Time trends in the incidence of work-related ill-health in the UK, 1996-2010: estimation from THOR surveillance data

Carder M, McNamee R, Holland F, Hussey L, Turner S, Agius R

Centre for Occupational and Environmental Health, Health Sciences Group, School of Community Based Medicine, Faculty of Medical and Human Sciences, The University of Manchester

http://www.medicine.manchester.ac.uk/oeh/research/thor/

September 2011

EXECUTIVE SUMMARY

BACKGROUND An important objective of the UK Health and Safety Executive (HSE) funding of the THOR project is to be able to monitor changes in national incidence rates, or trends, of work-related illness (WRI) over time. The Health and Occupation Research (THOR) network and its constituent schemes or predecessor (ODIN) has been collecting data on WRI in the UK since 1989. Approximately 1400 physicians participate in THOR, reporting in excess of 4000 case reports in 2010. Analysis of these data can therefore help fulfil this objective. This is the latest report comprising statistical analysis of THOR data for this purpose. Data from four of the THOR extant schemes were analysed: the Surveillance of Work-related and Occupational Respiratory Disease (SWORD), Occupational skin disease surveillance (EPIDERM), Occupational Physicians Reporting Activity (OPRA) and THOR in general practice (THOR-GP). Reporters to SWORD and EPIDERM are specialists employed as consultant physicians in the UK in the fields of respiratory and skin diseases respectively, while OPRA reporters are occupational physicians (OPs) and report on a broad spectrum of disease. Similarly, THOR-GP enables GPs to report all cases of WRI as seen in a general practice setting. In all schemes, physicians are asked to (voluntarily) report new cases of disease seen in the reporting month which, in their opinion, are caused or aggravated by work. Each scheme has guidelines for deciding whether a case is work-related. Physicians may report every month (core reporters) or one, randomly chosen month each year (sample reporters). Of importance, this report provides estimates of relative changes in incidence of specialist and GP diagnosed disease in the UK over time. It does not give estimates of absolute incidence.

METHODS A multi-level statistical model (MLM) was used to analyse the data. In the 2-level version appropriate to THOR data, the higher level is reporter and the lower level is time (month). The dependent variable was the number of actual cases, including zeros, per reporter per month. Variables were also included in the regression models to represent ‘season’, ‘reporter type’ (core or sample), and ‘first month/s as a new reporter’. The main change to the methodology for the present analyses related to the inclusion of estimates representing the UK working population (for each year) in the MLM. An additional (minor) methodological change was the changing of the reference year (for the categorical analyses) from the first year common to all datasets (2006) to the last year common to all datasets (2010). Otherwise, the methodology remained unchanged to that documented in the report submitted to HSE in 2010.

In addition to the 'main' estimates of trend, this report also includes an update on recent work undertaken to investigate the issue of reporter fatigue within THOR (included as Appendix A). Specifically, the work included here describes efforts undertaken to determine whether reporter fatigue, manifesting as an excess of zero returns, is present within the THOR data, and if so, how this can best be modelled in future.

RESULTS The majority (81%) of the 16515 case reports of skin disease reported to EPIDERM during 1996-2010 were contact dermatitis (CD), with smaller proportions of neoplasia (12%), contact urticaria (5%) and 'other' (2%). Skin diagnoses comprised only a small proportion of cases reported to OPRA and THOR-GP (10% of each), with CD being the predominant skin diagnosis (83% of OP and 78% of GP skin cases, respectively). Overall, the annual average change in incidence of work-related skin disease was little changed by the inclusion of a further year of data (i.e. 2010) with data from all three groups of physicians (dermatologists, OPs and GPs) continuing to suggest a downward trend for the reported incidence of this category of ill-health. The estimated annual decrease (1996 to 2010) was -3.4% (95% CIs: -4.0%, -2.8%) from reports from dermatologists and -8.5% (-10.2, -6.7%) from OPs. However, the graphs showing relative rates by year suggest that for both dermatologists and OPs much of the decrease occurred in the earlier part of the study period (<2005) with a comparative levelling out in later years. Restricting the data to the period 2006-2010 (enabling a direct comparison between dermatologists, OPs and GPs) suggested a decrease for THOR-GP (-5.3% (-12.9%, +2.8%)) compared to a relatively flat trend for EPIDERM (+0.4% (-2.4%, +3.2%)) and OPRA (+0.1% (-7.4%, +8.3%)), although none of these were statistically significant. Trends for CD were similar to those for skin overall but further analyses by type of CD (dermatologists only) did show some variation with a steeper decrease observed for allergic CD compared to irritant or mixed CD. A fall in incidence was also observed for both urticaria and neoplasia, with some variation observed between core and sample reporters.

Of the 10514 respiratory diagnoses reported to SWORD, 43% were benign pleural plaques, 20% mesothelioma, 19% asthma, 7% pneumoconiosis and 11% 'other'. Relatively few of the diagnoses (4%) reported to OPRA were respiratory, with asthma being the largest single diagnosis (46% of respiratory diagnoses). To date, too few respiratory cases have been reported to THOR-GP (132 diagnoses, 2% of total cases) to

enable a separate analysis. Overall, the trend for respiratory disease was similar to that observed for skin disease, with data from both chest physicians and OPs suggesting a significant, annual decrease in incidence, with a steeper average annual decrease (1999-2010) suggested by OPs (-7.4% (-10.7%, -4.1%)) compared to chest physicians (-3.6% (-4.5%, -2.6%)). Data from both groups of reporters also suggested a fall in the incidence of asthma, again steeper for OPs compared to chest physicians. An overall fall in incidence was also suggested for mesothelioma, benign pleural plaques and pneumoconiosis (but only the former was statistically significant).

