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## Trends in lifestyle among three cohorts of adults aged 55–64 years in 1992/1993, 2002/2003 and 2012/2013

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**Background:** Unhealthy lifestyle factors, such as obesity, smoking, excessive alcohol consumption and physical inactivity, are associated with increased morbidity and mortality risk, even in older age. We investigated trends in lifestyle among three cohorts of adults aged 55–64 years from the Netherlands. **Methods:** Data from the Longitudinal Aging Study Amsterdam were used. This study consisted of three randomly selected samples of men and women. Lifestyle data were collected in 1992/1993 (cohort 1,  $n=988$ ), in 2002/2003 (cohort 2,  $n=1002$ ) and in 2012/2013 (cohort 3,  $n=1023$ ). Trends in lifestyle across cohorts were tested using multivariable regression analyses. **Results:** Complete lifestyle data were available for 834 participants from cohort 1, 861 from cohort 2 and 845 from cohort 3. Among men, but not in women, mean BMI and prevalence of obesity increased over time. The mean minutes per day spent being physically active decreased among both men and women, from  $130 \pm 107$  and  $230 \pm 122$  (1992/1993) to  $114 \pm 100$  and  $192 \pm 109$  (2002/2003), and  $126 \pm 98$  and  $187 \pm 112$  (2012/2013), respectively. The percentage of men and women defined as excessive drinkers (>7 alcoholic consumptions per week) increased from 54.9%, 62.3% to 65.4% (men) and 22.7%, 36.1% to 37.4% (women), in 1992/1993, 2002/2003 and 2012/2013, respectively. The percentage of non-smoking men and women increased over time. **Conclusion:** The lifestyle of Dutch adults aged 55–64 years was less healthy in 2012/2013 compared with 2002/2003 and 1992/1993. Political attention regarding healthy ageing should target the prevention of overweight, physical inactivity and excessive alcohol consumption in middle-aged persons.

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## Introduction

There is an increase in the older population worldwide. In the year 2000, 600 million people worldwide were 60 years or older, while it is expected that in the year 2050 this number will increase up to 2 billion.<sup>1</sup> In addition to an increased share of older people, life expectancy has increased in the last decades, although life years with disability followed a lower rate, depending on the country.<sup>2</sup> It has been hypothesized that the discrepancy between life expectancy and the number of healthy life years could be (partly) due to an unhealthy lifestyle. Obesity, smoking, excessive alcohol consumption and physical inactivity are lifestyle factors which are known to increase disease risk, disability and premature death.<sup>3–7</sup> It is important to have insights in trends in these modifiable factors, in order to develop (intervention) programs to prevent functional decline and promote healthy ageing.

Previously, we have shown that several lifestyle factors of men and women aged 55–64 years in 2002/2003 from the Netherlands were less healthy compared with adults with the same age 10 years before.<sup>8</sup> It is of interest to determine whether this unhealthy lifestyle trend has continued over the subsequent 10 years. Therefore, the aim of this study was to describe trends in lifestyle across three cohorts of Dutch men and women aged 55–64 years, participants from the Longitudinal Aging Study Amsterdam (LASA). We compared lifestyle factors of men and women in 2012/2013 with those of previously collected data from 2002/2003 and 1992/1993.

## Methods

### Study sample

Data were used from the LASA, an ongoing study investigating physical, emotional, cognitive and social functioning in late life.<sup>9,10</sup> The study consisted of three randomly selected samples, collected at baseline in 1992/1993 and exactly 10 and 20 years after baseline, stratified by age, sex and expected 5-year mortality. Participants were from registers of 11 local municipalities from 3 geographical regions in the Netherlands. Citizens were randomly selected from municipal registries and received an invitation letter including additional information regarding the study. In the letter, it was mentioned that the research team would contact them to ask for their participation. The first LASA cohort (cohort 1, 1992/1993) consisted of 3107 men and women aged 55–85 years, with an over-sampling of the oldest and older men in particular. Of these, 988 men and women were 55–64 years old. The second cohort was recruited in 2002/2003 (cohort 2,  $n=1002$ ) and the third in 2012/2013 (cohort 3,  $n=1023$ ), all 55–64 years old. The recruitment strategy was identical between the three cohorts. The response rate was 62% in 1992/1993, 62% in 2002/2003 and 63% in 2012/2013. Measurements were performed by trained interviewers who visited the study participants at home. Two separate interviews were conducted: a main interview and a medical interview, including clinical measurements. In addition, respondents were asked to complete a self-administered questionnaire. Details on the interviews and measurements have been described elsewhere.<sup>10</sup> The lifestyle factors in the three cohorts were assessed using the exact same protocol in all three cohorts, which enables direct comparisons between cohorts. For the current analyses, we included men and women aged 55–64 years from all three cohorts with complete data on all lifestyle factors (cohort 1,  $n=834$ ; cohort 2,  $n=861$ ; cohort 3,  $n=845$ ). The LASA study was approved by the Ethical Review Board of the VU University Medical Center and all respondents provided informed consent.

