HRQOL and symptoms of patients who underwent gastroesophageal surgery for adenocarcinoma of the gastroesophageal junction  Disease specific measures: GQLI (total gastrectomy vs. esophagogastrectomy): total (98.0±15.1 vs. 15.8±92.5), symptom (56.7±7.7 vs. 53.6±8.2), emotion (13.0±2.8 vs. 12.3±2.6), function (20.7±4.6 vs. 19.6±7.5), social (9.9±2.9 vs. 8.8±2.6), LAGS (total gastrectomy vs. esophagogastrectomy): total (61.1±5.8 vs. 54.8±9.6)  Generic instruments: –	Total gastrectomy vs. esophagogastrectomy	>3 months	Patients had a relatively high QOL, but experienced difficulties with eating patterns, physical functioning, socialisation and happiness; there were significant differences in HRQOL and symptom frequency between the two procedures, with patients who underwent total gastrectomy faring better	
Diaz de Liano (22), 2003	To assess the HRQOL in patients in the medium to long term in patients who had curative resection for gastric cancer and had no signs of recurrent tumour  Disease specific measures: EORTC QLQ-C30 (total gastrectomy vs. proximal gastrectomy): total (31 vs. 24), clinical (39 vs. 39), physical (33 vs. 32), emotional (31 vs. 23), social (29 vs. 25)  Generic instruments: –	Total gastrectomy vs. proximal gastrectomy, D1 lymphadenectomy vs. D2 lymphadenectomy	Mean: 49 months	The HRQOL of patients undergoing curative surgery for gastric cancer, regardless of age, is not significantly influenced by the type of gastrectomy, or whether lymphadenectomy is performed	

Table 2 (continued)

**Table 2** (continued)

Table 2 (continued)				
Author, year	HRQOL system	Objective	Results	Conclusions
Kono (23), 2003	To investigate whether or not an improved HRQOL and good clinical course was observed with jejunal pouch reconstruction Disease specific measures: GSRS (no pouch vs. jejunal pouch): 3 months (4.9±1.1 vs. 3.1±0.3, P<0.05), 12 months (4.0±1.1 vs. 3.0±0.3), 48 months (1.0±1.2 vs. 3.5±0.9) Generic instruments: –			Jejunal pouch reconstruction provided a better HRQOL than Roux-en-Y construction without pouch both at short-term and long-term periods in early gastric cancer
Kahlke (24), 2004	To determine the impact of the intensity of pre-operative symptoms on post-operative survival and QOL Disease specific measures: EORTC QLQ-C30 (post-operative vs. pre-operative): PF (72 vs. 82), RF (66 vs. 70), EF (62 vs. 55), CF (78 vs. 81), SF (70 vs. 48), F (50 vs. 40), N/V (21 vs. 16), P (29 vs. 34), Dy (22 vs. 20), I (31 vs. 28), AL (42 vs. 38), C (16 vs. 25), Di (29 vs. 21), FP (a28 vs. 15) Generic instruments: –			The intensity of pre-operative symptoms influences post-operative survival, with a significantly lower survival rate for patients with major symptoms; HRQOL is partially influenced by pre-operative symptoms, with a trend to a better HRQOL in patients with major pre-operative symptoms
Hjermstad (25), 2006	To compare the HRQOL of patients treated at the Norwegian Radium Hospital with reference values from the general population Disease specific measures: STO-22 (total gastrectomy vs. partial gastrectomy vs. no gastric surgery): dysphagia (16 vs. 5 vs. 1), emotional (41 vs. 18 vs. 14), pain (26 vs. 14 vs. 12), dietary restrictions (36 vs. 7 vs. 5), upper GI symptoms (24 vs. 19 vs. 13), dry mouth (43 vs. 28 vs. 19), body image (32 vs. 2 vs. 0), hair loss (30 vs. 5 vs. 15), worries about hair (8 vs. 0 vs. 0) Generic instruments: –			If surgery is necessary due to bleeding, perforation or localised relapse, stomach-preserving surgery will certainly reduce the treatment related symptoms and improve HRQOL for some of the patients
Ikenaga (26), 2006	To evaluate the long-term HRQOL of patients who underwent laparoscopically assisted distal gastrectomy (LADG) compared with that of patients who underwent conventional open gastrectomy Disease specific measures: 15 question HRQOL survey (open surgery vs. laparoscopic surgery): for results see original paper Generic instruments: –			When compared with open gastrectomy, LADG did not unequivocally contribute to better long-term HRQOL; satisfaction with surgery was greater in patients who underwent LADG; a few complications were that impair the HRQOL were observed in the LADG group that were not seen in patients who underwent open surgery

Table 2 (continued)



