Reducing the impact of physical inactivity: evidence to support the case for targeting people with chronic mental and physical conditions

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Abstract

Background

Recent evidence suggests that small increases in the physical activity of those considered least active can have a bigger health impact than raising levels of those already achieving or close to achieving recommendations. Profiling the characteristics of those who are least active allows for appropriate targeting of interventions. This study therefore examined the characteristics of people in the lowest physical activity bracket.

Methods

Data were taken from the Collaboration for Leadership in Applied Health Research and Care (CLAHRC) funded 'South Yorkshire Cohort', a longitudinal observational dataset of residents of South Yorkshire, England. Five separate outcomes based on a shortened version of the GPPAQ were used to represent the lowest levels of physical activity. Potential predictors examined were; age, sex, Body Mass Index (BMI), ethnicity, chronic conditions, current employment and deprivation. Descriptive statistics and logistic regression were conducted.

Results

Individuals with chronic mental and physical conditions (fatigue, insomnia, anxiety, depression, diabetes, breathing problems, high blood pressure, heart disease, stroke and cancer) were more likely to report the lowest levels of physical activity across all five outcomes. Demographic variations were also observed.

Conclusions

Targeting people with chronic mental and physical conditions has the potential reduce the impact of physical inactivity.

Introduction

According to a recent economic analysis, physical inactivity related ill health cost the UK National Health Service £0.9 billion in 2006-2007.[1] Physical inactivity has been attributed to 6% of coronary heart disease, 7% type 2 diabetes, 10% breast cancer, 10% colon cancer and 9% premature mortality incidence globally.[2] Increasing physical activity has been associated with improvements in physical and mental health and wellbeing.[3-6] A recent review and network meta-analysis has demonstrated comparative effectiveness of physical activity with drug treatment on mortality for coronary heart disease, stroke, heart failure and prediabetes.[7]

Recent evidence suggests that smaller increases in the physical activity of those who are least active can have a bigger health and cost-effectiveness impact than raising levels of those already slightly active to guideline levels, at a population level.[8,9] With rates of physical inactivity increasing (for example walking and cycling for transport rates have declined over the past 18 years[10]), it is important to understand the factors associated with low physical activity so that interventions can target segments of the population whose health stands to benefit the most.

Research has concentrated on the predictors of levels of physical activity. Physical activity participation is related to various demographic and health factors such as age, sex, socioeconomic status and health status.[11-18] However, there has been less consideration of how these factors may differ as predictors of physical inactivity. Individuals who are inactive constitute a distinct subgroup that have not been profiled. They differ from individuals who are active since physical activity can represent a range of activity levels and hence incorporate different subgroups of individuals. Given that it is the physically inactive that can reap the largest health benefits, they form an important group to focus on compared to individuals of all levels of physical activity who may not gain as much.

The few studies that have focused on physical inactivity have provided an insight into important predictors of the population subgroup. Being female, older age and higher level of education were significantly associated with physical inactivity in a large-scale survey in five Asian countries.[19] Being an ethnic minority, of older age, less education and providing care to others were found to be correlated with physical inactivity in a large-scale survey of United States women aged 40 and over.[20] Physical inactivity among employees of a major academic institution in the United States was associated with higher prevalence of cardiovascular diseases, fair or poor health status and absenteeism from work.[21]

However, there has been little understanding of how chronic mental and physical health conditions may act as barriers to physical activity. If they are associated with physical inactivity, then they offer

a potential point of intervention given that individuals could be targeted through their use of health care. The demographic and health characteristics of those with the lowest levels of activity in a more general population in the United Kingdom (UK), however, have not yet been examined in detail. Profiling the characteristics of the least active will allow for appropriate targeting of interventions to increase physical activity among this group, thus providing the potential for greater improvements in health not just in those individuals but also at population level.

The current study aimed to expand on such findings by examining predictors of the lowest levels of physical activity, to identify segments of the population whose health could be most improved the most by increasing physical activity.

Methods

CLAHRC South Yorkshire Cohort

Data were obtained from the first wave of the Collaboration for Leadership in Applied Health Research and Care (CLAHRC) South Yorkshire Cohort (2010-2012), a longitudinal observational dataset set up to collect health data on the residents of South Yorkshire, England.[22,23] The cohort contains information on physical activity, current and long-term health, health care usage and demographic characteristics.

