Nutritional Management of the Obese Patient

Laura Healy (PhD)
Senior Clinical Nutritionist (Research)
St James's Hospital

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Overview

- Obesity in Ireland
- Nutritional Support in Obesity
  - Energy Expenditure
  - Hypocaloric Feeding
  - Enteral Obese Formula
- Obesity and Outcome
  - Paradoxical effect of obesity
  - Obesity and ICU Outcome

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"Globesity"

- Worldwide obesity has doubled since 1980
- 1.5 billion adults overweight (WHO 2005)
- 500 million clinically obese
- 43 million children under 5 are overweight (2010)
- Problem extends into developing world
- 65% world's population live where overweight and obesity kills more people than underweight
- Set to overtake smoking as worlds no 1 killer by 2020
- "Obesity is the greatest health threat facing the West"

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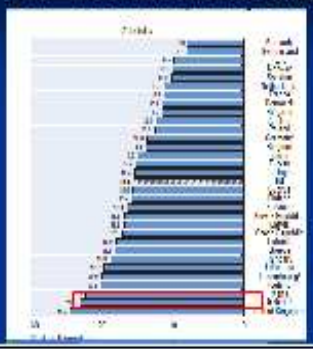
Ireland second in EU obesity top 10



Source: OECD Health Data 2010, Eurostat Statistics Database, WHO Global Infobase

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Irish among fattest in Europe as our obesity levels soar

By James O'Brien Sun Sept 26 2010

Soaring obesity 'a risk to years of health gains'

By Niall O'Hare Sun Dec 19 2010

- 30% hike in obesity levels
- 12% hike in overweight levels in one decade
- Puts in jeopardy the health gains made in recent year
- 40% drop in death from heart disease and stroke and an 11% drop in cancer deaths

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Obesity Tsunami

High blood pressure
2007: 852,000 (25.1%) Vs 2020: 1,192,000 adults ↑40%

Coronary Heart Disease (CHD, angina and heart attack)
2007: 151,000 (5.8%) Vs 2020: 195,000 adults ↑30%

Stroke
2007: 59,000 (1.7%) Vs 2020: 87,000 adults ↑48%

Diabetes (Type 1 and 2)
2007: 144,000 (4.5%) Vs 2020: 253,000 adults ↑82%

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Cost of Obesity in Ireland…

- 2,000 premature deaths in Ireland every year due to obesity
- Economic cost of €4 billion
- Diseases associated with obesity – 37% total health care costs
  → €540 million /year

Safefood funding a project in 2010 to look at direct and indirect costs of obesity

National Task Force on Obesity Report 2005

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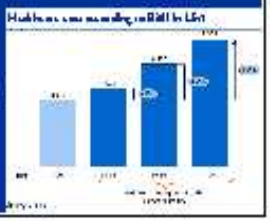
Direct and indirect Cost of obesity

- The individual, the family
- The economy, the taxpayer
- The health services
- The health insurance agencies
- The pension provider
- The employer
- The research funding agencies

Obesity = loss of 3.5 years disability-free, 1.9 years extra with disability



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The "OBESOGENIC" environment

Food environment
- Availability
- Cost
- Energy density
- Variety
- Portion sizes
- Norms for consumption
- High energy drinks

Activity environment
- High cost of activity
- Labour saving devices
- Sedentary travel
- Enjoyable sedentary pursuits

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Super sizing

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OBESITY

THE POLICY CHALLENGES

- Halting levels of overweight and obesity presents a major challenge
- Tobacco control experience has taught us that government policy and environmental changes are crucial to achieving changes in individual behaviour
- Purposeful changes in public policy are needed
- 93 different recommendations

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Your Health is Your Wealth: a Policy Framework for a Healthier Ireland 2012 – 2020

- improving the supply of healthy food products, calorie posting in restaurants
- marketing of food to children
- healthy eating guidelines
- the promotion of physical activity
- preventing obesity in adults and children who are already overweight
- The group will engage with other sectors such as transport and education.