**Table 2** (continued)

Author, year	HRQOL system	Objective	Results	Comparison group	Follow-up interval	Conclusions
Samarasam (27), 2006		To assess the feasibility and the survival advantage of resectional operation, in relation to the tumour load, the effectiveness of palliation of pre-operative symptoms following surgery for advanced gastric cancer, and the improvement in HRQOL following operation for gastric cancer	Disease specific measures: QOL survey (resectional vs. non-resectional surgery): normal activities (83% vs. 29%), normal diet (83% vs. 24%), vomiting (6% vs. 52%), haematemesis (0% vs. 14%), melaena (6% vs. 52%) Generic instruments: –	Resectional vs. non-resectional surgery	>6 months	In advanced gastric cancer, there is a significant survival advantage in patients who undergo gastrectomy; The HRQOL is undoubtedly better if a resectional operation is carried out
Huang (28), 2007		To determine whether clinical stages, reconstructive surgical procedures, and preservation of the stomach would affect the HRQOL for disease-free patients who had survived surgical treatment	Disease specific measures: EORTC QLQ-C30 (total gastrectomy vs. proximal gastrectomy): PF (83 vs. 87), RF (75 vs. 100), EF (71 vs. 83), CF (83 vs. 83), SF (83 vs. 83), F (39 vs. 33), N/V (17 vs. 0), P (17 vs. 17), Dy (0 vs. 0), I (33 vs. 0), AL (33 vs. 0), C (33 vs. 0), Di (33 vs. 33), FP (0 vs. 0), dysphagia (11 vs. 0), stomach pain (17 vs. 13), reflux (11 vs. 6), eating restriction (25 vs. 8), anxiety (33 vs. 22), dry mouth (33 vs. 0), body image (0 vs. 0), taste change (0 vs. 0), hair loss (0 vs. 0) Generic instruments: –	Total gastrectomy vs. proximal gastrectomy	Mean: 17 months	Patients with gastric adenocarcinoma who successfully survive treatment enjoy similar levels of global health, functional status, and symptom-free daily life, regardless of their original disease stage; proximal gastric preservation may have marginal advantages to improve patients' HRQOL by improving role function and reducing nausea/vomiting and appetite loss post-operatively
Kim (29), 2008		To evaluate laparoscopy assisted distal gastrectomy compared with open distal gastrectomy with regard to the HRQOL during the early post-operative period, up to 0-days, and the surgical outcome including morbidity and mortality	Disease specific measures: EORTC QLQ-C30 (open vs. laparoscopic gastrectomy): mean change GHS (–15.43 vs. –6.43), RF (–23.48 vs. –8.14), PF (–8.03 vs. –2.47), EF (5.31 vs. 12.2), F (14.58 vs. 6.26), AL (2.27 vs. –0.27), P (8.78 vs. 5.94), I (2.38 vs. –3.23) Generic instruments: –	Open vs. Laparoscopic gastrectomy	1-, 3-, 6-, 12-months	Minimal invasive treatment for early gastric cancer can be safely and effectively implemented with LADG, based on our analysis of the early post-operative period
Tyrvalinen (30), 2008		To evaluate HRQOL in the long-term survivors after total gastrectomy for gastric carcinoma, in comparison with the age and sex adjusted normal population	Disease specific measures: – Generic instruments: SF-36 (cases vs. controls): GH (56 vs. 53), PF (80 vs. 60), MH (77 vs. 75), SF (83 vs. 79), VT (67 vs. 60), BP (68 vs. 66), RP (70 vs. 57), RE (67 vs. 64), 15D (cases vs. controls): inadequate data	Age and sex matched	9 years	Patients who survived for long-term after total gastrectomy for gastric carcinoma have some problems with sleeping, eating, ability to defecate or urinate and with distress; mental health, physical and social functioning, energy and vitality do not differ from their normal population controls

**Table 2** (continued)

Table 2 (continued)