### Obesity

Weight was measured to the nearest 0.1 kg using a calibrated scale (Seca, model 100; Laméris, Amersfoort, the Netherlands). In

addition, weight was adjusted for 'clothing' (–1.0 kg), 'corset' (–1.0 kg) and 'shoes' (–1.0 kg) whenever applicable.<sup>11</sup> Height was measured to the nearest 0.1 cm after maximal inspiration using a stadiometer. Body mass index [BMI, body weight (kg) divided by height (m) squared] was calculated and classified as normal weight (<25.0 kg/m<sup>2</sup>), overweight (25.0–30.0 kg/m<sup>2</sup>) and obese (>30 kg/m<sup>2</sup>). Only 51 participants (2.0%) had a BMI <20.0 kg/m<sup>2</sup> and were therefore not considered as a separate category. Waist circumference was measured to the nearest 0.1 cm in the standing position, midway between the lower rib and the iliac crest, after a normal expiration. It was categorized into 'high-risk waist circumference' (>102 cm for men and >88 cm for women) and 'normal waist circumference'.<sup>12</sup>

### Smoking behaviour and alcohol intake

Smoking status (non, former, current) was assessed with a self-administered questionnaire. Former smokers who stopped smoking ≥15 years ago were also classified as non-smokers. Alcohol intake (does not drink, does drink) and the number of glasses of alcoholic beverages per week were also assessed with a self-administered questionnaire. Excessive alcohol intake was defined as >7 glasses per week, based on the recent Dutch Dietary Guidelines.<sup>13</sup> To enable comparison with other studies regarding excessive alcohol consumption, we also performed analyses using >21 alcoholic beverages per week for men and >14 alcoholic beverages per week for women as cut-off points. Binge drinking was defined as the consumption of more than six alcoholic beverages for men and four alcoholic beverages for women each time they reported to drink.

### Physical activity

Physical activity was assessed in minutes per day by the LASA Physical Activity Questionnaire (LAPAQ).<sup>14</sup> Participants were asked to report the frequency and duration of physical activities during the 2 weeks preceding the main interview. The LAPAQ covers the following activities: walking outside, bicycling, light household activities, heavy household activities and a maximum of two sport activities. The sum of minutes per day spent on these activities was used as total physical activity. For the current analyses, we included only sports of minimally moderate intensity. The LAPAQ was shown to be a valid and reliable instrument for classifying physical activity in older people, and highly correlated with a 7-day diary ( $r=0.68$ ).<sup>14</sup> Besides the number of minutes per day being physically active, a cut-off (≥150 minutes of moderate-intensity activity per week) was applied to approach identifying participants meeting the Dutch physical activity recommendation.<sup>15,16</sup> This cut-off was based on time spent walking, biking, heavy household activities and sports of at least moderate intensity.

Demographic variables included education, occupation, income and marital status. Education level included the highest attained education level. This was categorized into elementary school or less, secondary school or higher education. Participants were asked whether they were currently employed (yes/no), and among the current workers, the number of working hours per week were reported. Monthly income was categorized as 454–907 euro, 908–1361 euro, 1362–1815 euro, 1816–2269 euro, ≥2270 euro and missing. Marital status was defined as unmarried, married, divorced, widowed and registered partnership.

