education

FROM THE JOURNALS Edited highlights of weekly research reviews

Risks of anabolic steroids

The new series of *Gladiators* is nearly over, although I didn't get past the first episode (I've added it to my long list of things less appealing in my 40s than when I was a teenager). The original television series from the 1990s was marred by drug controversy, and one of the stars of the new series has admitted to taking anabolic steroids in the past.

With a new generation of children wondering how to get bodies that look like a gladiator's, an observational study that found an increase in mortality among males sanctioned for androgenic anabolic steroid (AAS) use seems topical. A total of 1189 males who tested positive for AAS from drugs testing at fitness centres in Denmark were each matched to 50 people of the same age. Of the 1189, 33 died over the median 11 year follow-up period—a death rate nearly three times higher than that of the controls (hazard ratio 2.81 (95% confidence interval 1.98 to 3.99)).

JAMA doi:10.1001/jama.2024.3180

Calcium, vitamin D, and all-cause mortality

Calcium and vitamin D supplements are often top of the deprescribing list when considering medications of questionable value that could be stopped. A randomised trial recruited 36 282 postmenopausal women in the US to take either calcium and vitamin D supplements or a placebo. After an impressively long median follow-up of 22.3 years, the hazard ratio for all-cause mortality was exactly 1.00 (95% confidence interval 0.97 to 1.03).

Interestingly, cancer mortality was 7% lower in the calcium and vitamin D group, but cardiovascular disease mortality was 6% higher. Although there's plenty of observational data linking low vitamin D levels to various poor outcomes, evidence of benefits of vitamin D supplementation for meaningful outcomes in randomised control trials remains harder to come by.

Ann Intern Med doi:10.7326/M23-2598

Fighting FIT 1: cell-free DNA blood tests

It's colorectal cancer screening week (again) in the *New England Journal of Medicine*. First up is a blood test, but not just any blood test—it's a cell-free DNA blood test. In a test population eligible for colorectal cancer screening, it missed 16.9% of people with colorectal cancer (sensitivity 83.1%), and 10.4% of those with a positive blood test did not have either colorectal cancer or an advanced neoplasia (specificity 89.6%). With a sensitivity and specificity that compete with those for faecal immunochemical tests (FIT), will blood screening take over and consign faecal tests (depositing your stool in an old takeaway box and scraping its surface with a swab) to history?

N Engl J Med doi:10.1056/NEJMoa2304714

Fighting FIT 2: pushing the envelope

It's sad to think that most post boxes these days probably have more samples of faeces being sent for FIT screening passing through their proud red rectangular mouths than actual letters. Although blood tests may be on the horizon, improved techniques may keep stool testing's nose in front—and the Royal Mail in business.

A new stool test—and not just any stool test, but a next generation multitarget stool DNA test—was tested in over 20 000 people at moderate risk of colorectal cancer and found to have a sensitivity of 93.9% (95% CI 87.1 to 97.7) for colorectal cancer and specificity for advanced neoplasia of 90.6% (90.1 to 91.0). This study directly compared the new test with standard FIT, which had a lower sensitivity but higher specificity—suggesting that the new test would identify more people with cancer but also lead to more colonoscopies than FIT screening.

N Engl J Med doi:10.1056/NEJMoa2310336

ADHD and deaths of despair

In people with attention deficit hyperactivity disorder (ADHD), does medication help to lower rates of "deaths of despair" (the term for deaths from alcohol, drug use, and suicide)? An observational study in Sweden sought to determine differences in mortality in people diagnosed with ADHD who are prescribed ADHD medication and those who aren't. They found that those prescribed ADHD medication had a lower risk of unnatural death—from suicide, accidental injuries, or accidental poisoning—than those who didn't. The lower risk after two years (25.9 *v* 33.3 per 10 000 individuals, risk difference −7.4 per 10 000 individuals (95% CI −14.2 to −0.5)) was mostly driven by fewer accidental poisonings in those taking ADHD medication. Whether this lower risk is due to ADHD medication isn't certain, though: confounding factors may be at play, or being prescribed ADHD medication may be a proxy for better overall support.

JAMA doi:10.1001/jama.2024.0851

Tom Nolan, clinical editor, *The BMJ*, London; sessional GP, Surrey

Cite this as: *BMJ* 2024;384:q680

Early, intense therapy for language problems after a stroke is linked to the greatest benefits

The study

Complex speech-language therapy interventions for stroke-related aphasia: the RELEASE study incorporating a systematic review and individual participant data network meta-analysis

Brady MC, Ali M, VandenBerg K, et al

Health Social Care Delivery Res 2022;10

CPD READING

0.5 HOURS

NIHR | National Institute for Health and Care Research

NIHR Alerts are summaries of NIHR-funded research with novel findings and implications for practice. They are intended for health and care professionals, commissioners, researchers and members of the public.

To read the full NIHR Alert, go to: https://bitly.ws/3fjlk

Why was the study needed?

More than 3.5 million people in the world have had a stroke that affects their speech and understanding of speech, reading, and writing (aphasia).

Stroke patients with aphasia can struggle more with daily activities, and have poorer recovery and wellbeing than those who did not develop aphasia. Speech and language therapy improves people's recovery, but therapists lack information on how to optimise the delivery of therapy for each individual.

What did this study do?

This review brought together data from previous studies. Researchers assessed the impact of various types of treatment, delivered with greater or less intensity, over different lengths of time.

The review included 174 studies from 28 countries (including 47 randomised controlled trials). Together, these studies included individual information on almost 6000 people.

What did it find?

Overall, the review concluded that for people with aphasia after a stroke, their best recovery is associated with:

- Therapy started within 28 days of the onset of aphasia
- 20-50 hours of speech and language therapy in total
- Two to four hours a week of therapy for general language improvement, over four to five days a week
- Tasks that are practised at home.

Starting therapy early was important. People who had had aphasia for more than three months needed extra therapy to make their best recovery. However, those who had a stroke more than six months previously could still improve with therapy.

Adults under 55 were likely to improve the most, though people over 75 still made gains with therapy. Men and people with milder aphasia were likely to need more therapy than others, the study found.

The intensity of therapy necessary varied according to the problem being addressed. The greatest improvements in overall language abilities and functional communication (the ability to communicate in real settings) were associated with two to four hours of therapy per week. But improvements in understanding speech were only evident when there were more than nine hours of therapy per week.

