Lessons learned from AMOS

(Adolescent Metabolic-Obesity Surgery)

Torsten Olbers
Professor of Metabolic Surgery
Linköping University

Dept of Surgery, Vrinnevi, Norrköping
Dept of Pediatrics, Skåne University Hospital, Malmö
SWEDEN

IFSO
XXVIII IFSO World Congress
9-12 September 2025 | Santiago, Chile

LINKÖPING UNIVERSITY

GÖTEBORGS UNIVERSITET
Karolinska Institutet
LUNDS UNIVERSITET

Disclosures

Johnson & Johnson	*Advisory board and Educational activities*
NovoNordisk	*Advisory board and Educational activities*
Vivus	*Advisory board*
Sandoz	*Educational activities*

Reimbursement to my institution


Threats
Opportunities

MBS is a recommended treatment in adolescents

Society/agency	Criteria	Additional information
IFSO/ASMBS, 2022	• No lower age limit. • BMI >35 + major comorbidity or BMI>40.	Autism, developmental delay, trauma, syndromic obesity NOT contraindications.
American Academy of Pediatrics (AAP) 2023, USA	• ≥13years • As IFSO/ASMBS	<13 years on a case-by-case basis only
National Institute for Health and Care Excellence (NICE) 2023, UK	• Achieved (or nearly) physiological maturity • As IFSO/ASMBS	Only in exceptional circumstances.
National Board of Health and Welfare 2023, Sweden	• ≥15 years • BMI ≥35 kg/m^2	Roux-en-Y gastric bypass given higher priority

IFSO=International Federation for the Surgery of Obesity and Metabolic Disorders

ASMBS= American Society of Metabolic and Bariatric Surgery

Evidence behind adolescent MBS

- **Randomized Controlled Trials**
  - Australia (2005-2008); LAGB; 2-year outcome data
  - The Netherlands (2011-?); LAGB; 1-year outcome data
  - Sweden (2014-2016); RYGB/SG; 2-year outcome data **AMOS2**

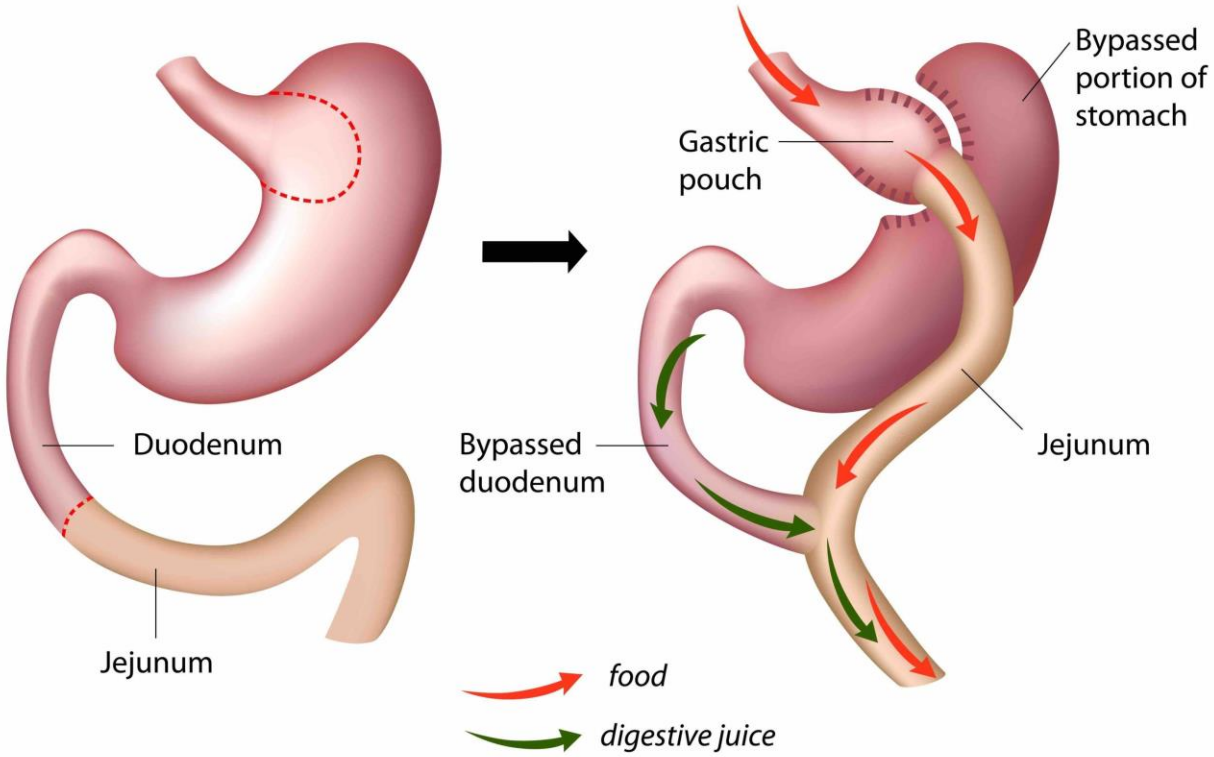
- **Several prospective controlled studies and case-series**:
  - USA ≥10 years+
  - Sweden 10 years+ **AMOS**
  - Saudi Arabia 10 years

Considerations for surgery in adolescents

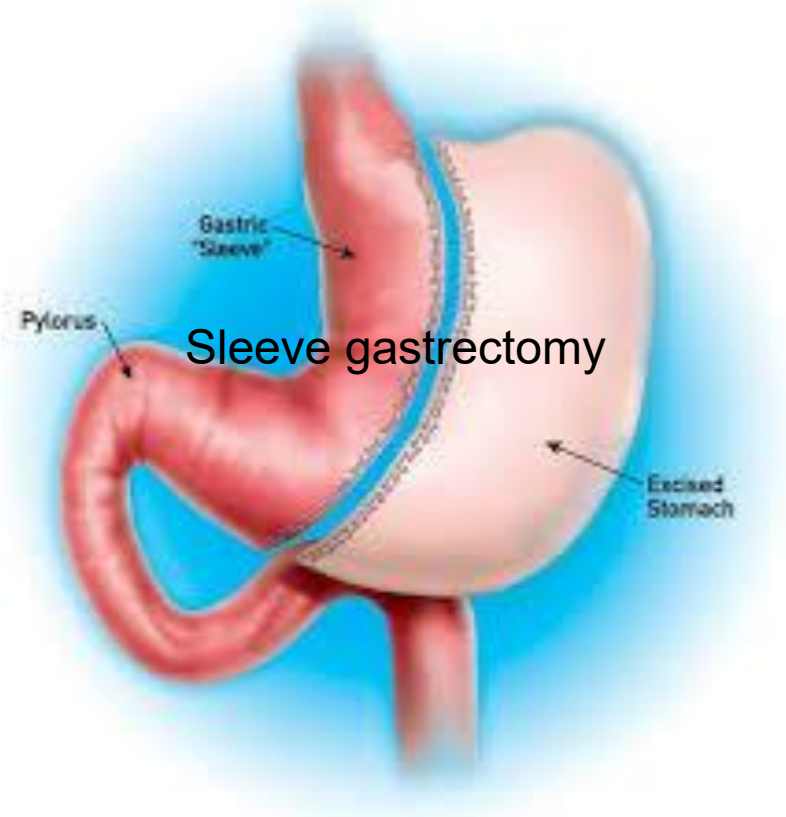
- A sound balance between efficacy and risk
- Awareness of the mechanisms of action
- Have the procedure stood the “test of time”?

Adolescents have a 70-80 years remaining life expectancy..

