

THOR-GP input to HSE Annual Statistics 2015/2016

Note on methods used for calculating incidence rates and 'caveats' in interpretation

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Summary

Introduction

For the 2016 THOR-GP annual statistics (2015 data) provided to HSE, the same 'THOR-GP denominator method' has been used as in the previous year. In 2014 (2013 data) methods used to calculate incidence rates or work-related ill-health for the HSE's annual statistics changed from the previously used 'Labour Force Survey (LFS) denominator method' to the 'THOR-GP denominator method'. The LFS denominator method required the THOR-GP numerator (number of cases of work-related ill-health reported to participating GPs) to be extrapolated to estimate the numerator for the whole of GB; this was then divided by the number of persons employed according to the LFS. This method also incorporated an adjustment for differences in core/sample reporting rates. This was used whilst methods were developed to more precisely define the size and employment characteristics of the THOR-GP population denominator (i.e. the patients registered with THOR-GPs' practices). The THOR-GP denominator method involves linking the THOR-GPs' postcodes to census area data to provide information from which to characterise a practice population. The 'methods and caveats' document which accompanied the 2014 (2013 data) annual statistics showed how incidence rates derived using the more precise population characteristics of the THOR-GP denominator method were higher than those calculated using the LFS denominator method used in previous years. This is due mainly to the adjustment made (of 2.7) for the core:sample reporting rate ratio used in the statistics provided in previous years.

This document describes the method used to calculate THOR-GP incidence rates using the THOR-GP denominator method and discusses caveats that need to be considered when interpreting the data.

Methods

The THOR-GP population denominator method is based on characterising a census geographical area of similar size to the national average practice size. The nearest geographical area in population magnitude to this is the Middle Layer Super Output Area (MSOAs) for England/Wales and the Intermediate Geography (IG) area for Scotland. The MSOA and IG codes for all THOR-GPs participating in 2015 were linked to tables giving the total population of each area and employment by industrial section and major occupational group. The size of the each practice list was found from published datasets and adjusted to only include the proportion of the population

that were employed. This now more accurate population size was then applied to the proportional distribution by industry and occupational group to give the population size within each section of the workforce of the THOR-GP denominator. The population for England/Wales and Scotland were then totalled to give the GB THOR-GP population.

Usually only one GP in each THOR-GP practice participates in the scheme. Therefore it was necessary to estimate the proportion of the practice study population covered by participating GPs. All THOR-GPs were therefore sent a questionnaire asking how many sessions they undertook each week, and how many sessions all the GPs in their practice undertook in total; this gave an estimate of the proportion of practice consultations covered by the THOR-GP participants, which was then used to adjust the population size derived above.

In 2015 all THOR-GPs were reporting on a sample basis (i.e. one randomly allocated month a year). Annual totals were estimated by multiplying these cases by 12. These estimated totals were adjusted by the reporter response rate. Incidence rates per 100,000 persons per annum were calculated by dividing this adjusted numerator by the THOR-GP denominator and multiplying by 100,000. These individual industrial incidence rates were weighted to adjust for any differences in employment between the THOR-GP population and the population of GB (according to the LFS).

Results

In total there were 210 GB GPs participating in THOR-GP in 2015. Estimates of the employed population size were applied to the proportional industrial distribution derived from Census 2011 data based on the MLSOA and IGs of each practice postcode to give an adjusted workforce size for each industrial section. When THOR-GPs (in 2013) were asked about the number of sessions carried out in their general practice, it emerged that in total THOR-GPs covered approximately an average 17% of their practices' populations. The THOR-GP population in 2015 was therefore then multiplied by 0.17 to give the population denominator covered by participating GPs (166,252 persons).

THOR-GP participants reported 1,548 estimated cases of work-related ill-health to the scheme in 2015. In order to calculate incidence rates, these cases are adjusted by reporter response rate (58%), divided by the corresponding denominator and multiplied by 100,000. The overall rate of incidence was 1,605 per 100,000 persons employed per annum. A GB adjusted rate was calculated (1,633 per 100,000 persons employed per annum) by taking the average incidence rate of each industry weighted by the proportional breakdown of the GB workforce according to the LFS. Incidence rates for work-related ill-health were highest in agriculture, forestry & fishing (5072), transport & storage (3042) and arts, entertainment, service activities & other industries (2782).