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Goals of Nutrition Support

- To defend lean body mass and slow down/prevent further deterioration in nutritional state.
- To support the metabolic response to injury & infection.
- To enhance wound healing.
- To preserve respiratory function.
- To improve patient outcome & reduce subsequent duration of recovery.

ASPEN 09', ACCP 09', ASPG 09'

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Overfeeding

Promote lipogenesis
Hyperglycaemia
Metabolic acidosis
Exacer Resp Failure
Fat overload syndrome, or Hepatic steatosis
Hypertriglyceridaemia

Underfeeding

Loss of LBM
↑ infections
Weak Resp Muscles
Organ dysfunction
Impaired Immunity
↑ Morbidity
↑Mortality

More negative outcomes

↑ Health Care Cost

Accurate determination of EE is essential

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Energy Expenditure: BMR Vs RMR

Conditions essential for measuring BMR

- post-absorptive (12 hour fast)
- lying still at physical and mental rest
- thermo-neutral environment (27 – 29 oC)
- no tea/coffee/nicotine in previous 12 hours
- no heavy physical activity previous day
- gases must be calibrated
- establish steady-state (~ 30 minutes)
- * if any of the above conditions are not met = RMR/REE

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Main components of energy expenditure:

- basal metabolic rate (BMR) represents about 45–70%
- alteration in BMR due to disease process (stress factors)
- Activity Levels (bedbound/mobile/PAL)
- Diet Induced Thermogenesis (DIT)

- Influenced by
  - Lean body Mass: ↓ ↓ decreases BMR
  - Age: ↓BMR ↓RMR
  - Sex
  - Medications
  - Inflammation/Chronic Process

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Measured Energy Expenditure

Indirect Calorimetry

- The method of choice to determine energy expenditure if the inspired oxygen is less than 60%
- Underutilised due to cost, lack of trained personel
- Measures O_2 consumption and CO_2 excretion, uses this to calculate respiratory quotient (ml/min)
- RQ is used to evaluate substrate utilization
  - 0.7-1.0 Normal
  - >1.0 excessive CCR and may indicate overfeeding
  - <0.7 Metabolic/nutritional causes
- Performed intermittently (30 mins) or continuously
- Not infallible; System leaks, the effect of water vapor pressure, dialysis, post op anaesthesia and errors in calibration can all contribute to erroneous values.

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Prediction Equations

- A good starting point for total energy expenditure
  - >200 different type of equations, Schofield, Ireton-Jones, Penn State, Harris-Benedict, Disease Specific where applicable
- Most adult hospitalised NS pts require 1800-2500kcals / d or 25-30kcals / kg
- Mean MEE in Hospitalized Patients (Barak et al 2002)
  - Female: 1670 +/- 655 kcal/24hours
  - Female: 1681 +/- 479 kcal/24hours
  - Female (surg): 1755 +/- 618 kcal/24hours
  - Female (surg): 1871 +/- 418 kcal/24hours
- Rarely within 10% of MEE

(Barak & Meker, 1975; Weijs, 2008; Swinamer & Grant, 1991)

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Predictive Equations: Sources of Error

Predicting BMR is very difficult

- without accounting lean body mass
- Sarcopenic Obesity "Pre Frail" patients

Unavailable or Inaccurately measured weight

- Altered fluid status (at 20% of hospital patients overloaded)
  - Gain 10% body weight before oedema clinically significant

Stress factor: degree of stress inaccurately assessed

Activity level: Inaccurately assessed

Diet Induced Thermogenesis:

- varies by depending on feeding method (Continuous EN 0%, Bolus EN 5%, Mixed meal 10%)

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Nutritional Requirements for Obese

- Controversial - variety of different methods used, no single method has been found to be precise and unbiased for all patients
- may over or under-estimate (compared with MEE)
- Study on 213 ventilated patients
  - 28% received calories within 10% MEE
  - 32-93% Overfed,
  - 12-30% underfed
- Different equations have strengths and weaknesses
  - Accurate for young obese but not elderly obese
- Understand the equations reference population

BMI	% Schofield	% Ireton-Jones
> 25	14.6%	59%
> 30	4.6%	18%

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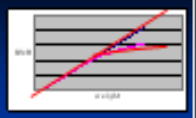
Nutritional Requirements of Obese