Roux-en-Y Gastric Bypass (RYGB)



or



Sleeve gastrectomy

AMOS

- Prospective controlled study
- 2006-2009.
- N=81
- Age <18 years.
- BMI ≥ 40, or ≥35 kg/m^2 with comorbidity
- Pubertal stage Tanner >3
- Only gastric bypass
- 5-year data

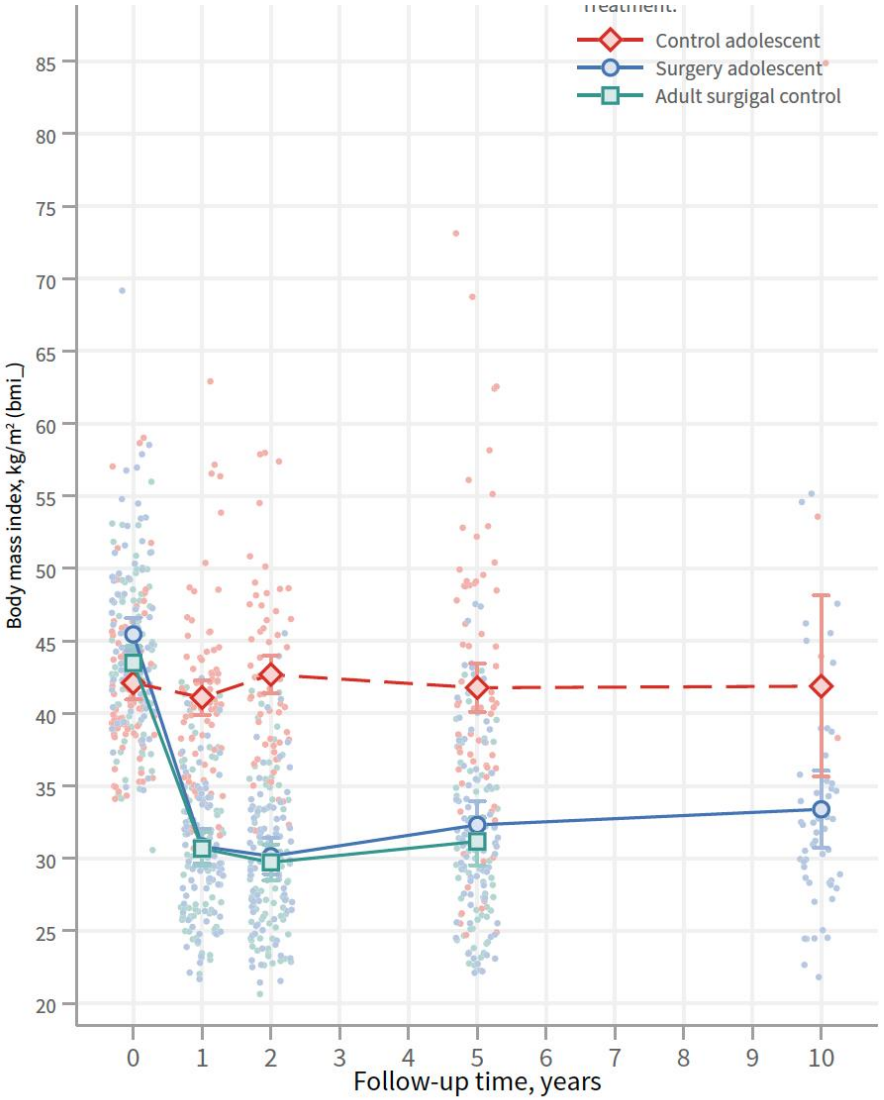
AMOS2

- RCT
- 2014-2017
- N=50
- Age 13-16 years
- BMI >35 kg/m^2
- Pubertal stage Tanner ≥ 3
- 23 Gastric bypass, 2 Gastric sleeve
- 2-year data

