

Statistical Annexe

Point estimates and confidence intervals for mean BMI, prevalence of overweight and obesity, and selected percentiles are presented in this annexe.

Confidence intervals for percentiles were derived using Woodruff's method (Woodruff 1952), which, in a nutshell, uses the empirical cumulative distribution function and its inverse to compute the percentile estimates and their confidence intervals.

Replicate weights using a jack-knife method (Kott 1998) were used to obtain standard errors for 1997 and 1989 estimates. Insufficient information about the design of the 1977 study meant that we were unable to create replicate weights for this data set. As a consequence, a rather crude process was used to derive the variances of the sample statistics of interest. A design effect of 2 was assumed for the 1977 survey. The variance of each sample statistic was calculated under a simple random sampling framework, and then multiplied by the assumed design effect.

Also note that in calculating prevalence estimates, we have assumed different BMI cut-offs for Māori and Pacific groups. The BMI cut-offs used are summarised in Table 16.

Table 16: BMI cut-offs for overweight and obesity

	Overweight	Obese	Extreme obesity¹²
European and Other	BMI 25.0–29.9	BMI ≥ 30.0	BMI ≥ 40.0
Māori and Pacific	BMI 26.0–31.9	BMI ≥ 32.0	BMI ≥ 40.0

Results are presented first for the total population, by age group and for all ages pooled. Then results are presented for Māori, with all ages pooled (age-specific rates are not shown due to small numbers). The 'all ages pooled' rates are crude, not age standardised.

¹² In theory, a higher cut-point should be used to determine 'extreme obesity' in Māori and Pacific peoples. However, due to the lack of research on such cut-points we will use the same cut-off for the entire population.

Total population

Table 17: Mean BMI (kg/m²) and 95% confidence intervals, total population

Age group	Year	Males			Females		
		Estimate	Lower CI	Upper CI	Estimate	Lower CI	Upper CI
All ages	1977	25.50	25.14	25.86	24.54	24.14	24.94
	1989	25.55	25.32	25.79	24.77	24.52	25.03
	1997	26.20	25.94	26.46	26.16	25.82	26.49
	2003	26.86	26.68	27.04	26.41	26.19	26.64
15–24 ¹³	1977	24.55	23.46	25.64	23.19	22.31	24.08
	1989	22.97	22.52	23.42	22.96	22.47	23.46
	1997	24.15	23.47	24.83	24.13	23.25	25.02
	2003	24.20	23.71	24.69	24.25	23.70	24.80
25–34	1977	25.06	24.45	25.68	23.57	22.84	24.29
	1989	25.42	24.83	26.01	24.34	23.57	25.10
	1997	25.46	24.93	25.99	25.28	24.75	25.81
	2003	26.58	26.18	26.97	26.08	25.62	26.53
35–44	1977	25.95	25.15	26.75	24.77	23.95	25.58
	1989	26.60	26.11	27.08	24.59	24.15	25.04
	1997	26.85	26.24	27.46	26.05	25.33	26.76
	2003	27.17	26.81	27.54	26.51	26.02	27.00
45–54	1977	25.83	25.18	26.49	25.71	24.75	26.68
	1989	26.82	26.28	27.35	26.75	25.88	27.63
	1997	27.50	26.89	28.11	27.94	27.23	28.66
	2003	28.11	27.64	28.58	27.02	26.45	27.58
55–64	1977	26.26	25.21	27.32	25.80	24.79	26.80
	1989	27.22	26.37	28.07	26.55	25.89	27.20
	1997	27.81	27.15	28.47	27.83	27.05	28.61
	2003	28.34	27.84	28.84	28.16	27.66	28.66
65–74	1989	26.40	25.62	27.18	25.60	24.86	26.35
	1997	26.59	25.95	27.23	27.21	26.45	27.97
	2003	27.68	27.19	28.17	27.53	27.03	28.03

¹³ Note that for the 1977 data set the sample statistics for the 15–24-year-old age group only include 20–24-year-olds.