Discussion

This document describes the methodology used to calculate incidence rates for the 2015 (2015 data) annual statistical submission to the HSE. This is the third year that the statistics have been produced using the 'THOR-GP Denominator Method'.

There are assumptions that have to be made with the THOR-GP denominator method which are likely to lead to some biases. As previously discussed, the THOR-GP coverage of 17% was applied uniformly across all the practices meaning some of the practices populations will be over-represented and others will be under-represented. This method of estimating the denominator is also based on ecological methods i.e. individuals registered with participating practices are not necessarily employed as the Census area data suggests. There are also recognised uncertainties (also as previously discussed) with the accuracy of the numerator with the disparity shown in core:sample reporting. These uncertainties are in the process of being investigated and the results of these analyses were reported in a document submitted to HSE in July 2015. Analyses included within this document lead to the conclusion that the 'true' incidence rate of work-related ill-health from cases reported from general practice is somewhere between that determined by 'core' reporting and 'sample' reporting, but probably closer to the latter.

Caveats in interpretation

There are a number of issues that should be considered when interpreting the data; the main considerations are as follows;

The data has some figures that may be small in number, therefore we would strongly caution against drawing conclusions on proportions or rates based on small numbers. The numbers of 'actual' cases on which the estimates are based are therefore provided with all tables to permit the reader to be better informed in making judgements based on the incidence information.

The difference between reporting rates for sample and core GP reporters has been previously shown to be a factor of three. The reasons for this difference are unclear, but may be related to multiple consultations at GP level and the fact that these may be dealt with by different practice members. We have previously noted and reported on the difference in incidence estimates based on sampling intervals. Further work is in hand to clarify the reasons for this difference. Measures have been put in place by amending the web portal to further reduce the risk of GPs reporting prevalent cases.

The number of cases reported by THOR-GPs has been adjusted by the GP response rates and assumes that the rate and nature of cases of non-responders would be the same as among those that did respond.

The sickness absence information has been factored up by 61% to adjust for the estimated under-reporting (based on retrospective audits) of sickness absence days.

1. Introduction

Since 2006, incidence rates of work-related ill-health have been calculated from THOR-GP data using the 'Labour Force Survey (LFS) denominator method'(1). This involves adjusting the numerator for GP response and for any part-time practice, calculating the number of cases reported per participating GP and multiplying this number by the number of GPs (full-time equivalent) in Great Britain (GB) to extrapolate THOR-GP data to national figures. This estimated numerator is then divided by LFS denominator data. A detailed description of the LFS denominator method can be found in Appendix 1.

Initially, most THOR-GPs participated as core reporters (i.e. reporting every month of the year), however in 2010 the majority of reporters changed to sample reporting (i.e. one randomly assigned month a year) (core:sample ratio 1:4). Since 2011, all reporters have been participating on a sample basis. It was found that this change to sample reporting had a marked effect on incidence rates producing incidence estimates almost three times that of core reporting. The reason for this disparity is not known for certain, however it is likely to be either a result of over-reporting by sample reporters (by submitting prevalent cases or harvesting cases from outside their reporting month) or under-reporting by core participants as a manifestation of fatigue (2). Most likely it is as a result of a combination of both of these factors. The factors influencing the differences in core and sample reporting are discussed in a report due to be submitted to HSE in July 2015 (3). Analyses included within this document lead to the conclusion that the 'true' incidence rate of work-related ill-health from cases reported from general practice is somewhere between that determined by 'core' reporting and 'sample' reporting, but probably closer to the latter. In order to bring rates in line with figures calculated from predominately core reporting, from 2010 sample cases were weighted by dividing by 2.7 (core:sample reporting ratio) as an interim adjustment.

The LFS denominator method was used whilst methods were developed to more precisely define the size and employment characteristics of the THOR-GP population denominator (i.e. the patients registered with THOR-GPs' practices). Linking patients' postcodes to census area data can provide information from which to characterise a practice population, including demographic and employment data. In the absence of personal information, denominator characterisation based on linking patients' postcodes in this way is considered to be the 'gold standard' method but it has often been reported that these individual patient data are not easily accessible to researchers (4;5). In the absence of patient postcode data, population characteristics based on the postcode of the practice are often used (4-7).