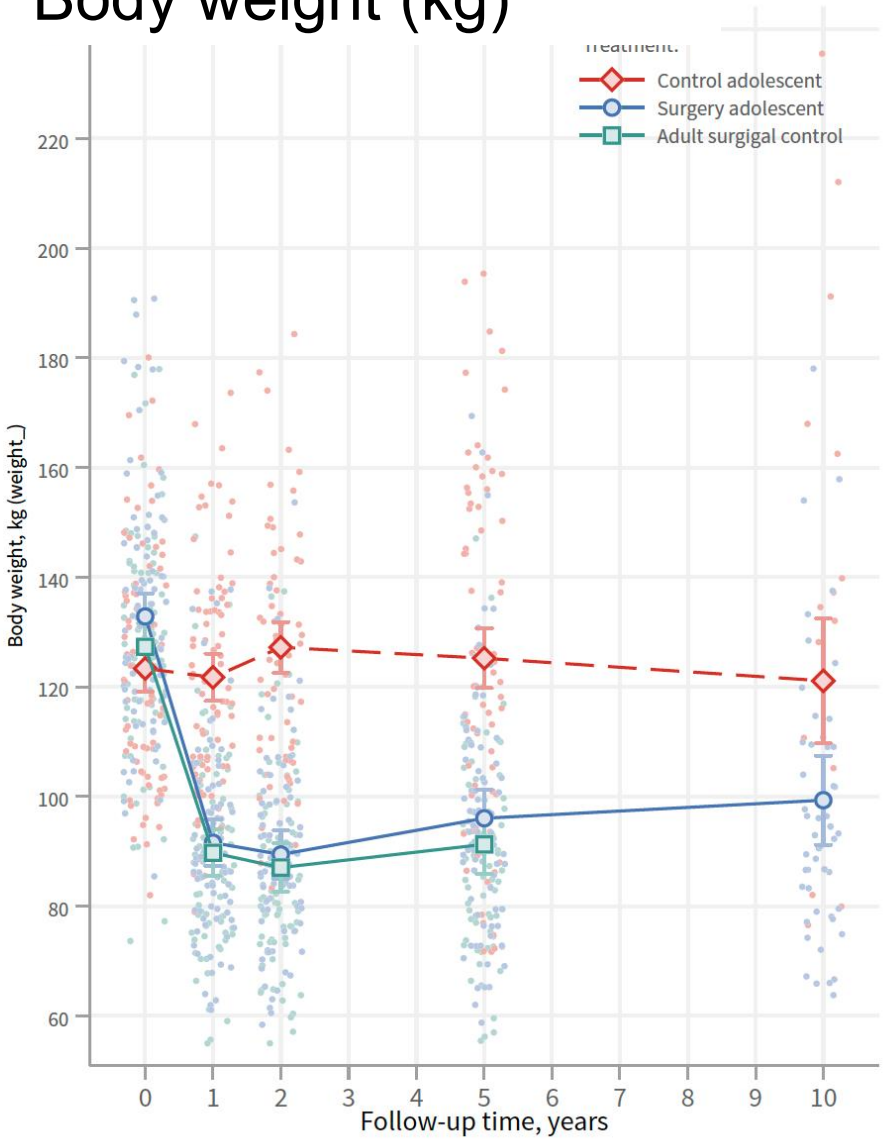
Primary outcome

AMOS- 10 y

Body Mass Index

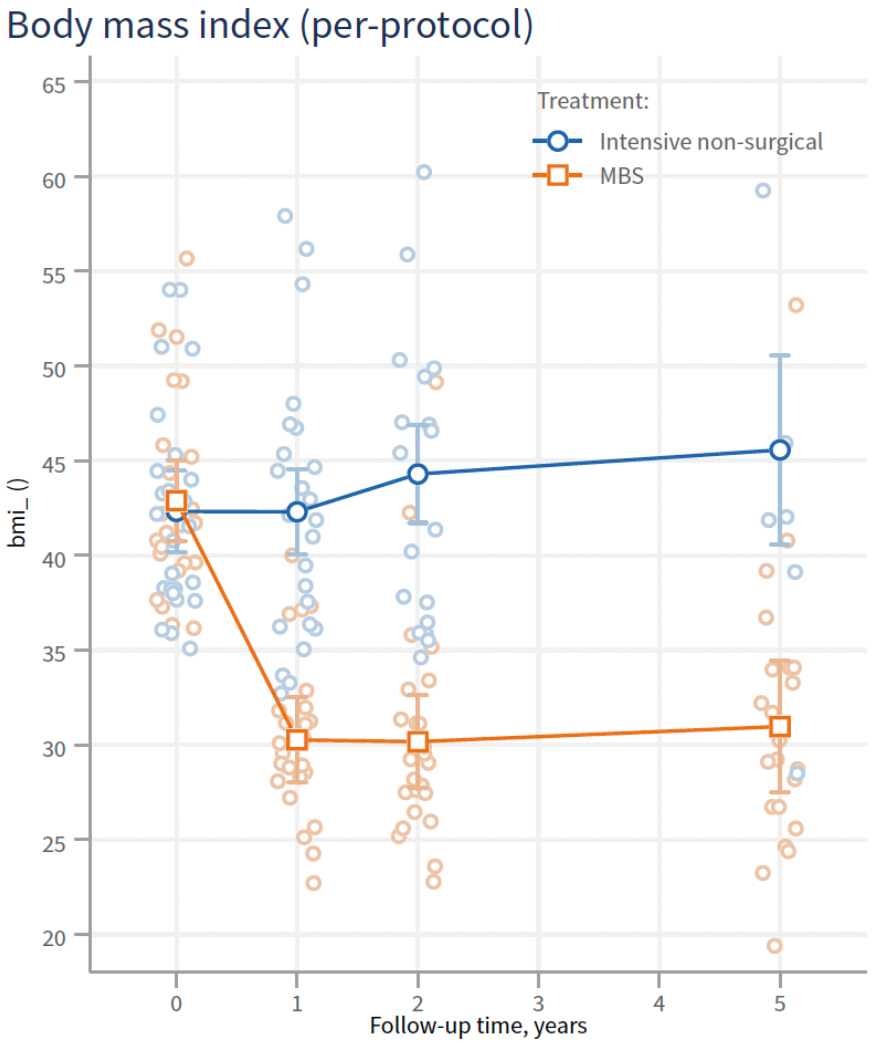


Body weight (kg)



