Ademi Z, et al. Adaptation of cost-effectiveness analyses to a single country: the case of bariatric surgery for obesity and overweight.

Swiss Med Wkly 2018;148:w14626. doi:10.4414/smw.2018.14626

Appendices 1 to 14

Table of Contents

Appendix 1: Search strategy – Initial search strings for the health economic systematic review (dated 6 August 2015)

Medline library

Clinical search string

1. obesity.ti,ab.

2. exp obesity/

3. obese.ti,ab.

4. exp Overweight/

5. overweight/

6. over weight.ti,ab.

7. overweight.ti,ab.

8. (overeating or over eating).ti,ab.

9. or 1-8

Intervention search string

10. exp Gastric Bypass/

11. (gastric adj5 bypass).ti,ab.

12. (gastric adj5 surgery).ti,ab.

13. exp Gastroplasty/

14. (gastroplasty or gastro?gastrostom*).ti,ab.

15. (gastrointestinal and bypass).ti,ab.

16. exp Biliopancreatic Diversion/

17. ((biliopancreatic or bilio?pancreatic or bilio pancreatic) and (diversion or surg$ or bypass)).ti,ab.

18. gastric band$.ti,ab.

19. silicon band$.ti,ab.

20. LAGB.ti,ab.

21. exp Gastrectomy/

22. gastrectom*.ti,ab.

23. (lap$ and band$).ti,ab.

24. Roux en Y.ti,ab.

25. RYGB.ti,ab.

26. Anastomosis, Roux-en-Y/

27. duodenal switch.ti,ab.

28. ((gastric or silicon) and sleeve).ti,ab.

29. exp Gastroenterostomy/

30. gastroenterostom*.ti,ab.

31. mason$ procedure.ti,ab.

32. or 10-31

Economics search string

33. costs

34. cost

35. costed

36. costing

37. economic*

38. price*

39. or 33-38

40. 9 AND 32 AND 39

41. animal/ not humans/

42. 40 not 41

43. limit 42 to yr="2005 -Current"

44. remove duplicates from 43 **Hits = (300)**

Embase library

Clinical search string

1. exp obesity/

2. obese.ti,ab.

3. obesity.ti,ab.

4. overweight.ti,ab.

5. over weight.ti,ab.

6. (overeating or over eating).ti,ab.

7. or 1-6

Intervention search string

8. exp stomach bypass/

9. (stomach adj5 bypass).ti,ab.

10. (gastric adj5 bypass).ti,ab.

11. exp gastroplasty/

12. (gastroplasty or gastro?gastrostom*).ti,ab.

13. (gastrointestinal and bypass).ti,ab.

14. exp biliopancreatic bypass/

15. ((biliopancreatic or bilio?pancreatic or bilio pancreatic) and bypass).ti,ab.

16. ((biliopancreatic or bilio?pancreatic or bilio pancreatic) and diversion).ti,ab.
17. ((biliopancreatic or bilio?pancreatic or bilio pancreatic) and surg$).ti,ab.
18. exp gastric banding/
19. gastric band$.ti,ab.
20. ((gastric or silicon) and band$).ti,ab.
21. silicon band$.ti,ab.
22. LAGB.ti,ab.
23. exp gastrectomy/
24. gastrectom*.ti,ab.
25. (lap$ and band$).ti,ab.
26. Roux en Y.ti,ab.
27. RYGB.ti,ab.
28. exp Roux Y anastomosis/
29. duodenal switch.ti,ab.
30. exp gastroenterostomy/
31. gastroenterostom*.ti,ab.
32. mason$ procedure.ti,ab.
33. or 8-32

Economics search string

34. costs
35. cost
36. costed
37. costing
38. economic*
39. price*
40. or 34-39
41. 7 AND 33 AND 40
42. animal/ not humans/
43. 41 not 42
44. limit 43 to yr="2005 -Current"
45. remove duplicates from 44 **Hits = (715)**

Cochrane library

Clinical search string

1. (over weight or overweight or overeating or over eating):ti,ab,kw

2. obesity:ti,ab,kw

3. MeSH descriptor: [Obesity] explode all trees

4. obese:ti,ab,kw

5. MeSH descriptor: [Overweight] explode all trees

6. or #1-#5

Intervention search string

7. MeSH descriptor: [Gastric Bypass] explode all trees

8. (gastric near/5 bypass):ti,ab,kw

9. MeSH descriptor: [Gastroplasty] explode all trees

10. (gastroplasty or gastrogastrostom*):ti,ab,kw

11. (digestive and bypass):ti,ab,kw

12. (gastrointestinal and bypass):ti,ab,kw

13. MeSH descriptor: [Biliopancreatic Diversion] explode all trees

14. (biliopancreatic and (diversion or surg* or bypass)):ti,ab,kw

15. (bilio pancreatic and (diversion or surg* or bypass)):ti,ab,kw

16. (gastric and (sleeve* or band*)):ti,ab,kw

17. (silicon and (sleeve* or band*)):ti,ab,kw

18. LAGB:ti,ab,kw

19. MeSH descriptor: [Gastrectomy] explode all trees

20. gastrectom*:ti,ab,kw

21. gastroenterostom*:ti,ab,kw

22. MeSH descriptor: [Gastroenterostomy] explode all trees

23. (lap* and band*):ti,ab,kw

24. Roux en Y:ti,ab,kw

25. RYGB:ti,ab,kw

26. MeSH descriptor: [Anastomosis, Roux-en-Y] explode all trees

27. duodenal switch:ti,ab,kw

28. mason* procedure:ti,ab,kw

29. or #7-#28

Economics search string

30. costs

31. cost

32. costed

33. costing

34. economic*

35. price*

36. or #30-#36

37. #6 and #29 and #36

38. Publication Year from 2000 to 2015, in Technology Assessments and Economic Evaluation **(Hits = 76)**

Center for review and dissemination

Clinical search string

1. obesity

2. obese

3. overweight

4. overeating

5. or #1-#4

Intervention search string

6. gastric Bypass

7. Gastroplasty

8. gastrostom

9. gastrointestinal and bypass

10. Biliopancreatic Diversion

11. Biliopancreatic surgery

12. Biliopancreatic bypass

13. gastric band

14. silicon band

15. LAGB

16. gastrectomy

17. lap and band

18. Roux en Y

19. RYGB

20. duodenal switch

21. gastric or silicon and sleeve

22. gastroenterostomy

23. gastroenterostom

24. mason procedure

25. or #6-#26

Economics search string

26. costs

27. cost

28. costed

29. costing

30. economic*

31. price*

32. or #28-#34

5 AND 27 AND 34 **(Hits = 92)**

ti=title, ab=abstract, kw=keywords

Appendix 2: Assessment of transferability

The following transferability factors were considered: (1) methodological characteristics (perspective of cost assessment, discount rate, medical cost approach, productivity cost approach), (2) healthcare system characteristics (absolute and relative prices in healthcare, clinical practice variation, differences in resource use, incentives and regulations for health-care providers, technology availability), and (3) population characteristics (demography, disease incidence and prevalence, case-mix, life expectancy, health-status preferences, acceptance, compliance, incentives to the patients and productivity and work-loss time).

Appendix 3: The adaptation of costs

This method was developed on behalf of the Swiss Federal Office of Public Health in order to estimate the cost of non-communicable diseases (NCDs) in Switzerland. The project was assessing the costs of NCDs using two approaches: one based on Swiss healthcare registries and data and the second based on the available national and international literature [1]. We took this method further to understand the impact on other disease. For this study we take an example of bariatric surgery versus conservative treatment for obesity and overweight. We present step-by-step methodology how to adapt international cost-effectiveness analysis to a single country. Fifteen studies were found to be qualitatively transferable to Switzerland and provided sufficient information on costs and effects. The included studies were performed in 11 countries (Austria, Finland, France, Germany, Italy, Portugal, Spain, Sweden, United Kingdom, Australia, and USA), with costing years ranging from 1999 to 2012).