### Statistical analyses

Data were analysed for men and women separately in order to enable comparison between the current study and previous observed trends in the LASA study.<sup>8</sup> Mean values (±SD) and prevalences (%) were internally weighted to the age distribution of 2012/2013, which ensures an identical distribution of age across the three cohorts. Continuous variables were tested for normality using the Shapiro–Wilk test. Cohort differences in continuous variables not normally distributed (minutes of physical activity per day and minutes of

sport activities per day) were tested using the Mann–Whitney *U* test. Cohort differences in all other continuous variables were tested using an ANOVA, and in case of categorical variables, a  $\chi^2$  test was performed. We conducted tests for trends across cohorts by entering cohort as a categorical variable, adjusted for age and education level, using linear, logistic or ordinal regression analyses for continuous, binary or ordinal variables, respectively. Analyses were performed with IBM SPSS Statistics for Windows, version 22.0 (IBM Corp; Armonk, NY). A two-sided *P* value < 0.05 was considered statistically significant.

## Results

Men and women from more recent cohorts were higher educated, more often currently working, had a higher income and were less often currently married (table 1). Lifestyle factors are presented by sex and per cohort in table 2.

### Obesity

Among men, mean BMI increased over time from  $26.3 \pm 2.9$  kg/m<sup>2</sup> in 1992/1993 to  $27.2 \pm 3.6$  kg/m<sup>2</sup> in 2002/2003 and  $27.4 \pm 3.9$  kg/m<sup>2</sup> in 2012/2013 (*P* for trend < 0.001). In addition, the percentage of obese men increased over time (*P* for trend < 0.001) from 9.6% to 17.8% and 23.0%, in 1992/1993, 2002/2003 and 2012/2013, respectively. Mean waist circumference and the prevalence of high-risk waist circumference also increased over time (*P* for trend < 0.001 for both). Among women, mean BMI remained more stable compared with men (*P* for trend = 0.11), although a decrease between 2002/2003 and 2012/2013 was observed. Although a large proportion of the women in all cohorts were overweight or obese (58–67%), there was a positive trend towards a more healthy weight (*P* for trend = 0.04). Mean waist circumference and prevalence of

high-risk waist circumference also fluctuated across cohorts in women.

### Smoking behaviour

The prevalence of men who were current smokers in 1992/1993 was 37.4%. This prevalence was 33.6% in 2002/2003 and 20.3% in 2012/2013, which was significantly lower compared with 1992/1993 (*P* for trend < 0.001). The percentage of non-smoking men was lower in 1992/1993 (34.5%) compared with 2002/2003 (47.0%) and 2012/2013 (58.7%) (*P* for trend < 0.001). In contrast, we observed a different trend among women. The percentage of non-smoking women was 62.7% in 1992/1993, 59.4% in 2002/2003 and 68.1% in 2012/2013. However, the percentage of current smokers had decreased from 26.3% in 2002/2003 to 16.3% in 2012/2013.

### Alcohol consumption

Results suggest a similar trend regarding the consumption of any alcoholic beverages among men and women, with an increase from 1992/1993 to 2002/2003, to a subsequent decrease from 2002/2003 to 2012/2013. A significant increasing trend was, however, observed for excessive alcohol consumption (>7 glasses per week) among both men and women.

Using a different cut-off point (>21 alcoholic beverages per week for men and >14 alcoholic beverages per week for women), no trends in excessive alcohol consumption were observed among men or women. Prevalences among men increased from 12.7% in 1992/1993 to 16.8% in 2002/2003, but decreased to 13.2% in 2012/2013. Among women, prevalences fluctuated from 14.6% to 25.8% and 23.2% in 1992/1993, 2002/2003 and 2012/2013, respectively.

