

Norfolk Vanguard Offshore Wind Farm

Appendix 27.1

Human Health Supporting Information

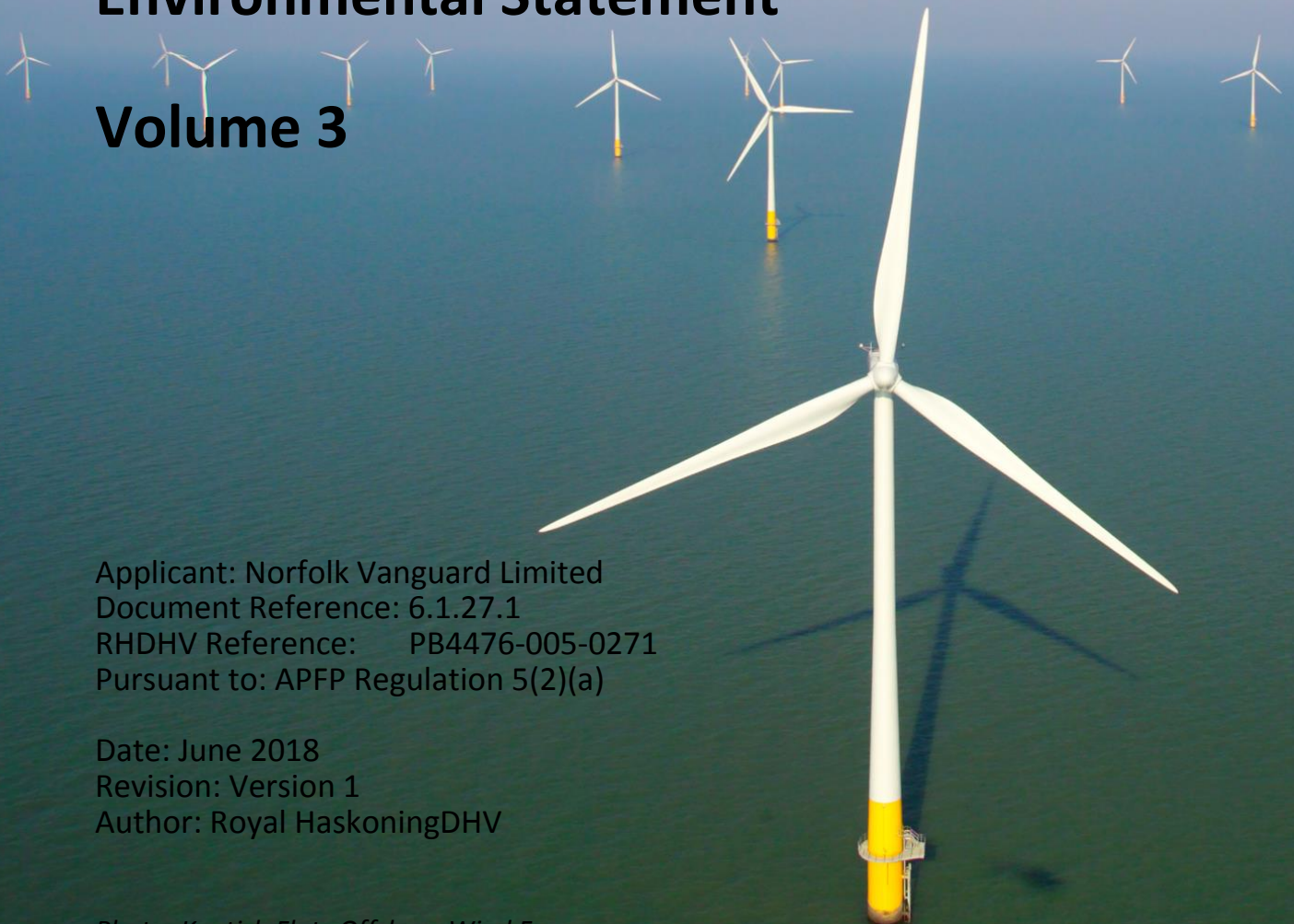
Environmental Statement

Volume 3

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For and on behalf of Norfolk Vanguard Limited

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27 SUPPORTING INFORMATION

1. An evidence base of publicly available information has been used to support the scoping and assessment conclusions of Chapter 27 Human Health for the Norfolk Vanguard Offshore Wind Farm. Evidence statements have been extracted from a review of abstracts and full articles published in English on PubMed¹ from the past five years. This document is Appendix 27.1 to Chapter 27 Human Health. The review is not exhaustive and aims to provide a summary only of the key issues relevant to the scope of Chapter 27 Human Health.

