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Women's physical activity as a determinant of health care expenditures

Summary: Physical activity is considered to be an essential part of a healthy lifestyle. Although physical activity is only one of the components of a healthy lifestyle, lack of physical activity is strongly linked to the incidence of chronic diseases. The paper deals with the problem of the relationship between physical activity (including professional sports activities) and women's subjective state of health. We have assumed that the better state of health should be reflected in frequency and structure of use of health benefits, and, as a result – costs of health care. We have posed three research hypotheses:

H1: physical activity extends life expectancy in good health;

H2: physically active women are less likely to use health services;

H3: physically active women generate lower costs in the health system.

We surveyed 400 women of 40–60 years of age. The questions included: sport activity present and in the past, self-assessment of the state of health, healthcare services utilization and out-of-pocket spendings.

In the next step we conducted an analysis of correlation between sport activity and healthcare use and expenditures. We have found out that contrary to our expectations physically active women are more frequent users of the second level (specialised care) of the healthcare sector.

MeSH: Fees and Charges, Social Determinants of Health, Women's Health, sports, Life Expectancy.

Keywords: HLE, women's physical activity, health care costs

1. Introduction

Health is often treated as "a subject" of health care system. Risky health behaviours, such as cigarette smoking, high BMI, and, among all, physical inactivity, are often underestimated as a direct cause, not only of reduction in life expectancy in good health (HLE), but also in increased medical costs, borne by societies.

Physical activity is considered to be an essential part of a healthy lifestyle. Although physical activity is only one of the components of a healthy lifestyle,

lack of physical activity is strongly linked to an incidence of chronic diseases [10]. Several studies confirmed existence of a link between regular physical activity and reduced risk of civilization diseases, especially chronic ones, like heart diseases, hypertension, stroke, type 2 diabetes and cancer ([47], [17], [33], [41], [34], [23], [36], [11], [7], [20], [5], [4], [21], [19], [15], [46]).

According to that, the relationship between physical activity and health seems to be undeniable, but the relationship between physical activity and health expenditures is not so clear. Some studies concluded, that better health in youth may reduce future health care expenditures; others suggested, that it may lead to even higher spending on health care, yet others indicate absence of any relationships [38].What is important, most studies focused on amateur sportsmen, and only a few included persons who trained professional sports, especially in the context of the long term effects. The question is whether, and to which extent, better state (as a result of physical activity) is reflected by expenditures on health care? Do people physically active, generate lower costs in the health system? Are these, if any, benefits the same for amateur and professional sportsmen?

The paper deals with the problem of the relationship between physical activity (including professional sports' activities) and women's subjective state of health. We have assumed, that the better state of health should be reflected in frequency and structure of health benefits' use, and, as a result – costs of health care system.

We have posed three research hypotheses:

H1: physical activity extends life expectancy in good health;

H2: physically active women are less likely to use health services;

H3:physically active women generate lower health costs in a long period of time.

H1 hypothesis refers to the health benefits related to physical activity, including lower risk of civilization diseases. We have assumed, that the physical activity not only increases life expectancy, but, above all, might increase life expectancy in good health, by raising its subjective quality.

H2 hypothesis assumes, that women who are physically active use health services more moderately than inactive ones. It is expected that the lower use of health benefits may be an outcome of a better subjective health status. This relationship, however, is not obvious.

H3 hypothesis is an amplification of the H2 hypothesis, which assumes less intensive use of health benefits, however, we have also taken into account the structure of benefits and costs generated for health system. We have assumed, that women characterised by better health status are more likely to use preventive medicine services (GP consultations, medical test) while those in poor health are more likely to benefit from more specialised services (specialist consultations or an inpatient treatment).This difference in the structure of provided services should be reflected in overall costs for health system generated by women active and inactive ones.

The paper is organised as follows: the second section describes the phenomenon of women's physical activity, both recreational and professional and deals with the relationship between women's state of health and being physically active. The third section presents adopted methodology. The fourth section presents the obtained results and provide the discussion.