The prevalence in men of binge drinking in 1992/1993 was 8.7% and 13.8% in 2002/2003, which was significantly higher, but no difference was observed compared with 2012/2013 (10.5%). No statistically significant trend across cohorts was observed (*P* for

**Table 1** Demographics of three generations of older men and women aged 55–64 years from the Longitudinal Aging Study Amsterdam

	Men <sup>a</sup>				Women <sup>a</sup>			
	1992/1993 <i>n</i> = 405	2002/2003 <i>n</i> = 408	2012/2013 <i>n</i> = 409	<i>P</i> for trend <sup>b</sup>	1992/1993 <i>n</i> = 429	2002/2003 <i>n</i> = 453	2012/2013 <i>n</i> = 436	<i>P</i> for trend <sup>b</sup>
Education				<0.001				<0.001
Elementary school or less	174 (43.0)	157 (38.5) <sup>d</sup>	114 (27.7) <sup>d,e</sup>		267 (62.2)	215 (47.4) <sup>d</sup>	110 (25.2) <sup>d,e</sup>	
Secondary school	146 (36.0)	126 (30.9) <sup>d</sup>	145 (35.5) <sup>d,e</sup>		126 (29.4)	185 (40.8) <sup>d</sup>	204 (46.8) <sup>d,e</sup>	
Higher education	85 (21.0)	125 (30.6) <sup>d</sup>	150 (36.8) <sup>d,e</sup>		36 (8.4)	53 (11.8) <sup>d</sup>	122 (28.0) <sup>d,e</sup>	
Occupation				<0.001				<0.001
No	243 (60.1)	192 (47.0) <sup>d</sup>	117 (28.6) <sup>d,e</sup>		336 (78.2)	309 (68.2) <sup>d</sup>	193 (44.3) <sup>d,e</sup>	
Yes	155 (38.2)	216 (53.0) <sup>d</sup>	292 (71.4) <sup>d,e</sup>		90 (20.9)	143 (31.6) <sup>d</sup>	243 (55.7) <sup>d,e</sup>	
Working hours per week (among current workers)	40.9 ± 15.7	35.5 ± 15.6 <sup>d</sup>	37.0 ± 13.0 <sup>d</sup>	0.092	19.5 ± 16.0	21.9 ± 14.6	22.5 ± 11.1	0.066
Income				<0.001				<0.001
454–907 euro	61 (15.0)	17 (4.2) <sup>d</sup>	15 (3.7) <sup>d,e</sup>		106 (24.7)	46 (10.2) <sup>d</sup>	26 (6.0) <sup>d,e</sup>	
908–1361 euro	108 (26.7)	60 (14.6) <sup>d</sup>	31 (7.6) <sup>d,e</sup>		119 (27.7)	85 (18.7) <sup>d</sup>	46 (10.6) <sup>d,e</sup>	
1362–1815 euro	84 (20.7)	75 (18.4) <sup>d</sup>	36 (8.8) <sup>d,e</sup>		58 (13.6)	77 (17.0) <sup>d</sup>	42 (9.6) <sup>d,e</sup>	
1816–2269 euro	50 (12.4)	71 (17.4) <sup>d</sup>	60 (14.7) <sup>d,e</sup>		24 (5.6)	80 (17.7) <sup>d</sup>	68 (15.6) <sup>d,e</sup>	
≥2270	46 (11.7)	166 (40.8) <sup>d</sup>	250 (61.1) <sup>d,e</sup>		17 (4.0)	107 (23.6) <sup>d</sup>	222 (50.9) <sup>d,e</sup>	
Missing	56 (13.8)	19 (4.7)	17 (4.2)		105 (24.5)	58 (12.8)	32 (7.3) <sup>e</sup>	
Marital status				0.349				0.026
Unmarried	26 (6.4)	24 (5.8)	46 (11.2) <sup>d,e</sup>		25 (5.8)	16 (3.5) <sup>d</sup>	50 (11.5) <sup>d,e</sup>	
Married	338 (83.4)	329 (80.6)	302 (73.8) <sup>d,e</sup>		314 (73.3)	341 (75.2) <sup>d</sup>	301 (69.0) <sup>d,e</sup>	
Divorced	24 (6.0)	33 (8.1)	40 (9.8) <sup>d,e</sup>		20 (4.7)	54 (12.0) <sup>d</sup>	36 (8.3) <sup>d,e</sup>	
Widow	17 (4.2)	19 (4.7)	8 (2.0) <sup>d,e</sup>		70 (16.2)	39 (8.5) <sup>d</sup>	36 (8.3) <sup>d,e</sup>	
Registered partnership <sup>c</sup>	–	3 (0.7)	13 (3.2)		–	4 (0.9)	13 (3.0) <sup>e</sup>	

a: Mean values (±SD) and prevalences (%) were internally weighted for age, which ensures an equal distribution of age across the three generations.

b: *P* values for trend adjusted for age.

c: Registered partnership was introduced in 1998, and therefore not available for cohort 1.

d: Significantly different compared with cohort 1.

e: Significantly different compared with cohort 2.

