KENT PUBLIC HEALTH OBSERVATORY

Health Checks Equity Audit

June 2017

Produced by

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| 1. Executive Summary

1.1 Introduction

This report explores equity differences in uptake of the NHS Health Checks Programme in Kent. The analysis relies on data extraction from the Kent Integrated Dataset (KID) and in particular from the GP Event level table which enables data mining at person and diagnostic level.

The findings are intended to shape the future deployment of the Health Checks Programme in Kent and to help inform how some of the main equity concerns might be addressed. The report also underlines the value and benefits of having access to a person level linked data set especially in the context of evaluating access to service differences that may otherwise remain opaque or invisible at higher levels of aggregation.

The authors acknowledge the help and advice from Public Health England, especially from the perspective of the helpful guidance set out in the 'NHS Health Check Programme: Health Equity Audit Guidance' published by Public Health England[1] (December 2016), Julia Fraser, whose helpful comments helped shape the report and ensure local relevance. Kent Community Health Foundation Trust for their support and insight in shaping the audit and finally, we are grateful for the advice and support received by the NHS Health Check Clinical Engagement Group who have overseen the development of the audit and who have provided useful feedback during periodic review sessions.

1.2 Findings

1. The original extract identified **105,453** patients who had been sent a Health Check invitation noted as Read Code '9mC1' (NHS Health Check invitation). All individuals were selected within the extract period 01 April 2015 to 30 November 2016 (20 months).
2. Following data quality checks (duplicate pseudonymised number, key attributes missing etc.) the original extract reduced to **105,305** patients.
3. The final 'cleansed' extract was further partitioned into Health Checks not completed within the extract window n=69,866 (66%) and Health Checks completed within the extract window n=35,439 (34%).
4. It is not clear why the completion rate in the equity extract is lower than the practice based performance data supplied by KCHFT. This data set identifies a higher completion rate over a similar period (circa 42%). One possible explanation for this is

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[1] http://www.healthcheck.nhs.uk/commissioners_and_providers/guidance/national_guidance1/

that missing practices i.e. practices that were not flowing data into the Kent Integrated Data set (KID) at the time of the extract process were practices that happened to have higher completion rates generally?

5. The gender split for completed and not completed cohorts were as follows: <u>Completed</u> (35,439 patients) = 14,907 males (42%), 20,532 females, 58%). <u>Not completed</u> (69,866 patients) = 34,344 males (49%), 35,522 females (51%).

6. The ratio of males completing a Health Check compared to females is 1 to 1.4. In other words, for every one male completing a Health Check, 1.4 (95% CI 1.32 - 1.44) females completed a Health Check. This represents a 40% equity deficit with respect to males.

7. The ratio of male to female inequity increases with age, with males becoming increasingly less likely to attend as they get older. For example in the 65-69 age group, when female completion rates are compared with male completion rates, the equity deficit for males rises to over 50%.

8. A valid ethnicity code was present in 86% of <u>completed</u> Health Checks. This equates to 1 in 7 patients not having a valid ethnic code on average.

9. When compared to the ethnic profile represented in the KID, Asian/Asian British, Black, African, Caribbean, Black British and mixed ethnic groups are moderately overrepresented in the Health Checks invitation profile. These differences were not statistically significant at the 95% confidence level (p>0.05).

10. Patients in the White ethnic group were proportionately more likely than all other ethnic groups to complete their Health Check, whereas the Mixed/Multiple ethnic group were most likely not to complete their Health Check.

11. Both of the cardiovascular and type 2 diabetes (South Asian or African Caribbean) high risk groups were less likely to complete a Health Check when compared to the White group.

12. Using the ACORN segmentation tool at house hold level to explore the odds of completing a Health Check, patients in the 'Affluent Achievers' and 'Comfortable Communities' categories, were significantly more likely to complete their Health Check when compared with patients categorised as 'Financially Stretched' or 'Urban Adversity'.

13. Similar inequity patterns were observed for both males and females separately however there was no statistical evidence of gender bias.

14. The differences identified above (12) were statistically absent when comparing the probability of completing a Health Check across IMD deciles (p>0.05).

15. Equity comparisons using the ACORN <u>Wellbeing</u> types showed that patients categorised as 'Anxious Adversity', 'Poorly Pensioners', Hardship Heartland', 'Perilous Futures' and 'Struggling Smokers' were significantly less likely to complete their Health Check when compared to higher wellbeing types (p>0.05).

16. Due to small numbers, it was not possible to comment on whether or not Health Checks conducted in non-GP settings are more or less equity enhancing.

17. Smoking_1: Of the 14,907 males and 20,532 females who completed a Health Check 8,959 (60%) and 13,474 (66%) respectively, had a valid Read Code for smoking status (i.e. smokers and non-smokers). The relatively high proportion of records with missing smoking status is a cause for concern.

18. Smoking_2: Smoking prevalence for males and females completing a Health Check was 21% (n=1851) and 15% (n=1982) respectively. These figures are similar to recent ONS smoking prevalence estimates (19% and 15%).

19. Smoking_3: The smoking prevalence findings indicate that males tend to smoke more heavily when compared to females (≥Moderate smoker males = 57.75%, 95% CI: 55.49 - 59.98, females = 50.45%, 95% CI: 48.25 – 52.65).

20. Smoking_4: In overall terms for males and females, the highest smoking prevalence rates were found among patients in the ACORN category 'Urban Adversity' (43.78 and 33.73). Males and females in the category 'Financially Stretched' had similarly high smoking prevalence rates.

21. Smoking_5: The lowest smoking prevalence rates for males and females were found among the ACORN categories 'Affluent Achievers' and 'Comfortable Communities'.

22. Hypertension_1: Of the 14,907 males and 20,532 females who completed a Health Check 485 (3.3%) and 494 (2.4%) had a valid hypertension Read Code recorded. This equates to a new diagnosis detection rate of 31 for males and 42 for females. (cf 20 to 33 NHS Health Checks rapid synthesis. RAND)

23. Hypertension_2: Case detection rates for hypertension were highest among 'Affluent Achievers' and 'Comfortable Communities' - groups where one might expect there to be a lower natural prevalence.

24. Hypertension_3: Relatively low detection rates were found among the groups 'Financially Stretched' and 'Urban Adversity'. This is of concern because it is likely that these groups have higher hypertension prevalence rates associated with health determinants bound up in lower socioeconomic status. It is also noteworthy that these high risk groups also tend to have significantly lower odds of completing their Health Check (see section 3.7).

25. Hypertension_4: Case detection rates across all ACORN categories were higher among males than females. This was especially apparent in the ACORN group 'Rising Prosperity'.

26. Diabetes_1: Of the 14,907 males and 20,532 females who completed a Health Check 144 (0.97%) and 92 (0.45%) respectively had a valid diabetes Read Code recorded. These rates equate to a new diagnosis detection rate of 104 for males and 223 for females. Detection rates found in other equity studies were found to be significantly higher (cf 76 NHS Health Checks rapid synthesis. RAND).

27. CKD_1: Of 14,907 males who completed a Health Check a total of 21 (0.14%) patients had a valid Read Code for CKD status. For females, out of 20,532 patients who completed their Health Check, 58 (0.28%) had a valid code recorded for CKD. These prevalence rates equate to a new diagnosis detection rate of around 710 for

males and 354 for females (male and female median = 518). The RAND evidence synthesis identified a lower (median) detection rate of 588.

28. Housebound patients were found to have a higher probability of not completing a Health Check.

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1.3 Call to Action

This report has highlighted a number of key equity issues associated with access to the NHS Health Checks Programme in Kent. The report also underlines the extensive value of being able to examine equity at a highly disaggregated (person level) due to the Kent Integrated Dataset.

- Females were significantly more likely to complete a health check when compared males and there was moderate evidence that this inequity increases with age. *Call to Action*: *a more focussed approach to raise awareness among males concerning the potential benefits of the Health Check programme (perhaps via local manual work place settings) should be considered. Special attention is required to reach males in the 65 plus age bracket? There may also be merit in considering health seeking behaviour differences and opportunities for channel shift messaging between males and females.*

- Ethnicity coding completeness in the KID (i.e. associated with having a Health Check) was approximately 86%. In the context of the audit it was not possible to assess the extent to which the missing coding was significantly biased i.e. are high risk ethnic groups more likely not to be coded? *Call to Action*: *this finding should be fed back to through the KID data quality mechanism and to KCHFT, perhaps with a view to raising awareness among clinicians of the need to collect ethnicity more assiduously?*

- Mixed and multiple ethnic groups were significantly less likely to complete a Health Check when compared to the White ethnic category. This also the case in general terms for all other ethnic groups considered in the analysis. *Call to Action*: *better targeting of awareness of the Health checks Programme should be focussed on geographical areas that are known to have high ethnicity profiles. There may be merit in considering the role of faith and community groups in this regard? South Asian and African Caribbean communities (both high cardiovascular and diabetes risk groups) might especially benefit from such action?*

- Patients categorised as 'Financially Stretched' or 'Urban Adversity' were significantly less likely to complete a Health Check when compared to ACORN segments 'Affluent Achievers' and 'Comfortable Communities'. Similar findings were identified among the ACORN Wellbeing categories for 'Anxious Adversity', 'Poorly Pensioners', Hardship Heartland', 'Perilous Futures' and 'Struggling Smokers'. *Call to Action: an assessment of the numeric scale of this inequity should be conducted and appropriate channels of communication should be applied to redress the inequity gradient. For example, taking both high risk ACORN groups 'Urban Adversity' and 'Finically Stretched' together, it is estimated that these groups potentially account for approximately 36% of the total Health Check eligible cohort – the scale therefore of effort required to redress the equity imbalance is likely to be challenging?*

- Incomplete smoking status coding: *Call to Action*: *this finding should be fed back to through the KID data quality mechanism and to KCHFT, perhaps with a view to*

raising awareness among clinicians of the need to collect smoking status more assiduously?

- Very elevated smoking prevalence rates among patients completing a Health Check in ACORN segments 'Urban Adversity' and 'Financially Stretched': *Call to Action*: *while this finding is unsurprising, the very elevated prevalence rates among these communities may call for enhanced Stop Smoking Action targeted toward these high risk groups? It will also be important to monitor smoking prevalence trends among these high risk communities going forward.*

- Case detection rates for hypertension and especially for diabetes were lower than reported in a comprehensive synthesis of equity analyses elsewhere in the country. Detection rates for CKD were higher than those identified in the same publication: *Call to Action*: *this may reflect a lower 'natural' level of undiagnosed prevalence in the Kent population. Further work is required to understand better understand the underlying reasons for this and with regard to diabetes, there may be merit in considering the benefits of point of care testing as an adjunct to this aspect of the Health Check Programme.*

- Housebound people are less likely to complete a Health Check compared with other groups. *Call to Action*: *given the fact that housebound people are more likely to have elevated cardiovascular risk due to the compounding influence of social isolation, further work is required to understand how housebound people can be supported to complete a Health Check, perhaps through targeted outreach. Giving that the coding of housebound is under reported the true scale of this inequity is likely to be understated; action is also required to raise awareness of the importance of this data through the KID data quality group and perhaps via KCHFT liaison with Health Check providers?*

- Exploring the potential to improve equity through further implementation of Health Checks in non-GP settings. *Call to Action*: *it was not possible to comment on the equity enhancing impact of Health checks in non-GP settings due to the relatively small numbers of patients that had taken up this aspect of the service. Further work is required to explore how non-GP provision of Health Checks might improve access especially for disadvantaged communities.*

- Health Check outcomes monitoring. *Call to Action*: *this report has highlighted significant 'inverse care law' processes associated with the Health Checks programme. These will require ongoing monitoring. Monitoring the impact of case detection performance. For example in the context of hypertension and diabetes, it will require a longitudinal evaluation framework to establish how patients (who have had been identified with long term conditions) are impacted by the follow-up clinical processes that are required to reduce secondary cardiovascular risk.*

| 2. Introduction & Objectives

2.1 Background

This equity audit examines who accesses the NHS Health Check Programme in Kent and, for patients found to be symptomatic, how their morbidity profile varies across equity vectors such as age, gender, ethnicity and ACORN classification.