Author, year	HRQOL system	Objective	Results	Comparison group	Follow-up interval	Conclusions
Wu (31), 2008	To examine HRQOL of gastric cancer patients receiving D1 or D3 surgery Disease specific measures: Spitzer HRQOL Index (post-operative vs. pre-operative): activity (2.01 vs. 1.94), daily living (2.00 vs. 1.99), health (1.87 vs. 1.69), support (1.96 vs. 1.93), outlook (1.91 vs. 1.60) Generic instruments: –			Post-operative vs. pre-operative, D3 vs. D1 surgery	6 months, 1-, 2-, 3-, 4-, 5-yrs	D1 and D3 patients showed no significant difference in HRQOL; the results suggest that changes of HRQOL are largely due to scope of gastrectomy and disease status, rather than the extent of lymph node dissection
Tokunaga (32), 2009	To compared the esophagogastrectomy (EG) and jejunal interposition (JI) reconstruction methods after proximal gastrectomy using a questionnaire survey to identify which is superior regarding subjective symptoms Disease specific measures: QOL survey (EG vs. JI): nausea (3% vs. 9%, P=0.237), vomiting (3% vs. 11%, P=0.145), heartburn (8% vs. 9%, P=0.600), regurgitation (8% vs. 7%, P=0.578), abdominal fullness (3% vs. 22%, P=0.008), discomfort (11% vs. 22%, P=0.130), abdominal distension (11% vs. 16%, P=0.367), continuous fullness (3% vs. 18%, P=0.028), continuous nausea (3% vs. 9%, P=0.237), belching (5% vs. 11%, P=0.292), epigastric discomfort (11% vs. 24% P=0.086), hiccup (0% vs. 13%, P=0.022) Generic instruments: –			Esophagogastrectomy vs. jejunal interposition	NR	EG is a better reconstruction method compared to a JI after a proximal gastrectomy when evaluating subjective symptoms
Avery (33), 2010	To examine HRQOL and survival in patients with potentially curable gastric cancer Disease specific measures: EORTC QLQ-C30 (post-operative vs. pre-operative): GHS (69 vs. 68), PF (80 vs. 85), RF (76 vs. 70), SF (71 vs. 72), EF (73 vs. 71), CF (82 vs. 85), N/V (54 vs. 36), P (69 vs. 39), F (81 vs. 68), AL (38 vs. 50), DI (54 vs. 14), I (54 vs. 39); EORTC QLQ-STO22 (post-operative vs. pre-operative): dysphagia (36 vs. 44), eating restrictions (76 vs. 59), reflux (68 vs. 67), dry mouth (60 vs. 56) Generic instruments: –			Post-operative vs. pre-operative	6 weeks, 3-, 6-, 9-, 12-, 18-, 24-months	Gastrectomy for cancer has a temporary negative impact on most aspects of HRQOL that typically recovers within the first post-operative year in patients surviving at least 2 years
Kobayashi (34), 2011	To evaluate the HRQOL after gastrectomy using EORTC instruments and to compare various aspects of HRQOL among surgical procedures Disease specific measures: EORTC QLQ-C30 (post-operative vs. pre-operative): inadequate data; EORTC QLQ-STO22 (post-operative vs. pre-operative): inadequate data Generic instruments: –			Post-operative vs. pre-operative; total gastrectomy vs. distal gastrectomy vs. laparoscopy-assisted distal gastrectomy	1-, 3-, 6-, 12-months	EORTC QLQ-C30 and STO22 detected differences in several aspects of HRQOL among patients treated by the three surgical procedures; the laparoscopic approach resulted in superior short-term outcomes, whereas TG continued to affect the HRQOL in several items 12 months after surgery

Table 2 (continued)

**Table 2** (continued)

Author, year	Objective		Comparison group	Follow-up interval	Conclusions
	HRQOL system	Results			
Jakstaite (35), 2012	To evaluate the HRQOL in relation to age, sex, clinical stage, post-operative complication, and adjuvant chemotherapy in patients who underwent curative total gastrectomy with D2 lymphadenectomy and Omega type esophagojejunostomy for gastric adenocarcinoma Disease specific measures: EORTC QLQ-C30 (stages 1-2 vs. stage 3): GHS (63.7 vs. 46.6), PF (70.6 vs. 55.7), RF (73.5 vs. 52.9), EF (68.1 vs. 60.3), CF (81.4 vs. 68.6), SF (75.5 vs. 61.8) Generic instruments: –	Male vs. female, stages 1-2 vs. stage 3	6-18 months	The global HRQOL and the social functioning was better in patients after 65 years and over, compared to patients under the age of 65 after total gastrectomy	
Kim (36), 2012	To examine changes of HRQOL in Korean patients with gastric cancer after curative resection Disease specific measures: EORTC QLQ-C30 (post-operative vs. pre-operative): GHS (70.5±18.5 vs. 61.6±21.9, P<0.01), PF (86.8±11.8 vs. 86.5±13.3, P=0.92), RF (85.3±18.2 vs. 88.7±17.5, P=0.01), EF (84.7±16.2 vs. 74.5±20.7, P<0.01), CF (83.7±16.5 vs. 86.8±15.7, P=0.03), SF (87.8±18.8 vs. 79.0±25.0, P<0.01); EORTC QLQ-STO22 (post-operative vs. pre-operative): dysphagia (10.2±11.7 vs. 6.4±10.5, P<0.01), chest and abdominal pain (15.0±14.8 vs. 15.7±14.9, P=0.46), reflux (8.7±12.4 vs. 10.7±14.0, P=0.03), eating restriction (14.6±20.4 vs. 8.5±12.9, P<0.01), anxiety (30.9±23.0 vs. 32.7±22.1, P=0.14): see original article for full results Generic instruments: –	Post-operative vs. pre-operative	3-, 12-months	Global HRQOL and emotional functioning improved over time in both groups; patients in the subtotal gastrectomy group were more likely to report better HRQOL than those in the total gastrectomy group, although both showed similar changes in QOL	
Kunisaki (37), 2012	To compare early and long-term surgical outcomes via a statistically generated case-control study between laparoscopy assisted gastrectomy (LAG) and open gastrectomy (OG) for curatively resected gastric cancer, therefore confirming the feasibility of LAG for gastric cancer Disease specific measures: QOL survey (open vs. laparoscopic gastrectomy): body weight ratio (0.83±0.24 vs. 0.88±0.24, P=0.55), volume of food (0.74±0.18 vs. 0.79±0.20, P=0.59), heart burn (26% vs. 17%, P=0.10), abdominal discomfort (25% vs. 19%, P=0.25), diarrhoea (16% vs. 10%, P=0.22), early-dumping syndrome (8% vs. 5%, P=0.39), late-dumping syndrome (7% vs. 5%, P=0.55), wound pain (11% vs. 3%, P=0.03); performance status (open vs. laparoscopic gastrectomy): 1 (87% vs. 90%), 2 (11% vs. 9%), 3 (2% vs. 1%) Generic instruments: –	Open vs. laparoscopic gastrectomy	Mean: 36.1±22.9 months	Laparoscopy assisted gastrectomy for gastric cancer may be both feasible and safe, offering advantages over open gastrectomy according to the surgical learning curve	