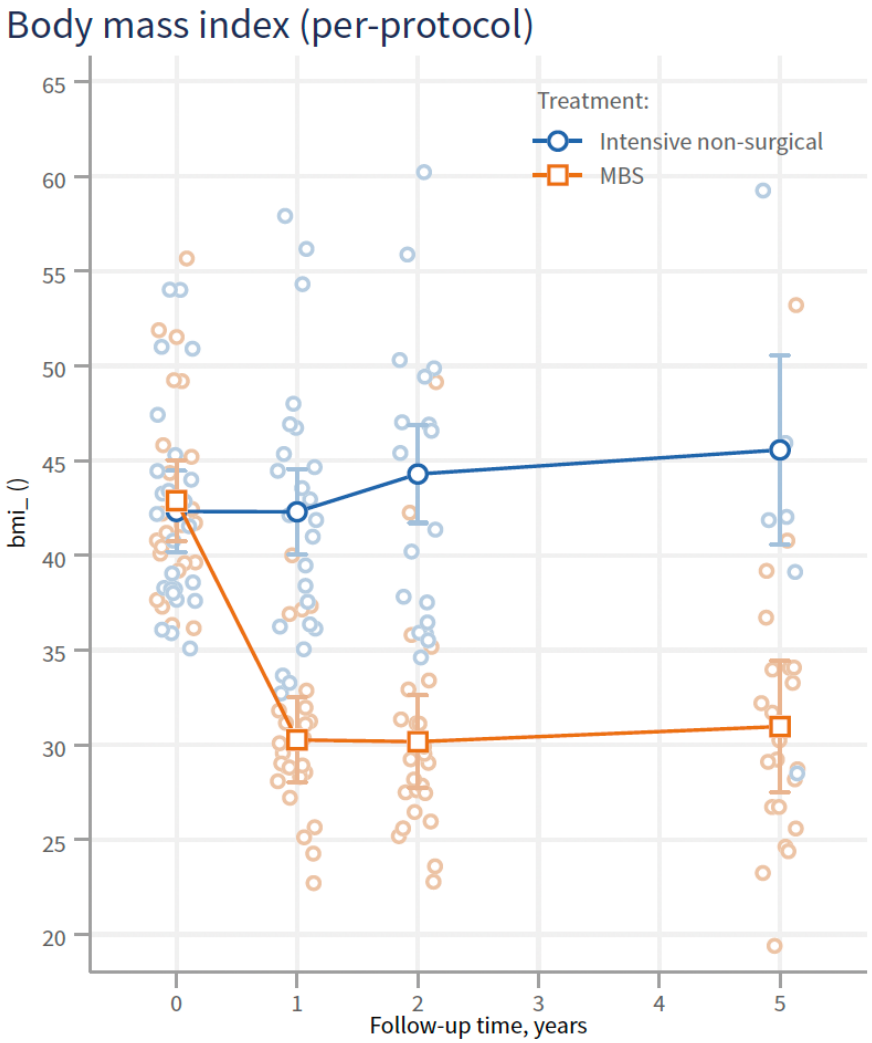
Unpublished

AMOS2- 5y Per protocol

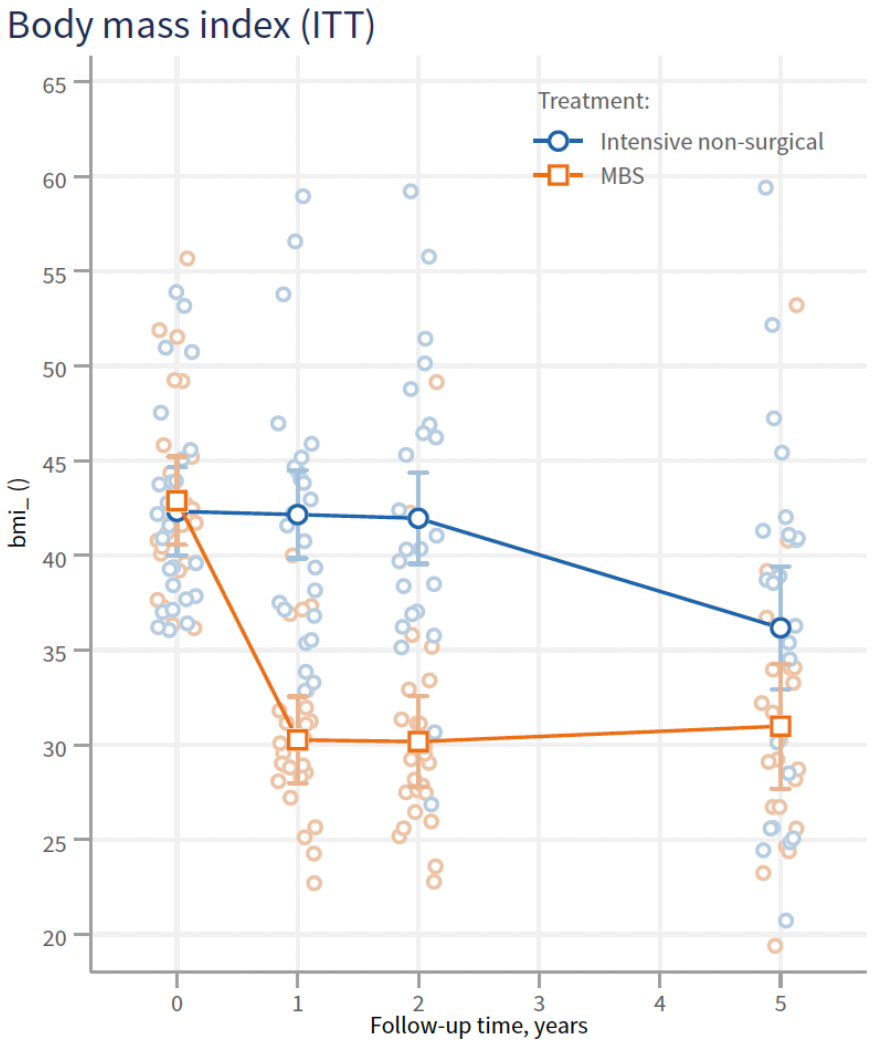


Unpublished

Per protocol



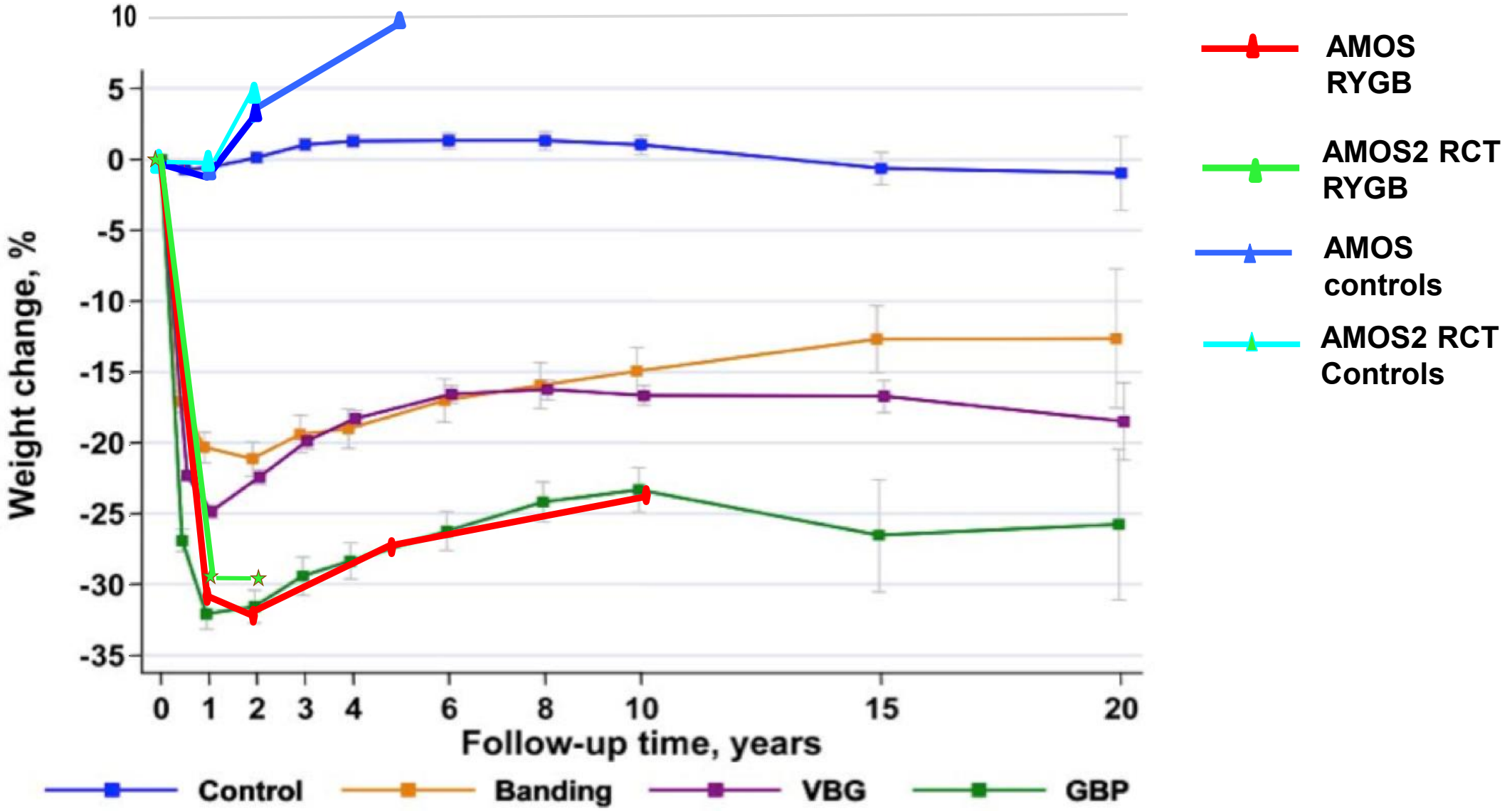
Intention To Treat



Unpublished

18 out of 25 (72%) of the controls in AMOS2 chose surgery (crossed over) up to 5 years

Weight loss AMOS och AMOS2 vs. SOS (adults)



Eva Gronowitz

Conclusions- *Body Weight & BMI*

- Similar weight outcomes in adolescents as in adults
- Somewhat greater variability.

- Behavioral factors do not predict weight outcomes
- More weight loss associated with better quality of life.

Olbers et al. *Lancet Diab End* 2017

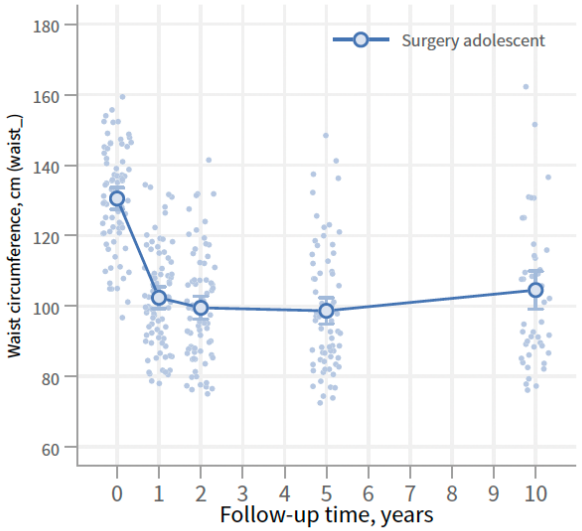
Inge et al, NEJM 2019

Ryder et al. *Int J Obes (Lond)* 2018

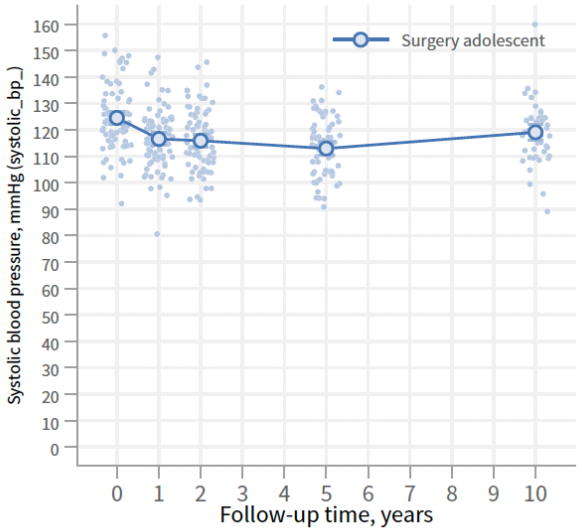
Secondary efficacy outcomes

Cardiovascular risk factors (AMOS, 10y)

