

Wirral PCT Lifestyle & Weight Management Programme

A preliminary report by the Health Economics Unit University of Liverpool Management School

Introduction

Obesity (defined as a body mass index greater than $30\text{kg}/\text{m}^2$) is a chronic clinical condition that is one of the most serious health problems within the UK. Prevalence of obesity is increasing in both adults and children with 17% of adult men and 21% of adult women being obese¹. In 1993, the NHS cost associated with obesity were estimated at £30m², but this will have substantially increased since this time.

A number of submissions to the National Institute for Health and Clinical Excellence for weight-loss drugs have attempted to estimate a direct relationship between weight loss and quality of life. In one case (Sibutramine), patients who experienced significant weight loss were also assessed to have experienced improved quality of life estimated to be equivalent to a utility increase of 0.00185 per kg^3 . Although obesity is a serious medical condition in its own right, the major health problems arise from it being a major risk factor in the development of a range of metabolic conditions, in particular Type II diabetes and cardiovascular disease. Both morbidity and mortality are known to increase within increasing BMI, with the risk factor growing exponentially as the patient becomes classified as being clinically obese^{4,5,6}.

Sustained and significant weight reduction therefore will lead to a range of health benefits to the obese individual including improved quality of life, reduced incidence of cardiovascular disease and diabetes and a lower level of obesity-related morbidity and mortality. For all of these reasons, obesity represents a serious health threat to the population of the Wirral.

The Lifestyle and Weight Management programme at Wirral PCT

The Wirral Lifestyle and Weight Management programme consists of an intensive twelve-week programme consisting of a variety of group meetings and one-to-one sessions tailored to the needs of each individual client. The target population is obese individuals (defined as having a BMI greater than 30) or persons with a BMI of greater than 28 with two coexisting co-morbidities (diabetes, hypertension or hyperlipidemia). The target outcome is for each client to achieve a 5% body mass reduction over the course of the twelve week course, with this reduction being sustained over the long term, leading to a 10% body mass reduction over 12 months.

The assumption underlying the Wirral Lifestyle and Weight Management programme is that obesity is directly linked to a range of health problems and therefore that sustained and significant weight reduction will lead to a range of health improvements. In particular, clients successfully losing weight as a consequence of the programme will experience improved quality of life, reduced incidence of

cardiovascular disease and diabetes leading to a lower level of obesity-related morbidity and mortality. However, even in the case where the programme is successful in helping clients to reduce weight, the issue remains as to whether the extent of the health gain generated is sufficient to justify the associated expenditure. In addition, a wide range of interventions are available to reduce obesity and it is important to ascertain whether there is a better way to invest these scarce resources and expertise in order to improve the health of obese patients in Wirral. Although we don't directly address this issue in this report, it is an important issue underlying the interpretation of the results provided in this analysis.

The objective of our study is therefore to calculate the incremental cost effectiveness associated with the weight loss generated by the Wirral Lifestyle and Weight Management programme. Achieving this aim requires accurate data to be obtained in three areas. Firstly, it is necessary to identify all resources consumed both directly and indirectly in the process of providing the programme. Secondly, it is necessary to identify all resources potentially saved as a consequence of the ill-health avoided through the operation of the programme. Finally, it is necessary to identify, measure and value the health benefits arising to the population of the Wirral as a consequence of the operation of the programme. Due to the complexity of the co-morbidities associated with obesity and the variable timescale underlying their appearance, the results obtained in this report should be perceived as being preliminary. A more substantial economic modelling analysis would be required to definitively ascertain the exact nature of the net flow of resources and the benefits generated, but it is hoped that this analysis provides a useful preliminary analysis. The analysis of outcomes concentrates entirely on the health benefits that were gained during the twelve-week period in which the obese individual was directly supported on the project. Unfortunately, very few clients provided twelve-month data and the reliability of such data was held to be insufficient to support any meaningful analysis. An important issue to be addressed relates to the extent to which such gains are sustained or even increased after the active support provided by the programme has ended or alternatively whether any initial gains resulting from the programme are lost once the active support disappears. The sustainability or otherwise over the long term of the initial weight loss will be the fundamental determinant of the long-term cost-effectiveness of the Wirral Lifestyle and Weight Management programme.

