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## Combined effect of physical activity, body mass index, waist to hip ratio and waist circumference on post menopausal breast cancer incidence in the Swedish National March Cohort

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# Introduction

- **Both physical inactivity and obesity have been recognized as important risk factors for major chronic diseases and premature mortality in most developed and developing countries.**
- **In this study we focused on examining the inter (and intra) relationships between total physical activity (PA), body mass index (BMI), waist circumference (WC), waist to hip ratio (WHR) and post menopausal breast cancer incidence in the Swedish National March Cohort.**

# Introduction

- **In September 1997 a general population cohort was targeted (The Swedish National March Cohort, people who took part in a national march during a four day national fund raising event arranged by the Swedish Cancer Society).**
- **All march participants were invited to fill out a 32-page questionnaire with detailed questions about energy intake, energy expenditure, anthropometric measures and conceivable confounders.**

# Data Set

- 43,879 participants in the National March Cohort in 1997 completed the questionnaire.
  
- **Exclusion criteria :**
  - Subjects that gave clear inconsistent answers (n=4)
  - Males (n=15,673)
  - Women with any type of cancer at time of enrollment (n=1,885)
  - Women younger than 35 years at the time of enrollment (n=6,002)
  - Women with death date before or equal to entry date (n=3)
  - Women with emigration date before or equal to entry date (n=1)
  - Women with incorrect national registration number (n=7)
  
- **Final Data Set**  
20,304 women included in the final analysis.  
Start of follow-up: 1997/10/01  
End of follow-up : 2006/12/31  
Death, Emigration, Diagnosis of any type of cancer, whichever came first.

# Methods

- **Pearson's chi-squared tests and one-way anova models were used to compare the differences between frequencies and means among different levels of total physical activity.**
- **Cox regression models were fitted to estimate hazard ratios (HRs) with 95% confidence intervals (CIs) of post-menopausal breast cancer incidence at different levels of PA, BMI, WHR, WC and their combinations, as compared with the reference categories.**
- **The proportional hazards assumption in the Cox regression models was tested by using scaled Schoenfeld residuals.**

# Analysis

- In order to avoid the influence of a potential bias due to early mortality in individuals with low physical activity and low BMI caused by potential sub-clinical illness, the analyses were repeatedly conducted after excluding the first two years of follow-up
1. Descriptive Analysis / PA.
  2. Survival Analysis – PA, BMI, WHR, WC.
  3. Survival Analysis – Joint Effect of BMI and PA.
  4. Results and discussion.

# Descriptive Analysis / PA

	<b>Low (PA&lt;31.4)</b>	<b>Medium (31.4≤PA&lt;38.5)</b>	<b>High (PA≥38.5)</b>	<b>P</b>
Nr Participants	6,772	6,764	6,768	-
Age	57.6(±11.7)	54.1(±10.9)	54.2(±11.1)	0.000
Height (m)	1.649(±0.06)	1.653(±0.06)	1.650(±0.06)	0.001
Weight (kg)	68.2(±10.9)	67.1(±10.3)	66.4(±10.3)	0.000
BMI (kg/m <sup>2</sup> )	25.0(±3.8)	24.5(±3.6)	24.3(±3.6)	0.000
Waist.Cr (cm)	83.0(±10.6)	81.3(±10.0)	80.3(±9.7)	0.000
Hip Cr (cm)	101.9(±10.0)	100.5(±12.2)	99.5(±13.1)	0.000
WHR	0.82(±0.09)	0.81(±0.10)	0.81(±0.10)	0.004

# Descriptive Analysis / PA

	<b>Low (PA&lt;31.4)</b>	<b>Medium (31.4≤PA&lt;38.5)</b>	<b>High (PA≥38.5)</b>	<b>P</b>
Education (>12 years,%)	27.1	33.5	27.8	0.000
Current smoking (%)	8.8	8.3	9.6	0.046
Alcohol drinking (%)	85.0	88.5	86.8	0.000
Treated for childlessness (%)	5.3	6.0	5.6	0.157
Age at first menstruation ≥15	19.4	17.5	18.1	0.019
Number of birth ≥3	31.5	33.0	35.5	0.000
Use of vitamin and mineral supplements(%)	55.2	55.9	56.6	0.262
Use of contraceptive pill (%)	57.9	65.5	63.2	0.000
Hormone replacement therapy (%)	36.0	32.7	30.9	0.000

