

1 **Title:**

2 Knowledge, attitudes and practices of medical staff towards obesity management in
3 patients with spinal cord injuries: an International Survey of four Western European
4 countries

5

6

7 **Authors:**

8 Samford Wong^{1,2,3}, Joost van Middendorp^{1,4}, Maurizio Belci¹, Ilse van Nes⁵, Ellen
9 Roels⁶, Eimear Smith⁷, Shashi P Hirani³, Alastair Forbes^{2,8}

10

11 ¹National Spinal Injuries Centre, Stoke Mandeville Hospital, Aylesbury, UK

12 ²Centre for Gastroenterology and Clinical Nutrition, University College London,
13 London, UK

14 ³School of Health Science, City University, London, UK

15 ⁴Stoke Mandeville Spinal Foundation, Stoke Mandeville Hospital, Aylesbury, UK

16 ⁵Sint Maartenskliniek, Department of Rehabilitation, Nijmegen, the Netherlands

17 ⁶Fysische Geneeskunde en Revalidatie, UZ Leuven Campus Pellenberg, Belgium

18 ⁷National Rehabilitation & Mater Misericordiae University Hospitals, Dublin,
19 Republic of Ireland

20 ⁸Faculty of Medicine & Health Sciences, University of East Anglia, Norwich, UK

21

22

23 Correspondence address:

24 Samford Wong, Department of Nutrition and Dietetics, National Spinal Injuries
25 Centre, Stoke Mandeville Hospital, Aylesbury, UK HP21 8AL.

26 Work fax: +44 (0)1296 315049

27 Email: Samford.Wong@ucl.ac.uk

28

29

30

31

32

33

34

35

36

37

38

39

40

41

42

43

44 Abstract

45 Objective: To 1) examine the opinions of medical staff working in spinal cord injury
46 (SCI) centres (SCICs); 2) evaluate their knowledge, attitudes and practices towards
47 obesity prevention and management; 3) report the number of beds and dietitians
48 available at each SCIC.

49 Methods: A 37-item questionnaire was sent to 23 SCICs in the UK, the Netherlands,
50 Belgium and the Republic of Ireland between September 2012 and January 2013.

51 Results: Eighteen SCICs returned the questionnaires for analysis. All respondents
52 stated that they had an interest in obesity treatment but only 2.3% of the respondents
53 received training in obesity management. Sixty-one percent of staff did not consider
54 body mass index (BMI) to be appropriate for use in SCI patients and subsequently less
55 than half of the respondents use BMI routinely. The majority of respondents reported
56 that they are confident in dealing with overweight (74.5%) and obese (66.1%) SCI
57 adults, less than half (44.1%) are confident in treating overweight and obese SCI
58 children. Respondents also indicated the need for nationally adopted guidelines and a
59 lack of physical-activity provision. There were 18.6 whole-time equivalent (WTE)
60 dietitians recorded in 22 SCICs, equivalent to 45 beds per WTE dietitians (range 10 –
61 400). Non-UK SCIC dietitians are significantly better resourced than in UK SCICs
62 (beds per WTE dietitian: 28.9 vs 76.7, $p=0.025$).

63 Conclusion: Medical staff expressed the need to participate in obesity prevention and
64 management. Appropriate training should be considered for all medical staff and the
65 development of specific weight management guidelines and dietetic provision should
66 be considered.

67

68 Keywords: Obesity management; Spinal Cord Injuries; Staff survey; Weight

69 management

70

71

72

73

74

75

76

77

78

79

80

81

82

83

84

85 Introduction

86 Obesity is common after spinal cord injury (SCI). It has become a major clinical and
87 public health problem which requires several medical interventions, modifications of
88 individual behaviour and environmental changes.¹ Recent literatures found that upto
89 45% of SCI patients were overweight and 29% were obese^{2,3}. Obesity is recognised as
90 both a cause and consequence of disease and it has been shown to be associated with
91 poorer clinical outcomes and increased healthcare costs². There are many health risks
92 and associated co-morbidities including hypertension, diabetes, ischaemic heart
93 disease, gallstones, osteoarthritis and some malignancies.¹

94 Yet in clinical practice, many patients, allied health professionals and hospital
95 managers do not realise how common obesity is in hospitalised patients^{4,5}. If ignored,
96 this will cause a greater problem with the development of chronic nutrition-related
97 complications¹.