Table 18: Prevalence (%) of overweight and 95% confidence intervals, total population

Age group	Year	Males			Females		
		Estimate	Lower CI	Upper CI	Estimate	Lower CI	Upper CI
All ages	1977	41.52	35.79	47.25	26.09	21.00	31.18
	1989	39.96	36.70	43.22	24.61	22.40	26.81
	1997	40.51	37.02	44.00	29.91	27.26	32.55
	2003	42.11	40.13	44.10	27.70	26.02	29.37
15–24	1977	23.83	8.08	39.58	19.65	8.48	30.81
	1989	16.87	10.60	23.15	14.53	9.54	19.53
	1997	25.02	16.35	33.69	20.23	12.02	28.44
	2003	22.03	17.10	26.96	21.00	16.87	25.13
25–34	1977	38.24	28.15	48.33	19.08	10.81	27.35
	1989	38.96	31.02	46.90	21.01	16.33	25.70
	1997	33.91	26.62	41.20	22.45	17.63	27.26
	2003	45.36	40.29	50.42	25.24	21.37	29.10
35–44	1977	39.92	27.80	52.05	29.32	18.88	39.77
	1989	49.73	43.59	55.87	24.26	19.73	28.78
	1997	44.60	39.12	50.07	28.96	24.21	33.70
	2003	45.52	40.49	50.56	25.02	22.18	27.86
45–54	1977	55.07	43.26	66.89	31.05	18.01	44.10
	1989	50.13	43.36	56.91	28.81	23.73	33.88
	1997	46.11	36.91	55.31	35.41	28.38	42.44
	2003	48.32	43.70	52.94	30.14	26.52	33.76
55–64	1977	50.86	34.38	67.34	34.11	19.78	48.44
	1989	49.94	41.50	58.38	34.47	27.43	41.50
	1997	51.25	42.71	59.79	38.31	30.68	45.95
	2003	46.55	41.13	51.98	34.32	30.29	38.36
65–74	1989	54.85	46.20	63.50	40.02	32.44	47.61
	1997	57.57	48.11	67.03	47.47	38.65	56.29
	2003	51.42	44.78	58.07	38.27	33.03	43.50

Table 19: Prevalence (%) of obesity and 95% confidence intervals, total population

Age group	Year	Males			Females		
		Estimate	Lower CI	Upper CI	Estimate	Lower CI	Upper CI
All ages	1977	9.39	6.50	12.28	10.81	8.06	13.56
	1989	9.77	7.88	11.66	12.54	10.82	14.25
	1997	15.02	12.86	17.18	19.36	17.37	21.35
	2003	19.90	18.41	21.39	22.13	20.59	23.67
15–24	1977	10.81	2.20	19.41	3.79	-0.80	8.38
	1989	3.04	0.64	5.45	6.60	3.06	10.14
	1997	6.32	2.99	9.66	12.05	7.09	17.01
	2003	9.43	6.16	12.69	12.07	8.31	15.82
25–34	1977	7.56	2.83	12.28	7.09	2.92	11.25
	1989	7.19	2.58	11.80	10.67	5.73	15.60
	1997	11.70	6.66	16.74	16.15	12.47	19.83
	2003	15.89	12.00	19.78	20.73	17.34	24.13
35–44	1977	12.64	5.92	19.36	9.65	4.24	15.06
	1989	12.22	8.75	15.69	9.68	6.92	12.44
	1997	16.52	10.94	22.11	18.09	14.09	22.08
	2003	20.70	17.29	24.10	22.24	18.80	25.69
45–54	1977	5.24	0.34	10.14	16.85	9.03	24.67
	1989	14.50	9.92	19.08	22.85	15.83	29.86
	1997	22.87	16.46	29.27	28.22	22.46	33.98
	2003	25.26	21.17	29.35	24.65	20.89	28.41
55–64	1977	12.04	2.83	21.25	18.17	9.42	26.93
	1989	19.95	12.37	27.54	19.74	13.93	25.55
	1997	23.30	17.16	29.45	24.57	18.18	30.97
	2003	29.80	25.09	34.51	30.73	26.66	34.79
65–74	1989	7.86	3.06	12.67	13.83	8.33	19.34
	1997	13.85	7.37	20.34	21.96	16.03	27.90
	2003	23.93	18.59	29.27	27.60	23.14	32.05

