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Influence of deprivation and rurality on patient-reported outcomes of men living with and beyond prostate cancer diagnosis in the UK: a population-based study

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Highlights

- National study exploring the impact of deprivation and rurality on self-reported health-related quality of life (HRQL) following prostate cancer
- The impact of deprivation and rurality on HRQL was not greater than would be expected in the general population
- Some functional prostate specific outcomes were affected by deprivation
- No clinically meaningful differences in HRQL were identified by rurality of residence

List of abbreviations

ADT: androgen deprivation therapy; AS: active surveillance; EPIC: Expanded Prostate Cancer Index Composite; HRQL: health related quality of life; HSE: Health Survey for England; IMD: Index of Multiple Deprivation; LAPCD: Life After Prostate Cancer Diagnosis; LSOA: Lower Super Output Area; NHS: National Health Service; NI: Northern Ireland; ONS: Office for National Statistics; pph: persons per hectare; PSA: Prostate Specific Antigen; SAH: self-assessed health; UAG: User Advisory Group; UK: United Kingdom

Abstract

Background

In the UK, inequalities exist in prostate cancer incidence, survival and treatment by area deprivation and rurality. This work aimed to identify variation in patient-reported outcomes of men with prostate cancer by area type.

Methods

A population-based survey of men 18-42 months after prostate cancer diagnosis (N=35608) measured self-assessed health (SAH) using the EQ-5D and five functional domains using the Expanded Prostate Cancer Index Composite (EPIC-26).

Results

Mean SAH was higher for men in least deprived areas compared to most deprived (difference 6.3 (95%CI 5.6 to 7.2)). SAH scores were lower for men in most urban areas compared to most rural (difference 2.4 (95%CI 1.8 to 3.0)). Equivalent estimates in the general population reported a 13 point difference by deprivation and a 4 point difference by rurality. For each EPIC-26 domain, functional outcomes were better for men in the least deprived areas, with clinically meaningful differences observed for urinary incontinence and hormonal function. There were no clinically meaningful differences in EPIC-26 outcomes by rurality with less than a three point difference in scores for each domain between urban and rural areas.

Conclusion

In men 18-42 months post diagnosis of prostate cancer in the UK, impacts of area deprivation and rurality on self-assessed health related quality of life were not greater than would be expected in the general population. However, clinically meaningful differences were identified for some prostate functional outcomes (urinary and hormonal function) by deprivation. No impact by rurality of residence was identified.

1. Introduction

Socioeconomic deprivation and rurality are associated with variations in health outcomes. In the United Kingdom (UK), for general health conditions, all-cause mortality and life expectancy outcomes are more favourable in less deprived areas [1-3]. "Rurality of residence" is a complicated concept evaluating urban versus rural habitation classified by higher to lower population densities and by less to more greenspace [4]. Variations in health by rurality are known to occur: in the main, illness and mortality levels increase with higher levels of urbanisation [5, 6]. However, a U-shape in illness and mortality levels, with better health in suburban and semi-rural areas compared with urban and far rural areas, is known to exist. It is postulated that the latter relates to distances to health and support services [7]. Generally urban areas tend to be more deprived and rural areas less deprived but for each measure there is sufficient variation to investigation health outcomes by both of these area types [8].

In the UK, as for the majority of the developed world, prostate cancer survival has increased substantially over the last 40 years [9] with a current predicted 10-year net survival of 78% [10]. Socioeconomic gradients in prostate cancer survival have been demonstrated with lower incidence and survival for men living in more deprived areas [11-14]. However, the deprivation gap in survival has narrowed over time [15]. For men diagnosed in 2010 in England there were no differences in 1-year survival by deprivation [16]. Analysis by rurality of residence shows greater heterogeneity, reviews of international studies have suggested lower incidence and survival rates in more rural areas [17-19]. However, in England prostate cancer incidence is higher is rural areas [20]. Additionally, deprivation and rurality have been shown to impact on uptake of Prostate Specific Antigen (PSA) testing, stage of presentation and types of treatment received [18, 21, 22]. Men from more deprived areas have lower rates of PSA testing and more advanced stage of disease at presentation as do men living in rural areas [18, 21]. In the UK men from more deprived areas were less likely to be treated with surgery or radiotherapy, after adjustment for case-mix including stage [21, 22].