# Survival Analysis / PA

	Total physical activity			
	Low (PA<31.4)	Medium (31.4≤PA<38.5)	High (PA≥38.5)	P-trend
Nr Breast Cancer	145	102	104	-
Person-years	59033	60032	60349	-
* Incidence rate	229.0	176.0	178.2	-
**HR (95% CI)	<b>1.00(ref.)</b>	0.77(0.60-0.97)	0.79(0.61-1.01)	0.054
***HR(95% CI)	<b>1.00(ref.)</b>	0.85(0.64-1.14)	0.85(0.63-1.14)	0.311

\* Incidence rates were presented as per 100,000 person-years, standardized to the age distribution of person-years experienced by all study participants using 5-year age categories..

\*\* Adjusted for age at enrollment.

\*\*\* Adjusted for age at enrollment, physical activity, cigarette smoking status, alcohol drinking, vitamins and minerals use, education level, contraceptive pill use, hormone therapy replacement, age at the first menstruation, number of children and childlessness

# Survival Analysis / BMI

	BMI				
	Underweight ( $<18.5$ )	Normal ( $18.5 \leq \text{BMI} < 25$ )	Overweight ( $25 \leq \text{BMI} < 30$ )	Obesity ( $\geq 30$ )	P-trend
Nr Breast Cancer	9	187	104	36	-
Person-years	2164	102015	52753	14199	-
* Incidence rate	458.2	192.8	183.1	247.3	-
**HR (95% CI)	2.35(1.20-4.59)	<b>1.00(ref.)</b>	0.94(0.74-1.19)	1.23 (0.86-1.75)	0.550
***HR(95% CI)	2.91(1.48-5.72)	<b>1.00(ref.)</b>	0.98(0.75-1.30)	1.40(0.94-2.09)	0.720

\* Incidence rates were presented as per 100,000 person-years, standardized to the age distribution of person-years experienced by all study participants using 5-year age categories..

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\*\*\* Adjusted for age at enrollment, physical activity, cigarette smoking status, alcohol drinking, vitamins and minerals use, education level, contraceptive pill use, hormone therapy replacement, age at the first menstruation, number of children and childlessness

# Survival Analysis / WHR

	WHR		P
	≤0.8	>0.8	
Nr Breast Cancer	127	224	-
Person-years	67845	111576	-
* Incidence rate	186.8	203.6	-
**HR (95% CI)	<b>1.00(ref.)</b>	1.10(0.88-1.36)	0.410
***HR(95% CI)	<b>1.00(ref.)</b>	1.14(0.89-1.47)	0.301

\* Incidence rates were presented as per 100,000 person-years, standardized to the age distribution of person-years experienced by all study participants using 5-year age categories..

\*\* Adjusted for age at enrollment.

\*\*\* Adjusted for age at enrollment, physical activity, cigarette smoking status, alcohol drinking, vitamins and minerals use, education level, contraceptive pill use, hormone therapy replacement, age at the first menstruation, number of children and childlessness

# Survival Analysis / WAIST

	Waist Circumference			P-trend
	<80 cm	80≤WC<88cm	≥88 cm	
Nr Breast Cancer	131	86	134	-
Person-years	67483	44626	67305	-
* Incidence rate	201.0	183.1	198.2	-
**HR (95% CI)	<b>1.00(ref.)</b>	0.90(0.68-1.18)	0.97(0.76-1.24)	0.824
***HR(95% CI)	<b>1.00(ref.)</b>	0.77(0.56-1.06)	0.98(0.75-1.29)	0.943

\* Incidence rates were presented as per 100,000 person-years, standardized to the age distribution of person-years experienced by all study participants using 5-year age categories..

\*\* Adjusted for age at enrollment.