A study was conducted to compare population estimates based on patient and practice postcode and results showed that in the absence of patient postcode data, it is satisfactory to use practice postcode data (8). As a result of the completion of this work, the HSE Annual Statistics submission in 2014 (for 2013 data) and

subsequently the submissions for 2015 (for 2014 data) and 2016 (for 2015 data) were conducted using the more precise THOR-GP denominator method.

The 'methods and caveats' document that accompanied the 2014 (2013 data) annual statistics showed how incidence rates derived using the more precise population characteristics of the THOR-GP denominator method were higher than those calculated using the LFS denominator method used in previous years. This is due mainly to the adjustment made (of 2.7) for the core:sample reporting rate ratio used in the statistics provided in previous years (9).

This document describes the method used to calculate THOR-GP incidence rates using the THOR-GP denominator method and discusses issues/caveats that need to be considered when interpreting the data.

2. Methods

2.1 The Denominator

The THOR-GP population denominator method is based on characterising a census geographical area of similar size to the national average practice size. England and Wales have a different geographical system to Scotland therefore the postcodes of these different countries have to be processed separately (Figure 1). The average practice list size was estimated at approximately 6,000 patients for England & Wales and 5,000 for Scotland (10;10). The nearest geographical area in population magnitude to this is the Middle Layer Super Output Area (MLSOAs) for England/Wales and the Intermediate Geography (IG) area for Scotland.

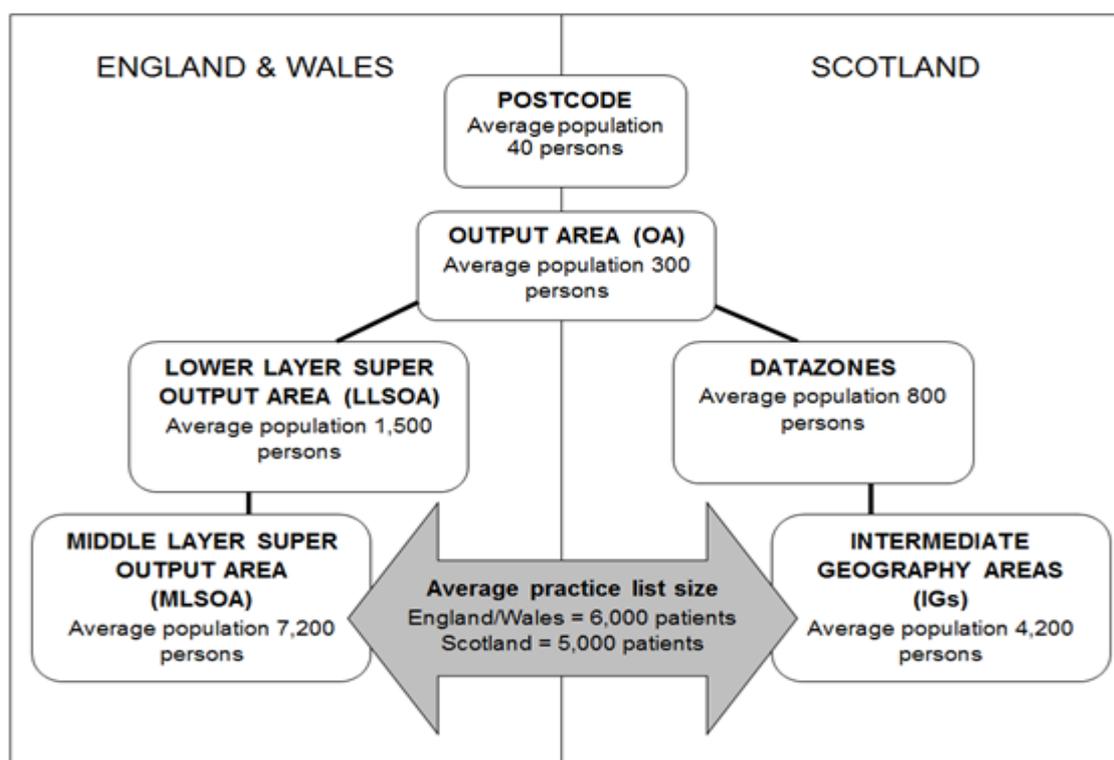


Figure 1. Hierarchical census areas

The postcode of the main practice address of all GP participants in 2015 was selected from the database. Some practices had branch surgeries, however only the postcode of the main practice was used; the inclusion of branch surgeries has been found to have little effect on results in other work (7). The MLSOA and IG codes were found for each practice postcode. Lists of MLSOA and IG codes were linked to tables downloaded from the Office for National Statistics (ONS) and Scotland's Census 2011 web sites (11;12) giving the total population of each area and employment by industrial section and major occupational group. Ten (nine in England/Wales and one in Scotland) of the participating GP practices had two THOR-GP reporters, for these practices, the corresponding MLSOAs or IG areas were included twice.