98 Among medical staff, knowledge of, attitudes towards and practices in the
99 management of obesity have been studied in various English-speaking countries,
100 especially amongst General Practitioners (GPs)⁶⁻⁹. However, despite high awareness of
101 obesity as a medically significant issue¹⁰, the magnitude of the obesity epidemic
102 remains high and is worsening, particularly in patients with neurological disabilities
103 such as spinal cord injuries². Weight management is not commonly offered to SCI
104 patients, at least not in the UK^{11,12}.

105 SCI specialists have been identified as important potential contributors to the
106 prevention and treatment of overweight and obesity, in part, because of continued
107 involvement during rehabilitation. SCI medical staff are therefore in a unique position
108 to provide guidance to patients. In some countries, SCI consultants will continue to see
109 their patients as part of life-long follow up. They are the most frequently used source
110 for information about weight control and are perceived to be the most reliable formal
111 source of information. However to our knowledge, no studies reporting the views of
112 SCI specialists have been published.

113 A more detailed understanding of knowledge, attitudes and practice is necessary
114 to determine the best way to facilitate the contribution of SCI medical staff in
115 addressing obesity after SCI. Although there are standard published recommendations
116 for SCI management and optimal staffing levels^{13,14}, these documents do not make
117 specific recommendations on obesity management.

118

119 Whilst dietitians are considered essential members of the multidisciplinary team
120 (MDT) caring for patients with obesity management,^{1,15} the availability of dietitians in
121 British and European SCICs remains variable.⁴

122 We therefore conducted this international survey in order to include all the
123 SCICs in four western European Countries including Belgium, the Republic of Ireland,
124 the Netherlands, and the United Kingdom who share similar management approach for
125 SCI care. The aim of the study were: (i) to examine the opinions of weight management
126 among medical staff working in SCICs; (ii) to evaluate their knowledge, attitudes and
127 practices towards obesity prevention and management; (iii) to report the number of
128 dietitians per bed available at each SCIC.

129

130 Methods

131 A 37 item cross-sectional survey was developed based on reviewed literature⁸ and was
132 modified further by a team of multi-disciplinary professionals working in SCICs.

133 Three, 3, 4 and 5-point scales were used, in which the participants had to
134 indicate their level of agreement with each statement by selecting one from ‘strongly
135 agree’, ‘agree’, ‘neutral’, ‘disagree’ or ‘strongly disagree’; or in practice statements,
136 from ‘very confident’, ‘fairly confident’ or ‘not confident’ and in service statements,
137 from ‘all of the time’, ‘most of the time’, ‘occasionally’ or ‘not at all’.

138 The questionnaire consisted of five sections; 5 questions on demographic data
139 and staff awareness; 10 statements on exploring attitudes; 3 statements on self efficacy;
140 11 statements on major limitations and; 8 statements on service improvements.

141 In addition to gathering baseline demographic data and professional
142 characteristics, a spokesman for each SCIC was asked to provide the number of
143 available SCI beds and the number of whole time equivalent (WTE) dietetic staff.

144 Because of the small sample size and for ease of presenting the data, most of
145 the responses were grouped together, such that ‘agreed’ encompassed both ‘strongly
146 agreed’ and ‘agreed’, ‘disagreed’ both ‘strongly disagreed’ and ‘disagreed’, and ‘most
147 of the time’ referring to ‘all’ and ‘most of the time’.

148

149 Ethics

150 Formal ethical permission to conduct the study was not required by the Stoke
151 Mandeville hospital review board as this was considered to be a clinical audit not
152 involving active patient participation (NRES).¹⁶ This was accepted by the other centres.

153 The questionnaires were approved by the local clinical audit departments for phrasing
154 and grammar of the questions. In addition, a pilot study (n=3) was performed to assess
155 the content and the time required to complete the questionnaire; feedback from this
156 guided the drafting of the final version of the questionnaire (Appendix 1). For Dutch
157 and Belgian participants, the English survey was translated into native language by the
158 study co-author (JvM) and validated by co-authors (ER and IVN) all of whom are
159 competent in both languages (Appendix 2).