**Table 2** (continued)

Table 2 (continued)

Author, year	HRQOL system	Objective	Results	Comparison group	Follow-up interval	Conclusions
Lee (38), 2012	To compare the HRQOL of a laparoscopy assisted distal gastrectomy group (LADG) and an open distal subtotal gastrectomy (ODSG) group after the early post-operative period and before reaching 5 years post-operatively, when patients are considered to be disease-free Disease specific measures: EORTC QLQ-C30 (ODSG vs. LADG): GHS (57.4±18.2 vs. 56.0±19.0, P=0.73), PF (88.9±15.1 vs. 19.5±81.3, P=0.054), RF (93.0±14.9 vs. 82.9±22.7, P=0.026), EF (90.6±17.4 vs. 81.7±23.4, P=0.065), CF (89.6±15.2 vs. 81.0±20.7, P=0.034), SF (89.3±19.8 vs. 81.0±21.8, P=0.079); EORTC QLQ-STO22 (ODG vs. LDAG): dysphagia (7.9±9.9 vs. 12.4±14.7, P=0.127), pain (15.2±15.0 vs. 15.2±12.7, P=0.987), reflux (12.1±19.4 vs. 11.7±14.2, P=0.925), eating restrictions (6.4±10.1 vs. 13.6±12.8, P=0.009), anxiety (13.1±17.0 vs. 22.2±20.7, P=0.033); see original article for full results Generic instruments: –	ODSG vs. LADG	6 months to 5 years	Patients who have undergone LADG may experience unexpected reversal of HRQOL by experiencing lower HRQOL compared to those who have undergone ODSG until long-term survival is achieved		
Namikawa (39), 2012	To evaluate short- and long-term post-operative outcomes of jejunal pouch interposition after proximal gastrectomy compared with conventional RY construction after total gastrectomy for cancer Disease specific measures: EORTC QLQ-C30 (no pouch vs. jejunal pouch): GHS (63.5±28.8 vs. 56.7±19.9, P=0.968), PF (70.0±27.8 vs. 87.3±9.1, P=0.161), RF (76.2±31.7 vs. 95.0±11.2, P=0.118), EF (89.6±7.9 vs. 9.0±79.2, P=0.112), CF (58.2±25.2 vs. 66.7±22.2, P=0.214), SF (86.6±29.9 vs. 86.7±13.1, P=0.877); EORTC QLQ-STO22 (no pouch vs. jejunal pouch): eating solid food (1.6±0.9 vs. 1.4±0.8, P=0.271), eating soft food (1.1±0.4 vs. 1.1±0.3, P=0.356), drinking liquids (1.4±0.7 vs. 1.5±0.5, P=0.964), discomfort when eating (1.5±0.9 vs. 1.7±0.5, P=0.820), pain in stomach area (1.6±0.9 vs. 1.6±0.7, P=0.517), discomfort in stomach area (1.8±0.9 vs. 1.8±0.6, P=0.627), abdominal bloating (1.8±1.0 vs. 1.5±0.7, P=0.265), reflux (1.8±1.0 vs. 1.7±0.8, P=0.708), acid indigestion (1.7±1.1 vs. 1.9±0.7, P=0.921); see original article for full results Generic instruments: –	No pouch vs. jejunal pouch	1-, 5-years	Compared to RY reconstruction, JPI reconstruction after proximal gastrectomy achieves better food intake and improves the patient's HRQOL in the early period after gastrectomy		
HRQOL, health related quality of life; NA, not applicable; NR, not recorded; P, prospective; PR, participation rate; HRQOL, quality of life; R, retrospective; RR, response rate; DOI, depth of invasion; GC, gastric cancer; GQLI, gastroenterology quality of life index; GSRS, gastrointestinal symptom rating scale; LAGS, life after gastric surgery; SF-36, medical outcomes survey short form 36 questions; BP, bodily pain; GH, general health; MCS, mental component summary score; MH, mental health; PCS, physical component summary score; PF, physical functioning; RE, role emotional; RP, role physical; SF, social functioning; VT, vitality; ECOG, eastern cooperative oncology group performance status rating; EORTC QLQ-C30, European organisation for research and treatment of cancer quality of life questionnaire-cancer specific; AL, appetite loss; C, constipation; CF, cognitive function; Di, diarrhoea; Dy, dyspnoea; EF, emotional function; F, fatigue; FP, financial problems; GHS, global health status; I, insomnia; N/V, nausea/vomiting; P, pain; PF, physical function; RF, role function; SF, social function; EORTC QLQ-STO22, European organisation for research and treatment of cancer quality of life questionnaire-colon specific.						