Previous research (8) has shown that although this method estimates well the industrial distribution of the THOR-GP population, it is not so accurate at estimating the size of the population. Therefore the size of each practice list was found from published datasets (13-15). The resulting population was for all patients, whereas the THOR-GP population denominator is limited to those within employment. In order to adjust for this, the proportion of the population within each MLSOA and IG area in employment was calculated from the downloaded Census 2011 datasets (employment by industry, occupational group and total residents of each MLSOA and IG area). The proportion for each MLSOA or IG area was applied to the population of registered patients for the corresponding practice to give a total employed population. This now more accurate population size was then applied to the proportional distribution by industry to give the population size within each industrial section of the THOR-GP denominator. The population for England/Wales and Scotland were then totalled to give the GB THOR-GP population.

Usually only one of the GPs in each THOR-GP practice participates in the scheme. Therefore it was necessary to estimate the proportion of the practice study population covered by participating GPs. For example, a practice may have four GPs of whom only one reports to THOR-GP; additionally these four GPs will undertake a different number of clinical sessions per week. In 2013 all participating GPs were therefore sent a questionnaire asking how many sessions they undertook each week, and how many sessions all the GPs in their practice undertook in total; this gave an estimate of the proportion of practice consultations covered by the THOR-GP participants, which was then used to adjust the population size derived above.

2.2 Calculation of incidence rates

In 2015 all THOR-GPs were reporting on a sample basis (i.e. one randomly allocated month a year). Annual totals were estimated by multiplying these cases by 12. These estimated totals were adjusted by the reporter response rate. Incidence rates per 100,000 persons per annum were calculated by dividing this adjusted numerator by the THOR-GP denominator (as determined in section 2.1 above) and multiplying by 100,000.

The THOR-GP population may be slightly different in its employment characteristics than the GB population. Therefore in order to calculate the incidence rates for GB as a whole required by the HSE, it is necessary to adjust the overall rate of incidence for this. For example, when calculating rates for specific diagnostic categories; if the THOR-GP population had a higher proportion (than the GB population) of its population working within service public sector industries known to have higher rates of work-related mental-ill health diagnoses (16); this would be reflected in the results with an increased overall rate of these psychological conditions in the population. In order to adjust for this, data from the THOR-GP population would have to be weighted by the proportional distribution by industry in the GB workforce according to LFS data.

3. Results

3.1 The Denominator

In total there were 210 GB GPs (189 in England/Wales and 21 in Scotland) participating in THOR-GP in 2015. Table 1 shows the figures used to calculate the employed population of the patients registered with THOR-GPs' practices. Census 2011 data were used to calculate what proportion of the residential population of the relevant MLSOAs and IG areas were employed; this was then applied to the number of patients registered with the THOR-GP practices.

Table 1. Census 2011 data and number of registered patients information used to calculate the size of the (unadjusted for number of GP sessions) THOR-GP population

	England/Wales	Scotland
Census 2011 all residents	1,556,519	93,172
Census 2011 all employed persons	734,961	46,016
Proportion of Census population employed overall	47%	49%
Practices' registered patients	1,939,278	124,267
917,508	945,898	60,445

*Calculated for each MLSOA or IG individually

These estimates of the employed population size (917,508 England/Wales and 60,445 Scotland) were applied to the proportional distribution derived from Census 2011 data to give an adjusted workforce size for each industrial section (Table 2). For example, in England/Wales 10.05% (74,009 persons) of the THOR-GP population according to MLSOA data (population size 734,961 persons) is employed in education. When the overall population size is increased according to practice list data to 917,508 and the industrial proportional distribution applied, this results in 92,725 persons employed in education.