160

161 Survey administration

162 The survey was administered to all medical staff working in the SCICs over four
163 European countries (Belgium: n=3, the Republic of Ireland: n=1; the Netherlands: n=8,
164 and the United Kingdom: n=11) between October 2012 and May 2013, with a covering
165 letter addressed to the local medical lead explaining that findings would be used to
166 identify current knowledge, attitude and practices of medical staff and to identify areas
167 for improvement. Participants were reassured that all findings would be treated
168 anonymously and in confidence to encourage respondents to answer honestly.
169 Completed questionnaires were anonymised prior to analysis. Two reminders were sent
170 (one at 8 weeks and one 12 weeks after the initial survey distribution).

171

172 Statistical analysis

173 Descriptive statistics were used to calculate the response frequency. Data are reported
174 as medians (ranges).

175 Further statistical analysis was conducted to compare the existence of
176 associations between respondents' demographic and professional characteristics and
177 their survey responses. In addition, the dietetics workforce was compared between UK
178 and non-UK SCICs. For numeric data on an ordinal level, the Mann-Whitney test was
179 used, and for cross-tabulation on a nominal level, the Chi-squared test was performed.
180 The data were analysed using Minitab version 15 (Minitab Ltd, Coventry, UK) and
181 significance was accepted if $p < 0.05$.

182

183 Results

184 Medical staff from 23 SCICs were approached. The centres contained a total of 823
185 SCI beds (48 in Belgium, 36 in the Republic of Ireland, 258 in the Netherlands, and
186 481 in the United Kingdom). (Table 1 and Table 2)

187 The overall SCIC response rate was 78.4% (18/23 SCICs; 59 individual
188 responses, 2-12 responses per SCIC, 63.6% in the United Kingdom (n=7), 66.7% in
189 Belgium (n=2), 62.5% in the Netherlands (n=5) and 100% in the Republic of Ireland
190 (n=1).

191

192 Demographics and professional characteristics

193 Nearly half of the respondents were male (n=26). The median duration of practice in
194 SCICs was 2.5 years. Fifty-four percent (n=32) of respondents were senior
195 doctors/consultants (had completed training) and 67.8% (n=40) were from the UK
196 SCICs. (Table 1)

197 No junior/trainee doctors reported that they had received formal training in
198 obesity management of SCI patients and only 2 (6.3%) senior doctors reported that they
199 had formal training in this area.

200

201 Medical staff attitudes and knowledge towards obesity management

202 Forty-seven (76%) respondents agreed with the statement, “Obesity is a major health
203 problem amongst patients with SCI and requires urgent action”. Non-UK respondents
204 (100% v 70%, p=0.037) and non-UK consultants (100% v 71.4%, p=0.028) were more
205 likely to agree with the statement than UK respondents. (Table 3)

206 Most respondents believed that they have a role in obesity prevention (64.5%)
207 and offer advice to their patients (77.9%). Most (86.5%) believed that advice on weight
208 maintenance should be given to all patients with SCI in order to prevent obesity. Most
209 respondents (86.4%) believed that weight management should be offered at an early
210 stage rather than waiting until the patients are obese (18.6%).

211 Although all surveyed SCICs have dietitian support (Table 3), not all
212 respondents reported that their centre has a dietitian that deals with weight management
213 for SCI patients.

214

215 Obesity recognition

216 Most of the respondents (61%) reported that they do not believe that BMI is an
217 appropriate measure to guide weight management in SCI patients. A minority (35.6%)
218 of the respondents reported they monitor patients’ BMI. In the out-patient setting this
219 is even less common (23.7%). Non-UK respondents were less likely to use BMI

220 measurements (26.3% v 35.6% in in-patients; 0% v 35% in out-patients) than UK
221 respondents.