Resource utilisation

The statistics of healthcare expenses per capita provided by the OECD and corrected for purchasing power was used. A correction factor between Switzerland and the countries in which the selected cost-effectiveness analyses were performed has been calculated (more concretely, the current expenditure on health per capita in Switzerland in a defined year was divided by the expenditure on health in the other countries for the same year). Table below summarizes the correction factors used for the bariatric surgery example.

Prices of healthcare services

Prices of healthcare services: the correction for different healthcare prices across countries was corrected through the purchasing power parity. As for the resource utilisation correction, a correction factor was calculated.

Ratio Switzerland/Country - Current expenditure on health, per capita, US$ purchasing power parities

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Austria	1.188	1.182	1.237	1.248	1.227	1.207	1.208	1.192	1.228	1.244	1.258	1.268	1.327	1.356
Finland	1.845	1.816	1.820	1.799	1.761	1.679	1.625	1.616	1.646	1.633	1.667	1.707	1.746	1.805
France	1.315	1.297	1.290	1.288	1.338	1.336	1.295	1.301	1.333	1.378	1.367	1.383	1.442	1.518
Germany	1.223	1.233	1.256	1.280	1.248	1.269	1.218	1.213	1.247	1.264	1.255	1.232	1.283	1.308
Italy	1.665	1.595	1.563	1.668	1.693	1.671	1.620	1.573	1.660	1.638	1.691	1.728	1.826	1.957
Portugal	2.400	2.162	2.200	2.227	2.151	2.091	1.931	1.952	2.000	2.026	2.005	2.035	2.267	2.454
Spain	2.185	2.161	2.177	2.189	1.942	1.911	1.837	1.741	1.748	1.739	1.746	1.822	1.964	2.097
Sweden	1.525	1.480	1.431	1.427	1.395	1.391	1.414	1.387	1.396	1.418	1.463	1.517	1.255	1.295
Switzerland	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
UK	1.547	1.498	1.510	1.514	1.487	1.434	1.413	1.408	1.430	1.491	1.457	1.495	1.525	1.588
Australia	1.953	1.871	1.798	1.774	1.706	1.631	1.563	1.527	1.599	1.652	1.632	1.747	1.870	1.934
US	0.714	0.705	0.697	0.688	0.658	0.645	0.622	0.624	0.637	0.664	0.674	0.676	0.708	0.726

Purchasing Power Parities for GD, National currency per US$

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Austria	2.039	2.056	2.007	1.975	2.005	2.002	1.964	1.939	1.845	1.819	1.801	1.795	1.713	1.669
Finland	1.870	1.861	1.822	1.770	1.752	1.795	1.781	1.749	1.700	1.688	1.683	1.658	1.575	1.525
France	1.948	1.970	2.004	1.956	1.891	1.862	1.885	1.840	1.792	1.757	1.765	1.762	1.694	1.641
Germany	1.918	1.915	1.927	1.879	1.932	1.953	2.007	1.983	1.925	1.909	1.879	1.897	1.824	1.781
Italy	2.286	2.264	2.280	2.095	2.075	2.007	2.007	1.993	1.958	1.965	1.951	1.936	1.860	1.832
Portugal	2.683	2.647	2.610	2.500	2.511	2.444	2.544	2.511	2.424	2.388	2.401	2.389	2.306	2.361
Spain	2.551	2.520	2.490	2.415	2.354	2.306	2.275	2.259	2.198	2.153	2.144	2.106	2.031	2.035

Sweden	0.201	0.203	0.197	0.189	0.190	0.192	0.186	0.183	0.180	0.177	0.170	0.168	0.162	0.159
Switzerland	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
UK	2.864	2.909	2.939	2.818	2.766	2.769	2.736	2.652	2.481	2.381	2.317	2.185	2.043	2.014
Australia	1.438	1.412	1.383	1.321	1.301	1.277	1.252	1.186	1.119	1.047	1.056	1.007	0.947	0.921
US	1.870	1.850	1.840	1.770	1.770	1.750	1.740	1.660	1.600	1.550	1.520	1.510	1.430	1.400

Change in cost over time

The final correction step was performed using the yearly growth rates of total Swiss healthcare expenditures. To simplify the calculations, the overall health care cost changes depending on a reference year (1999) were calculated. In the case of a specific disease and set of treatment strategies, costs may change over time due to mere price changes but no changes in resource utilisation, or resource utilisation for the treatment of the disease of interest may also change. In our 'base case' approach, we assumed the latter, and that changes in resource utilisation occur with the same cost impact as at the level of total Swiss health care expenditures.

The resulting correction was based on the yearly growth rates of total Swiss healthcare expenditures, as reported by the Swiss Federal Office of Statistics (Swiss FSO 2015a). In a sensitivity analysis, we alternatively assumed no change in resource utilisation over time. The resulting, alternative correction was thus based on the change in Swiss price levels. General instead of healthcare-specific change in price levels was used, as the reporting of the latter may have been influenced by recent changes in the methodology applied by the Swiss FSO [1]. The adaptation of cost data representing indirect costs followed a similar approach. However, the first of the above-described steps is irrelevant in the case of indirect costs. The third step was based on the change in Swiss salaries over time (Swiss FSO 2015b) [2].

Healthcare cost growth rate in Switzerland, proportion (%)

1999	**1**	**1.04**	**1.11**	**1.15**	**1.20**	**1.24**	**1.27**	**1.28**	**1.34**	**1.42**	**1.48**	**1.52**	**1.57**	**1.65**
2000		1	1.06	1.11	1.15	1.19	1.21	1.23	1.29	1.36	1.42	1.46	1.51	1.59
2001			1	1.04	1.08	1.12	1.14	1.16	1.21	1.28	1.34	1.37	1.42	1.492
2002				1	1.04	1.08	1.10	1.11	1.17	1.23	1.29	1.32	1.36	1.43
2003					1	1.04	1.06	1.07	1.12	1.19	1.24	1.27	1.31	1.38
2004						1	1.02	1.03	1.08	1.15	1.20	1.23	1.27	1.33
2005							1	1.01	1.06	1.12	1.17	1.20	1.24	1.31
2006								1	1.05	1.11	1.16	1.18	1.22	1.29
2007									1	1.06	1.10	1.13	1.17	1.23
2008										1	1.04	1.07	1.11	1.16
2009											1	1.02	1.06	1.11
2010												1	1.03	1.09
2011													1	1.05
2012														1

Appendix 4: Overview of types of costs included in the eligible cost-effectiveness analyses

Author and publication year	Direct medical costs								Parent time / travel	Indirect costs
	Preoperative assessment	Surgery	Hospitalisation	GP visits	Specialist visits	Complication / death	Comorbidities	Laboratory tests		
Ackroyd 2006 [3]	Yes	Yes	Yes	Yes	Yes	Yes		Yes		
Borg 2014 [4]		Yes				Yes	Yes			Yes
Campbell 2010 [5]	Yes	Yes				Yes				
Castilla 2014 [6]		Yes					Yes			
Clegg 2003 [7]	Yes	Yes	Yes	Yes	Yes	Yes				
Craig 2002 [8]		Yes				Yes	Yes			
Hoerger 2010 [9]		Yes		Yes	Yes	Yes				
Ikramuddin 2009 [10]		Yes		Yes	Yes	Yes				
Keating 2009 [11]		Yes	Yes			Yes	Yes			
Mäklin 2011 [12]		Yes				Yes				
Michaud 2012 [13]		Yes	Yes							Yes
Picot 2009 [14]	Yes	Yes	Yes	Yes	Yes	Yes	Yes			
Picot 2012 [15]		Yes	Yes	Yes	Yes	Yes				
Pollock 2013 [16]		Yes		Yes	Yes	Yes				
Wang 2014 [17]		Yes				Yes				

Appendix 5: Types of costs and main sources used in the eligible cost-effectiveness analyses