The report is intended to stimulate discussion among local policy makers and to inform the strategic commissioning process with regard to the deployment of future resources aimed at preventing cardiovascular disease. The report also aims to highlight how access issues to the Health Checks programme might be improved for people who have the most to benefit from cardiovascular preventive action.

2.1.1 Background to the NHS Health Checks Programme

Regulations 4 and 5 of the Local Authorities (Public Health Functions and Entry to Premises by Local Healthwatch Representatives) 2013, states that Local Authorities are responsible for making provision to offer an NHS Health Check to eligible individuals aged 40-74 years once every five years.

The Health Check programme aims to prevent cardiovascular disease (heart disease, stroke, diabetes) and kidney disease. The programme also seeks to raise awareness of dementia in persons aged 65-74[2].

Because the Health Check programme is aimed at preventing disease, people with previously diagnosed vascular disease or who meet the exclusion criteria below are excluded from the programme.
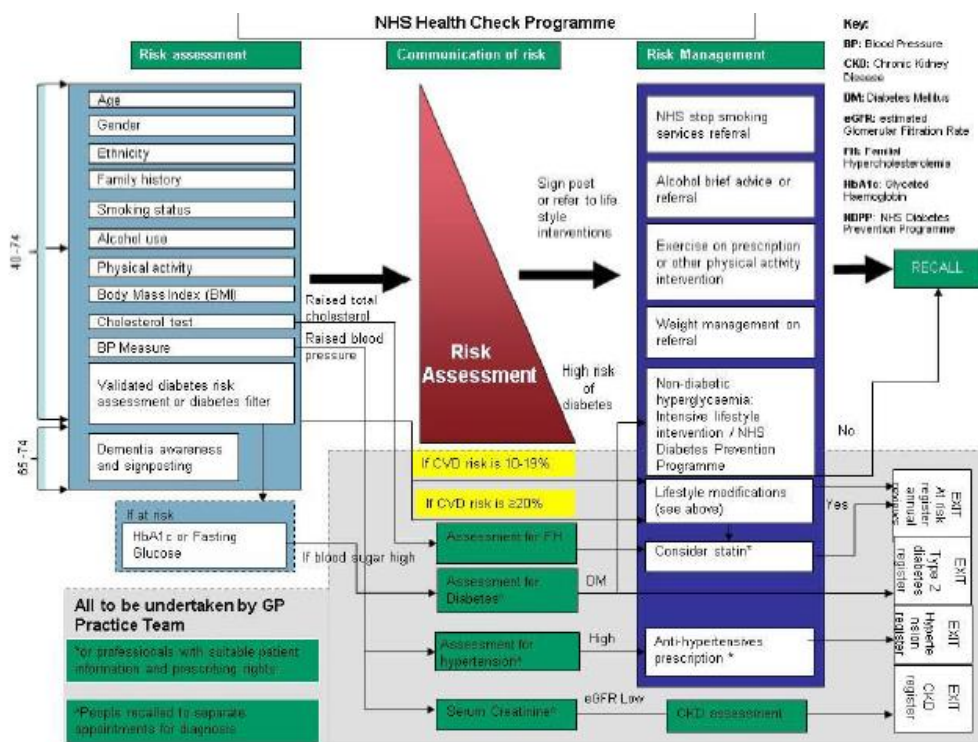
Exclusion criteria:

- coronary heart disease
- chronic kidney disease
- diabetes
- hypertension
- atrial fibrillation

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[2]NHS Health Check Programme: Health Equity Audit Guidance
(http://www.healthcheck.nhs.uk/document.php?o=1237)

- transient ischaemic attack
- hypercholesterolemia
- heart failure
- peripheral arterial disease
- stroke
- prescribed statins
- people who have previously had a Health Check or any other check in England, and found to have a 20% or higher risk of developing cardiovascular disease over the next ten years (QRISK2).

Figure 1: NHS Health Check programmes schema

Source: NHS Health Check guidance Best Practice (February 2017)

2.1.2 The Kent Health Checks Programme

In keeping with the national aspiration to reach vulnerable groups, The Kent Health Check programme operates an outreach element which aims to target people from the most deprived areas of the county (i.e. quintiles 1 and 2 using the 2015 Index of Multiple Deprivation score). The current programme has been extended to run until 30 September 2017 with the existing provider Kent Community Health Foundation Trust (KCHFT).

During the period April 2013 to February 2017, a total of 360,840 invitations were dispatched. Over the same period 146,144 (40.5%) patients completed a health check (Table 1).

Table 1

Health Check year	Invites	Checks received	% achieved
2013/14	75,644	25,436	33.62
2014/15	107,030	45,623	42.63
2015/16	86,325	36,937	42.89
2016/17	91,841 (100,190)*	38,148 (41,616)*	41.54*
April 2013 to February 2017	360,840	146,144	40.50

*expected outturn based on cumulative April 2016 to February 2017 YTD

Source: KCHFT

The majority of practices in Kent take part in full delivery of the Health Check programme (81.61%), 30 practices (15.31%) practices defer the Health Check activity to KCHFT and 6 practices (3.06%) are not currently engaged in the Health Check programme[3].

Seventeen practices (8.67%) that do not provide Health Checks directly are grouped among the fifth most deprived across the County. Figure 2 shows the spatial distribution of GP practices by contract delivery type.
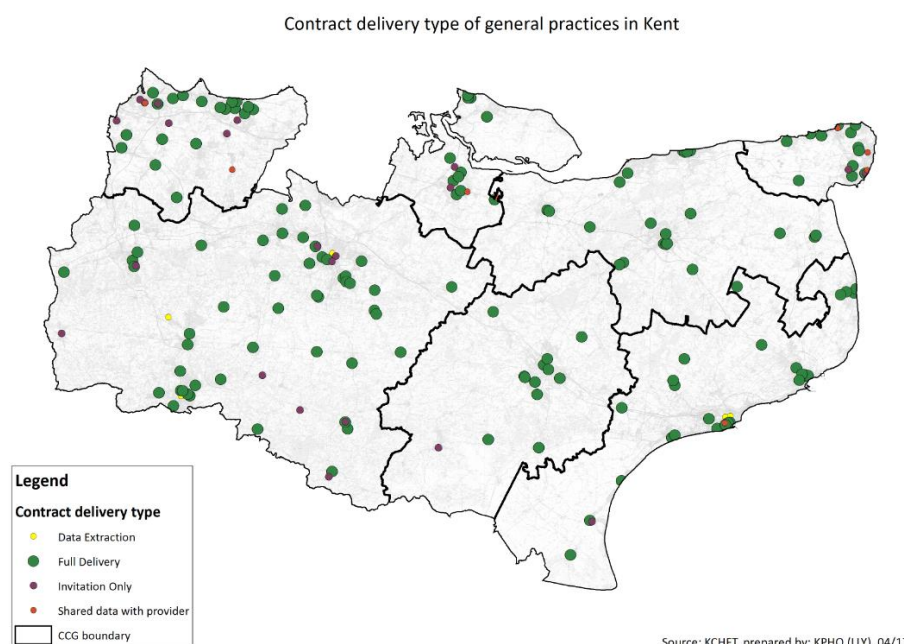
Table 2

Contract delivery type (2016/17)	Definition	Count	%
Full Delivery (GP)	Health delivered in GP practice	158	81.61
Invitation only	GP sends invites but check is carried out by KCHFT	24	12.24
Shared Data with Provider	GP not signed up for delivery invites are handled separately	8	4.08

[3] Patient from non-participating practices are picked separately for their Health Check through an arrangement with NHS England

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Data extraction NHS Digital	GP forward cohort information and check is coordinated by KCHFT	6	3.06
Total		196	100.00

Source: KCHFT

Figure 2: Geographical distribution of GP practices by contract delivery type.

Contract delivery type of general practices in Kent

Source: KCHFT, prepared by: KPHO (LLY), 04/17

Health Check performance might be considered from two perspectives. The first, is the proportion of completed checks relative to the eligible cohort. The second, is the proportion of completed checks relative to the invited cohort. In both instances, and in line with patterns observed across the country, performance is well below 100%. The underlying reasons for current performance levels are well understood and are governed by affordability and service infrastructure constraints that are apparent across the country. Overall, Health Check performance levels in Kent are on par or in excess of performance levels elsewhere in the country.

Kent Health Check Performance at practice level relative to the 1 year eligible cohort, indicates an overall performance level of 42.51% (April 2016 to February 2017). In terms of the distribution of performance at GP practice level, Figure 3 shows that the majority of practices fall well below the 'expected' volume of eligible cohort.

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The purpose of the funnel plot is not to highlight low performance but rather to indicate the scale of challenge in motivating individuals to take up their health check invitation. Practices are encouraged to send second invitations as part of the routine health check process and, from the beginning of the 2016/17 Health Check cycle, revised service level agreements have removed a nominal 'cap' on invitation volumes with a view to increasing the overall level of health check activity.

On average the YTD (February 2017) enhanced invitation rate was 102% across Kent. At the time of analysis it was unclear whether or not this service level revision had achieved its intended impact?

Figure 3: Funnel plot of invitation versus completed Health Checks by GP practice
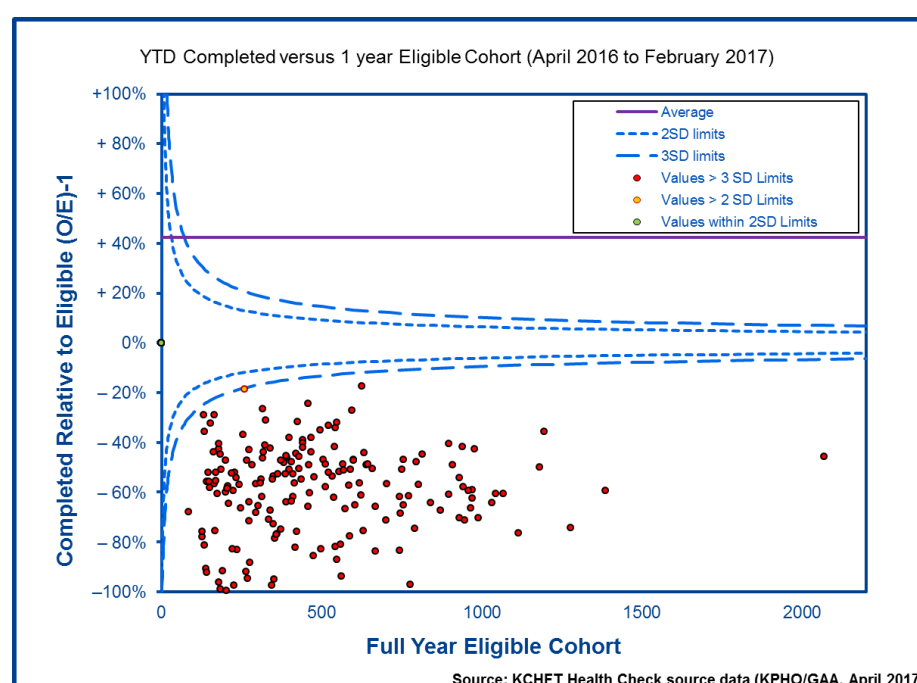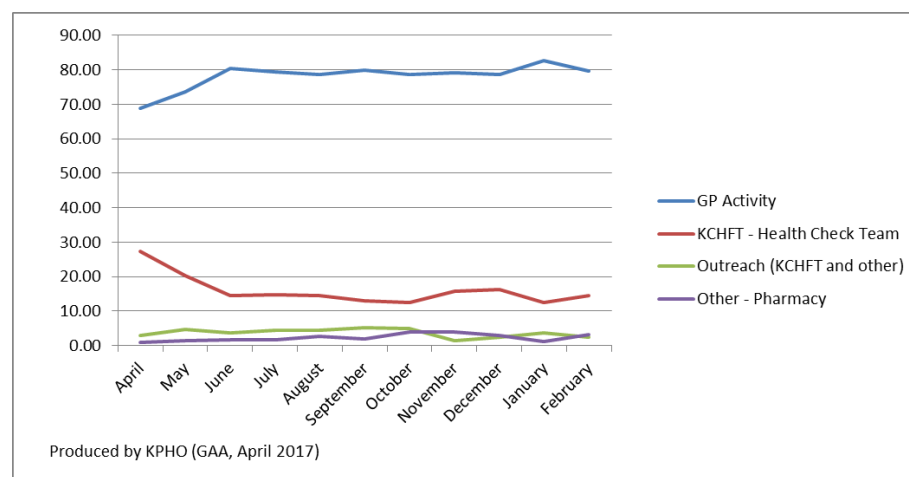

Figure 4 shows monthly activity for NHS Health Checks by provider. General Practitioner activity accounts for around 80% of the total number of completed Health Checks in Kent. Around 15% of Health Checks are carried out by the KCHFT Health Check Team (Table 3).