**Table 2** Lifestyle characteristics of three generations of older men and women aged 55–64 years from the Longitudinal Aging Study Amsterdam

	Men <sup>a</sup>					Women <sup>a</sup>					P for trend <sup>b</sup>
	Cohort 1 1992/1993	Cohort 2 2002/2003	Cohort 3 2012/2013	P for trend <sup>b</sup>		Cohort 1 1992/1993	Cohort 2 2002/2003	Cohort 3 2012/2013	P for trend <sup>b</sup>		
	n = 405	n = 408	n = 409			n = 429	n = 453	n = 436			
Body mass index (kg/m <sup>2</sup> )	26.3 ± 2.9	27.2 ± 3.6 <sup>c</sup>	27.4 ± 3.9 <sup>c</sup>	<0.001		27.1 ± 4.3	27.6 ± 4.8	26.8 ± 5.1 <sup>d</sup>		0.106	
BMI class, n (%)				<0.001						0.039	
<25 kg/m <sup>2</sup> (normal weight)	139 (34.3)	106 (26.0) <sup>c</sup>	124 (30.3) <sup>c,d</sup>			153 (35.7)	149 (33.0)	183 (42.0) <sup>d</sup>			
25–30 kg/m <sup>2</sup> (overweight)	227 (56.1)	229 (56.2) <sup>c</sup>	191 (46.7) <sup>c,d</sup>			186 (43.4)	179 (39.6)	160 (36.7) <sup>d</sup>			
>30 kg/m <sup>2</sup> (obesity)	39 (9.6)	72 (17.8) <sup>c</sup>	94 (23.0) <sup>c,d</sup>			90 (21.0)	124 (27.4)	93 (21.3) <sup>d</sup>			
Waist circumference (cm)	98.8 ± 9.5	100.2 ± 10.1 <sup>c</sup>	101.2 ± 11.5 <sup>c</sup>	<0.001		93.5 ± 11.7	94.3 ± 12.4	92.6 ± 13.3 <sup>d</sup>		0.141	
High risk waist circumference, n (%) <sup>e</sup>	138 (34.0)	166 (40.7)	185 (45.2) <sup>c</sup>	<0.001		284 (66.2)	308 (68.0)	270 (61.9)		0.456	
Smoking, n (%)				<0.001						0.022	
Non-smoker	140 (34.5)	192 (47.0) <sup>c</sup>	240 (58.7) <sup>c,d</sup>			269 (62.7)	269 (59.4)	297 (68.1) <sup>c,d</sup>			
Former	113 (27.9)	79 (19.4) <sup>c</sup>	84 (20.5) <sup>c,d</sup>			58 (13.5)	65 (14.3)	68 (15.6) <sup>c,d</sup>			
Current	152 (37.4)	137 (33.6) <sup>c</sup>	83 (20.3) <sup>c,d</sup>	0.350		102 (23.8)	119 (26.3)	71 (16.3) <sup>c,d</sup>		0.786	
Alcohol consumers, n (%)											
No	35 (8.6)	16 (4.0) <sup>c</sup>	39 (9.5) <sup>d</sup>			86 (20.1)	51 (11.2) <sup>c</sup>	70 (16.1) <sup>d</sup>			
Yes	370 (91.4)	392 (96.0) <sup>c</sup>	370 (90.5) <sup>d</sup>			343 (79.9)	402 (88.8) <sup>c</sup>	366 (83.9) <sup>d</sup>			
Excessive drinking <sup>f</sup>	203 (54.9)	244 (62.3) <sup>c</sup>	242 (65.4) <sup>c</sup>	0.008		78 (22.7)	145 (36.1) <sup>c</sup>	137 (37.4) <sup>c</sup>		0.021	
Binge drinking	32 (8.7)	54 (13.8) <sup>c</sup>	39 (10.5)	0.127		13 (3.8)	35 (8.7) <sup>c</sup>	31 (8.5) <sup>c</sup>		0.009	
Total physical activity <sup>g</sup> , min/day	130 ± 107	114 ± 100 <sup>c</sup>	126 ± 98	0.457		230 ± 122	192 ± 109 <sup>c</sup>	187 ± 112 <sup>c</sup>		<0.001	
≥150 min/week of moderate intensity physical activity, n (%)	303 (74.9)	285 (69.9)	327 (80.0) <sup>d</sup>	0.238		372 (86.7)	344 (76.0) <sup>c</sup>	367 (84.2) <sup>d</sup>		0.236	
Sports (min/day) (among those who perform sport activities)	n = 23038 ± 50	n = 22031 ± 30	n = 26237 ± 38 <sup>c,d</sup>	0.902		n = 26027 ± 34	n = 25325 ± 27	n = 29830 ± 27 <sup>c,d</sup>		0.208	