Article	Type of costs	Sources
Ackroyd 2006 [3]	Human resources (surgeons, physicians, nurses, nutritionists), imaging and laboratory tests, operating-room overhead, post-surgical recovery room, hospital stay, consultations, complications, implants, and other not specified factors	National tariffs, registries, publications and interviews when no other source was available. For diabetes: CODE-2 survey published results
Borg 2014 [4]	Direct costs: intervention cost of the surgical procedure including any plastic surgery required, cost of adverse events, and excess healthcare costs of treating obesity related diseases. Indirect costs: productivity loss	One of the major organisations performing GBP in Sweden, official hospital prices in the Southern Healthcare Region in Sweden, previous publications, Statistics Sweden [18, 19]
Campbell 2010 [5]	Initial procedure cost, complication/death costs, other medical expenditures, and follow-up costs	Healthcare Cost and Utilization Project (HCUP) Database with International Classification of Diseases, Ninth Revision codes, the guidelines of the American Society for Metabolic and Bariatric Surgery, input from a clinical expert, the Physician Fee Guide, the Red Book (drug costs), and a study of the Medical Expenditure Panel Survey [20]
Castilla 2014 [6]	Direct costs including surgery and comorbidities.	Several (mainly) national publications.
Clegg 2003 [7]	Costs included preoperative assessment (visits, specialist consultations), hospitalisation, complications, and 20-years follow-up	National Health Services in Scotland Information and Statistics Division. Scottish Health Service Costs 1999/2000
Craig 2002 [8]	Medical costs associated with the initial surgery, treatment of complications, follow-up care, and treatment of obesity-related diseases (e.g. coronary heart disease, stroke, diabetes, hypercholesterolemia, and hypertension)	Medical Care Component of the Consumer Price Index for All Urban Consumers, published literature [21], Healthcare Cost and Utilization Project (HCUPnet, Agency for Healthcare Research and Quality, 2000 Drug Topics Red Book (Montvale, NJ), Data File Documentation of the National Health Interview Survey 1997, National Center for Health Statistics

Hoerger 2010 [9]	Surgery costs, complications, 40 years follow-up (care visits, nutritional supplements, long-term complications)	Medstat claims by Eric A. Finkelstein (2008, unpublished data), publication of Parikh 2006 [22], UK Prospective Diabetes Study (UKPDS), or the opinion of an expert panel
Ikramuddin 2009 [10]	Direct costs including surgery, management, and complications	Agency for Healthcare Quality and Research (Healthcare Cost & Utilization Project, HCUP), MAG Mutual Healthcare Solutions Physicians' Fee and Coding Guide, Drug Topics Redbook, DRG Guidebook, and published literature [22]
Keating 2009 [11]	Intervention, maintenance, complications, diabetes monitoring/remission, and health care costs to treat diabetes	Private hospital and private medical specialists, Australian Government Department of Health and Ageing (in particular Australian 2006 Medicare Benefits Schedule and Pharmaceutical Benefits Schedule)
Mäklin 2011 [12]	Intervention costs and other average annual healthcare costs including complications (no medication and productivity loss)	Hospital discharge register and hospital benchmarking database from the National Institute for Health and Welfare. Annual healthcare costs were estimated from the Health 2000 *Health Examination Survey* data
Michaud 2012 [13]	Treatment and medication costs, deadweight, and income changes	Medical Expenditure Panel Survey (MEPS, prior to age 65), the Medicare Current Beneficiary Survey (MCBS, after age 65), and published literature [23, 24].
Picot 2009 [14]	Costs included preoperative assessment (visits, specialist consultations), hospitalisation, complications, and 20 years follow-up	Clegg 2002 [25], published literature, discussion with surgical specialists and a costing developed for Aberdeen specialist obesity services (U. Kulkarni, NHS Grampian, 2008, personal communication)
Picot 2012 [15]	Costs of visits, surgery, hospitalisation, specialist consultation, physiotherapy, and complications were included for the LAGB. Out-patient visits and medical management for weigh loss program for usual care	Finance Department of the Southampton University Hospitals NHS Trust (SUHT), Department of Health (NHS Reference Costs 2006–2007), Unit costs of Health and Social Care
Pollock 2013 [16]	Costs of surgery, complications, diabetes, medication, and visits (physician, dietician, psychologist)	Cost-effectiveness analysis in UK patients with type 2 diabetes (Baudet 2011), NHS Electronic Drug Tariff, Health and Social Care Information Centre, NHS National Tariff using Healthcare Resource Group (HRG) code FZ05B, HTA (Picot 2009), a cost-effectiveness analysis (Salem 2008)

Wang 2014 [17]	Surgery, complications, and follow-up	Medicare claims database (2004–2008)

Appendix 6: Effectiveness assumption for bariatric surgery and conservative treatment in the eligible studies

	Bariatric surgery strategy assumptions	Conservative treatment strategy assumptions
Ackroyd 2006 [3]	Baseline: BMI > 35kg/m^2. Follow-up years 1-5: BMI reduction ranging from 16.1 to 17.7 kg/m^2, type 2 diabetes prevalence 50%. Mortality was not included in the model	Follow-up year 1: BMI reduction by 3 kg/m^2, 80% type 2 diabetes prevalence. Follow-up years 2-5: no BMI reduction, type 2 diabetes prevalence 100%
Borg 2014 [4]	Baseline: BMI 40-44 kg/m^2. First year average weight loss of 27%. Thereafter only 75% of the reduction is maintained lifelong. Surgical and post-surgical, BMI dependent mortality were included in the model	Annual BMI increment over time. The increment is +0.12 kg/m^2 in patients aged < 45 years, +0.07 kg/m^2 for age 45 to 65 years, and -0.14 kg/m^2 for age ≥ 65 years, regardless of gender
Campbell 2010 [5]	Baseline: BMI > 40 kg/m^2. Cumulative BMI reduction: -19.2% after year 1 and -32.0% after 5 years. Thereafter a constant BMI was assumed lifelong. Surgical and post-surgical, BMI dependent mortality were included in the model	Patients receiving no treatment were assumed to maintain a constant BMI for the duration of the model
Castilla 2014 [6]	Baseline BMI: 50.7 kg/m^2. Two years after surgery: 37% BMI reduction. Long-term effects, based on the SOS study: sustained 25% BMI reduction. Surgical and post-surgical, BMI dependent mortality were included in the model	Patients not operated were considered to remain in the same BMI range their whole lifetime
Clegg 2003 [7]	Baseline: BMI 45 kg/m^2. 1-5 years after surgery: BMI 29 kg/m^2. 6-20 years after surgery: BMI = baseline (i.e. No benefit). Surgical mortality was included in the model	Constant for 20 years
Craig 2002 [8]	Mean percentage reduction of excess weight of about 58% five years after surgery (Excess weight was defined as the weight above a body mass index of 22 kg/m^2). After 5 years: with successful surgery (93.7% of the cases) lifetime reduction of BMI. Surgical and post-surgical, comorbidity dependent mortality was included in the model	Lifetime with initial BMI
Hoerger 2010 [9]	Baseline: BMI >35 kg/m^2. Excess weight loss of 63.25% and a BMI loss of 16.17 kg/m^2 were assumed (time unit was unclear). Diabetes remission rate: 80.3% for persons with newly diagnosed diabetes and 40% for persons with established diabetes. Surgical and post-surgical mortality (based on effects on blood pressure, cholesterol, remission or improvement of diabetes) were included in the model	Not reported

