Use of behaviour change techniques in lifestyle change interventions for people with intellectual disabilities: a systematic review

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Abstract

Background People with intellectual disabilities (ID) experience more health problems and have different lifestyle change needs, compared with the general population.

Aims To improve lifestyle change interventions for people with ID, this review examined how behaviour change techniques (BCTs) were applied in interventions aimed at physical activity, nutrition or physical activity and nutrition, and described their quality.

Methods and Procedures After a broad search and detailed selection process, 45 studies were included in the review. For coding BCTs, the CALO-RE taxonomy was used. To assess the quality of the interventions, the Physiotherapy Evidence Database (PEDro) scale was used. Extracted data included general study characteristics and intervention characteristics.

Outcomes and Results All interventions used BCTs, although theory-driven BCTs were rarely used. The most frequently used BCTs were 'provide information on consequences of behaviour in general' and 'plan social support/social change'. Most studies were of low quality and a theoretical framework was often missing.

Conclusion and implications This review shows that BCTs are frequently applied in lifestyle change interventions. To further improve effectiveness, these lifestyle change interventions could benefit from using a theoretical framework, a detailed intervention description and an appropriate and reliable intervention design which is tailored to people with ID.

What this paper adds

So far, lifestyle change interventions for people with ID do not seem to be very effective: not only are well-designed studies scarce but the description of the intervention content is often lacking sufficient detail to replicate or learn from the studies. This review aims to explore the use of behaviour change techniques (BCTs) in lifestyle interventions for people with ID. We identify key concepts, types of evidence and gaps in research, and provide recommendations for future research studies. Therefore, this review adds to existing knowledge by identifying how to improve the effectiveness of lifestyle interventions via the inclusion of BCTs.

Keywords: Intellectual disability, behaviour change technique, health promotion, lifestyle change intervention, physical activity, nutrition, Physiotherapy Evidence Database (PEDro) scale.

1. Introduction

People with intellectual disabilities (ID) experience up to twice as many health problems as the general population (Van Schrojenstein Lantman-De Valk & Walsh, 2008). They have very low physical activity levels (Temple, Frey, & Stanish, 2006; Hilgenkamp, Reis, Van Wijck, & Evenhuis, 2012) and both obesity and overweight are highly prevalent in this population (Melville, Hamilton, Hankey, Miller & Boyle, 2007; Waninge et al., 2013). Factors like low activity levels, use of medication causing weight gain and having Down syndrome (Hsieh, Rimmer, & Heller, 2014) are associated with higher rates of obesity in people with ID (Peterson, Janz, & Lowe, 2008). Physical inactivity, obesity and overweight cause serious health problems (WHO, 2009). Due to the health risks associated with physical inactivity and obesity, research on the promotion of physical activity and healthy eating habits for people with ID is necessary (Robertson et al., 2000).

Lifestyle change interventions, aimed at weight management in the general population, have found to be effective in managing weight (Loveman et al., 2011). However, minimal evidence is available for the effectiveness of lifestyle change interventions in ID populations (Brooker et al., 2015; Scott & Havercamp, 2016; Spanos et al., 2013). People with ID have different health promotion needs, compared to the general population (Robertson, 2000). They experience intrinsic barriers to a healthy lifestyle and lifestyle change as multimorbidity (Herman & Evenhuis, 2014) and barriers related to cognitive, behavioural and mobility impairments. In addition, persons with ID face many external barriers such as financial barriers, physical limitations and policy guidelines that limit health choices (Caton et al., 2012; Kuijken, Naaldenberg, Nijhuis-Van der Sande, & Van Schrojenstein-Lantman de Valk, 2016; Messent, Cooke & Long, 1999). As a contrast, the general population mostly experiences barriers as intrinsic to the individual, according to theoretical models of the determinants of physical activity (Robertson, 2000). Considering the cognitive impairments of people with ID and the barriers described above, programme materials have to be changed to be accessible for people with ID (Elinder, Bergström, Hagberg, Wihlman, & Hagströmer, 2010). Additionally, people with ID experience barriers to access lifestyle change services (Van Schrojenstein Lantman-De Valk & Walsh, 2008).

To improve the effectiveness of lifestyle change interventions for people with ID, it is necessary to identify the effective ingredients within interventions (Michie et al., 2011). However, reporting of intervention content in published articles is heterogeneous with regards to the used descriptions (Naaldenberg, Kuijken, Van Dooren, & Van Schrojenstein Lantman-De Valk, 2013) and is often undetailed (Michie, Fixen, Grimshaw, & Eccles, 2009). For the general population, behaviour change techniques (BCTs) have been found to be an effective component of interventions changing health behaviours (Bird et al. 2013, Greaves et al., 2011; Olander et al., 2013). Abrahams and Michie (2008) developed a 26-item taxonomy to categorize the BCTs. This taxonomy was later refined by Michie et al. (2011). Multiple reviews have used these taxonomies to review the BCTs in lifestyle change

interventions for the general population (Dombrowski et al., 2012; Malik, Blake & Suggs, 2014; Olander et al., 2013; Williams & French, 2011) and have informed the development of new interventions.

Although BCTs have been shown to be effective components of lifestyle change interventions for the general population, it is unclear whether these BCTs can be used in the same way in interventions for people with ID (Van Schijndel-Speet, 2015). The level of complexity and abstraction of some BCTs may complicate their use for this population, given the intellectual disabilities and special needs of people with ID (Robertson, 2000; Kuijken et al., 2015). Scott and Havercamp (2016) reviewed lifestyle change interventions for people with ID and described the content and structure of the interventions. However, they did not examine the BCTs used within the interventions. As a consequence, there is no research on BCTs as a possible effective ingredient used in lifestyle change interventions for people with ID. Therefore, this review will examine how BCTs are applied in lifestyle change interventions for people with ID and describes the quality of these studies.

2. Methods

2.1 Search strategy

An extensive search strategy (see Appendix A) was used to retrieve papers from the electronic databases Embase, Medline (OvidSP), Web of Science, Psychinfo (OvidSP), Cochrane, PubMed publisher and from Google Scholar. This search was conducted in March 2015 with an information specialist of the Erasmus MC University Medical Center Rotterdam. Reference lists from included papers (N=55) as well as from relevant review papers (n= 51) retrieved in the original dataset were hand searched for missed papers fulfilling the inclusion criteria.

2.2 Selection criteria for studies

2.2.1 Inclusion criteria

Papers were eligible if they discussed lifestyle change interventions for people with ID, in all age ranges, with all levels of ID. To be included in the review, the intervention had to target changes in physical activity (PA), nutrition (e.g. increasing levels of physical activity or fitness, improving nutrition habits, or reducing weight) or both physical activity and nutrition. In the paper, the authors had to state that the intervention program aimed to achieve a change in daily lifestyle. Only peer-reviewed journal articles, published between 2000 and 2015 and written in English were eligible for inclusion. Study outcomes had to include at least one aspect of participants' PA levels, cardiorespiratory fitness, body composition or dietary intake. Adherence to PA or nutrition programs was also considered a relevant outcome measure.

2.2.2 Exclusion criteria

Excluded were interventions focusing only on staff or caregivers of people with ID, and papers discussing interventions for people with autism, schizophrenia or other psychiatric disorders without explicitly mentioning ID. Papers with study outcomes on improving motor performance or skills, improving inflammation, oxidative stress, blood composition, or muscle mass, or solely improving other fitness components than cardiorespiratory fitness (such as strength, balance, flexibility, reaction time, speed, agility) or on cognitive outcomes, were excluded. Furthermore, interventions using lab-based training or exercise programs (as opposed to community-based) and interventions with hormone therapy or other medical treatment for weight control, or interventions focusing on smoking cessation, alcohol or drug use, were excluded. Studies with less than six participants were excluded because the results of small case studies are hard to interpret or generalise for the entire ID population. Review papers, conference abstracts and editorials were also excluded.

2.2.3 Screening process

In the first stage of the selection process, 10% of the title screening was conducted by two authors (Initials), resulting in 97.7 % agreement; the remaining 90% of titles were screened by one author (Initials). Screening all abstracts and, subsequently, completing inclusion checklists for the full-text papers were done by two authors (Initials) and disagreements were resolved by a consensus discussion. For two records the full-text article was unavailable, after the authors were contacted. Therefore, these articles were excluded. See Figure 1 for a flow diagram of the search process.

2.3 Data extraction

A data extraction form was developed and refined after testing on two randomly selected studies, by two authors (Initials). Two reviewers (Initials) independently performed both data extraction and the quality assessment. Results were compared and disagreements were resolved by consensus discussion. In the case of remaining uncertainty, a third author (Initials) was consulted. Multiple reports of the same intervention study were counted as two papers during the data extraction, but counted as one in the analysis, e.g. Bodde, Seo, Frey, Lohrmann and Van Puymbroeck (2012) and Bodde, Seo, Frey, Van Puymbroeck and Lohrmann (2012) concerned a study protocol and an outcome paper for the same study.

Data extracted from the papers were categorized as 1) General study characteristics (aim of intervention, study design, sample characteristics); 2) Intervention characteristics (short description, theoretical framework, setting, duration, frequency, intensity, deliverer and mode of delivery of intervention); and 3) Use of BCTs in the intervention.

For coding of the BCTs the Coventry Aberdeen London Refined (CALORE) taxonomy was used (Michie, Ashford, Sniehotta et al., 2011). This taxonomy consists of a 40-item list of theory-based definitions of behaviour change techniques that may be used in interventions aiming to improve

physical activity or nutrition. General study characteristics and intervention characteristics were extracted by one author (Initials) and BCTs were coded by two authors (Initials).

2.4 Quality assessment

The quality of the selected articles was assessed using the 10-point Physiotherapy Evidence Database (PEDro) scale (Maher, Sherrington, Herbert, Moseley, & Elkins, 2003; PEDro, 2015). The purpose of the PEDro scale is to support users to determine the internal and external validity of studies (PEDro, 2015; Sherrington, Herbert, Maher, & Moseley, 2000). The first criterion of the scale describes the study's external validity, but is not used calculating the final PEDro score. Criteria 2-9 describe the study's internal validity, while criteria 10 and 11 describe the interpretability of the results (Sherrington et al., 2000). The PEDro scale includes the following criteria: 1) eligibility criteria were specified 2) random allocation to groups 3) concealed allocation 4) similar groups at baseline regarding the most important prognostic indicators 5) blinding of all subjects 6) blinding of all therapists who administered the therapy 7) blinding of all assessors who measured at least one key outcome 8) measures of at least one key outcome were obtained from more than 85% of the subjects initially allocated to groups 9) all subjects for whom outcome measures were available received the treatment or control condition as allocated or, where this was not the case, data for at least one key outcome was analysed by 'intention to treat' 10) reported results of between-group statistical comparisons for at least one key outcome 11) both point measures and measures of variability are provided for at least one key outcome. The criteria are rated on a yes-no score and the total of yes-scores gives the PEDro scale score of the article (Sherrington et al., 2000). Detailed results of the PEDro assessment are provided in Supplementary Table S4.

2.5 Synthesis of results

Included articles were categorized together by their aim (e.g. physical activity, nutrition, or both physical activity and nutrition) in the result tables and the result section in the paper. The extracted data were organized in general characteristics, intervention characteristics, BCTs and PEDro quality scores.

3. Results

Table 1 provides an overview of the most important results, categorized by the aim of the studies to change physical activity, nutrition or both physical activity and nutrition. Table 2 shows the used BCTs in all of the interventions. Details of the results can be found in four supplemental tables. Table S1 provides an overview of the study characteristics. Table S2 gives detailed information of the intervention characteristics. Table S3 shows the ratings for all BCTs. Table S4 shows the results of the PEDro quality assessment.