Table 3: Distribution of Health Check providers

Provider	% share
GP Activity	78.42
KCHFT - Health Check Team	15.47
Outreach (KCHFT and other)	3.77
Other - Pharmacy	2.33

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Figure 4: 2016/17 Activity by Health Check provider

Produced by KPHO (GAA, April 2017)

| 3. Equity in the Health Check programme for Kent

3.1 What is equity in health care

The World Health Organisation (WHO) defines equity as the 'absence of avoidable or remediable differences among groups of people, whether those groups are defined socially, economically, demographically, or geographically'.

Health equity is different from health equality, because it refers only to the absence of disparities in controllable or remediable aspects of health.

A health equity audit is a review process which 'examines how health determinants, access to health services and related outcomes are distributed in relation to the health needs of different groups and areas[4].

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[4] NHS Health Check Programme: Health Equity Audit Guidance. Published by Public Health England (January 2017)

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3.2 Identifying the Health Check cohort for audit

This section sets out the parameters for exploring Health Check equity gradients in the Kent population. The principle data repository used for these analyses was the Kent Integrated Dataset (KID) and in particular the GP_Event table which is located in the DB_YOC_PSEUDONYMISED data folder.

The GP_Event table contains so-called 'event' history of patients' interactions with GP's and other clinicians in a general practice referral setting. The GP_Event table contains a longitudinal clinical record for all registered patient GP activity. While historical data goes back for a considerable period, day to day use of the KID tends to focus on data extracts from 2014 onwards.

At the time of analysis a total (Kent only) of 143 /196 (73%) were flowing 'event' (i.e. data at Read code level required to conduct this analysis) level data into the KID.

3.3 Cohort extract parameters

All individuals were selected within the extract period 01 April 2015 to 30 November 2016 (20 months) where the event Read Code = '9mC1' (NHS Health Check invitation).

Read Codes'8BAg' (NHS Health Check Completed, GP) or '8BAg0' (NHS Health Check Completed, third party provider) were to identify completed checks within the overall invitation extract.

Only health checks provided to Kent registered residents were used in the analysis and health checks carried out on Medway residents were excluded. Duplicate or 'null' pseudonymised numbers were also excluded for the analysis.

Using the extraction criteria set out above, a total of 105,305 invitations were identified with a total of 35,439 (34%) having completed a health check within the extract time frame were also identified.

3.4   Equity vectors

Checks to ensure the avoidance of systematic bias, for example as might be introduced through missing practice data were conducted by comparison of the equity cohort with Kent across the following equity vectors:
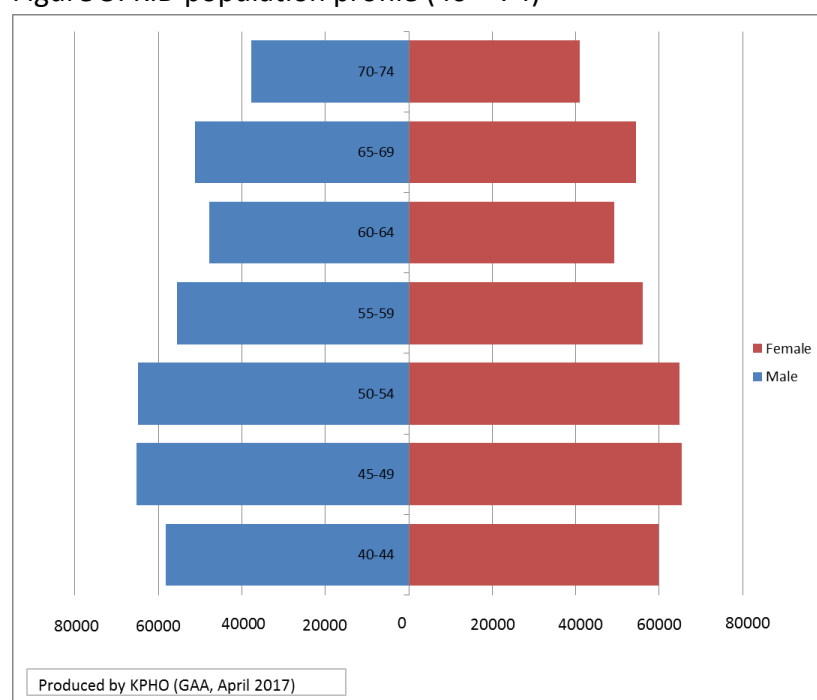
1. Population and gender structure
2. Ethnicity
3. IMD deprivation
4. ACORN Classification (household)
5. ACORN Wellbeing (postcode)

3.5   Population and gender structure

This section examines the population and gender 'structure' of persons invited for a Health Check, persons completing a Health Check and persons invited for a Health Check but having <u>no</u> Read code present in the KID indicating that they completed the Health Check.

Figure 5 shows the 0-74 population structure of the KID. The structure reflects well documented 'spikes' in birth at the end of World War II reflected in the bulge among the 65 to 69 age band, the 1960's baby boom reflected in the bulge among the mid 40's to mid 50's group. Lower fertility in the 1970s is reflected in the narrowing among the 40-44 age group.

Figure 5: KID population profile (40 – 74)

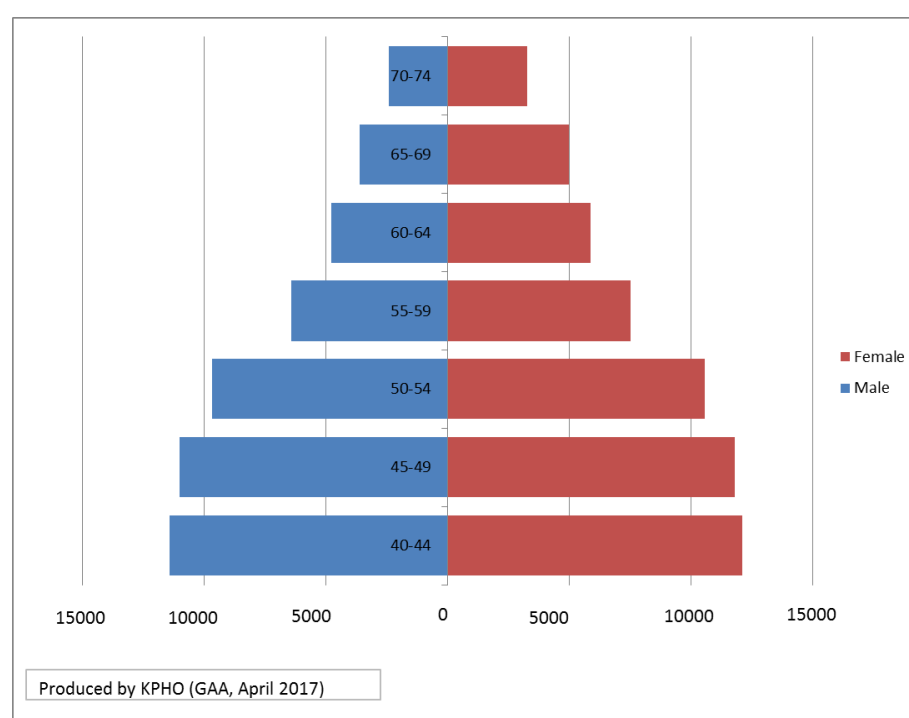
Produced by KPHO (GAA, April 2017)

Source: KID

Figure 6 shows the demographic profile for males and females who were invited for a Health Check over the study period. More invitations were received by women when compared to men. This observation is true across all age groups but the difference becomes more apparent in the 50+ age cohorts. In part, this might be explained by the fact that there are marginally more females than males especially in older age groups because females live longer than males on average.

Part of the difference might also be explained because the distribution in prevalence of multimorbidity increases markedly for both men and women with age and therefore the probability of exclusion from eligibility for a Health Check also increases with age?

Figure 6: All Health Check Invitations population profile (40 – 74)

Source: KID

Figure 7 shows the profile for persons completing a Health Check indicating that females are more likely to attend the Health Check across all age groups, weighted mean ratio = 1.38, (95% CI,1.32 - 1.44).
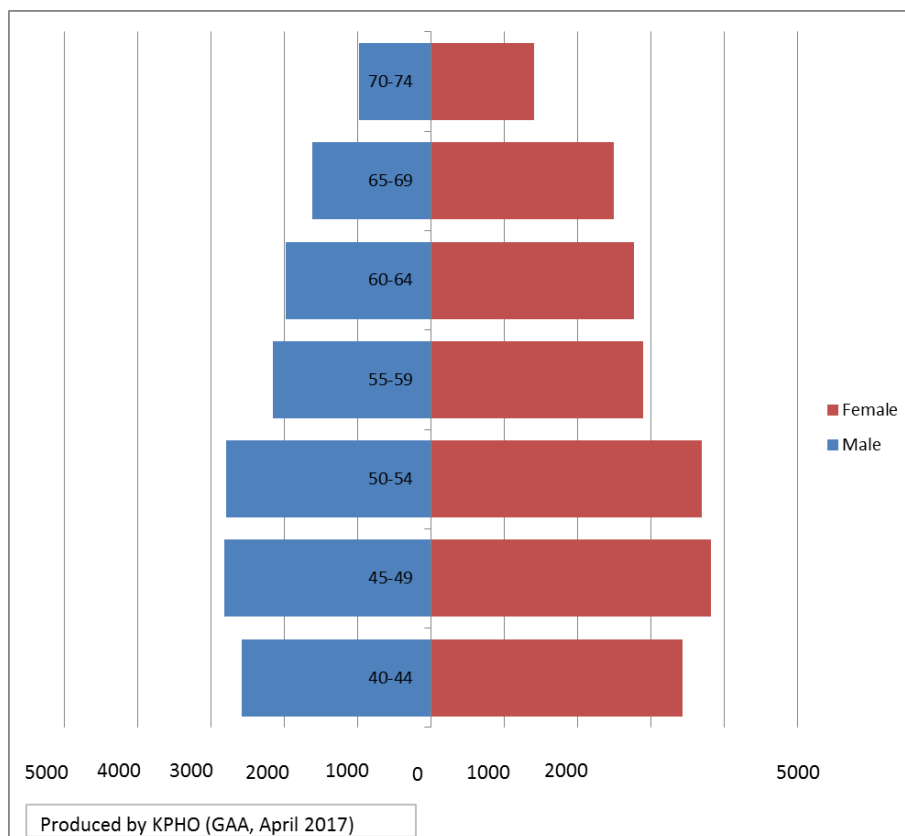
Ratio tests indicate that there was a moderate increase in inequity with increasing age, with the 65 plus age group displaying the largest level of inequity (see Figure 8).

This finding, though not especially surprising, is interesting because recent research has shown that females are at increased risk of multimorbidity prevalence, especially in the 40 -

64 age range where the difference in prevalence between males and females has been shown to be between 5.8% (35-44) and 5.4% (55-64)[5].