222

223 Self-reported proficiency / ability

224 Most respondents felt more confident in treating overweight than obese SCI adults
225 (Table 4). Three out of 4 respondents (74.6%) felt adequately trained to treat patients
226 who are overweight, but only 2/3 (66.1%) of respondents rated themselves competent
227 in managing obesity; fewer than half (44.1%) were confident in treating paediatric
228 obesity, even though most centres were also responsible for the care of children with
229 SCI. (Table 4)

230 Significantly fewer UK respondents reported being confident in treating obese
231 paediatric patients with SCI than non-UK correspondents (35% v 63.2%, $p=0.042$, χ^2 :
232 4.144). (Table 3)

233

234 Barriers to weight management

235 The leading five obstacles, identified as limitations in delivering optimal care to obese
236 patients, in descending order, were lack of nationally adopted guidelines (64.4%), lack
237 of patient motivation and non-compliance (61%), lack of provision of a suitable
238 physical activity programme (61%), short consultation time for medical staff (55.9%)
239 and lack of specialist weight management clinics to which to refer patients (52.5%).
240 (Table 5)

241 There were significantly more UK respondents reported short consultation
242 times to be a limiting factor (70% v 26.3%, $p=0.015$). Similarly, there were
243 significantly more UK respondents who felt they had inadequate training in providing
244 lifestyle and behavioural counselling for their patients when compared to non-UK
245 respondents (65% v 21.1%, $p=0.030$).

246

247 Weight management strategies

248 All respondents felt an ideal weight management programme should include dietary
249 advice (100%) and physical activity advice (100%). Leaflets and education material
250 were rated as highly important as preventive measures and in general support. (Table
251 6)

252 A large majority of respondents stated that family support (93.2%) and
253 behavioural counselling (88.1%) were important. Most respondents would consider

254 referred their patients to a dietitian (84.7%) as a first treatment step. Pharmacotherapy
255 and bariatric surgery were the least used strategies, only 6.8% of respondents
256 considered anti-obesity medications, and only 3.4% considered bariatric surgery as an
257 option for weight management.

258

259 Dietetic provision in SCICs

260 The 22 responding centres house a total of 823 SCI beds. There were 18.42 whole-time
261 equivalent (WTE) dietitians recorded; the median of 65.7 beds per WTE dietitian
262 conceals a huge range (from 10 – 400). The workforce allocation is summarised in
263 Table 1. Non-UK SCICs were significantly better resourced than UK SCICs (beds per
264 WTE dietitian: 29.3 vs 76.7, $p=0.0322$).

265

266 Suggestions

267 Ten out of fifty-nine respondents (16.9%) provided additional feedback. All responses
268 were positive; common suggestions were the need for specific guidelines for weight
269 management and opportunities to attend training.

270

271 Discussion

272 To the best of our knowledge, this is the first international multicentre survey to report
273 on knowledge, attitudes and practices of SCIC medical staff in weight management and
274 on the provisions of dietitians in SCICs. Previous surveys have primarily focused on
275 obesity management among general practitioners and found that practices regarding
276 obesity management vary widely.⁷⁻⁹

277 Weight gain after SCI is common. This is most likely due to reduced nutritional
278 requirements secondary to enforced inactivity and immobilisation as a result of
279 paralysis and changes in body composition¹⁷, most marked in tetraplegia.¹⁸ In the long
280 term, there seems to be a tendency for people with SCI to gain weight. Energy needs
281 tend to decrease as a function of time post-injury related to loss of muscle mass.
282 Desirable body weight / BMI for people with SCI may be lower than for the general
283 population.¹⁹⁻²⁰ After SCI, the percentage of body fat increases and muscle decreases.
284 The body composition represented by a fixed BMI will therefore change after SCI.
285 Buccholz's¹⁹ and Laughton's group²⁰ have showed that BMI in chronic SCI subjects
286 indicates a much higher body fat percentage as compared to age and gender matched
287 able-bodied subjects suggesting further research to define optimal BMI is needed.

288 All respondents agree that successful weight management should start with
289 prevention. Currently, there are no SCI specific guidelines for prevention and
290 management of overweight and obesity. Generic guidelines published by the UK
291 National Institute for Health and Clinical Excellence (NICE) suggest that dietary and
292 lifestyle changes (a reduction in energy intake, following the eat-well plate set by the
293 government)¹ and increased physical activity in conjunction with behaviour
294 modification support should be considered before any anti-obesity medications or
295 bariatric surgery^{20,21}.