27.1 Scientific Literature

27.1.1 Noise

2. Noise is pervasive in everyday life and can cause both auditory and non-auditory health effects. Although people tend to habituate to noise exposure, degree of habituation differs for individuals and is rarely complete. If exposure to noise is chronic and exceeds certain levels, then negative health outcomes can be seen (Basner et al., 2014).
3. Environmental noise (e.g. noise from road, rail, and air traffic, and industrial construction) has been linked to a range of non-auditory health effects including annoyance, sleep disturbance, cardiovascular disease, and impairment of cognitive performance in children (Basner et al., 2014).
4. Annoyance is the most prevalent community response in a population exposed to environmental noise. Noise annoyance can result from noise interfering with daily activities, feelings, thoughts, sleep, or rest, and might be accompanied by negative responses, such as anger, displeasure, exhaustion, and by stress-related symptoms. In severe forms, it could be thought to affect wellbeing and health, and because of the high number of people affected, annoyance substantially contributes to the burden of disease from environmental noise. Although the overall community response depends on societal values, several personal (e.g. age and noise sensitivity) and situational characteristics (e.g. dwelling insulation) might affect the individual degree of annoyance (Basner et al., 2014).
5. Sleep disturbance is thought to be the most deleterious non-auditory effect of environmental noise exposure, because undisturbed sleep of a sufficient length is needed for daytime alertness and performance, quality of life, and health. Human beings perceive, evaluate, and react to environmental sounds, even while asleep. Elderly people, children, shift-workers, and people with a pre-existing (sleep)

¹ <https://www.ncbi.nlm.nih.gov/pubmed/>

disorder are thought of as at-risk groups for noise-induced sleep disturbance (Basner et al., 2014).

6. Regarding noise and health, groups at risk most often mentioned in the literature are children, the elderly, the chronically ill and people with a hearing impairment. Other categories encountered are those of sensitive persons, shift-workers, people with mental illness (e.g., schizophrenia or autism), people suffering from tinnitus, and fetuses and neonates (van Kamp and Davies, 2013).
7. The available evidence shows that children are less vulnerable for annoyance than adults, but more vulnerable for cognitive effects of noise. They are not *per se* more vulnerable as a group, but more at risk because of less-developed coping strategies, and they are in a sensitive developmental period. This is indicative of a life phase effect rather than an age effect. Children seem to be less vulnerable for awakenings due to noise but more vulnerable for physiological effects during sleep and related motility (van Kamp and Davies, 2013).
8. Evidence does not indicate that the elderly are more vulnerable to noise in terms of annoyance and sleep disturbance. Age-specific comparisons rather show an inverted U-shaped relation and indicate that both young and older people are less at risk as far as annoyance and disturbance are concerned. But, possibly, the elderly are more vulnerable regarding cardiovascular effects, and this may be a combined effect of air pollution and noise (van Kamp and Davies, 2013).

27.1.2 Air Quality

9. Air pollution is a heterogeneous and a complex mixture of dust, particulate matter (PM), fumes, gases, carbon monoxide, nitrogen dioxide, sulphur dioxide and ozone. Environmental air pollution is associated with increased risk of cardiovascular diseases (Meo and Suraya, 2015) and with moderate or severe asthma exacerbation (Orellano et al., 2017).
10. The main anthropogenic sources of PM are traffic and transportation, and combustion processes. Nitrogen dioxide and carbon monoxide are principally emitted from fossil fuel combustion in urban environments. Ozone is a secondary pollutant formed by photochemical reactions between sunlight and pollutant precursors, such as nitrogen oxides and volatile organic compounds (Orellano et al., 2017).
11. Increased pollution exposures have been associated with increased numbers of hospital admissions and emergency-room visits, mainly due to exacerbations of chronic obstructive pulmonary disease and asthma (Orellano et al., 2017).