This preliminary analysis concentrates entirely on two elements of health benefit that are likely to arise from the weight loss programme. Firstly, the reduced risk of coronary heart disease^{7,8,9} and secondly, the reduced incidence of diabetes¹⁰. The reduction in coronary heart disease associated with weight loss has been calculated using the Framingham risk equations which relate risk of heart disease to a range of factors including weight. In the case of diabetes, the relationship between weight and the incidence and severity of diabetes has been comprehensively analysed in a range of published reports and literature. In order to capture this element of health benefit, a comprehensive search of this literature has been undertaken.

The costs incorporated in the analysis were provided by Wirral PCT and are held to represent an accurate estimate of the direct costs incurred in administering and running the Lifestyle and weight Management programme (see Table 1). In estimating the net resource costs, these direct costs have to be offset by the estimated savings to health services in Wirral as a consequence of reduced levels

of coronary heart disease and diabetes experienced in the future by clients supported by the programme.

Table 1. Direct costs associated with Wirral Lifestyle and Weight Management Programme

07/08 Subjective Code	08/09 Subjective Code	Account Description	05/06 Actual	M11 06/07 Actual	07/08 Actual	08/09 Budget	M1 - M3 08/09 Actual
Payroll							
AH00		Agency - Admin & Clerical		7,612	9,762		
DC35	5236	Nurse Band 7		8,111	33,582	33,815	8,593
EB50		Senior 1 / Supt / Head / Chief		21,183			
EB99	5331 E715	PAMS Recharge		2,494	3,627		917
KA10	5658	Admin & Clerical Band 2		4,323	17,710	28,611	5,015
	5657	Admin & Clerical Band 3					2,097
KA25	5639	Admin & Clerical Band 5			1,840		675
KB00	5024	Senior Officers A & C		294,475	336,998	335,864	78,300
KS99		A & C Staff Recharge		5,038			
				343,236	403,519	398,290	95,597
Non-Pay							
RH92	7020	M & S Medical Equipment		724	5,935	5,148	701
	7041	M & S Maint Contract					210
RK07		EBME Parts & Maintenance			-65		
SA46		General Provisions		174	157		
	7180	Staff Uniforms & Clothing					23
SH01	7200	Bedding & Linen Disposable			15		3
TA04	7221	Stationery		2,971	3,173	2,155	403
TA34	7220	Printing		2,748	2,997		2,396
TA42		Books & Journals			1,250		
TB01		Postages			103		
TD17	7243	Telephone Calls / Rental		1,298	5		31
TD18		Mobile Phones		547	1,101		
TF01	7270	Staff Travelling Expenses		9,681	8,034	10,462	974
TF02	7271	Excess Travelling Expenses			1,212		252
TF03		Subsistence / Accommodation		332	251		
TF35		Patient Travel / Outings		10	10		
TJ01	7307	Course Fees		5,202	3,289	2,250	44
TJ11	7302	Conferences			471		75
UD05	7488	Transport Taxis (Patients)			37	78	
VG05	7191	Cleaning Agents			15	3	
VK21		Office Equipment		8			
VL01		Computer Equipment		1,055	1,416		
VQ02	7319	Hire of Rooms		11,320	10,000	13,331	6,160
	7430	External Consultancy				21,013	
XF36	7487	Miscellaneous		448	2,903		39
XF38	7275	Hospitality		1,100	1,052	2,000	57
XF67	7341	Disposal of Waste		120	134		20
	7350	Furniture & Fittings					9,851
XJ05		Resources		22	1,694		
XY01		Internal Recharge		-2,363			
				35,397	45,189	56,757	21,239
TOTAL			406,135	378,633	448,708	455,047	116,836
06/07 Month 12 Estimate				413,054			

	05/06 Actual	06/07 Actual	07/08 Actual
Costs exc accommodation	406,135	413,054	448,708
LWMS Accommodation			
Costs - pro rata			
Hamilton Square	11,239	12,646	
Argyle Street			6,555
Gibraltar House			31,704
Estimated total cost of LWMS service	417,374	425,700	486,967