a: Mean values (±SD) and prevalences (%) were internally weighted for age, which ensures an equal distribution of age across the three cohorts.

b: P values for trend adjusted for age and education.

c: Significantly different compared with cohort 1.

d: Significantly different compared with cohort 2.

e: Men: > 102 cm; Women: > 88 cm.

f: ≥ 8 glasses of alcohol beverages per week.

g: Includes walking, biking, light and heavy house hold activities, and sports.



trend=0.127). In contrast, in women, there was a significant increasing trend in the prevalence of binge drinking ( $P$  for trend=0.009). In 1992/1993, among the alcohol consumers, 3.8% were defined as binge drinkers. In 2002/2003 and 2012/2013, 8.7% and 8.5% were defined as binge drinkers, respectively, which was significantly higher compared with 1992/1993. No difference was observed between 2002/2003 and 2012/2013.

### Physical activity

A negative trend was observed for total minutes per day spent physically active. Based on self-reported data, men and women from 1992/1993 spent more time being physically active compared with their peers from more recent cohorts, although only a statistically significant trend was observed for women ( $P$  for trend = 0.457 for men and  $P$  for trend < 0.001 for women). Results suggest a non-significant trend regarding the percentage of men and women meeting the Dutch physical activity guideline ( $\geq 150$  minutes of moderate-intensity activity per week), with a decrease from 1992/1993 to 2002/2003, to an increase from 2002/2003 to 2012/2013. In 1992/1993, 56.7% of men and 60.9% of women reported sport activities during the previous 2 weeks. These prevalences decreased slightly across cohorts with 53.9% of men and 55.9% of women in 2002/2003, to a significant increase of 64.1% of men and 68.6% of women in 2012/2013. Among the participants who reported sporting activities, no trends were observed regarding time (min/day) spent on sports.

### Discussion

In this study, we investigated trends in lifestyle across three cohorts, each assessed 10 years apart, of adults aged 55–64 years from the Netherlands. We have shown that more recent cohorts have a less healthy lifestyle compared with their peers in 2002/2003 and 1992/1993, i.e. more men were obese and had a high-risk waist circumference, more men and women were excessive alcohol drinkers and less time was spent being physically active. On a positive note, fewer men and women were current smokers compared with the previous cohorts and more men and women from the most recent cohort met the Dutch physical activity guideline.

Our results indicate an increase in the prevalence of obesity among men, whereas no change in prevalence over time among women was observed, even though the prevalence of obesity remained high. These results are in line with a study comparing generations of men and women aged > 65 years between 1999 and 2010 from the USA.<sup>17</sup> In addition, a recent report from the NCD Risk Factor Collaboration investigating worldwide trends of BMI among adults between 1975 and 2014 showed that mean BMI increased over time and that age-standardized prevalence of obesity increased from 3.2% in 1997 to 10.8% in 2014 in men and from 6.4% to 14.9% in women aged 18 years and older.<sup>18</sup> Trend data regarding physical activity are scarce, although our trend of decreasing time spent on total physical activity was also observed in several studies across the world.<sup>19–22</sup> Our results showed a decreasing trend in time spent per day being physically active among women, while more women of the most recent cohort met the Dutch physical activity guideline compared with 2002/2003. This can potentially be explained by the fact that more non-active people became active, while at the same time the older people who were physically active for more than 150 minutes per week became less physically active, though still more than 150 minutes per week.