Table 20: Prevalence (%) of extreme obesity and 95% confidence intervals, total population

Age group	Year	Males			Females		
		Estimate	Lower CI	Upper CI	Estimate	Lower CI	Upper CI
All ages	1977	0.32	-0.24	0.88	1.17	0.22	2.12
	1989	0.45	0.07	0.82	1.66	0.79	2.53
	1997	1.24	0.69	1.79	2.96	1.99	3.93
	2003	2.15	1.62	2.68	2.95	2.43	3.47
15–24	1977	0.00	0.00	0.00	0.00	0.00	0.00
	1989	0.00	0.00	0.00	0.64	-0.64	1.92
	1997	1.44	0.05	2.84	2.09	-0.28	4.45
	2003	1.81	0.49	3.13	1.49	0.42	2.55
25–34	1977	0.00	0.00	0.00	1.70	-0.40	3.80
	1989	0.00	0.00	0.00	2.71	-0.56	5.98
	1997	0.50	-0.14	1.14	1.78	0.82	2.75
	2003	1.21	-0.01	2.42	2.53	1.69	3.36
35–44	1977	0.51	-0.93	1.96	1.09	-0.81	2.99
	1989	0.68	-0.30	1.65	0.99	0.04	1.93
	1997	0.88	0.25	1.52	2.95	1.16	4.75
	2003	1.95	0.85	3.04	3.86	2.54	5.19
45–54	1977	0.00	0.00	0.00	1.88	-0.96	4.72
	1989	1.51	0.04	2.99	3.49	1.18	5.80
	1997	2.19	0.19	4.20	4.87	2.27	7.47
	2003	4.12	2.38	5.85	3.49	2.07	4.91
55–64	1977	1.38	-1.92	4.69	0.68	-1.19	2.55
	1989	0.00	0.00	0.00	1.05	-0.39	2.50
	1997	2.27	0.04	4.51	3.20	0.98	5.42
	2003	2.48	0.70	4.27	4.16	2.62	5.70
65–74	1989	1.20	-1.80	4.21	1.23	-0.68	3.14
	1997	0.26	-0.21	0.73	3.60	0.74	6.46
	2003	0.55	-0.05	1.14	1.82	0.58	3.05

Table 21: 10th percentile of BMI and 95% confidence intervals, total population

Age group	Year	Males			Females		
		Estimate	Lower CI	Upper CI	Estimate	Lower CI	Upper CI
All ages	1977	21.28	20.79	21.65	19.88	19.51	20.13
	1989	20.97	20.66	21.27	19.71	19.51	19.87
	1997	21.28	20.83	21.57	20.19	19.79	20.46
	2003	21.26	20.94	21.47	19.94	19.77	20.15
15–24	1977	20.15	18.64	20.94	19.38	18.29	20.09
	1989	19.58	18.83	19.95	18.98	18.35	19.37
	1997	19.59	17.95	20.26	18.93	17.05	19.99
	2003	19.22	18.64	19.74	18.69	18.33	19.06
25–34	1977	21.17	20.37	21.58	19.44	18.74	19.94
	1989	21.48	20.72	22.01	19.63	19.29	19.80
	1997	21.34	20.43	21.70	20.00	19.39	20.45
	2003	21.76	21.09	22.36	19.67	19.38	20.20
35–44	1977	21.85	20.49	22.49	20.14	19.45	20.65
	1989	22.42	21.82	22.84	20.16	19.68	20.42
	1997	21.95	21.35	22.55	19.70	19.29	20.59
	2003	21.94	21.21	22.32	20.29	19.83	20.57
45–54	1977	21.81	20.79	22.73	20.69	19.78	21.56
	1989	22.46	21.58	23.05	20.88	20.26	21.42
	1997	22.78	22.04	23.28	21.27	20.72	21.98
	2003	22.31	21.62	22.87	20.77	20.12	21.39
55–64	1977	22.54	18.45	23.34	20.36	18.69	21.75
	1989	22.32	21.54	22.88	21.18	20.35	21.85
	1997	23.24	21.88	23.44	22.01	21.43	22.53
	2003	23.41	22.84	23.60	21.62	21.04	22.56
65–74	1989	22.40	20.99	22.98	20.20	19.37	20.70
	1997	22.16	21.08	23.31	21.52	20.12	22.75
	2003	22.48	21.71	23.23	21.72	20.60	22.19