Given that an increase in the prevalence of chronic conditions would on average reduce eligibility for a Health Check, the inequity represented here may indicate an inverse care process with regard to males?
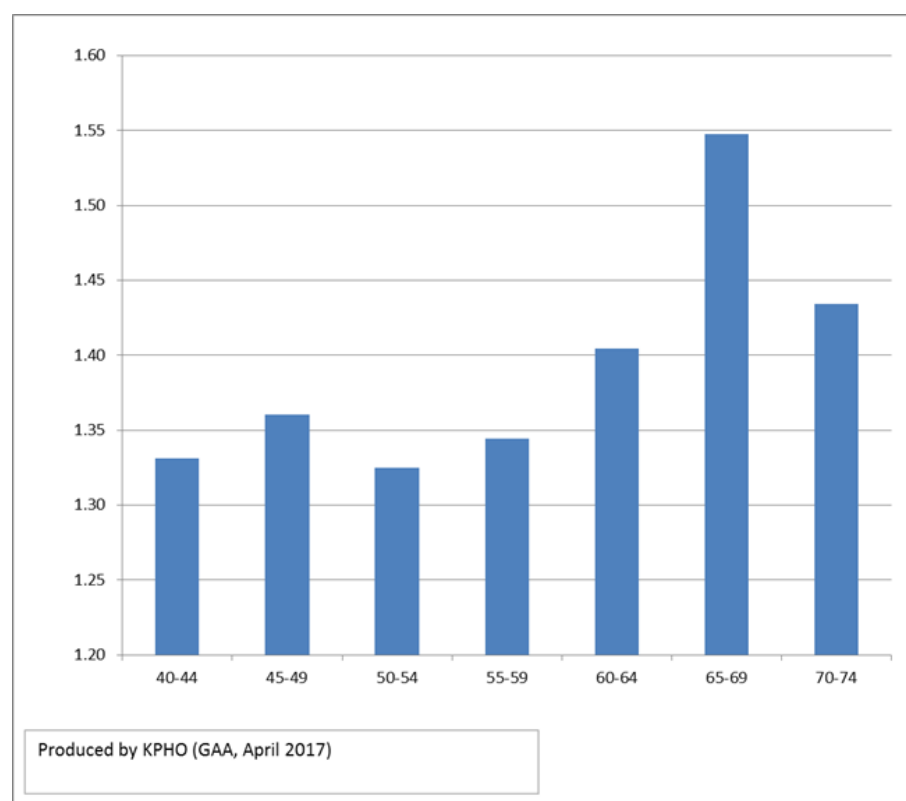
Figure 7: Completed Health Checks

Source: KID

Figure 8: Ratio of male to female Health Checks completed

Produced by KPHO (GAA, April 2017)

Source: KID

Figure 9 shows the distribution of males and females invited to a Health Check but who have no subsequent Read code indicating that they completed the Check? In overall terms, there was no significant difference in the ratio of non-completion between males and females weighted mean ratio = 0.97, (95% CI, 0.90 - 1.04). However, from age 55 onwards it becomes increasingly more likely that males will not complete a Health check once invited (Table 4) and by time patients reach the 70-74 age band, females are a third more likely to complete a Health Check when compared to males.

Figure 9: Persons invited to a Health Check but not having a record of completing a Health check

Source: KID

Table 4: Ratio of female to male non-completion Health Checks

Age band	Male	Female	Ratio
40-44	8813	8654	0.98
45-49	8190	7968	0.97
50-54	6871	6860	1.00
55-59	4275	4622	1.08
60-64	2779	3093	1.11
65-69	1987	2477	1.25
70-74	1429	1848	1.29
Total	34344	35522	1.03

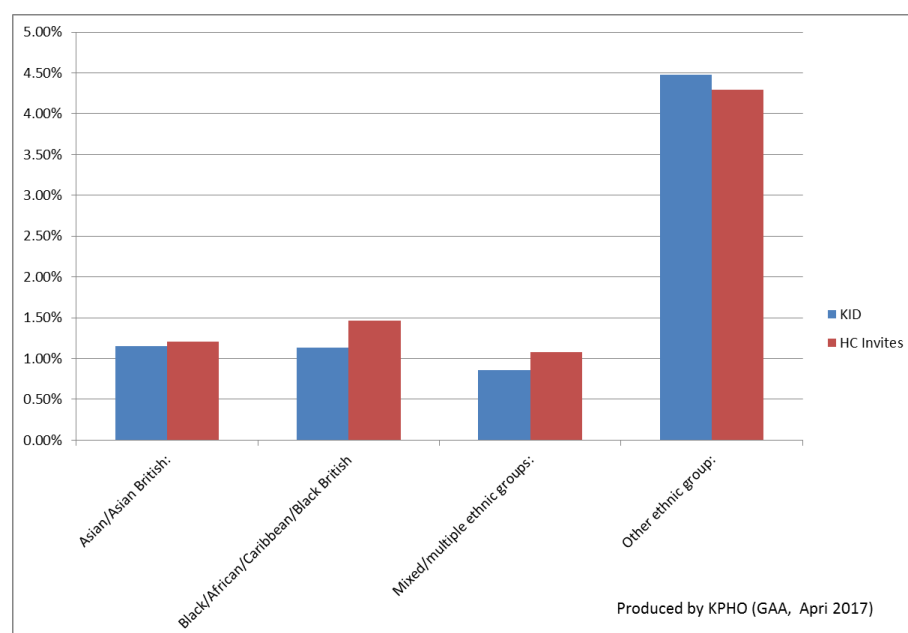Source: KID

3.6   Ethnicity

Ethnicity can have an important bearing on healthcare need and therefore exploring how services are used by different ethnic groups is an important factor when considering equity. For example, in the context of cardiovascular disease, South Asian's are at increased risk of developing coronary heart disease. Older South Asians have an increased risk of stroke and people from an African Caribbean background are significantly more likely to have elevated

blood pressure. The risk of developing type 2 diabetes among people of South Asian or African Caribbean backgrounds is also significantly elevated when compared with the general population[6].

Using the GP_Event table the Read Code for all ethnic categories was linked to the original data extract used in this report (i.e. all Health check invitations extended to Kent residents between the period 1 April 2015 to 30 November 2016 (n = 105,305 patients). A valid Read Code for ethnicity was found for 30,572 invited patients (29%), of these 12,388 (41%) had completed their Health check and 18,184 (59%) had not completed a Health Check.

Figure 10 shows the percentage of total population by ethnic group for all people aged 40-74 in the KID versus Health Check invites for the period 1 April 2015 to 30 November 2016. From an invitation perspective the Asian and Black groups are proportionately more likely to be represented among the <u>invitation</u> group when compared to the total KID group. It is unclear why this is the case?

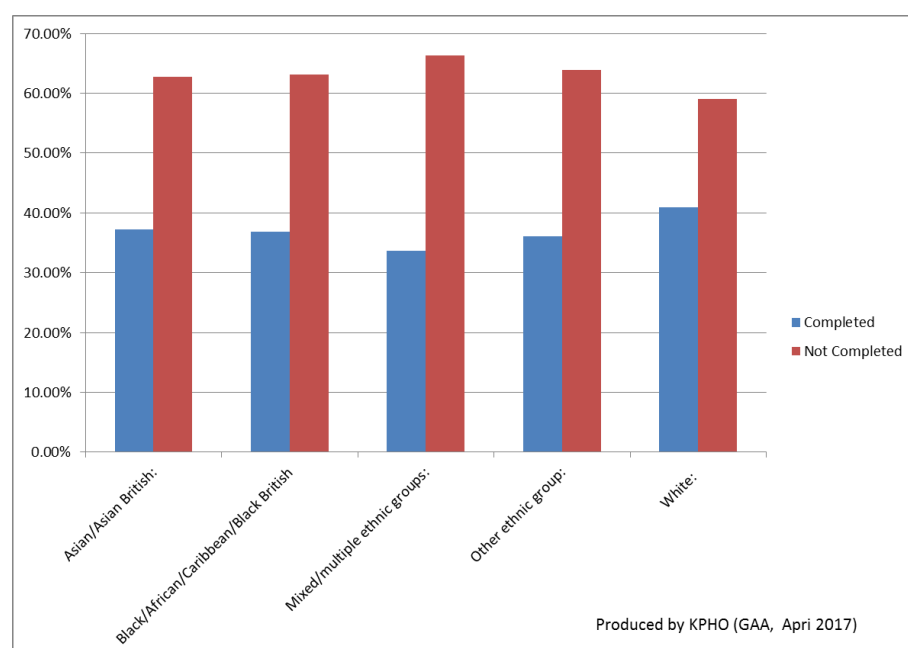Figure 10: Percentage total by Ethnic group

Source: KID

Figure 11 shows the percentage of patients who completed or did not complete their Health check expressed as a fraction of the total number of invitations by ethnic category. The White group were more likely than all ethnic groups to complete their Health Check

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[6] British Heart Foundation

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whereas the Mixed/Multiple ethnic group were likely to complete. Both of the cardiovascular and type 2 diabetes high risk groups were less likely to complete a Health check when compared to the White group.

Statistical tests on the significance of these differences were not performed in order <u>not</u> to imply high data accuracy especially as the completeness of ethnicity coding was relatively low across all ethnic categories (i.e. 30%).

Figure 11: Percentage of total invites by ethnic group and whether or not completed

Source: KID

The finding that ethnicity coding is not well recorded is not surprising. Personal communication with a local GP indicates that aside from the day to day constraints of the consultation process driven by rising demand and reduced capacity, ethnicity is seen as secondary to the value of sound clinical coding for clinical risk management.

Added to this is perhaps a natural sensitivity or reticence about asking questions about ethnicity generally? Notwithstanding ethnicity coding data quality concerns and acknowledging that these findings may point to a <u>moderate</u> inequity concern for two high risk ethnic groups, it is difficult to identify this as a key finding. There is merit however, in signalling this as a data quality deficit to the primary care community.

3.7   ACORN vs Index of Multiple Deprivation (IMD)

ACORN is a consumer classification system that helps to contextualise the attributes of households and postcodes. The ACORN classifications are on based on demographic, socio-economic, population and consumer behaviour. The ACORN segments are used provide insights into people's behaviour, lifestyle and attitudes. When taken together these insights can be used to shed light on how services are provided and deployed making them more accessible to people who need them.

Two types of ACORN descriptors are used in this section of the report, ACORN household and ACORN Well-being. The basic ACORN categories are 'Affluent Achievers', 'Rising Prosperity', 'Comfortable Communities', 'Financially Stretched' and 'Urban Adversity'. A sixth ACORN category ('Not in Private Households') was excluded from this analysis due to small cell sizes and uncertainty regarding the precise nature of the category in the Kent context. A pen portrait of each general ACORN category is provided in the Appendix 1.

Table 5 shows the propensity scores for health risks and preferred communication channels by ACORN type.by the general ACORN categories. The first column of numbers on the left hand side of the table represents the national baseline propensities. For example, comparing smoking propensity between 'Affluent Achievers' (9.9%) and 'Urban Adversity' (34.3%), the inequality of lifestyle risk is clearly evident. Using this example and compering risk in index terms (i.e. observed/expected) with the UK baseline figure (20.3), 'Affluent Achievers' has an index value of 49 and 'Urban Adversity' (169), indicating the scale of heightened risk in the latter group.

Table 5 also shows the preferred communication channel by ACORN category. This data is helpful in understanding how to reach sub groups in the population for example in terms of an invitation to an NHS Health Check. Once again considering the extremes, it is very evident that people in the category 'Affluent Achievers' have a stronger preference for email communication when compared with people categorised as 'Urban Adversity'. Such channel shift insights are important therefore in the context of reducing perverse equity gradients when considering service accessibility.