Neither the delivery method (in-person versus video, for example) nor who (professional therapist versus a family member who had received training from a professional therapist) delivered the speech and language therapy programme made a meaningful difference.

Why is this important?

Overall, the greatest gains were linked to therapy that was delivered early (within 28 days of the start of aphasia), frequently, and in high doses. Home practice and therapy tailored to the individual's needs (and the level of their language difficulty) were linked with the greatest improvements.

Some of the studies in the review were small. The researchers noted variation in how data were collected and reported, including information about the people who took part, their aphasia (such as reading and writing problems), and the therapy delivered. Some of the findings therefore need to be interpreted with caution.

Further research could explore groups of people unrepresented in the data, examine in more detail the link between dose of therapy and recovery, and develop more tailored speech and language therapies.

What's next?

The findings have been included in the National Clinical Guideline for Stroke for the UK and Ireland and in Australian and New Zealand Clinical Guidelines. They are being considered by the National Institute for Health and Care Excellence for its forthcoming update to guidelines on stroke rehabilitation in adults, and by the European Stroke Organisation Guidelines on Aphasia Rehabilitation after Stroke.

Competing interests: *The BMJ* has judged that there are no disqualifying financial ties to commercial companies.
Further details of other interests, disclaimers, and permissions can be found on bmj.com

Cite this as: *BMJ* 2023;383:p2560

STATE OF THE ART REVIEW

Long term outcomes of metabolic/bariatric surgery in adults

Anita P Courcoulas,[1] Christopher R Daigle,[2] David E Arterburn[3 4]

[1]Department of Surgery, University of Pittsburgh Medical Center, Pennsylvania
[2]Bariatric Surgery Program, Washington Permanente Medical Group, Bellevue, Washington
[3]Kaiser Permanente Washington Health Research Institute, Seattle
[4]Department of Medicine, University of Washington, Seattle, Washington
Correspondence to: D E Arterburn David.E.Arterburn@kp.org

The is a summary of Clinical Review "Long term outcomes of metabolic/bariatric surgery in adults" published on bmj.com (www.bmj.com/content/383/bmj-2022-071027).

CPD READING
0.5 HOURS

Obesity is a well established risk factor for developing many chronic diseases, such as type 2 diabetes, cardiovascular disease, and cancer, and increases the risk of covid-19 related hospital admission and death. Despite these known risks, many patients, doctors, and health policy makers remain uncertain about the long term efficacy and safety of available treatments for obesity. Recent advances in drug therapy have increased the demand for obesity treatments, but long term (five years or more of follow-up) data on drug therapy for obesity have remained relatively scant.

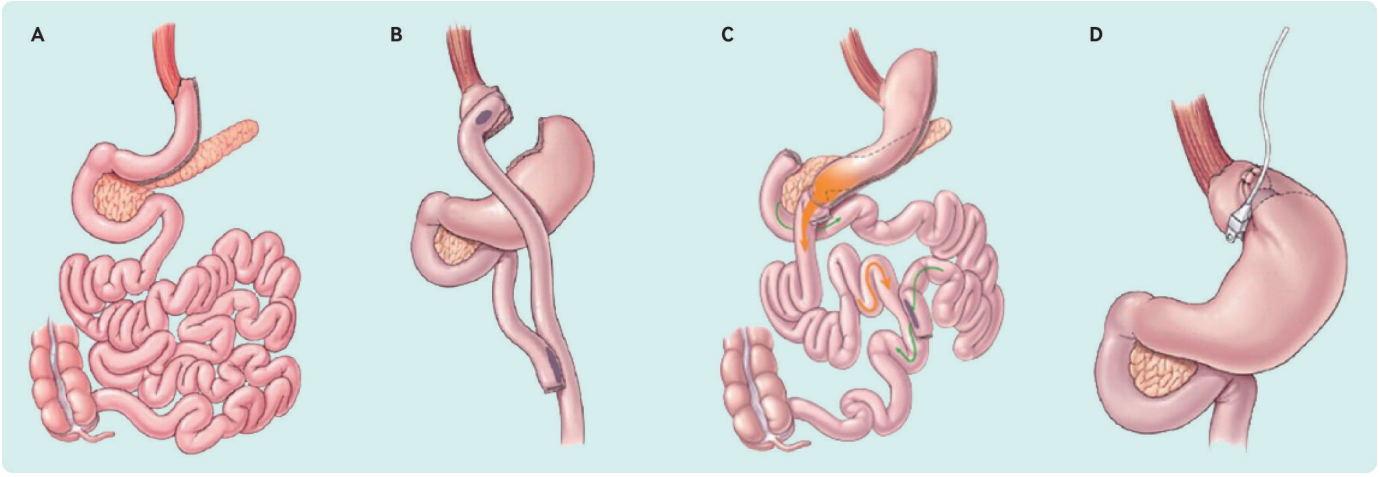
On the other hand, long term evidence on the efficacy and safety of metabolic/bariatric surgery (MBS) has continued to accrue over the past 25 years, particularly for adults with type 2 diabetes. This review summarises recent and emerging evidence related to the safety, efficacy, and metabolic outcomes of MBS to help guide clinical decision making. Clinical guidelines on MBS are discussed in the full version of the article on bmj.com.

Procedures

All MBS procedures are now routinely carried out laparoscopically. The figure shows the four most common bariatric procedures. Sleeve gastrectomy is a stomach-only operation that is performed by mobilising the greater curvature of the stomach from its attachments and then dividing the stomach vertically around a calibrated bougie that is 36 to 40 French in size. The transected part of the stomach, which consists of approximately two thirds to three quarters of the stomach, is removed, and the new remaining stomach is a long and narrow curved tube. Roux-en-y gastric bypass (RYGB) is a stomach and small intestine operation that consists of a small divided proximal gastric pouch and a modest small intestinal bypass of approximately 100-150 cm in length.

The common channel of small intestine beyond the bypass allows for adequate absorption of nutrients. The residual stomach is not removed but is a conduit for digestive secretions only. Biliopancreatic diversion with or without duodenal switch is a gastric sleeve stomach resection with a longer intestinal bypass component at the end of the stomach. Finally, adjustable gastric banding (AGB) is a silicone ring that is wrapped around the upper stomach, just below the oesophagus, with an inflatable inner balloon to adjust the amount of gastric restriction via an infusion port placed outside the abdominal cavity.