3.1 General characteristics

The three categories of studies (aiming to promote physical activity, nutrition or both physical activity and nutrition) all showed considerable variation in the number of participants, ranging from six to 443 participants (Table 1). The population of the studies differed between the three study categories: most physical activity interventions (53%) and physical activity and nutrition interventions (87%) were designed for adults with ID, while a small majority of the nutrition interventions was designed for children or adolescents with ID (67%). The level of ID varied in all three study categories. Further details of the study characteristics are provided in supplementary Table S1.

3.2 Intervention characteristics

A case series was the most commonly used design in all three study categories (n=21) (Table 1). According to Reeves, Deeks, Higgins, and Wells (2008), a case series is a study that collects observations on a series of individuals, receiving the same intervention. These observations are made before and after an intervention, with no control group (Reeves et al., 2008). Another similarity in the three study categories was the lack of a theoretical framework to inform the design of the intervention (n=31). Only three studies mentioned the use of behaviour change techniques in the description of the intervention components (Beeken et al., 2013; Mitchell et al., 2013; Van Schijndel-Speet, Evenhuis, Van Empelen, Van Wijck, & Echteld, 2013). Two of these studies were aimed at physical activity (Mitchell et al., 2013; Van Schijndel-Speet, Evenhuis et al., 2013) and one aimed both physical activity and nutrition (Beeken et al., 2013) (Table S2). A few studies (n=16) included a follow-up period (Table 1 and S2). All studies used face-to-face delivery, except the physical activity intervention of Thomas & Kerr (2011), which was delivered by log-books. These log-books contained information about exercise and helped clients to set personal goals. Details of the intervention characteristics can be found in supplementary Table S2.

3.3 Behaviour change techniques

All of the interventions used at least one BCT. However, not all of the BCTs were used in the studies (Table 2) with 9/40 BCTs not used in any of the included studies. The studies in the both physical activity and nutrition intervention category (n=23) used the largest proportion of the BCTs, using 31 out of the 40 BCTs, while the physical activity interventions (n=15) used 22 different BCTs and the nutrition studies (n=3) used 12 different BCTs (Table 1). The mean number of BCTs used in the different categories of interventions was 5.9 (SD 4.0; Range 1-14) for the physical activity interventions, 5.3 (SD 5.10; Range 1-11) for the nutrition interventions and 7.8 (SD 3.8; Range 2-15) for the both physical activity and nutrition interventions. An overview of the ratings for BCTs used is provided in supplementary Table S3.

The three categories of studies all frequently used ‘Provide information on consequences of behaviour in general’ (n=27) and the ‘Social support’ BCT (n=26) but there was a wide variation in which BCTs

were commonly used (Table 2 and Table S3). 'Social support' means the help of others to achieve a target behaviour/ outcome. This will include support during interventions e.g., setting up a 'buddy' system or other forms of support and following the intervention including support provided by the individuals delivering the intervention, partner, friends, family (Michie et al., 2011). Physical activity interventions, and nutrition interventions both frequently used the BCT 'Instruction on how to perform the behaviour', but only 50% of the interventions to improve both physical activity and nutrition used this BCT (Table S3). The nutrition interventions and the both physical activity and nutrition interventions frequently used the BCT 'Provide information on consequences in general', but this BCT was used in less than half of the physical activity interventions.

3.4 PEDro quality scores

While most of the interventions in all three categories of studies were of low quality, the RCT studies (10/13) were of medium or even high quality, in the category of physical activity studies and the category of both physical activity and nutrition studies. None of the nutrition studies used an RCT design. All case series were of low quality, except for one physical activity study (Bodde, Seo, Frey, Lohrmann & Van Puymbroeck, 2012) and one both physical activity and nutrition study (Pett et al., 2013), which were of medium quality. The most common limitation was the same for all three categories of studies, namely insufficient blinding of patients/therapists/assessors. The results of the PEDro quality assessment are provided in Table S4.

4. Discussion

4.1 Principal findings

This systematic review aimed to identify the BCTs used in interventions targeting physical activity, nutrition or both physical activity and nutrition for people with ID, and to describe the quality of these interventions. All interventions used at least one BCT, but BCTs were rarely used within the context of a theoretical framework for intervention design. Given their complexity, it is still unclear to what extent BCTs are accessible for people with ID.

4.2 Behaviour change techniques

BCTs were used in all interventions, which may indicate that the importance of BCTs is recognized by researchers developing interventions. Several of the most commonly used BCTs are similar to facilitators of health behaviour for people with ID as reported by adults with ID (Kuijken et al, 2016) . For example, adults with ID reported that support from others, motivational support and environmental resources can facilitate health behaviour which reflects two of the most commonly used BCTs found in this review (Kuijken et al. 2016). In fact, most BCTs in this review are consistent with these facilitators, as they are aimed at providing social support or maintaining the motivation of participants. This suggests that the BCTs used in the studies included here meet the needs for health behaviour of people with ID.

However, many of the BCTs included in the CALORE taxonomy are complex and involve a significant amount of abstraction. This raises a question about the extent to which BCTs are accessible for people with ID. People with ID may experience challenges to interpret knowledge and may not be able to live healthy although they have the required knowledge (Kuijken et al., 2016). This might indicate that complex BCT's will not fit into the capabilities of people with ID, which may make these BCT's ineffective when included in lifestyle change interventions. For example, a trial of a walking intervention reported that, even with support from carers, most participants with ID were unable to use pedometers to self-monitor daily step count (Melville et al., 2015). This is particularly relevant because self-monitoring has been shown to be important to the effectiveness of lifestyle change interventions (Michie et al, 2009). It is recommended that researchers minimize and simplify the BCTs included in lifestyle change interventions for disadvantaged groups (Michie, Jochelson, Markham, & Bridle, 2009). However, many of the interventions used ten or more BCTs. To tailor lifestyle change interventions to the needs of people with ID, researchers should consider testing whether individual BCTs can be made accessible, for example via support from carers, or using assistive technology, and during the design phase of interventions give careful consideration to which, and how many, BCTs should be included.

4.3 Quality of the included studies

Low quality scores were found for a majority of the included lifestyle change interventions, as was also found in a previous review of Scott and Havercamp (2016). In line with another review, the most common limitation was blinding of participants, therapists and assessors (Ogg-Groenendaal et al., 2014). Additionally, data presentation was often incomplete and studies mostly failed to report accurate about recruitment of participants, drop-out rates and baseline similarities. This may result in different interpretations of the intervention content and issues with representativeness and generalisation of the findings. This is in line with a review of Scott and Havercamp (2016), which found that most lifestyle change interventions use weak designs. Weak designs made findings about effectiveness of the included studies less reliable since the design of the study is used to quantitatively test the study (Scott & Havercamp, 2016). Our findings correspond with the commentary that there is heterogeneity in reporting intervention content in lifestyle change research (Michie et al., 2011; Naaldenberg et al., 2013; Ogg-Groenendaal et al., 2014). Heterogeneity is also found for multiple study characteristics, like levels of disability, setting of the interventions, the targeted populations and the aimed lifestyle change (nutrition or PA, or both PA and nutrition). Only three studies were aimed at changing nutrition, which makes it hard to generalise the findings from this category of studies. This might indicate that lifestyle change is dependent on the specific social and cultural context, and therefore research in this field might need to be tailored to the specific situation and context of the people with ID. However, the majority of included studies do not properly describe context related characteristics, as mentioned above. Also, the varying level of disability could affect the efficacy of the studies, because the level of ID determines the

understanding of participants. Therefore, intervention content needs to be tailored to the capabilities of the participants.

Although a theoretical base is important for interventions in order to be effective and for understanding of the results, a majority of the included studies did not use any kind of theoretical framework. In addition, the BCTs were mostly used in an implicit way, not referring to any theoretical base nor describing the BCT explicitly. In the field of lifestyle change for the general population, the same lack of theoretical base has been found (Golley, Hendrie, Slater & Corsini, 2011). Furthermore, the RCT is the gold standard to evaluate lifestyle change interventions (Tones, 2000), but an RCT design was not often used in the included interventions. This could partly be explained by perceptions about the ethical issues surrounding the inclusion of people with ID in lifestyle change research. For example, the conflict between one's own autonomy to participate and the dependence on family and staff for participation (Naaldenberg et al., 2013; Maïano et al., 2014; Spanos, Melville, & Hankey, 2013). Also, previous research shows high drop-out rates and large amount of incomplete data in lifestyle change RCTs for people with ID (Bergström, Hagströmer, Hagberg, & Elinder, 2013; McDermott et al., 2012; Van Schijndel-Speet, Evenhuis, Van Wijck, Van Montfort, & Echteld, 2016), which may limit the generalizability of the results. Naaldenberg et al. (2013) called for greater use of other design studies, that can be implemented more easily, are less expensive and fit the ethical issues experienced in research for people with ID. However, people with ID are entitled to the same level of evidence-based healthcare as all citizens and the RCTs included in this review suggest that it is feasible to use this design to test the effectiveness of interventions, considering the mentioned difficulties.

4.4 Strengths and weaknesses of the review

A strength of this review is the systematic use of the CALO-RE taxonomy to research BCT intervention components. This systematic way of describing BCTs has been used in the general population (Birds et al., 2013) but not for people with ID. Another strength is the comprehensive search strategy, which gives a thorough overview of the field of lifestyle change for people with ID. Finally, the coding of the interventions was conducted independently by two authors, and then checked for any differences, which increased the reliability and therefore the quality of this review.

To examine the quality of the interventions, the Physiotherapy Evidence Database (PEDro) Scale was used whereby the quality coding was checked by two authors. This method increased the reliability of the coding and therefore the results of this review. The use of PEDro for various intervention designs caused a more general quality assessment, which may limit the possibility to assess the depth of the studies. However, a general quality assessment was most appropriate for this review, because we aimed to target the differences in quality between studies. Additionally, the use of various designs enables a more suitable overview of the actual situation in recent literature. An even more complete overview would have been provided if not only English articles would have been included in this review.

4.5 Implications for future research

A review of the evaluation of effectiveness of interventions is the logical next step to explore possible relationships between the use of certain BCTs in interventions and the effectiveness of these interventions. Furthermore, this field could benefit from interventions that are based on an explicitly mentioned theoretical framework, and a detailed description of intervention content would make a contribution to the existing knowledge. Since most studies included in this research were of poor quality researchers should aim to use rigorous designs to minimize the risk of bias.

4.6 Conclusion

Our findings suggest that the field of lifestyle change for people with ID lacks theory-driven interventions. Although the inclusion of BCTs can contribute to the quality and effectiveness of lifestyle change interventions, researchers should strive to include a detailed intervention description and use rigorous research methodologies.

4.7 Acknowledgements

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4.8 Competing interests

The authors declare that they have no competing interests.

5. References

Abraham, C., & Michie, S. (2008). A taxonomy of behaviour change techniques used in interventions. *Health Psychology, 27*(3), 379-387.

Alesi, M., & Pepi, A. (2015). Physical Activity Engagement in Young People with Down Syndrome: Investigating Parental Beliefs. *Journal of Applied Research in Intellectual Disabilities, 28*(2), 61-80.

Bartley, J. (2011). Promoting healthy eating and weight loss. *Learning Disability Practice,* 14(3), 12 -16.

Bartlo, P., & Klein, P.J. (2011). Physical activity benefits and needs in adults with intellectual disabilities: Systematic review of the literature. *American Journal on Intellectual and Developmental Disabilities, 116*(3), 220-232.

Beeken, R. J., Spanos, D., Fovargue, S., Hunter, R., Omar, R., Hassiotis, A., King, M., Wardle, J., & Croker, H. (2013). Piloting a manualised weight management programme (Shape Up-LD) for overweight and obese persons with mild-moderate learning disabilities: study protocol for a pilot randomised controlled trial. *Trials, 14*(1), 1-9.