2. Physical activity of women

Sports at a young age is usually a prognostic of a good, very good or outstanding health. This effect occurs regardless of age, gender or economic and social status ([7], [22]). Accordingly, sports activity in middle age is associated with reduced mortality and lower risk of developing chronic diseases in the elderly [17]. Whereas women usually report less physical activity (of any type) than men, and the level of activity decreases with age ([23], [36], [12], [35]). Even young girls are traditionally discouraged from sports, treating it as an activity promoting rivalry and aggression [23]. Though the biggest decline of physical activity usually occurs during the third decade of life, which is usually linked to marriage and motherhood ([41], [16]). What is important, being active significantly improves women's health status in middle and old age [32], and the strength of this effect is even stronger for women than men, regardless of the type of activity and other lifestyle's factors [20] .Older women are more heavily burdened with disabilities than men ([9], [18]), which potentially means more health benefits, if it is possible to increase the activity of older women' group [28].

Several studies indicate, that these patterns also apply to former athletes, who are usually more active and healthier than the general population [43] and display lower risk of non-communicable diseases especially elite ones [2]. However, this effect continues even after termination of the professional sports activity only in the case of sportsmen who continue their physical activity in any way [43]. Though former athletes have usually a more vigorous lifestyle [2]. Some studies indicate a significant (5,5 year) lengthening of life expectancy for former athletes [14], while others suggest that women who were engaged in full-contact sports disciplines have a higher mortality [26]. Teramoto and Bugum [40] conclude, that higher life expectancies are related to aerobic and mixed-sports, not necessarily to anaerobic athletes.

It appears that elite endurance (aerobic) athletes and mixed-sports (aerobic and anaerobic) athletes survive longer than the general population, as indicated by lower mortality and higher longevity. Lower cardiovascular disease mortality rate is the most likely primary reason for their better survival rates. On the other hand, there are inconsistent results among studies of power (anaerobic) athletes. When elite athletes engaging in various sports are analysed together, their mortality is lower than that of the general population. In conclusion, long-term vig-

orous exercise training is associated with increased survival rates of specific groups of athletes [40].

Low physical activity, by increasing the risk of chronic diseases also creates a significant burden on society, though studies in this area are limited to the general population [34]. Zhang and Chaaban [44] report, that physical inactivity is responsible for more than 15% of non-communicable diseases' costs (medical and non-medical).Physical inactivity might be also blamed for 1,5–3% of total direct health costs in developed countries [31] (Peeters et all., 2014).Another US study, indicates a one-third decrease in annual costs for physically active people [4] (Brown, Hockey & Dobson, 2008). Carlson [6] (et all., 2015) estimates, that 11,1% of health care expenditures may be associated with physical inactivity or insufficient activity. It is estimated, that twenty minutes of additional physical activity may lower, by several percent, an average number of inpatient days, what directly translates into health expenditure [34]. An Australian study found, that an increase in women's activity could save AU$40 million in yearly healthcare expenditure [31]. These results should be confronted with others, indicating, that well-being, expressed, inter alia, by longer life expectancies, does not automatically mean lower expenditure on medical treatment during life cycle, although changing its distribution over time lifespan [38].

3. Method

Sample's selection

We assumed, that the research sample would cover women of 40–60 years of age. The cohort approach, presented in this research, where the cohort is defined by the year of birth, was forced by the proper allocation to the study group. Sampling scheme, provided for the uniform country's distribution of the sample, assured, at the same time, the maximum scatter of interviewed individuals. The subject of the sampling was a list of women 40–60 years of age, containing information about the number of women, who were employed during the year 2014 and, due to that, came under a compulsory occupational health' medical examination (the periodical and the monitoring ones). The set of sampling units consisted of health care units. According to the above, the research the sample was of cluster-stratified nature.