12. In the atmosphere, different PM sizes can be found. The coarse fraction (PM₁₀–PM_{2.5}) can penetrate into the upper airways, but the fine fraction (PM_{2.5} - PM₁) can be deposited in the lung, especially in the alveoli, although it could pass to the systemic circulation. Besides the size of PM, the chemical composition of particulates are very important to understand the health effects (Orellano et al., 2017).

27.1.3 Ground and / or Water Contamination

13. Recreational exposure to natural toxins by skin contact, accidental swallowing of water or inhalation can cause a wide range of acute or chronic illnesses (Koreiviene et al., 2014).
14. Drinking water supplies from both surface water and ground water sources may be contaminated during flooding events (Andrade et al., 2018).
15. Cyanobacteria are ubiquitous photosynthetic micro-organisms forming blooms and scums in surface water; among them some species can produce cyanotoxins giving rise to some concern for human health (Testai et al., 2016).
16. The safety of water supplies is of paramount public health importance. Although microbiological contamination is the largest contribution to waterborne disease and mortality at a global scale, chemical contaminants in water supplies also can cause disease, sometimes after long periods of exposure. Water supplies often include mixtures of chemical contaminants that vary in time and space. However, drinking-water quality is regulated and monitoring is conducted routinely

27.1.4 Physical Activity

17. There is strong evidence that active travel (such as walking or cycling) can result in substantial health benefits (Winters et al., 2017). Engagement in leisure activities is also associated with increased subjective well-being (Kuykendall et al., 2015) and decreased risk of type 2 diabetes (Huai et al., 2016).
18. Natural environments such as green or open spaces, but also attractive views of nature integrated within the urban landscape, are important environmental factors sustaining physical activity in the population (Calogiuri and Chroni, 2014).
19. An activity friendly neighbourhood that is walkable, dense, accessible, equipped with walk/cycle facilities and safe from traffic is associated with more active transportation to school in children (D’Haese et al., 2015).
20. Physical activity can improve mental health, the strongest evidence indicates that this is through improvements in physical self-perceptions that accompanied enhanced self-esteem (Lubans et al., 2016).

21. Anxiety symptoms (below the threshold of anxiety disorders) are common in older adults. Regular physical activity may be effective for improving anxiety symptoms in older adults (Mochcovitch et al., 2016).
22. Nearly half of people aged over 60 years are inactive. Access difficulties (environmental barriers or affordability) are one of the barriers to physical activity participation amongst older people (Franco et al., 2015).

27.1.5 Journey Times and / or Reduced Access

23. Areas with greater access to primary health care have lower hospitalization rates for ambulatory care sensitive conditions (conditions which are potentially avoidable by well-functioning primary care) (Rosano et al., 2013).
24. Transportation barriers are often cited as barriers to healthcare access. Transportation barriers lead to rescheduled or missed appointments, delayed care, and missed or delayed medication use. These consequences may lead to poorer management of chronic illness and thus poorer health outcomes (Syed et al., 2013).
25. Transportation barriers to health care access are common, and greater for vulnerable populations. Patients with a lower socio-economic status have higher rates of transportation barriers to ongoing health care access than those with a higher socio-economic status. Transportation barriers can also affect access to pharmacies and thus medication adherence (Syed et al., 2013).
26. When patients cannot get to their health care provider, they miss the opportunity for evaluation and treatment of chronic disease states, changes to treatment regimens, escalation or de-escalation of care and, as a result, delay interventions that may reduce or prevent complications (Syed et al., 2013).
27. Lack of access to transport can mean the difference between care delivered in a timely manner that has a greater chance of improved health outcomes and an inefficient utilisation of health care services. This may be late, or non-, presentation at primary health care and a higher level of treatment in accident and emergency departments (Syed et al., 2013).
28. Shortages of sufficient health care in rural areas relate to staff shortages, uneven distribution of resources, quality deficiencies, access limitations and the inefficient utilisation of health care services. The reasons for such shortages include physical/infrastructural, professional, educational, social-cultural, economic and political issues (Weinhold and Gurtner, 2014).