Bergström, H., Hagströmer, M., Hagberg, J., & Elinder, L. S. (2013). A multi-component universal intervention to improve diet and physical activity among adults with intellectual disabilities in community residences: a cluster randomised controlled trial. *Research in Developmental Disabilities, 34*(11), 3847-3857.

Bird, E. L., Baker, G., Mutrie, N., Ogilvie, D., Sahlqvist, S., & Powell, J. (2013). Behavior change techniques used to promote walking and cycling: A systematic review. *Health psychology, 32*(8), 829.

Bodde, A. E., Seo, D. C., Frey, G. C., Lohrmann, D. K., & Van Puymbroeck, M. (2012). Developing a physical activity education curriculum for adults with intellectual disabilities. *Health Promotion Practice, 13*(1), 116-123.

Bodde, A. E., Seo, D. C., Frey, G. C., Van Puymbroeck, M., & Lohrmann, D. K., (2012). The effect of a designed health education intervention on physical activity knowledge and participation of adults with intellectual disabilities. *American Journal of Health Promotion, 26*(5), 313-316.

Brooker, K., Van Dooren, K., McPherson, L., Lennox, N., & Ware, R. (2015). Systematic review of interventions aiming to improve involvement in physical activity among adults with intellectual disability. *Journal of Physical Activity and Health, 12*(3), 434-444.

Caton S., Chadwick D., Chapman M., Turnbull S., Mitchell D. & Stansfield J. (2012) Healthy lifestyles for adults with intellectual disability: knowledge, barriers and facilitators. *Journal of Intellectual & Developmental Disability, 37*(3), 248–59.

Davison, K. K., Jurkowski, J. M., Li, K., Kranz, S., & Lawson, H. A. (2013). A childhood obesity intervention developed by families for families: results from a pilot study. *International Journal of Behavioral Nutrition and Physical Activity, 10*(3), 1-11.

Dombrowski, S. U., Sniehotta, F. F., Avenell, A., Johnston, M., MacLennan, G., & Araújo-Soares, V. (2012). Identifying active ingredients in complex behavioural interventions for obese adults with obesity-related co-morbidities or additional risk factors for co-morbidities: a systematic review. *Health Psychology Review, 6*(1), 7-32.

Elinder, L. S., Bergström, H., Hagberg, J., Wihlman, U., & Hagströmer, M. (2010). Promoting a healthy diet and physical activity in adults with intellectual disabilities living in community residences: Design and evaluation of a cluster-randomized intervention. *BMC Public Health, 10*(1), 761.

Frey, G. C., Buchanan, A. M., & Sandt, D. D. R. (2005). "I'd Rather Watch TV": An examination of physical activity in adults with mental retardation. *Mental Retardation, 43*(4), 241–254.

Golley, R. K., Hendrie, G. A., Slater, A., & Corsini, N. (2011). Interventions that involve parents to improve children's weight-related nutrition intake and activity patterns–what nutrition and activity targets and behaviour change techniques are associated with intervention effectiveness? *Obesity Reviews, 12*(2), 114-130.

Greaves, C. J., Sheppard, K. E., Abraham, C., Hardeman, W., Roden, M., Evans, P. H., & Schwarz, P. (2011). Systematic review of reviews of intervention components associated with increased effectiveness in dietary and physical activity interventions. *BMC public health, 11*(1), 119.

Hageman, P. A., & Thomas, V. S. (2002). Gait performance in dementia: The effects of a 6- week resistance training program in an adult day-care setting. *International Journal of Geriatric Psychiatry, 17*, 329–334.

Heller, T., Hsieh, K., & Rimmer, J. H. (2002). Barriers and supports for exercise participation among adults with Down syndrome. *Journal of Gerontological Social Work, 38*(1-2), 161–178.

Heller, T., Hsieh, K., & Rimmer, J. H. (2004). Attitudinal and psychosocial outcomes of a fitness and health education program on adults with Down syndrome. *American Journal on Mental Retardation, 109*(2), 175–185.

Heller, T., McCubbin, J. A., Drum, C., & Peterson, J. (2011) Physical activity and nutrition health promotion interventions: what is working for people with intellectual disabilities? *Intellectual and Developmental Disabilities*, *49*(1), 26–36.

Hermans, H., & Evenhuis, H. M. (2014). Multimorbidity in older adults with intellectual disabilities. *Research in Developmental Disabilities*, *35*(4), 776-783.

Hilgenkamp, T. I., Reis, D., van Wijck, R., & Evenhuis, H. M. (2012). Physical activity levels in older adults with intellectual disabilities are extremely low. *Research in Developmental Disabilities*, *33*(2), 477-483.

Hsieh, K., Rimmer, J. H., & Heller, T. (2014). Obesity and associated factors in adults with intellectual disability. *Journal of Intellectual Disability Research: JIDR*, *58*(9), 851-63.

Hubbard, K. L., Bandini, L. G., Folta, S. C., Wansink, B., & Must, A. (2014). The adaptation of a school based health promotion programme for youth with intellectual and developmental disabilities: a community-engaged research process. *Journal of Applied Research in Intellectual Disabilities*, *27*(6), 576-590.

James, A. S., & Shireman, T. I. (2010). Case Managers' and Independent Living Counselors' Perspectives on Health Promotion Activities for Individuals with Physical and Developmental Disabilities. *Journal of Social Work in Disability & Rehabilitation*, *9*(4), 274-288.

Jinks, A., Cotton, A., & Rylance, R. (2011). Obesity interventions for people with a learning disability: an integrative literature review. *Journal of Advanced Nursing*, *67*(3), 460-471.

Kuijken, N. M. J., Naaldenberg, J., Nijhuis-Van der Sanden, M. W., & Schrojenstein-Lantman de Valk, H. M. J. (2016). Healthy living according to adults with intellectual disabilities: towards tailoring health promotion initiatives. *Journal of Intellectual Disability Research*. In press.

Loveman, E., Frampton, G. K., Shepherd, J., Picot, J., Cooper, K., Bryant, J., Welch, K., Clegg, A. (2011). The clinical effectiveness and cost-effectiveness of long-term weight management schemes for adults: a systematic review. *Health Technology Assessment-Southampton*, *15*(2) 1-182.

Maïano, C., Normand, C. L., Aimé, A., & Bégarie, J. (2014). Lifestyle interventions targeting changes in body weight and composition among youth with an intellectual disability: A systematic review. *Research in Developmental Disabilities*, *35*(8), 1914-1926.

Maher, C. G., Sherrington, C., Herbert, R. D., Moseley, A. M., & Elkins, M. (2003). Reliability of the PEDro scale for rating quality of randomized controlled trials. *Physical Therapy*, *83*(8), 713 -721.

Malik, S. H., Blake, H., & Suggs, L. S. (2014). A systematic review of workplace health promotion interventions for increasing physical activity. *British Journal of Health Psychology, 19*(1), 149 -180.

McDermott, S., Whitner, W., Thomas-Koger, M., Mann, J. R., Clarkson, J., Barnes, T. L., Bao, H., & Meriwether, R. A. (2012). An efficacy trial of 'Steps to Your Health', a health promotion programme for adults with intellectual disability. *Health education journal, 71*(3), 278-290.

Melville, C. A., Hamilton, S., Hankey, C. R., Miller, S., & Boyle, S. (2007). The prevalence and determinants of obesity in adults with intellectual disabilities. *Obesity Reviews, 8*(3), 223-230.

Melville, C. A., Mitchell, F., Stalker, K., Matthews, L., McConnachie, A., Murray, H. M., Melling, C., & Mutrie, N. (2015). Effectiveness of a walking programme to support adults with intellectual disabilities to increase physical activity: walk well cluster-randomised controlled trial. *International Journal of Behavioral Nutrition and Physical Activity, 12*(1), 1-11.

Messent, P. R., Cooke, C., & Long, J. (1999). What choice: a consideration of the level of opportunity for people with mild and moderate learning disabilities to lead a physically active lifestyle. *British Journal of Learning Disabilities, 27*(2), 73–77.

Michie, S., Ashford, S., Sniehotta, F.F., Dombrowski, S.U., Bishop, A., & French, D.P. (2011). A refined taxonomy of behaviour change techniques to help people change their physical activity and healthy eating behaviours: The CALO-RE taxonomy. *Psychology & Health, 26*(11), 1479-1498.

Michie, S., Fixsen, D., Grimshaw, J. M., & Eccles, M. P. (2009). Specifying and reporting complex behaviour change interventions: The need for a scientific method. *Implementation Science, 4*(40), 1-6.

Michie, S., Jochelson, K., Markham, W. A., & Bridle, C. (2009). Low-income groups and behaviour change interventions: a review of intervention content, effectiveness and theoretical frameworks. *Journal of Epidemiology & Community Health, 63*(8), 610-622.

Mitchell, F., Melville, C., Stalker, K., Matthews, L., McConnachie, A., Murray, H., Walker, A., & Mutrie, N. (2013). Walk well: a randomised controlled trial of a walking intervention for adults with intellectual disabilities: study protocol. *BMC public health, 13*(1), 1-13.

Naaldenberg, J., Kuijken, N., van Dooren, K., & de Valk, H. V. S. L. (2013). Topics, methods and challenges in health promotion for people with intellectual disabilities: a structured review of literature. *Research in Developmental Disabilities, 34*(12), 4534-4545.

National Heart, Lung, and Blood Institute, & North American Association for the Study of Obesity. (2000). *The practical guide: Identification, evaluation, and treatment of overweight and obesity in adults.* Bethesda, Md.: National Heart, Lung, and Blood Institute.

Ogg-Groenendaal, M., Hermans, H., & Claessens, B. (2014). A systematic review on the effect of exercise interventions on challenging behavior for people with intellectual disabilities. *Research in Developmental Disabilities, 35*(7), 1507-1517.

Olander, E. K., Fletcher, H., Williams, S., Atkinson, L., Turner, A., & French, D. P. (2013). What are the most effective techniques in changing obese individuals' physical activity self-efficacy and behaviour: a systematic review and meta-analysis. *International Journal of Behavioral Nutrition and Physical Activity, 10*(29), 1-15.

Peterson, J. J., Janz, K. F., & Lowe, J. B. (2008). Physical activity among adults with intellectual disabilities living in community settings. *Preventive Medicine, 47*(1), 101-6.

Pett, M., Clark, L., Eldredge, A., Cardell, B., Jordan, K., Chambless, C., & Burley, J. (2013). Effecting healthy lifestyle changes in overweight and obese young adults with intellectual disability. *American Journal on Intellectual and Developmental Disabilities, 118*(3), 224-243.

Physiotherapy Evidence Database PEDro Scale. Retrieved July 10, 2015, from www.pedro.org.au

Reeves, B. C., Deeks, J. J., Higgins, J. P. T., & Wells, G. A. (2008). Chapter 13: Including non-randomized studies. In: Higgins, J. P. T., & Green, S. (Eds), *Cochrane Handbook for Systematic Reviews of Interventions*. Version 5.0.1 [updated September 2008]. The Cochrane Collaboration, 2008. Available from www.cochrane-handbook.org.

Robertson, J., Emerson, E., Gregory, N., Hatto, C., Turner, S., Kessissoglou, S., & Hallam, A. (2000). Lifestyle related risk factors for poor health in residential settings for people with intellectual disabilities. *Research in Developmental Disabilities, 21*(6), 469-86.

Rothman, A. J. (2004). Is there nothing more practical than a good theory? Why, innovations and advances in health behavior change will arise if interventions are used to test and refine theory. *International Journal of Behavioral Nutrition and Physical Activity, 1*(11), 1-7. (http://www.ijbnpa.org/content/1/1/11).