The sampling procedure assumed a two-stage random sampling. During the first stage, health care patients were randomly sampled. Then, during the second stage, women, of 40–60 years of age were sampled, provided that, they met an obligation of occupational medical examination. To women, selected in this way, an invitation to the survey was sent, via e-mail.

Sample size was set, in the case of stratified sampling, and when determining the structure's rate, the following formula was applied:

$$n = \frac{u_{\alpha/2}^2 \times 0.25 \times N}{u_{\alpha/2}^2 \times 0.25 + (N-1) \times d^2} \quad (1)$$

where:

$u_{\alpha/2}$ – the value read from the tables of the normal distribution for the demanded significance level $\alpha/2$

The sample size, assuming the sampling without replacement from the population of 5,267,932 women, significance level – 95% and the standard error – 5%, was calculated (1):

$$n = \frac{1.92^2 \times 0.25 \times 5267932}{1.96^2 \times 0.25 + (5267932 - 1) \times 0.05^2} = 399.97 \cong 400$$

Research tools

In order to measure the quality of women's health, we developed the questionnaire *The impact of physical activity on women's health*, which includes questions about the noticeable changes in the health status of women physically active and the inactive ones. The time horizon of the study included 6 months. The questions included: time (number of minutes) and the structure of the weekly sports activity, assessment of the state of health, frequency of utilization of healthcare services (GP consultation, specialist's consultation, the number of days of hospitalization) out-of-pocket spending on healthcare (doctor's consultations, drugs, medical test).We have asked about the physical activity at present and in the past (more than 10 years ago). When analysing physical activity we have assumed, that individuals who haven't declared any regular physical activity are considered inactive. We have adopted a following definition of professional sport: a form of human activity, undertaken on a voluntary basis, by competition, for maximum athletic performance.

The determination of the number of points obtained from the survey, basing on individual responses was a two-step process. First, a number of obtained points (before encoding) was recorded, then numeric values were allotted for every individual's result. Finally, numerical values, obtained from the responses to each question range from 0 to 100. Fewer number of points meant, that a person was less satisfied with its state health, what also meant lower satisfaction with the health-related quality of life.

The reliability of the developed scale was assessed using α-Cronbach coefficients [42] according to the following formula:

$$\alpha = \frac{u}{u-1}\left(1 - \frac{\sum_{j=1}^{u} S_j^2}{\sum_{j=1}^{u} S_j^2 + \sum_{\substack{i=1 \\ i<j}}^{u}\sum_{j=2}^{u} r_{ij} S_i S_j}\right) \quad (2)$$

where:

u - the number of questions composing the entire block used to assess the mental health,

S_j^2 –the variance of measurement results, for$j$- question,

r_{ij} – the coefficient of correlation between answers for i-question and j-question.

The α-Cronbach coefficient might take values from 0 to 1. In our research its values ranged from 0.78 to 0.93, which meant, concerning a level of measurement's internal coincidence, that from 78% to 93% of the volatility should be assigned to true results, while the rest – to the error.

In order to measure the *Healthy Life Expectancy* (*HLE*), the Sullivan method was employed. To calculate *HLE*, survey data, concerning individual's subjective health state, were used. The construction of life tables included the participation of women (aged 40-60) π_{lx}assessing their health's state as "bad" or "very bad" in a given age group. On the basis of the value of D_{lx} – the overall number of healthy life, we received the expected number of life years in good health HLE_x:

$$HLE_x = \frac{D_{1x}}{l_x} \quad (3)$$

4. Results and discussion

We started with an analysis of relationship between present physical activity and selected socio-economic indicators: age, income, education and past physical activity. We have assumed that women's physical activity is negatively correlated with age and income and positively correlated with a level of education. Women who were active in the past are also more likely to be active at present (table 1).

Table 1. Pearson's correlation between present physical activity and selected socio-economic indicators

	Age	Education	Income	Previous physical activity
Spearman's correlation coefficient	−0,20	0,38	−0,08	0,44
p-value	<1%	<1%	12%	<1%

Source: own study.