Ikramuddin 2009 [10]	Not reported in the document. Based on the sensitivity analyses, no assumption with respect to weight gain after LRYGB was made (i.e. the effects of surgery on BMI reduction were maintained constant). Surgical and post-surgical, non-specific mortality were included in the model	Not reported
Keating 2009 [11]	Baseline BMI: 37 kg/m^2. Based on diabetes remission: 11.4 years over a lifetime. Surgical and post-surgical, diabetes dependent mortality was included in the model	Based on diabetes remission: 2.1 years over a lifetime
Mäklin 2011 [12]	Baseline BMI: 47 kg/m^2. Excess weight loss over a 10-years horizon: 60%. Diabetes prevalence reduction: 82%. Surgical and post-surgical, BMI dependent mortality were included in the model	BMI remain constant, based on the SOS study results
Michaud 2012 [13]	Baseline BMI >40 kg/m^2 (or 35-40 kg/m^2 with comorbidities). A permanent weight reduction of 25% is achieved. Post-surgical mortality was included in the models	Not reported
Picot 2009 [14]	Baseline cohort: BMI >40. 5 years after LRYGB: 36% reduction of initial weight (Clegg 2003). From 5 to 10 years after surgery: 17.7% decline in percentage of weight loss (SOS study). Surgical mortality was included in the model	Baseline cohort: Stable BMI over time
Picot 2012 [15]	Baseline BMI: 33.5 kg/m^2. Excess weight loss at 2-years follow-up: 62.5% (Dixon 2008 [26]) - 87.2% (O'Brien 2006 [27]). Diabetes remission: 70%. Lifetime: weight reduction until 10 years, thereafter baseline values. Mortality was <u>not</u> included in the model	Baseline BMI: 33.5 kg/m^2. Excess weight loss at 2-years follow-up: 4.3% (Dixon 2008 [26]) - 21.8% (O'Brien 2006 [27]). Diabetes remission: 13%. Lifetime: weight reduction until 10 years, thereafter baseline values
Pollock 2013 [16]	Baseline BMI: 37.1 kg/m^2. In the first year, diabetes remission at 73%. Thereafter natural course of risk progression based on UKPDS and Framingham studies. Surgical mortality was included in the model	Baseline BMI: 37.1 kg/m^2. In the first year, diabetes remission at 13%. Thereafter natural course of risk progression based on UKPDS and Framingham studies
Wang 2014 [17]	Baseline BMI: 44 kg/m^2. BMI changes post procedure were derived from Picot et al. (Picot 2009). Surgical and post-surgical, BMI specific mortality was included in the model	Baseline BMI: 44 kg/m^2. BMI changes post procedure were derived from Picot et al. (Picot 2009)

Appendix 7: Overview of the inclusion or exclusion of short-term effectiveness, long-term, effectiveness, mortality (surgical and post-surgical), complications or adverse events, and diabetes remission

	Short-term effectiveness (≤20 years)	Long-term effectiveness (> 20 years)	Surgical mortality	Post-surgical mortality	Complications or adverse events	Diabetes remission
Ackroyd 2006 [3]	Yes	No	No	No	Yes	Yes
Borg 2014 [4]	Yes	Yes	Yes	Yes	Yes	No
Campbell 2010 [5]	Yes	Yes	Yes	Yes	Yes	No
Castilla 2014 [6]	Yes	Yes	Yes	Yes	No	No
Clegg 2003 [7]	Yes	No	Yes	No	Yes	No
Craig 2002 [8]	Yes	Yes	Yes	Yes	Yes	No
Hoerger 2010 [9]	Yes	Unclear	Yes	Yes	Yes	Yes
Ikramuddin 2009 [10]	Unclear	No	Yes	Yes	Yes	No
Keating 2009 [11]	Yes	Yes	Yes	Yes	Yes	Yes
Mäklin 2011 [12]	Yes	No	Yes	Yes	Yes	Yes
Michaud 2012 [13]	Yes	Yes	No	Yes	Yes	Yes
Picot 2009 [14]	Yes	No	Yes	No	Yes	Yes
Picot 2012 [15]	Yes	No	No	No	Yes	Yes
Pollock 2013 [16]	Yes	No	Yes	No	Yes	Yes
Wang 2014 [17]	Yes	No	Yes	Yes	Yes	No

Appendix 8: Effectiveness and utility main sources used in the selected cost-effectiveness studies

Article	Sources of effectiveness estimates	Sources of utility estimates
Ackroyd 2006 [3]	National institutes or registries: National Institute for Clinical Excellence (NICE), the "Agence Nationale d'Accréditation et d'Evaluation en Santé" (ANAES), the Australian Safety and Efficacy Register of New Interventional Procedures (ASERNIP-S), the Swedish Council on Technology Assessment in Health Care (SBU) and the "Deutsche Adipositas Gesellschaft" DGA	Health Outcomes Data Repository (HODaR) Cardiff Research Consortium
Borg 2014 [4]	The Swedish Obese Subjects (SOS) trial - a prospective controlled intervention study (Sjöstrom 2013).	Health Outcomes Data Repository (HODaR) Cardiff Research Consortium (Ackroyd 2006).
Campbell 2010 [5]	Angrisani 2007 [28], O'Brien 2006 [27]	EQ-5D data from the 2000 Medical Expenditure Panel Survey; utilities reported for laparoscopic surgery for hernia repair in the United Kingdom (McCormack 2005) [29]
Castilla 2014 [6]	The Swedish Obese Subjects (SOS) study for long-term [30]	National publications (in particular 2011)
Clegg 2003 [7]	HTA (Clegg 2002) including 17 RCT and 1 cohort study (the Swedish Obese Subjects (SOS) study) [25]	Economic evaluation of orlistat (Hakim 2002) [31]
Craig 2002 [8]	Pories 1995 [32]	Framingham Heart Study [21]
Hoerger 2010 [9]	Several publications, in particular a meta-analysis (Buchwald 2009) and the Swedish Obese Subjects (SOS) study (Sjöstrom 2004)	Average of five different sources
Ikramuddin 2009 [10]	A prospective observational study conducted at an academic medical center in the United States (Minnesota cohort; unpublished data, University of Minnesota Medical Center, Minneapolis)	Cost of Diabetes in Europe–type 2 (CODE-2) study [33]
Keating 2009 [11]	2-year randomized controlled trial involving 60 obese participants (BMI 30-40 kg/m^2) in Australia [26]	DiabCo$t study [34]

Mäklin 2011 [12]	Several publications, in particular a meta-analysis [35] (Buchwald et al. 2004 and 2009) and the Swedish Obese Subjects (SOS) study [36]	Randomized trials and 15D utilities from the Health 2000 Health Examination survey
Michaud 2012 [13]	A randomised controlled trial [26] (Dixon 2008), a HTA [14], and the Swedish Obese Subjects (SOS) study [37]	Unclear. Probably Dixon 2008 (a randomised controlled trial), Picot 2009 (a meta-analysis) [14], or Sjöstrom 2004 [37]
Picot 2009 [14]	HTA [25], Swedish Obese Subjects (SOS) study [37], Angrisani 2007 [28], Australian studies [26, 27]	Economic evaluation of orlistat [31], Australian study [38], Currie 2006 [39], Lee 2005 [40]
Picot 2012 [15]	Australian studies [26, 27]	Economic evaluation of orlistat [31]
Pollock 2013 [16]	Australian study [26]	UK Prospective Diabetes Study (UKPDS), Cost of Diabetes in Europe–type 2 (CODE-2) study [33]
Wang 2014 [17]	HTA [14]	Published studies [41–43]

Appendix 9: Results of economic evaluations for laparoscopic gastric bypass, as originally reported by the authors

Study	Total Costs of I	Total costs of C	Outcome of I (QALY)	Outcome of C (QALY)	Cost per QALY (ICER)
	(Difference)		(Difference)		
Ackroyd 2006 [3] - *Gastric bypass versus conservative therapy*					
Germany	€ 12,166	€ 17,197	3.34	2.0	* Bariatric surgery dominant
	(€ -5031)		(1.34)		
France	€ 13,399	€ 19,276	3.34	2.0	Bariatric surgery dominant
	(€ -5,877)		(1.34)		
United Kingdom	€ 9,121	€7,083	3.34	2.0	Bariatric surgery dominant
	(€ 2038)		(1.34)		
Borg 2014 [4] - *Gastric bypass versus conservative therapy*					
Male (age 45-54) BMI 30-34 kg/m^2	SEK 63,143	SEK 41,795	14.64	11.68	SEK 7,212
	(SEK 21,348)		(2.96)		
Male (age 45-54) BMI 35-39 kg/m^2	SEK 87,422	SEK 196,141	13.51	10.17	Bariatric surgery dominant
	(SEK -108,719)		(3.34)		
Male (age 45-54) BMI 40-44 kg/m^2	SEK 146,381	SEK 469,978	11.91	8.43	Bariatric surgery dominant
	(SEK -323,597)		(3.48)		
Male (age 45-54) BMI 45-49 kg/m^2	SEK 297,941	SEK 888,649	10.6	7.17	Bariatric surgery dominant
	(SEK -590,708)		(3.43)		