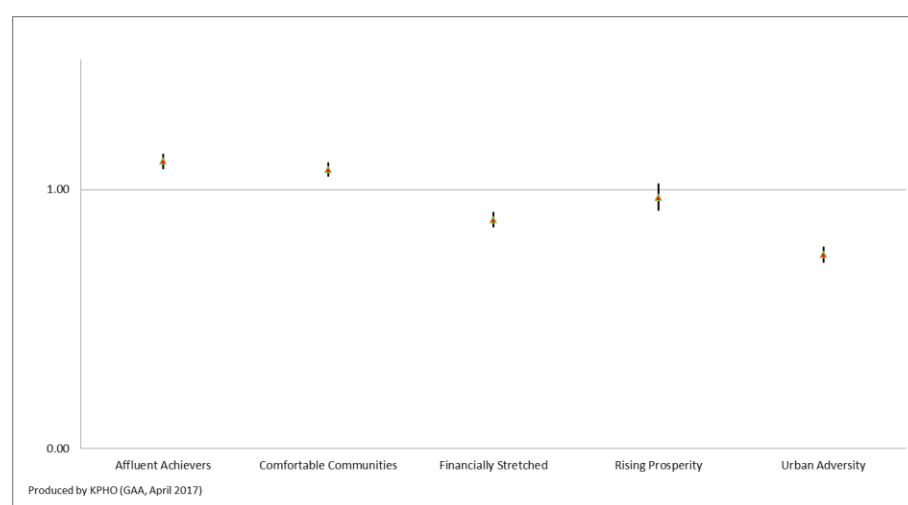Table 5: ACORN Category by health behaviour propensity score

		① Category 1 Affluent Achievers	② Category 2 Rising Prosperity	③ Category 3 Comfortable Communities	④ Category 4 Financially Stretched	⑤ Category 5 Urban Adversity
Currently Smoke	20.3	9.9	18.8	16.1	27.1	34.3
BMI > 30	21.0	18.6	12.6	21.3	24.0	25.9
High Cholesterol	26.8	29.5	23.5	29.3	25.5	24.3
Alcohol Consumption: Women >3 units per day	28.9	32.4	33.3	29.3	26.8	25.6
Alcohol Consumption: Men >4 units per day	41.3	42.1	45.8	41.3	40.0	41.9
Diabetes	3.9	3.5	2.8	3.8	4.9	3.8
Heart Attack/Angina	1.3	1.2	0.5	1.4	1.7	1.4
Hypertension/High Blood Pressure	18.8	20.5	12.0	20.8	20.0	17.0
Asthma	16.1	13.3	15.2	15.5	19.3	18.1
Arthritis/rheumatism/fibrositis	6.5	5.8	3.0	7.0	8.1	6.9
Mental illness/anxiety/depression/nerves	3.5	2.3	3.2	2.4	4.5	5.9
Email	5.5	11.1	2.8	5.7	2.4	2.9
Phone or SMS	34.7	26.5	5.8	38.9	46.3	38.0
Mail	58.4	61.4	90.6	54.4	49.8	56.2
Visit	1.4	1.1	0.8	1.0	1.5	2.9

Source: http://acorn.caci.co.uk/downloads/Acorn-Knowledge-sheet.xls (ACORN CACI)

Figure 12 shows the odds ratio and 95% confidence interval for persons completing a Health Check by their ACORN type. Odds ratio's above the horizontal line set at position 1 indicate higher relative odds of completing a Health Check. Values below the horizontal line indicate lower odds of completion. Where the 95% confidence interval touches the horizontal line, this indicates non-significant odds in either direction (i.e. no more or less likely to complete).

These analyses indicate that persons categorised by house hold types 'Affluent Achievers' and 'Comfortable Communities' are more likely to complete a Health Check when compared with persons categorised as being 'Financially Stretched' or in 'Urban Adversity'. The group type 'Rising Prosperity' showed no effect one way or the other.
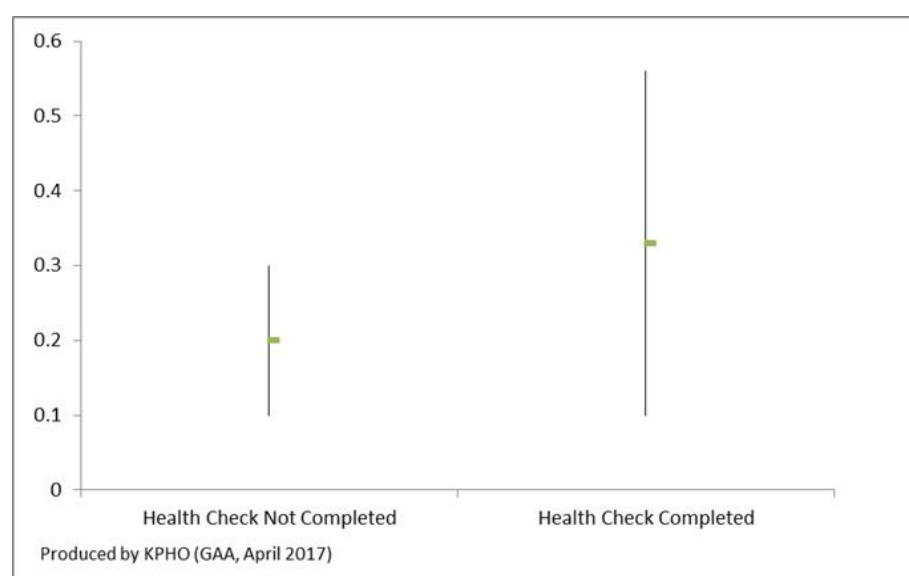
Figure 12: Odds ratio of completing a Health Check by ACORN type (persons)

Produced by KPHO (GAA, April 2017)

Source: KID and ACORN CACI

Interestingly, when deprivation gradients for IMD for completed Health Checks vs non completed Checks were compared slope differences between the two groups were found to be non-significant (Figure 13) indicating that the average rate of change across IMD deciles was not statistically different.

Figure 13: Slope difference with 95% confidence interval (slopes measured across IMD deciles)

Source: KID and Index of Multiple Deprivation (LSOA) 2015 using 2011 LSOA boundary.

The fact that this audit has identified significant equity differences using a segmentation tool not previously considered in such analyses is of interest for a number of reasons.

First, by 'attaching' ACORN categories at household level to individual patient records (in this instance patients who have been invited for a NHS Health Check and completed the Check vs those invited but who didn't complete the Check), we are able to obtain equity 'signals' not previously visible, probably because of the effects of ecological fallacy.

For example in Kent the average Lower Super Output Area (LSOA) population size is around 1700 persons[7]. Using an estimate of average household size in 2015 (2.28 persons per household)[8] this would equate to an average of around 745 households per LSOA – a sizable

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[7]The ONS 2015 population for Kent is 1,524,719, dividing this figure by the 902 Lower Super Output Area (LSOA) geographies gives an average LSOA population size of 1690. In this report this figure has been rounded up to 1700.
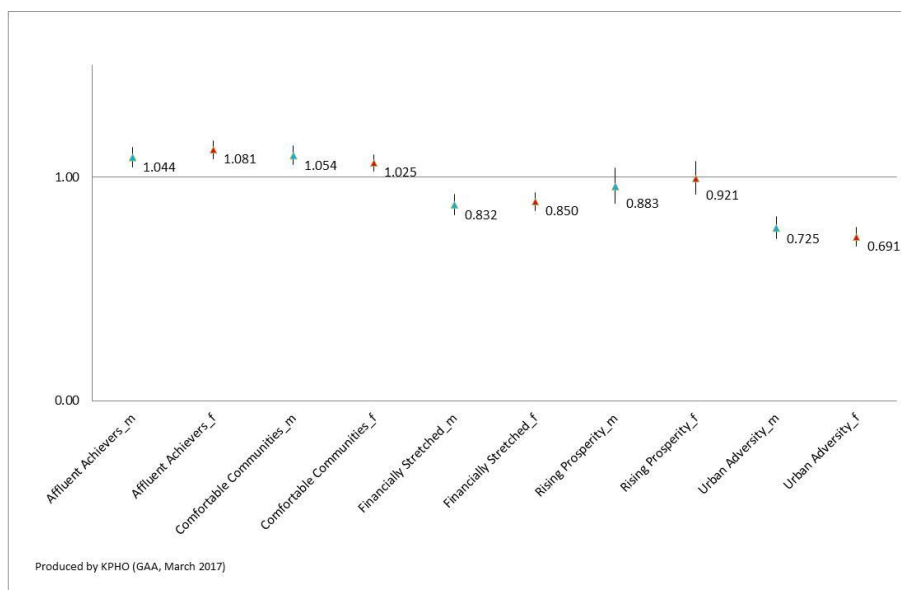
[8]Family structure of households in Kent. Research & Evaluation Statistical Bulletin December 2011

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difference in granularity when compared with household level with considerable scope for ecological confounding if we base considerations of equity at LSOA level?

Second, by understanding the detail behind the segmentation category i.e. the preferences, behaviours and preferred communication channels that are likely to characterise individuals within a particular segment type, from a strategic commissioning perspective it is more likely to generate insights that are better targeted and impactful.

Figure 14 shows the same analysis as Figure 12 broken down by gender (green markers = males, red markers = females). As expected similar patterns are observed although it is notable that females in the ACORN group 'Urban Adversity' are less likely than males in this group to attend their Health Check (these differences are not statistically significant at the 95% level).

Figure 14: Odds ratio of completing a Health Check by ACORN type and broken down by gender (male = green, female = red)

Source: KID and ACORN CACI

3.7   ACORN Wellbeing

The ACORN health and wellbeing segmentation tool has been linked at person level in the KID in the same way that general ACORN tool is linked. The only difference is that the wellbeing product is linked at postcode level not household.

On average across the United Kingdom each postcode covers an average of around 15 households[9]. While this is not as granular as segmentation at household level, it is significantly more granular than segmentation at LSOA level (i.e. 15 households at postcode level vs 745 households at LSOA level). The scope for ecological confounding is therefore significantly reduced.

3.8   About ACORN Wellbeing

Wellbeing ACORN has been designed to provide insights on the clustering effects of lifestyle risks. Set in the context of access to the NHS Health Checks Programme and in particular undiagnosed disease, the King's Fund stated that "if policy-makers, public health commissioners and the NHS wish to address health inequalities, they will need to find effective ways to help people in lower socio-economic groups to reduce the number of unhealthy behaviours they have." Considering equity of access by groups of lifestyle challenge is central to reducing inequality and improving overall health and wellbeing in the longer term.

This section of the report considers these clustering effects in the context of the odds of completing a Health Check by ACORN wellbeing segment.

Figure 15 groups the 25 health and wellbeing types into 4 logical groups with 'Health Challenges' depicting population groups with highest concentration of illness, health challenges and risky behaviours. The 'At Risk' group tend to be characterised with lower levels of illness but high levels of unhealthy behaviour. This group also has the highest rate of smoking alongside alcohol concerns. Furthermore there is a high concentration of social issues such as debt and general dissatisfaction associated with this group.

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[9]BPH postcodes: A guide to UK postcodes (http://www.bph-postcodes.co.uk/guidetopc.cgi)

Figure 15: ACORN Well-Being Types

Source: The ACORN Well-Being User Guide – A health and wellbeing classification system
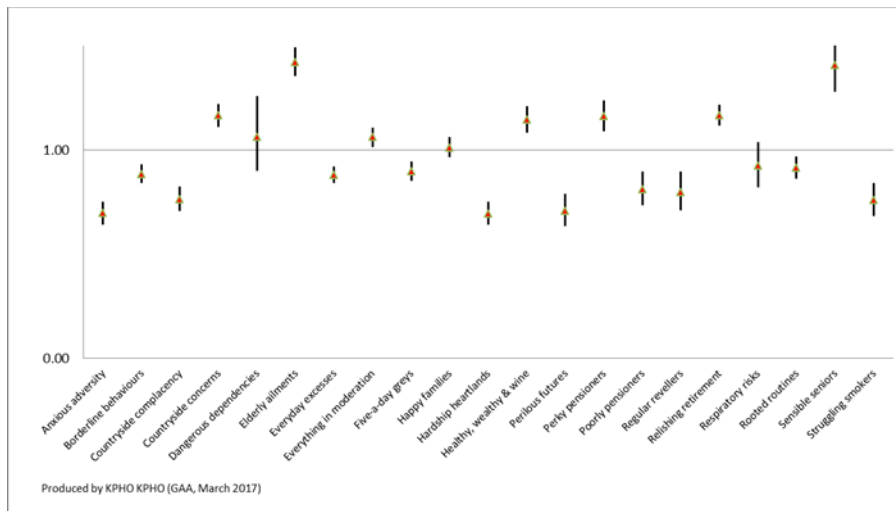
The 'Caution' group is characterised by good health and wellbeing overall but there are also some risky behaviours that may impact negatively later in life. The 'Healthy' group are generally health and well but there may be higher alcohol concerns associated with this group, especially among females. More detail about the ACORN Wellbeing categories can be found in Appendix 2.

Figures 15 and 16 show the odds ratio of completing a Health Check for all Health Check providers and for all non-GP providers respectively. It focusses on ACORN groups 1 and 2 which are groups that exhibit the highest levels of healthcare needs.