Significantly more people from the more recent cohorts were alcohol consumers. When applying the relatively strict Dutch alcohol recommendation, we observe increasing trends for excessive drinking across cohorts. This is in line with the results from a comprehensive review of studies including men and women within the age range of 15–80 years, investigating cohort effects in alcohol consumption including studies from the USA

and Europe, which showed that more recent birth cohorts (both men and women) consistently consumed more alcohol than older cohorts and were engaging in more episodic and problem drinking.<sup>23</sup> In addition, based on the strongest methodological studies, the authors conclude a converge in differences between men and women, whereby an increasing trend of heavy drinking and alcohol disorders was observed among women in the more recent cohorts, but not in men.<sup>23</sup> This is also in line with our results where an increasing trend was observed among the percentage of women, but not men, defined as binge drinkers.

A positive trend observed in the current study was the decrease in the prevalence of current smoking. However, there was a different pattern in smoking behaviour among men compared with women, which could be explained by the different historical smoking patterns between men and women, with smoking prevalence having peaked approximately two decades earlier among men than women.<sup>24</sup>

Due to better welfare standards and medical and technological improvements, life expectancy has increased over time. However, the concomitant increase in years in good health has a slower rate, which results in higher numbers of older adults coping with physical limitations and poor health. For example, recent results from a large prospective cohort study investigating health expectancies over two decades in England showed that life expectancy at age 65 increased, with much smaller increases in disability-free years.<sup>25</sup> Also in the Netherlands, life expectancy among men and women has increased in the last decades; however, the number of years in well perceived health and the number of years with disability has decreased.<sup>26</sup> The discrepancy between the rate of increase in life expectancy and disability-free years may be explained by higher rates of obesity, lower physical activity and excessive alcohol consumption among recent generations of older men and women. Indeed, more than 10 years ago, Olshansky et al. predicted that the obesity trend would have a negative effect on life expectancy.<sup>27</sup> This prediction is confirmed by recent data from the Centers for Disease Control and Prevention, showing that life expectancy in the USA has declined in the last 2 years,<sup>28</sup> which is likely a result of the obesity epidemic that started in the late 1970s.<sup>29</sup> Future studies should focus on improving lifestyle with the purpose of reversing the obesity epidemic, which is then likely to lead to an increase in the number of disability-free years. Hence, promoting and improving nutritional status and physical activity across the lifespan may help accomplishing a healthier lifestyle in old age.

As a means of treatment of obesity, it is important to improve nutritional status by promoting weight loss and stimulating physical activity among obese, inactive adults. Previous studies have shown that weight loss and improvements in body composition are achievable by dietary restriction and/or exercise up to very old age.<sup>30–36</sup> Independent of physical inactivity, sedentary behaviour—behaviour characterized by an energy expenditure  $\leq 1.5$  metabolic equivalents, such as television viewing, reading and computer use<sup>37</sup>—is associated with negative health outcomes, such as type 2 diabetes, cardiovascular diseases and mortality.<sup>38–41</sup> Although trends in sedentary behaviour were not investigated in this study, we know that sedentary behaviour is most common among older adults and is greater in more recent generations.<sup>41</sup> A recent meta-analysis suggests that the increased mortality risk associated with long sedentary time can be compensated by high levels of moderate-intensity physical activity (about 60–75 min per day).<sup>42</sup> Taken together, these results highlight the importance of a healthy diet, physical activity and limited sedentary behaviour in order to promote healthy ageing.

A strength of the current study is the inclusion of three samples of men and women aged 55–64 years old randomly selected 10 years apart. In addition, we performed the exact same sampling and recruitment strategies, which enabled direct cohort comparisons. Furthermore, objectively measured anthropometric variables were included, which limits the risk of reporting bias. Unfortunately, we did not have data regarding other lifestyle factors, such as

dietary intake or stress management in each cohort, nor did we have an objective measure of physical activity, such as accelerometry data, available for all cohorts.