The current study examined data from the 10,628 participants recruited via 14 Sheffield GP practices within the CLAHRC South Yorkshire Cohort (response rate of 17.1%). The restriction to Sheffield only data was to help inform 'Move More', a recently launched citywide campaign to increase physical activity across the population of Sheffield (http://www.movemoresheffield.com).[24] Therefore, a focus on examining the predictors of the least active among Sheffield residents contributes to the effort to understand where targeted community and individual interventions could have the greatest impact in terms of population health and reducing inequalities. In addition, analyses here intend to provide a baseline of physical activity for Sheffield, providing direction for interventions linked to the 'Move More' programme.

Physical activity measure

Frequency and intensity of self-reported physical activity were measured by mailed and online questionnaire using the question, "During the last WEEK, how many hours did you spend on each of the following activities?" The different types of activities were categorised into:

- Physical exercise such as swimming, jogging, aerobics, football, tennis, gym workout etc.
- Cycling, including cycling to work and during leisure time
- Walking, including walking to work, shopping, for pleasure etc.

Response options were: 'none', 'some but less than 1 hour', 'at least 1 hour but less than 3 hours' and '3 hours or more'.[22,23] This item is a shortened version of the General Practice Physical Activity Questionnaire (GPPAQ), a validated physical activity screening tool for primary care.[25,26]

Outcomes

Five separate outcomes were used to represent the lowest levels of physical activity:

- Combined outcome – lowest level of physical activity across all three categories, i.e. those people who reported 'none' for physical exercise and cycling and 'none' or 'less than 1 hour' for walking
- Lowest level of physical activity for physical exercise and cycling categories combined (i.e. those reporting 'none' to both)
- Lowest level of physical exercise (i.e. those reporting 'none')
- Lowest level of cycling (i.e. those reporting 'none')
- Lowest level of walking (i.e. those reporting 'none' or 'less than 1 hour')

The combined outcome aimed to examine the predictors of those who have reported doing none of the activities listed in the three categories. We also included minimal walking (less than one hour a week) since these low levels of movement still represent an inactive lifestyle that may be missed by using 'none' alone (e.g. walking around the house, or from work to the car). The analyses were repeated using only 'none' for the walking measure, however they produced similar results. The second outcome, combining the physical exercise and cycling categories but excluding walking is a more sensitive outcome, since walking was excluded in the GPPAQ due to the difficulty in determining the contribution of the self-reported walking to overall physical activity (e.g., speed, duration of bouts, intensity).[26] Finally, each category (physical exercise, cycling and walking) was examined separately as they were found to be measuring distinct behaviours.

Potential predictors measured in the CLAHRC cohort

The following predictors were examined[22], from self-report measures:

- Age
- Sex
- Body mass index (BMI)

- Ethnicity (split as 'White' (93%) and 'Non-White' (overall 7%; consists of 1% 'Mixed', 3.7% 'Asian', 1.7% 'Black' and 0.6% 'Other'))
- Employed or not
- Deprivation (measured using postcode and Indices of Deprivation 2010)[16]
- Chronic conditions (tiredness/fatigue, insomnia, anxiety/nerves, depression, diabetes, breathing problems, high blood pressure, heart disease, stroke and cancer)

These predictor variables were selected as they encompass all the demographic and health characteristics of the cohort sample that were in the dataset and are potential predictors of ability to benefit from physical activity, which research has suggested are related to physical activity.[11-18] The mental and physical conditions were all included because there is relatively robust evidence that physical activity is associated with a decreased risk of development, progression or symptoms of the condition.[5,6,27-56]

Analysis

The percentages of individuals identified as physically inactive according to the five outcomes were examined across the explanatory variables (Table I). Patterns of low activity/inactivity were also examined by age and gender (Figures I and II). A logistic regression analysis was undertaken to test the predictive value of each explanatory variable on each of the five outcomes (Table II). Finally, utilising the results and applying the sample weights, it was possible to extrapolate the results to explore the numbers of people that could be targeted through interventions (Table III).