The association between weight loss and reductions in coronary heart disease

The Framingham risk equation¹¹ calculates 10 year CHD risk based on an interaction of factors (age, gender, BMI, blood pressure, cholesterol, cigarette usage, diabetes status and ventricular hypertrophy). Isolating the impact of each individual element of this risk equation is inherently based on a number of assumptions and hence, again, the results should be interpreted as being indicative rather than definitive. However, the Framingham risk equation highlights the importance of weight as an individual risk factor and emphasises that a reduction in weight in obese patients would significantly reduce the risk of coronary heart disease in direct proportion to the estimated weight loss. The costs and morbidity avoided in Wirral as a consequence of fewer cases of CHD can be estimated. In addition, if it is assumed that a third of all CHD events are fatal, it would also be possible to calculate the number of deaths avoided and life years lost due to the weight reduction project. If the age of clients supported on the programme is known, then standard life tables can be used to calculate the number of life years gained to the Wirral population. For the two-thirds of non-fatal CHD's, the patient is likely to experience a significant reduction in quality of life. Estimating this quality of life loss (reduced mobility, reduced ability to undertake activities of daily living) is difficult as it will be intrinsically linked to the severity of the disability suffered, however, for the purposes of this analysis, it has been estimated at 0.85¹². The estimated cost savings to the health service associated with an avoided CHD event have been estimated at £2,577 (non-fatal) or £2,160 (fatal), with the ongoing yearly cost of supporting a patient who has suffered non-fatal CHD event being estimated at £619^{13,14} for the remainder of their lives. A wide range of estimates are available linking weight to cardiovascular risk. For the purposes of this analysis, it is assumed that the annual risk of coronary heart disease is reduced by 1% as a consequence of each kilogramme lost as a consequence of the programme¹⁵. This implies a reduction of 2.6% in the cardiovascular risk for female patients and 4.2% in the cardiovascular risk for male patients.

The association between weight loss and reductions in incidence of diabetes

A significant body of literature is available that emphasises the extent of the relationship between obesity and an increased risk of diabetes. Two studies^{4,14} were identified as perhaps holding particular relevance in informing the potential benefits associated with the reduction in the future incidence of diabetes amongst the Wirral population as a consequence of the operation of the Lifestyle and Weight Management programme. The study by Sjostrom¹⁶ of 1,690 severely obese subjects found that the two-year incidence rate of diabetes falls from 6.3% at a BMI of 42kg/m² to 0.2% at 33kg/m². The estimated relationship between the incidence of diabetes and body mass index is provided in Table 2. Again, a wide range of estimates are available linking weight to NIDDM. For the purposes of this analysis, it is assumed that patients' relative risk for NIDDM is reduced from 54.0 (average for people with BMI of 33.0-34.9) to 40.3 (average for people with BMI of 31.0-32.9) implying a risk reduction of 25% in the development of NIDDM. However, this risk reduction is perhaps better interpreted as being a delay in the development of NIDDM, providing an improved quality of life and avoidance of healthcare costs for the population of Wirral over a longer period of time. Again, it is important to emphasise the preliminary nature of these risk reduction estimates.

A total of 11,590 people in Wirral (population 310,800) had been diagnosed with diabetes (QOF data). If it is assumed that 10% of these are insulin dependent, then this leaves an estimated population of NIDDM in Wirral OF 10,500.

Table 2. Relationship between attained BMI and relative risk for non-insulin dependent diabetes

Body Mass Index kg/m ²	Age-Standardized Incidence Rate* %	Age-Adjusted Relative Risk (95% CI)
>22.0	13.0	1.0 (reference)
22.0 – 22.9	37.4	2.9 (2.0 to 4.1)
23.0 – 23.9	54.9	4.3 (3.1 to 5.8)
24.0 – 24.9	62.9	5.0 (3.6 to 6.6)
25.0 – 26.9	103.5	8.1 (6.2 to 10.5)
27.0 – 28.9	200.4	15.8 (12.7 to 19.8)
29.0 – 30.9	354.5	27.6 (22.7 to 33.5)
31.0 – 32.9	521.2	40.3 (33.7 to 48.3)
33.0 – 34.9	703.6	54.0 (45.6 to 64.0)
≥35.0	1190.5	93.2 (81.4 to 106.6)