27.1.6 Employment

29. Employment is beneficial for health, particularly in having a protective effect on depression and general mental health (van der Noordt et al., 2014).
30. Unemployment is not only an effect of illness, but also a cause of it. The long-term unemployed carry a markedly higher burden of disease, particularly mental illness, compared to employed persons and those who are unemployed only for a short time (Herbig et al., 2013). Negative health effects are associated with unemployment linked to socioeconomic status (manual workers suffer more) and being unemployed due to health reasons (Norstrom et al., 2014).
31. Job insecurity can pose as great a threat to health and mental health as unemployment. Job insecurity constitutes a chronic stressor which does not immediately affect health, but its impact intensifies over the period that jobs are perceived to be at risk (Kim and von dem Knesebeck, 2015).
32. Low socio-economic status is associated with higher risk factors for non-communicable diseases, such as increased risk of mortality from lung cancer, chronic obstructive pulmonary disease, and reduced breast cancer survival (Sommer et al., 2015).

27.1.7 Electromagnetic Fields

33. There is a growing body of literature indicating there is no causal relationship between exposure to EMFs and subjective well-being in members of the public whether or not they report perceived sensitivity to EMFs (Eltiti et al., 2015).
34. HVDC lines transport large amounts of energy over long distances. The operation of these lines produces static electric fields. Humans are able to perceive the presence of static electric fields at sufficiently high levels due to superficial sensory stimulation of hair and skin. Consistent with other reviews, including by the WHO and specifically in the UK, the evidence does not indicate that static electric fields have adverse health effects (Petri et al., 2017).
35. As a consequence of their design, some types of equipment do not produce an external electric field. This applies to underground cables and gas insulated switchgear (GIS), which are enclosed in a metal sheath (a protective metal layer within the cable) and have solid metal enclosures respectively.
36. In the Scoping Opinion, Public Health England note that the evidence to date suggests that in general there are no adverse effects on the health of the population of the UK caused by exposure to extremely low frequency electromagnetic fields below the guideline levels. The scientific evidence, as reviewed by Public Health England, supports the view that precautionary measures should address solely the

possible association with childhood leukaemia and not other more speculative health effects. The measures should be proportionate in that overall benefits outweigh the fiscal and social costs, have a convincing evidence base to show that they will be successful in reducing exposure, and be effective in providing reassurance to the public.

27.2 Baseline Statistics

Table 27.1 Baseline census statistics 2011

Population group	Site specific						Local				Regional		National			
	North Norfolk 012A LSOA (representative of the population at landfall)		Breckland 004C LSOA (representative of the onshore cable corridor population)		Breckland 004A LSOA (representative of the population at the onshore project substation)		North Norfolk District		Broadland District		Breckland		Norfolk County		England	
	number	%	number	%	number	%	number	%	number	%	number	%	number	%	number	%
KS101EW - Usual resident population																
All usual residents	2,386	100	1,586	100	1,923	100	101,499	100	124,646	100	130,491	100	857,888	100	53,012,456	100
Area (Hectares)	3,547	-	3,536	-	1,548	-	96,333	-	55,240	-	130,512	-	537,056	-	13,027,843	-
Density (number of persons per hectare)	0.7	-	0.4	-	1.2	-	1.1	-	2.3	-	1.0	-	1.6	-	4.1	-
QS418EW - Dwellings																
Number of dwellings	1,305	-	669	-	924	-	53,224	-	54,860	-	57,425	-	401,756	-	22,976,066	-
KS102EW - Age structure																
Age 0 to 15 – children and young people	1,627	14	922	16	1,167	13	67,893	15	75,849	17	80,409	18	546,741	17	32,998,902	19
Aged 16 to 64 – working age people	1,457	61	982	62	1,011	53	57,633	57	75,841	61	79,369	61	527,672	62	34,329,091	65
Aged 65 and over – older people	607	25	351	22	669	35	29,197	29	27,816	22	28,138	22	185,231	22	8,660,529	16
KS301EW - Health and provision of unpaid care																
Day-to-day activities limited a lot	259	11	183	12	237	12	10,456	10	10,089	8	11,537	9	77,696	9	4,405,394	8