Treatment for prostate cancer may impact physically, psychologically and socially, affecting overall health-related quality of life (HRQL). Declines in urinary, bowel and sexual function following prostate cancer treatment have been reported [23-25]. The UK population-based Life After Prostate Cancer Diagnosis (LAPCD) study has reported HRQL and functional outcomes for men with prostate cancer 18-42 months post diagnosis [26]. HRQL was

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generally high, with the exception of sexual function, and similar to men in the general population. In addition, regional variations in self-reported outcomes remained after adjustment for patient case-mix, including deprivation [27].

In order to sustain the well-being of the ever increasing number of cancer survivors, large unselected studies of HRQL and functional outcomes are needed to identify problems in potentially disadvantaged groups. To date, it is not known if there are differences in the HRQL of men living with and beyond prostate cancer diagnosis by deprivation and rurality. This population-based study examines the associations between area of residence (based on both deprivation and rurality) and self-reported outcomes in men with prostate cancer in the UK.

2. Materials and Methods

2.1 Study population

The Life After Prostate Cancer Diagnosis (LAPCD) study methodology has been described in detail elsewhere [26, 28]. Briefly a cross-sectional postal survey of men diagnosed with prostate cancer in the previous 18-42 months in the UK was conducted. Men with prostate cancer were identified from national cancer registries in England, Wales and Northern Ireland (NI) and through cancer registry verified hospital activity data in Scotland. In England, all NHS Trusts were approached and 111 participated (21 declined and 4 were excluded as they were involved in similar studies). All providers in Wales, Scotland and NI participated. Overall, 82% of eligible men in the UK were invited to participate in the study. Each eligible man was sent a postal survey, via an approved survey provider. Consent was obtained via completion and return of the survey. The postal survey was sent out between October 2015 and November 2016. Details of the response rates have been published previously [26], respondents were more likely to be younger, of white ethnicity, be diagnosed with earlier stage disease and live in less deprived areas.

2.2 Outcomes

The survey contained questions to measure HRQL including EQ-5D self-assessed health (SAH) [29] and the Expanded Prostate Cancer Index Composite short form (EPIC-26) [30]. SAH was based on a visual analogue scale ranging from 0 to 100, where a score of 100

represents the best possible health. EPIC-26 measures functional outcomes across five domains (urinary incontinence, urinary irritation and obstruction, bowel, sexual and hormonal function) using 26 items. Summary scores for each domain were calculated ranging from 0 to 100, with 100 representing best possible function.

2.3 Deprivation and rurality

Deprivation and rurality measures were assigned based on postcode of residence at time of diagnosis. Within the UK, the various Indexes of Multiple Deprivation are country specific so, to ensure consistency, we calculated UK-wide deprivation based on the Townsend Index [31, 32]. Townsend scores and population weighted quintiles were calculated for each UK Lower Super Output Area (LSOA) in England and Wales, Datazone in Scotland and Super Output Area in NI using four census variables (unemployment, non-car ownership, non-home ownership and household overcrowding). Population density was calculated for each small area in the UK based on person per hectare (pph) from the 2011 census. The areas were then ranked according to population density and split into fifths, to define five categories with decreasing rurality as follows: 1 most urban, 33-681 pph; 2 very urban, 26-33 pph; 3 urban, 13-26 pph; 4 rural, 1- 13; 5 very rural, 0.01 – 1 pph.