*Rate per 100,000 persons standardized to the age distribution of length of follow-up in the cohort

Diabetes directly results in an increased risk of death and could also be expected to impose a significant reduction in the quality of life experienced by the patient. The level of diabetes-related mortality has been examined by De Grauw¹⁷ who suggested that individuals with diabetes have a 33% increased risk of mortality in comparison to non-diabetics of the same age and sex. With regard to quality of life, the extent of any loss will be intrinsically related to the nature and severity of the disease and also the existence of any complications or coexisting conditions. As such, there were very few evidence-based assessments of the utility difference between people living with diabetes and those without the disease. For the purposes of this analysis, it was assumed that a utility loss of 0.05 (thus assuming that quality of life in NIDDM is 95% of normal) was associated with NIDDM. Direct cost savings to the health services resulting from a reduced incidence of diabetes have been estimated as being approximately £780 per patient avoided per year¹⁸.

How clinically effective is the Lifestyle and Weight Management programme?

This analysis is based on the records of patients referred to the Lifestyle and Weight Management Programme at Wirral PCT. The analysis excluded clients who were classed for some reason in the variable 'DischargeOutcome' as being 'Unsuitable Referral', which was applied to 129 (3.3%) out of the total 3,939 cases in the initial sample. Therefore 3810 clients were analysed in total and where appropriate were sub-divided and separately analysed in relation to the type of programme they had been initially assigned to (collective and/or individualised service).

Individuals referred to the weight management programme had a mean age of 51 years, with 78% being recorded as having been allocated to a group programme. However, the true figure allocated to this type of programme may be higher since 344 (9%) had no record of the type of programme to which they had been assigned. Furthermore, 12% seem to have been simultaneously allocated to both a group and an individual programme.

Analysis of the socio-demographic characteristics of clients referred emphasizes that a greater proportion of individuals in full time employment were referred to group exercise programmes than to other types of programme (see Table 3). In contrast, individuals recorded as requiring 'disabled access' were more likely to be supported through one-to-one sessions (15% of clients supported through one-to-one sessions were categorised as having special requirements, compared to only 10% supported on group programmes). The vast majority of clients supported on the weight management programme were classified as 'white' (99.3%), with women constituting approximately two thirds of those referred to the programme.

The client mix between the programmes varied more clearly in terms of lifestyle indicators, with smokers and alcohol drinkers being more likely to be supported through the more intensive one-to-one programmes (see Table 4). However, the validity of the results obtained must be questioned as less than 4% of all clients admitted to being a smoker and less than 20% of all clients admitted to drinking alcohol – an unlikely result given the prevalence of smoking and alcohol use in the general population supported by Wirral PCT.

Table 3. Socio-demographic and physical characteristics: Numbers (percentages) unless otherwise specified

Characteristic	Overall sample	Sub-groups by programme			
	n=3810	One to One n=45	One to One and Group n=453	Group n=2968	Not Recorded n=344
Age mean (range)	51.37 (16 -89)	50.87 (16 -75)	47.15 (17 -81)	51.87 (16 -89)	52.74 (19 -88)
Female (%)	2527 (66.3)	29 (64.4)	285 (62.9)	1975 (66.5)	238 (69.2)
Living arrangements					
Living alone (%)	2648 (95.1)	33 (97.1)	338 (93.4)	2109 (95.3)	168 (96.5)
Single with children (%)	12 (0.4)	0	2 (0.5)	9 (0.4)	1 (0.6)
Living with other adults (%)	123 (4.4)	1 (2.9)	22 (6.1)	95 (4.3)	5 (2.9)
Ethnicity					
White (%)	3696 (99.3)	45 (100)	446 (99.3)	2925 (99.3)	280 (99.3)
Asian (%)	5 (0.1)	0	2 (0.4)	2 (0.1)	1 (0.3)
Mixed African/ African/Other (%)	12 (0.3)	0	1 (0.2)	10 (0.2)	1 (0.3)
Not recorded (%)	7 (0.2)	0	0	7 (0.2)	0
Employment status					
Full-time	1153 (30.9)	12 (26.7)	175 (39.6)	878 (29.9)	88 (28.3)
Part-time	388 (10.4)	4 (8.9)	37 (8.4)	322 (11.0)	25 (8.0)
Self-employed	68 (1.8)	1 (2.2)	4 (0.9)	59 (2.0)	4 (1.3)
Studying	59 (1.6)	2 (4.4)	3 (0.7)	49 (1.7)	5 (1.6)
Not in paid employment & not studying	1686 (45.2)	22 (48.9)	186 (42.1)	1317 (44.9)	161 (51.8)
Sick/Disabled	363 (9.7)	4 (8.9)	34 (7.7)	298 (10.1)	27 (8.7)
Not known	16 (0.4)	0 (0)	3 (0.7)	12 (0.4)	1 (0.3)
Total	3782 (100)	45 (100)	442 (100)	2935 (100)	311 (100)
Requiring disabled access	389 (10.2)	7 (15.5)	50 (11)	2954 (9.6)	48 (13.9)