Of the 18893 case reports to OPRA, 39% were musculoskeletal disorders (MSDs). The majority of these MSDs were disorders of the upper limb (56%) or spine/back (34%). Similarly, 53% of the 5455 cases reported to THOR-GP were MSDs (48% of these were upper limb and 37% were spine/back). Data from both OPs and GPs suggested a downward trend in the incidence of work-related MSDs with a much larger annual average decrease in incidence suggested by GPs compared to OPs. For the period 2006-2010, the annual average decrease was -5.8% (-9.3%, -2.2%) for OPs and -15.2% (-18.5%, -11.8%) for GPs (using all OP data i.e. from 1996, it was -3.3%). The graph of relative rates by year showed a sharp drop in incidence for THOR-GP between 2006 and 2007 with rates continuing to fall thereafter. Similarly, the equivalent graph for OPRA also suggested that much of the fall in incidence occurred later on in the study period (from 2006 onwards). The pattern for upper limb disorders was very similar to that observed for total MSDs, whilst for spine/back disorders generally a larger annual decrease was observed.

Mental ill-health comprised 43% and 32% of the cases reported to OPRA and THOR-GP, respectively. Anxiety and depression and other work stress were the most frequently reported mental ill-health diagnoses for both schemes. For the period 1996-2010, data from OPs suggested an annual average increase in the incidence of total mental ill-health of +5.7% (+4.5%, +7.0%). Further analysis by sub-diagnosis suggested that whilst there was some evidence that the incidence of anxiety and depression may have peaked circa 2004 with the trend flattening out thereafter, the incidence of other work stress appears to have been increasing, albeit gradually, throughout the study period (annual average increase of +9.5% (+7.7%, +11.3%)). In contrast, data from GPs (2006-2010) suggested an annual average decrease in the incidence of total mental ill-health of -8.8% (-13.1%, -4.1%) and in the sub-categories of anxiety and depression (-7.1% (-13.7%, 0.0%)) and other work stress (-10.6% (-15.9%, -5.1%)).

The results of the investigations into whether there was evidence of fatigue, manifesting as an increase in zero returns over time (which are fully discussed in Appendix A), suggested evidence of zero-inflation (i.e. proportion of 'false zero' reports) in EPIDERM (both core and sample reporters) and in OPRA (sample reporters only) but not in SWORD, THOR-GP or OPRA (core reporters). Evidence that the percentage of false zeros increased with membership time was observed for EPIDERM sample reporters only.

DISCUSSION For the clinical specialists and OPs, the addition of a further year of data little altered the observed trends. For work-related skin and respiratory disease, although an overall fall in incidence was observed for both groups of reporters, the graphs showing relative rates by year suggested much of this fall occurred in the earlier part of the study period with relatively flat trends over the last few years. The generally steeper decrease in incidence of skin and respiratory disease observed for OPs compared to clinical specialists could be attributed to the fact that OPs tend to work in larger industries with progressive reduction in exposure to agents causing skin and respiratory disease, whereas clinical specialists would see cases from small and medium enterprises (SMEs), such as hairdressers, who do not have access to OPs and in whose workplaces there has perhaps not been the hoped for reduction in exposure. However, the largest fall in OP incidence (for skin disease anyway) occurred between the first two years of reporting and it is possible that this was partly due to OPs, on first reporting to OPRA, tending to favour reporting skin and respiratory diagnoses (over other diagnoses) as a legacy of previously reporting to SWORD and EPIDERM. The continued observed fall in incidence of MSDs may in part reflect a change in how a patient presents their illness i.e. in previous years a patient may have presented with 'back pain' as a 'generic' illness when seeking time off work whereas in more recent times, the combination of mental ill-health becoming more 'acceptable' and the policy of generally no longer prescribing long periods of rest for MSDs, may mean that such cases are more likely to present as 'stress' rather than back pain or other MSDs. The equivalent OP data for other work stress is consistent with this theory, with the annual plots suggesting a steady rise in incidence throughout the study period.

Data from GPs continued to suggest a decrease in incidence of skin, musculoskeletal and mental ill–health over the study period (2006-2010), which was typically much larger than the equivalent change for clinical specialists and OPs over the same time period. It is not yet clear whether this large downward trend in GP reported incidence was a 'true' change

in incidence or whether it was due to other factors, for example, reporter fatigue. Of interest, for skin and mental ill-health there was a slight suggestion of an increase in incidence in 2010 compared to previous years. However, it is important not to place too much emphasis on changes over one year, particularly as the implications of the shift in 2010 from predominantly core reporting to predominantly sample reporting in THOR-GP on estimates of incidence may have been associated with an increase in incident reporting rate, and is still being investigated.

An ongoing important issue in the investigation of trends in incidence using THOR data is the extent to which reporter 'fatigue' might be influencing the observed trends. Although there was some evidence of excess zeros for some of THOR schemes, this would only impact on the trends analysis if there was further evidence that the percentage of false zeros changed over time and such evidence was found for EPIDERM sample reporters only. Thus, apart from this group of reporters there was no evidence of fatigue, as manifested by an increase of excess zeros over time, in the THOR data. However, it is premature to draw firm conclusions regarding the presence or absence of fatigue in the THOR data. Further work is underway (forming part of the remaining work packages of this body of work) and will be reported on in due course.

CONCLUSION THOR continues to provide an invaluable source of data on the incidence and burden of WRI in the UK and is almost unique in its comprehensiveness and in its reporting by specialist physicians, or by GPs with specialist training. Whilst some of the observed trends are in accordance with those expected either as a result of Government initiatives (for example, the observed decline for asthma and contact dermatitis) or according to anecdotal (and other) evidence (for example, the increase of other work stress) others may, at least in part, reflect a change in management and referral patterns rather than a true trend. For example, the observed trends for non-malignant asbestos related diseases may be associated with better availability of NHS imaging techniques, whilst the apparent reduction in MSD incidence may be the consequence of change in clinical management and referral policy. For THOR-GP, the apparent decrease in incidence should be interpreted with caution until other issues such as reporter fatigue and changes in reporting frequency are better understood. However, continued efforts are being made to refine the methodology to enable these and other partially resolved issues to be investigated further. Furthermore, as the quality and quantity of the THOR data

increases, it is becoming possible to begin to investigate trends at a more resolved level, for example in relation to specific industries or specific causal agents.

CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

GLOSSARY OF TERMS

ACTIVE REPORTER in a given month – someone who returns their reporting card/webform either with cases or declaring 'I have nothing to report'

ZERO RETURN A monthly report card/webform which is returned 'blank', i.e. with no cases of disease recorded.

CORE REPORTER A reporter who reports cases on a monthly basis.

EPIDERM Occupational skin surveillance. A surveillance scheme that started in 1993 and which collects information on cases of work-related skin disease reported by consultant dermatologists.

INDICATOR VARIABLE In a statistical model a variable which takes the value 1 or 0 depending on whether a condition is true.

MEMBERSHIP TIME in a given month – the length of time the reporter has been a member of the scheme.

MOSS Musculoskeletal Occupational Surveillance Scheme. A surveillance scheme that started in 1997 and which collects information on cases of work-related musculoskeletal disorders reported by consultant rheumatologists.

MULTI-LEVEL STATISTICAL MODEL (MLM) A model which assumes a hierarchical data structure with data units at lower levels (e.g. time) nested within units at a higher level (e.g. reporter).

OPRA Occupational Physicians Reporting Activity. A surveillance scheme that started in 1996 and which collects information on cases of all work-related ill-health reported by occupational physicians.

REPORT CARD/WEB FORM The card/web form on which reporters record new cases of work-related disease seen that month.

REPORTING FATIGUE Any tendency whereby reporters become less interested in participation as time since joining the scheme increases.

SAMPLE REPORTER A reporter who reports on only one, randomly sampled month per year. Only cases seen during the sample month should be reported.

SEASONAL VARIATION Variation in reporting cases within a year, the pattern for which tends to be repeated from one year to the next

SICKNESS ABSENCE RETURN The number of days certified sick leave associated with a case of work-related ill-health reported to THOR-GP

SOSMI Surveillance of Occupational Stress and Mental Illness. A surveillance scheme that started in 1999 and which collects information on cases of work-related mental ill-health reported by consultant psychiatrists.

SWORD Surveillance of work-related and occupational respiratory disease. A surveillance scheme that started in 1989 and which collects information on cases of work-related respiratory disease reported by consultant chest physicians.

THOR-GP a project which uses a research network of General Practitioners with training in Occupational Medicine to determine the incidence of occupational disease, work-related ill-health and sickness absence burden in the UK

THOR network The Health and Occupation Research network which runs several surveillance schemes for work-related disease. Took over from the Occupational Disease Intelligence Network (ODIN), which had the same role until 2001.

TREND, True The true variation over calendar time of the incidence of specialist-diagnosed, work-related disease in the UK

TREND, Estimated An estimate of the true trend derived from THOR data

TREND, Systematic A systematic change in incidence over time, e.g. a pattern of increases from year to year or decreases from year to year

Zero-inflated Poisson (ZIP) A two component zero-inflated Poisson count model which estimates the probability of excess zeros and also predicts the mean cases.

Zero-inflated negative binomial (ZINB) A two component zero-inflated negative binomial count model which estimates the probability of excess zeros and also predicts the mean cases allowing for more variability than the Poisson model.

1. BACKGROUND

An important objective of the UK Health and Safety Executive (HSE) funding of the THOR programme is to be able to monitor changes in national incidence rates, or trends, of work-related illness (WRI) over time. The Health and Occupation Research (THOR) network and its constituent schemes or predecessor (ODIN) has been collecting data on WRI in the UK since 1989 [1, 2]. Analysis of this data can therefore help fulfil this objective. The data collected by THOR enables changes in national incidence rates, or trends for specific diseases as seen by different groups of physicians to be estimated. This is the latest report comprising statistical analysis of THOR data for this purpose.

THOR is operated by the Centre for Occupational and Environmental Health (COEH) based at The University of Manchester. For the current round of analyses, data from the four main extant THOR (HSE supported) schemes were analysed. The Surveillance of Work-related and Occupational Respiratory Disease (SWORD), Occupational skin disease (EPIDERM), Occupational Physicians Reporting Activity (OPRA) and THOR in general practice (THOR-GP) surveillance schemes for WRI in the UK, began in 1989, 1993, 1996 and June 2005 respectively [2, 3, 4, 5]. Reporters to SWORD and EPIDERM are specialists employed as consultant physicians in the UK in the fields of respiratory and skin diseases respectively, while OPRA reporters are occupational physicians (OPs) and report on a broad spectrum of disease. Similarly, THOR-GP enables GPs to report all cases of WRI as seen in a general practice setting. Previously, analyses of trends have also included data reported to Musculoskeletal Occupational Surveillance Scheme (MOSS) and Surveillance of Occupational Stress and Mental Illness (SOSMI), by consultant rheumatologists and consultant psychiatrists, respectively. However, the HSE stopped funding data collection for MOSS and SOSMI at the end of 2008 with COEH undertaking a further year of data collection (2009) before data collection ceased.

Thus, for the current round of analyses, data from the EPIDERM, SWORD, OPRA, and THOR-GP surveillance schemes were used to estimate the trend in the incidence of medically diagnosed, WRI in the UK over the period 1996-2010 (EPIDERM and OPRA), 1999-2010 (SWORD) and 2006-2010 (THOR-GP).