Scott, H. M., & Havercamp, S. M. (2016). Systematic Review of Health Promotion Programs Focused on Behavioral Changes for People With Intellectual Disability. *Intellectual and developmental disabilities, 54*(1), 63-76.

Sherrington, C., Herbert, R. D., Maher, C. G., & Moseley, A. M. (2000). PEDro. A database of randomized trials and systematic reviews in physiotherapy. *Manual Therapy, 5*(4), 223-226.

Spanos, D., Melville, C. A., & Hankey, C. R. (2013). Weight management interventions in adults with intellectual disabilities and obesity: a systematic review of the evidence. *Nutrition Journal*, *12*, 1-16.

Stanish, H. I., Temple, V. A., & Frey, G. C. (2006). Health-promoting physical activity of adults with mental retardation. *Mental Retardation and Developmental Disabilities Research Reviews, 12*(1), 13-21.

Temple, V. A., Frey, G. C., & Stanish, H. I. (2006). Physical activity of adults with mental retardation: review and research needs. *American Journal of Health Promotion, 21*(1), 2-12.

Thomas, G. R., & Kerr, M. P. (2011). Longitudinal follow-up of weight change in the context of a community-based health promotion programme for adults with an intellectual disability. *Journal of Applied Research in Intellectual Disabilities, 24*(4), 381-387.

Tones, K. (2000). Evaluating health promotion: a tale of three errors. *Patient Education and Counseling*, *39*(2), 227-236.

Ulrich, D. A., Burghardt, A. R., Lloyd, M., Tiernan, C., & Hornyak, J. E. (2011). Physical activity benefit of learning to ride a two-wheel bicycle for children with Down syndrome: a randomized trial. *Physical Therapy*, *91*(10), 1463-1477.

Van den Driessen Mareeuw, F. D., Vaandrager, L., Klerkx, L., Naaldenberg, J., & Koelen, M. (2015). Beyond bridging the know-do gap: a qualitative study of systemic interaction to foster knowledge exchange in the public health sector in The Netherlands. *BMC Public Health*, *15*(1), 1-15.

Van Schijndel-Speet, M. (2015, February 11). *An evidence-based Physical Activity and Fitness Programme for Ageing Adults with Intellectual Disabilities*. Erasmus University Rotterdam. Retrieved from http://hdl.handle.net/1765/77544

Van Schijndel-Speet, M., Evenhuis, H. M., Van Empelen, P., Van Wijck, R., & Echteld, M. A. (2013). Development and evaluation of a structured programme for promoting physical activity among seniors with intellectual disabilities: a study protocol for a cluster randomized trial. *BMC Public Health, 13*(1), 1-11.

Van Schijndel-Speet, M., Evenhuis, H. M., Van Wijck, R., Montfort, K. C. A. G. M., & Echteld, M. A. (2016). A structured physical activity and fitness programme for older adults with intellectual disabilities: results of a cluster-randomised clinical trial. *Journal of Intellectual Disability Research*. DOI:10.1111/jir.12267

Van Schijndel-Speet, M., Evenhuis, H. M., Van Wijck, R., Van Empelen, P., & Echteld, M. A. (2014). Facilitators and barriers to physical activity as perceived by older adults with intellectual disability. *Mental Retardation, 52*(3), 175-186.

Van Schrojenstein Lantman-De Valk, H. M. J., & Walsh, P. N. (2008). Managing health problems in people with intellectual disabilities. *British Medical Journal: BMJ, 8*(1), A2507.

Walsh, P. A. (2005). Ageing and health issues in intellectual disabilities. *Current Opinion in Psychiatry, 18*(5), 502–506.

Waninge, A., van der Putten, A. A., Stewart, R. E., Steenbergen, B., van Wijck, R., & van der Schans, C. P. (2013). Heart rate and physical activity patterns in persons with profound intellectual and multiple disabilities. *The Journal of Strength and Conditioning Research, 27*(11), 3150-3158.

WHO. (2009). *Global health risks: Mortality and burden of disease attributable to selected major risks.* Geneva, Switzerland: World Health Organization.

Williams, S. L., & French, D. P. (2011). What are the most effective intervention techniques for changing physical activity self-efficacy and physical activity behaviour—and are they the same? *Health Education Research, 26*(2), 308-322.

Wilson, J. J., O'Neill, B., Collins, E. G., & Bradley, J. (2014). Interventions to Increase Physical Activity in Patients with COPD: A Comprehensive Review. *COPD: Journal of Chronic Obstructive Pulmonary Disease, 12*(3), 332-343.

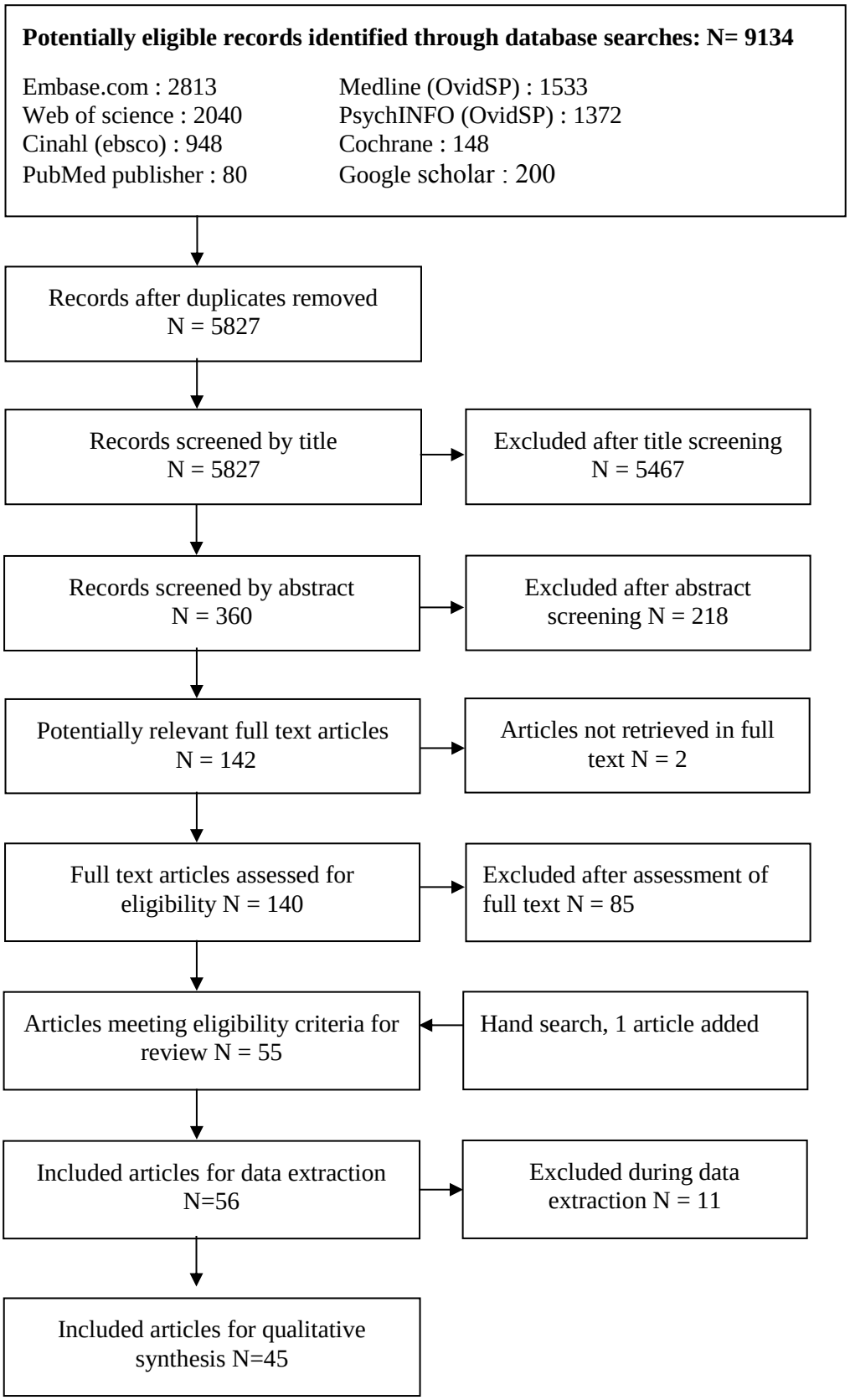

Figure 1 Flow diagram of selection process

	Studies aiming to improve physical activity (N=15)	*Studies aiming to improve nutrition (N=3)*	*Studies aiming to improve both physical activity and nutrition (N=23)*
General characteristics:			
Mean no of participants (range)	64 (8-191)	51 (12-89)	74 (6-443)
Most targeted population	Adults with ID (53%)	Youth/adolescents with ID (67%)	Adults with ID (87%)
Range of mean age (range of age)	12.2-41.3 (8-80+)	19-40.3 (9-63)	14.9-46.9 (10-71)
Most targeted level of ID (%)	Mild-moderate: (33%)	Mild-Moderate (33%)	Mild-Moderate (45%)
Sex, range of % of females	33-58	49-67	25-100
Most used intervention setting	Training facility (33%)	School (66%)	Home of participants (43%)
Intervention characteristics:			
Most used design	Case series (53%)	Case series (67%)	Case series (48%)
Use of any theoretical framework	None (73%)	None (100%)	None (74%)
Most used theoretical framework	Theory of planned behaviour and social cognitive theory (15%)	-	Social cognitive theory (26%)
Intervention duration range	1 week-24 months	6-12 months	6 weeks-24 months
Frequency of delivery per week range	2-5 days	0.5-5 days	0.25-7 days
Studies using follow-up	8 (53%)	0	8 (35%)
Range of follow-up period	10 weeks-12 months	-	2 weeks-4.5 years
Most used intervention delivery	Face-to-face (93%)	Face-to-face (100%)	Face-to-face (100%)
Behaviour Change Techniques:			
Mean no of used BCTs (SD) per study	5.9 (5.4)	5.3 (5.1)	7.8 (3.8)
Range of no of used BCTs per study	1-14	1-11	2-15

No of different BCTs used per category of studies (PA, nutrition or both of them)	22	12	31
PEDro quality assessment:			
Mean PEDro score (SD), range	3 (2.0), 1-8	1.7 (1.5), 0-3	2.8 (1.93), 0-6
Mean quality of interventions (PEDro)	Low quality	Low quality	Low quality

Table 1: Overview of the results, categorized by the aim of the studies

BCT	*Frequency*	*BCT*	*Frequency*
Provide information on consequences of behaviour in general	27	General communication skills training	5
Plan social support/social change	26	Prompt review of outcome goals	4
Provide instruction on how to perform the behaviour	23	Teach to use prompts/cues	4
Goal setting (behaviour)	19	Facilitate social comparison	4
Prompt practice	17	Stress management/emotional control training	4
Barrier identification/problem solving	15	Use of follow-up prompts	3
Prompt self-monitoring of behaviour	14	Prompt identification as role model/position advocate	3
Action planning	13	Prompting generalisation of a target behaviour	2
Model/demonstrate the behaviour	13	Provide information about others' approval	1
Provide feedback on performance	11	Shaping	1
Provide information on where and when to perform behaviour	10	Stimulate anticipation of future rewards	1
Provide rewards contingent on successful behaviour	9	Provide information on consequences of behaviour to the individual	0

Set graded tasks	9	Provide normative information about others' behaviour	0
Environmental restructuring	8	Agree behavioural contract	0
Prompt rewards contingent on effort or progress towards behaviour	7	Prompt anticipated regret	0
Prompt self-monitoring of behavioural outcome	7	Fear arousal	0
Relapse prevention/coping planning	8	Prompt self-talk	0
Prompt review of behavioural goals	6	Prompt use of imagery	0
Goal setting (outcome)	5	Motivational interviewing	0
Prompting focus on past success	5	Time management	0