Table 4. Lifestyle and biochemistry indicators

Characteristic	Overall sample	Programme			
		One to One	One to One and Group	Group	Not Known
n	3810	45	453	2968	344
Smoking (%)	3.38	6.7	5.1	3.4	0.3
Alcohol consumption (%)	19.3	35.6	23.4	20.0	5.8
Weight loss medication (%)	4.7	4.4	5.1	5.0	1.4
Weight (kg)	106.48	121.63	118.88	104.14	108.96
BMI	38.34 (20-77)	44.80 (30-66)	42.78 (22-77)	37.49 (23-75)	39.11 (20-62)
SBP	135.59 (15-210)	136.44 (105-176)	136.60 (85-200)	135.74 (15-210)	132.71 (35-190)
DBP	81.46 (4-130)	78.72 (34-100)	82.94 (4-120)	81.55 (7-116)	79.00 (58-130)
Total cholesterol	5.35 n=3300	5.21 n=38	5.45 n=397	5.34 n= 2579	5.31 n=286
LDL	3.35 n=2325	3.44 n=27	3.42 n=259	3.38 n=1818	3.06 n=221
HDL	1.42 n=2371	1.16 n=28	1.34 n=265	1.45 N=1855	1.28 n=223
LDL/HDL	2.67 n=2316	3.04 n=27	2.75 n=257	2.67 n=1812	2.49 n=220
Total cholesterol/HDL	4.43 n=2361	4.88 n=27	4.49 n=264	4.44 n=1847	4.27 n=223

How cost-effective is the Wirral Lifestyle and Weight Management Programme?

Unfortunately, the dataset generated to evaluate the operational effectiveness of the weight loss programme suffered from significant data deficiencies. In particular, the design of the patient questionnaire that formed the basis of the database suffered from significant design and coding inconsistencies which are likely to have reduced the reliability of the results. In addition, the quality of the recording of data did not meet standards required to identify the different types of non-response, lost to follow-up and errors in recording. These differences have implications for valid statistical analysis, which constrained the extent to which data could be analysed. Further these results should be considered with caution since the extent of missing data from baseline to 12 weeks is likely to be informative of the prospects for successful programme completion and therefore using these results may lead to biased inferences. Further limited documentation made available to the analyst at the University of Liverpool PRG resulted in the amount of time spent on identification and consistency checking exceeding the standard time required for that purpose in projects of this nature.

Programme drop-out and missing data records resulted in very small numbers of observations with outcome data. In what follows only reference is made to outcomes at 12 weeks, since results at 12 month were only available for <=785 (<20%). Further, due to the limited data available at 12 weeks (>90% missing data) for all indicators other than weight, only results for weight loss and BMI are presented here.

Table 3 provides the mean estimated weight loss experienced by clients from baseline to 12 weeks by service type and sex. The good news for the Wirral Lifestyle and Weight Management programme is that, from the limited evidence available, the service does appear to be an effective method of inducing weight loss amongst the population served. Almost all subgroups showed reductions in weight between baseline and 12 weeks (mean reduction females 2.62 Kg (2.56%), 95% CI: 2.3 to 2.9; mean reduction males 4.23 Kg (3.60%), 95% CI: 3.7 to 4.7; $p < 0.001$ for both groups). The only subgroups that failed to show statistically significant weight reductions were female clients on One to One programmes and Males without a recorded programme. Preliminary estimates of the costs and health losses averted as a consequence of the existence of the Wirral Lifestyle and Weight Management programme are provided in Tables 5 (NIDDM) and 6 (CHD). Table 7 combines these estimates to obtain a preliminary estimate of the overall cost-effectiveness of the Wirral Lifestyle and Weight Management programme.