Figure 16 shows that people categorised as 'Anxious Adversity', 'Hardship Heartlands', 'Perilous Futures', 'Poorly Pensioners' and 'Struggling Smokers' have among the lowest odds of completing their Health Check. Given the probability that these groups have the higher levels of cardiovascular and impaired glucose tolerance risk especially undiagnosed prevalence[10], this finding is of interest from an equity perspective.

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[10]Social inequalities in prevalence of diagnosed and undiagnosed diabetes and impaired glucose regulation in participants in the Health Surveys for England series. Diabetes and endocrinology research. http://dx.doi.org/10.1136/bmjopen-2015-010155

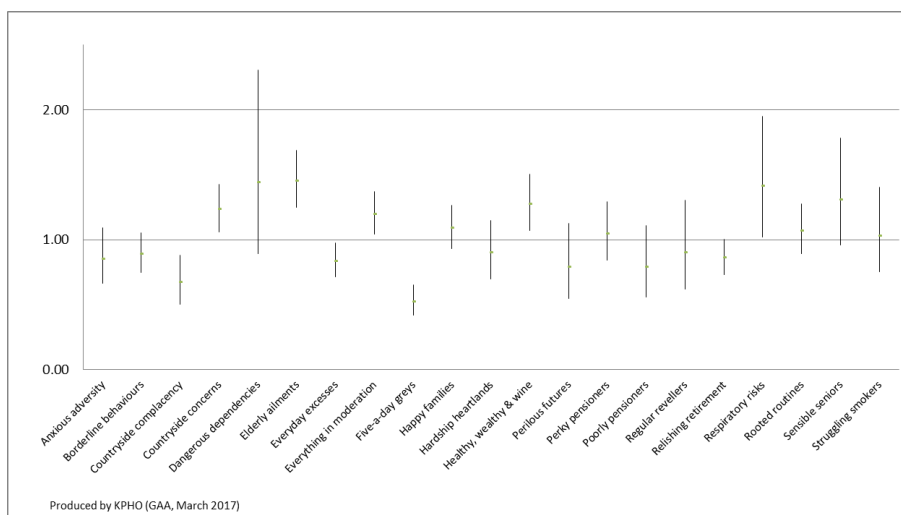Kent Health Checks Equity Audit, June 2017

Figure 16: Odds ratio of completing a Health Check by ACORN Wellbeing type: <u>All</u> Health Check providers (persons)

Source: KID and ACORN CACI

Figure 17 shows a less definitive equity profile due to smaller numbers (and hence wider confidence intervals) in the non-GP provider group. For this reason it is not feasible to comment on the equity enhancing potential of non-GP led Health Check services. Once these services have attracted sufficient numbers it will be possible to re-visit this aspect of the equity audit.

Figure 17: Odds ratio of completing a Health Check by ACORN Wellbeing type: All <u>Non GP</u> Health Check providers (persons)

Source KID and ACORN CACI

| 4   Smoking

Smoking is a major risk factor associated with cardiovascular disease and in the in the UK, smoking is responsible for around 20,000 deaths every year. Using the KID GP_Event table smoking status for all persons completing a Health Check (post check date) was extracted. The Read Codes that were used to identify smoking status are set out in Table 5.

Out of 14,907 males who completed a Health Check a total of 8,958 (60.1%) patients had a valid Read Code for smoking status. For Females, out of 20,532 patients who completed their Health Check, 13,474 (65.6.2%) had a valid code recorded. It is not possible to comment on the underlying reason for the relatively high proportion of patients where smoking status is not recorded (i.e. 40% for males and 34% for females).

Overall, smoking prevalence[11] is 20.7% (n=1851) for males and 14.7% (n=1982) for females. National estimates for smoking prevalence developed by ONS suggest prevalence rates of 19% and 15% for males and females respectively.
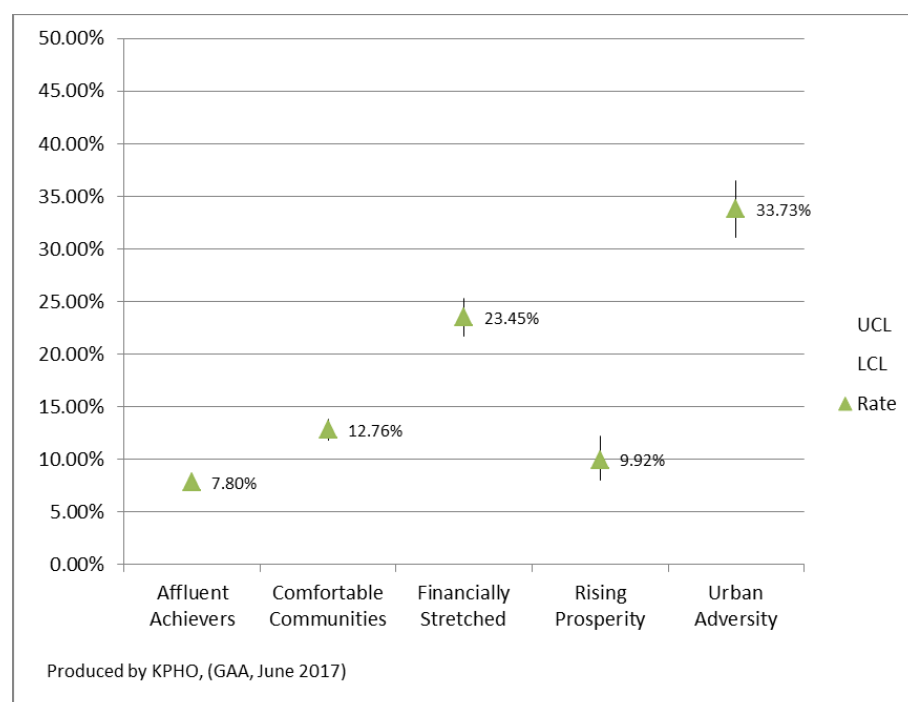
Figure 18: Smoking prevalence for patients completing a Health Check (Males) by ACORN category

Produced by KPHO, (GAA, June 2017)

Source: KID, ACORN CACI

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[11] Note smoking prevalence has been calculated where a valid smoking code is present. Read Codes used to derive the denominator are: 1371 : Never smoked tobacco, 1372 : Trivial smoker <1 cig/day, 1373 : Light smoker 1-9 cigs/day, 1374 : Moderate smoker 10-19 cigs/day, 1375 : Heavy smoker 20-39 cigs/day, 1376 : Very heavy smoker 40+ cigs/day

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Figure 19: Smoking prevalence for patients completing a Health Check (Females) by ACORN category

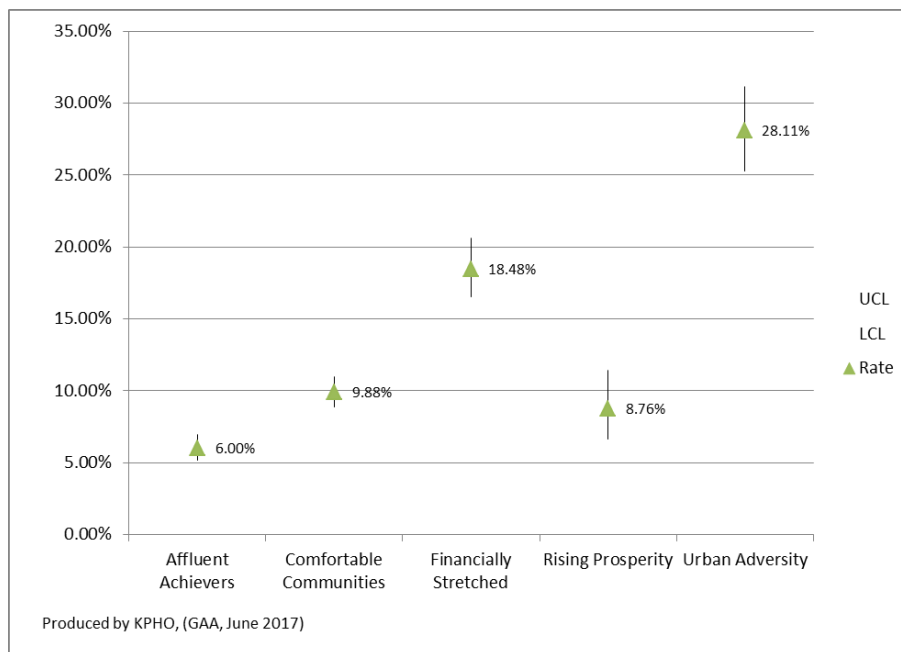Produced by KPHO, (GAA, June 2017)

Source: KID, ACORN CACI

When smoking prevalence is segmented by ACORN category, stark differences in prevalence are apparent. For example, comparing smoking prevalence rates between socio-economic extremes in the ACORN categories ('Affluent Achievers' and 'Urban Adversity'), there is a fourfold difference for both males and females with the most deprived ACORN category: 'Urban Adversity' having smoking prevalence rates significantly in excess of average prevalence. The same pattern (but to a lesser extent) is also evident in the category 'Financially Stretched' (figures 18 and 19). Overall males in the most deprived categories have the highest smoking prevalence rates.

Figure 20 and 21 show the prevalence of moderate to heavy smoking for males and females by ACORN segment[12]. Unsurprisingly, the prevalence pattern reflects overall smoking patterns however; it is evident that males across all ACORN categories are more likely to be heavy smokers when compared with females. This difference is especially marked in the ACORN segment 'Urban Adversity'.

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[12] Moderate to heavy smoking has been defined by using Read Codes indicating smoking habits in excess of 10 cigarettes/day i.e. includes moderate, heavy and very heavy smokers
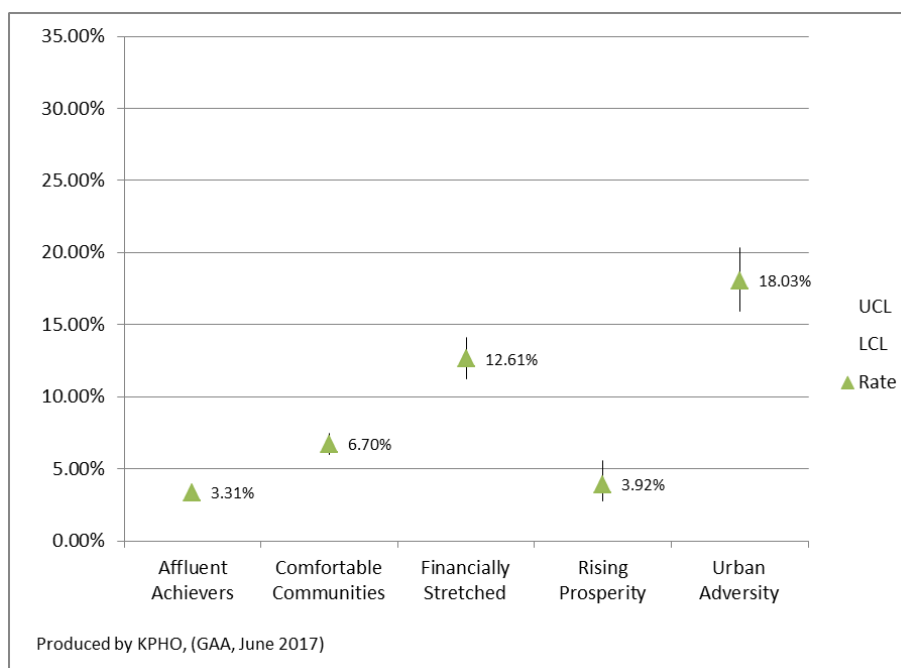
Kent Health Checks Equity Audit, June 2017
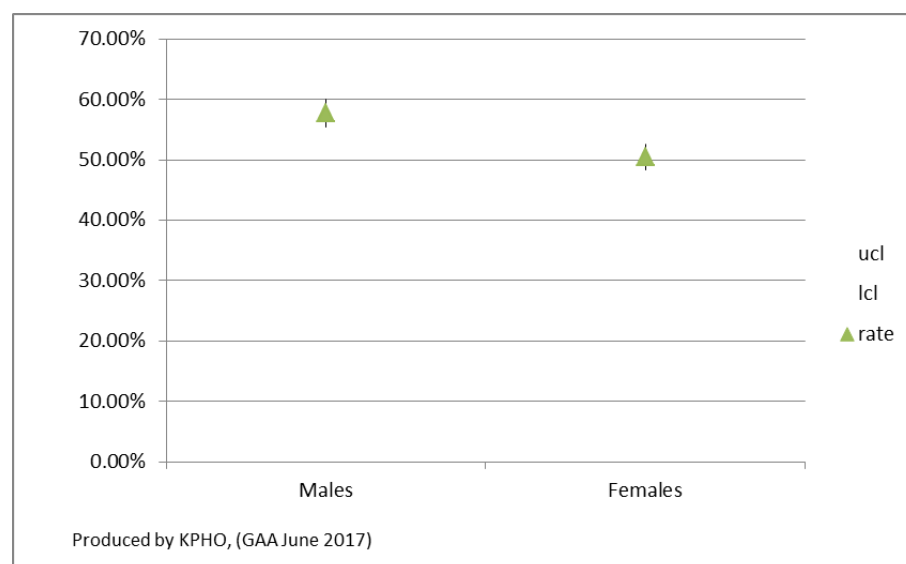
Figure 20: Moderate to heavy smoking prevalence among males by ACORN segment

Source: KID, ACORN CACI

Figure 21: Moderate to heavy smoking prevalence among females by ACORN segment

Source: KID, ACORN CACI

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When the overall pattern of moderate to heavy smoking is compared between males and females (figure 22) it becomes evident that these differences and statistically significant (p<0.05).