These deprivation and rurality measures were linked to each respondent in England, Wales and NI. Due to differences with data regulations and access to data in Scotland we were unable to link the same area-based indicators, and therefore different indices for deprivation and rurality were included. The Scottish Index of Multiple Deprivation (SIMD) [33] was used with deprivation scores split into fifths. Rurality was assigned based on the Scottish Government 6-fold Urban-Rural classification which incorporates population size of settlements and accessibility measured by drive time to an urban area [34] (Table A.1).

2.4 Other variables

Other socio-demographic and clinical variables were taken from the questionnaire or available from cancer registry data including: age at questionnaire, stage at diagnosis, treatment received and number of other long-term conditions.

2.5 Statistical methods

The association between deprivation, rurality and SAH and each of the five EPIC-26 domains were assessed by log-linear models with robust standard errors to account for the skewed distribution of scores. Results are presented from adjusted models which included age at questionnaire, stage at diagnosis and other long-term conditions.

Initially separate models for each nation were considered due to the lack of consistent deprivation and rurality indicators across the four nations. In addition, the rurality trend by deprivation varied by country (Figure A.1). Initial analyses showed a similar deprivation pattern in England, Wales and NI therefore these three countries were combined in models investigating the association between deprivation and self-reported outcomes. Separate models for Scotland were run using the SIMD. Models for rurality were run separately for each nation.

Further analysis was stratified by treatment including models for those treated with androgen deprivation therapy (ADT) and active surveillance (AS). ADT was of interest as it has previously been shown that men treated with ADT had poorer hormonal and sexual scores than in other treatment groups [26]. As a comparator group, men on AS were chosen as these represent a group of men who have not received treatment for their tumour therefore any reported function problems are not directly related to treatment. For deprivation analysis England, Wales and NI were included in the models stratified by treatment. For rurality analysis stratification by treatment was only conducted for England due to small numbers in the other nations (when breaking down by treatment and rurality groups).

Multiple imputation was used to account for missing data for all outcomes, socio-demographic and clinical variables [35, 36]. No imputations were made for missing geographic indicators. Multiple imputation using chained equations was conducted separately for each country and accounted for all outcomes, deprivation, rurality, age, stage, treatment, long-term conditions and geographic indicators (Cancer Alliances for England, Local Authority Districts in Wales, Local Government Districts in NI and Health Boards in Scotland). Twenty imputations were run, and the results combined by Rubin's rule. The results presented in this paper are from the imputed models.

From the regression models adjusted means scores (based on geometric means) and 95% confidence intervals were calculated for each deprivation and rurality category, assuming the country specific distribution of the other covariables in the model. The large sample size included in this study means that statistical significance of results may be evident with only small differences in mean scores which may not be clinically relevant. Minimally important differences in scores have been previously published [37, 38] and these have been used alongside the predicted estimates when interpreting the results (Table A.2). For example, for SAH a 7-point difference between groups is considered clinically meaningful while for the sexual function domain of EPIC a difference of 10-12 points is considered clinically important.

EQ-5D SAH was collected in the 2012 Health Survey for England [39]. Mean SAH scores for men aged 60+ completing this survey by area level deprivation (using IMD 2010 [40]) and rurality (using 2011 ONS Urban-Rural classification [41]) were calculated to provide comparator scores in the general population.

3. Results

A total of 35823 men responded to the survey (60.8%). For this study, 215 were excluded from analysis due to missing geographic information (78 from England, 13 from Wales and 124 from Scotland), resulting in a final sample of 35608 men: 30387 in England, 2507 in Wales, 1019 in NI and 1695 in Scotland. Clinical details of the study population are provided in Table 1. Overall, 38% of men were treated with ADT and 8% on AS (Tables 1, A.2, A.3).

In England 32% of men lived in the least deprived areas compared to 26% in Wales, 14% in NI and 28% in Scotland, while 9% of men in England, 4% of men in Wales, 7% of men in NI and 13% of men in Scotland lived in the most deprived areas. In England 46% of men lived in the most urban areas compared to 20% in Wales, 21% in NI and 37% of men in Scotland lived in Large Urban Areas (Table 2). Compared to the general population of all men aged 60+ within each country the study sample included more men in the least deprived areas and fewer men in the most deprived areas (Table 2).