- equations (such as Schofield) are linear
- weight increases linearly with estimated BMR
- may overestimate in obese
  - BMR increases more slowly as bodies weight
- Best method to assess energy requirements?
  - Measured by indirect calorimetry where possible
  - Use predictive equations validated in patient populations that include obese patients

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Hypocaloric Feeding

- Not necessary or desirable to fully meet patients requirements
- Adipocyte contents can be oxidised for fuel
- Provide 50-125g CHO for the brain
- Adequate protein to maintain lean tissue
- Improve glucose control
- Improve patient outcomes

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Summary Of Clinical Studies

[illegible]

Hypocaloric Feeding Critical Ill

- Evidence to support
- Reasons are not clear but maybe due to
  - Reduction in the metabolic rate and oxidative stress,
  - reduction in mitochondrial free radical generation,
  - an up-regulation of the plasma membrane redox system,
  - an improvement in insulin sensitivity,
  - And changes in neuroendocrine and sympathetic nervous system function

(Arabi et al 2011, Am J Clin Nutr 2011;93:569–77)

- Possibly better to err on the side of hypocaloric nutrition support in obese, diabetic patients rather than overfeeding.
- The optimal duration of hypocaloric nutrition support is also not known (Reeds et al 2009)

Overweight but undernourished

- Obese patients can still be at risk of refeeding syndrome
  - Initial Weight and BMI and diet, nutrition History
- Nutrition Screening
  - [illegible]
- Prolonged periods of NPO are not justified in obese
- Obese like lean counterparts - same benefit from early enteral nutrition support
- Anyone who has minimal intake for >5days has some degree of risk of refeeding syndrome
- Constellation of Metabolic disturbances that occur as a result of reintroduction of nutrition
  - Oedema, Hypoglycaemia, Hypomagnesaemia, Hypokalaemia, Severe hypophosphataemia → cardiac, respiratory dysfunction, central nervous system dysfunction, red blood cell and leucocyte dysfunction

Protein

Table [illegible] Nitrogen and protein requirements in health and disease

	Nitrogen g/kg/day	Protein g/kg/day
Normal	0.17 (0.14 - 0.20)	1.06 (0.87 - 1.25)
Hypermetabolic		
5-25%	0.2 (0.17 - 0.25)	1.25 (1.06 - 1.56)
25-50%	0.25 (0.20 - 0.30)	1.56 (1.25 - 1.87)
>50%	0.3 (0.25 - 0.30)	1.87 (1.56 - 1.87)
Depletion	0.3 (0.2 - 0.4)	1.87 (1.25 - 2.5)

- Protein requirements in obesity (NSRG) 1.5 – 2.5 g/kg IBW
- For BMI > 30 kg/m2 use 75% of value calculated from ABW
- For BMI > 40 kg/m2 use 65% of value calculated from ABW

Enteral Nutrition in Obese

Standard (±fibre)	1 kcal/ml 4g protein/100ml	Normocatabolism
Protein Plus	1.2kcals/ml 5.5g Protein/100ml	Moderate catabolism High protein, moderate kcals
High Protein	1.0kcal/ml 8g Protein/100ml	Hypercatabolism Low Kcal: high Protein
Diabetic Specific Formula	Low CHO, high MUFA	Raised BSL Uncontrolled BSL

Parenteral Nutrition in Obese

- SJH Specific PN Regimen (eg 8C)
- Low kcal (1173kcals/2000mls)
- High nitrogen (18gN/112.5g Protein)
- Glucose (200g)
- Low fat (51g)
- Na⁺ (60mmol)

Ideal Formula for Obesity

- Very low protein calorie: Nitrogen Ratio 35:1
- 0.75 -1.0kcal/ml
- Pharmaconutrients to consider (Mg, Zn, Arginine, Fish Oil etc)

Clinical Practice

- Non Stressed Patients (Weight Reduction Factor)
  - [illegible] by 500-1000kcal [illegible]
- mild to moderately stress
  - [illegible]
- severe stress
  - [illegible] BMR
- SJH
  - Ireton Jones for obese pts
  - Schofield (No AF or no SF) — Range for obese patients
  - 18-21 kcals/kg
  - [illegible] kcals/kg
- Clinical Judgement and monitoring essential e.g. blood glucose, triglycerides