Table 22: 25th percentile of BMI and 95% confidence intervals, total population

Age group	Year	Males			Females		
		Estimate	Lower CI	Upper CI	Estimate	Lower CI	Upper CI
All ages	1977	23.06	22.57	23.38	21.47	21.02	21.86
	1989	22.83	22.63	23.09	21.28	21.07	21.44
	1997	23.21	22.90	23.44	22.07	21.82	22.37
	2003	23.43	23.25	23.61	22.16	22.00	22.39
15–24	1977	21.78	20.27	22.71	20.82	19.89	21.63
	1989	20.82	20.54	21.29	20.33	19.70	20.76
	1997	21.03	20.43	21.56	20.64	20.04	21.30
	2003	20.94	20.45	21.45	20.61	19.95	21.00
25–34	1977	22.50	21.84	23.30	20.54	20.13	21.33
	1989	23.02	22.56	23.63	20.86	20.32	21.21
	1997	22.64	22.18	23.20	21.46	21.03	22.04
	2003	23.61	23.09	24.09	21.99	21.55	22.28
35–44	1977	23.29	22.51	24.05	21.47	20.83	22.44
	1989	24.02	23.63	24.38	21.49	21.19	21.87
	1997	24.03	23.27	24.57	21.79	21.06	22.54
	2003	24.01	23.50	24.56	22.07	21.73	22.42
45–54	1977	23.99	22.65	24.65	22.42	21.48	23.30
	1989	24.23	23.66	24.72	22.69	22.28	23.16
	1997	24.67	23.60	25.48	23.67	22.84	24.29
	2003	24.83	24.15	25.23	22.87	22.45	23.25
55–64	1977	24.10	22.83	24.99	22.98	21.50	23.91
	1989	24.38	23.73	25.10	23.18	22.52	23.76
	1997	24.88	23.97	25.77	23.67	23.05	24.65
	2003	25.29	24.67	25.69	23.92	23.35	24.31
65–74	1989	23.84	23.33	24.50	22.65	21.50	23.16
	1997	24.36	23.49	25.47	24.32	23.29	25.04
	2003	25.03	24.21	25.72	23.88	23.50	24.59

Table 23: 50th percentile of BMI and 95% confidence intervals, total population

Age group	Year	Males			Females		
		Estimate	Lower CI	Upper CI	Estimate	Lower CI	Upper CI
All ages	1977	25.09	24.74	25.44	23.77	23.37	24.21
	1989	25.09	24.82	25.35	23.56	23.37	23.85
	1997	25.67	25.35	25.97	25.00	24.65	25.33
	2003	26.30	26.06	26.45	25.10	24.84	25.43
15–24	1977	23.82	22.66	24.94	22.53	21.96	23.56
	1989	22.60	22.21	23.07	21.94	21.55	22.34
	1997	23.42	22.27	24.15	22.75	22.23	24.13
	2003	23.17	22.77	23.53	22.91	22.36	23.44
25–34	1977	24.64	23.72	25.33	22.66	21.96	23.37
	1989	24.79	24.29	25.44	22.91	22.44	23.52
	1997	24.88	23.98	25.36	23.79	23.36	24.56
	2003	26.29	25.85	26.53	24.34	23.88	25.20
35–44	1977	25.28	24.64	26.10	24.01	23.05	24.82
	1989	26.13	25.56	26.50	23.48	23.04	23.94
	1997	26.04	25.46	26.55	24.85	23.86	25.40
	2003	26.59	26.14	27.12	24.73	24.19	25.38
45–54	1977	25.60	24.90	26.67	24.66	23.74	25.81
	1989	26.22	25.79	26.72	25.33	24.27	26.04
	1997	26.51	26.04	27.35	27.13	25.76	27.84
	2003	27.09	26.71	27.59	25.73	25.19	26.42
55–64	1977	25.87	24.91	26.90	25.18	24.40	26.21
	1989	26.96	25.96	27.36	25.70	24.56	26.85
	1997	27.02	26.20	28.18	26.72	25.71	27.65
	2003	27.80	27.04	28.48	27.11	26.51	27.68
65–74	1989	26.18	25.32	27.07	25.45	24.13	26.12
	1997	26.33	25.91	27.13	26.28	25.67	27.25
	2003	27.59	27.02	27.94	26.82	26.23	27.49