3.1 Association between deprivation and HRQL

Within each country, mean SAH scores were highest for men living in the least deprived areas compared to those living in the most deprived with differences ranging from 4 points in Wales to 12 points in NI (Table 3). Equivalent estimates from the general population showed a 13 point difference. For England, Wales and NI combined, the mean difference in adjusted SAH scores was 6.3 points (95% CI 5.6-7.2) overall, 5.4 points (4.1-6.8) for men treated with ADT and 7.3 points (4.3-10.3) for men on AS (Table 4).

There were differences in mean scores for each EPIC-26 domain by deprivation. In England, Wales and NI combined, the adjusted mean scores were highest (signifying better function) in men living in the least deprived areas and lowest for those in most deprived (Figure 1, Table A.5), with clinically meaningful differences in urinary incontinence and hormonal function. For sexual function analysed by type of treatment, the difference between the least and most deprived men treated with ADT was 1.9 points versus 7.4 points for men on AS (Figure1). However, neither of these differences reached the threshold for a minimally important clinical difference.

3.2 Association between rurality and HRQL

In England, mean SAH was 75.9 (75.6-76.2) for men living in the most urban areas and 78.3 (77.7-78.8) for men in the most rural areas. Within the other countries there was no clear pattern in outcomes by rurality (Table 5). In England, the mean difference in adjusted scores was 2.4 points (1.8-3.0) higher for men in rural areas compared to urban areas, a similar difference was found when stratifying by treatment (mean difference 2.4 (1.3-3.4) for ADT and mean difference 2.7 (0.8-4.7) for AS) (Table 4). Equivalent estimates from the general population showed a 4 point difference in mean SAH between men from urban and rural areas (Table 5).

In England the EPIC-26 scores for each domain were generally higher for those living in the most rural areas compared to the most urban, but differences were small (less than a 3 point difference for all domains) (Figure 2, Table A.6). Stratification by treatment showed similar differences between the most urban and most rural for ADT and AS except for sexual function where the difference between most urban and most rural areas was -1.6 points for men treated with ADT compared to -5.7 points for men on AS (Figure 2). However, this difference was not clinically meaningful.

4. Discussion

To the best of our knowledge, this is the largest whole population-based report on the impact of deprivation on the quality of survival of men diagnosed with prostate cancer and the first to explore the impact of rurality of residence for any of the common cancer sites. The impact of increasing deprivation on overall self–reported HRQL appears to be less marked, and definitively no greater, than in the general population. Urinary and hormonal function domains were impacted by deprivation with no effects reported in sexual and bowel function. Rurality of residence had no meaningful impact on self-reported overall HRQL and functional outcomes.

The differences in SAH reported by men with prostate cancer in the least and most deprived areas (6 point difference) was no greater than that reported by men in the general population (13 point difference). The absence of a deleterious effect of deprivation is reassuring but perhaps surprising because of the evidence for some functional differences. One possible explanation for this may be the "gap hypothesis", originally proposed by Calman, whereby quality of life measures the gap, at a particular period of time between an individual's hopes and expectations and their present experiences [42]. An individual's aims and goals may be modified by cancer diagnosis and treatment and quality of life may improve due to a reduction in expectations and satisfaction with what they have, so that they report relatively high HRQL [42, 43]. Without baseline measures of SAH within the LAPCD cohort we cannot assess any individual level changes in HRQL, however it may be that this "gap hypothesis" operates differentially between men living in less and more deprived areas.