Table 2. England/Wales (MLSOA) and Scotland populations (IG areas) weighted by number of registered patients, THOR-GP participants 2014

Section	Industry	England/Wales			Scotland		
		Population according to MLSOA	%	Population weighted by number of registered patients	Population according to IG areas	%	Population weighted by number of registered patients
A	Agriculture, Forestry & Fishing	5109	0.70	5756	1242	2.70	1442
B	Mining & Quarrying	1355	0.18	1587	1019	2.21	1401
C	Manufacturing	63602	8.65	79984	3558	7.73	4981
D	Electricity, Gas Steam & Air Conditioning Supply	4378	0.60	5595	401	0.87	538
E	Water Supply; Sewerage, Waste Management and Remediation Activities	4875	0.66	6170	460	1.00	595
F	Construction	52005	7.08	66113	3551	7.72	4584
G	Wholesale & Retail Trade; Repair of Motor Vehicles & Motorcycles	115106	15.66	144781	6393	13.89	8713
H	Transport & Storage	36572	4.98	45185	2154	4.68	2825
I	Accommodation & Food Service Activities	44507	6.06	54254	3186	6.92	4419
J	Information & Communication	30070	4.09	37091	1173	2.55	1412
K	Financial & Insurance Activities	31408	4.27	40763	1788	3.89	2223
L	Real Estate Activities	10219	1.39	12799	583	1.27	749
M	Professional, Scientific & Technical Activities	48363	6.58	59768	2869	6.23	3652
N	Administrative & Support Service Activities	35806	4.87	44254	1794	3.90	2266
O	Public Administration & Defence; Compulsory Social Security	47575	6.47	59926	3307	7.19	4156
P	Education	74009	10.07	92725	4037	8.77	5213
Q	Human Health & Social Work Activities	92934	12.64	115335	6395	13.90	8573
R, S, T, U	Arts, Entertainment, Service Activities and Other Industries	37068	5.04	45422	2106	4.58	2701
Total	All Industry Sections	734961	100.00	917508	46016	100.00	60445

Note: Figures may not calculate exactly due to rounding

Table 3. THOR-GP GB population adjusted by number of practice sessions carried out by participation GP, 2015 numerator adjusted by response rate and incidence rates per 100,000 persons employed per annum unadjusted and adjusted for GB industrial distribution

Section	Industry	GB THOR-GP population		LFS (%)	THOR-GP population adjusted by THOR-GP sessions (X 0.17)	THOR-GP numerator 2015 (estimated cases)	THOR-GP numerator 2015 adjusted for response rate (/0.58)	Incidence rate per 100,000 persons employed
		N	%					
A	Agriculture, Forestry & Fishing	7199	0.74	1.10	1224	36	62	5072
B	Mining & Quarrying	2987	0.31	0.45	508	0	0	0
C	Manufacturing	84965	8.69	9.59	14444	144	248	1719
D	Electricity, Gas Steam & Air Conditioning Supply	6133	0.63	0.60	1043	12	21	1985
E	Water Supply; Sewerage, Waste Management and Remediation Activities	6766	0.69	0.70	1150	0	0	0
F	Construction	70697	7.23	7.23	12019	132	228	1894
G	Wholesale & Retail Trade; Repair of Motor Vehicles & Motorcycles	153495	15.70	13.15	26094	168	290	1110
H	Transport & Storage	48010	4.91	5.02	8162	144	248	3042
I	Accommodation & Food Service Activities	58673	6.00	5.28	9974	144	248	2489
J	Information & Communication	38504	3.94	3.96	6546	48	83	1264
K	Financial & Insurance Activities	42986	4.40	4.01	7308	36	62	849
L	Real Estate Activities	13548	1.39	1.19	2303	12	21	898
M	Professional, Scientific & Technical Activities	63419	6.48	7.15	10781	0	0	0
N	Administrative & Support Service Activities	46520	4.76	4.75	7908	72	124	1570
O	Public Administration & Defence; Compulsory Social Security	64082	6.55	6.00	10894	84	145	1329
P	Education	97938	10.01	10.53	16649	144	248	1491
Q	Human Health & Social Work Activities	123908	12.67	13.36	21064	240	414	1964
R, S, T, U	Arts, Entertainment, Service Activities and Other Industries	48124	4.92	5.94	8181	132	228	2782
Missing	No industry recorded	0	-	-	0	0	0	-
Total	All Industry Sections (unadjusted for industrial distribution)	977954	100	100	166252	1548	2669	1605
Total GB	All Industry Sections (adjusted for GB (LFS 2013) industrial distribution)	-	-	-	-	-	-	1633