Results

Table I presents summary descriptive statistics for our outcome variables. The highest proportions of those reporting the lowest levels of physical activity across all five outcomes were found in those with chronic mental and physical conditions. In addition, the proportions of people reporting the lowest levels of activity increased incrementally across most outcomes with increasing age, weight (although higher proportions of underweight than normal weight individuals reported the lowest levels of activity across all outcomes) and deprivation quintile. Higher proportions of unemployed (versus employed) people reported the lowest levels of activity on all outcomes. For sex, the relationship was less clear-cut, with a higher proportion of males reporting lowest levels in terms of the combined outcome and walking and females reporting lowest levels in terms of the combined outcome excluding walking, physical exercise and cycling. Similarly, for ethnicity, non-white

participants reported lowest levels on the combined outcome and walking, with white participants reporting lowest levels on the combined outcome excluding walking, physical exercise and cycling.

The incremental increase in the proportion of people reporting the lowest levels of activity with increasing age held for males and females across the five activity outcomes (Figures I and II), with a particularly marked increase in the proportion reporting the lowest levels of physical exercise and cycling in males with age. There were also slight increases in the proportions of males and females reporting the lowest levels of activity around the time of state retirement age (i.e. from the 65-74 to the ≥75 age group).

The results of the logistic regression analysis suggest that certain chronic conditions were significant independent predictors of the lowest levels of physical activity on four of the five outcomes (Table II). Fatigue significantly predicted the lowest levels of physical activity on the combined outcome, the combined outcome excluding walking, physical exercise and walking. Anxiety significantly predicted the lowest levels of physical activity on the combined outcome excluding walking and physical exercise. Depression significantly predicted the lowest levels of physical activity on combined outcome, and breathing problems significantly predicted the lowest levels of physical activity on the combined outcome and walking. Variation in cycling was significantly accounted for overall by the presence of long term conditions. Whilst the predictor variables were correlated in our data, these correlations were not strong suggesting that their multiple inclusion in the model is not problematic.

Age is consistently positively associated with physical inactivity across each measure, as are BMI and deprivation. Being employed was positively associated with cycling, possibly reflecting individuals who cycle to work. Ethnic minorities were over twice as likely to be inactive overall as compared to the individuals who were White and this is due to inactivity in relation to walking. Whilst males were significantly more likely to be physically inactive, this was due to differences in walking behaviour after accounting for the other variables (but the opposite was seen for physical exercise and cycling).

Robust data from the cohort enables extrapolation to the Sheffield population in terms of numbers of people in Sheffield who will benefit from interventions specifically targeted at those with certain chronic conditions (Table III). Depending on the physical activity variable targeted, between 72,245 and 225,853 people would stand to benefit from increased physical activity if those with all chronic conditions were targeted.

Discussion

Main finding of this study

Our study has presented a detailed profiling of the characteristics of inactive individuals across a range of demographic factors and health conditions. These findings could help to inform interventions aimed at improving physical activity levels amongst inactive individuals.

What is already known on this topic

Research has demonstrated that raising physical activity levels in the inactive can have the greatest improvement in health than compared to individuals of low physical activity levels.[8,9] However, there has been little research into the factors associated with physical inactivity, with most research concentrated in understanding individuals who are active.

What this study adds

Together, the Cohort figures for those with chronic mental and physical conditions can be extrapolated to between 72,245 and 225,853 inactive people in Sheffield (depending on the measure), who may potentially benefit from a targeted intervention. Since small increases in the physical activity of those who are least active can result in greater population health benefit than increasing the levels of more active people to the recommended levels,[8,9] targeting people with chronic mental and physical conditions might optimally reduce the impact of physical inactivity on population health.

The issue of cause and effect may be pertinent. The data examined in the current study is cross-sectional, so it could be that a low level of physical activity was an initiating factor in the chronic condition, or that the chronic condition resulted in low levels of activity, or a combination of the two. The implication of the current findings, then, is that if interventions can successfully increase physical activity in those with chronic mental and physical conditions then health improvements may be noticed that in turn might make it easier to further increase participation in physical activity.

Since individuals with chronic conditions often access health services, these sub-populations of people could be targeted for increasing activity through health service settings. For example, brief counselling could be added to clinic appointments or relevant, tailored written information could be available in waiting rooms. The healthcare environment could be changed to make it easier for physical activity to be part of NHS care pathways for people with chronic disease, for example NHS clinics being co-located with swimming pools and gym facilities.