Previous analysis of this cohort has identified that men treated with ADT reported greater problems particularly with hormone-related functioning and sexual health [26]. The trends in deprivation, rurality and outcomes for men receiving ADT were similar to the full cohort. However, a stronger deprivation gradient and rurality gradient were observed for men on active surveillance, particularly for sexual function. Differences in sexual function scores of 7 points by deprivation and 6 points by rurality were observed, but these differences were not thought to be clinically meaningful. However, it should be noted that the overall mean sexual scores for men on AS were substantially higher (i.e. better functioning) than in men treated with ADT for whom there was little variation by deprivation or rurality, with poor sexual function reported by all men regardless of place of residence.

Whilst the sample size is large, there is a potential responder bias within the study. Compared to all men diagnosed with prostate cancer during the same time period, respondents were more likely to be younger, of white ethnicity, be diagnosed with earlier staged disease and live in less deprived areas [26]. Despite participants completing validated internationally recommended outcome measures [44], no equivalent UK wide baseline population data are available for prostate specific outcomes. To compensate for this, men managed with AS (who received no treatment) have been used as a comparator. For the EQ-5D HRQL assessment, normative data from the Health Survey for England [39] was used, thereby identifying that the men living with and beyond prostate cancer diagnosis did not self-report worse HRQL than the general population and the effects of increasing deprivation were similar. Further work examining inequalities of other outcomes such as psychological wellbeing and social support, which are not included in this study are needed.

Our measure of rurality is based on population density, whilst this is not strictly an urban-rural measure it is a good proxy and there are no alternative consistently adopted UK-wide urban-rural measures. Two smaller scale studies in Ireland have investigated urban-rural inequalities in quality of life in survivors of breast cancer [45] and head and neck cancer [46]. These studies used a composite measure of urban-rural classification based on population density, settlement size and proximity to treatment hospital. However defined, rurality measures a complex series of interactions between social, environmental and behavioural processes. We were unable to account for travel time or distance to treatment centre as this data was not available. These factors are known to impact on types of treatment used in prostate cancer.

Other measures of area level deprivation are commonly used including country specific Indexes of Multiple Deprivation [33, 40, 47, 48] which are composite scores derived from a number of indicators covering different domains including: income, employment, education, skills and training, health and disability, crime, housing and living environment. IMD includes a larger range of domains, and uses data from local government and other agencies and is not only based on census data like Townsend, which focusses on four indicators of material deprivation (unemployment, non-car ownership, non-home ownership and household overcrowding). However, the Townsend measure was used in this study as it can be calculated consistently across the all countries in the UK, although it was not possible to use this measure in Scotland (due to data access issues). The implications of using a different

measure in Scotland cannot currently be determined but correlations of 0.85 between Townsend and the Scottish IMD and 0.51 between the density based and Scottish scheme suggest results would be similar whichever measures were used.

In this study, we have examined associations with deprivation and rurality independently; however, there is a strong correlation between the two measures with a tendency for urban areas to be more deprived and rural areas less deprived but sufficient variation to justify investigation of both of these area typologies [8]. Many factors such as differences in quality and access to primary care, differences in health seeking behaviours and distances and willingness to travel to hospitals for treatment may explain why differences persist between deprivation and rurality groups.

In conclusion, it is reassuring to have identified little impact of deprivation and rurality of residence on self-assessed health-related quality of life and prostate functional outcomes (bladder, bowel, sexual) 18-42 months post diagnosis of prostate cancer across the UK. However, further targeted work is needed to establish whether this finding holds for hard to reach population groups known to be at increased risk of poor health access such as Black and Minority Ethnic groups and those with restricted geographic mobility such as those with limited access to transport. Additionally, as cancer survival and prevalence increase, to support elimination of health inequalities it is recommended that the impact of rurality of residence and deprivation on quality of outcomes from other cancer types be evaluated.

Public Benefit and Privacy Panel (0516-0364), Office of Research Ethics Northern Ireland (16/NI/0073) and NHS R&D approval from Wales, Scotland and Northern Ireland.

Data availability

Consent for data sharing outside the research team was not sought from survey respondents.