Surgery results in larger improvements in cardiovascular risk factors and chronic kidney disease than lifestyle or medical therapy



Common metabolic/bariatric surgery procedures. A: sleeve gastrectomy; B: Roux-en-Y gastric bypass; C: biliopancreatic diversion; D: adjustable gastric banding. Adapted from American Society for Metabolic and Bariatric Surgery. Bariatric Surgery Procedures (https://asmbs.org/patients/bariatric-surgery-procedures)

Randomised controlled trials of metabolic/bariatric surgery versus medical and lifestyle treatment for type 2 diabetes treatment

Study	No of patients	Follow-up (months)	Patients with BMI <35 (%)	Study design	Remission criteria	Remission* (%)	P value
Parikh[8]	57	6	100	RYGB/LAGB/SG *v* control	HbA_{1c} <6.5%	65 *v* 0	0.001
Liang[9]	101	12	100	RYGB *v* control	HbA_{1c} <6.5%	90 *v* 0†	<0.001
Halperin[10]	38	12	34	RYGB *v* control	HbA_{1c} <6.5%	58 *v* 16	0.03
Ding[11]	45	12	34	LAGB *v* control	HbA_{1c} <6.5%	33 *v* 23‡	0.46
Cummings[12]	43	12	25	RYGB *v* control	HbA_{1c} <6.0%	60 *v* 5.9	0.002
Dixon[13]	60	24	22	LAGB *v* control	HbA_{1c} <6.2%	73 *v* 13	<0.001
Wentworth[14]	51	24	100	LAGB *v* control	FBG <7.0 mmol/L	52 *v* 8	0.001
Simonson[15]	45	36	39	LAGB *v* control	HbA_{1c} <6.5% and FBG <126 mg/dL	13 *v* 5	0.60
Kirwan[16]	316	36	35	RYGB/LAGB/SG *v* control	HbA_{1c} ≤6.5%	37.5 *v* 2.6	<0.001
Schauer[17]	150	60	36	RYGB *v* SG *v* control	HbA_{1c} ≤6.0%	22 *v* 15 *v* 0	<0.05
Ikramuddin[18]	120	60	59	RYGB *v* control	HbA_{1c} <7.0%	23 *v* 4	0.01
Courcoulas[19]	69	60	43	RYGB *v* LAGB *v* control	HbA_{1c} <6.5% and FBG <125 mg/dL	30 *v* 19 *v* 0	0.02
Mingrone[20]	60	120	0	RYGB *v* BPD *v* control	HbA_{1c} <6.5% and FBG <100 mg/dL	25 *v* 50 *v* 5.5	0.008

BPD=biliopancreatic diversion; BMI=body mass index; FBG=fasting blood glucose; HbA_{1c}=glycated haemoglobin; LAGB=laparoscopic adjustable gastric band; RYGB=Roux-en-Y gastric bypass; SG=sleeve gastrectomy.

*Remission without diabetes medications. †Remission was not defined; HbA_{1c} <6.5% by extrapolation. ‡Intermittent diabetes medications.

Bariatric surgery versus medical and lifestyle therapy

In the past 15 years, 13 randomised controlled trials (RCTs) have compared MBS with lifestyle and medical therapy for the treatment of type 2 diabetes (table), showing that MBS results in significantly larger short- to mid-term improvements in glycaemic control, disease remission, cardiovascular risk factors, and chronic kidney disease.

These RCTs have their limitations, including small sample sizes and, for most studies, inadequate duration to detect differences in the incidence of cardiovascular and end organ complications of type 2 diabetes. In addition, the definition of remission of diabetes varied between studies, as did the proportion of people with BMI <35 (table 1). Finally, the type of non-surgical treatments (lifestyle, drugs, exercise) and adherence to the programme varied between studies.

Cardiovascular disease, microvascular disease, and mortality

Cardiovascular disease is a leading cause of death among adults, particularly those with severe obesity. Although behavioural and pharmacological weight loss interventions can improve cardiovascular risk factors (for example, blood pressure and glycaemic control) among adults with obesity, no studies have shown that non-surgical weight loss can reduce the incidence of major cardiovascular disease events.[25] On the other hand, we identified 10 observational studies involving nine separate cohorts with a total of >120 000 patients who had MBS (table 2, bmj.com) that consistently show a significant association between MBS and a lower risk of primary or secondary cardiovascular disease events compared with non-surgical interventions or usual medical care, including several studies among adults with type 2 diabetes.

A major limitation in this area is a lack of RCTs (owing to the high cost of conducting trials powered for cardiovascular disease endpoints); however, the magnitude of the effect sizes is so large in these observational studies that unmeasured confounders are unlikely to be driving this association.[35 36] Also, these studies have not compared MBS against newer non-surgical interventions, such as sodium-glucose cotransporter-2 inhibitors or glucagon-like peptide-1 receptor agonists, which have been shown to reduce the risk of cardiovascular events. Finally, up until 2021, most of the data have come from patients undergoing RYGB; however, two recent large observational studies suggest that sleeve gastrectomy may also be associated with better cardiovascular disease outcomes than usual non-surgical treatment.[33 34]

Evidence has emerged that metabolic/bariatric surgery may reduce the risk of microvascular complications of type 2 diabetes

Microvascular disease—Evidence has emerged in recent years indicating that MBS may reduce the risk of microvascular complications of type 2 diabetes, such as nephropathy, retinopathy, and neuropathy. This includes limited data from three randomised trials comparing MBS with intensive medical-lifestyle treatment of type 2 diabetes and obesity,[17-37] which suggest that MBS may result in less microalbuminuria and greater improvement in estimated glomerular filtration rate (table 3, bmj.com). We identified additional support for improvements in microvascular outcomes after MBS from two recent systematic reviews.

The first identified two RCTs and 12 observational studies involving more than 110 000 patients receiving MBS that together estimated an 83% lower relative risk (0.17, 0.13 to 0.22) of diabetic retinopathy at a median of two years' follow-up compared with non-surgical treatment.[38] The second involved three RCTs and seven observational studies including 3459 patients receiving MBS, which together suggested a 74% lower risk (odds ratio 0.26, 95% confidence interval 0.15 to 0.42) of developing any microvascular disease (composite of nephropathy, retinopathy, and neuropathy).[39] In both these systematic reviews, most of the data come from the retrospective observational studies.