296 Although weight loss has been advocated as a primary treatment strategy for
297 obesity, to date, little high quality evidence exists to support this concept in patients
298 with SCI. To our best knowledge, only limited trials have reported the effect of dietary
299 interventions in obese SCI individuals. Studies demonstrate that a carefully planned
300 program with restricted dietary intake and lifestyle modification could be an effective
301 way to reduce the body weight of obese patients with SCI without compromising total
302 lean body mass and overall health.^{11,12}

303 It is acknowledged that all patients with SCI should receive dietary advice in
304 order to prevent obesity and its complications. In clinical practice, to include all patients
305 would lead to an unmanageable caseload. To offer educational material and input in
306 patient education sessions may be an alternative, more effective and achievable
307 approach. One UK SCIC offers dietetic input for patients with a BMI of 28 kg/m² or
308 above and the preliminary data has suggested that this approach has helped overweight
309 individuals with SCI to reduce weight without compromising lean body mass.¹²

310 Dietitians see as their remit the management of factors related to obesity
311 surrounding the physiological, psycho-social and ethnic needs of the patient.
312 Professional guidelines and recommendations offer assistance on how dietitians might
313 improve the quality of care and outcomes.²² To tackle malnutrition and nutrition-related
314 complications, the dietetic practice manual published by the British Dietetics
315 Association has recommended that each SCIC should have access to a specialist
316 dietitian in order to assess patients' nutritional status and to provide further nutritional
317 advice.²² More recently, the American Dietetic Association has also published
318 guidelines for managing patients with SCI.²⁴ It has emphasised the importance of a
319 specialist dietitian in managing patients in acute, rehabilitation and community settings.
320 The present study found considerable variation in dietetic provision among SCICs

321 varied between centres and British centres has significantly lower dietetic provision
322 when compare to some non-UK centres.

323

324 Strengths and limitations

325 The main strength of this study is that it is the first official international survey
326 conducted in a multicentre European setting which obtained an overall 78.4% response
327 rate from across 4 European countries.

328 Although the respondent sample size (n=59) was small, we feel this is adequate
329 to reflect the views of SCI doctors working in SCICs. To our knowledge, this represents
330 at least 46.8% of all senior medical staff in the UK and Ireland SCICs (15 out of a total
331 32) which is comparable to the literature (53% response rate).²⁵

332 Because the centre response rate varied from 2-12 responses per SCIC, some
333 larger centres may be over-represented in the results. In addition, our technique of
334 secondary invitation of respondents by selected lead individuals within a SCIC could
335 introduce selection bias and we acknowledge this; however, guidance was provided to
336 them to circulate the questionnaire to all medical staff, with varying degrees of
337 experience and special interest, working in the SCIC.

338 There was a predominance of respondents from the UK (n=40) compared to
339 non-UK respondents (n=19). Although this arguably over-represents one country's
340 perspective, it does not reflect the reality of staff mix in the SCI centres. The numbers
341 of senior medical staff surveyed was comparable in the UK and non-UK centres (14 vs
342 19).

343

344 Conclusion

345 Limited knowledge among medical staff and variation in dietetic provision in SCIC are
346 probably barriers to effective weight management.⁴ Without proper guidelines and
347 training, it is unlikely that healthcare staff will have sufficient knowledge to identify at-
348 risk patients or to offer appropriate treatment. This study reinforces the need to consider
349 collaborating with national professional bodies to develop SCI-specific weight
350 management guidelines which include clear guidance on optimal dietetic service
351 provision within the SCICs.

352 Contributions

353 SW- Protocol development, Questionnaire development, data analysis, manuscript
354 preparation

355 JvM – Questionnaire translation, manuscript revision

356 MB- Clinical supervision, manuscript revision
357 IvN, Questionnaire translation, manuscript revision
358 ER – Questionnaire translation, manuscript revision
359 ES- manuscript revision
360 SH – Statistical supervision, manuscript revision
361 AF – Academic supervision, manuscript revision and guarantor
362

363 Acknowledgements:

364 All authors contributed to the report. The authors are grateful to all medical-staff
365 facilitating the dissemination of study questionnaires from the UK, the Netherlands,
366 Belgium and the Republic of Ireland.