Table 5. Cost savings and health benefits: NIDDM

Population data	
Population served by the programme	3,810
Prevalence of NIDDM in Wirral population	2.5%
Estimated NIDDM patients in programme population	95
Estimated risk reduction due to weight loss generated	25%
Estimated number of NIDDM's averted per annum	24
Estimate of costs averted	
Reduced number of NIDDM patients	24
Annual healthcare cost per NIDDM patient	£780
Total averted healthcare cost to Wirral	£18,720
Estimate of health loss averted*	
Reduced number of NIDDM patients	24
Estimated annual quality of life loss per patient	0.05 QALYs
Total averted loss per year	1.2 QALYs

*This estimate does not include the wide range of co-morbidities (such as CHD) from which NIDDM patients are at a greater risk of suffering

Table 6. Cost savings and health benefits: CHD

Population data	
Total population served by the programme	3,810
of which females	2,527
of which males	1,283
Reduced risk of CHD due to weight loss generated - Females	2.6%
Reduced risk of CHD due to weight loss generated – Males	4.2%
Estimated number of CHD cases averted per annum – Females	65
Estimated number of CHD cases averted per annum - Males	53
Proportion of fatal CHD cases	33%
Proportion of non-fatal CHD cases	67%
Estimate of costs averted	
Reduced number of fatal CHD cases – Female	21
Reduced number of fatal CHD cases – Male	17
Reduced number of non-fatal CHD cases – Female	44
Reduced number of non-fatal CHD cases – Male	36
Cost per fatal CHD case	£2,160
Total fatal CHD cases averted	38
Total averted healthcare cost to Wirral	£82,080
First year cost per non-fatal CHD case	£2,577
Total non-fatal CHD cases averted	80
Total averted healthcare cost to Wirral	£206,160
Total averted healthcare costs – all CHD cases	£288,240*

*This estimate does not include an annual support cost of £619 for non-fatal CHD patients

Table 7. Preliminary cost and outcome estimates

Total cost of service	£486,867		
Total number of clients	3810		
Direct cost per client supported	£128		
CHD			
No of clients	Estimated risk reduction	Estimated health benefits	Associated cost savings
3,810	2.5%	38 lives plus 12 QALYs	£288,240
NIDDM			
No of clients	Reduced number of NIDDM patients	Estimated health benefits	Associated cost savings
3,810	24	1.2 QALYs	£18,720

Discussion

The lifestyle and weight management programme initiated by Wirral has been found to generate weight loss when compared to the pre-programme experience of patients. Such weight loss may be expected to lead to fewer cases of diabetes and fewer incidences of CHD, together with a higher quality of life in responding patients. As in all such analyses, the estimates are based upon a range of assumptions with regard to the relationship between weight loss in obese patients and their health experience. While keeping these limitations in mind, it is important to emphasise that the results strongly support the clinical benefits that appear to be generated to the population of the Wirral as a consequence of the Lifestyle and Weight Management programme. The estimated annual cost of the programme (£486,000) is significantly offset by savings generated through anticipated annual reductions in the costs of treating NIDDM (£18,720) and particularly in CHD (£288,240). As a consequence, the net cost of the programme from the perspective of Wirral PCT as a whole is reduced to £179,040. In addition, the programme is estimated to avert 38 deaths from CHD while providing the equivalent of an additional 13.2 QALYs to the population of the Wirral (12.0 QALYs from averted CHD and 1.2 QALYs from averted NIDDMs). With regard to any 'threshold' for cost-effectiveness currently utilised in the UK, the programme therefore appears to provide significant 'value for money' in return for the resources that it consumes.