Mortality—Although numerous RCTs of MBS have been conducted, none has yet been powered to investigate its effect on long term mortality compared with non-surgical treatment. However, at least 32 observational studies have examined the effects of MBS on mortality (supplementary table, bmj.com[25]) involving more than 173 000 patients receiving MBS, with a median relative reduction in mortality of 46% (range 16-89%).[25]

Long term comparative outcomes of gastric bypass versus sleeve gastrectomy

Sleeve gastrectomy is now the most common bariatric procedure performed worldwide. Some studies of the differences in outcomes between RYGB and sleeve gastrectomy were designed to compare directly outcomes between the procedures, whereas others prospectively compared metabolic procedures head to head with intensive medical management.[17-46] In the STAMPEDE trial, involving 49 patients having RYGB and 47 having sleeve gastrectomy, RYGB showed better mean weight loss compared with sleeve gastrectomy (−23.2 (standard deviation 9.6) kg *v* −18.6 (7.5) kg; P=0.01), but no statistically significant differences in diabetes outcomes were seen.[17 47]

In the SM-BOSS trial, which compared 110 RYGB and 107 sleeve gastrectomy procedures, the authors observed no difference between RYGB and sleeve gastrectomy at five years with respect to weight loss, glycaemic control, or complications requiring intervention. Of note, remission of acid reflux was observed in 60.4% of patients after RYGB compared with 25.0% after sleeve gastrectomy (P=0.002). Increasing acid reflux symptoms or escalation in reflux treatment also occurred more often after sleeve gastrectomy (31.8%) than after RYGB (6.3%) (P=0.006).[41] The SLEEVEPASS five year trial compared outcomes of 119 RYGB and 121 sleeve gastrectomy procedures and showed no significant differences in weight loss, remission of type 2 diabetes, or complications at five years;[43] however, at 10 years' follow-up the percentage total weight loss was 3.5% higher for RYGB than sleeve gastrectomy (26.9% *v* 23.4%; P<0.001), but with no difference in type 2 diabetes remission rates.[46]

An analysis that merged five year data from the SLEEVEPASS and SM-BOSS found that percentage total weight loss was 3.2% (95% confidence interval 1.6% to 4.7%) larger with RYGB than with sleeve gastrectomy, with no difference in type 2 diabetes remission between the two procedures and more complications in the RYGB cohort.[42] These findings are consistent with the multicentre US PCORnet Bariatric Study, an observational comparative effectiveness study of 24 982 patients undergoing RYGB and 18 961 patients undergoing sleeve gastrectomy, which showed significantly greater percentage total weight loss with RYGB than sleeve gastrectomy at five years (mean difference 6.7%, 5.8% to 7.7%),[48] a 10% higher rate of type 2 diabetes remission with RYGB than sleeve gastrectomy (hazard ratio 1.10, 1.04 to 1.16), a 25% lower type 2 diabetes relapse rate with RYGB than sleeve gastrectomy (hazard ratio 0.75, 0.67 to 0.84),[49] and a significantly lower risk of operation or intervention after sleeve gastrectomy than RYGB (hazard ratio 0.72, 0.65 to 0.79).[50]

In the SM-BOSS trial, reoperation or reintervention was reported in 15.8% (16/101) of patients after sleeve gastrectomy and 22.1% (23/104) after RYGB. The most frequent indications for reintervention were acid reflux for sleeve gastrectomy and internal hernia for RYGB.[41] In the 10 year SLEEVEPASS paper, the authors reported reoperation rates of 15.7% and 18.5% for sleeve gastrectomy and RYGB, respectively.[46] When considering differences in weight regain between the procedures, the PCORnet Bariatric study found that weight regain to within 5% of the preoperative baseline occurred least often among patients who had RYGB (3.3%), followed by those who had sleeve gastrectomy (12.5%) and AGB (36.0%), at five year follow-up. These findings have been corroborated by two other smaller retrospective observational studies.[51 52]

Collectively, these studies highlight the important trade-offs between the benefits and risks of RYGB and sleeve gastrectomy, to help to inform shared decision making conversations with patients (table 4, bmj.com).

Anastomosis gastric bypass (OAGB) is a surgical procedure that uses a long gastric pouch connected by a single wide gastro-jejunal anastomosis to a loop of jejunum 150-200 cm distal to the ligament of Treitz, thus creating a gastric bypass by way of a loop and with a single anastomotic connection.[65 66] In a meta-analysis of 25 RCTs comparing OAGB and RYGB, including a total of 2715 patients, RYGB showed a better weight loss after three months (two studies, 131 patients; mean difference 2.41%, 0.46% to 4.36%; I^2=76%, P=0.02), six months (two studies, 69 patients; 3.83%, 2.46% to 5.21%; I^2=5%, P<0.001), one year (three studies, 180 patients; 6.35%, 4.69% to 8.01%; I^2=0%, P<0.001), and five years (two studies, 128 patients; 3.90%, 1.21% to 6.59%; I^2=0%, P=0.005).[67] In terms of remission of type 2 diabetes, two RCTs have been published but no meta-analysis has been done.[66 68] In the first study, among 33 patients randomised only three had type 2 diabetes—one in the OAGB group and two in the RYGB group—all of whom had remission at five years.[68] In a French study, 253 patients were randomised to RYGB or OAGB, but no significant difference was found between the type 2 diabetes remission rates at two years.[66]

An International Federation for the Surgery of Obesity (IFSO) position statement on OAGB reviewed 95 studies with a total of 23 341 patients and found limited data on complications reported from seven out of 95 studies of OAGB. Perioperative complications occurred in 5.5% and reoperation in 1.0%, and perioperative mortality was low (<0.05%). Late complications occurred in 5.5%, including marginal ulcers, bowel obstruction, protein malnutrition, and biliary reflux, with a reoperation rate of 1.3%.[65]

Observational studies indicate that metabolic/bariatric surgery is associated with an increased risk of alcohol and substance use disorders compared with usual care

Risks of metabolic/bariatric surgery

The perioperative risks of MBS have declined in the laparoscopic era.[70] Perioperative mortality is between 0.1% and 1.1%, and perioperative morbidity varies widely between 2% and 20% depending on both the specific type of procedure and characteristics of

patients.[71 72] In the longer term, from a large, national comparative outcomes study of MBS procedures at five years, operation or intervention, endoscopy, and hospital admission were more likely after RYGB than after sleeve gastrectomy, but no difference in mortality was seen.[50]