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Case Study

- Post Oesophagectomy for Adenocarcinoma
- Weight 92kg Height 1.69 BMI 32.2kg/m2 Age 58 ♂
- Schofield 1931kcals/day
- 18-21kcals/kg 1656-1932kcals/d
- Ireton Jones 1709 kcals/day
- Protein 75% 1.2-1.5g/day 83-103.5g Protein

Enteral Feeding Regimen

- 1.0 Osmolite Plus 40.5 Jevity HP Plus

1866 kcals (20.3kcals/kg) and 96.1g Prot

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Summary

- Use Indirect calorimetry to determine EE where possible
- Estimated requirements are only a starting point
  - set realistic goals of treatment for each patient
  - monitor and amend as patient's condition changes
- Overweight but still undernourished
- Avoid overfeeding
  - High protein Hypocaloric feeding recommended in Obese ICU patient
- Use Clinical Judgement
- Standard Formulas can be used

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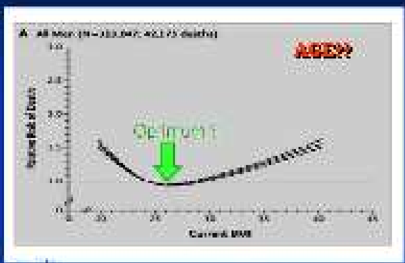
BMI and Outcome



Adams et al; NEJM; 2006; 355:763-778

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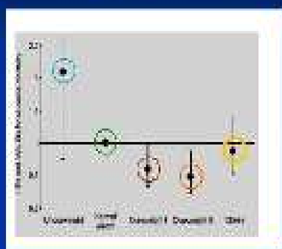
Obesity Paradox in PCI Patients



N= 4880,

219 deaths in 5 years

Hastie et al; EHJ; 2009

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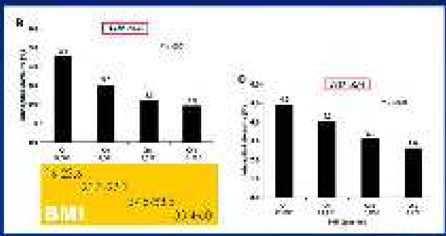
Acute Heart Failure and BMI



Fonarow et al; AHJ; 2007;153: 74-81

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Frail Elderly and BMI

Reference	Details	FUp	Lowest Mortality
Allard 2004	Canada N=408	19	BMI>26
Payette 1999	US N=281	60	BMI>29
Kaiser 2010	Germany N=200	12	BMI>30
Kinyagarov 2010	Israel N=82	12	BMI>27

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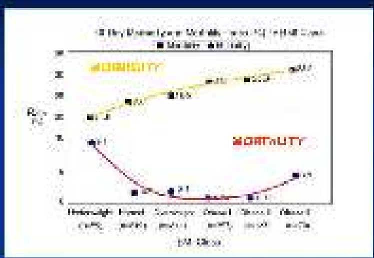
Morbidity and Mortality in Cancer Surgery



Mullen et al; Annals Surg Onc ; 2008;15: 2164

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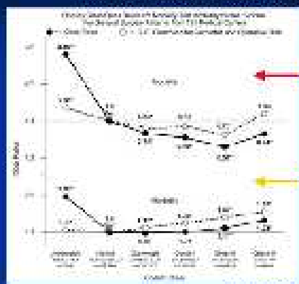
Non Bariatric Surgery



Mullen et al; 2009; 250: 166

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Obesity increases ICU mortality??