Table 2: Overview of frequencies for used BCTs

Appendix A. Search string for database searches (2813 hits)

Embase.com

('mental deficiency'/exp OR 'intellectual impairment'/de OR (((mental* OR intellect*) NEXT/1 (deficien* OR handicap* OR disab* OR retard* OR impair* OR challenged)) OR (developmental NEXT/1 (disabilit* OR handicap* OR deficien*)) OR (Down* NEXT/1 syndrome*) OR 'prader willi'):ab,ti) AND (('lifestyle modification'/exp OR 'diet therapy'/de OR 'diet restriction'/exp OR 'low calory diet'/exp OR 'low carbohydrate diet'/exp OR 'low fat diet'/exp OR 'weight control'/exp OR 'weight reduction'/exp OR (((lifestyle* OR life-style OR calor* OR nutrition* OR diet*) NEAR/3 (rehab* OR modif* OR program* OR restrict* OR therap* OR treat*)) OR (low NEXT/1 (calor* OR carb* OR fat)) OR (weight NEAR/3 (loss OR losing OR reduction OR control*))):ab,ti) OR (('dietary intake'/de OR lifestyle/exp OR 'sedentary lifestyle'/exp OR 'body mass'/exp OR 'physical activity'/exp OR exercise/exp OR kinesiotherapy/exp OR 'treadmill exercise'/exp OR obesity/exp OR ('body mass' OR bmi OR lifestyle OR life-style OR obes* OR overweight* OR (physical* NEAR/3 activ*) OR exercise OR kinesiotherap* OR kinesitherap* OR swimming OR walking OR jogging OR running OR cycling OR treadmill OR ((diet* OR nutrient*) NEAR/3 intake*)):ab,ti) AND ('education program'/exp OR 'health education'/de OR 'health promotion'/de OR 'nutrition education'/de OR 'program development'/exp OR 'program evaluation'/exp OR 'health program'/exp OR 'intervention study'/exp OR 'randomized controlled trial'/exp OR (program* OR promoti* OR educat* OR interven* OR randomi* OR trial*):ab,ti))) NOT ([Conference Abstract]/lim OR [Letter]/lim OR [Note]/lim OR [Conference Paper]/lim OR [Editorial]/lim) AND [english]/lim NOT ([animals]/lim NOT [humans]/lim)

Medline (OvidSP)

(exp Intellectual Disability/ OR Mentally Disabled Persons/ OR (((mental* OR intellect*) ADJ (deficien* OR handicap* OR disab* OR retard* OR impair* OR challenged)) OR (developmental ADJ (disabilit* OR handicap* OR deficien*)) OR (Down* ADJ syndrome*) OR prader willi).ab,ti.) AND ((diet therapy/ OR diet therapy.xs. OR Caloric Restriction/ OR "Diet, Reducing"/ OR "Diet, Carbohydrate-Restricted"/ OR "Diet, Fat-Restricted"/ OR Weight Loss/ OR Weight Reduction Programs/ OR (((lifestyle* OR life-style OR calor* OR nutrition* OR diet*) ADJ3 (rehab* OR modif* OR program* OR restrict* OR therap* OR treat*)) OR (low ADJ (calor* OR carb* OR fat)) OR (weight ADJ3 (loss OR losing OR reduction OR control*))).ab,ti.) OR ((life style/ OR sedentary lifestyle/ OR body mass index/ OR exp exercise/ OR exp exercise therapy/ OR exp Overweight/ OR (body mass OR bmi OR lifestyle OR life-style OR obes* OR overweight* OR (physical* ADJ3 activ*) OR exercise OR kinesiotherap* OR kinesitherap* OR swimming OR walking OR jogging OR running OR cycling OR treadmill OR ((diet* OR nutrient*) ADJ3 intake*)).ab,ti.) AND (health

education/ OR "Patient Education as Topic"/ OR exp health promotion/ OR program development/ OR program evaluation/ OR intervention studies/ OR randomized controlled trial.pt. OR (program* OR promoti* OR educat* OR interven* OR randomi* OR trial*).ab,ti.))) NOT (letter OR news OR comment OR editorial OR congresses OR abstracts).pt. AND english.la. NOT (exp animals/ NOT humans/)

Cochrane

((((mental* OR intellect*) NEXT/1 (deficien* OR handicap* OR disab* OR retard* OR impair* OR challenged)) OR (developmental NEXT/1 (disabilit* OR handicap* OR deficien*)) OR (Down* NEXT/1 syndrome*) OR 'prader willi'):ab,ti) AND (((((lifestyle* OR life-style OR calor* OR nutrition* OR diet*) NEAR/3 (rehab* OR modif* OR program* OR restrict* OR therap* OR treat*)) OR (low NEXT/1 (calor* OR carb* OR fat)) OR (weight NEAR/3 (loss OR losing OR reduction OR control*))):ab,ti) OR ((('body mass' OR bmi OR lifestyle OR life-style OR obes* OR overweight* OR (physical* NEAR/3 activ*) OR exercise OR kinesiotherap* OR kinesitherap* OR swimming OR walking OR jogging OR running OR cycling OR treadmill OR ((diet* OR nutrient*) NEAR/3 intake*)):ab,ti) AND ((program* OR promoti* OR educat* OR interven* OR randomi* OR trial*):ab,ti)))

Web of science

TS=(((((mental* OR intellect*) NEAR/1 (deficien* OR handicap* OR disab* OR retard* OR impair* OR challenged)) OR (developmental NEAR/1 (disabilit* OR handicap* OR deficien*)) OR (Down* NEAR/1 syndrome*) OR "prader willi")) AND (((((lifestyle* OR life-style OR calor* OR nutrition* OR diet*) NEAR/3 (rehab* OR modif* OR program* OR restrict* OR therap* OR treat*)) OR (low NEAR/1 (calor* OR carb* OR fat)) OR (weight NEAR/3 (loss OR losing OR reduction OR control*)))) OR ((("body mass" OR bmi OR lifestyle OR life-style OR obes* OR overweight* OR (physical* NEAR/3 activ*) OR exercise OR kinesiotherap* OR kinesitherap* OR swimming OR walking OR jogging OR running OR cycling OR treadmill OR ((diet* OR nutrient*) NEAR/3 intake*))) AND ((program* OR promoti* OR educat* OR interven* OR randomi* OR trial*)))) NOT ((animal* OR rat OR rats OR mouse OR mice OR murine OR pig OR swine OR porcine) NOT (human* OR patient* OR person*)))

PubMed publisher

(Intellectual Disability[mh] OR Mentally Disabled Persons[mh] OR (mental deficien*[tiab] OR mental handicap*[tiab] OR mental disab*[tiab] OR mental retard*[tiab] OR mental impair*[tiab] OR mental challenged*[tiab] OR mentally deficien*[tiab] OR mentally handicap*[tiab] OR mentally disab*[tiab] OR mentally retard*[tiab] OR mentally impair*[tiab] OR mentally challenged*[tiab] OR intellectual deficien*[tiab] OR intellectual handicap*[tiab] OR intellectual disab*[tiab] OR intellectual retard*[tiab] OR intellectual impair*[tiab] OR intellectual challenged*[tiab] OR intellectually deficien*[tiab] OR intellectually handicap*[tiab] OR intellectually disab*[tiab] OR intellectually retard*[tiab] OR intellectually impair*[tiab] OR intellectually challenged*[tiab] OR developmental disabilit*[tiab] OR developmental handicap*[tiab] OR developmental deficien*[tiab] OR Down syndrome*[tiab] OR prader willi*[tiab])) AND ((diet therapy[mh] OR diet therapy[sh] OR Caloric Restriction[mh] OR "Diet, Reducing"[mh] OR "Diet, Carbohydrate-Restricted"[mh] OR "Diet, Fat-Restricted"[mh] OR Weight Loss[mh] OR Weight Reduction Programs[mh] OR (((lifestyle*[tiab] OR life-style OR calor*[tiab] OR nutrition*[tiab] OR diet*[tiab]) AND (rehab*[tiab] OR modif*[tiab] OR program*[tiab] OR restrict*[tiab] OR therap*[tiab] OR treat*[tiab])) OR low calor*[tiab] OR low carb*[tiab] OR low fat*[tiab] OR weight loss*[tiab] OR losing weight*[tiab] OR weight reduction*[tiab] OR weight control*[tiab])) OR ((life style[mh] OR sedentary lifestyle[mh] OR body mass index[mh] OR exercise[mh] OR exercise therapy[mh] OR Overweight[mh] OR (body mass OR bmi OR lifestyle OR life-style OR obes*[tiab] OR overweight*[tiab] OR (physical*[tiab] AND activ*[tiab]) OR exercise OR kinesiotherap*[tiab] OR kinesitherap*[tiab] OR swimming OR walking OR jogging OR running OR cycling OR treadmill OR ((diet*[tiab] OR nutrient*[tiab]) AND intake*[tiab])))) AND (health education[mh] OR "Patient Education as Topic"[mh] OR health promotion[mh] OR program development[mh] OR program evaluation[mh] OR intervention studies[mh] OR randomized controlled trial.pt. OR (program*[tiab] OR promoti*[tiab] OR educat*[tiab] OR interven*[tiab] OR randomi*[tiab] OR trial*[tiab])))) NOT (letter[pt] OR news[pt] OR comment[pt] OR editorial[pt] OR congresses[pt] OR abstracts[pt]) AND english[la] NOT (animals[mh] NOT humans[mh]) AND publisher[sb]

PsycINFO (OvidSP)

(exp Intellectual Development Disorder/ OR Cognitive Impairment/ OR (((mental* OR intellect*) ADJ (deficien* OR handicap* OR disab* OR retard* OR impair* OR challenged)) OR (developmental ADJ (disabilit* OR handicap* OR deficien*)) OR (Down* ADJ syndrome*) OR prader willi).ab,ti.) AND ((Weight Control/ OR Dietary Restraint/ OR Weight Loss/ OR Lifestyle Changes/ OR (((lifestyle* OR life-style OR calor* OR nutrition* OR diet*) ADJ3 (rehab* OR modif* OR program* OR restrict* OR therap* OR treat*)) OR (low ADJ (calor* OR carb* OR fat)) OR (weight ADJ3 (loss OR losing OR reduction OR control*))).ab,ti.) OR ((diets/ OR lifestyle/ OR body mass index/ OR exp exercise/ OR exp Overweight/ OR (body mass OR bmi OR lifestyle OR life-style

OR obes* OR overweight* OR (physical* ADJ3 activ*) OR exercise OR kinesiotherap* OR kinesitherap* OR swimming OR walking OR jogging OR running OR cycling OR treadmill OR ((diet* OR nutrient*) ADJ3 intake*)).ab,ti.) AND (health education/ OR "client Education"/ OR exp health promotion/ OR program development/ OR program evaluation/ OR intervention/ OR (program* OR promoti* OR educat* OR interven* OR randomi* OR trial*).ab,ti.))) NOT (letter OR news OR comment OR editorial OR congresses OR abstracts).pt. AND english.la. NOT (exp animals/ NOT humans/)

Cinahl (ebsco)