In the past decade, more studies have assessed the potential for non-operative adverse outcomes following MBS, including the risk of substance and alcohol use disorders and suicide or accidental deaths.[73] Overall, 18 observational studies with sample sizes ranging from 50 patients to >4000 patients indicate that MBS is associated with an increased risk of alcohol and substance use disorders compared with usual care.[74 75] A meta-analysis of five observational studies at three years after surgery found that the pooled odds of alcohol use disorder were 1.83 (1.53 to 2.18; P<0.001) for RYGB compared with non-surgical treatment. In a matched controlled, multisite study of US veterans (predominantly men), eight years after a sleeve gastrectomy, the probability of unhealthy alcohol use was higher in surgical versus control patients (7.9% (95% confidence interval 6.4% to 9.5%) versus 4.5% (4.1% to 4.9%); difference 3.4% (1.8% to 5.0%)). Similarly, eight years after an RYGB, the probability of unhealthy alcohol use was higher in surgical than control patients (9.2% (8.0% to 10.3%) versus 4.4% (4.1% to 4.6%); difference 4.8% (3.6% to 5.9%)).[62]

Some mechanisms have been proposed to explain these findings, including pharmacokinetic studies showing higher peak blood alcohol concentrations after RYGB compared with controls, changes in reward sensitivity via a neurobiological mechanism, changes to the ghrelin system, and altered genetic expression in some regions of the brain.[76] Together, these findings strongly suggest that education, screening, evaluation, and referral for treatment should be incorporated into both preoperative and postoperative bariatric surgical care as well as into careful lifelong monitoring in primary care settings.

An early study in the US showed that suicide rates in one state over 10 years among post-MBS patients were 13.7 per 10 000 among men and 5.2 per 10 000 among women, rates much higher than in age and sex matched US controls (2.4/10 000 men aged 35-64; 0.7/10 000 women aged 35-64).[77] A systematic review including 28 studies estimated an overall suicide rate of 4.1 per 10 000 person years, which was higher than in the general population.[78] Not included in this review, a more recent Canadian study examined self-harm emergencies both before and after MBS and found that the rate of these events increased from 2.3 events per 1000 people three years before surgery to 3.6 events per 1000 three years after surgery, with the most common cause being medication overdose.[79]

A recent multisite study of US veterans involving more than 3800 patients having MBS and 34 000 carefully matched (including for mental health conditions) non-surgical controls with a mean follow-up of 4.6 years found that the risk of suicidal ideation was still significantly higher for post-MBS patients (adjusted hazard ratio 1.21, 1.03 to 1.41), as was risk of suicide attempt (1.62, 1.22 to 2.15).[64] On the other hand, another study of 12 000 cases of MBS from Western Australia showed no increased incidence of suicide or self-harm in the MBS population after an average of three years' follow up.[80]

Finally, a recent Swedish registry study of more than 22 500 people showed that an increased risk of self-harm diagnoses, hospital admissions for depression, and completed suicides two years after MBS was completely attributed to a previous history of self-harm or depression that was present before the MBS procedure.[81] These authors note that bariatric patients may be a particularly vulnerable population that could benefit from preoperative screening and recognition of these problems before surgery.

HOW PATIENTS WERE INVOLVED IN CREATION OF THIS ARTICLE

After email communication from the authors, one of our long time bariatric patient research partners agreed to review and provide feedback on our manuscript outline, plan, and final drafts.

Metabolic/bariatric surgery and cancer

Obesity is associated with an increased risk of developing certain cancers.[83] Observational data have been published with respect to cancer (risk) outcomes after MBS, mostly showing a reduction in both obesity related and all cause cancer cases and cancer related mortality. A recent systematic review identified eight observational studies including more than 600 000 patients and found that MBS was associated with a reduced risk of all types of cancer (pooled odds ratio 0.72, 0.59 to 0.87) and of obesity associated cancer (0.55, 0.31 to 0.96).[84]

A single large, multisite cohort study that compared 22 198 patients with severe obesity who underwent MBS and 66 427 non-surgical controls showed a 33% lower risk of incident cancer of any type (hazard ratio 0.67, 0.60 to 0.74; 488 incident cases in MBS group over 87 071 person years versus 2055 incident cases in non-surgical group over 228 010 person years) and a larger reduction in obesity associated cancers, such as postmenopausal breast cancer (0.58, 0.44 to 0.77) and endometrial cancer (0.50, 0.37 to 0.67).[85] In a recently published retrospective cohort study of more than 30 000 patients, MBS (RYGB and sleeve gastrectomy) was significantly associated with a lower risk of obesity associated cancer (adjusted hazard ratio 0.68, 0.53 to 0.87) and cancer related mortality (0.52, 0.31 to 0.88).[86]

However, for incident colorectal cancer, some studies have reported an increased risk with MBS, whereas others report a decreased risk. In a systematic review of 18 studies and more than 12 million patients, MBS was found to be significantly protective for colorectal cancer incidence (hazard ratio 0.81; P=0.0142). The protective effect persisted for subgroups of women (relative risk 0.54; P=0.0014) but not for men (0.74; P=0.2798). No differences were found between surgical procedures.[8]

Competing interests: APC has received a research grant from Allurion Technologies.

Cite this as: *BMJ* 2023;383:e071027

Find the full version with references at doi: 10.1136/bmj-2022-071027

SUSTAINABLE PRACTICE

Switching from disposable to reusable PPE

Rebecca Bromley-Dulfano,[1 2 4] Joshua Chan,[3 4] Navami Jain,[3 4] James Marvel[1 4]

Full author details on bmj.com.

Correspondence to: R Bromley-Dulfano rabd@stanford.edu

This article is part of a series that offers practical actions clinicians can take to support reaching net zero. Browse all the articles at www.bmj.com/content/383/bmj.p2461. To pitch your idea for an article go to https://bit.ly/46Etl9i

CPD READING

0.5 HOURS

Sustainable sourcing, use, and disposal of personal protective equipment (PPE) can help healthcare providers reduce the environmental impacts of their work. In this article we review supporting evidence and provide guidance for healthcare institutions to adopt reusable forms of PPE as safe, cost saving, and sustainable alternatives to single use disposables.