Male (age 25–34) BMI 40-44kg/m^2	SEK 184,961	SEK 568,371	14.84	10.97	Bariatric surgery dominant
	(SEK -383,410)		(3.87)		
Male (age 35–44) BMI 40-44 kg/m^2	SEK 163,096	SEK 516,825	13.74	9.94	Bariatric surgery dominant
	(SEK -353,729)		(3.8)		
Male (age 45–54) BMI 40-44 kg/m^2	SEK 146,381	SEK 469,979	11.91	8.43	Bariatric surgery
	(SEK -323,597)		(3.48)		
Male (age 55 - 64) BMI 40-44 kg/m^2	SEK 131,629	SEK 357,771	9.6	6.59	Bariatric surgery dominant
	(SEK -226,142)		(3.01)		
Male (age 65–74) BMI 40-44 kg/m^2	SEK 112,050	SEK 226,819	6.78	4.54	SEK 89,958
	(SEK -114,769)		(2.24)		
Female (age 45-54) BMI 30–34 kg/m^2	SEK 71,198	SEK 39,063	15.53	12.62	SEK 11,043
	(SEK 32,135)		(2.91)		
Female (age 45-54) BMI 35–39 kg/m^2	SEK 95,196	SEK 119,142	14.29	10.95	Bariatric surgery dominant
	(SEK -23,946)		(3.34)		
Female (age 45-54) BMI 40–44 kg/m^2	SEK 126,427	SEK 274,136	13.00	9.35	Bariatric surgery
	(SEK -147,709)		(3.65)		
Female (age 45-54) BMI 45–49 kg/m^2	SEK 204,017	SEK 50,018	11.46	7.97	Bariatric surgery dominant
	(SEK -296,101)		(3.49)		
Female (age 25–34) BMI 40-44 kg/m^2	SEK 145,526	SEK 329,448	15.27	11.4	Bariatric surgery dominant
	(SEK -183,922)		(3.87)		
Female (age 35–44) BMI 40-44 kg/m^2	SEK 135,213	SEK 304,438	14.55	10.72	Bariatric surgery dominant
	(SEK -169,226)		(3.83)		

Female (age 45–54) BMI 40-44 kg/m^2	SEK 126,427	SEK 274,136	13.00	9.35	Bariatric surgery
	(SEK -147,709)		(3.65)		
Female (age 55–64) BMI 40-44 kg/m^2	SEK 116,142	SEK 211,766	10.75	7.57	Bariatric surgery dominant
	(SEK -95,624)		(3.18)		
Female (age 65–74) BMI 40-44 kg/m^2	SEK 102,357	SEK 138,453	7.93	5.35	Bariatric surgery dominant
	(SEK -36,096)		(2.58)		
Campbell 2010 [5] - *Laparoscopic Roux-en-Y gastric bypass versus conservative therapy*					
Aggregate population (Base case - 40 years) – Angrisani et al. [28]	$ 124,811	$ 108,523	19.054	16.55	$ 5,618
	($ 16,288)		(2.9)		
Aggregate population (Base case - 40 years) – O'Brien et al. [27]	$ 129,442	$ 108,523	18.56	16.155	$ 8,698
	($ 20,919)		(2.4)		
Males (Angrisani et al. [28]) BMI 35-39.9 kg/m^2	$ 117,087	$ 87,943	18.431	16.38	$ 14,210
	($ 29,144)		(2.05)		
Males (Angrisani et al. [28]) BMI 40-49.9 kg/m^2	$ 120,594	$ 101,778	17.966	14.805	$ 5,953
	($ 18,816)		(3.16)		
Males (Angrisani et al. [28]) BMI > 50 kg/m^2	$ 122,712	$117,284	17.682	12.835	$ 1,120
	($ 5,428)		(4.85)		
Males (O'Brien et al. [27]) BMI 35-39.9 kg/m^2	$ 117,776	$ 87,943	18.335	16.38	$ 15,260
	($ 59,833)		(1.96)		
Males (O'Brien et al. [27]) BMI 40-49.9	$ 124,687	$ 101,778	17.421	14.805	$ 8,757
	($ 22,909)		(2.62)		
Males (O'Brien et al. [27]) BMI > 50 kg/m^2	$ 131,959	$ 117,284	16.435	12.835	$ 4,076
	($ 14675)		(3.60)		

Females (Angrisani et al. [28]) BMI 35-39.9 kg/m^2	$ 122,592	$ 95,334	19.662	17.756	$ 14,301
	($ 27,258)		(1.91)		
Females (Angrisani et al. [28]) BMI 40-49.9 kg/m^2	$ 126,667	$ 112,316	19.238	16.338	$ 4,952
	($ 14,361)		(2.90)		
Females (Angrisani et al. [28]) BMI > 50 kg/m^2	$ 129,148	$ 132,033	18.979	14.449	Bariatric surgery dominant
	($ -2,885)		(4.53)		
Females (O'Brien et al. [27]) BMI 35-39.9 kg/m^2	$ 123,433	$ 95,334	19.567	17.756	$ 15,516
	($ 28,099)		(1.81)		
Females (O'Brien et al. [27]) BMI 40-49.9 kg/m^2	$ 131,758	$ 122,316	17.728	16.338	$ 13,987
	($19,442)		(1.39)		
Females (O'Brien et al.) [27] BMI > 50 kg/m^2	$ 140,683	$ 132,033	17.804	14.449	$ 2,578
	($ 8650)		(3.36)		
Castilla 2014 [6] - *Gastric bypass versus conservative therapy*					
Lifetime time horizon (base case)	€ 17,431	€ 31,425	18.18	12.55	Bariatric surgery dominant
	(€ -13,994)		(5.63		
Clegg 2003 [7] - *Gastric bypass versus conservative therapy*					
Females 90% BMI 45 kg/m^2	£ 9,764	£ 6,964	11.67	11.22	£ 6,289
	(£ 2,800)		(0.45)		
Hoerger 2010 [9] - *Gastric bypass versus conservative therapy*					
Newly diagnosed diabetes	$ 86,665	$ 71,130	11.76	9.55	$ 7,029
	($ 15,535)		(11.76)		
Established diabetes	$ 99,944	$ 79,618	9.38	7.68	$ 11,956
	($ 20,326)		(1.7)		
Ikramuddin 2009 [9] - *Laparoscopic Roux-en-Y gastric bypass versus conservative therapy*					
Females 77.9% (age 50.1) BMI 48.4 kg/m^2	$ 83,482	$ 63,722	6.782	5.833	$ 21,980
	($ 19,760)		(0.899)		

Mäklin 2011 [12] - *Gastric bypass versus conservative therapy*					
Females 65% (age 43) BMI 47 kg/m^2	€ 33,379	€ 50,667	7.67	7.04	Bariatric surgery dominant
	(€ -17,288)		(0.63)		
Michaud 2012 [13] - *Roux-en-Y gastric bypass versus conservative therapy*					
BMI > 40 or BMI > 35 kg/m^2 with high risk comorbidities	$ 369,585	$ 354,234	30.35	28.8	$ 9,904
	($ 15,351)		(1.55)		
BMI > 35 or BMI > 30 kg/m^2 with qualifying comorbidities	$ 352,244	$ 338,205	29.87	28.87	$ 12,999
	($ 14,039)		(1.08)		
Picot 2009 [13] – *Gastric bypass versus non-surgical intervention*					
20 years time horizon (age 40) BMI $\geq$ 40 kg/m^2	£ 19,824	£ 13,561	12.32	10.8	£ 4,120
	(£ 6,263)		(1.52)		
Wang 2014 [17] - *Laparoscopic gastric bypass versus conservative therapy*					
Females 78% (age 50.1) BMI 48.4 kg/m^2	$ 169,074	$ 150,934	13.4	10.6	$ 6,479
	($ 18,140)		(2.8)		

I=intervention, C-comparator, QALY-quality adjusted life years, BMI-body mass index, Bariatric surgery dominant= cost saving, ICER, incremental cost effectiveness ratio.