(MH "Intellectual Disability+" OR MH "Mentally Disabled Persons+" OR (((mental* OR intellect*) n1 (deficien* OR handicap* OR disab* OR retard* OR impair* OR challenged)) OR (developmental n1 (disabilit* OR handicap* OR deficien*)) OR (Down* n1 syndrome*) OR prader willi)) AND ((MH "diet therapy" OR MH "Restricted Diet+" OR MH "Diet, Fat-Restricted+" OR MH "Weight Loss+" OR MH "Weight Reduction Programs+" OR (((lifestyle* OR life-style OR calor* OR nutrition* OR diet*) N3 (rehab* OR modif* OR program* OR restrict* OR therap* OR treat*)) OR (low n1 (calor* OR carb* OR fat)) OR (weight N3 (loss OR losing OR reduction OR control*)))) OR ((MH "life style+" OR MH "body mass index+" OR MH exercise+ OR MH "Therapeutic Exercise+" OR MH obesity+ OR (body mass OR bmi OR lifestyle OR life-style OR obes* OR overweight* OR (physical* N3 activ*) OR exercise OR kinesiotherap* OR kinesitherap* OR swimming OR walking OR jogging OR running OR cycling OR treadmill OR ((diet* OR nutrient*) N3 intake*))) AND (MH "health education+" OR MH "Patient Education+" OR MH "health promotion+" OR MH "program development+" OR MH "program evaluation+" OR MH "Experimental Studies+" OR MH "Randomized Controlled Trials+" OR (program* OR promoti* OR educat* OR interven* OR randomi* OR trial*)))) NOT PT (letter OR news OR comment OR editorial OR congresses OR abstracts) AND LA english NOT (MH animals+ NOT humans+)

Google scholar

"mental|mentally|intellectual|intellectually deficiency|deficient|handicap|handicapped|disabled|impaired|retarded|retardation" lifestyle|"life style"|caloric|diet|"weight loss|reduction"|bmi|obesity|overweight program|promotion|education|intervention

Appendix B. Data Extraction Form

Author & record info	
Data extraction author name Date of data extraction Article record nor in Endnote Title Authors Year of publication	
GENERAL CHARACTERISTICS	
Intervention aimed at behavioural / lifestyle changes in	Physical activity, nutrition, both
Sample characteristics:	
Sample Size	Number of subjects, (if more groups, nor of subjects for each group)
Age	Mean age (if more groups, mean age for each group)
Age group	Children (<12), adolescents (12-18), adults (18-45), seniors (45+)
Sex	Percentage of females in sample (if more groups, % for each group)
Target group	describe; e.g. Individuals with ID, Down syndrome, Prader-Willy, developmental disorder, etc.
Level of ID	Borderline (IQ 70-80), mild (IQ 50-69), moderate (IQ 35- 49), severe (IQ < 35)
Study Design	Randomized controlled trial, non-randomized controlled trial, controlled before-and-after study, interrupted-time-series study, historically controlled study, cohort study, cross-sectional study, case series (uncontrolled longitudinal study), case-control study
Additional remarks on study design	
Additional remarks concerning General Characteristics	
INTERVENTION CHARACTERISTICS (partly based on Olander et al. 2013)	**instructions for author**
Description intervention	(short) the content or elements of the intervention

Intervention delivered by	e.g. Family/peers, Nurse, Health practitioner, Researcher….
Outcome measures	e.g. physical activity, weight loss, nutrition habits
Setting of intervention	e.g. Participants home, Sports centre, Hospital,
Duration of intervention	total duration of period in which intervention is given(e.g. 3 weeks, 12 weeks, 3 months)
The frequency of intervention?	(e.g., 3 times a week; twice a day)
The intensity of intervention?	contact time: duration per session (e.g. 1 hour)
The mode of delivery	(e.g., face-to-face or by telephone, web-based)
Theoretical basis mentioned?	Theoretical basis explicitly mentioned, some theory mentioned, no theoretical basis mentioned
Mentioned Theory	e.g. Social cognitive theory, self-determination theory….
Additional remarks concerning Intervention Characteristics	
PEDRO QUALITY ASSESSMENT.	
1 Eligibility criteria were specified.	Yes, No
2 Subjects were randomly allocated to groups (in a crossover study, subjects were randomly allocated an order in which treatments were received).	Yes, No
3 Allocation was concealed.	Yes, No
4 The groups were similar at baseline regarding the most important prognostic indicators.	Yes, No
5 There was blinding of all subjects.	Yes, No
6 There was blinding of all therapists who administered the therapy.	Yes, No
7 There was blinding of all assessors who measured at least one key outcome.	Yes, No
8 Measures of at least one key outcome were obtained from more than 85% of the subjects initially allocated to groups.	Yes, No
9 All subjects for whom outcome measures were available received the treatment or control condition as allocated or, where this was not the case, data for at least one key outcome was analysed by "intention to treat".	Yes, No
10 The results of between-group statistical comparisons are reported for at least one key outcome.	Yes, No
11 The study provides both point measures and measures of variability for at least one key outcome.	Yes, No
BEHAVIOR CHANGE TECHNIQUES	

(based on CALORE Taxonomy for behavioural change Techniques (Michie et al. 2011))	
1	Provide information on consequences of behaviour in *general*
2	Provide information on consequences of behaviour *to the individual*
3	Provide information about others' approval
4	Provide normative information about others' behaviour
5	Goal setting (behaviour)
6	Goal setting (outcome)
7	Action planning
8	Barrier identification/problem solving
9	Set graded tasks
10	Prompt review of behavioural goals
11	Prompt review of outcome goals
12	Prompt rewards contingent on effort or progress towards behaviour
13	Provide rewards contingent on successful behaviour
14	Shaping
15	Prompting generalization of a target behaviour
16	Prompt self-monitoring of behaviour
17	Prompt self-monitoring of behavioural outcome
18	Prompting focus on past success
19	Provide feedback on performance
20	Provide information on *where and when* to perform behaviour
21	Provide instruction on how to perform the behaviour
22	Model/demonstrate the behaviour
23	Teach to use prompts/cues
24	Environmental restructuring
25	Agree behavioural contract
26	Prompt practice
27	Use of follow-up prompts
28	Facilitate social comparison
29	Plan social support/social change
30	Prompt identification as role model/position advocate

31	Prompt anticipated regret
32	Fear arousal
33	Prompt self-talk
34	Prompt use of imagery
35	Relapse prevention/coping planning
36	Stress management/emotional control training
37	Motivational interviewing
38	Time management
39	General communication skills training
40	Stimulate anticipation of future rewards

Study	*Year*	*Setting*	*Population*	*N*	*Age (M)*	*Level of ID*	*Sex (%F)*
	Interventions aimed at physical activity (15)						
Podgorski	2004	Day habilitation setting	Older adults with ID	12	40-80+	All levels. Mild= 40%; Moderate=13.3%; Severe= 20.0%; Profound=26.7%	46.7
Jones	2007	Residential facility	People with ID	8	41.3 (SD= 6.5)	Severe (100%)	Unknown
Pitetti	2007	Gymnasium	Adolescents/youth with severe developmental disabilities	10	17 (14-19 years, SD= 1.9)	Moderate-severe. Mild I= 10%; Severe= 60%; ID unclassified= 20%; Asperger syndrome=10%	40
Geller	2009	Community health centre	Overweight adults with developmental delay	43	42.6	All levels	58.1
Temple	2011	YMCA fitness centre	Youth with ID in the community	20	17.8 (15-21 years, SD= 1.6)	Mild (100%)	50
Thomas	2011	Unknown	Adults with ID	191	42 (19-72 years)	Unknown	38.2
Ulrich	2011	Training facility	Children (8-15 years) with Down Syndrome	46	12.2 (8-15)	Unknown	56.5
Bodde[1]	2012	Agencies that serve adults with ID	Ambulatory adults with ID	42	38.8 (19-62 years)	Mild-moderate	50
Stanish	2012	YMCA Branches	Adolescents with ID	20	17.8 (15-21 years, SD= 1.6)	Mild-moderate	50
Yen	2012	Institution	Adults with ID, living in institution	135	33.7 (19-67 years, SD= 10.0)	All levels. Mild= 3.6%; Moderate= 30.4%; Severe =31.9%; Profound= 34.15	33.3
Mitchell	2013	Participant's home	Adults with ID	Protocol	Protocol	All levels	Protocol
Perez-Cruzado	2013	Occupational centre	People with ID	Protocol	Protocol	Mild-moderate	Protocol
Shields[2]	2013	Gymnasium	Adolescents with Down Syndrome	68	17.9 (14-22 years, SD= 2.6)	Mild-moderate. Mild=50%; Moderate=50%	44
Lante	2014	Local community settings	Adults with ID	90	18-55 years	Unknown	Unknown
Van Schijndel-Speet[3]	2014	Day activity centre	Older individuals with ID	146	44+ years	Mild-moderate	Unknown
	Interventions aimed at nutrition (3)						
Bartley	2011	Day centre	People with ID	12	40.3 (25-63 years, SD= 11.4)	Unknown	67
Wallén	2013	Upper secondary school	Students with ID	89	19 (16-21 years, SD=1)	Mild-moderate	49

[1] These results are combined with the process evaluation paper from Bodde et al. (2012) describing the same study.
[2] These results are combined with the protocol paper from Shields et al. (2010) describing the same study.
[3] These results are combined with the protocol paper from Van Schijndel-Speet et al. (2013) describing the same study.

Hubbard	2014	Private specialized residential school	Students with I/DD	Unknown	9-22 years	Unknown	Unknown
Interventions aimed at both physical activity and nutrition (23)							
Cluphf	2001	Sheltered workshop	Adults with ID	27	38.0	Mild (100%)	44.4
Marshall	2003	Several locations	Overweight people with ID	20	10 years and over	Unknown	Unknown
Ewing	2004	Primary care setting	Individuals with ID	92	39.7 (SD=11.5)	All levels	54.4
Bradley	2005	Unknown	Overweight women with ID	9	Unknown	Unknown	100
Chapman	2005	Participant's home	Individuals with ID	72	40.7 (19-70 years)	Unknown	43
Mann	2006	Community disability service	Overweight adults with ID	192	38.6 (SD = 11.5)	Mild-moderate	66.7
Sailer	2006	Human service centre	Obese individuals with ID	6	46 (34-54 years, SD= 7.7)	Mild (100%)	67
Chapman	2008	Participant's home	Adults with ID	73	46.9	Unknown	41
Bazzano	2009	Community locations	Overweight adults with ID	44	18–59 years	Unknown	61.4
Melville	2011	Participants home	Adults with ID and obesity	54	45.3 (23–71 years, SD= 12.01)	All levels	59.3
Saunders	2011	Unknown	Overweight adults with ID	73	18-62 years	Unknown	59
Casey	2012	25m pool	Adults with ID	8	41 (21-57 years, SD= 13.7)	Unknown	25
McDermott	2012	Local disability agency service facilities	Individuals with ID	443	38.8 (19-70 years)	Mild-moderate	50.3
Wilhite	2012	Unknown	Adults with IDD	16	40.4 (22-69 years)	Mild-moderate	75
Beeken	2013	Day centres	Overweight persons with ID	Protocol	Protocol	Mild-moderate	Protocol
Bergstrom[4]	2013	Residence	Adults with ID living in residences	129	37.8 (20-66 years)	Mild-moderate	56.9
Curtin	2013	Unknown	Adolescents and young adults with down syndrome	21	20.5 (13-26 years, SD= 3.2)	Mild-moderate	81.0
Donnelly	2013	Participant's home	Overweight adults with ID and DD	150	18 years and over	Mild-moderate	Design/rationale

[4] These results are combined with the protocol paper from Elinder et al. (2010) describing the same study.