Population group	Site specific						Local				Regional		National			
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	number	%	number	%	number	%	number	%	number	%	number	%	number	%	number	%
Day-to-day activities limited a little	289	12	156	10	299	16	13,153	13	13,241	11	14,108	11	94,735	11	4,947,192	9
Day-to-day activities not limited	1,838	77	1,247	79	1,387	72	77,890	77	101,316	81	104,846	80	685,457	80	43,659,870	82
Very good health	930	39	671	42	707	37	39,504	39	55,219	44	55,097	42	366,280	43	25,005,712	47
Good health	900	38	564	36	698	36	38,336	38	46,106	37	48,663	37	314,157	37	18,141,457	34
Fair health	402	17	216	14	383	20	17,412	17	17,475	14	19,565	15	129,218	15	6,954,092	13
Bad health	127	5	111	7	103	5	4,839	5	4,499	4	5,623	4	37,527	4	2,250,446	4
Very bad health	27	1	24	2	32	2	1,408	1	1,347	1	1,543	1	10,706	1	660,749	1
Provides no unpaid care	2,068	87	1,379	87	1,672	87	89,097	88	110,303	89	116,566	89	763,197	89	47,582,440	90
Provides 1 to 19 hours unpaid care a week	201	8	128	8	135	7	7,959	8	9,925	8	8,537	7	59,858	7	3,452,636	7
Provides 20 to 49 hours unpaid care a week	36	2	31	2	35	2	1,450	1	1,527	1	1,811	1	11,626	1	721,143	1
Provides 50 or more hours unpaid care a week	81	3	48	3	81	4	2,993	3	2,891	2	3,577	3	23,207	3	1,256,237	2
KS106EW - Adults not in employment and dependent children and persons with long-term health problems or disability for all households																
No adults in employment in household	436	40	200	32	456	52	20,152	44	18,164	34	19,390	36	138,644	37	7,348,649	33

Population group	Site specific						Local				Regional		National			
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	number	%	number	%	number	%	number	%	number	%	number	%	number	%	number	%
Dependent children in household: All ages	205	19	156	25	168	19	9,511	21	14,024	26	14,918	27	94,194	25	6,425,647	29
One person in household with a long-term health problem or disability	303	28	182	29	272	31	13,538	29	13,507	25	14,506	27	100,637	27	5,659,606	26
QS119EW - Households by deprivation dimensions																
Household is not deprived in any dimension	432	40	258	41	306	35	18,030	39	25,372	48	21,907	40	153,938	41	9,385,648	43
Household is deprived in 1 dimension	389	36	238	38	327	37	16,676	36	17,819	33	19,344	35	126,531	34	7,204,181	33
Household is deprived in 2 dimensions	222	20	110	18	207	24	9,469	21	8,804	17	10,881	20	74,131	20	4,223,982	19
Household is deprived in 3 dimensions	35	3	20	3	37	4	1,731	4	1,267	2	2,210	4	16,122	4	1,133,622	5
Household is deprived in 4 dimensions	7	1	2	0	-	0	140	0	74	0	177	0	1,363	0	115,935	1
QS416EW - Car or van availability																
No cars or vans in household	91	8	50	8	111	13	7,455	16	6,106	11	8,462	16	70,096	19	5,691,251	26
One or more cars or vans in household	994	92	578	92	766	87	38,591	84	47,230	89	46,057	84	301,989	81	16,372,117	74
QS702EW - Distance travelled to work																
Average distance travelled to work (km)	25	-	21	-	25	-	21	-	15	-	20	-	17	-	15	-