The first step to reducing the environmental impact of PPE usage is to reduce unnecessary consumption of supplies.[1 2] However, we discuss those situations where PPE use is unavoidable, and offer more sustainable alternatives with a focus on reusable isolation and surgical gowns, masks, and eye protection. The evidence for alternatives to single use gloves, surgical drapes, and other PPE is still emerging.[3 4]

Why change is needed

Global PPE usage has been rising over the past several decades,[5] driven by heightened attention to employee safety (particularly that of healthcare workers), increasingly stringent regulations for work environments, and robust economic growth in middle and high income countries.[5] The covid-19 pandemic caused usage of PPE to surge globally to unprecedented levels.[6 7] Unicef estimated that 2.2 billion surgical masks, 1.1 billion gloves, 13 million goggles, and 8.8 million face shields were needed to protect against covid-19 during the first year of the pandemic.[8] Global production of healthcare PPE increased by approximately 300-400% during the pandemic, with the steepest increases in surgical masks.[5-10] While demand for PPE has decreased relative to its peak during the pandemic, the global market for PPE, which was worth more than $52.7bn (£41.7bn) in 2019, is estimated to be growing at a compound annual growth rate of 8.7% and will reach over $92.5bn by 2027.[11]

PPE is critical to protect healthcare workers and patients from highly infectious diseases. However, single use PPE requires extraction of resource intensive materials, manufacturing, packaging, and transportation, and generates large amounts of waste, which together are environmentally destructive and financially costly to healthcare systems.[12]

Peer reviewed studies quantifying the global environmental impacts of PPE related pollutants are limited, but well established concerns include high emissions (primarily produced during manufacture) and environmental contamination from plastic waste.[13] For example, in the US (the world's largest importer of PPE), use of isolation gowns and surgical masks alone contributed more than 70 million tons of carbon dioxide equivalent (CO_2e) in 2019 and more than 292 million tons of CO_2e in 2020, roughly equal to the emissions generated from the continuous running of 19 or 78 coal fired power plants for one year, respectively.[5]

China (the world's leading producer of PPE by a considerable margin) exported more than 220 billion disposable masks in 2020.[10-15] Globally, an estimated 8-11 million tons of plastic waste associated with the pandemic were generated in 2021, creating strain on an already intractable global plastic waste problem and posing major threats to marine and oceanic ecosystems worldwide.[6-18]

Together these impacts make switching to reusable PPE an important area for the healthcare industry to reduce its environmental impact. Reusable gowns, goggles, face shields, and N95 surgical masks all offer less severe environmental consequences while preserving safety. With increased demand relative to the pre-pandemic period expected to continue, and additional surges anticipated with future pandemics, adopting reusable PPE may increase resilience to PPE shortages during future public health emergencies, in addition to creating considerable environmental benefit.[6-20]

WHAT YOU NEED TO KNOW

- Globally, demand for PPE is rising, despite a recent decrease relative to its peak in the covid pandemic
- In 2020, use of isolation gowns and surgical masks in the US alone contributed the carbon dioxide equivalent of 78 coal fired power plants running continuously
- Reusable PPE preserves safety, while offering less severe environmental consequences and reducing costs. Successful deployments of reusable gowns at large US medical centres have resulted in the diversion of hundreds of tons of landfill waste with cost savings of nearly 50% per gown with no impact on infection rates.

EDUCATION INTO PRACTICE

- What does your organisation's current PPE usage look like (eg, what types of PPE are used and how frequently?)
- What are the areas of your clinical practice where you (and your department or institution) could reduce unnecessary PPE use and/or transition to using more reusable PPE?
- How might you engage with key stakeholders in your workplace about transitioning to reusable PPE? Who could you reach out to in your organisation to co-organise or partner with on this effort?
- What peer institutions could you reach out to for support, resource sharing, or collaboration?

Resources for transitioning towards reusable PPE

Gowns

- Practice Greenhealth. Ronald Reagan UCLA Medical Center: Reusable isolation gowns. practicegreenhealth.org/tools-and-resources/ronald-reagan-ucla-medical-center-reusable-isolation-gowns

Masks and respirators

- Centers for Disease Control and Prevention. Filtering out confusion: frequently asked questions about respiratory protection. www.cdc.gov/niosh/docs/2018-128/pdfs/2018-128.pdf
- Golladay G, Leslie KA, Zuelzer WA, et al. Rationale and process for N95 respirator sanitation and reuse in the coronavirus disease 2019 (COVID-19) pandemic N95 respirator sanitation and reuse. *Infect Control Hosp Epidemiol* 2022;43:40-4.
- Seresirikachorn K, Phoophiboon V, Chobarporn T, et al. Decontamination and reuse of surgical masks and N95 filtering facepiece respirators during the COVID-19 pandemic: a systematic review. *Infect Control Hosp Epidemiol* 2021;42:25-30.

Face shields and goggles

- Shah A, Zhuang E, German J. Surface contamination of reusable respirators and face shields during care of critically ill covid-19 patients. *Workplace Health Saf* 2023;71:137-43.
- Wang Q, Mo J, Huang F, Pu Y, Lyu B. Comparison of three medical goggle sterilizing approaches (article translated from Chinese). *Comparative Study* 2020;49:609-13.

Data collection and quality improvement

- UCLA Health reusable isolation gowns. cleanmedeurope.org/wp-content/uploads/2021/03/James-Evans_Victor-Mitry_UCLA-Health_reusable-isolation-gowns.pdf

Evidence for the solution

Evidence suggests that reusable PPE is as safe, cheaper, and more sustainable than disposable PPE. In a cradle-to-grave life cycle assessment from an independent research firm specialising in medical equipment, reusable isolation gowns were found to have a 30% reduction in greenhouse gas emissions and a 28% reduction in energy consumption compared with disposable gowns.[12] Reassessments of this comparison across various geographical regions may be needed to characterise how emissions vary depending on the energy generation mix in different countries.

A recent study comparing the performance of reusable and disposable gowns found that reusables were safer: regardless of the number of times they were washed, reusables outperformed disposables in consistently meeting PB70 performance specifications (from the Association of the Advancement Instrumentation), and had greater seam strength and comparatively superior resistance to breaking, tearing, and pilling.[21] Furthermore, deployment of reusable gowns at large US medical centres resulted in diverting hundreds of tons of landfill waste and creating cost savings of nearly 50% per gown, saving millions of dollars over years with no impact on infection rates.[22-24] Similarly, pilot studies in a US tertiary hospital system showed a transition to reusable surgical gowns would be feasible and safe, and would reduce waste and costs.[25]

A modelling study from the US found that using reusable respirators with filters in place of single use N95 masks would have decreased costs by $5.2bn (80% reduction) and waste generation by 68 million kg (81% reduction) across the country during the first six months of the covid-19 pandemic.[26] Many candidate respirators exhibit comparable or greater safety than disposable masks.[27]

Finally, a large lifecycle decision analysis across the NHS found that switching to reusable gowns and face shields, reducing plastic glove use, and maximally recycling during the first six months of the pandemic would have led to a 7.5% reduction in total emissions and would have averted (direct and resource depletion related) costs of just over $1.2m.[28]

Global production of healthcare PPE increased by approximately 300-400% during the pandemic

What you can do

Here we present a framework of potential steps towards, and the relevant stakeholders necessary for, initiating a transition to reusable PPE.