There is a need for more innovative evidence-based approaches that can overcome the significant barriers to behaviour change, and particularly increasing physical activity, for individuals with health problems and physical limitations. Significant cultural and attitudinal changes may still be required to ensure the benefits of physical activity are seen to outweigh any condition-associated risks, and ensure it is seen as important and worthwhile to tackle the barriers to increased activity. Improving physical activity in these groups of people may also have the added benefit of improvement in the prognosis or management of their conditions, as evidence suggests a beneficial effect of physical activity on fatigue,[43,49] insomnia,[47,50] anxiety,[27,30,37] depression,[33,39,48] diabetes,[6,28,29,41,51] breathing problems,[38,42,45] high blood pressure,[44,52] heart disease,[5,34,35,53] stroke[31,46,54] and cancer,[3,32,36,55]. Since April 2013, the Quality and Outcomes Framework (QOF) for UK general practices has included screening (using the GPPAQ) and brief intervention to reduce inactivity for patients with hypertension. Similar incentives, if shown to be effective, could be extended to other chronic conditions.

The proportions of people with the lowest physical activity in the current analysis are similar to those in previous studies examining general practice patient populations using similar measures. For example, 45% of general practice patients in London were found to be inactive (no physical exercise or cycling) as measured on the GPPAQ in an evaluation of the Let's Get Moving physical activity intervention (compared with our estimate of 42.8%).[56] In another study examining GPPAQ use, 43% of GP patients in low SES areas were categorised as inactive (no physical exercise or cycling) on the GPPAQ.[57] Although our sample is similar to other patient-based populations, non-patient populations suggest differences. For example, a report for the British Heart Foundation estimated physical inactivity to be 30% for males and 38% for females.[58] This may suggest that our estimates for individuals who could benefit from intervention may be upwardly biased.

Limitations of this study

The CLAHRC South Yorkshire Cohort consists of a self-selected sample, and it is known that volunteer samples can differ from the overall population on a number of important characteristics.[28,29] The South Yorkshire Cohort is broadly representative, only containing a slightly older, more affluent and female population resulting in a small bias in our results.[22] Although the physical activity measure used in the South Yorkshire Cohort data was based on a validated measure, the measure makes no reference to household or occupational physical activity, levels of which could potentially be high even among those with low levels of physical exercise, cycling and walking. The measure is not validated to discriminate between minimal levels of walking, however the guidance given to participants is not totally clear and so this type of minimal activity may have been reported.

Likewise, the measure does not capture sedentary behaviour, which still confers health risk even among those who meet Department of Health (2011) guidelines for physical activity.[59]

The data were also entirely self-reported, which can potentially be a source of recall bias and presentation bias. For example, correlations between self-reported physical activity and more objective measures such as accelerometry and pedometry tend to be weak.[16,60,61] This may be less problematic for our study, however, as self-reported physical activity is typically overestimated compared with objective measures and we were concerned with examining the lowest levels of physical activity.

The data were cross-sectional and this restricts the potential to use our analysis to make any causational associations. This is particularly relevant in the context of chronic conditions and physical activity, because of the bi-directional influences of some modelled relationships (a chronic condition may influence physical inactivity, but physical inactivity could also influence the onset and prognosis of a chronic condition). Finally, the Cohort dataset did not include data on commuting patterns or car ownership. However, these factors have been shown to be related to physical inactivity, with increased levels of car ownership and usage associated with lower levels of walking and cycling.[17,62,63] Further research should incorporate such information into analyses to help better design interventions.

Conclusion

Targeting people with chronic mental and physical conditions may potentially be a very effective and cost-effective strategy to reduce the impact of physical inactivity. The impact would be twofold, since people with chronic conditions represent an important group to target as a large and relatively inactive population and physical activity is known to improve such conditions. Profiling the wider characteristics of individuals who are physically inactive can also usefully inform the design and targeting of interventions.