367 We also thank the following persons who provided information for this study: Anthony
368 Twist, Sian Gruffudd, Carolyn Taylor, Kim Paterson, Philippa Bearne, Heather Nunn,
369 Rees Colling, Nusrat Kauser, Tebbe Sluis, Christof Smit, Janneke Stolwijk, Dirk van
370 Kuppevelt, Govert Snoek, Helma Bongers, Marga Tepper, Willemijn Faber, Hans
371 Slooman, David Gobets, Catja Dijkstra, Casper van Koppenhagen and Annick Viaene.
372

373 Conflict of interest: Parts of the study data were presented at the International Spinal
374 Cord Society annual conference in October 2013, in Istanbul, Turkey and the British
375 Association of Parenteral and Enteral Nutrition annual meeting in November 2013, in
376 Harrogate, UK. University College London (UCL) Staff receive support from the
377 Biomedical Research Centre funding awarded to UCL and its partner Trust by the
378 National Institute for Health Research.
379

380

381

382

383

384

385

386

387

388

389

390

391

392

393 References

394 1. National Institute for Health and Clinical Excellence: Guideline on the prevention,
395 identification, assessment and management of overweight and obesity in adults and
396 children. NICE 2006, London

- 397 <http://www.nice.org.uk/nicemedia/live/11000/30365/30365.pdf> [accessed
398 25Dec2013]
- 399 2. Wong S, Derry F, Jamous A, Hirani SP, Grimble G, Forbes A. The prevalence of
400 malnutrition in spinal cord injured patients - a UK multicentre study. *Br J Nutr* 2012;
401 **108**, 918-923.
- 402 3. De Groot S, Post MW, Hoekstra T, Valent LJ, Faber WX, van der Woude LH.
403 Trajectories in the course of body mass index after spinal cord injury. *Arch Phys Med*
404 *Rehabil* 2014; **95**, 1083-1092.
- 405 4. Wong S, Derry F, Grimble G, Forbes A. How do spinal cord injury centres manage
406 malnutrition? A cross-sectional survey of 12 regional centres in the United
407 Kingdom and Ireland. *Spinal Cord* 2012; **50**, 132-135.
- 408 5. Wong S, Derry F, Graham A, Grimble G, Forbes A. An audit to assess awareness and
409 knowledge of nutrition in a UK spinal cord injuries centre. *Spinal Cord* 2012; **50**,
410 446-451.
- 411 6. Campbell K, Engel H, Timperio A, Cooper C, Crawford. Obesity Management:
412 Australian General Practitioners' attitudes and practices. *Obesity Research* 2000; **8** ,
413 459-466.
- 414 7. Thuan JF, Avignon A. Obesity management: attitudes and practices of French
415 general practitioners in a region of France. *Int J Obes* 2005; **29**, 1100-1106.
- 416 8. Al-Ghawi A, Uauy R. Study of the knowledge, attitudes and practices of physicians
417 towards obesity management in primary health care in Bahrain. *Pub Health Nutr*
418 2009; **12**, 1791-1798.
- 419 9. Fogelman Y, Vinker S, Lachter J, Biderman A, Itzhak B, Kitai E. Managing
420 obesity: a survey of attitudes and practices among Israeli primary care physicians.
421 *Int J Obes* 2002; **26**, 1393-1397.
- 422 10. Kristeller JL, Hoerr RA. Physician attitudes toward managing obesity:
423 differences among six speciality groups. *Prev Med* 1997; **26**, 542-549.
- 424 11. Chen Y, Henson S, Jackson AB, Richards JS. Obesity intervention in persons
425 with spinal cord injury. *Spinal Cord* 2006; **44**, 82-91.
- 426 12. Wong S, Graham A, Grimble, Forbes A. Spinal Clinic for Obese Out-patient
427 Project (SCOOP) – a 1 year report. *Food Nutr Sci* 2011; **2**, 901-907.