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Table 1: Characteristics of LAPCD cohort by country, values are n(%) unless otherwise stated

	England N= 30387	Wales N=2507	Northern Ireland N=1019	Scotland N=1695
Age, mean(SD)	71.7 (8.0)	71.5 (7.9)	70.1 (8.2)	70.8 (7.4)
Treatment				
Active surveillance	2480 (8.2)	243 (9.7)	90 (8.8)	95 (5.6)
Surgery alone	6134 (20.2)	448 (17.9)	9 (9.2)	347 (20.5)
EBRT alone	2051 (6.7)	236 (9.4)	132 (13.0)	106 (6.3)
Brachytherapy alone	998 (3.3)	46 (1.8)	62 (6.1)	93 (5.5)
ADT alone	2723 (9.0)	166 (6.6)	62 (6.1)	146 (8.6)
Watchful waiting	1975 (6.5)	171 (6.8)	61 (6.0)	76 (4.5)
EBRT & ADT	6242 (20.5)	609 (24.3)	258 (25.3)	335 (19.8)
Surgery & EBRT/ADT	2046 (6.7)	147 (5.9)	44 (4.3)	97 (5.7)
Systemic & ADT	515 (1.7)	49 (2.0)	16 (1.6)	45 (2.7)
Systemic & EBRT	430 (1.4)	34 (1.4)	16 (1.6)	30 (1.8)
Missing	4793 (15.8)	358 (14.3)	184(18.1)	325 (19.2)
Stage				
I/II	16,768 (55.2)	1,446 (57.7)	617 (60.5)	719 (42.4)
III	6,178 (20.3)	403 (16.1)	226 (22.2)	384 (22.7)
IV	3,226 (10.6)	233 (9.3)	126 (12.4)	330 (19.5)
Missing	4,215 (13.9)	425 (17.0)	50 (4.9)	262 (15.5)
Number of long-term conditions				
0	8,881 (29.2)	684 (27.3)	294 (28.9)	475 (28.0)
1	10,606 (34.9)	873 (34.8)	362 (35.5)	609 (35.9)
2	6,020 (19.8)	544 (21.7)	204 (20.0)	350 (20.6)
3	2,656 (8.7)	245 (9.8)	95 (9.3)	155 (9.1)
4+	2224 (7.3)	161 (6.4)	64 (6.3)	106 (6.3)

Systemic therapy includes chemotherapy, abiraterone, and enzalutamide

ADT = Androgen deprivation therapy, EBRT = external beam radiotherapy, LAPCD= Life After Prostate Cancer Diagnosis

Table 2: Distribution of geographic indicators by country, LAPCD cohort and the general population*

	England		Wales		Northern Ireland		Scotland		
Townsend Deprivation	LAPCD N=30387 n (%)	*General population 60+ years (%)*	LAPCD N=2507 n (%)	*General population 60+ years (%)*	LAPCD N=1019 n (%)	*General population 60+ years (%)*	Index of multiple deprivation	LAPCD N=1695 n (%)	*General population 60+ years (%)*
1 Least deprived	9617 (31.7)	*(21.0)*	663 (26.5)	*(19.6)*	140 (13.7)	*(11.3)*	1 Least deprived	469 (27.7)	*(19.0)*
2	8228 (27.1)	*(20.2)*	708 (28.2)	*(24.0)*	253 (24.8)	*(20.1)*	2	393 (23.2)	*(19.8)*
3	5926 (19.5)	*(19.2)*	681 (27.2)	*(28.0)*	344 (33.8)	*(32.1)*	3	364 (21.5)	*(22.6)*
4	3984 (13.1)	*(19.6)*	353 (14.1)	*(20.4)*	208 (20.4)	*(24.9)*	4	253 (14.9)	*(23.3)*
5 Most deprived	2632 (8.7)	*(20.0)*	102 (4.1)	*(8.0)*	74 (7.3)	*(11.7)*	5 Most deprived	216 (12.7)	*(15.3)*
Rurality							**Urban/rural indicator**	**N (%)**	
1 Most urban	14067 (46.3)	*(52.7)*	505 (20.1)	*(26.8)*	218 (21.4)	*(22.4)*	1 Large Urban Area	618 (36.5)	*(29.6)*
2 Very urban	2830 (9.3)	*(8.0)*	163 (6.5)	*(7.0)*	64 (6.3)	*(7.1)*	2 Other Urban Area	469 (27.7)	*(34.8)*
3 Urban	4960 (16.3)	*(14.4)*	401 (16.0)	*(15.9)*	157 (15.4)	*(15.3)*	3 Accessible Small Town	161 (9.5)	*(10.1)*
4 Rural	5791 (19.1)	*(18.1)*	939 (37.5)	*(33.6)*	303 (29.7)	*(28.3)*	4 Remote Small Town	63 (3.7)	*(4.2)*
5 Very rural	2739 (9.0)	*(6.7)*	499 (19.9)	*(16.7)*	277 (27.2)	*(26.9)*	5 Accessible Rural	213 (12.6)	*(13.1)*
							6 Remote Rural	171 (10.1)	*(8.2)*