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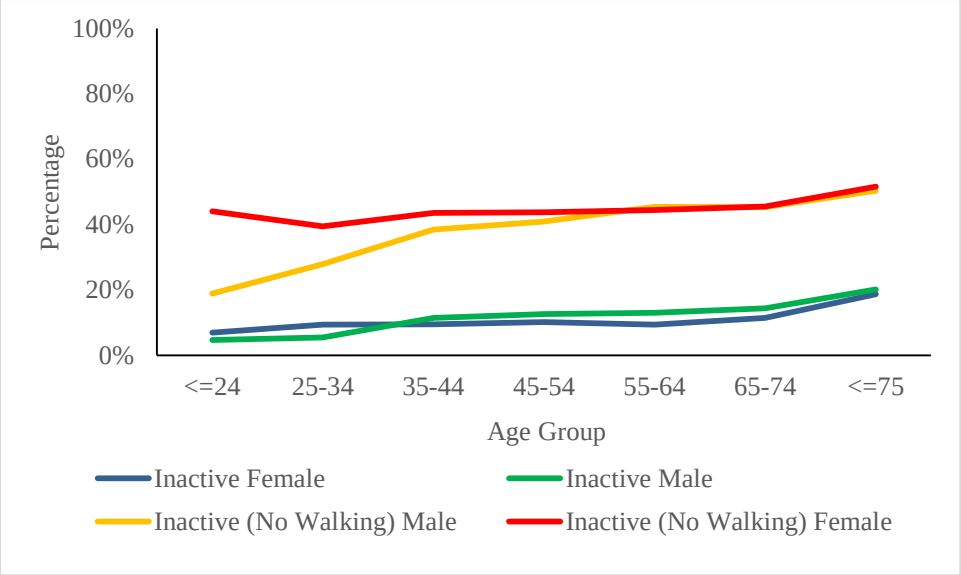

Figure I: Age and sex differences in physical inactivity

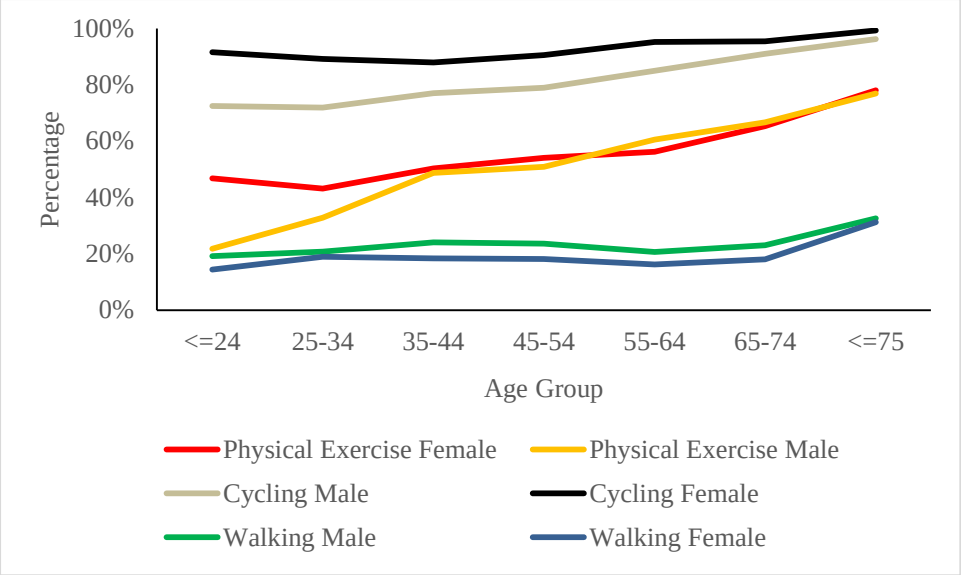

Figure II: Patterns of different types of physical inactivity by age and sex

Table I: Percentage of individuals reporting physical inactivity across the explanatory variables