\*\*\* Adjusted for age at enrollment, physical activity, cigarette smoking status, alcohol drinking, vitamins and minerals use, education level, contraceptive pill use, hormone therapy replacement, age at the first menstruation, number of children and childlessness

# Survival Analysis /Joint Effect of BMI and PA

BMI	Total physical activity		
	Low (PA<31.4)	Medium (31.4≤PA<38.5)	High (PA≥38.5)
<b>Underweight (&lt;18.5)</b>			
Nr Breast Cancer	4	4	2
Person-years	727	677	749
* Incidence rate	526.6	504.5	363.9
**HR (95% CI)	2.59(0.81-8.30)	4.46(1.61-12.36)	1.88(0.46-7.74)
***HR(95% CI)	2.93(0.90-9.51)	4.97(1.78-13.89)	2.29(0.55-9.51)
<b>Normal (18.5≤BMI&lt;25)</b>			
Nr Breast Cancer	85	68	78
Person-years	30290	35448	36434
* Incidence rate	276.7	214.1	232.2
**HR (95% CI)	1.38(0.96-1.99)	<b>1.00(ref.)</b>	1.30(0.90-1.87)
***HR(95% CI)	1.13(0.75-1.72)	<b>1.00(ref.)</b>	1.29(0.86-1.92)

\* Incidence rates were presented as per 100,000 person-years, standardized to the age distribution of person-years experienced by all study participants using 5-year age categories..

\*\* Adjusted for age at enrollment.

\*\*\* Adjusted for age at enrollment, physical activity, cigarette smoking status, alcohol drinking, vitamins and minerals use, education level, contraceptive pill use, hormone therapy replacement, age at the first menstruation, number of children and childlessness

# Survival Analysis /Joint Effect of BMI and PA

BMI	Total physical activity		
	Low (PA<31.4)	Medium (31.4≤PA<38.5)	High (PA≥38.5)
<b>Overweight (25≤BMI&lt;30)</b>			
Nr Breast Cancer	67	46	31
Person-years	18766	17570	16519
* Incidence rate	313.6	244.0	172.0
**HR (95% CI)	1.42(0.95-2.11)	1.14(0.73-1.76)	0.84(0.51-1.38)
***HR(95% CI)	1.39(0.89-2.17)	1.15 (0.70-1.87)	0.80(0.45-1.40)
<b>Obesity (≥30)</b>			
Nr Breast Cancer	22	13	6
Person-years	5918	4356	3939
* Incidence rate	331.6	304.3	179.7
**HR (95% CI)	1.93(1.15-3.24)	1.40(0.71-2.75)	0.94(0.40-2.19)
***HR(95% CI)	2.08(1.18-3.66)	1.56(0.76-3.20)	0.89(0.32-2.48)

\* Incidence rates were presented as per 100,000 person-years, standardized to the age distribution of person-years experienced by all study participants using 5-year age categories..

\*\* Adjusted for age at enrollment.

\*\*\* Adjusted for age at enrollment, physical activity, cigarette smoking status, alcohol drinking, vitamins and minerals use, education level, contraceptive pill use, hormone therapy replacement, age at the first menstruation, number of children and childlessness

# Results and discussion

Compared with a low level of physical activity:

- **Multivariate-adjusted HRs associated with both medium and high physical activity levels were 0.85. Our study suggests this relation is limited to overweight (HR=0.57(0.31-1.01) for high level compared to low level of physical activity) and obese women (HR=0.50(0.17-1.52)).**
- **Obese women had a 40 percent increased post-menopausal breast cancer risk compared with normal weight women.**
- **High WHR was not associated with post menopausal breast cancer incidence, but tended to increase the risk in women.**
- **No relationship seemed to exist between waist circumference and post menopausal breast cancer risk.**
- **Looking the joint effects of physical activity and BMI on post menopausal breast cancer incidence, we can see that, compared to women with a normal BMI and normal physical activity, sedentary overweight women have a HR of 1.39(0.89-2.17), and sedentary women with a BMI over 30 have a significant HR of 2.08(1.18-3.66).**

# Results and discussion

So, lose weight and start to run!!