Appendix 10: Other bariatric surgeries, as originally reported by the authors

Study	Total Costs of I	Total costs of C	Outcome of I (QALY)	Outcome of C (QALY)	Cost per QALY (ICER)
	(Difference)		(Difference)		
Ackroyd 2006 [3] – *Adjustable gastric banding versus conservative therapy*					
Germany	€ 13,610	€ 17,197	3.03	2.0	* Bariatric surgery dominant
	(€ -3,587)		(1.03)		
France	€ 14,796	€ 19,276	3.03	2.0	Bariatric surgery dominant
	(€ -4,480)		(1.03)		
United Kingdom	€ 9,072	€7,083	3.03	2.0	€ 1,931
	(€ 3,203)		(1.03)		
Craig 2002 [8] – Open *Gastric bypass versus conservative therapy*					
	$ 68,600	$ 38,500	19.56	18.51	$ 28,667
Males (age 35) BMI 40 kg/m^2	($ 30,100)		(1.05)		
Males (age 35) BMI 50 kg/m^2	$ 75,000	$ 53,200	18.87	16.83	$ 10,686
	($ 21,800)		(2.04)		
Males (age 55) BMI 40 kg/m^2	$ 77,600	$ 47,900	13.32	12.48	$ 35,357
	($ 29,700)		(0.84)		
Males (age 55) BMI 50 kg/m^2	$ 85,300	$ 63,500	12.81	11.17	$ 13,293
	($ 21,800)		(1.64)		
Females (age 35) BMI 40 kg/m^2	$ 59,000	$ 35,300	19.82	18.21	$ 14,720
	($ 23,700)		(1.61)		
Females (age 35) BMI 50 kg/m^2	$ 64,800	$ 48,500	18.88	16.03	$ 5,719
	($ 16,300)		(2.85)		
Females (age 55) BMI 40 kg/m^2	$ 69,600	$ 84,200	13.94	12.62	$ 1,612
	($ 21,400)		(1.32)		
Females (age 55) BMI 50 kg/m^2	$ 77,000	$ 64,100	13.23	10.88	$ 5,489
	($ 12,900)		(2.35)		
Hoerger 2010 [9] - *Banding surgery versus conservative therapy*					
Newly diagnosed diabetes	$ 89,029	$ 71,130	11.12	9.55	$ 11,401
	($ 17,899)		(1.57)		
Established diabetes	$ 96,921	$ 79,618	9.02	7.68	$ 12,913
	($ 17,303)		(1.34)		

Keating 2009 [11] – *Laparoscopic adjustable gastric banding versus conservative therapy*					
Females 55% (age 49) BMI 30-39.9 kg/m^2	AUD 98,931	AUD 101,376	15.7	14.5	Bariatric surgery dominant
	(AUD -2,445)		(1.2)		
Mäklin 2011 [11] – *Gastric banding versus conservative therapy*					
Females 65% (age 43) BMI 47 kg/m^2	€ 34,594	€ 42,070	7.39	7.19	Bariatric surgery dominant
	(€ -7,476)		(0.2)		
Picot 2009 [14] - *Adjustable gastric banding versus non-surgical intervention*					
20 years time horizon (age 40) BMI > 40 kg/m^2	£ 17,126	£ 13,561	11.72	10.8	£ 3,875
	(£ 3,565)		(0.92)		
Picot 2012 [15] – *Laparoscopic adjustable gastric banding versus conservative therapy*					
5 years time horizon BMI ≥30 and <40 kg/m^2), with	£ 14,182	£ 11,148	4.09	3.48	£ 4,974
	(£ 3,034)		(0.61)		
20 years time horizon BMI ≥30 and <40 kg/m^2), with T2D	£ 35,055	£ 33,262	11.49	10.39	£ 1,630
	(£ 1,793)		(1.1)		
5 years time horizon BMI ≥30 and <35 kg/m^2)	£ 9,923	£4,801	4.03	3.74	£ 17,662
	(£ 5,122)		(0.29)		
20 years time horizon BMI ≥30 and <35 kg/m^2)	£ 15,211	£ 9,750	11.52	11.12	£ 13,653
	(£ 5,461)		(0.4)		
Pollock 2013 [16] – *Laparoscopic adjustable gastric banding versus conservative therapy*					
10 years time horizon Females 53.5% (age 46.9) BMI 42.4 kg/m^2	£ 12,58	£ 7,826	5.63	5.35	£ 16,993
	(£ 4,758)		(0.28)		
20 years time horizon Females 53.5% (age 46.9) BMI 42.4 kg/m^2	£ 18,089	£ 14,633	8.63	8.05	£ 5,959
	(£ 3,456)		(0.58)		
30 years time horizon Females 53.5% (age 46.9) BMI 42.4 kg/m^2	£ 122,203	£ 19,047	9.85	8.99	£ 3,670
	(£3,156)		(0.86)		

Lifetime horizon Females 53.5% (age 46.9) BMI 42.4 kg/m^2	£ 23,562	£ 20,263	10.05	9.14	£ 3,625
	(£ 3,299)		(0.91)		
Wang 2014 [17] – *Laparoscopic adjustable gastric banding versus conservative therapy*					
Females 77.9% (age 50.1) BMI 48.4 kg/m^2	$ 164,313	$ 150,934	12.8	10.6	$ 6,081
	($ 13,379)		(2.2)		
Wang 2014 [17] – conventional open *Roux-en-Y gastric bypass versus conservative*					
Females 77.9% (age 50.1), BMI 48.4 kg/m^2)	$ 194,858	$ 150,934	13.2	10.6	$ 16,894
	($ 43,924)		(2.6)		

I=intervention, C-comparator, QALY-quality adjusted life years, BMI-body mass index, Bariatric surgery dominant= cost saving, ICER, incremental cost effectiveness ratio.

Appendix 11: Results of economic evaluations, adapted for Switzerland - only RYGB

Study	Total Costs of I	Total costs of C	Outcome of I (QALY)	Outcome of C (QALY)	Cost per QALY (ICER)
	(Difference)		(Difference)		
Ackroyd 2006 [3] - *Gastric bypass versus conservative therapy*					
Germany	CHF 38,832	CHF 54,891	3.34	2.0	*Bariatric surgery dominant
	(CHF -16,058)		(1.34)		
France	CHF 42,725	CHF 61,465	3.34	2.0	Bariatric surgery dominant
	(CHF -18,740)		(1.34)		
United Kingdom	CHF 44,477	CHF 34,539	3.34	2.0	CHF 7,416
	(CHF 9,938)		(1.34)		
Borg 2014 [4] - *Gastric bypass versus conservative therapy (life time horizon)*					
Male (age 45-54) BMI 30-34 kg/m^2	CHF 12,975	CHF 8,588	14.64	11.68	CHF 1,482
	(CHF 4,387)		(2.96)		
Male (age 45-54) BMI 35-39 kg/m^2	CHF 17,964	CHF 40,305	13.51	10.17	Bariatric surgery dominant
	(CHF -22,340)		(3.34)		
Male (age 45-54) BMI 40-44 kg/m^2	CHF 30,080	CHF 96,575	11.91	8.43	Bariatric surgery dominant
	(CHF -66,495)		(3.48)		
Male (age 45-54) BMI 45-49 kg/m^2	CHF 61,223	CHF 182,607	10.6	7.17	Bariatric surgery dominant
	(CHF -121,383)		(3.43)		
Male (age 25–34) BMI 40-44 kg/m^2	CHF 38,007	CHF 116,793	14.84	10.97	Bariatric surgery dominant
	(CHF -78,786)		(3.87)		
Male (age 35–44) BMI 40-44 kg/m^2	CHF 33,514	CHF 106,201	13.74	9.94	Bariatric surgery dominant
	(CHF -72,687)		(3.8)		
Male (age 45–54) BMI 40-44 kg/m^2	CHF 30,080	CHF 96,575	11.91	8.43	Bariatric surgery dominant
	(CHF -66,495)		(3.48)		