In order to verify the H1 hypothesis, we have assessed healthy life expectancy (HLE). We have constructed the life tables in good health, and calculated HLE, at the age of 40–60 (table 2).

Table 2. Life expectancy and healthy life expectancy at the age of 40–60, depending on present and past lifestyle (active or inactive)

	Inactive women (in the past and at present)	Women active professionally in the past, inactive at present	Women professionally active in the past, at present do recreational sport
$HLE_{40–45}$	31,31	28,56	31,87
$HLE_{45–50}$	26,84	24,17	27,40
$HLE_{50–55}$	22,46	19,86	23,01
$HLE_{55–60}$	18,56	16,32	19,07

Source: own study.

We have observed, that, in each age group, HLE is higher for former athletes, who, continue their recreational sport activity, than for inactive women. The difference in HLE ranged from 0,51 years in the group aged 55–60 to 0,56 years for women aged 40–50.

This allows us to adopt the H1 hypothesis, assuming that physical activity extends healthy life expectancy (HLE). These results are partially consistent with the expected values, though, originally, we expected a greater difference in HLE between active and inactive women. At the same time, it is surprising, that HLE for women who have never been active is higher than for women who have given up their professional sports activity. It's also important that all women, who were inactive in the past, are inactive at present – in analysed research sample there are no women who have started physical activity during the last 10 years.

This difference might have two potential explanations – firstly – HLE indicator contains a subjective component, secondly – women are generally more affected by disability. It seems, however, that the subjective component may be particularly important. For people engaged in sports, particularly professional athletes, age-related efficiency's deterioration, can be felt as particularly distressful, especially, if at a later age they do not even exercise recreationally. On the other hand, in the case of inactive women, performance constraints can be assessed as an integral part of the aging process, and does not produce significant experience of health's deterioration. It could also be a root of longer HLE for inactive women in each age group, then for women who terminated their sports careers and did not sustain recreational sports.

These results confirm findings of Zaccagni, Onisto and Gualdi-Russo [43], who claimed, that former athletes were healthier than the general population. According to our results we could conclude, that this relation was true, on condition, that sport activities has been continued in any form – mostly recreational.

In order to verify the H2 hypothesis we have examined the present utilization of health care services – during last 6 months (table 3). We expected, that physical activity in the past (more than 10 years) ago, should have affected the present utilization of health care services by lowering the number of health benefits or, at least, by changing its structure, for example a reallocation from highly specialized services into less specialized ones.

Table 3. The utilization of health care services for women aged 40–60 depending on lifestyle in the past (active or inactive) within a period of 6 months

	Women inactive in the past	Women active recreationally in the past	Women active professionally in the past
Number of hospital days	1,08	1,90	6,67
Number of GP consultations	1,50	1,34	0,67
Number of specialist consultations	1,33	1,52	5,33

Source: own study.

The results obtained are directly opposite to the expected ones and designed research hypotheses (table 3). We have seen, that women inactive in the past use the least intensively health benefits, and are more likely to benefit from the GP's advice. Women who did recreational sports in the past, more often, than women inactive in the past, use specialist's consultation (1,52 in comparison to 1,33) and hospital treatment (1,90 days, in comparison to 1,08 days) but are less likely to benefit from the GP consultation(1,34 in comparison to 1,50). The most surprising results were obtained for a group of women engaged in professional sports in the past – for this group the number of GP consultations(0,67) is definitely lower than in both of the other groups. At the same time, the number of specialist consultations (5,33) and the number of hospital days (6,67) is significantly higher. It seems that these results are contrary to the majority of previous research studies presented in Section 2. It should, however, be taken into account, that a more frequent use of health benefits does not automatically mean a worse health state and may also be the result of greater awareness – professional sport is associated with constant control of the state of health and viability of organism. On the other hand, it may be associated with the consequences of increased body burden in the past.