- Start with an assessment of current practice (identify areas for reduction or avoidance of PPE use, annual PPE usage, etc).
- Identify appropriate departments to pilot reusable PPE implementation (high volume departments, such as the emergency department or intensive care unit).
- Engage stakeholders, including infection control, operations, and hospital staff:
  - Involve stakeholders in the design and implementation of the new workflow.
  - Introduce training or educational materials to support staff with changes to workflows and with the correct reuse of PPE.
- Track safety, sustainability, and cost savings metrics (including but not limited to infection rates, tons of waste, and sourcing costs) from before and after implementation.
- Collaborate with environmental services for laundering, tracking, transport, and disposal.
  - For reusable gowns, environmental services departments may want to consider chip and scanning technologies to track reusable gown laundry cycles and flag individual gowns for replacement when they reach their maximum number of uses (typically between 75 and 100 washes).
- Monitor the programme and iterate based on feedback (ie, anonymised surveys to staff and users), and scale up the programme.
  - The box includes resources on how to safely implement reusable PPE and collect, analyse, and make actionable changes using results from quantitative and qualitative pilot studies.
- Engage with peer institutions to share knowledge and resources (box).
- Establish a public data repository with results:
  - For example, UCLA Health compiled a publicly available resource presenting data from their reusable gown pilot programme, which includes metrics such as cost effectiveness, sustainability, and staff receptiveness and comfort (box).
  - Publishing pilot results will support the creation of evidence based guidelines and policies that can enable broader adoption of sustainable practices and prevent healthcare supply chain shortages during future global health crises.

Patient involvement: No patients were directly involved in the creation of this article.

Competing interests: None declared.

Cite this as: *BMJ* 2024;384:e075778

Find the full version with references at doi: 10.1136/bmj-2023-075778

CASE REVIEW

Hypertriglyceridaemia and abdominal pain

A woman in her 60s presented with a two day history of abdominal pain and nausea. She did not report any vomiting or diarrhoea. Her history included hypertension and type 2 diabetes. She reported a high dietary carbohydrate intake as well as low adherence to her insulin regimen. She also took—and reported adherence to—amlodipine, clonidine, and pravastatin as prescribed. The patient did not consume alcohol and had no relevant family history. On examination she was afebrile and had a raised blood pressure of 141/68 mm Hg, normal pulse, and normal respiratory rate. On palpation she had central abdominal tenderness without any rebound. The table shows the results of initial laboratory investigations.

1 **What do the laboratory investigations show?**
2 **What is the most likely diagnosis?**
3 **How would you manage this condition?**

Submitted by Rachel Kim and Kushal Patel

Patient consent obtained.

Cite this as: *BMJ* 2024;384:e077441

Relevant laboratory test results

Test	Result	Normal range
Sodium (mmol/L)	121	136-145
Blood glucose (mmol/L)	26.42	‹6.0
Calcium (mmol/L)	2.3	2.2-2.6
Lipase (U/L)	259	‹60
Alkaline phosphatase (U/L)	140	35-104
Total bilirubin (µmol/L)	5.13	‹21
Aspartate aminotransferase (U/L)	25	≤32
Alanine transaminase (U/L)	24	≤33
Haemoglobin A_{1c} (%)	13.6	≥5.6
Cholesterol (mmol/L)	23.88	‹5
High density lipoprotein cholesterol (mmol/L)	0.3	›1.2
Triglycerides (mmol/L)	60.2	≤1.7
Plasma osmolality (mOsm/kg)	306	275-295

If you would like to write an Endgames article, please see our author guidelines at bit.ly/29HCBAL and submit online at bit.ly/29yyGSx

answers

CASE REVIEW **Hypertriglyceridaemia and abdominal pain**

1 What do the laboratory investigations show?

The blood glucose and haemoglobin A_{1c} levels are extremely high, and the results also indicate hypercholesterolaemia and severe hypertriglyceridaemia, likely caused by uncontrolled diabetes mellitus. The result for lipase is more than three times the upper limit of normal. Low serum sodium and raised plasma osmolality indicate pseudohyponatraemia secondary to hypertriglyceridaemia and hyperglycaemia.

2 What is the most likely diagnosis?

Acute pancreatitis secondary to hypertriglyceridaemia—acute pancreatitis typically presents with epigastric abdominal pain that radiates to the back and is relieved on leaning forward. It is also associated with nausea and loss of appetite. The most common risk factors are gallstones, excessive alcohol consumption, and hypertriglyceridaemia. Hypertriglyceridaemia induced pancreatitis has been associated with triglyceride levels ›10 mmol/L. According to the Revised Atlanta Criteria, fulfilment of two of the following criteria is diagnostic: characteristic abdominal pain, lipase or amylase greater than three times the upper limit of normal, and radiological evidence of acute pancreatitis (mostly abdominal CT).

3 How would you manage this condition?

Medical management of acute pancreatitis is generally supportive and includes fluid resuscitation and pain control. If hypertriglyceridaemia is the cause, additional management includes intravenous insulin and dietary fat restriction, with management of high triglyceride levels with appropriate drugs, perhaps omega 3 fatty acid use, and strict glycaemic control.

Therapeutic plasma exchange is an alternative treatment in patients with severe disease involving end organ damage.

Complications of acute pancreatitis include disseminated intravascular coagulation, acute respiratory distress syndrome, and pancreatic abscess. The Ranson criteria may be used to estimate the mortality of patients with pancreatitis, with a score of 3 or greater indicating severe disease and increased mortality.