	Inactive	Inactive (excluding walking)	No physical exercise	No cycling	<1 hour walking
Age					
<=24	6.1	34.7	37.7	84.6	16.1
25-34	8.0	35.4	39.6	83.0	19.6
35-44	10.3	41.5	49.6	83.1	20.7
45-54	11.3	42.5	52.5	84.9	20.6
55-64	11.1	45.0	58.3	90.1	18.3
65-74	12.9	45.5	66.0	93.2	20.4
<=75	19.4	50.9	77.5	97.7	31.9
Gender					
Female	10.6	44.3	55.2	92.2	18.7
Male	12.7	41.0	54.4	82.7	23.3
BMI					
Underweight	16.5	48.8	59.4	85.7	23.6
Normal	8.4	38.1	48.2	85.3	16.8
Overweight	10.9	42.9	56.1	88.3	20.4
Obese	18.0	53.1	67.7	93.2	28.4
Morbidly Obese	25.5	63.8	73.8	97.4	36.2
Ethnicity					
White	10.9	43.0	55.1	88.0	19.3
Non-White	18.3	42.1	52.4	86.0	38.6
Employment Status					
Unemployed	14.5	46.5	63.5	92.1	23.3
Employed	8.6	39.9	47.9	84.4	18.0
Deprivation Quintile					
Least Deprived	7.2	34.0	42.9	83.7	16.1
2	10.1	43.0	54.5	88.3	18.1
3	13.0	44.7	56.2	88.5	22.4
4	11.2	43.9	59.0	89.1	20.5
Most Deprived	16.5	49.7	65.2	90.7	27.2
Long-Term Health Condition					
Fatigue	26.9	59.5	74.5	94.4	36.8
Insomnia	23.6	56.5	70.2	92.7	32.7
Anxiety	21.9	58.8	72.7	92.7	29.9
Depression	25.3	58.7	73.5	93.0	33.8
Diabetes	20.8	55.9	73.3	95.2	32.0
Breathing Problems	20.4	51.0	65.0	92.0	30.5
High Blood Pressure	16.7	51.6	70.7	93.6	25.9
Heart Disease	22.6	52.9	72.1	94.7	33.0

Stroke	27.9	60.4	80.7	96.7	40.4
Cancer	19.1	49.8	70.5	92.6	26.2
Total	11.5	42.8	54.8	87.9	20.7

Table II: Results of logistic regression analyses of sedentary behaviour

Explanatory variables	Dependent variable				
	Inactive	Inactive (excluding walking)	No physical exercise	No cycling	<1 hour walking
Age	1.013***	1.008***	1.023***	1.020***	1.005*
Gender (Male or not)	1.223**	0.836***	0.883*	0.340***	1.317***
BMI					
Underweight	1.858*	1.503*	1.738**	0.979	1.307
Normal			Reference		
Overweight	1.123***	1.143**	1.124*	1.221*	1.122
Obese	1.718***	1.485***	1.529***	1.647***	1.589***
Morbidly Obese	2.454***	2.066***	1.721*	3.476*	2.154***
Ethnic Minority (Non-white or not)	2.054***	1.012	0.977	0.948	2.666***
Employed	0.968	1.051	0.953	0.733**	1.014
Deprivation Score					
Least Deprived			Reference		
2	1.263*	1.345***	1.425***	1.400**	1.073
3	1.82***	1.491***	1.660***	1.433**	1.451***
4	1.315	1.376***	1.748***	1.580**	1.098
Most Deprived	1.726***	1.705***	2.276***	1.853***	1.350***
Fatigue	2.292***	1.505***	1.528***	1.459*	1.895***
Insomnia	1.221	0.985	0.864	0.773	1.255*
Anxiety	1.126	1.372***	1.429***	1.053	0.979
Depression	1.466***	1.216*	1.375**	1.085	1.271*
Diabetes	1.066	1.27**	1.308*	1.752*	1.077
Breathing Problems	1.427***	1.135	1.131	1.282	1.356***
High Blood Pressure	0.933	1.092	1.208*	1.160	0.952
Heart Disease	1.196	0.967	0.890	1.108	1.253*
Stroke	1.475*	1.424*	1.793**	1.770	1.539*
Cancer	1.107	0.926	1.042	0.814	0.993
Constant	0.024***	0.292***	0.205***	3.475***	0.094***

Note: * = $p < 0.05$, ** = $p < 0.01$, *** = $p < 0.001$

Table III: Extrapolated estimates of numbers of individuals who could benefit from intervention

Long-term condition	Inactive	Inactive (excluding walking)	No physical exercise	No cycling	<1 hour walking
Fatigue	15817	35701	37666	42690	20655
Insomnia	5366	12974	13864	16210	7172
Anxiety	8844	25262	26915	30177	11988
Depression	9593	23508	25039	28118	12011
Diabetes	5157	13446	13992	16465	6821
Breathing Problems	9034	23399	24378	32802	12653
High Blood Pressure	10716	31825	33686	38026	15263
Heart Disease	4154	10237	10671	11964	5731
Stroke	1759	3703	3995	4041	2399
Cancer	1805	4480	4710	5360	2398
Total	72245	184535	194916	225853	97091