surgery is conflicted. Lee *et al.* reported no statistical differences between the two groups (38), while Kim *et al.* noted significantly better outcomes in the laparoscopic group compared to the open surgery group (29). Patients in both these studies did not achieve their pre-operative HRQOL levels in the EORTC QLQ-C30.

### Physical health domain

Physical health deteriorates rapidly after surgery, with patients reporting considerably lower scores in the EORTC QLQ-C30 after discharge (20,24,34). Recovery begins between 4 to 6 weeks and continues to around 3 months (33,34). However, physical health scores in the EORTC do not reach baseline levels. Other studies reported better outcomes, but also noted a longer recovery time, with scores equalling or surpassing pre-operative levels at 6 or 12 months (33,36).

The majority of studies report better physical health in patients undergoing partial gastrectomy compared to total gastrectomy (21,25,28,34,39). Two studies indicated total gastrectomy patients achieved better scores (15,22), but this was not statistically significant in one (15). There was no major difference between laparoscopic and open surgery patients' physical functioning scores (29). Both groups experienced a decline after surgery which slowly improved with recovery, but remained below baseline levels at 90 days (29).

### Emotional health domain

Post-operative emotional well-being levels on EORTC showed continuous improvement of scores from immediately after surgery to 3 months, before plateauing to 12 months (34,36). An initial decline in emotional health may occur, but eventually becomes similar or better than baseline levels (24,29). Avery *et al.* reported no change in scores before or after surgery (33).

Patients who underwent partial gastrectomy reported significantly better results compared to those who had undergone total gastrectomy (20,25,28,39). By 5 years HRQOL after partial or total gastrectomy may become similar (39). Two studies reported better scores in the total gastrectomy group, but this was not statistically significant (15,22). HRQOL results are conflicted in comparing laparoscopic and open surgery (29,38). Kim *et al.* reported a marked improvement in patients following laparoscopic surgery, while patients undergoing open surgery had an initial decline before rising to above baseline levels after 30 days (29).

### Social health domain

Social wellbeing scores followed a similar trend of initial deterioration followed by recovery to a level equal to or greater than baseline (33,34,36). Two studies reported worse social functioning outcomes (20,24). Hokschi *et al.* noted that recovery was slower than other health domains, but patients were still able to complete housework and the majority returned to their jobs (20).

Total gastrectomy appears to confer superior HRQOL scores, but statistical significance is not achieved (15,22). Hjerstad *et al.* suggest partial gastrectomy confers greater benefits (25). Huang *et al.* report no differences in scores (28). Similar scores were reported at 1 year after surgery, but partial gastrectomy patients experienced a decline in social wellbeing while the scores of total gastrectomy patients remained unchanged after this point (39). Comparisons between laparoscopic and open surgery showed no difference (38).

### Functional health domain

Functional health is a measure of a patient's ability to function in life and society. Most patients reached a post-operative functional state at least as good as pre-operatively by 6 or 12 months in role functioning on EORTC (24,33,34). Scores were only slightly lower than baseline in two studies (20,36). Cognitive functioning was largely unaffected by surgery and remained near baseline levels throughout follow-up (20,24,33,34,36).

Partial gastrectomy patients reported higher functional health scores on the EORTC compared to total gastrectomy (25,28,39). Spector *et al.* reported total gastrectomy patients having a higher, but not statistically significant score (15). Kim *et al.* reported that patients undergoing laparoscopic surgery attained higher functional status compared to those undergoing open surgery, although both groups remained below pre-operative levels (29). Lee *et al.* suggested laparoscopic surgery resulted in significantly lower role functioning scores on the EORTC (38).

Patient satisfaction was similar between total and partial gastrectomy patients (21). However, patients undergoing laparoscopic surgery showed a markedly higher level of post-operative satisfaction compared to patients undergoing open surgery (26).