Of importance, this report also updates on progress undertaken to investigate the important issue of whether participants of THOR exhibit reporting ‘fatigue’ as their

membership time in THOR increases. It uses new statistical approaches to address how this manifests, what impact it has on the estimates of trends, and how it can be addressed in the modelling approach.

2. METHODS

The methodology employed in this study has been described in full in previous reports [6-11]. For the purpose of this report, a summary has been provided and any changes to the methodology since the 2010 trends report highlighted.

2.1 DATA PERIOD

The data period used for the trends analysis is shown in Table 1.

Table 1 Data period for trends analyses

	Scheme start date	Data period for trends study
EPIDERM	**1993**	**1996-2010**
SWORD	**1989**	**1999-2010**
OPRA	**1996**	**1996-2010**
THOR-GP	**June 2005**	**2006-2010**

2.2 CATEGORIES OF ILLNESS

Initial power calculations undertaken for the THOR specialist schemes suggested that a specific disease category should only be investigated (separately) if the number of actual cases reported during the study period exceeded 250 [10]. For THOR-GP it was decided that, although over a shorter time period, the minimum number of cases required for any disease category to be included in the analysis would remain at 250. The resulting disease groups to be included in the analysis are shown in Table 2.

Table 2 Categories of illness included in the analyses

	Clinical specialist	OPRA	THOR-GP
All WRI	**-**	**Yes**	**Yes**
Total skin	**Yes**	**Yes**	**Yes**
Contact dermatitis (CD)	**Yes**	**Yes**	**Yes**
• **Allergic CD**	**Yes**	**-**	**-**
• **Irritant CD**	**Yes**	**-**	**-**
• **Mixed CD**	**Yes**	**-**	**-**
Neoplasia	**Yes**	**-**	**-**
Contact urticaria	**Yes**	**-**	**-**
Other skin[a]	**Yes**	**Yes**	**-**
Total respiratory	**Yes**	**Yes**	**-**
Asthma	**Yes**	**Yes**	**-**
Mesothelioma	**Yes**	**-**	**-**
Benign pleural disease	**Yes**	**-**	**-**
Pneumoconiosis	**Yes**	**-**	**-**
Other respiratory disease[b]	**Yes**	**Yes**	**-**
Total musculoskeletal	**-**	**Yes**	**Yes**
Upper limb disorders[c]	**-**	**Yes**	**Yes**
Spine/back disorders[d]	**-**	**Yes**	**Yes**
Lower limb disorders[e]	**-**	**-**	**Yes**
Total mental ill-health	**-**	**Yes**	**Yes**
Anxiety and depression	**-**	**Yes**	**Yes**
Other work stress	**-**	**Yes**	**Yes**

[a]Other than contact dermatitis
[b]Other than asthma, mesothelioma, benign pleural disease or pneumoconiosis
[c]Hand/wrist/arm, shoulder and elbow
[d]Neck/thoracic spine, lumbar spine/trunk
[e]Hip/knee, ankle/foot

2.3 REPORTER GROUPS

Physicians reporting to THOR typically report either as core reporters (reporting every month) or as sample reporters (reporters who report one randomly selected month a year). Analyses were based on all reporters in each scheme combined, and separately (where appropriate) for core or sample reporting groups within each relevant scheme. It is important to note that for the purpose of these analyses, if a reporter changed from the core reporting group to sample reporting or vice versa, he or she was treated as a new reporter for the period after the change (See Section 2.5). We have previously shown [12] that there are differences in behaviour for the same reporter depending on whether they are reporting as core or as sample. Further information relevant to each scheme is provided in the following sections.

2.3.1 EPIDERM

After initial piloting, consultant dermatologists began reporting (UK wide) to EPIDERM in 1993 [3]. Initially all reporters reported at 3-month intervals. In January 1996 the scheme was redesigned to consist of a core group with a special interest in occupational skin disease who reported to the scheme on a monthly basis (24 dermatologists originally) with the remaining specialists (220 originally) assigned to report on a sample basis. This mix of core and sample reporters i.e. a smaller core group consisting of 'keen specialists' and a larger sample group, continued for the period covered by the trends analyses (1996-2010). For this scheme, analyses based on all reporters combined and separately for core and sample groups were carried out.

2.3.2 SWORD

UK wide SWORD reporting began in 1989 [2]. The original objective was for all chest physicians to report on a monthly basis. However, during the recruitment process it became apparent that some chest physicians saw relatively few eligible cases and were therefore reluctant to participate on a monthly basis. To address this it was decided that physicians could report either monthly (78% of physicians originally), quarterly (19%), bi-annually (<1%) or annually (2%). This original system of reporting was modified in January 1992 (to combat potential reporter fatigue) with those physicians who had reported the most cases forming a core group (approximately 10% of physicians at that time) with the remainder assigned to report on a sample (monthly) basis. As for EPIDERM, this structure of a smaller group of keen specialists and a larger sample group continued throughout the time period covered by these analyses (1999-2010 for SWORD). For this scheme, analyses based on all reporters combined and separately for core and sample groups were carried out.

2.3.3 OPRA

Prior to 1996, occupational physicians could report to SWORD and EPIDERM but in 1996 OPRA was established as an independent scheme [4]. The situation for OPRA is slightly different from that of the clinical specialist schemes in that there had not been a self

selected core group, as in the other schemes, until 2006. Prior to 2004 all OPRA reporters reported on a sample basis. In 2004, a randomised crossover trial was set up to study the impact of core reporting in OPRA [12]. Physicians who had reported at least one case in the preceding three years were invited to be part of the trial. Volunteering reporters were then randomly allocated to one of two groups: those who were to be core in 2004 and those who would be core in 2005. The trial finished in December 2005, after which reporters were asked if they would like to continue to be core; over half the OPRA members in the trial agreed and a few others also. Thus for the period covered by the current round of analyses (1996-2010), the reporters consisted of sample only for the period 1996-2003, then both core and sample for the period 2004-2010.