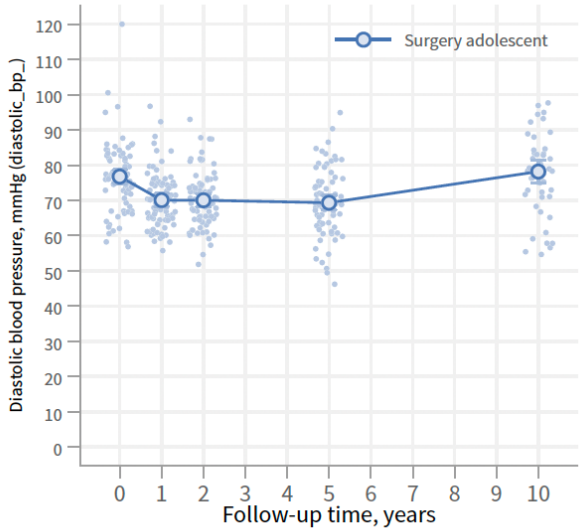
Waist circumference, cm



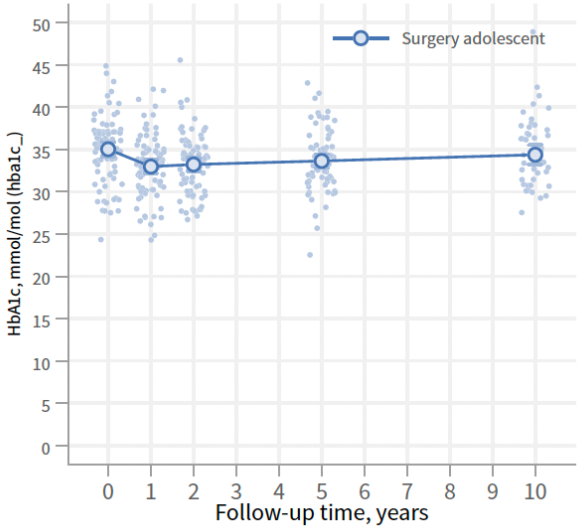
Systolic blood pressure, mmHg



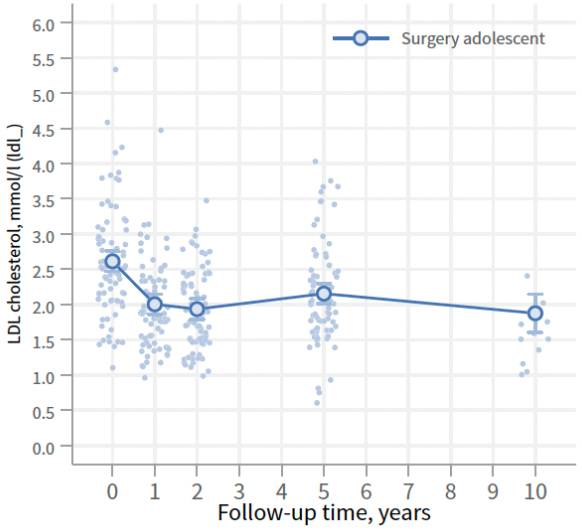
Diastolic blood pressure, mmHg



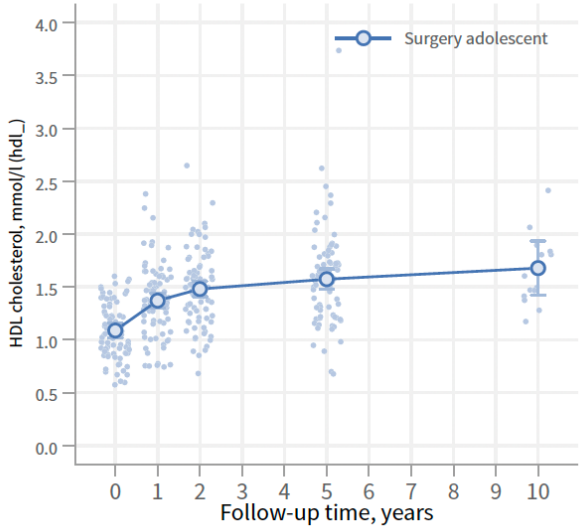
HbA1c, mmol/mol



LDL cholesterol, mmol/l



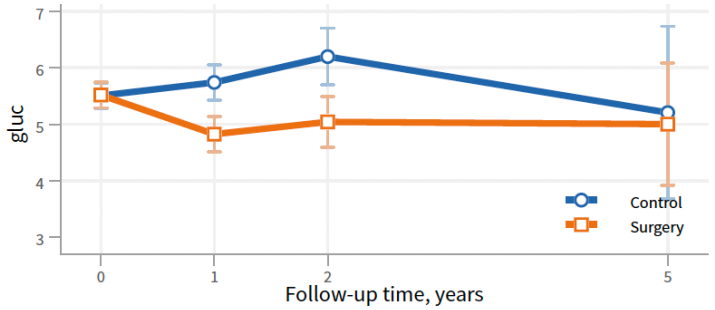
HDL cholesterol, mmol/l



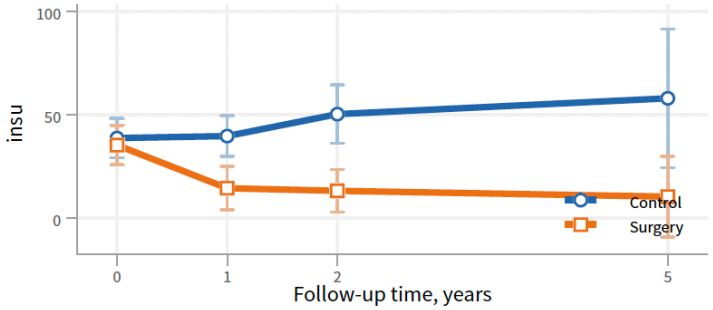
Unpublished

Cardiovascular risk factors (AMOS2, 5y)