PATIENT OUTCOME

The patient was treated with intravenous fluids, intravenous insulin, pain management, atorvastatin, and omega 3 fatty acids. Her abdominal pain and nausea resolved before discharge. In addition, her laboratory test results improved—the sodium level normalised to 135 mmol/L and triglyceride levels improved to 8.6 mmol/L

LEARNING POINTS

- Hypertriglyceridaemia is the third most common cause of acute pancreatitis, with risk increased when triglyceride concentrations are ›10 mmol/L.
- The Revised Atlanta Criteria can be used to diagnosis acute pancreatitis.
- Treatment of acute pancreatitis includes supportive care and treatment of the underlying cause, when known.

CPD READING
0.5 HOURS

You can record CPD points for reading any article. We suggest half an hour to read and reflect on each.

LEARNING MODULE

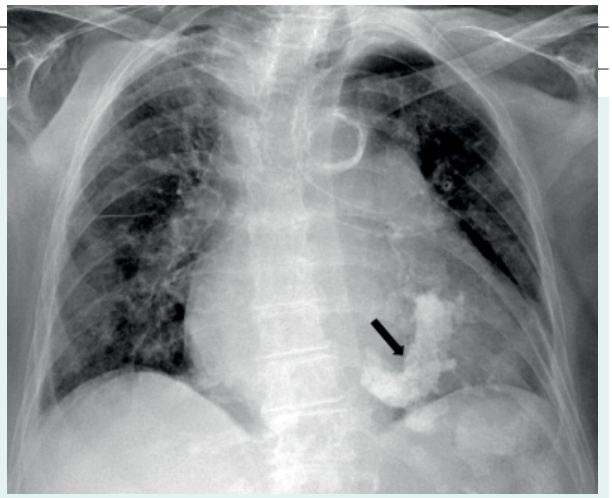
Articles with a "learning module" logo have a linked BMJ Learning module at learning.bmj.com.

MINERVA

Senile non-rheumatic mitral valve calcification

This is the chest radiograph of a woman in her late 80s with a history of hypertension, diabetes, heart failure, and atrial fibrillation. She had been referred because of fever and worsening dyspnoea. Examination showed bilateral lung crackles, a grade 4/6 blowing high pitched holosystolic murmur of mitral regurgitation, and a grade 3/4 low pitched mid-diastolic rumbling murmur of mitral stenosis over the apex. The radiograph showed pulmonary congestion, and a heavily calcified mitral valve (arrow) and aortic ring. A subsequent echocardiogram showed severe mitral calcification, severe mitral regurgitation, moderate mitral stenosis, and mild aortic stenosis.

Non-rheumatic mitral calcification is a chronic, progressive process related to ageing and atherosclerosis. It is commonly associated with aortic calcification, diastolic dysfunction, and atrial fibrillation. Mitral calcification can cause severe dysfunction that might need surgical intervention when feasible. The patient was advised against valve replacement surgery because of her comorbidities and high surgical risk. Her condition was managed medically with antibiotics for suspected pulmonary infection and diuretics.



Sameer Kassem (sameerkassem@gmail.com); Nizar Hijazi, Israel Institute of Technology, Haifa, Israel

Patient consent obtained.

Cite this as: *BMJ* 2024;384:e076186

If you would like to write a Minerva picture case, please see our author guidelines at bit.ly/29HCBAL and submit online at bit.ly/29yyGSx

Sleep, diet, and type 2 diabetes

Compared with people who slept seven to eight hours each night, participants in the UK Biobank study who slept for five hours or less were slightly more likely to develop type 2 diabetes. The risk was higher for those sleeping three to four hours a night. Whatever the reason, it doesn't seem to be diet. The association between short sleep duration and increased risk of type 2 diabetes was present even when the analysis was restricted to people eating healthily (*JAMA Netw Open* doi:10.1001/jamanetworkopen.2024.1147).

Cerebral venous thrombosis

Although cerebral venous thrombosis accounts for less than 3% of all strokes, it carries a substantial risk of death or dependency, despite intensive medical treatment. Predisposing conditions include pregnancy, the puerperium, use of oral contraceptives, thrombophilia, obesity, and covid-19 vaccine induced thrombocytopenia. The clinical presentation is diverse but headaches and seizures are common. Diagnosis depends on cerebral venography by magnetic resonance imaging or computed tomography. Initial treatment is usually parenteral heparin followed by a transition to oral vitamin K antagonists. As yet, the value of endovascular intervention is unproved (*Stroke* doi:10.1161/STR.0000000000000456).

Stroke and myocardial infarction in people taking triptans

A case crossover study from Denmark shows that caution in giving triptans to people with ischaemic heart disease or a history of myocardial infarction is justified. Among 430 000 people who redeemed a first prescription, risks of myocardial infarction and stroke were around three times higher in the period taking the triptan than in equivalent periods off the drug. However, for those without cardiovascular risk factors, the likelihood of an ischaemic event with triptans was small (*JAMA Neurol* doi:10.1001/jamaneurol.2023.5549).

Sight threatening diabetic retinopathy

Socioeconomic deprivation is associated with poorer outcomes for many medical conditions. So the findings of a study from the UK which show that severe diabetic retinopathy is commoner in people living in poorer areas aren't a surprise. What is surprising, however, is the size of the effect. Among people with type 1 diabetes, sight threatening diabetic retinopathy was almost three times more frequent in the most deprived areas than in the least deprived areas (*Diabetes Care* doi:10.2337/dc23-1626).

History of head trauma increased by 30% the risk of developing multiple sclerosis

Head trauma and multiple sclerosis

A large population based case control study from Sweden reports that a history of head trauma carried a 30% increase in the risk of subsequently developing multiple sclerosis. There was also evidence of a synergistic effect between head trauma and two HLA alleles known to confer a greater risk of the disease. Recent head trauma in individuals with both these genetic risk factors led to an 18-fold increased risk of multiple sclerosis when compared with those who had neither the genetic risk factors nor a history of head trauma (*J Neurol Neurosurg Psychiatry* doi:10.1136/jnnp-2023-332643).

Nuclear war

In 1985, the Nobel Peace prize was awarded to International Physicians for the Prevention of Nuclear War. Minerva was always doubtful about why doctors should have been singled out. Surely plumbers and carpenters were just as keen to avoid a nuclear conflagration? But even if you don't agree with her—especially if you don't agree with her—it's worth reading a piece in the *New York Times* about the changing risks. At the moment, megaton warheads are probably a lesser threat than small nuclear weapons of a few kilotons on a contested battlefield (www.nytimes.com/interactive/2024/03/04/opinion/nuclear-war-prevention.html).

Cite this as: *BMJ* 2024;384:q639