*General population comparison includes males aged 60+ years only

LAPCD= Life After Prostate Cancer Diagnosis

Table 3: Adjusted mean self-assessed health (SAH) scores (95% confidence interval) by deprivation and country, LAPCD cohort and HSE

Deprivation*	England (N=30387)		Wales (N=2507)		Northern Ireland (N=1019)		Scotland (N=1695)		HSE, men aged 60+ (N=1016)	
	Mean SAH	95%CI	Mean SAH	95%CI	Mean SAH	95%CI	Mean SAH	95%CI	Mean SAH	(SD)
1 Least deprived	78.0	(77.7, 78.3)	75.0	(73.9, 76.3)	78.2	(76.2, 80.3)	76.9	(75.6, 78.3)	79.8	(16.1)
2	77.4	(77.1, 77.8)	74.1	(72.9, 75.4)	77.7	(75.9, 79.5)	75.6	(74.0, 77.2)	76.3	(19.4)
3	76.6	(76.2, 77.0)	73.2	(71.8, 74.6)	74.6	(72.8, 76.5)	74.0	(72.2, 75.8)	73.5	(18.8)
4	75.0	(74.5, 75.6)	71.0	(68.9, 73.1)	75.5	(73.2, 77.9)	72.5	(70.3, 74.8)	68.0	(21.7)
5 Most deprived	71.7	(70.9, 72.4)	70.6	(67.3, 74.1)	66.6	(61.6, 71.9)	70.0	(67.3, 72.7)	66.7	(21.4)

Adjusted for age, stage at diagnosis and long-term conditions

*Townsend used for England, Wales and Northern Ireland, Scottish Index of Multiple Deprivation used in Scotland, English Index of Multiple Deprivation used for HSE

CI = Confidence interval, HSE= Health Survey for England, LAPCD= Life After Prostate Cancer Diagnosis, SAH = Self-assessed Health, SD = Standard Deviation

Table 4: Self-assessed health (SAH) adjusted mean scores and difference in mean scores (95% confidence interval) overall and stratified by treatment, LAPCD cohort