Separate analysis of the trial data revealed a very sharp decline in the monthly incidence rates for core reporters from January to December, which was over and above any seasonal variation expected. We interpreted this as possibly due to a short-term fatigue effect. In view of these differences from the other schemes, and the observed short-term decline, analyses to 2007 for OPRA treated all core reporters as though they were sample only by using their data from one month only chosen at random from the 12. This improved the comparability of the data, but did not render them absolutely equivalent.

However, as the core group continued it was felt that it was inappropriate to continue to 'ignore' >90% of the data provided by these reporters by treating them as sample reporters. Therefore, from 2007 onwards, it was decided to model the OPRA reporters in the same manner as the specialist data i.e. all reporters modelled together then separately by core and sample (with all core data used rather than 1 month in 12). However, it is possible that the observed trends provided for all reporters' combined and core reporters separately are more affected by reporter fatigue than previous estimates for this group.

2.3.4 THOR-GP

Initially all reporters to THOR-GP reported on a core basis. This permitted the scheme to 'come up to speed' rapidly, and to provide the HSE with early data on the distribution of GP reported WRI from THOR-GP. Sample reporting was introduced to THOR-GP in April 2007, partly to counteract possible reporter fatigue, and also to move towards the originally intended core-sample mix (envisaged as 60 core and 240 sample), with a small number of sample reporters (33 (7%) reporters during the period April 2007 to December 2009).

However, in 2010, the proportion of sample reporters increased to 78% thus reaching the original envisaged ratio of 1:4. Since the introduction of sample reporting in 2007, all new reporters to the scheme have been randomly allocated to participate as either core or sample. Additionally, in 2010 all reporters not previously assigned core or sample status were randomly allocated to one of these two different reporting groups. Therefore, during the time period covered by these analyses (2006-2010), reporters to THOR-GP can be viewed as belonging to one of 4 groups

1. Core reporters who were initially recruited as core prior to 2007 and remained core when randomly allocated status in 2010
2. Sample reporters who were initially recruited as core prior to 2007 then became sample when randomly allocated status in 2010
3. Sample reporters recruited since 2007 (who were allocated status upon recruitment)
4. Core reporters recruited since 2007 (who were allocated status upon recruitment)

Ideally, it would be useful to be able to carry out separate analyses for each of these 4 groups and as the data increases it may be possible to do so. However, since the numbers of cases reported for some of the groups are presently relatively small, for the current round of analyses, results are shown for all reporters and (all) core reporters only.

2.4 DEFINITION OF AN ACTIVE REPORTER

For the purpose of the analyses it was deemed important to include only those reporters with evidence of active participation. For the THOR specialist schemes an active reporter was defined as a reporter who either returned cases or declared 'I have nothing to report' (a zero return) during the study period. For THOR-GP, reporters can submit a sickness absence (SA) return only in any given month (i.e. information about additional sickness absence that has been issued to a previously reported case). Approximately 5 reporters a month submit a SA return with no other information about cases (case or zero return): ideally they should also have submitted a zero return if there are no new cases. While these reporters are, in the general sense of the word, active, in terms of contributing information about incidence they are not. On the other hand, it could be assumed that, if they had seen new cases they would have contributed them and therefore this

corresponds to a zero return in terms of incidence. However, as it is difficult to be sure of this and this activity accounts for a very small proportion of the monthly returns, we considered them to be inactive. Therefore for the purpose of this trends analysis also, a THOR-GP reporter has to have submitted a case or zero return to be considered active for the purpose of studying trends in incidence.

2.5 THE MULTI-LEVEL MODEL

The STATA software command **xtnbreg** was used to fit longitudinal, negative binomial (i.e. over-dispersed) Poisson models with random effects. The dependent variable was the number of actual cases, including zeros, per reporter per month. Variables were also included in the regression models to represent 'season', 'reporter type' (core or sample), and 'first month/s as a new reporter'. These variables and the rationale for including them have been described in full previously [6-11] and are summarised below:

Season **–** Seasonal variation refers to variation within a year whose pattern tends to be repeated from year to year. This short-term variation could be due to seasonal variation in illness or seasonality in reporting behaviour; the latter could occur because of holidays, for example. To address this, indicator variables for months (with June as the reference category) were included in the models. Seasonal variation should not bias the assessment of long-term changes in this study. However it could affect precision in the estimate of trend if not controlled.

Reporter type – Reporter type (core or sample) had been shown to cause variation in incidence between reporters. Thus, a variable which took the value '1' if a core reporter and '0' if a sample reporter was included in the models. Furthermore, for the purpose of the analysis, if a reporter changed from the core reporting group to sample reporting or vice versa, he or she was treated as a new reporter for the period after the change.

First month/s as a new reporter **–** It is conceivable that, in the first month/s of reporting, a new entrant to a surveillance scheme might include cases seen over a period longer than a month. If there was a sufficiently big 'harvest' of old cases, it could produce a false, decreasing 'trend' over time. For the THOR specialist schemes, initial investigations suggested harvesting might be occurring during the first month that a reporter actively reported to a scheme. Thus, to control for harvesting, a variable which took the value '1' if

it was the first month the reporter had reported and '0' for all other months was included in the models. Initial investigations suggested the period of 'harvesting' maybe longer for THOR-GP compared to the specialist schemes (5 months compared to 1). This might occur because, compared to specialists, there is more opportunity for 'old' cases to present themselves again to a GP, thus prompting a report. Thus, variables representing the first 5 months of active reporting were included in the THOR-GP regression models. In addition, for these main analyses, the first 7 months of THOR-GP were excluded (June to December 2005). Since approximately 25% of the GPs (reporting between 2006 and 2009) joined the scheme in 2005, it was felt that the 2005 data may have been particularly prone to the effect of harvesting.