YES

- N Bercault et al. Crit Care Med 2004;32:998-1003.
- SA Nasraway et al. Crit Care Med 2006;34:964-70

NO

- AA El-Solh et al. Chest 2001;120:1989-1997.
- A Tremblay et al. Crit Care Med 2003
- DE Ray et al. Chest 2005;127:2125-2131

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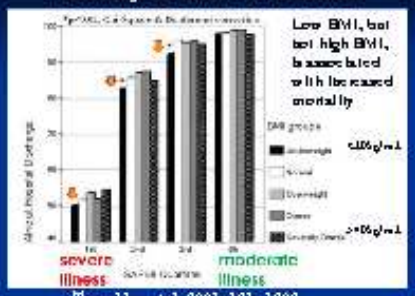
Severity & BMI & Survival



Tremblay et al, 2003; 123: 1202

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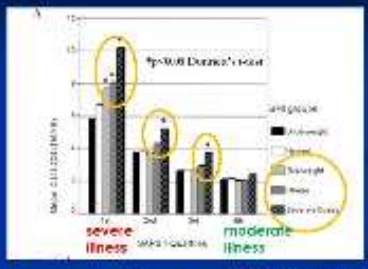
Severity & BMI & ICU LOS



Tremblay et al 2003; 123:1202-1207.

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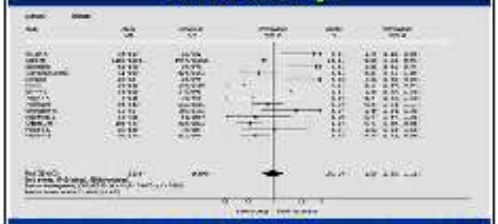
Obesity & ICU: Metaanalysis & ICU Mortality



No change

Akinusi et al, 2008; 36: 151

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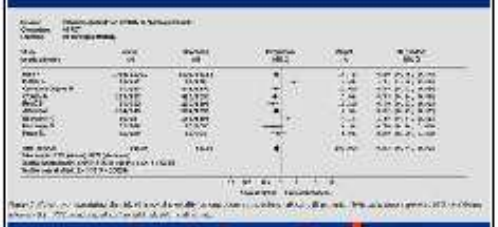
Obesity & ICU: Metaanalysis & hospital mortality



hospital mortality ↓

Akinusi et al, 2008; 36: 151

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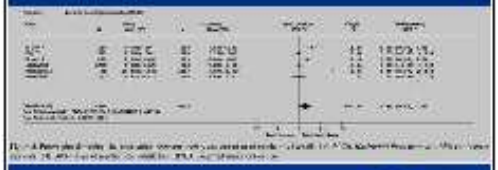
Obesity & ICU: Metaanalysis & ventilation



Ventilation duration ICU ↑

Akinusi et al, 2008; 36: 151

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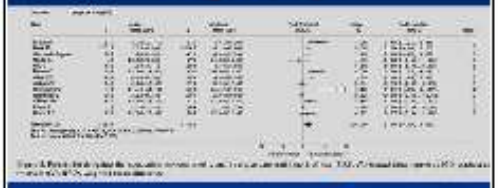
Obesity & ICU: Metaanalysis & length of stay



length of stay ICU ↑

Akinusi et al, 2008; 36: 151

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Obesity & ICU: Metaanalysis

Akinnusi et al, 2008; 36: 151

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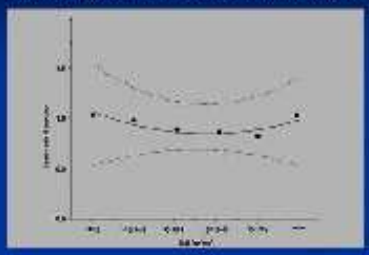
Obesity & ICU: Metaanalysis



Akinnusi et al, 2008; 36: 151

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Obesity Paradox: Hypothesis

- Reserve for illness
  - Lean body mass higher in absolute values
  - Reduced metabolic rate
- Fat and inflammation
  - Cholesterine availability – increased availability
- Obesity and hypoxia
  - Preconditioning ?

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Acknowledgments

- Department of Clinical Nutrition
  - Aisling McHugh (Clinical Specialist Dietitian)
  - Deirdre McCormack (ICU Dietitian)
- M. Hiesmayr (Austria) – "Survival of the Fattest" Talk ESPEN 2011
- Clare Soulsby Research Dietitian (PEN Group) "Current Evidence for Estimating Energy Requirements"

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Thank You

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