Table 24: 75th percentile of BMI and 95% confidence intervals, total population

Age group	Year	Males			Females		
		Estimate	Lower CI	Upper CI	Estimate	Lower CI	Upper CI
All ages	1977	27.48	27.03	27.92	26.32	25.83	27.21
	1989	27.84	27.40	28.28	26.95	26.66	27.40
	1997	28.42	27.98	29.06	29.13	28.65	29.48
	2003	29.46	29.23	29.72	29.76	29.34	30.04
15–24	1977	26.72	24.91	28.45	24.56	23.86	25.78
	1989	24.58	23.69	25.68	24.46	23.77	25.52
	1997	26.00	25.14	27.57	26.35	25.16	28.21
	2003	25.94	25.40	27.01	26.52	25.90	27.85
25–34	1977	27.13	26.02	28.21	25.19	24.34	26.31
	1989	27.55	26.37	28.81	26.09	25.25	27.02
	1997	27.81	26.68	28.39	27.96	27.01	29.25
	2003	28.91	28.28	29.71	29.28	28.50	30.31
35–44	1977	27.79	26.88	29.38	26.83	25.61	27.79
	1989	28.57	27.79	29.92	26.25	25.83	26.94
	1997	29.01	28.01	30.10	28.56	27.76	29.92
	2003	29.65	29.09	30.15	29.80	28.95	30.85
45–54	1977	27.72	26.99	28.72	27.63	26.13	30.21
	1989	28.77	27.92	29.90	29.61	28.02	31.93
	1997	29.97	28.78	30.85	31.23	29.98	32.05
	2003	30.35	29.64	31.11	30.11	29.35	31.17
55–64	1977	27.73	26.87	29.78	27.93	26.49	30.51
	1989	29.21	28.49	30.55	29.32	28.28	30.12
	1997	29.95	29.25	31.01	30.05	29.29	32.31
	2003	30.79	30.33	31.48	31.12	30.48	31.93
65–74	1989	28.67	27.80	29.53	27.76	27.28	29.10
	1997	28.18	27.54	29.53	29.40	28.74	31.30
	2003	29.89	29.42	30.81	30.51	29.77	31.49

Table 25: 90th percentile of BMI and 95% confidence intervals, total population

Age group	Year	Males			Females		
		Estimate	Lower CI	Upper CI	Estimate	Lower CI	Upper CI
All ages	1977	29.91	29.29	30.88	30.30	29.06	31.74
	1989	30.50	29.97	31.23	31.34	30.56	32.85
	1997	31.70	31.16	32.09	33.50	33.01	34.31
	2003	32.93	32.57	33.37	34.30	33.92	34.91
15–24	1977	30.20	27.20	34.16	26.64	25.30	35.20
	1989	26.99	25.95	28.63	28.54	26.56	30.55
	1997	29.64	27.84	31.90	31.02	28.46	34.31
	2003	30.53	29.23	32.01	31.56	30.03	33.33
25–34	1977	29.46	28.43	30.98	28.43	27.24	31.31
	1989	29.97	29.01	31.94	30.77	28.04	34.90
	1997	30.30	30.07	31.78	32.90	31.17	33.73
	2003	32.07	31.43	32.91	34.30	33.57	35.32
35–44	1977	31.00	29.41	33.41	29.87	28.05	33.88
	1989	31.37	30.77	32.34	30.21	29.21	32.94
	1997	32.36	31.12	34.88	34.71	32.50	37.56
	2003	32.81	32.17	33.80	34.54	33.68	36.10
45–54	1977	29.31	28.70	30.44	32.12	30.02	35.02
	1989	31.26	30.18	32.84	34.45	33.24	37.30
	1997	32.49	31.06	35.06	35.56	33.22	38.21
	2003	35.30	33.41	36.53	34.36	33.38	36.73
55–64	1977	30.48	28.55	38.92	31.77	30.14	35.05
	1989	32.53	30.60	38.09	33.03	32.03	34.15
	1997	32.92	31.96	34.39	36.62	33.18	38.31
	2003	34.35	33.15	35.57	36.34	35.05	37.86
65–74	1989	30.76	29.06	38.26	31.23	29.64	33.75
	1997	31.27	29.64	32.92	33.47	32.26	35.21
	2003	33.03	32.59	33.89	34.53	33.59	35.61