2.6 CALENDAR TIME

For the main analyses, changes in incidence were estimated in two different ways; these are related to the treatment of calendar time in the analysis model:

(i) 'non-parametric' approach: the model contained separate indicator variables for different years. In previous analyses, 1999 was taken as a reference year (2006 for THOR-GP) and the percentage increase or decrease in incidence compared to 1999 (or 2006) was estimated. For the present round of analyses, 2010 was taken as the reference year (THOR and THOR-GP) and the percentage increase or decrease in incidence compared to 2010 was estimated. These analyses had no in-built assumptions about the pattern of change over time.

(ii) 'parametric approach' with a continuous time variable measured on a scale of years. The statistical models for these analyses *assumed a systematic trend* throughout the period being studied. Specifically, it was assumed that the percentage change from one year to the next is a constant throughout the relevant period. Where the assumption is valid, this parametric approach offers a more precise way of estimating change than approach (i).

2.7 POPULATION CHANGES

In previous analyses we assumed that the size of the UK working population base (and therefore the population which in theory is covered by physicians reporting to THOR) remained constant over the period of the study. However, analysis of data from the UK Labour Force Survey (LFS) shows a fairly regular increase in the size of the working population of the order of 1% a year [13]. One might perhaps expect to see an increase in cases over time of this order even if true incidence *rates* remained constant. Previously, we made no allowance for this increase or any other change in the population base but rather suggested a rough correction for the 1% yearly population increase could be made by subtracting one point from the percentage change figures shown in the Tables, e.g. 3% would become 2%. However, for the current round of analyses we have accounted for this change in population base by including in the ML model an offset variable representing the UK working population, obtained from the LFS, for each year.

For EPIDERM, SWORD and THOR-GP, using data from the LFS for this purpose was considered appropriate as in theory all of the UK workforce have equal access to a clinical specialist or a GP. For OPRA, however, the situation is less clear. Access to an OP amongst the UK workforce is known to be biased towards the public sector and larger employers in general, with earlier studies suggesting that approximately 12% of the UK working population had access to an OP [14]. In view of this, it would be beneficial to use the information collected by the OPRA rolling denominator surveys (in which each OP reporting to OPRA is asked, once in every three year period, to estimate the industries and numbers of employees they cover) to inform the yearly population estimates. However, initial analyses of these data suggested that further work is required before it would be appropriate to apply the data collected in these surveys to the OPRA numerator data. In particular, there are issues relating to the rapidly changing patient coverage (i.e. contracts for provision of services change frequently) for OPs, and this has become more of an issue recently compared to earlier eras (e.g. when Corbett McDonald's denominator study was undertaken) [14]. In view of this, after careful consideration, it was decided that the best option for the current round of analyses would be to include data from the LFS as the population offset in the MLM for OPRA (as for the other schemes). It was agreed that, since we are estimating relative incidence (not absolute incidence) from the current analyses, including data from the LFS would be a reasonable thing to do if it is assumed that the relationship between the size of the population with access to an OPRA reporter and the size of total working population (LFS) has remained fairly stable over the study period (e.g. if the total percentage of the UK working population covered by OPRA has remained around 12%). Thus:

Given years 1,2,3,… with corresponding true population P1, P2, P3,.. and LFS population L1, L2, L3,..

then for trend estimation it is valid to use L provided that the change in L e.g. L2/L1 is the same as change in P e.g. P2/P1

It was agreed with HSE that this approach would be acceptable for the time being as long as it is made very clear that this assumption has been made. Further work is being undertaken to address this issue.

2.8 SENSITIVITY ANALYSES

In addition to the 'main' estimates of trend provided in Section 3.2, this report also includes an update on recent work undertaken to investigate the issue of reporter fatigue within THOR (Appendix A). Specifically, the work included here describes efforts undertaken to determine whether reporter fatigue, manifesting as an excess of zero returns, is present within the THOR data, and if so, how this can best be modelled. Importantly, it was agreed, with the HSE, that for the present round of analyses, the 'main' trends estimates presented in Section 3.2 would not be adjusted in light of the findings outlined in Appendix A but that there would, instead, be an attempt to link the two areas of work in the discussion.

The work undertaken to investigate excess zeros is part of a wider programme of work, consisting of a number of work packages investigating specific issues pertaining to THOR trends and incidence estimation [15], and for which additional HSE funding was obtained, further results from which will be presented on in due course.

In addition to the investigation of reporter fatigue, the impact on the trends estimates of including population as an offset in the MLM was investigated, with additional analyses carried out without this offset.

3 RESULTS

3.1 OVERVIEW OF SCHEMES

An overview of the reporting activity of the physicians participating in EPIDERM, SWORD, OPRA and THOR-GP is provided in Appendix B and described below.

3.1.1 EPIDERM

Response rates (cards returned/cards sent out) were high for both core and sample groups (91% and 77%, respectively)(Table B1). For each reporter, the percentage of returned cards which were blank was also calculated; on average this was 16% among core reporters and 63% for sample reporters. The number of reporters in EPIDERM by year and type is shown in Figure B2, whilst Figure B3 shows the number of active reporters per month and Figure B4 the number of cases per active reporter per month. Overall, reporter numbers have remained relatively steady over the last 15 years with an average of 33 active reporters per month and 92 cases per month. The majority of the diagnoses reported to EPIDERM were contact dermatitis (CD) (81%) which were subdivided into allergic CD (37% of total CD cases), irritant CD (44%), mixed CD (15%) and unclear (4%). The remainder of the cases comprised contact urticaria (5%), neoplasia (12%) and 2% 'other' skin disease (Table B2). On average, core reporters reported more cases per active reporter per month than sample reporters; mean cases per active reporter per month were 0.91 for sample reporters and 3.79 for core reporters.