Although we have concentrated upon only two of the co-morbidities associated with obesity, Hughes and others¹⁴ suggest that a total of ten co-morbidities are commonly associated with obesity including hypertension; angina; hyperlipidaemia; cerebrovascular disease; digestive disease; osteoarthritis; cancer of the uterus and cancer of the colon. Thus a much more detailed and exhaustive analysis would be required to quantify all of the healthcare benefits that are likely to be associated with moderate weight loss in obese patients.

A major uncertainty in the model relates to the actual cost of the Wirral Anti-Obesity Project. Although the costs of administering the programme were provided by Wirral PCT, many of the additional cost (the privately-borne costs of visiting the GP; the opportunity cost arising from health professionals concentrating on obesity management, etc) could not be effectively captured in this preliminary analysis. A further uncertainty is the relationship between weight loss and changes in utility, related either to reduced prevalence of co-morbidities or reduced weight in itself. No evidence was found in the literature relating either to the costs or benefits associated with diet and exercise monitoring of obese patients. The majority of the data generated in the literature related to the costs and benefits associated with weight controlling drugs.

Areas for further research

Summary statistics or analysis of predictors for weight loss is a potentially relevant analysis that might be of interest to decision makers at Wirral PCT. These analyses were not undertaken due to limitations of time available and since in any case the validity of such analysis is compromised by the quality of data recording and limited information in the dataset. If this analysis of predictors for weight loss, which could be used to characterise patients likely to succeed under each type of programme, were to be of interest to managers at Wirral PCT, the respective timelines could be determined soon after requesting such work.

An additional piece of information of potential interest is the characterisation of clients of the LWMP by socio-economic status associated with place of residence. Since the dataset made available to PRG contains only the first three letters of the Postcode, data managers at Wirral PCT may still have confidential access to full postcodes, which would be required to classify individuals using the MOSAIC algorithm, and could therefore provide the information on socio-economic classification of individuals in the LMWP dataset provided to PRG without disclosing the full postcode information to the latter.

Conclusion

Any lifestyle and weight management service should only be provided as part of a long term integrated therapeutic approach to tackling obesity in Wirral. Such an integrated approach would have to include dietary and behaviour modification as well as increased physical activity and be supported by drug therapy or cognitive behavioural therapy as required. Only through such an integrated approach, would a sustained change in eating habits and behaviour and an associated weight loss be likely to arise. Such sustained change in behaviour is fundamental to the long-term maintenance of the reduced weight level initiated by the lifestyle and weight management service.

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Appendix 1

Table 1a. Relationship of obesity to morbidity: Summary of Analyses

Males

Age group	CHD	Diabetes	Stroke	Hypertension	Varicose veins	Piles
18-24	No effect	No effect	No effect	No effect	No effect	No effect
25-34	No effect	Positive gradient	No effect	Positive gradient	No effect	No effect
35-44	Step effect: increase at BMI=30	Positive gradient	No effect	Positive gradient	No effect	No effect
45-54	Step effect: increase at BMI=30	Positive gradient	Positive gradient	Positive gradient	Non-linear effect: maximum at BMI=32	No effect
55-64	Positive gradient	Positive gradient	Positive gradient	Positive gradient	Positive gradient	Positive gradient
65-74	Positive gradient	Positive gradient	Positive gradient	Positive gradient	No effect	No effect
75-84	No effect	No effect	No effect	No effect	No effect	No effect
85+	No effect	No effect	No effect	No effect	No effect	No effect

Females

Age group	CHD	Diabetes	Stroke	Hypertension	Varicose veins	Piles
18-24	No effect	No effect	No effect	Positive gradient	No effect	No effect
25-34	No effect	No effect	No effect	Positive gradient	No effect	No effect
35-44	No effect	Positive gradient	No effect	Positive gradient	Positive gradient	No effect
45-54	Positive gradient	Positive gradient	Positive gradient	Positive gradient	Positive gradient	Positive gradient: maximum at BMI=30
55-64	Positive gradient	Positive gradient	Positive gradient	Positive gradient	Positive gradient	Positive gradient: maximum at BMI=32
65-74	Positive gradient	Positive gradient	Step effect at BMI=32	Positive gradient	Positive gradient	Positive gradient: maximum at BMI=31
75-84	No effect	Positive gradient	No effect	No effect	No effect	No effect
85+	No effect	No effect	No effect	No effect	No effect	No effect