Note: Figures may not calculate exactly due to rounding

3.2 Calculation of incidence rates

THOR-GP participants reported 1548 estimated cases of work-related ill-health to the scheme in 2015. Table 3 shows how this breaks down by industry. In order to calculate incidence rates, these cases are adjusted by the reporter response rate of 58% (/0.58), divided by the corresponding denominator and multiplied by 100,000 (to give an incidence rate expressed as new cases per 100,000 persons per year). A GB adjusted rate for all cases is calculated by taking the average incidence rate of each industry weighted by the proportional breakdown of the GB workforce according to the LFS 2015.

This same methodology was used to calculate incidence rates by major diagnostic category. The results are shown in Table 4.

Table 4. Number of cases and incidence rates per 100,000 persons employed per annum unadjusted and adjusted for GB industrial distribution by major diagnostic category

	Number of estimated cases 2014	Number of estimated cases adjusted for response rate (/0.67)	Incidence rate per 100,000 person employed (unadjusted for GB industrial distribution)	Incidence rate per 100,000 person employed (adjusted for GB (LFS industrial distribution))
Musculoskeletal	876	1510	908	926
Mental ill-health	480	828	498	502
Skin	60	103	62	56
Respiratory	60	103	62	64
Other	84	145	87	97
All cases	1548	2669	1605	1633

4. Discussion and caveats in interpretation

4.1 Discussion

This document describes the methodology used to calculate incidence rates for the 2016 (2015 data) annual statistical submission to the HSE. This is the third year that the statistics have been produced using the 'THOR-GP Denominator Method'.

As discussed previously, the LFS method used prior to the 2014 annual statistics submission relied upon extrapolating the THOR-GP numerator to estimate GB figures which are then divided by LFS denominator data. The THOR-GP denominator method described in this document characterises the employment of the population denominator based on census information about the geographical

areas where the participants' practices are based. It is also able to estimate well the size of the population through published practice list size data, again using census information to estimate what proportion of these registered patients are employed. Incidence rates based on the THOR-GP population are then weighted to adjust for any differences in industrial employment to give rates for GB as a whole.

There are assumptions that have to be made with the THOR-GP denominator method which are likely to lead to some biases. As previously discussed, the THOR-GP coverage of 17% was applied uniformly across all the practices meaning some of the practices populations will be over-represented and others will be under-represented. This method of estimating the denominator is also based on ecological methods i.e. individuals registered with participating practices are not necessarily employed as the Census area data suggests. There are also recognised uncertainties (also as previously discussed) with the accuracy of the numerator with the disparity shown in core:sample reporting.

4.2 Caveats in interpretation

There are a number of issues that should be considered when interpreting the data as the following describes.

The data has some figures that may be small in number, especially when broken down by industrial sectors, we would strongly caution against drawing conclusions on proportions or rates based on small numbers. The number of actual cases on which the incidence rate estimates are based are included in all tables to enable the reader to be guided as regards the reliability of the estimates.

At the start of THOR-GP data collection, all participating GPs reported incident cases every month (core reporters), thus permitting the rapid collection of relatively large incident datasets for analysis and interpretation. As the scheme progressed, in common with other THOR schemes, an increasing proportion (now 100%) of GPs were asked to report incident data during only one randomly selected month of the year (sample reporters). This helped to contain costs and also to reduce the potential of GPs to 'fatigue' in their reporting. In line with the practice in the specialist THOR schemes, estimates for the number of cases seen by the reporting group as a whole were calculated by multiplying the case numbers reported by sample reporters by 12. However, from 2010, it became apparent when applying this approach to the data, that the reporting rate per reporting month was much higher for sample reporters than for core reporters.