3.1.2 SWORD

During the study period (1999-2010), there were a total of 778 reporters (733 active) in SWORD, with response rates of 86% and 77% for the core and sample groups respectively (Table B3). The percentage of returns that were zero returns (i.e. no cases to report) was slightly higher than that seen for EPIDERM, at 29% for the core group and 71% for the sample group. As indicated in Figure B5, four reporters were responsible for approximately 50% of the actual cases reported during this period. Reporter numbers have been relatively steady throughout the study period, with a gradual increase until 2007 followed by a small, gradual drop (Figure B6). Similarly, the number of active reporters per

month appears to have remained relatively stable during the earlier years, with a small decrease during 2010 (Figure B7). This is reflected in the mean cases per active reporter per month (Figure B8). The majority of the actual diagnoses (43%) reported to SWORD during the study period were benign pleural plaques (Table B4). Of the remaining cases 20% were mesothelioma, 19% asthma, 7% pneumoconiosis, and 11% 'other' respiratory disease. Taking the time period as a whole, the mean cases per active reporter per month was 1.54 cases. Core reporters reported 80% of the total cases with a mean of 3.26 cases per active reporter per month, compared to 0.49 cases per active reporter per month by sample reporters.

3.1.3 OPRA

As shown in Table B5, the reporter participation rates for the occupational physicians were high for both the core (86%) and sample reporters (81%) with only 1 core reporter never having returned at least one case during the study period and 252 sample reporters having never returned a case. Figure B9 indicates that approximately 50% of the cases were reported by 51 reporters. Although the number of occupational physicians reporting to OPRA has fallen since 1999 (Figure B10) the number of active reporters per month has increased since the introduction of core reporting in 2004 (Figure B11), although this has also began to decline in recent years. Overall, the mean case per active reporter per month during the study period was 2.22 (Figure B12). The majority of the cases reported to OPRA (63%) over the last 15 years were reported by sample reporters but the core reporters reported more cases per active reporter per month than the sample reporters (3.14 and 1.95 cases, respectively) (Table B6). Overall, mental ill-health comprised the greatest proportion of reported cases (43%), followed by musculoskeletal disorders (39%), skin (10%), and respiratory (4%).

3.1.4 THOR-GP

The reporting activity for THOR-GP during the period 2006-2010 is provided in Table B7. During this period a total of 653 reporters have participated, the majority of these as core reporters (note: for the purpose of trends analyses physicians are assigned new reporter status if they change from core to sample reporting or vice versa). The results in Table B7 show the activity of the core and sample reporters with 75% of both the core reporters and

sample reporters considered active over this period. There was a much greater response rate amongst the sample reporters (74%, as opposed to core reporters, 58%), and of those that did respond fewer were with blank returns (29%, as opposed to core reporters, 60%).

Figure B13 shows the percentage of actual cases by percentage of reporters for SWORD, EPIDERM, OPRA and THOR-GP. The results show that for THOR-GP, approximately 17% of reporters were responsible for 50% of cases. This compares to 7% of reporters for OPRA, 4% for EPIDERM and 1% for SWORD.

The number of active reporters per month decreased considerably in 2010, with the already discussed move to a much greater proportion of sample reporters (Figure B15). There had been a general decrease of the number of cases per active reporter per month (Figure B16) until 2010 which saw a sharp increase (coinciding with the move to predominantly sample reporting). The majority of the 4969 actual cases reported between 2006 and 2010 were musculoskeletal disorders (53%) and mental ill-health diagnoses (32%). The remaining cases included skin (10%), and respiratory (2%) diagnoses.

3.2 TIME TRENDS BY DISEASE CATEGORY

Presentation of results

This report follows the approach first adopted in the trends report submitted to HSE in September 2010 [6], in that the statistical uncertainty (confidence intervals) in the graphs illustrating time trends are presented in such a way as to allow the reader to assess the significance of the difference between any two years. This approach suggested by the HSE liaison officer when steering the research follows the method described by Firth and de Menezes [16] which assigns a confidence (or comparison) interval to the reference category (2010 in the present analyses) and reduces the width of the confidence (comparison) intervals of non-reference categories in such a way that all pairwise comparisons between years can validly be made using these adjusted confidence intervals. This approach improves on the conventional way of presenting this kind of information (which we have used prior to 2010) which is to choose one year as the "reference year" and show the estimated relative levels of other years in relation to this reference year together with confidence intervals reflecting the statistical uncertainty of these estimates. A reader wanting to assess the significance of the difference between two non-reference years cannot do so using these conventional confidence intervals, because these intervals both include a component of uncertainty belonging to the reference year.

Because of concerns about possible variation in the effective coverage of the schemes from year to year, we did not attempt (in the current round of analyses) to convert the estimated case numbers directly into an absolute incidence rate. These coverage effects were controlled for in the modelling process described above, and we were left with measures of the relative incidence levels in different years.

3.2.1 TOTAL WORK-RELATED ILL-HEALTH

The average annual percentage change in risk of total work-related ill-health, as reported to OPRA and THOR-GP is shown in Table 3 whilst the relative rates by year are shown in Table 4 and Figure 1. For the period 1996-2010, an overall relatively flat trend was observed for OPRA with a similar trend observed when using data from all reporters and when using data from sample reporters only. When the data was restricted to the period 2006-2010 (to enable a comparison with THOR-GP), a significant downward trend was observed for OPRA. However, the average annual decrease observed for THOR-GP over the same time period was much larger (approximately 12% compared to 3%). The graphs showing relative rates by year for THOR-GP suggest a slight increase in incidence in 2010 compared to the previous year. However, the confidence intervals for the 2010 estimate are wider than previous years (reflecting the move to a greater proportion of sample reporters) and overlap previous years. Restricting the THOR-GP analyses to cases reported by core reporters only has little impact on the trend estimate. Core reporting in OPRA commenced in 2004. Analyses based on all data from this subset of reporters (2004-2010) suggested a significant downward trend which remained relatively unchanged when the data were restricted to the period 2006-2010.