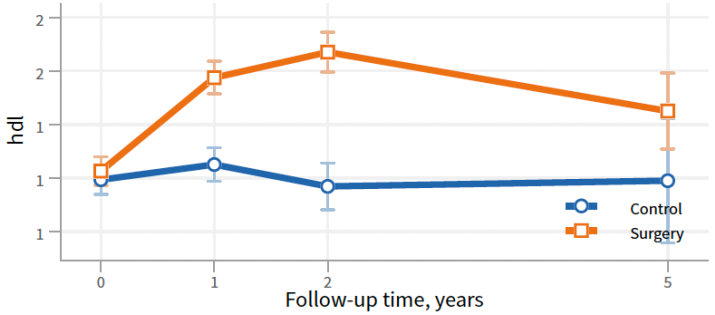
F-Glucose



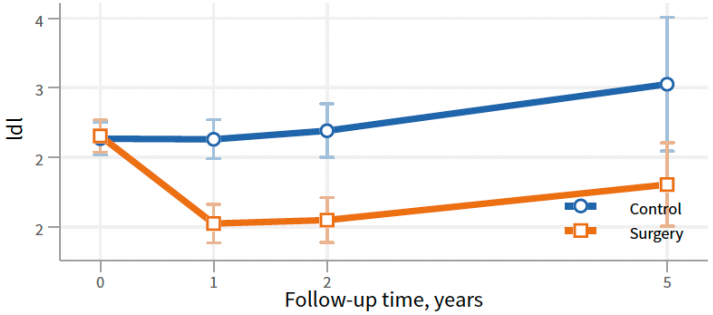
Insulin



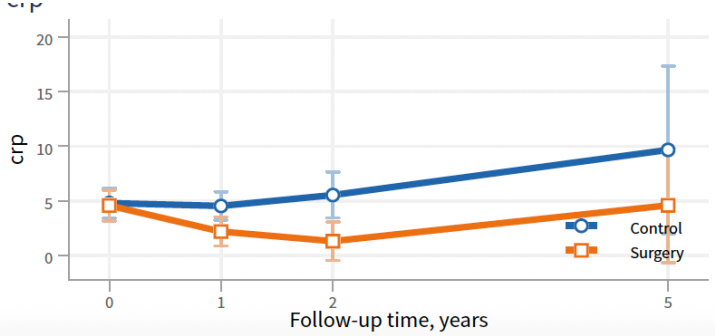
HDL



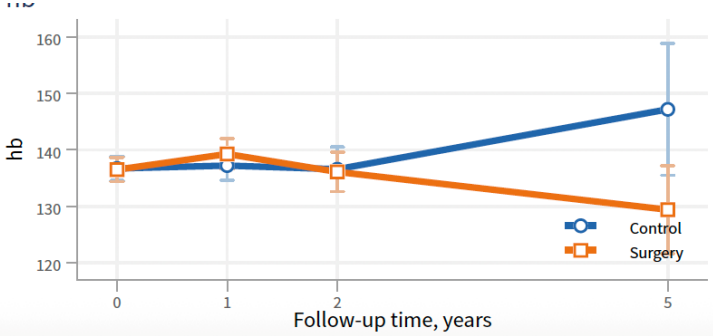
LDL



CRP



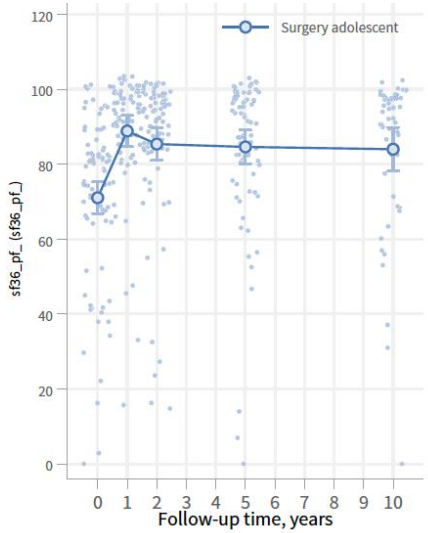
Hb



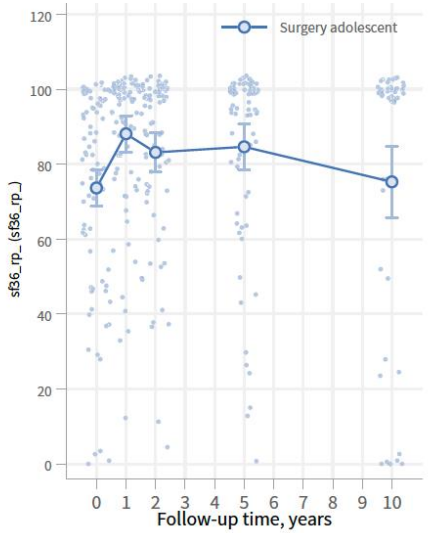
Unpublished

Secondary outcomes- *Quality of Life (AMOS, 10y)*

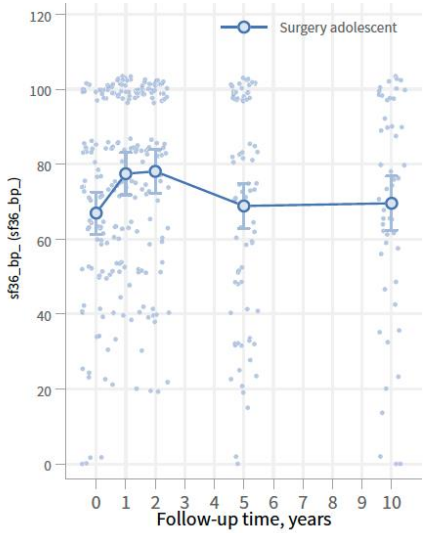
Physical function



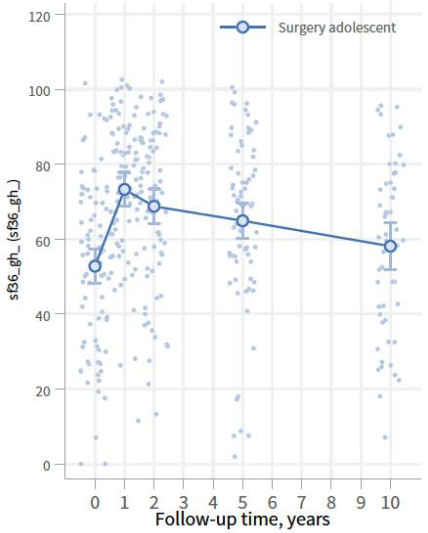
Role physical



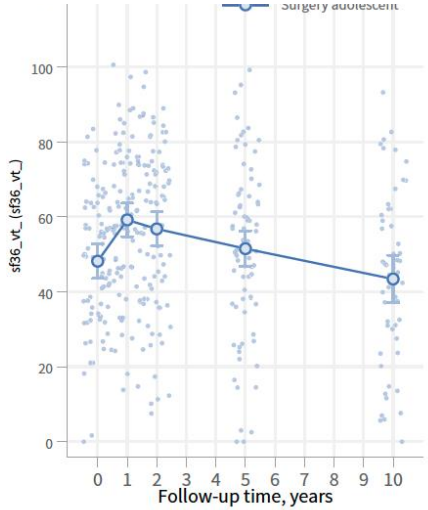
Bodily pain



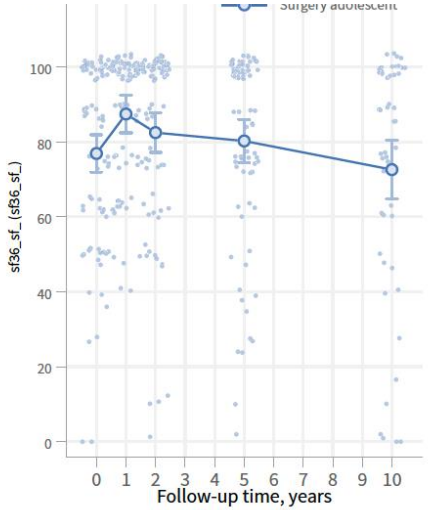
General health



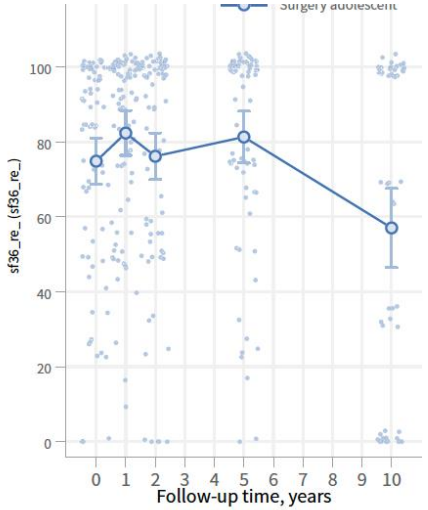
Vitality



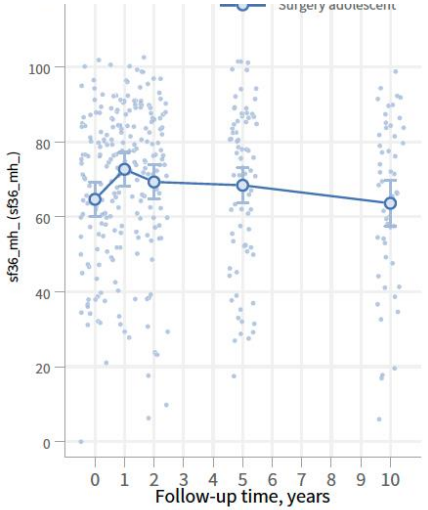
Social function



Role emotional

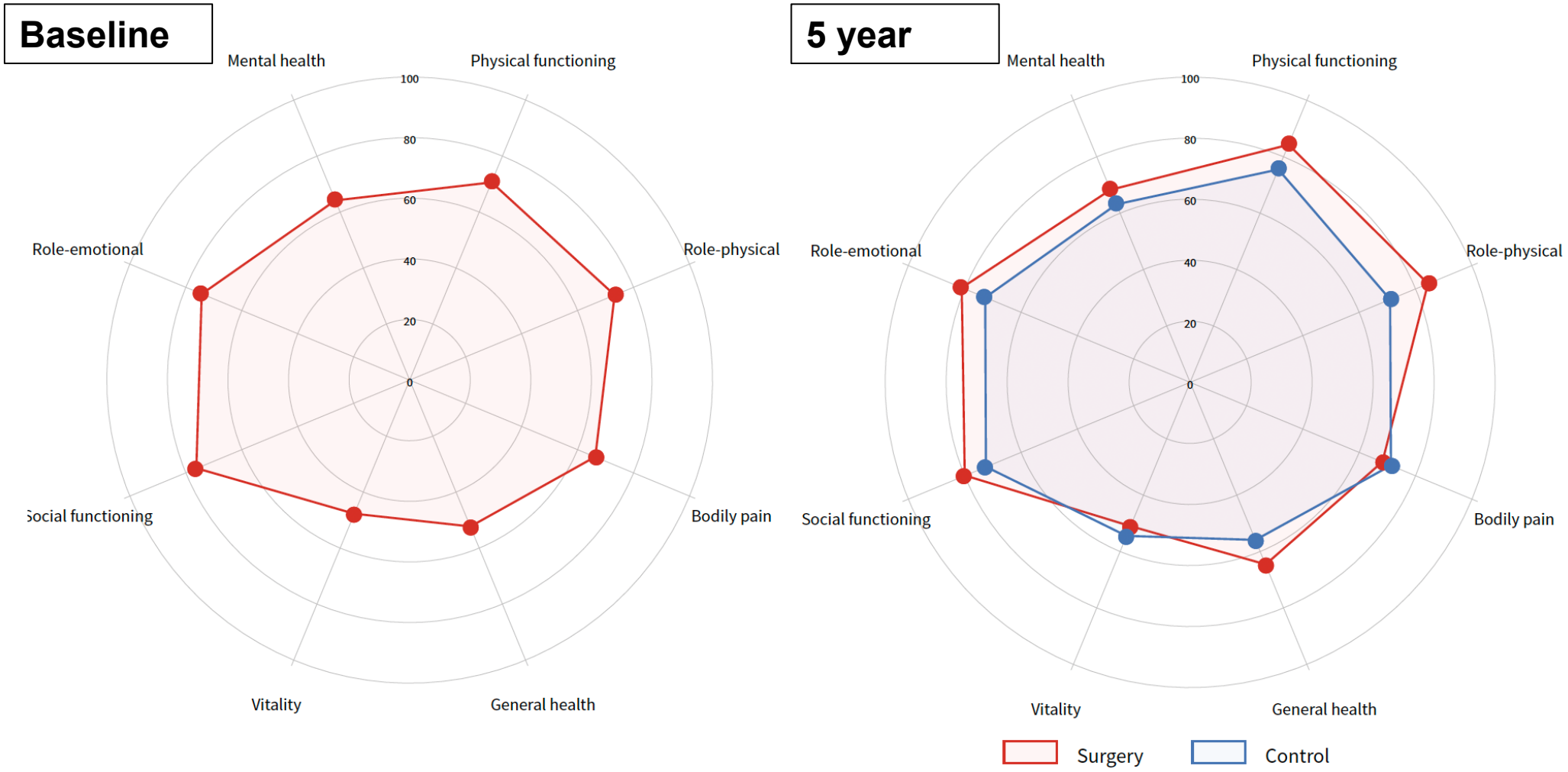


Mental health



Unpublished

Secondary outcomes- *Quality of Life (AMOS2, 5y)*



Unpublished

Conclusions- *Secondary efficacy outcomes*