Figure 22: Overall differences in moderate to heavy smoking prevalence between males and females

Produced by KPHO, (GAA June 2017)

Source KID

| 5   Hypertension

Hypertension is elevated blood pressure. Over time persistent hypertension can damage the arteries and increase the risk of a heart attack. Furthermore, hypertension contributes to more than a fifth of all heart attacks and half of all strokes[13]. Studies that have assessed gender differences in hypertension have consistently shown that males tend to have higher blood pressure in middle to early late life when compared with females however this difference tends to 'flip' beyond early late life with women tending to have a higher prevalence of hypertension when compared with men[14].

Of 14,907 males who completed a Health Check a total 485 (3.3%) patients had a valid Read Code for hypertension status. For Females out of 20,532 patients who completed their Health Check 494 (2.4%) had a valid code recorded. These crude prevalence rates equate to a new diagnosis detection rate of around 31 for males and 42 for females. A recent study by
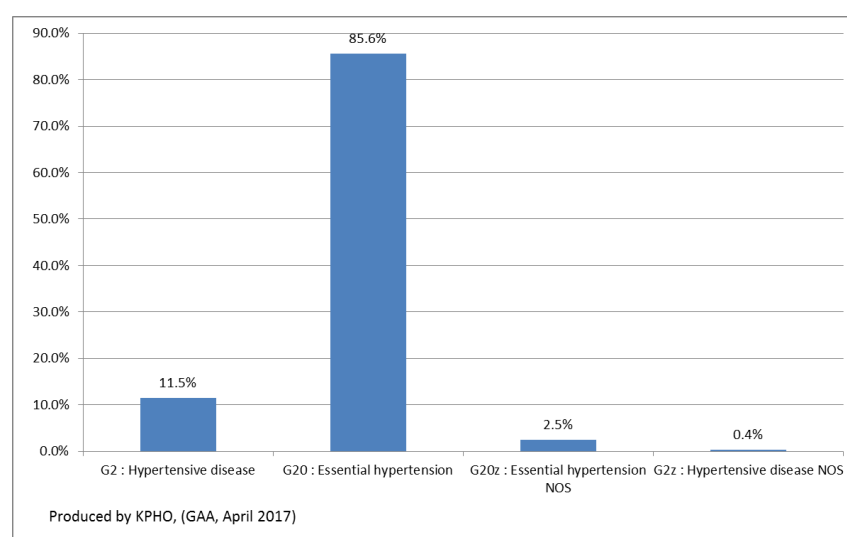
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[13] British Heart Foundation
[14] Sex differences in primary hypertension, 10.1186/2042-6410-3-7

the RAND group identified higher detection rates of between 20-33[15]. It is not clear why the detection rate identified in the analysis is lower than those found elsewhere?

No material differences between males and females were found in the specificity of Read Codes for hypertension.

Figure 23: Hypertension Read Code diagnostic profile (males)

Produced by KPHO, (GAA, April 2017)

Source: KID, ACORN CACI

Figure 24: Hypertension Read Code diagnostic profile (females)

Produced by KPHO, (GAA, April 2017)

Source: KID, ACORN CACI

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[15]NHS Health Check Programme rapid evidence synthesis. The Primary Care Unit, University of Cambridge and RAND Europe (Box 7.1.1).

Figure 25 shows the number of patients that have to be screened through the Health Check process in order to identify 1 patient with hypertension. Across all ACORN categories, detection rates for females are lower when compared with males. Hypertension detection rates are highest among 'Comfortable Communities' and 'Affluent Achievers'. The lowest detection rates wer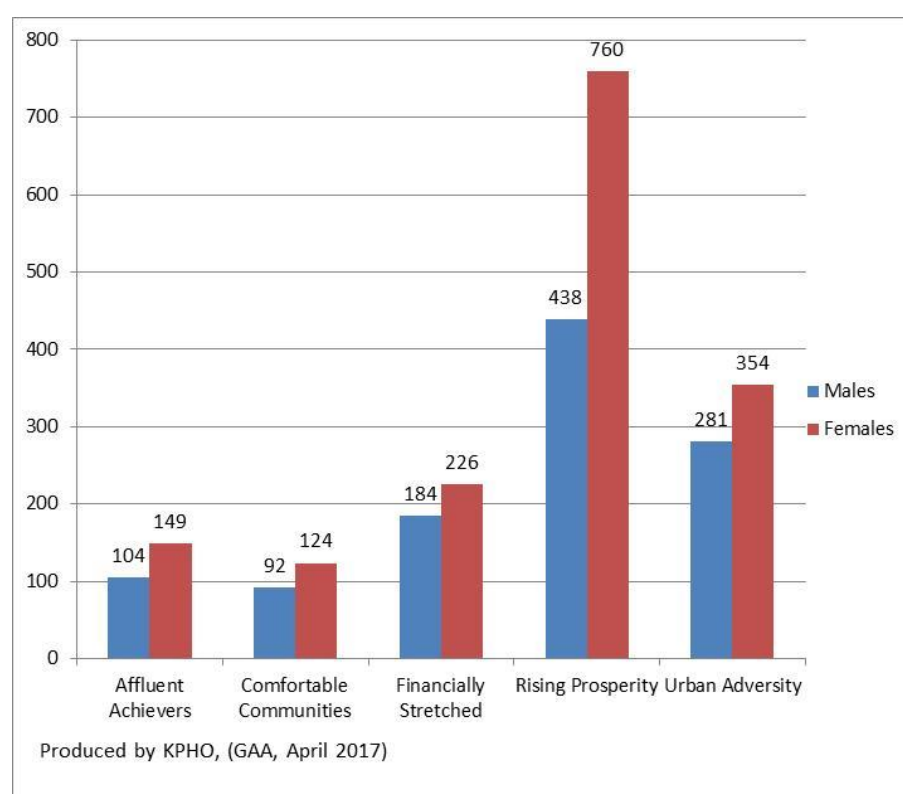e found among the groups 'Rising Prosperity' however this can be explained by the prevailing younger demographic of this group.

The relatively low detection rates among the groups 'Financially Stretched' and 'Urban Adversity' is of concern as it is likely that these groups have higher hypertension prevalence rates associated with the health determinants bound up in lower socioeconomic status. It is also noteworthy that these high risk groups also tend to have significantly lower odds of completing their health check (see section 3.7).

Figure 25: Case detection by gender (e.g. the number of patients screened through the Health Check process that are required to detect 1 case of hypertension)

Produced by KPHO, (GAA, April 2017)

Source: KID, ACORN CACI

| 6   Diabetes

In its State of the Nation report for 2016[16], Diabetes UK estimate that there are around three million people living with diabetes in England. In Kent, the 2015/16 Quality Outcomes Framework (QOF) report indicates that are 78,256 diabetics on QOF registers (17+)[17] This equates to a local prevalence rate of 6.37%. Between 2014/15 and 2015/16 the prevalence rate for diabetes increased by 0.15%, representing an additional 2400 new diabetes cases.

Of 14,907 males who completed a Health Check a total 144 (0.97%) patients had a valid Read Code for diabetes status. For females, of 20,532 patients who completed their Health Check 92 (0.45%) had a valid code recorded. These crude prevalence rates equate to a new diagnosis detection rate of around 1 in 104 for males and 1 in 223 for females. The RAND study found that on average a new case of diabetes was found for every 76 persons completing the Check[18]. These detection rates are significantly higher than the rates identified in this study. The underlying reason for this difference is not clear?

Diagnostic data for diabetes coding were not sufficiently differentiated to discriminate a full diagnostic profile. Furthermore with such a small detection rate (n=236, persons) it was not deemed feasible to explore equity issues in the context of ACORN group.

| 7   Chronic Kidney Disease (CKD)

Chronic Kidney Disease (CKD) is more prevalent in women (7.4%) than men (4.7%)[19] and, as with most long term conditions, there is a sharp rise in prevalence with age. For example, using the CKD prevalence model developed by Public Health England, it is estimated that persons aged between 55-64 have a median prevalence rate of 5.5%, in the age group 65 – 74 prevalence has risen to 13.4% and for persons aged 75 and over the median prevalence rate has risen to 32.0% (See figure 26).

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[16] State of the Nation 2016: Time to take control of diabetes, Diabetes UK
[17] Quality and Outcomes Framework 2015-16, NHS Digital
[18]NHS Health Check Programme rapid evidence synthesis. The Primary Care Unit, University of Cambridge and RAND Europe.
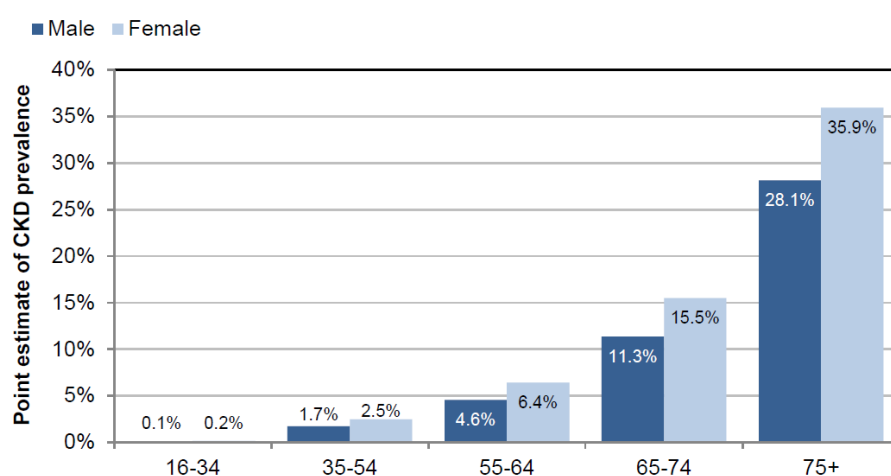[19]Chronic Kidney Disease Prevalence Model, PHE, 2014.
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/612303/ChronickidneydiseaseCKDprevalencemodelbriefing.pdf

Further modelling work carried out by PHE suggests that the scale of disparity with QOF registers is around 30%. In England this equates to approximately 750,000 with CKD who have <u>not</u> been diagnosed and registered[20].

Comparing the median modelled PHE estimate (6.05%) with the Kent 2015/16 QOF prevalence estimate, we calculate a 0.82 recorded prevalence ratio indicating that in Kent we have less unrecorded CKD than other parts of the country.

Figure 26: Chronic Kidney Disease (stage 3-5) point prevalence estimate

Source: PHE

In Kent, the 2015/16 QOF report indicates that are 59,887 people with CKD on QOF registers, this equates to a local prevalence rate of 4.95%, as previously indicated this is less than the expected modelled prevalence (6.05%).