Population group	Site specific						Local				Regional		National			
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	number	%	number	%	number	%	number	%	number	%	number	%	number	%	number	%
Work mainly at or from home	184	18	142	18	110	15	6,822	16	6,724	11	7,477	12	45,406	11	2,581,832	10
QS601EW - Economic activity																
Economically active: Total	1,103	61	817	69	798	58	45,819	63	64,232	71	65,029	69	424,732	68	27,183,134	70
Economically inactive: Total	701	39	367	31	567	42	26,634	37	26,073	29	29,147	31	199,066	32	11,698,240	30
Economically inactive: Retired	441	24	228	19	410	30	17,240	24	16,776	19	16,939	18	111,739	18	5,320,691	14
Economically inactive: Looking after home or family	78	4	49	4	45	3	2,918	4	3,116	3	3,987	4	25,902	4	1,695,134	4
Economically inactive: Long-term sick or disabled	103	6	44	4	50	4	2,847	4	2,512	3	3,288	3	24,187	4	1,574,134	4
QS606EW - Occupation (Minor Groups)																
Plant and Machine Operatives	10	-	9	-	8	-	380	-	573	-	769	-	4,493	-	243,654	-
Construction Operatives	6	-	3	-	5	-	312	-	413	-	398	-	2,935	-	154,615	-
Elementary Construction Occupations	10	-	3	-	4	-	262	-	237	-	318	-	2,172	-	127,074	-
QS501EW - Highest level of qualification																
No qualifications	625	30	350	26	542	32	23,838	27	23,744	23	30,057	28	187,738	26	9,656,810	22
Level 1 qualifications	273	13	182	14	220	13	12,236	14	15,328	15	16,104	15	101,897	14	5,714,44	13

Population group	Site specific						Local				Regional		National				
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	number	%	number	%	number	%	number	%	number	%	number	%	number	%	number	%	
																1	
Level 2 qualifications	294	14	245	18	272	16	14,106	16	18,098	17	18,149	17	115,753	16	6,544,614	15	
Apprenticeship	93	5	56	4	91	5	4,087	5	5,651	5	4,276	4	29,592	4	1,532,934	4	
Level 3 qualifications	220	11	170	13	179	11	9,137	11	12,388	12	11,917	11	83,896	12	5,309,631	12	
Level 4 qualifications and above	472	23	267	20	273	16	19,326	22	24,026	23	20,046	19	156,412	22	11,769,361	27	
Other qualifications	87	4	63	5	103	6	4,100	5	4,422	4	6,958	6	37,615	5	2,461,829	6	
QS613EW - Approximated social grade																	
AB Higher and intermediate managerial/administrative/professional occupations	281	20	194	20	140	14	9,868	17	16,162	21	12,597	16	95,838	18	7,737,602	23	
C1 Supervisory, clerical and junior managerial/administrative/professional occupations	425	30	268	27	299	30	14,980	27	24,271	32	21,768	28	151,115	29	10,238,039	30	
C2 Skilled manual occupations	419	29	300	31	333	33	16,975	30	20,494	27	22,410	29	136,188	26	7,396,569	22	
DE Semi-skilled and unskilled manual occupations; unemployed and lowest	296	21	215	22	239	24	14,594	26	14,393	19	21,110	27	135,042	26	8,362,138	25	

Variable	Population group		Site specific						Local				Regional		National	
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	number	%	number	%	number	%	number	%	number	%	number	%	number	%	number	%
grade occupations																