We have also analysed the consequences of giving up physical activity on utilization of health care benefits. We have found, that women who have continued professional sport activity in any way, generally as recreation, utilize health service much more moderately than the other group. What is important, the structure of this utilization is more favourable (than in the case of women permanently inactive). Women who gave up professional sport activity not only use much more health services but also those, which are much more expensive, from the point of view of the health care system (table 4).

Table 4. The utilization of health care services for women aged 40–60 depending on lifestyle in the past and at present (active or inactive) within a period of 6 months

	Inactive women (in the past and at present)	Women active professionally in the past, inactive at present	Women active professionally in the past, at present do recreational sport
Number of hospital days	1,08	6,97	0,98
Number of GP consultations	1,50	1,22	1,54
Number of specialist consultations	1,33	6,32	1,21

Source: own study.

In order to prove the H3 hypothesis, we have analysed the influence of physical activity (at present and in the past) on individual's OOP spending on health (table 5 and 6). The OOP category is very important, because patients in Poland bear important part of costs (generally about 25%, but in the case of drugs – almost 40%).

Table 5. The average health care out-of-pocket expenditure for women aged 40–60 depending on their lifestyle in the past (active or inactive) within a period of 6 months in PLN[1]

	Women inactive in the past	Women active recreationally in the past	Women active professionally in the past
Expenditures on drugs	343	218	433
Expenditures on doctor's consultations	241	153	333
Total OOP expenditures	584	371	766

Source: own study.

Our study revealed that women who were active professionally in the past spend much more on health care, then those who were inactive or active recreationally (766 PLN, comparing to 581 PLN and 371 PLN). It is important, that health expenditures are the lowest for women, who did recreational sport in the past (table 5).

This finding seems to be a little surprising, when compared with the results related to health care service utilization. That is why we have decided to analyse this phenomenon much more profoundly.

We have found out that OOP spending rises with age in every group of physical activity. We can also observe that women who were active professionally in the past and are inactive at present spend much more on healthcare in every age group. On the other hand the women who were active professionally and contin-

[1] 1 EUR ≈ 4,2 PLN

ue sports activity are characterised by the lowest level of health care expenditures. This finding seems to be extremely important, and suggest, that continued activity is crucial from the point of view of health care costs (table 6).

Table 6. The average health care out-of-pocket expenditure for women aged 40–60 depending on present and past lifestyle (active or inactive) within a period of 6 months in PLN

	Inactive women (in the past and at present)	Women active professionally in the past, inactive at present	Women active professionally in the past, at present do recreational sport
$K_{40–45}$	209	280	125
$K_{45–50}$	300	408	200
$K_{50–55}$	300	500	200
$K_{55–60}$	580	850	240

Source: own study.

During the last part of the verification of the H3 hypothesis, we have examined the average total cost of health care services for active and inactive women. On the basis of the data on benefit utilization and costs of provided health care services, we have estimated the average per capita expenditures on selected benefits (hospital day, GP consultation, specialist's consultation). Costs of benefits have been estimated pursuant to costs of National Health Fund[2].

Table 7. The average cost of health care services for women aged 40–60 depending on past lifestyle (active or inactive) within a period of 6 months in PLN

	Women inactive in the past	Women active recreationally in the past	Women active professionally in the past
Number of hospital days	718,20	1263,50	4435,55
Number of GP consultations	72,00	64,32	32,16
Number of specialist consultations	62,51	71,44	250,51
Total	**852,71**	**1399,26**	**4718,22**

Source: own study.

We have found that health expenditures for women inactive in the past are significantly lower than for the two other groups, but health expenditures for women who were professionally active in the past are more than 3 times lower than for those who were active recreationally (table 7). The difference between active and inactive women has its source in frequency of an inpatient treatment, which is significantly more expensive than an ambulatory treatment.

[2] National Health Fund is a public body, providing compulsory public health insurance.