### Factors affecting HRQOL

Patients with increased symptom frequency and severity, separate from their post-operative complications, were more likely to experience a lower HRQOL (15). Those



older than 65 or 70 years of age experienced higher scores in all dimensions of HRQOL compared to younger patients (22,35). However, they were also more likely to experience more severe symptoms after surgery. Díaz De Liaño *et al.* reported that women were more likely to achieve higher scores on EORTC, but there were no significant differences (22).

## Discussion

### *Summary of evidence and interpretation*

This systematic review summarises modern outcomes after gastrectomy and this is reflected in the inclusion criteria where only studies published from the year 2000 onwards were included.

Despite improvements in peri-operative morbidity, mortality, and long-term survival, gastrectomy remains a major surgical intervention. The potential for harm and negative impact on HRQOL after surgery must be carefully balanced against the survival benefits and chance of cure. The monitoring of HRQOL after gastrectomy is advised as a standard of care and is critical as both an outcome measure and assessment of patients' progress after surgery (28). Most patients experience a significant decline in overall health, physical and functional domains of HRQOL within the first few months after surgery which is then followed by significant improvements by 1 year. Patients should expect this initial decline in HRQOL in the early post-operative period as a trade-off for longer survival and improved HRQOL in the longer term. The greatest dilemma facing clinicians and patients is whether the prolonged survival is long enough for the patient to pass the initial recovery period and experience the positive HRQOL benefits.

This review shows that even though patients suffered from ongoing gastrointestinal symptoms up to 6 months after surgery, physical health improves after recovery. There is a noticeable decline within the first 3 months, but between 6 months and 1 year, physical health becomes at least as good as pre-operatively. However, it appears HRQOL is not well maintained after 5 years. Patients should be counselled about ongoing symptoms and the decline in physical health during the early post-operative period, as the severity of symptoms appears to be closely related to post-operative HRQOL. This will allow for realistic expectations of surgical outcome. These results indicate further emphasis on treatment of post-operative and disease-related symptoms is required.

Emotional health is the greatest beneficiary of surgery.

Despite the relatively high morbidity of gastrectomy and the initial decline in physical health after surgery, emotional health improves. This may be the product of increased hope for prolonged survival, especially once physical recovery begins and the severity and frequency of symptoms decreases. In the context of an already limited life expectancy, emotional health benefits are critical for patients and this should be stressed during pre-operative decision making.

Surgery appears to have little impact on social health domains, with social functioning remaining unchanged up to 1 year post-operatively. By the time patients are being evaluated for gastrectomy, the effects of diagnosis and long-term impacts on social health parameters have likely plateaued. Unless the patients, and more importantly their friends and families, are aware of the curative intent of surgery and post-operative results, attitudes towards the patient and their diagnosis are unlikely to change.

Despite the initial deterioration, functional status is at least as good as pre-operatively in most patients by 1 year and only marginally below baseline for others. Functional status is a key marker of success after surgery as it allows patients independence and the capacity to undertake their normal daily activities. Even though functional status may not necessarily be superior to pre-operatively, similar results are a positive finding in the context of a morbid operation. The ability to work and resume normal daily activities is a crucial outcome of surgery, and impacts positively on HRQOL through a number of factors. In addition, the maintenance of cognitive function is a positive finding which is very important for patients and families in particular.

Data on HRQOL compared to reference populations is limited and unclear. Overall HRQOL appears to be comparable to that of the general population, with no statistically significant differences between the two groups in any of the health domains. These results are to be interpreted with caution because the comparison reference populations are heterogeneous and may not be appropriately matched populations for age, disease status and type of surgical operation.

The majority of studies reviewed had levels of evidence II or III, with only one randomised control trial included. There appeared to be no significant difference in results between studies of different levels of evidence, with most studies concluding similar results in all HRQOL domains.

When evaluating cancer treatment, post-operative HRQOL is widely accepted as an increasingly important

outcome of surgical interventions, is on par with mortality and survival (36). The limited life-expectance of gastric carcinoma patients further increases the importance of HRQOL. HRQOL information allows patients and clinicians to make more informed pre-operative decisions, as well as improve patient care and symptom management.

To our knowledge this is the first systematic review on HRQOL outcomes following gastrectomy and provides a synthesised modern reference when considering patients for surgery.

### Limitations

A key limitation of this study was that a meta-analysis was unable to be performed due to clinical, statistical and methodological heterogeneity. Furthermore, the HRQOL findings of this review may not be applicable to all patients. Patients with gastric carcinoma have a variety of tumour stages, lymph node involvement, extent of disease and prognosis which were not analysed separately. However, it appears the type of surgery remains the largest influence on post-operative HRQOL. The superior expertise and operative outcomes of high volume tertiary centres compared to institutions with lower volumes is also important. These factors may all have different impacts on HRQOL.

Language bias may be present due to the English language eligibility criteria, as none of the contributing authors could translate from other languages.