Previously published work by us in relation to occupational physicians' reporting (2) in the OPRA scheme (a sister scheme of THOR-GP) showed that incidence rates based on sample reporting were modestly (26%) higher than those based on core reporting, to a degree that was plausibly ascribable to lower levels of under-reporting

in sample reporters. We concluded that it is not possible to be certain which type of reporting (core or sample) gave estimates nearer the true incidence. However the results of the study showed that the incidence for core reporters declines throughout the year suggesting that these reporters might find the assembling and reporting of cases every month an onerous task. Therefore the, evidence in respect of occupational physicians reporting in OPRA suggests that incidence rates based on sample reporting may be closer to the 'true' incidence. However sample reporting may contain a degree of telescoping bias. The difference between reporting rates for sample and core GP reporters in THOR-GP was much larger (than it was for occupational physicians reporting); a factor of nearly threefold. The reasons for this difference are unclear, but may be related to multiple consultations at GP level and the fact that these may be dealt with by different practice members with 'incident' reports being recorded by the THOR-GP. Therefore, it can be argued that incidence rates based on sample reports (as is the case in these data) may be over-estimated. Further work is submitted to HSE in 2015 also concluded that sample reporting may be closer to the true incidence (3). Measures have been put in place to help reduce the risk of GPs reporting prevalent cases. When a GP reports a case they are required to check a box confirming that they understand the guidelines about reporting incident cases; it is hoped that this will reinforce the requirements for THOR-GP case eligibility and make them consider more carefully whether the case they are about submit is truly incident.

The number of cases reported by THOR-GPs has been adjusted by the GP response rates and assumes that the rate and nature of incident cases seen by non-responders would be the same as among those that did respond. It is difficult to conclude how this assumption may influence the incidence estimates without knowing the reasons for non-response. If reporters fail to submit a response because they had nothing to report, incidence would be overestimated. However if, alternatively, there is no response due to a reporter being too busy, they may well have seen relevant cases which are not included in the data. Incidence rates might therefore be underestimated.

In this study (and in other studies using geographical area based on census data), the classifications are based on ecological methods and some error at an individual level is inherent e.g. individuals registered with participating practices may not necessarily be employed as the census area data suggests. Also, a number of the practices included had branch surgeries, but only the MLSOA of the main practice was used in population estimates based on practice postcode. However, as stated previously, the inclusion of branch surgeries was found to have little effect on results in other work (7). There may also be some inaccuracies incurred due to the doubling up of the MLSOAs/IG areas where there were two participating THOR-GPs in a single practice. GPs in a practice are unlikely to have an equal share in the patient workload; however this was applied to a very small sample (5%) of the participating practices.

The sickness absence information has been factored up to adjust for a 61% estimated under-reporting of sickness absence days. This arises from auditing of sickness absence data provided by participating GPs. A paper outlining this work has recently been accepted by Occupational Medicine and is currently in press (17). To date 22% of all sickness absence cases have been audited and results from these have estimated that the total number of days sickness absence certified reported with the case submissions is approximately 39% of the days certified until the end of the actual sick leave. Participating GPs are asked to continue to submit information on further sickness absence issued to previously reported cases and the continuation of this may be difficult especially in cases of the long term sick. The audit data has consistently shown this level of under-estimation, therefore the sickness absence data has been adjusted to reflect this (as well as by reporter response rate). However caution has to be applied to the interpretation of these. The number of days sickness absence in GB is calculated by dividing the number of days reported by participating GPs (adjusted by response rate and under-reporting) and dividing this by the THOR-GP population denominator (166,252 persons) to obtain a figure for the number of days absence per person in the THOR-GP population. This is then multiplied by the number of persons employed in GB according to the LFS to give an estimated figure for the national population.

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Appendix 1. LFS Denominator Method

For previous years where there were two different groups of reporters (core and sample), rates for these two groups were calculated separately, as the number of reporters and response rates differ. These were then combined to give rates for a single year using a weighted average (based on the number of reporters in each group). For the annual statistics submitted in 2013, three year averages for 2010 to 2012 were required. For 2010 data, both core and sample reporters were participating in the scheme, therefore a single combined rate was calculated using this method, however in 2011 and 2012, GPs were only participating on a sample basis, therefore it was not necessary to use this method to combine two rates. The one year average rate (for 2010 to 2012) was calculated by taking the average of the core/sample combined rates for 2010 and the sample reporters rates for 2011 and 2012. For the 2015 annual statistics (including data for 2013 to 2015) core data is no longer included therefore the method to combine core and sample data does not apply. However it has remained in the explanation of the methodology below as it is applicable to previous year's annual statistics.

The GB incidence rates for all years (and reporter groups) has been calculated as follows with a working example (for 2010 as it has both core and sample reporters) shown in red. Sickness absence data is extrapolated to GB figures using the same methodology.