Table 7. The average cost of health care services for women aged 40-60 depending on past and present lifestyle (active or inactive) within a period of 6 months in PLN

	Inactive women (in the past and at present)	Women active professionally in the past, inactive at present	Women active professionally in the past, at present do recreational sport
Number of hospital days	718,2	4635,05	651,7
Number of GP consultations	72	58,56	73,92
Number of specialist consultations	63,84	297,04	56,87
Total	**854,04**	**4990,65**	**782,49**

Source: own study.

Inclusion of information about the current sports activity in the analysis, significantly changes obtained results. We have found that continuation of the professional activity, even recreationally, results in a number of benefits, including lower costs of health benefits. Women who have continued their previous sports activity, presently generate lower costs than non-active persons, regardless of physical activity in the past (table 7). That allowed us to adopt, at least partially, the H3 hypothesis.

To conclude, we can say that physical activity increases healthy life expectancy and can bring important savings in the health care system, provided, however, that activities, particularly professional ones, are continued in the form of recreation. We can confirm Zaccagni, Onisto and Gualdi-Russo [43] findings, that former athletes are healthier if they continue physical activity.

Generally our results seem to confirm the observations, showing that physical activity does not automatically mean lower utilization of health services (or expenditures) [38]. They are opposite to findings of the Wanless Commission, who claimed, that healthier people need fewer health benefits, which leads to some reduction of expenses of a health care system. On the other hand, according to some researchers, a better state of health state result in increased spending on health care [25] Van Baal [45] studied obese people and smokers and found, that during their entire life, health expenditure was the highest in a group of healthy individuals. This phenomenon could be a result of lower LE.

The presented study does not allow to draw to any far-reaching conclusions, because we haven't examined the distribution of health spending during entire lifetime. Larger perspective cannot change conclusions, because an inactive person could generate higher cost in his or her older age. Lubitz demonstrated that functional improvement among patients aged 70, i.e. physical activity, led to the extension of lifespan, but without an increase in individual total health expenditure. What is more, the estimated total expenditure on health care, in the case of

a person enjoying relatively good health at the age of 70, was about 9000 USD lower, than for person who has experienced at least one limitation of daily living activities, despite LE higher by 2,7 years.

5. Conclusion

Our study generally confirms the relationship between physical activity and healthy life expectancy. Being active may also bring important savings for the health care system in a long run (in our study – 10 years), but only if physical activity is enduring.

This study has several limitations. Firstly, we haven't examined the level of health expenditures during the whole life cycle. Secondly, we should be aware, that being active is considered as a part of a healthy lifestyle, which also includes some prevention test. This can be a source of more intensive utilization of health care services, which can be important for younger age groups.

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Aktywność fizyczna kobiet jako wyznacznik wydatków na opiekę zdrowotną

Synopsis: Aktywność fizyczna jest uważana za istotny aspekt zdrowego stylu życia. Mimo że jest ona tylko jednym z elementów zdrowego stylu życia, brak aktywności fizycznej jest silnie związany z występowaniem chorób przewlekłych. W pracy omówiony został problem relacji między aktywnością fizyczną (w tym zajęć sportowych zawodowych) a subiektywnym stanem zdrowia kobiet. Założono, że lepszy stan zdrowia powinien znaleźć odzwierciedlenie w częstotliwości wykorzystania świadczeń zdrowotnych.

Postawiono trzy hipotezy badawcze:

H1: aktywność fizyczna wydłuża długość życia w dobrym zdrowiu;

H2: aktywne fizycznie kobiety są mniej skłonne do korzystania z usług zdrowotnych;

H3: aktywne fizycznie kobiety generują niższe koszty systemu opieki zdrowotnej.

Przebadano 400 kobiet w wieku 40–60 lat. Pytania obejmowały: sport (uprawiany obecnie i w przeszłości), samoocenę stanu zdrowia, wykorzystanie usług zdrowotnych i wydatki out-of-pocket. W następnym etapie przeprowadzono analizę korelacji pomiędzy aktywnością sportową i wydatkami na opiekę zdrowotną.

Słowa kluczowe: HLE, aktywność fizyczna kobiet, koszty opieki zdrowotnej.