### Implications for future research

This review demonstrates the lack of pre-operative compared to post-operative HRQOL results of the same patients as well as appropriate data for meta-analysis. Prospective studies with pre-determined follow-up time points that accurately reflect current survival rates and consistent use of previously validated HRQOL instruments are recommended. Multi-centre involvement is ideal to increase patient numbers and minimise bias. In addition, future studies should compare HRQOL results to properly matched sample populations, such as patients with gastric carcinoma who don't receive gastrectomy. Further investigation is required on defining the predictors of better HRQOL outcomes and to define strategies for improvement.

### Conclusions

Gastrectomy for gastric carcinoma has a demonstrable

benefit for patients' HRQOL in a broad range of health domains. Overall, HRQOL returns to similar or better levels by 1 to 2 years compared to before surgery. The most significant improvements were demonstrated in emotional health which is a particularly salient component of HRQOL in oncology patients.

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### Footnote

*Conflicts of Interest:* The authors have no conflicts of interest to declare.

### References

1. Munene G, Francis W, Garland SN, et al. The quality of life trajectory of resected gastric cancer. *J Surg Oncol* 2012;105:337-41.
2. Viudez-Berral A, Miranda-Murua C, Arias-de-la-Vega F, et al. Current management of gastric cancer. *Rev Esp Enferm Dig* 2012;104:134-41.
3. Ohtani H, Tamamori Y, Noguchi K, et al. Meta-analysis of laparoscopy-assisted and open distal gastrectomy for gastric cancer. *J Surg Res* 2011;171:479-85.
4. Lew JI, Posner MC. Surgical Treatment of Localized Gastric Cancer. In: Posner MC, Vokes EE, Weichselbaum RR, editors. *American Cancer Society Atlas of Clinical Oncology, Cancer of the Upper Gastrointestinal Tract*. Hamilton: BC Decker Inc., 2002;13:252-77.
5. Akoh JA, Macintyre IM. Improving survival in gastric cancer: review of 5-year survival rates in English language publications from 1970. *Br J Surg* 1992;79:293-9.
6. Dassen AE, Dikken JL, van de Velde CJ, et al. Changes in treatment patterns and their influence on long-term survival in patients with stages I-III gastric cancer in The Netherlands. *Int J Cancer* 2013;133:1859-66.
7. Menges M, Hoehler T. Current strategies in systemic treatment of gastric cancer and cancer of the gastroesophageal junction. *J Cancer Res Clin Oncol* 2009;135:29-38.
8. Cervantes A, Roselló S, Roda D, et al. The treatment of advanced gastric cancer: current strategies and future perspectives. *Ann Oncol* 2008;19 Suppl 5:v103-7.
9. Cardoso R, Coburn NG, Seevaratnam R, et al. A systematic review of patient surveillance after curative