Step 1. Number of cases reported in 2010

460 cases, 220 of which were reported by core reporters and 240 reported by sample reporters

Step 2. Weighting of sample cases

Cases reported by sample reporters are multiplied by 12 to give an estimated annual total; this is then weighted to adjust for the effect of sampling on reporter behaviour. The number of cases per reporter per month from 2005 to 2010 was calculated for core and sample reporters. Sample = 1.8 and Core = 0.67 therefore the sample:core reporting rate ratio is therefore 2.7. The same weighting factor was used (after consultation with HSE) for the 2011 annual statistics. Estimated cases reported by sample reporters were divided by 2.7 to adjust for this sampling effect and added to the core reporter cases.

240 sample cases multiplied by 12, divided by 2.7 and added to core cases.

$240 \times 12/2.7 = 1067$

$1067 + 220 = 1287$ estimated and weighted cases

The following steps are calculated for core and sample reported cases separately.

Step 3. Number of cases reported per GP.

This is calculated by taking the number of cases and dividing it by the average number of GPs actively reporting each month (e.g. 200 GPs reporting per month at a 75% response rate = 150 GPs).

Core reports: $220 / 31 = 7.1$ cases per GP

Sample reports: $1067 / 147 = 7.3$ cases per GP

Step 4. Adjusting for the part-time (PT) practice of THOR-GPs.

At the beginning of January 2011 all participating GPs were asked how many GP sessions they undertook each week as part of an exercise to characterise the GP reporting denominator. 200 GPs responded to this question and the total number of sessions = 1399. If full time (FT) practice is considered to be 10 sessions per week, this would mean that if all these GPs worked FT the number of sessions would = 2,000. THOR-GPs therefore work 70% of this. For previous annual statistics, it was agreed with HSE that the 131 GPs that responded to a previous survey was a large enough sample to assume the PT/FT nature of the remaining GPs' practice. Therefore, this recent survey is not only based on a larger sample of GPs but validates the results of the previous questionnaire (part-time practice was estimated at 71%). The number of cases per GP is then factored up to estimate FT practice reporting.

Core reports: $7.1 / 70 \times 100 = 10.1$ cases per GP

Sample reports: $7.3 / 70 \times 100 = 10.4$ cases per GP

Step 5. Extrapolating to GB figures.

As the THOR-GP cases have been adjusted to FT practice the figure for the number of Full Time Equivalent (FTE) (or Whole Time Equivalent (WTE) used in Wales and Scotland) GPs was used. The most recent figure available for each country for 2012 data (England 2012 (1), Wales 2012 (2) and Scotland 2009 (3)) was combined to give the best possible estimate for the number of FTE GB GPs (40,886). Although the Information Services Division for NHS Scotland routinely publish GP headcount information, WTE figures have not been available since 2006 (3); the 2009 WTE figure is based on a Workforce Planning Survey published in December 2009 (3). The figure for 2012 cases per GP is therefore multiplied by this number. The figure for 2010 to 2012 cases is multiplied by the mean of 2012 and the best estimate for the previous two years.

Core reports: $10.1 \times 40781 = 411,888$ cases in GB

Sample reports: $10.4 \times 40781 = 424,122$ cases in GB

Step 6. Calculation of incidence rates

This number of GB cases is then divided by the number of persons employed in GB = 27,721,475 (LFS 2010) and multiplied by 100,000 to give an incidence rate per 100,000 persons employed. For 2010 to 2012 data the mean of 2010 and 2012 LFS data is used.

Core reports: $411,888 / 27,721,475 \times 100,000 = 1486$ cases per 100,000 persons employed

Sample reports: $424,122 / 27,721,475 \times 100,000 = 1530$ cases per 100,000 persons employed

Step 7. Overall incidence rate calculated

The overall annual incidence rate is calculated by taking the weighted average of the core and sample rates. In 2010 the rates were based on cases reported by 178 **active** reporters; 31 (17%) core reporters and 147 (83%) sample reporters, therefore incidence rates calculated from these GPs were multiplied by 0.17 and 0.83 respectively and added together to produce a combined rate for 2010.

$(1486 \times 0.17) + (1530 \times 0.83) = 1522$ cases per 100,000 persons employed