- Broad and sustained improvements in cardio-vascular risk factors

- Substantial and sustained improvements in **physical quality** of life.

Secondary safety outcomes

Adverse events in the surgical group n=4,

- all mild and without need for treatment.

Järvholm et al,
Lancet CAH, 2023

LUNDS UNIVERSITET

Safety outcomes -Height and Puberty

- Final height not affected

- Weight loss appears to be beneficial for pubertal development

Alqahtani et al. *J Am Coll Surg* 2021; 233: 657-664

He Q & Karlberg J. *Pediatr Res* 2001; 49: 244-251

Putri et al. *J Clin Endocrinol Metab* 2023; 109: e314-e320

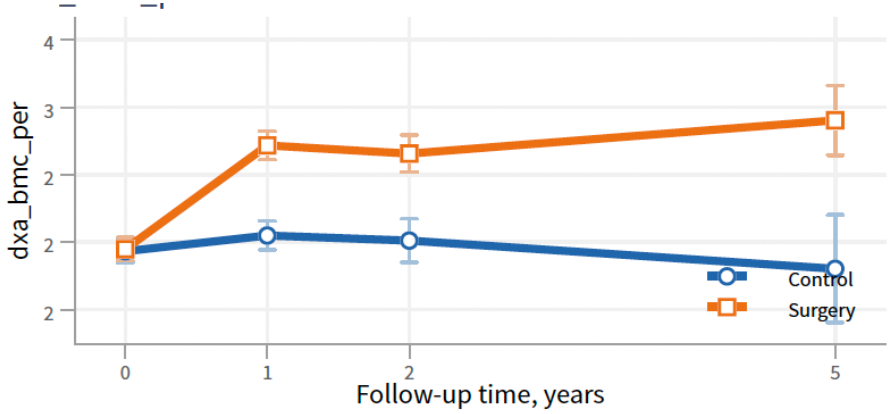
Secondary safety outcomes AMOS 5y – *Nutrition*

	Non-surgical	RYGB	p-value
Hemoglobin	138.6 (11.7) 23	134.7 (8.3) 23	0.199
B_{12}	. (.) 0	353.7 (51.2) 3	.
D-vitamin	43.7 (19.6) 6	46.3 (26.1) 9	0.838
Ferritin	25.0 (13.5) 3	39.5 (14.7) 4	0.239
Iron	8.8 (2.9) 4	12.7 (5.8) 6	0.251