- gastrectomy for gastric cancer: a brief review. *Gastric Cancer* 2012;15 Suppl 1:S164-7.
10. Dorcaratto D, Grande L, Ramón JM, et al. Quality of life of patients with cancer of the oesophagus and stomach. *Cir Esp* 2011;89:635-44.
  11. Liberati A, Altman DG, Tetzlaff J, et al. The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate health care interventions: explanation and elaboration. *J Clin Epidemiol* 2009;62:e1-34.
  12. Kaptein AA, Morita S, Sakamoto J. Quality of life in gastric cancer. *World J Gastroenterol* 2005;11:3189-96.
  13. Eypasch E, Williams JJ, Wood-Dauphinee S, et al. Gastrointestinal Quality of Life Index: development, validation and application of a new instrument. *Br J Surg* 1995;82:216-22.
  14. Svedlund J, Sjödin I, Dotevall G. GSRS--a clinical rating scale for gastrointestinal symptoms in patients with irritable bowel syndrome and peptic ulcer disease. *Dig Dis Sci* 1988;33:129-34.
  15. Spector NM, Hicks FD, Pickleman J. Quality of life and symptoms after surgery for gastroesophageal cancer: a pilot study. *Gastroenterol Nurs* 2002;25:120-5.
  16. Oken MM, Creech RH, Tormey DC, et al. Toxicity and response criteria of the Eastern Cooperative Oncology Group. *Am J Clin Oncol* 1982;5:649-55.
  17. Aaronson NK, Ahmedzai S, Bergman B, et al. The European Organization for Research and Treatment of Cancer QLQ-C30: a quality-of-life instrument for use in international clinical trials in oncology. *J Natl Cancer Inst* 1993;85:365-76.
  18. Vickery CW, Blazeby JM, Conroy T, et al. Development of an EORTC disease-specific quality of life module for use in patients with gastric cancer. *Eur J Cancer* 2001;37:966-71.
  19. Ware JE Jr, Sherbourne CD. The MOS 36-item short-form health survey (SF-36). I. Conceptual framework and item selection. *Med Care* 1992;30:473-83.
  20. Hokschi B, Ablassmaier B, Zieren J, et al. Quality of life after gastrectomy: Longmire's reconstruction alone compared with additional pouch reconstruction. *World J Surg* 2002;26:335-41.
  21. Shiraishi N, Adachi Y, Kitano S, et al. Clinical outcome of proximal versus total gastrectomy for proximal gastric cancer. *World J Surg* 2002;26:1150-4.
  22. Díaz De Liaño A, Oteiza Martínez F, Ciga MA, et al. Impact of surgical procedure for gastric cancer on quality of life. *Br J Surg* 2003;90:91-4.
  23. Kono K, Iizuka H, Sekikawa T, et al. Improved quality of life with jejunal pouch reconstruction after total gastrectomy. *Am J Surg* 2003;185:150-4.
  24. Kahlke V, Bestmann B, Schmid A, et al. Palliation of metastatic gastric cancer: impact of preoperative symptoms and the type of operation on survival and quality of life. *World J Surg* 2004;28:369-75.
  25. Hjermstad MJ, Hollender A, Warloe T, et al. Quality of life after total or partial gastrectomy for primary gastric lymphoma. *Acta Oncol* 2006;45:202-9.
  26. Ikenaga N, Nishihara K, Iwashita T, et al. Long-term quality of life after laparoscopically assisted distal gastrectomy for gastric cancer. *Journal of laparoendoscopic & advanced surgical techniques Part A* 2006;16:119-23.
  27. Samarasinghe I, Chandran BS, Sitaram V, et al. Palliative gastrectomy in advanced gastric cancer: is it worthwhile? *ANZ J Surg* 2006;76:60-3.
  28. Huang CC, Lien HH, Wang PC, et al. Quality of life in disease-free gastric adenocarcinoma survivors: impacts of clinical stages and reconstructive surgical procedures. *Dig Surg* 2007;24:59-65.
  29. Kim YW, Baik YH, Yun YH, et al. Improved quality of life outcomes after laparoscopy-assisted distal gastrectomy for early gastric cancer: results of a prospective randomized clinical trial. *Ann Surg* 2008;248:721-7.
  30. Tyrväinen T, Sand J, Sintonen H, et al. Quality of life in the long-term survivors after total gastrectomy for gastric carcinoma. *J Surg Oncol* 2008;97:121-4.
  31. Wu CW, Chiou JM, Ko FS, et al. Quality of life after curative gastrectomy for gastric cancer in a randomised controlled trial. *Br J Cancer* 2008;98:54-9.
  32. Tokunaga M, Hiki N, Ohyama S, et al. Effects of reconstruction methods on a patient's quality of life after a proximal gastrectomy: subjective symptoms evaluation using questionnaire survey. *Langenbecks Arch Surg* 2009;394:637-41.
  33. Avery K, Hughes R, McNair A, et al. Health-related quality of life and survival in the 2 years after surgery for gastric cancer. *Eur J Surg Oncol* 2010;36:148-54.
  34. Kobayashi D, Kodera Y, Fujiwara M, et al. Assessment of quality of life after gastrectomy using EORTC QLQ-C30 and STO22. *World J Surg* 2011;35:357-64.
  35. Jakstaite G, Samalavicius NE, Smalyte G, et al. The quality of life after a total gastrectomy with extended lymphadenectomy and omega type oesophagojejunostomy for gastric adenocarcinoma without distant metastases. *BMC Surg* 2012;12:11.
  36. Kim AR, Cho J, Hsu YJ, et al. Changes of quality of

- life in gastric cancer patients after curative resection: a longitudinal cohort study in Korea. *Ann Surg* 2012;256:1008-13.
37. Kunisaki C, Makino H, Kosaka T, et al. Surgical outcomes of laparoscopy-assisted gastrectomy versus open gastrectomy for gastric cancer: a case-control study. *Surg Endosc* 2012;26:804-10.
  38. Lee SS, Ryu SW, Kim IH, et al. Quality of life beyond the early postoperative period after laparoscopy-assisted distal gastrectomy: the level of patient expectation as the essence of quality of life. *Gastric Cancer* 2012;15:299-304.
  39. Namikawa T, Oki T, Kitagawa H, et al. Impact of jejunal pouch interposition reconstruction after proximal gastrectomy for early gastric cancer on quality of life: short- and long-term consequences. *Am J Surg* 2012;204:203-9.
  40. Howick J, Chalmers I, Glasziou P, et al. The Oxford Levels of Evidence 2. Oxford Centre for Evidence-Based Medicine, 2013. Accessed on Sep 12th, 2013. Available online: <http://www.cebm.net/index.aspx?o=5653>
  41. Liberati A, Altman DG, Tetzlaff J, et al. The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate health care interventions: explanation and elaboration. *J Clin Epidemiol* 2009;62:e1-34.
  42. Stern JM, Simes RJ. Publication bias: evidence of delayed publication in a cohort study of clinical research projects. *BMJ* 1997;315:640-5.

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