## Conclusions

The lifestyle of more recent cohorts of adults aged 55–64 years in the Netherlands was less healthy in 2012/2013 compared with their peers in 2002/2003 and 1992/1993. Political attention regarding healthy ageing should focus on the prevention of obesity and physical inactivity at middle age, moderate alcohol consumption and on the development of effective and sustainable interventions aiming at improving body weight, increasing physical activity and lowering alcohol consumption.

### Key points

- The lifestyle of Dutch adults currently aged 55–64 years adults is less healthy compared with generations of similar age 10 and 20 years ago regarding nutritional status (obesity, physical activity) and alcohol consumption;
- The single exception is the decreasing trend in the proportion of current smokers among both men and women;
- Prevention of overweight, physical inactivity and excessive alcohol consumption is imperative for healthy ageing;
- Development of effective and sustainable interventions in order to improve nutritional status and to lower alcohol consumption is needed.

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## Health related quality of life and physical activity in prison: a multicenter observational study in Italy

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**Background:** Inmates have a poorer health status than the general population. The physical activity is well known that improves the wellness of the people. This multicentric cross-sectional study aimed to assess the relationship between Quality of Life (QoL) and physical activity levels among Italian prisoners. **Methods:** Inmates from eight prisons completed a questionnaire. The *Metabolic Equivalent of Task* (MET) was used to measure inmates' weekly physical activity levels (MATwk). Their QoL was measured using two components of Short Form with 12 items (SF12): MCS (mental score) and PCS (physical score). **Results:** A total of 636 questionnaires were compiled. High level of MET was significantly ( $P < 0.05$ ) associated with both PCS (OR = 1.02) and MCS (OR = 1.03). The correlations between PCS, MCS vs. METwk scores were respectively significant:  $r = 0.17$  and  $r = 0.10$ ,  $P < 0.05$ . The number of years of detention was associated to higher MET (OR = 1.04  $P < 0.05$ ). The presence of Physical Exercise Areas (PEAs) within Jails did not improve the QoL level. **Conclusions:** Jails may not seem like the ideal place to fight sedentary behavior, but, in any case, health promotion can occur within its walls. The heterogeneity of Italian jails, and particularly relative PEAs therein (areas had different characteristics between jails), suggests that such spaces should be regulated or well defined. Furthermore, the implement of training schedules could be done in a standardized way. Despite this heterogeneity both the physical and mental components of inmates' quality of life were associated to a high level of physical activity.

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## Introduction

Prisoners usually have a poorer health status than the general population.<sup>1</sup> Penal institutions are generally sickness-prone places, and are often overcrowded.<sup>2</sup> One aspect that afflicts penitentiary inmates is that they are at greater risk of unhealthy behaviors such as smoking, drug abuse, inactivity and irregular diet, factors that often lead to the development of a high rate of acute and chronic physiological and psychological disease. In particular, incarceration has been associated with sedentary habits, a known risk factor for diabetes mellitus, heart disease and other chronic disabilities.<sup>3</sup> The impact of the institution itself can contribute to an unhealthy living condition,<sup>4</sup> but it can also promote redemption.<sup>1</sup>

Concerning physical inactivity, it is now known that there is a connection between physical exercise and Health Related Quality of Life (HRQoL) in the general population. Exercise impacts not just physical mobility but its lack can also favor mental and sensory impairment.<sup>5</sup> Aerobic activities such as brisk walking, cycling, or even walking around the house or yard reduce the risks of developing

coronary heart disease, hypertension, colon cancer and diabetes.<sup>6</sup> This association has also been seen in detention environments,<sup>7-9</sup> and two Italian studies suggest that physical activity in the prison population increases psychological wellbeing and reduces depression levels.<sup>10,11</sup>

The aim of this investigation was to extend a previous pilot study<sup>11</sup> in order to confirm the correlation seen between HRQoL levels and high levels of physical activity.

## Methods

### Participants

Participation was voluntary. All apparently healthy prisoners were invited to participate. The study excluded prisoners who had special regimes that did not permit them to have received outside visits, as outlined under the Italian law (as follows):

- regimens provided for by article 41bis/20.P. (crimes of mafia, terrorism, exploitation of prostitution, criminal association);
- justice collaborators assigned to high security sections.