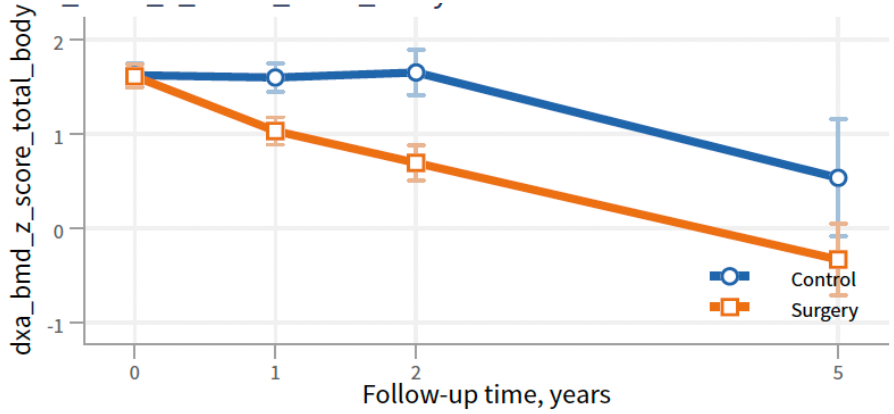
Unpublished

Secondary safety outcomes AMOS 5y – *Bone health*

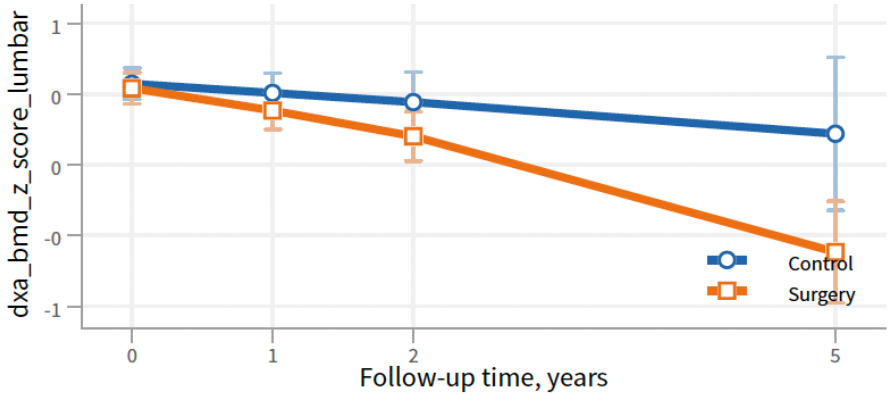
DEXA Bone Mineral Content



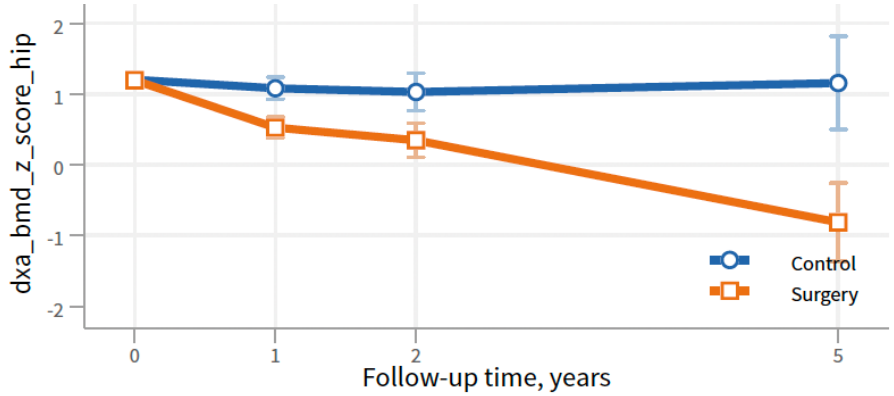
DEXA Bone Mineral Density (BMD) z-score



DEXA BMD z-score Lumbar



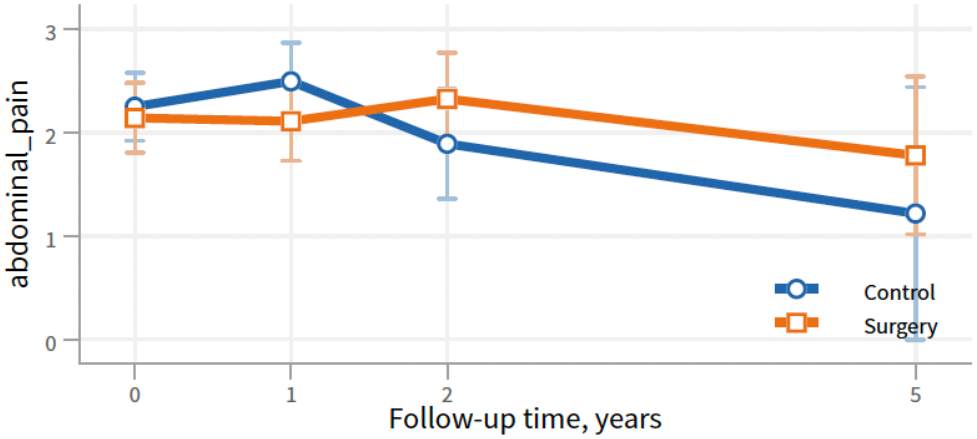
DEXA z-score Hip



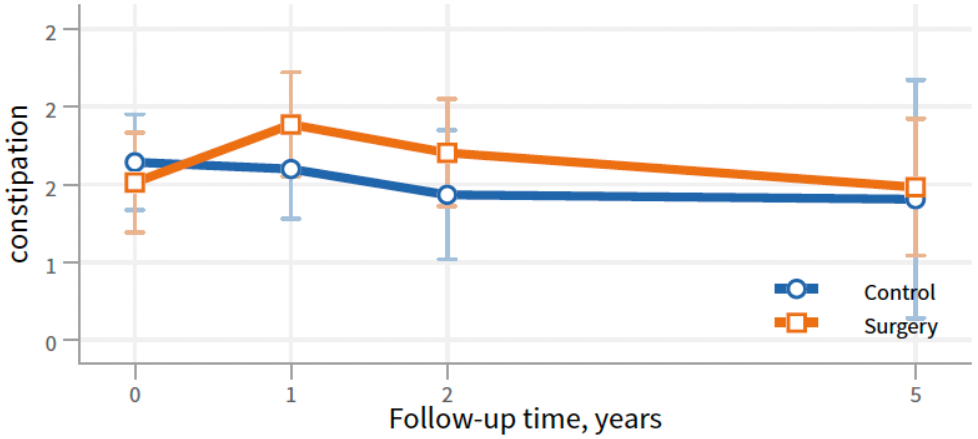
Unpublished

Gastro-Intestinal Symptoms

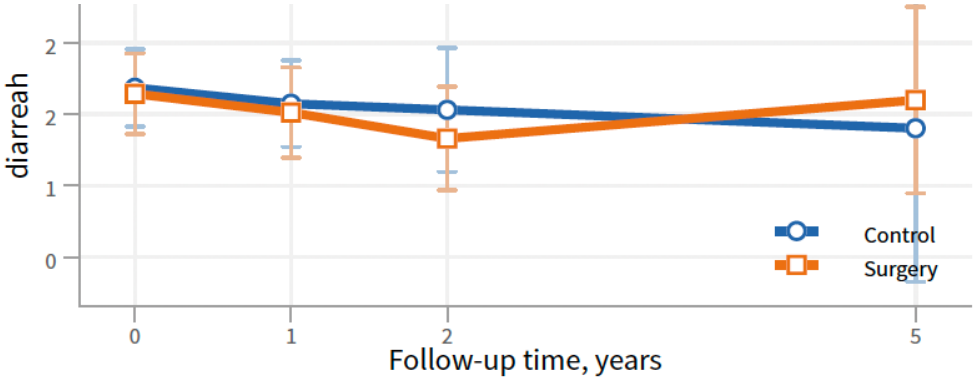
Abdominal pain



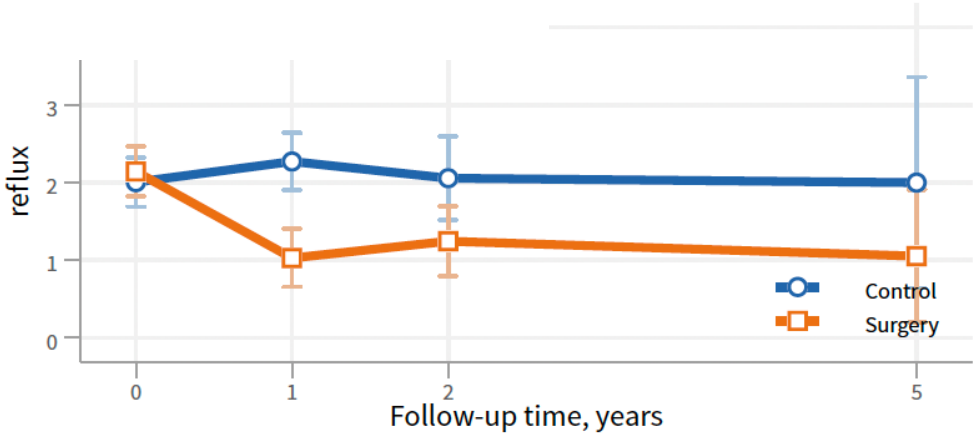
Constipation



Diarrhea



Reflux



Unpublished

AMOS2- regretting participation?

- **Surgical group**: None
- **Non-surgical group**: 2

What should the adolescent considering surgery be told?

- You will most likely lose a lot of weight
- Weight loss makes you healthier, not necessarily “happier”
- We would like to follow you for many years after MBS
- You need to take supplements
- Please, contact us if you need our help!

Multidisciplinary team

- Pediatrician
- Pediatric nurse
- Psychologist
- Surgeon
- Dietician

At least one in the team should know the patient well


Mind the gap between the child and adult clinics!

Further reading

Volume 108, Issue 9
September 2023

JOURNAL ARTICLE

Long-term Outcomes Following Adolescent Metabolic and Bariatric Surgery

Andrew J Beamish ✉ , Elizabeth Ryan Harper , Kajsa Järvholm , Annika Janson , Torsten Olbers

The Journal of Clinical Endocrinology & Metabolism, Volume 108, Issue 9, September 2023, Pages 2184–2192, https://doi.org/10.1210/clinem/dgad155

Published: 22 March 2023 **Article history** ▾

Volume 96, Issue 6
December 2023

REVIEW ARTICLES | MARCH 09 2022

Metabolic and Bariatric Surgery in Adolescents: For Whom, When, and How?

Special Collection: Karger e-Journal Backfile Collection 2023

Subject Area: Endocrinology , Women's and Children's Health

Annika Janson ; Kajsa Järvholm ; Lovisa Sjögren ; Jovanna Dahlgren ; Andrew J. Beamish ; Eva Gronowitz ; Torsten Olbers

Horm Res Paediatr (2023) 96 (6): 609–619.
https://doi.org/10.1159/000524002 Article history
PubMed:35263750

Review Article

SJS SCANDINAVIAN JOURNAL OF SURGERY

Metabolic and bariatric surgery for adolescents with severe obesity: Benefits, risks, and specific considerations

Scandinavian Journal of Surgery
1–12

DOI: 10.1177/14574969241297517
journals.sagepub.com/home/sjs
Sage

Kajsa Järvholm, Annika Janson, Pia Henfridsson, Martin Neovius, Lovisa Sjögren and Torsten Olbers

Corresponding author:
Kajsa Järvholm
Department of Psychology, Lund University Box 213 SE- 221 00

Acknowledgements

Gothenburg

Eva Gronowitz
Lovisa Sjögren
Malin Örn
Andrew Beamish
My Engström
Jovanna Dahlgren
Anna Svedlund
Anna Björk
Malin Werling
Staffan Mårild
Peter Friberg
Anna Laurenius
Hans Lönroth
Gunnar Göthberg
Lars Sjöström
Markku Peltonen
Jan Karlsson

Stockholm

Annika Janson
Claude Marcus
Kerstin Ekbom
Martin Neovius
Gustaf Bruze

Malmö

Kajsa Järvholm
Emma Kjellberg
C-E Flodmark

Thank you!