- 428 13. Joint Standard Development Groups of the South England Review Group
429 (2010) Standard for patients requiring spinal cord injury care (Revised 2010).
430 <http://www.secscg.nhs.uk/EasySiteWeb/getresource.axd?AssetID=99975&type=full>
431 [&servicetype=Attachment](http://www.secscg.nhs.uk/EasySiteWeb/getresource.axd?AssetID=99975&type=full&servicetype=Attachment) assessed 20 November 2010.
- 432 14. NHS England (2013) NHS standard contract for spinal cord injuries (all
433 ages). NHS England, Redditch. [http://www.england.nhs.uk/wp-](http://www.england.nhs.uk/wp-content/uploads/2013/06/d13-spinal-cord.pdf)
434 [content/uploads/2013/06/d13-spinal-cord.pdf](http://www.england.nhs.uk/wp-content/uploads/2013/06/d13-spinal-cord.pdf) [accessed 09.09.2013]
- 435 15. Gall A, Turner-Stokes L, Guideline Development Group. Chronic spinal cord
436 injury: management of patients in acute hospital settings. *Clin Med* 2008; **8**, 70-74.
- 437 16. National Research Ethics Service. Is Your Project Research? 2011.
438 <http://www.nres.nhs.uk/applications/is-your-project-research/> (accessed on
439 24June2013)
- 440 17. Spungen A, Bauman WA, Wang J, Pierson RN. The relationship between total
441 body potassium and resting energy expenditure in individuals with paraplegia. *Arch*
442 *Phys Med Rehabil* 1993; **66**, 420-426.
- 443 18. Mollinger LA, Spurr GB, El Ghatit AZ, Barboriak JJ, Rooney CB, Davidoff
444 DD, Bongard RD. Daily energy expenditure and basal metabolic rates of patients
445 with spinal cord injury. *Arch Phys Med Rehabil* 1985; **66**, 420-426.
- 446 19. Buchholz AC, Bugaresti JM. A review of body mass index and waist
447 circumference as markers of obesity and coronary heart disease risk in persons with
448 chronic spinal cord injury. *Spinal Cord* 2005; **43**, 513-518.
- 449 20. Laughton GE, Buchholz AC, Martin Ginis KA, Goy RE. Lowering body mass
450 index cutoffs better identifies obese persons with spinal cord injury. *Spinal Cord*
451 2009; **47**, 757-762.
- 452 21. Wong S, Barnes T, Coggrave M, Forbes A, Pounds-Cornish E, Appleton S,
453 Belci M (2013) Morbid obesity after spinal cord injury: an ailment not to be treated?
454 *Eur J Clin Nutr* 2013; **67**, 998-999.
- 455 22. Joint Standard Development Groups of the South England Review Group.
456 Standard for Patients Requiring Spinal Cord Injury Care (Revised 2010) 2010.
457 [http://www.secscg.nhs.uk/EasySiteWeb/getresource.axd?AssetID=99975&type=full](http://www.secscg.nhs.uk/EasySiteWeb/getresource.axd?AssetID=99975&type=full&servicetype=Attachment)
458 [ll&servicetype=Attachment](http://www.secscg.nhs.uk/EasySiteWeb/getresource.axd?AssetID=99975&type=full&servicetype=Attachment) (accessed 20 November 2013).

459 23. Thomas B, Bishop J. Manual of Dietetic Practice. Blackwell Publishing:
460 Oxford, 2007.

461 24. American Dietetic Association (2009) Spinal cord injury (SCI). Evidence-based
462 nutrition practice guideline. American Dietetic Association, Chicago.
463 <http://www.guideline.gov/content.aspx?id=14889> [accessed 20 Nov 2013]

464 25. Ferrante J, Piasecki AK, Ohman-Strickland PA, Crabtree BF. Family
465 Physicians' practices and attitudes regarding care of extremely obese patients.
466 *Obesity* 2009; **17**, 1710-1716.

467
468
469
470
471
472
473
474
475
476
477
478
479
480
481
482
483
484
485
486
487
488
489
490
491
492
493
494
495
496
497
498
499