Table 27.2 PHE Health assets profile Norfolk

Health assets indicators	Period	Norfolk		England
		Count	Value	Value
Gender pay equality	2015	-	78.9%	79.4%
Housing affordability ratio	2016	-	8.0	7.2
Percentage of people aged 16-64 in employment	2016/17	401,100	76.9%	74.4%
Income deprivation	2015	-	13.2%	14.7%
Income deprivation in older people (IDAOPI)	2015	-	14.1%	16.2%
Income deprivation in children (IDACI)	2015	25,807	17.7%	19.9%
GCSEs achieved (5A*-C including English & Maths)	2015/16	4,347	54.6%	57.8%
School Readiness: the percentage of Year 1 pupils achieving the expected level in the phonics screening check	2016/17	7,354	77.9%	81.1%
School Readiness: the percentage of children achieving a good level of development at the end of reception	2016/17	6,806	70.1%	70.7%
Healthy life expectancy at birth (Male)	2014 - 16	-	64.7	63.3
Healthy life expectancy at birth (Female)	2014 - 16	-	64.4	63.9
People's access to woodland	2015	94,781	10.7%	16.8%
Proportion of people who use services who feel safe	2015/16	-	67.8%	69.2%
Access to NHS dental services - successfully obtained a dental appointment	2015/16	3,918	95.1%	94.7%
Percentage of people who said they had good experience when making a GP appointment	2015/16	9,985	75.7%	73.4%
Social connection: percentage of adult social care users who have as much social contact as they would like	2016/17	-	49.3%	45.4%
Social connection: percentage of adult carers who have as much social contact as they would like	2016/17	176	32.0%	35.5%
Proportion of people who use services who have control over their daily life	2015/16	-	78.2%	76.6%
Self-reported well-being: % of respondents with a high happiness score	2015/16	-	74.9%	74.7%
Self-reported well-being: % of respondents with a high satisfaction score	2015/16	-	82.6%	81.2%
Percentage of people aged 16+ with sports club membership	2015/16	-	19.3%	22.0%
Percentage of physically active adults	2015	-	56.5%	57.0%
Utilisation of outdoor space for exercise/health reasons	Mar 2015 - Feb 2016	-	18.8%	17.9%
Additional Wider Determinants of Health indicators				
Exposure to road, rail and air transport noise of 65 dB(A) or more during the daytime	2011	18,410	2.1%	5.2%
Exposure to road, rail and air transport noise of 55 dB(A) or more during the night-time	2011	26,160	3.0%	8.0%

Table 27.3 PHE Wider Determinants of Health

Indicator	Period	North Norfolk District		Broadland District		Breckland		Norfolk County		England
		Count	Value	Count	Value	Count	Value	Count	Value	Value
Rate of complaints about noise ²	2014/15	412	4.0	443	3.5	71	0.5	4,865	5.5	7.1
Number of premises licensed to sell alcohol per square kilometre	2015/16	494	0.5	291	0.5	408	0.3	-	-	1.3
Density of fast food outlets	2014	95	92.4	47	37.3	69	51.5	676	77.0	88.2
Killed and seriously injured (KSI) casualties on the roads ³	2014 - 16	124	40.0	167	44.0	195	48.0	1,170	44.1	39.7
Air pollution: fine particulate matter ⁴	2015	-	8.2	-	8.7	-	8.4	-	8.9	8.3
Access to Healthy Assets & Hazards Index ⁵	2016	30,298	29.3%	18,599	14.7%	35,227	26.0%	281,123	31.8%	21.2%
Overcrowded households	2011	883	1.9%	668	1.3%	1,452	2.7%	8,917	2.4%	4.8%
Affordability of home ownership	2016	220,000	9.4	220,000	8.1	195,000	8.1	195,000	7.4	7.7
Fuel poverty	2015	5,357	11.3%	3,619	6.6%	5,367	9.5%	36,389	9.5%	11.0%
Injuries due to falls in people aged 65 and over	2016/17	556	1,594	518	1,556	633	1,880	3,852	1,769	2114
Excess winter deaths index ⁶	Aug 2015 - Jul 2016	75	16.8	41	8.4	103	21.1	417	13.4	15.1

² Number of complaints per year per local authority about noise per thousand population (according to statistics collected by the Chartered Institute of Environmental Health).

³ Rate of people KSI on the roads, all ages, per 100,000 resident population.

⁴ Annual concentration of human-made fine particulate matter at an area level, adjusted to account for population exposure. Fine particulate matter is also known as PM_{2.5} and has a metric of micrograms per cubic metre (µg/m³).

⁵ Percentage of the population who live in LSOAs which score in the poorest performing 20% on the Access to Healthy Assets & Hazards (AHAH) index. The AHAH index is comprised of three domains: access to retail services, access to health services, and physical environment. The AHAH index provides information on how conducive to good health an area is relative to other areas.

⁶ Excess Winter Deaths Index is the excess winter deaths measured as the ratio of extra deaths from all causes that occur in the winter months compared with the expected number of deaths, based on the average of the number of non-winter deaths.

27.3 References

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