Male (age 55-64) BMI 40 -44 kg/m^2	CHF 27,048	CHF 73,518	9.6	6.59	Bariatric surgery dominant
	(CHF -46,469)		(3.01)		
Male (age 65–74) BMI 40 -44 kg/m^2	CHF 23,025	CHF 46,609	6.78	4.54	Bariatric surgery dominant
	(CHF -23,584)		(2.24)		
Female (age 45-54) BMI 30–34 kg/m^2	CHF 14,630	CHF 8,027	15.53	12.62	CHF 2,269
	(CHF 6,603)		(2.91)		
Female (age 45-54) BMI 35–39 kg/m^2	CHF 19,562	CHF 24,482	14.29	10.95	Bariatric surgery dominant
	(CHF -4,921)		(3.34)		
Female (age 45-54) BMI 40–44 kg/m^2	CHF 25,979	CHF 56,332	13.00	9.35	Bariatric surgery dominant
	(CHF -30,352)		(3.65)		
Female (age 45-54) BMI 45–49 kg/m^2	CHF 41,923	CHF 102,768	11.46	7.97	Bariatric surgery dominant
	(CHF -60,845)		(3.49)		
Female (age 25–34) BMI 40-44 kg/m^2	CHF 29,904	CHF 67,698	15.27	11.4	Bariatric surgery dominant
	(CHF -37,794)		(3.87)		
Female (age 35–44) BMI 40-44 kg/m^2	CHF 27,785	CHF 62,558	14.55	10.72	Bariatric surgery dominant
	(CHF -34,774)		(3.83)		
Female (age 45–54) BMI 40-44 kg/m^2	CHF 25,979	CHF 56,332	13.00	9.35	Bariatric surgery dominant
	(CHF -30,352)		(3.65)		
Female (age 55–64) BMI 40-44 kg/m^2	CHF 23,866	CHF 43,515	10.75	7.57	Bariatric surgery dominant
	(CHF -19,650)		(3.18)		
Female (age 65–74) BMI 40-44 kg/m^2	CHF 21,033	CHF 28,450	7.93	5.35	Bariatric surgery dominant
	(CHF -7,417)		(2.58)		
Campbell 2010 [5] - *Laparoscopic Roux-en-Y gastric bypass versus conservative therapy*					
Aggregate population (Base case - 40 years) – using Angrisani et al. [28]	CHF 166,423	CHF 144,705	19.054	16.55	CHF 7,492
	(CHF 21,718)		(2.9)		

Aggregate population (Base case - 40 years) using O'Brien et al. [27]	CHF 172,598	CHF 144,705	18.56	16.155	CHF 11,598
	(CHF 27,893)		(2.4)		
Males (Angrisani et al. [28]) BMI 35-39.9 kg/m^2	CHF 156,124	CHF 117,263	18.431	16.38	CHF 18,947
	(CHF 38,861)		(2.05)		
Males (Angrisani et al. [28]) BMI 40-49.9 kg/m^2	CHF 160,800	CHF 135,711	17.966	14.805	CHF 7,937
	(CHF 25,089)		(3.16)		
Males (Angrisani et al. [28]) BMI > 50 kg/m^2	CHF 163,624	CHF 156,387	17.682	12.835	CHF 1,493
	(CHF 7,238)		(4.85)		
Males (O'Brien et al. [27]) BMI 35-39.9 kg/m^2	CHF 157, 043	CHF 117,263	18.335	16.38	CHF 2,0347
	(CHF 39,779)		(1.96)		
Males (O'Brien et al. [27]) BMI 40-49.9 kg/m^2	CHF 166,258	CHF 135,711	17.421	14.805	CHF 11,677
	(CHF 30,547)		(2.62)		
Males (O'Brien et al. [27]) BMI > 50 kg/m^2	CHF 175,954	CHF 156,387	16.435	12.835	CHF 5,435
	(CHF 19,568)		(3.60)		
Females (Angrisani et al. [28]) BMI 35-39.9 kg/m^2	CHF 163,464	CHF 127,118	19.662	17.756	CHF 16,069
	(CHF 36,346)		(1.91)		
Females (Angrisani et al. [28]) BMI 40-49.9 kg/m^2	CHF 168,911	CHF 149,762	19.238	16.338	CHF 6,603
	(CHF 19,149)		(2.90)		
Females (Angrisani et al. [28]) BMI > 50 kg/m^2	CHF 172,206	CHF 176,053	18.979	14.449	Bariatric surgery dominant
	(CHF -3,847)		(4.53)		
Females (O'Brien et al. [27]) BMI 35-39.9 kg/m^2	CHF 164,586	CHF 127,118	19.567	17.756	CHF 20,689
	(CHF 37,467)		(1.81)		
Females (O'Brien et al. [27]) BMI 40-49.9 kg/m^2	CHF 175,686	CHF 149,762	17.728	16.338	CHF 18,650
	(CHF 25,924)		(1.39)		
Females (O'Brien et al. [27]) BMI > 50 kg/m^2	CHF 187,587	CHF 176,053	17.804	14.449	CHF 3,438
	(CHF 11,534)		(3.36)		
Castilla 2014 [6] - *Roux-en-Y Gastric bypass versus conservative therapy*					
5 years time horizon	CHF 74,396	CHF 134,121	18.18	12.55	Bariatric surgery dominant
	(CHF -59,725)		(5.63)		

Clegg 2003 [7] - *Roux-en-Y Gastric bypass versus conservative therapy*					
Females 90% BMI 45 kg/m^2	CHF 67,507	CHF 48,148	11.67	11.22	CHF 43,480
	(CHF 19,360)		(0.45)		
Hoerger 2010 [9] -*Gastric bypass versus conservative therapy*					
Newly diagnosed diabetes	CHF 122,442	CHF 100,494	11.76	9.55	CHF 9,931
	(CHF 21,948)		(11.76)		
Established diabetes	CHF 141,203	CHF 112,486	9.38	7.68	CHF 16,892
	(CHF 28,717)		(1.7)		
Ikramuddin 2009 [10] - *Laparoscopic Rouxen-Y gastric bypass versus conservative therapy*					
Females 77.9% (age 50.1) BMI 48.4 kg/m^2	CHF 104,819	CHF 80,008	6.782	5.833	CHF 27,598
	(CHF 24,810)		(0.899)		
Mäklin 2011 [12] - *Gastric bypass versus conservative therapy*					
Females 65% (age 43) BMI 47 kg/m^2	CHF 102,712	CHF 155,910	7.67	7.04	Bariatric surgery dominant
	(CHF -53,198)		(0.63)		
Michaud 2012 [13] - *Roux-en-Y gastric bypass versus conservative therapy*					
BMI > 40 kg/m^2 or BMI > 35 kg/m^2 with high risk comorbidities	CHF 410,672	CHF 393,614	30.35	28.8	CHF11,005
	(CHF 17,058)		(1.55)		
BMI > 35 or BMI > 30 kg/m^2 with qualifying comorbidities	CHF 391,403	CHF 375,803	29.87	28.87	CHF 14,444
	(CHF 15,600)		(1.08)		
Picot 2009 [14] – *Gastric bypass versus non-surgical intervention*					
20 years time horizon (age 40) BMI $\geq$ 40 kg/m^2	CHF 81,860	CHF 55,998	12.32	10.8	CHF 17,015
	(CHF 25,862)		(1.52)		
Wang 2014 [17] - *Laparoscopic gastric bypass versus conservative therapy*					
Females 77.9% (age 50.1) BMI 48.4 kg/m^2	CHF 187,870	CHF 167,713	13.4	10.6	CHF 7,199
	(CHF 20,157)		(2.8)		

I=intervention, C-comparator, QALY-quality adjusted life years, BMI-body mass index, Bariatric surgery dominant= cost saving, ICER, incremental cost effectiveness ratio.