Māori population

Table 26: Mean BMI and 95% confidence intervals, Māori population

Year	Males			Females		
	Estimate	Lower CI	Upper CI	Estimate	Lower CI	Upper CI
1989	27.21	26.06	28.35	27.75	26.55	28.95
1997	28.69	27.79	29.59	28.66	27.82	29.50
2003	29.26	28.46	30.06	28.48	27.86	29.09

Table 27: Prevalence (%) of overweight and 95% confidence intervals, Māori population

Year	Males			Females		
	Estimate	Lower CI	Upper CI	Estimate	Lower CI	Upper CI
1989	30.80	19.97	41.63	28.68	18.86	38.50
1997	30.25	22.22	38.28	32.57	25.61	39.53
2003	37.15	31.88	42.43	31.31	26.55	36.07

Table 28: Prevalence (%) of obese and 95% confidence intervals, Māori population

Year	Males			Females		
	Estimate	Lower CI	Upper CI	Estimate	Lower CI	Upper CI
1989	19.26	9.77	28.75	20.02	12.43	27.62
1997	27.18	20.25	34.11	27.94	21.44	34.44
2003	27.01	21.91	32.12	26.47	22.16	30.78

Table 29: Prevalence (%) of extreme obesity and 95% confidence intervals, Māori population

Year	Males			Females		
	Estimate	Lower CI	Upper CI	Estimate	Lower CI	Upper CI
1989	3.20	-0.54	6.94	7.05	1.73	12.37
1997	3.75	1.21	6.30	6.03	2.88	9.18
2003	7.80	4.67	10.93	6.66	4.25	9.07

Table 30: 10th percentile of BMI and 95% confidence intervals, Māori population

Year	Males			Females		
	Estimate	Lower CI	Upper CI	Estimate	Lower CI	Upper CI
1989	23.86	16.37	24.71	21.77	19.65	22.63
1997	23.86	21.51	24.17	22.23	21.04	23.01
2003	23.27	22.07	23.96	21.62	21.09	22.32

Table 31: 25th percentile of BMI and 95% confidence intervals, Māori population

Year	Males			Females		
	Estimate	Lower CI	Upper CI	Estimate	Lower CI	Upper CI
1989	25.28	24.00	26.06	23.65	22.63	24.48
1997	25.12	24.18	26.06	24.89	24.02	25.48
2003	25.73	24.91	26.52	24.37	23.78	25.27

Table 32: 50th percentile of BMI and 95% confidence intervals, Māori population

Year	Males			Females		
	Estimate	Lower CI	Upper CI	Estimate	Lower CI	Upper CI
1989	27.83	25.95	30.40	25.89	24.81	27.64
1997	28.69	27.62	30.43	29.00	27.75	30.36
2003	29.10	27.91	30.12	29.14	28.26	29.80

Table 33: 75th percentile of BMI and 95% confidence intervals, Māori population

Year	Males			Females		
	Estimate	Lower CI	Upper CI	Estimate	Lower CI	Upper CI
1989	31.83	29.95	33.75	31.55	29.19	33.68
1997	32.88	31.42	35.28	33.43	31.89	36.60
2003	33.00	31.66	34.65	33.26	32.46	34.71

Table 34: 90th percentile of BMI and 95% confidence intervals, Māori population

Year	Males			Females		
	Estimate	Lower CI	Upper CI	Estimate	Lower CI	Upper CI
1989	33.81	32.84	43.77	36.95	33.46	44.04
1997	36.38	35.28	41.37	38.37	37.60	41.24
2003	38.59	36.97	41.52	38.96	37.37	40.74