	All LAPCD study			Androgen deprivation therapy only			Active surveillance only		
	Mean SAH	Difference	95%CI	Mean SAH	Difference	95%CI	Mean SAH	Difference	95%CI
Deprivation (England, Wales and NI)	N=33913			N=12877			N=2813		
1 Least deprived	77.8	ref	-	75.4	ref	-	80.5	ref	-
2	77.2	0.7	(0.2, 1.1)	75.1	0.3	(-0.4, 1.0)	79.7	0.8	(-0.4, 2.1)
3	76.2	1.7	(1.2, 2.1)	73.9	1.5	(0.6, 2.3)	80.2	0.4	(-1.1, -1.9)
4	74.7	3.1	(2.5, 3.7)	72.5	2.8	(1.8, 3.9)	77.5	3	(1.1, 5.0)
5 Most deprived	71.5	6.3	(5.6, 7.2)	70.0	5.4	(4.1, 6.8)	73.3	7.3	(4.3, 10.3)
Rurality (England only)	N=30387			N=11526			N=2480		
Most urban	75.9	ref	-	73.9	ref	-	78.8	ref	-
Very urban	76.3	-0.5	(-1.2, 0.2)	73.9	0.04	(-1.1, 1.1)	79.9	-1.1	(-3.1, 0.8)
Urban	77.0	-1.2	(-1.7, -0.6)	74.9	-1	(-1.9, -0.1)	80.4	-1.6	(-3.3, -0.03)
Rural	77.5	-1.6	(-2.1, -1.2)	74.9	-1	(-1.8, -0.2)	79.7	-0.9	(-2.4, 0.6)
Very rural	78.3	-2.4	(-3.0, -1.8)	76.3	-2.4	(-3.4, -1.3)	81.5	-2.7	(-4.7, -0.8)

Deprivation models include men in England, Wales and Northern Ireland, Rurality models include men in England only

Adjusted for age, stage at diagnosis and long-term conditions

CI = Confidence interval, LAPCD= Life After Prostate Cancer Diagnosis, NI = Northern Ireland, SAH = Self-assessed Health,

Table 5: Adjusted mean self-assessed health (SAH) scores (95% confidence interval) by rurality and country, LAPCD cohort and HSE

	England (N=30387)		Wales (N=2507)		Northern Ireland (N=1019)		Scotland (N=1695)		HSE, men aged 60+ (N=1016)	
Rurality	Mean SAH	95%CI	Mean SAH	95%CI	Mean SAH	95%CI	Mean SAH	95%CI	Mean SAH	(SD)
Most urban	75.9	(75.6, 76.2)	73.4	(71.9, 75.0)	73.9	(71.5, 76.3)				
Very urban	76.3	(75.8, 76.9)	71.6	(68.9, 74.5)	76.2	(72.7, 79.8)				
Urban	77.0	(76.6, 77.5)	73.6	(71.8, 75.4)	75.3	(72.7, 78.0)				
Rural	77.5	(77.1, 77.9)	74.0	(72.9, 75.1)	76.3	(74.6, 78.1)				
Very rural	78.3	(77.7, 78.8)	73.3	(71.9, 74.8)	75.8	(73.8, 77.8)				
Scottish Urban-Rural										
Large Urban area							73.7	(72.4, 75.1)		
Other urban area							75.2	(73.6, 76.7)		
Accessible small town							74.3	(71.7, 77.0)		
Remote small town							69.2	(64.8, 74.0)		
Accessible rural							75.2	(73.1, 77.4)		
Remote rural							76.1	(73.8, 78.5)		
HSE Rurality of dwelling										
Urban									73.0	(20.2)
Town and Fringe									76.4	(19.0)
Village, hamlet and isolated dwellings									77.4	(17.2)

Rurality of dwelling based on 2011 ONS Urban-Rural classification [41]

CI = Confidence interval, LAPCD= Life After Prostate Cancer Diagnosis, SAH = Self-assessed Health, SD = Standard deviation

Figure 1: Adjusted mean scores for each EPIC-26 domain by deprivation, stratified by treatment, men in England, Wales and Northern Ireland

Footnote: Deprivation group 1 = least deprived, 5 = most deprived

ADT =Androgen Deprivation Therapy, AS = Active Surveillance

Figure 2: Adjusted mean scores for each EPIC-26 domain by rurality fifth, stratified by treatment, men in England only

Footnote: Rurality group 1 = Most Urban, 5 = Very rural

ADT =Androgen Deprivation Therapy, AS = Active Surveillance