Applying the difference between the observed and the expected prevalence rates equates to a numerical shortfall of around 14,000 adults who have CKD but are not being treated for it across Kent. In this context it is notable that between 2014/15 and 2015/16 the prevalence rate for CKD decreased by -0.11%, representing a numerical decrease of 840 CKD cases.

Of 14,907 males who completed a Health Check a total of 21 (0.14%) patients had a valid Read Code for CKD status. For females out of 20,532 patients who completed their Health

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[20]Chronic Kidney Disease Prevalence Model, PHE, 2014.
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/612303/ChronickidneydiseaseCKDprevalencemodelbriefing.pdf

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Check 58 (0.28%) had a valid code recorded for CKD. These crude prevalence rates equate to a new diagnosis detection rate of around 710 for males and 354 for females (male and female median = 518). The RAND study identified a lower (median) detection rate of 588[21].

The diagnostic profile for CKD was not sufficiently granular to comment on equity differences in diagnoses between males and females. For example, 90% of males and 86% of females received a Read Code of 'chronic kidney disease stage 3'. In line with national prevalence estimates, females had a higher CKD prevalence rate when compared with males and although locally the scale of difference was significantly different to the referenced estimate (i.e. the female rate is more than double the male rate), the small numbers involved expose this finding to the vagaries of random variation rather than evidence of perverse equity?

| 8   Atrial Fibrillation

Atrial fibrillation (AF) is one of the most common forms of abnormal heart rhythm and is also a major cause of stroke[22].

Of 14,907 males who completed a Health Check a total of 48 (0.32%) patients had a valid Read Code for AF status. For females out of 20,532 patients who completed their Health Check, 36 (0.18%) had a valid code recorded for AF. The detection rate for males is 1 in 311 and for females 1 in 570. Due to an absence of published evidence on detection rates for AF in other equity studies, it is not possible to comment on validity of this finding.

| 9   Housebound

Being housebound is strongly associated with age especially among persons aged 65 and over. Between 2005 and 2014 the number of people aged 65 and over increased by almost 20%. In the future, the projected increase in people aged 65 and over is expected to by around 50% by 2035[23]. People who are housebound have additional difficulties in accessing healthcare and because they are more likely to be older, they are also more likely to have elevated cardio-vascular risk. In this regard, this group represents a significant and rising sub-group in the context of the Health checks programme.

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[21]NHS Health Check Programme rapid evidence synthesis. The Primary Care Unit, University of Cambridge and RAND Europe
[22] CVD STATISTICS – BHF UK FACTSHEET (https://www.bhf.org.uk/-/media/files/research/heart-statistics/bhf-cvd-statistics---uk-factsheet.pdf?la=en)
[23] Office for National Statistics

Of 14,907 males who completed a Health Check a total of 37 (0.25%) patients had a valid Read Code for 'housebound'. For Females out of 20,532 patients who completed their Health Check 54 (0.26%) had a valid code for 'housebound'. While these numbers are small, for the reasons set out above this group represents a significant sub-group in terms of unmet cardiovascular need.

Furthermore, it is likely that the prevalence estimates obtained from the KID significantly underestimate the true prevalence of housebound in Kent. For example a recent evidence review estimated that 9% of older people feel trapped in their home. In addition, 41% of people aged 65 and over in the UK feel out of touch with the pace of modern life and 12% say they feel cut off from society[24].

When comparing Health Check completion rates among housebound patients, it was found that the housebound group were significantly more likely not to attend for their Health Check (OR males, 1.58, $p < 0.05$, females, 1.54, $p < 0.05$).

[24] Evidence Review: Loneliness in Later Life, age UK, https://www.ageuk.org.uk/Documents/EN-GB/For-professionals/Research/Age%20UK%20Evidence%20Review%20on%20Loneliness%20July%202014.pdf?dtrk=true

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Appendix 1

ACORN CACI category descriptions[25]

<u>Affluent Achievers</u>

These are some of the most financially successful people in the UK. They live in wealthy, high status rural, semi-rural and suburban areas of the country. Middle aged or older people, the 'baby-boomer' generation, predominate with many empty nesters and wealthy retired. Some neighbourhoods contain large numbers of well-off families with school age children, particularly the more suburban locations.

<u>Rising Prosperity</u>

These are generally younger, well educated, and mostly prosperous people living in our major towns and cities. Most are singles or couples, some yet to start a family, others with younger children. Often these are highly educated younger professionals moving up the career ladder.

<u>Comfortable Communities</u>

This category contains much of middle-of-the-road Britain, whether in the suburbs, smaller towns or the countryside. All life stages are represented in this category. Many areas have mostly stable families and empty nesters, especially in suburban or semi-rural locations. There are also comfortably well-off? pensioners, living in retirement areas around the coast or in the countryside and sometimes younger couples just starting out on their lives together.

<u>Financially Stretched</u>

This category contains a mix of traditional areas of Britain. Housing is often terraced or semi-detached, a mix of lower value owner occupied housing and homes rented from the council or housing associations, including social housing developments specifically for the elderly. This category also includes student term-time areas. There tends to be fewer traditional married couples than usual and more single parents, single, separated and divorced people than average.

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[25] ACORN CACI

Urban Adversity

This category contains the most deprived areas of large and small towns and cities across the UK. Household incomes are low, nearly always below the national average. The level of people having difficulties with debt or having been refused credit approaches double the national average. The numbers claiming Jobseeker's Allowance and other benefits is well above the national average. Levels of qualifications are low and those in work are likely to be employed in semi-skilled or unskilled occupations.

Appendix 2

ACORN CACI Wellbeing category descriptions[26]

Health Challenges

These areas contain the population with the greatest levels of illness and consequently, those with the greatest health challenges and risky behaviours now and in the past. They contain some of the oldest people in the most deprived neighbourhoods. This group contains some of the highest levels of smoking and the lowest levels of fruit and vegetable consumption. Issues around isolation and mental wellbeing are most prevalent here with many lacking a support network in their communities.

Group 1 Types:

1. Limited living

2. Poorly pensioners

3.Hardship heartlands

4. Elderly ailments

5. Countryside complacency

At Risk

These neighbourhoods do not generally have high incidences of illness. However, multiple unhealthy behaviours, as a result of their lifestyles, could put their health at risk in the future. They have the highest rates of smoking in the country along with some alcohol concerns. Social issues such as unemployment, debt and dissatisfaction with life overall contribute to one of the lowest scores on the mental wellbeing scale.

Group 2 Types:

6. Dangerous dependencies

7. Struggling smokers

8. Despondent diversity

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[26] ACORN CACI

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9. Everyday excesses

10. Respiratory risks

11. Anxious adversity

12. Perilous futures

13. Regular revellers

Caution

These are areas where the health and wellbeing of the residents are generally good. Some behaviours do create health risks and may result in lifestyle related ailments in time. There are lower levels of smoking and generally below average incidence of illness. They are less likely to have high blood pressure but tend to be overweight and have high cholesterol. Whilst smoking is low, alcohol consumption can exceed the recommended limits.

Group 3 Types:

14. Rooted routines

15. Borderline behaviours

16. Countryside concerns

17. Everything in moderation

18. Cultural concerns

Healthy

These neighbourhoods are more affluent, often with older residents. Their health, given their age, is especially good with very low levels of illness and good lifestyle behaviours. Smoking is very low and consumption of fruit and vegetables are extremely high. There are, however, issues with alcohol intake, particularly for women.

Group 4 Types:

19. Relishing retirement

20. Perky pensioners

21. Sensible seniors

22. Gym & juices

23. Happy families

24. Five-a-day greys

25. Healthy, wealthy & wine

Appendix 3

SQL Scripts for data extraction

Hypertension SQL

```
SELECT distinct [Pseudonymised_NHS_Number]
,[Provider_Code]
,[Commissioner_Code]
,[Practice_Code]
,[Age]
,[Sex]
,[Event_Read_Code]
,[Num_Result]
,[Num_Result_2]
,[Activity_Date]
FROM [DB_YOC_PSEUDONYMISED].[dbo].[GP_Event]
where ([Pseudonymised_NHS_Number] in ())
and ([Event_Read_Code] in
('G2','G20','G200','G201''G202','G203','G20z','G24','G240','G2400','G240z','G241','G2410','G
241z','G244','G24z','G24z0','G244zz','G2y','G2z'))
and ([Activity_Date] >='2015-04-01')
```

Diabetes SQL

```
SELECT distinct [Pseudonymised_NHS_Number]
,[Provider_Code]
,[Commissioner_Code]
,[Practice_Code]
,[Age]
,[Sex]
,[Event_Read_Code]
,[Num_Result]
,[Num_Result_2]
 ,[Activity_Date]
  FROM [DB_YOC_PSEUDONYMISED].[dbo].[GP_Event]
 where ([Pseudonymised_NHS_Number] in ())
and ([Event_Read_Code] like 'C10%')
and ([Activity_Date] >='2015-04-01')
```

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CKD SQL

```sql
SELECT distinct [Pseudonymised_NHS_Number]
,[Provider_Code]
,[Commissioner_Code]
,[Practice_Code]
,[Age]
,[Sex]
,[Event_Read_Code]
,[Num_Result]
,[Num_Result_2]
,[Activity_Date]
FROM [DB_YOC_PSEUDONYMISED].[dbo].[GP_Event]
where ([Pseudonymised_NHS_Number] in ())
and ([Event_Read_Code] in ('1Z12',
'1Z13',
'1Z14',
'1Z15',
'1Z16',
'1Z1B',
'1Z1C',
'1Z1D',
'1Z1E',
'1Z1F',
'1Z1G',
'1Z1H',
'1Z1J',
'1Z1K',
'1Z1L',
'1Z1T',
'1Z1V',
'1Z1W',
'1Z1X',
'1Z1Y',
'1Z1Z',
'1Z1a',
'1Z1b',
'1Z1c',
'1Z1d',
'1Z1e',
'1Z1f'))
and ([Activity_Date] >='2015-04-01')
```

AF SQL

```sql
SELECT distinct [Pseudonymised_NHS_Number]
,[Provider_Code]
,[Commissioner_Code]
,[Practice_Code]
,[Age]
,[Sex]
,[Event_Read_Code]
,[Num_Result]
,[Num_Result_2]
,[Activity_Date]
FROM [DB_YOC_PSEUDONYMISED].[dbo].[GP_Event]
where ([Pseudonymised_NHS_Number] in ())
and ([Event_Read_Code] like 'G573%')
and ([Activity_Date] >='2015-04-01')
```

All persons with a valid smoking status Read Code SQL

```sql
SELECT distinct [Pseudonymised_NHS_Number]
,[Provider_Code]
,[Commissioner_Code]
,[Practice_Code]
,[Age]
,[Sex]
,[Event_Read_Code]
,[Num_Result]
,[Num_Result_2]
,[Activity_Date]
FROM [DB_YOC_PSEUDONYMISED].[dbo].[GP_Event]
where ([Event_Read_Code] in ('1371',
'1372',
'1373',
'1374',
'1375',
'1376'))
and ([Activity_Date] >='2015-04-01')
and ([Age] between 40 and 74) and ([Commissioner_Code]<>'09W')
```

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All persons with a valid housebound Read Code status Read Code SQL

```sql
SELECT distinct [Pseudonymised_NHS_Number]
,[Provider_Code]
,[Commissioner_Code]
,[Practice_Code]
,[Age]
,[Sex]
,[Event_Read_Code]
,[Num_Result]
,[Num_Result_2]
,[Activity_Date]
FROM [DB_YOC_PSEUDONYMISED].[dbo].[GP_Event]
where ([Pseudonymised_NHS_Number] in ())
and ([Event_Read_Code] like '13C%')
and ([Activity_Date] >='2015-04-01')
```

Appendix 4

Data Extract scheme

Original Extract Invitations
n=105,453
After DQ cleaning
n= 105,305
143/196 practices (73%)

Not Completed (DQ)
n=69,866 (66%)
Males = 34,344 (49%)
Females = 35,522
(51%)

Completed (DQ)
n=35,439 (34%)
Males = 14,907 (42%)
Females = 20,532 (58%)

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