Results of economic evaluations, adapted for Switzerland (other bariatric surgeries)

Appendix 12: Results of economic evaluations, adapted for Switzerland (other bariatric surgeries)

Study	Total costs of surgical strategy	Total costs of comparator strategy	Outcome of surgical strategy (QALY)	Outcome of surgical strategy (QALY)	Cost per QALY (ICER)
	(Difference)		(Difference)		
Ackroyd 2006 [3] – *Adjustable gastric banding versus conservative therapy*					
Germany	CHF 43,441	CHF 54,891	3.03	2.0	Bariatric surgery dominant
	(CHF -11,449)		(1.03)		
France	CHF 47,180	CHF 61,465	3.03	2.0	Bariatric surgery dominant
	(CHF -14,285)		(1.03)		
United Kingdom	CHF 44,238	CHF 34,539	3.03	2.0	CHF 9417
	(CHF 9,699)		(1.03)		
Craig 2002 [8] - Open *Gastric bypass versus conservative therapy*					
Males (age 35) BMI 40 kg/m^2	CHF 131,201	CHF 73,633	19.56	18.51	CHF 54,826
	(CHF 57,568)		(1.05)		
Males (age 35) BMI 50 kg/m^2	CHF 143,441	CHF 101,747	18.87	16.83	CHF 20,438
	(CHF 41,694)		(2.04)		
Males (age 55) BMI 40 kg/m^2	CHF 148,413	CHF 91,611	13.32	12.48	CHF 67,622
	(CHF 56,802)		(0.84)		
Males (age 55) BMI 50 kg/m^2	CHF 163,140	CHF 121,447	12.81	11.17	CHF 25,423
	(CHF 41,693)		(1.64)		
Females (age 35) BMI 40 kg/m^2	CHF 112,840	CHF 67,513	19.82	18.21	CHF 28,154
	(CHF 45,327)		(1.61)		
Females (35 years) BMI 50 kg/m^2	CHF 123,933	CHF 92,758	18.88	16.03	CHF 10,938
	(CHF 31,174)		(2.85)		
Females (age 55) BMI 40 kg/m^2	CHF 133,113	CHF 92,185	13.94	12.62	CHF 31,006
	(CHF 40,928)		(1.32)		
Females (age 55) BMI 50 kg/m^2	CHF 147,266	CHF 122,594	13.23	10.88	CHF 10,499
	(CHF 24,672)		(2.35)		
Hoerger 2010 [9] - *Banding surgery versus conservative therapy*					
Newly diagnosed diabetes	CHF 125,782	CHF 100,494	11.12	9.55	CHF 16,107
	(CHF 25,288)		(1.57)		
Established diabetes	CHF 136,932	CHF 112,486	9.02	7.68	CHF 18,243
	(CHF 24,446)		(1.34)		

Keating 2009 [11] – *Laparoscopic adjustable gastric banding versus conservative therapy*					
Females 55% (age 49) BMI 30-39.9 kg/m^2	CHF 230,703	CHF 236,405	15.7	14.5	Bariatric surgery dominant
	(CHF -5,702)		(1.2)		
Mäklin 2011 – *Gastric banding versus conservative therapy*					
Females 65% (age 43) BMI 47 kg/m^2	CHF 106,451	CHF 129,455	7.39	7.19	Bariatric surgery dominant
	(CHF -23,005)		(0.2)		
Picot 2009 [14] -*Adjustable gastric banding versus non-surgical intervention*					
20 years time horizon (age 40) BMI $\geq$ 40 kg/m^2	CHF 70,719	CHF 55,998	12.32	10.8	CHF 9,685
	(CHF 14,721)		(1.52)		
Picot 2012 [15] – *Laparoscopic adjustable gastric banding versus conservative therapy*					
5 years time horizon BMI ≥30 kg/m^2 and <40 kg/m^2, with T2D	CHF 50,406	CHF 39,623	4.09	3.48	CHF 17,678
	(CHF 10,784)		(0.61)		
20 years time horizon BMI ≥30 kg/m^2 and <40 kg/m^2, with T2D	CHF 124,594	CHF 118,222	11.49	10.39	CHF 5,793
	(CHF 6,373)		(1.1)		
5 years time horizon BMI ≥30 kg/m^{2}and <35 kg/m^2	CHF 35,269	CHF 17,064	4.03	3.74	CHF 62,775
	(CHF 18,205)		(0.29)		
20 years time horizon BMI ≥30 kg/m^2 and <35 kg/m^2	CHF 54,064	CHF 34,654	11.52	11.12	CHF 48,524
	(CHF 19,410)		(0.4)		
Pollock 2013 [16] – *Laparoscopic adjustable gastric banding versus conservative therapy*					
10 years time horizon Females 53.5% (age 46.9) BMI 42.4 kg/m^2	CHF 44,727	CHF 27,816	5.63	5.35	CHF 60,397
	(CHF 16,911)		(0.28)		

20 years time horizon Females 53.5% (age 46.9) BMI 42.4 kg/m^2	CHF 64,293	CHF 52,009	8.63	8.05	CHF 21,178
	(CHF 12,283)		(0.58)		
30 years-time horizon, Females 53.5% (age 46.9) BMI 42.4 kg/m^2	CHF 78,915	CHF 67,698	9.85	8.99	CHF 13,043
	(CHF 14,473)		(0.86)		
Lifetime horizon Females 53.5% (age 46.9) BMI 42.4 kg/m^2	CHF 83,745	CHF 72,020	10.05	9.14	CHF 12,885
	(CHF 11,725)		(0.91)		
Wang 2014 [17] *Laparoscopic adjustable gastric banding versus conservative therapy*					
Females 77.9% (age 50.1) BMI 48.4 kg/m^2	CHF 182,580	CHF 167,713	12.8	10.6	CHF 6,757
	(CHF 14,866)		(2.2)		
Wang 2014 [17] – conventional open *Roux-en-Y gastric bypass versus conservative therapy*					
Females 77.9% (age 50.1) BMI 48.4 kg/m^2	CHF 216,520	CHF 167,713	13.2	10.6	CHF 18,772
	(CHF 48,807)		(2.6)		

Appendix 13: Alternative approach to adaptation of costs, using inflation rates instead of the increase in health care costs in step 3

Study	Difference (%) in resultant ICERs	Study	Difference (%) in resultant ICERs
Ackroyd 2006 [3]	- 20.4	Mäklin 2011 [12]	-8.5
Cambell 2010 [5]	- 20.2	Michaud 2012 [13]	-8.5
Clegg 2003 [7]	-31.7	Picot 2009 [14]	-9.9
Craig 2002 [8]	-28.1	Picot 2012 [15]	-8.5
Hoerger 2010 [9]	-20.4	Pollock 2013 [16]	-8.5
Ikramuddin 2009 [10]	-17.1	Wang 2014 [17]	-8.5
Keating 2009 [11]	-20.2		

Appendix 14: Differences between cost-effectiveness studies

QALY estimates were a major driver. For example, five studies found a low-net QALY difference (bariatric surgery versus conservative treatment) of below 1.0 [7, 10, 12, 15, 16]. Of these, Picot et al. [15] studied a low BMI population. The studies by Ikramuddin et al. [10] and Pollock et al. [16] were both based on the same diabetes model and used a low, regression-estimated utility effect per one unit change in BMI (0.004). In the study by Mäklin et al. [12], utility was based on a population health survey and subsequent regression analysis. There was no mortality difference modelled in the Mäklin et al. [12] and the time horizon of the analysis was restricted to 10 years.

In contrast, four studies reported QALY differences > 2.5 [4–6, 17]. The study with the highest QALY difference was Castilla et al. [6]. The reporting of this study was insufficient and there may have been methodological issues. In particular, event-related utilities appeared to be very high and it was not clear for how long these were applied in the model. In all other cases (Borg 2014 et al., Campbell 2010 et al., and Wang 2014 et al.) [4, 5, 17], the high QALY difference was at least partially driven by the modelling of condition-related mortality. In the study by Campbell et al. [5], the use of a more conservative set of related assumptions in an alternative analysis led to a lower QALY difference.

The rest of the studies reported QALY differences between 0.9 and 2.0 [3, 8, 9] [11, 15]. In some cases, modelling of long-term mortality was undertaken, but it may have been counteracted by other conservative assumptions (for example, on effect size or duration of BMI change).

Another partial explanation for the differences between cost-effectiveness studies may lie in the cost items taken in consideration, and other differences in the modelling of costs of bariatric surgery. For example, Michaud et al. [13] assessed total health care costs as opposed to condition specific costs, therefore absolute costs in this study were much higher than observed in the other reviewed studies. Some studies found a high net cost difference between bariatric surgery and conservative treatment. Even though there was no unequivocal pattern between studies, this may have been due to very low estimates of conservative treatment costs that did not account for all potential, obesity-related costs during follow-up.

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