Marks	2013	Community-based organisations	Adults with ID	67	45.2 (31-64 years, SD=7.6)	Mild-moderate	52
Pett	2013	Recreation centre	Obese home dwelling young adults with ID	30	24.2 (18-33 years, SD= 4.2)	Mild-moderate	60
Wallén	2013	Upper secondary school	Students with ID	27	20.7 (19.2-21.8 years)	Mild-moderate	33.3
Spanos	2014	Participant's home	Adults with ID	52	51 (26-73 years)	Mild, moderate, severe	60.9
Ptomey	2015	Participants home	Adolescents with IDD with overweight	22	14.9 (11-18 years, SD= 2.2)	Mild-moderate. Mild= 60%; Moderate=40%	45

Supplemental Table 1: General characteristics

Study	*Year*	*Design*	*Theoretical framework*	*Delivery*	*Number/ frequency per week*	*Intervention duration (weeks)*	*Follow-up*
			Interventions aimed at physical activity (15)				
Podgorski	2004	Case series	None	Face-to-face, group	4	12	9 months
Jones	2007	Case series	None	Face-to-face	3-5	16	3 months
Pitetti	2007	Non-RCT	None	face-to-face, group	3	9 months	None
Geller	2009	Case series	None	Face-to-face, group and individually	2	13,5 months	None
Temple	2011	Case series	None	Face-to-face, group	2	15	None
Thomas	2011	Case series	None	logbooks	Unknown	24 months	None
Ulrich	2011	RCT	Dynamic systems theory	Face-to-face	5 consecutive days	5 consecutive days	12 months
Bodde[5]	2012	Case series	Theory of planned behaviour	Face-to-face, group	8 sessions in total	Unknown	None
Stanish	2012	Case series	None	Face-to-face with peer partner	2	15	None
Yen	2012	Case series	None	Face-to-face	4	9 months	None
Mitchell	2013	RCT	Social cognitive theory, Behaviour change techniques, transtheoretical model	Face-to-face, individually	3 times	12	3 months
Perez-Cruzado	2013	RCT	None	Face-to-face, group	2	26	10 weeks
Shields[6]	2013	RCT	None	Face-to-face, group	2	10	14 weeks
Lante	2014	RCT	None	Face-to-face	Group 1: 1 group 2: 3	12	6 months
Van Schijndel[7]	2014	RCT	Behaviour change techniques, Theory of planned behaviour, Social cognitive theory	Face-to-face	3	32	6 months
			Interventions aimed at nutrition (3)				
Bartley	2011	Case series	None	Face-to-face, group	0,5 (once in 2 weeks)	12 months	None

[5] These results are combined with the process evaluation paper from Bodde et al. (2012) describing the same study.
[6] These results are combined with the protocol paper from Shields et al. (2010) describing the same study.
[7] These results are combined with the protocol paper from Van Schijndel-Speet et al. (2013) describing the same study.

Wallén	2013	Controlled before-and-after study	None	Face-to-face	5	6 months	None
Hubbard	2014	Case series	None	Face-to-face	Unknown	Unknown	None
			Interventions aimed at both physical activity and nutrition (23)				
Cluphf	2001	Non-RCT	None	Face-to-face, group	3	12	6 weeks
Marshall	2003	Case series	None	Face-to-face	1	6-8	None
Ewing	2004	Non-RCT	None	Face-to-face, group	1	8	None
Bradley	2005	Case series	None	Face-to-face, group	1	12 months	None
Chapman	2005	Controlled before-and-after study	None	Face-to-face, individually	Unknown	12 months	None
Mann	2006	Case series	None	Face-to-face, group	1	9	None
Sailer	2006	Case series	None	Face-to-face, group	1	10	2, 3 and 4 weeks
Chapman	2008	Controlled before-and-after study	None	Face-to-face	4-5 per year	18 months	4,5 years
Bazzano	2009	Case series	Social cognitive theory	Face-to-face	2	7 months	None
Melville	2011	Case series	None	Face-to-face, individually	1 in 2-3 weeks	24	None
Saunders	2011	Case series	None	Face-to-face, individually	Monthly	6 months	6 months
Casey	2012	Case series	None	Face-to-face	4	13	None
McDermott	2012	RCT	Social cognitive theory	Face-to-face, group	1	8	10 months
Wilhite	2012	Case series	None	Face-to-face, individually	3	12	None
Beeken	2013	RCT	Social cognitive theory, control theory, Behaviour change techniques	Face-to-face, group	1	12	3 months
Bergstrom[8]	2013	RCT	Social cognitive theory	Face-to-face, group	10 sessions	12-16 months	None
Curtin	2013	RCT	None	Face-to-face, group	1	6 months	6 months
Donnelly	2013	RCT	None	Face-to-face	5-7	18	None

[8] These results are combined with the protocol paper from Elinder et al. (2010) describing the same study.

Marks	2013	RCT	Transtheoretical model, social cognitive theory	Face-to-face	3	12	None
Pett	2013	Case series	Transtheoretical model, social cognitive theory, Bronfenbrenner ecological theory of human development	Face-to-face	2	12	3 months
Wallén	2013	Historically controlled study	None	Face-to-face	2-3	24 months	None
Spanos	2014	Case series	None	Face-to-face, individually	9 sessions	16	None
Ptomey	2015	RCT	None	Face-to-face	1	8	None

Supplemental Table 2: Intervention Characteristics

Study	*Year*	*Information in general*	*Information to the individual*	*Information others' approval*	*Normative information others' behaviour*	*Goal setting (behaviour)*	*Goal setting (outcome)*	*Action Planning*	*Barrier identification*	*Graded tasks*	*Review behavioural goals*	*Review outcome goals*	*Rewards behaviour*	*Rewards successful behaviour*
		Interventions aimed at physical activity (15)												
Podgorski	2004	-	-	-	-	-	-	-	-	-	-	-	-	-
Jones	2007	-	-	-	-	-	-	YES	-	-	-	-	-	-
Pitetti	2007	-	-	-	-	YES	-	-	-	YES	YES	-	-	-
Geller	2009	YES	-	-	-	-	-	YES	-	-	-	-	-	-
Temple	2011	-	-	-	-	YES	-	-	YES	-	-	-	-	-
Thomas	2011	YES	-	-	-	YES	-	-	-	-	-	-	-	YES
Ulrich	2011	-	-	-	-	-	-	-	-	YES	-	-	-	-
Bodde[9]	2012	YES	-	-	-	-	-	-	YES	-	-	-	-	-
Stanish	2012	-	-	-	-	YES	-	YES	YES	YES	-	-	-	-
Yen	2012	-	-	-	-	-	-	-	-	-	-	-	-	-
Mitchell	2013	YES	-	-	-	YES	-	YES	YES	YES	YES	-	YES	-
Perez-Cruzado	2013	YES	-	-	-	-	-	-	-	-	-	-	-	-
Shields[10]	2013	-	-	-	-	-	-	-	YES	YES	-	-	-	-
Lante	2014	-	-	-	-	YES	-	YES	-	-		-	-	-
Van Schijndel[11]	2014	YES	-	-	-	YES	-	YES	YES	YES	-	-	YES	YES
		Interventions aimed at nutrition (3)												
Bartley	2011	YES	-	-	-	-	-	-	-	-	-	-	YES	YES
Wallén	2013	YES	-	-	-	-	-	-	-	-	-	-	-	-
Hubbard	2014	-	-	-	-	-	-	-	-	-	-	-	-	-
		Interventions aimed at both physical activity and nutrition (23)												
Cluphf	2001	-	-	-	-	-	-	-	-	-	-	-	YES	YES

[9] These results are combined with the process evaluation paper from Bodde et al. (2012) describing the same study.
[10] These results are combined with the protocol paper from Shields et al. (2010) describing the same study.
[11] These results are combined with the protocol paper from Van Schijndel-Speet et al. (2013) describing the same study.

Marshall	2003	YES	-	-	-	-	-	-	-	-	-	-	-	-
Ewing	2004	YES	-	-	-	-	-	YES	YES	-	-	-	-	-
Bradley	2005	YES	-	-	-	-	-	-	-	-	-	-	-	-
Chapman	2005	YES	-	-	-	-	-	YES	YES	-	-	-	-	-
Mann	2006	YES	-	-	-	-	-	-	-	-	-	-	-	-
Sailer	2006	YES	-	-	-	-	YES	-	-	-	-	YES	YES	YES
Chapman	2008	YES	-	-	-	-	-	YES	-	-	-	-	-	-
Bazzano	2009	YES	-	-	-	-	-	-	-	-	-	-	-	YES
Melville	2011	YES	-	-	-	YES	YES	-	YES	YES	YES	YES	-	-
Saunders	2011	-	-	-	-	YES	-	-	YES	-	-	-	-	YES
Casey	2012	YES	-	-	-	YES	YES	-	-	YES	-	-	YES	-
McDermott	2012	YES	-	-	-	-	-	-	YES	-	-	-	-	-
Wilhite	2012	YES	-	-	-	YES	-	YES	-	-	YES	-	-	YES
Beeken	2013	YES	-	-	-	YES	-	-	-	-	-	-	-	-
Bergstrom[12]	2013	YES	-	YES	-	YES	-	YES	-	-	-	-	-	-
Curtin	2013	YES	-	-	-	YES	-	YES	-	-	-	-	YES	-
Donnelly	2013	YES	-	-	-	YES	YES	-	YES	-	YES	YES	-	YES
Marks	2013	YES	-	-	-	YES	-	-	YES	-	-	-	-	-
Pett	2013	YES	-	-	-	YES	-	-	YES	-	-	-	-	-
Wallén	2013	YES	-	-	-	-	-	-	-	-	-	-	-	-
Spanos	2014	-	-	-	-	YES	-	YES	-	-	-	-	-	-
Ptomey	2015	-	-	-	-	YES	YES	-	YES	YES	YES	YES	-	-
Total	-	*27*	*0*	*1*	*0*	*19*	*5*	*13*	*15*	*9*	*6*	*4*	*7*	*9*

[12] These results are combined with the protocol paper from Elinder et al. (2010) describing the same study.

Study	*Year*	*Shaping*	*Generali-sation of target behaviour*	*Self-monitoring of behaviour*	*Self-monitoring of outcome*	*Focus on past success*	*Feedback on perfor-mance*	*Informatio n where and when to perform behaviour*	*Instruction on how to perform the behaviour*	*Model/ demonstra te behaviour*	*Teach to use prompts /cues*	*Environmenta l restructuring*	*Behaviour-al contract*	*Prompt practice*
		Interventions aimed at physical activity (15)												
Podgorski	2004	-	-	-	-	-	-	-	-	YES	-	-	-	-
Jones	2007	-	-	-	-	-	-	YES	YES	-	-	-	-	-
Pitetti	2007	-	-	-	-	-	-	YES	YES	YES	-	-	-	YES
Geller	2009	-	-	-	-	-	-	-	-	-	-	-	-	-
Temple	2011	-	-	YES	-	-	YES	-	YES	-	-	-	-	-
Thomas	2011	-	-	-	-	-	-	-	-	-	-	-	-	-
Ulrich	2011	-	YES	-	-	-	-	-	YES	-	-	-	-	YES
Bodde[13]	2012	-	-	-	-	YES	-	YES	YES	YES	YES	-	-	YES
Stanish	2012	-	-	YES	-	-	YES	-	YES	-	-	-	-	-
Yen	2012	-	-	-	-	-	-	YES	-	-	-	-	-	-
Mitchell	2013	-	-	YES	-	-	-	YES	YES	YES	-	YES	-	-
Perez-Cruzado	2013	-	-	YES	-	-	-	-	-	-	YES	-	-	-
Shields[14]	2013	-	-	YES	-	-	-	-	YES	-	-	-	-	YES
Lante	2014	-	-	-	-	-	-	-	-	YES	-	-	-	-
Van Schijndel[15]	2014	-	-	-	-	-	YES	-	YES	YES	-	-	-	YES
		Interventions aimed at nutrition (3)												
Bartley	2011	-	-	-	YES	-	YES	-	YES	YES	-	-	-	YES
Wallen	2013	-	-	-	-	-	-	-	YES	-	-	YES	-	-
Hubbard	2014	-	-	-	-	-	-	-	-	-	-	YES	-	-
		Interventions aimed at both physical activity and nutrition (23)												

[13] These results are combined with the process evaluation paper from Bodde et al. (2012) describing the same study.
[14] These results are combined with the protocol paper from Shields et al. (2010) describing the same study.
[15] These results are combined with the protocol paper from Van Schijndel-Speet et al. (2013) describing the same study.

Cluphf	2001	-	-	-	-	-	-	-	-	-	-	-	-	-
Marshall	2003	-	-	-	YES	-	-	-	-	-	-	-	-	-
Ewing	2004	-	-	-	-	YES	-	-	YES	-	-	-	-	YES
Bradley	2005	-	-	-	YES	-	-	-	-	YES	-	-	-	-
Chapman	2005	-	-	-	-	-	-	-	-	-	-	-	-	-
Mann	2006	-	-	-	-	-	YES	YES	-	YES	-	-	-	YES
Sailer	2006	-	YES	YES	YES	-	YES	YES	YES	YES	-	-	-	YES
Chapman	2008	-	-	-	-	-	-	-	YES	-	-	-	-	-
Bazzano	2009	-	-	-	-	-	-	-	YES	YES	-	-	-	YES
Melville	2011	-	-	YES	YES	-	YES	YES	-	-	YES	YES	-	-
Saunders	2011	-	-	YES	YES	-	YES	-	YES	-	-	-	-	-
Casey	2012	-	-	-	-	-	YES	-	YES	-	-	-	-	-
McDermott	2012	-	-	-	-	YES	-	-	-	-	-	-	-	YES
Wilhite	2012	-	-	YES	-	-	-	-	YES	-	-	-	-	YES
Beeken	2013	-	-	YES	-	-	-	-	YES	-	-	-	-	-
Bergstrom[16]	2013	-	-	-	-	-	-	-	YES	-	-	YES	-	YES
Curtin	2013	-	-	YES	-	YES	-	-	YES	YES	-	YES	-	YES
Donnelly	2013	YES	-	YES	-	-	YES	-	-	-	-	-	-	-
Marks	2013	-	-	-	-	-	-	YES	YES	-	-	-	-	YES
Pett	2013	-	-	-	-	YES	-	-	-	YES	-	YES	-	YES
Wallen	2013	-	-	-	-	-	-	-	-	-	-	-	-	YES
Spanos	2014	-	-	YES	-	-	-	YES	YES	-	-	-	-	-
Ptomey	2015	-	-	YES	YES	-	YES	-	-	-	YES	YES	-	-
Total	-	*1*	*2*	*14*	*7*	*5*	*11*	*10*	*23*	*13*	*4*	*8*	*0*	*17*

[16] These results are combined with the protocol paper from Elinder et al. (2010) describing the same study.

Study	*Year*	*Use of follow-up prompts*	*Facilitate social comparison*	*Plan social support/ social change*	*Identifi-cation as role model*	*Prompt antici-pated regret*	*Fear arousal*	*Self-talk*	*Use of imagery*	*Relapse prevention /coping planning*	*Stress management /emotional control training*	*Motivational interviewing*	*Time manage-ment*	*General commu-nication skills training*	*Stimulate anticipation of future rewards*
		Interventions aimed at physical activity (15)													
Podgorski	2004	-	YES	-	-	-	-	-	-	-	-	-	-	-	-
Jones	2007	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pitetti	2007	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Geller	2009	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Temple	2011	-	-	YES	-	-	-	-	-	-	-	-	-	YES	-
Thomas	2011	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ulrich	2011	-	-	YES	-	-	-	-	-	-	-	-	-	-	-
Bodde[17]	2012	-	-	YES	-	-	-	-	-	-	-	-	-	YES	-
Stanish	2012	-	-	YES	-	-	-	-	-	-	-	-	-	-	-
Yen	2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mitchell	2013	-	-	YES	-	-	-	-	-	YES	-	-	-	-	-
Perez-Cruzado	2013	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Shields[18]	2013	-	-	YES	-	-	-	-	-	-	-	-	-	-	-
Lante	2014	-	-	YES	-	-	-	-	-	-	-	-	-	-	-
Van Schijndel[19]	2014	-	YES	YES	-	-	-	-	-	-	-	-	-	-	-
		Interventions aimed at nutrition (3)													
Bartley	2011	YES	YES	YES	-	-	-	-	-	-	-	-	-	-	-
Wallen	2013	-	-	YES	-	-	-	-	-	-	-	-	-	-	-
Hubbard	2014	-	-	-	-	-	-	-	-	-	-	-	-	-	-

[17] These results are combined with the process evaluation paper from Bodde et al. (2012) describing the same study.
[18] These results are combined with the protocol paper from Shields et al. (2010) describing the same study.
[19] These results are combined with the protocol paper from Van Schijndel-Speet et al. (2013) describing the same study.

Interventions aimed at both physical activity and nutrition (23)															
Cluphf	2001	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Marshall	2003	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ewing	2004	-	-	YES	-	-	-	-	-	YES	YES	-	-	YES	-
Bradley	2005	-	-	YES	-	-	-	-	-	-	-	-	-	-	-
Chapman	2005	-	-	YES	-	-	-	-	-	-	-	-	-	-	-
Mann	2006	-	-	-	-	-	-	-	-	YES	YES	-	-	YES	-
Sailer	2006	-	-	YES	-	-	-	-	-	-	-	-	-	-	-
Chapman	2008	YES	-	-	-	-	-	-	-	-	-	-	-	-	-
Bazzano	2009	-	-	YES	YES	-	-	-	-	-	-	-	-	-	-
Melville	2011	-	-	YES	-	-	-	-	-	YES	-	-	-	-	-
Saunders	2011	-	-	-	-	-	-	-	-	-	-	-	-	-	YES
Casey	2012	-	-	YES	-	-	-	-	-	-	-	-	-	-	-
McDermott	2012	-	-	-	-	-	-	-	-	-	YES	-	-	YES	-
Wilhite	2012	-	YES	YES	-	-	-	-	-	YES	-	-	-	-	-
Beeken	2013	-	-	YES	-	-	-	-	-	YES	-	-	-	-	-

Study	Year	Total score	Item 1*	Item 2	Item 3	Item 4	Item 5	Item 6	Item 7	Item 8	Item 9	Item 10	Item 11	-
Interventions aimed at physical activity (PA) (15)														
Total score of 'PA'	-	*45 (M=3)*	*13**	*5*	*5*	*4*	*0*	*1*	*2*	*4*	*5*	*7*	*11*	
Donnelly	2013	-	-	YES	-	-	-	-	YES	-	-	-	-	-
Marks	2013	-	-	YES	-	-	-	-	YES	-	-	-	-	-
Pett	2013	-	-	YES	-	-	-	-	-	YES	-	-	-	-
Podgorski	2004	1	●	○	○	○	○	○	○	○	○	○	●	-
Wallen	2013	-	-	-	-	-	-	-	-	-	-	-	-	-
Jones	2007	2	○	YES	○	○	○	○	○	●	○	○	●	-
Spanos	2014	-	-	YES	-	-	-	-	-	-	-	-	-	-
Pfeiffer	2007	3	●	○	○	●	○	○	○	○	○	●	●	-
Ptomey	2015	-	-	YES	-	-	-	-	-	-	-	-	-	-
Total	-	*3*	*4*	*26*	*3*	*0*	*0*	*0*	*0*	*8*	*4*	*0*	*0*	*5*	*1*
Geller	2009	1	●	○	○	○	○	○	○	○	○	○	●	
Temple	2011	2	●	○	○	○	○	○	○	○	●	○	○	
Thomas	2011	1	●	○	○	○	○	○	○	○	●	○	○	
Ulrich	2011	4	●	●	○	●	○	○	○	○	○	●	●	
Bodde[21]	2012	5	●	○	○	●	○	○	○	●	●	●	●	
Stanish	2012	1	●	○	○	○	○	○	○	○	○	○	●	
Yen	2012	2	○	○	○	○	○	○	○	●	○	○	●	
Mitchell	2013	3	●	●	●	○	○	○	●	○	○	○	○	
Perez-Cruzado	2013	5	●	●	●	○	○	●	○	○	○	●	●	
Shields[22]	2013	8	●	●	●	●	○	○	●	●	●	●	●	
Lante	2014	5	●	●	●	○	○	○	○	○	●	●	●	

[20] These results are combined with the protocol paper from Elinder et al. (2010) describing the same study.
[21] These results are combined with the process evaluation paper from Bodde et al. (2012) describing the same study.
[22] These results are combined with the protocol paper from Shields et al. (2010) describing the same study.

van Schijndel[23]	2013	2	●	○	●	○	○	○	○	○	○	●	○
		Interventions aimed at nutrition (3)											
Total score of 'nutrition'	-	*5 (M=1.7)*	*1**	*0*	*0*	*1*	*0*	*0*	*0*	*1*	*0*	*1*	*1*
Bartley	2011	2	●	○	○	○	○	○	○	●	○	○	○
Wallén	2013	3	○	○	○	●	○	○	○	○	○	●	●
Hubbard	2014	0	○	○	○	○	○	○	○	○	○	○	○
		Interventions aimed at both physical activity and nutrition (23)											
Total score of 'both'	-	*69 (M=3)*	*15**	*8*	*5*	*6*	*0*	*0*	*3*	*12*	*6*	*13*	*16*
Cluphf	2001	3	○	○	○	●	○	○	○	○	○	●	●
Marshall	2003	2	○	○	○	○	○	○	○	●	○	○	●
Ewing	2004	1	○	○	○	○	○	○	○	○	○	●	○
Bradley	2005	1	○	○	○	○	○	○	○	●	○	○	○
Chapman	2005	3	○	○	○	○	○	○	○	●	○	●	●
Mann	2006	1	●	○	○	○	○	○	○	○	○	○	●
Sailer	2006	1	○	○	○	○	○	○	○	●	○	○	○
Chapman	2008	3	○	○	○	○	○	○	○	●	○	●	●
Bazzano	2009	0	●	○	○	○	○	○	○	○	○	○	○
Melville	2011	2	●	○	○	○	○	○	○	●	○	○	●

[23] These results are combined with the protocol paper from Van Schijndel-Speet et al. (2014) describing the same study.

Saunders	2011	1	●	○	○	○	○	○	○	●	○	○	○
Casey	2012	3	●	○	○	○	○	○	○	●	●	○	●
McDermott	2012	6	●	●	●	●	○	○	○	○	●	●	●
Wilhite	2012	1	●	○	○	○	○	○	○	○	○	○	●
Beeken	2013	3	●	●	●	○	○	○	●	○	○	○	○
Bergstrom[24]	2013	4	●	●	●	○	○	○	○	○	○	●	●
Curtin	2013	6	●	●	○	●	○	○	○	●	●	●	●
Donnelly	2013	6	●	●	●	●	○	○	●	○	●	●	○
Marks	2013	5	●	●	○	○	○	○	●	○	●	●	●
Pett	2013	6	●	●	●	●	○	○	○	●	○	●	●
Wallén	2013	2	●	○	○	○	○	○	○	○	○	●	●
Spanos	2014	4	○	○	○	●	○	○	○	●	○	●	●
Ptomey	2015	5	●	●	○	○	○	○	○	●	●	●	●
Total score of all studies	-	*117 (M=2.6)*	*29**	*13*	*10*	*11*	*0*	*1*	*5*	*17*	*11*	*21*	*28*

Supplemental Table 4: PEDro Quality Scores

Note: Black circles = meets the PEDro criterion for that item; white circles = does not meet the PEDro criterion for that item. For full list of PEDro items, see the Methods section.

* = The first item describes the study's external validity and is not used to calculate the total PEDro score.

[24] These results are combined with the protocol paper from Elinder et al. (2010) describing the same study.