Table 3 Average annual percentage change in risk in total work-related illness

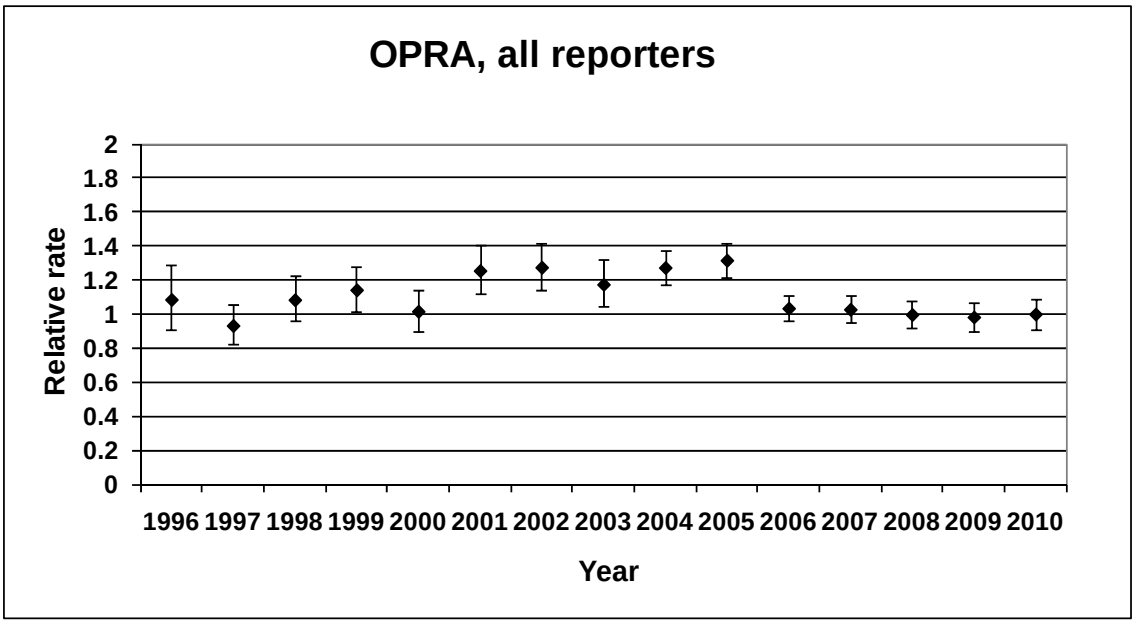
		ESTIMATED % CHANGE (95% CONFIDENCE INTERVAL)	
Reporters	**Year (continuous)**	**OPRA**	**THOR-GP**
All	**1996-2010**	-0.9 (-1.8, 0.0)	N/A
	2006-2010	-2.6 (-4.9, -0.1)	-12.3 (-14.8, -9.7)
Core	**2004-2010**	-5.7 (-7.5, -3.8)	N/A
	2006-2010	-3.3 (-6.0, -0.5)	-12.2 (-14.8, -9.6)
Sample	**1996-2010**	0.2 (-0.8, 1.1)	N/A

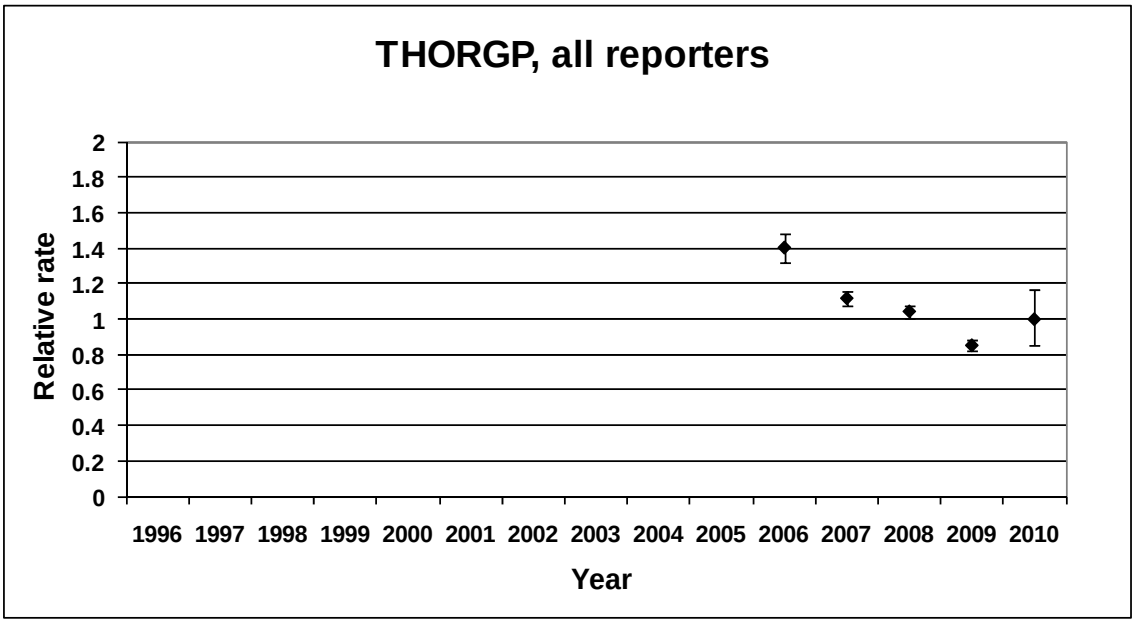
Table 4 Relative rates by year, with 95% comparison intervals, total work-illness (2010 estimate = 1)

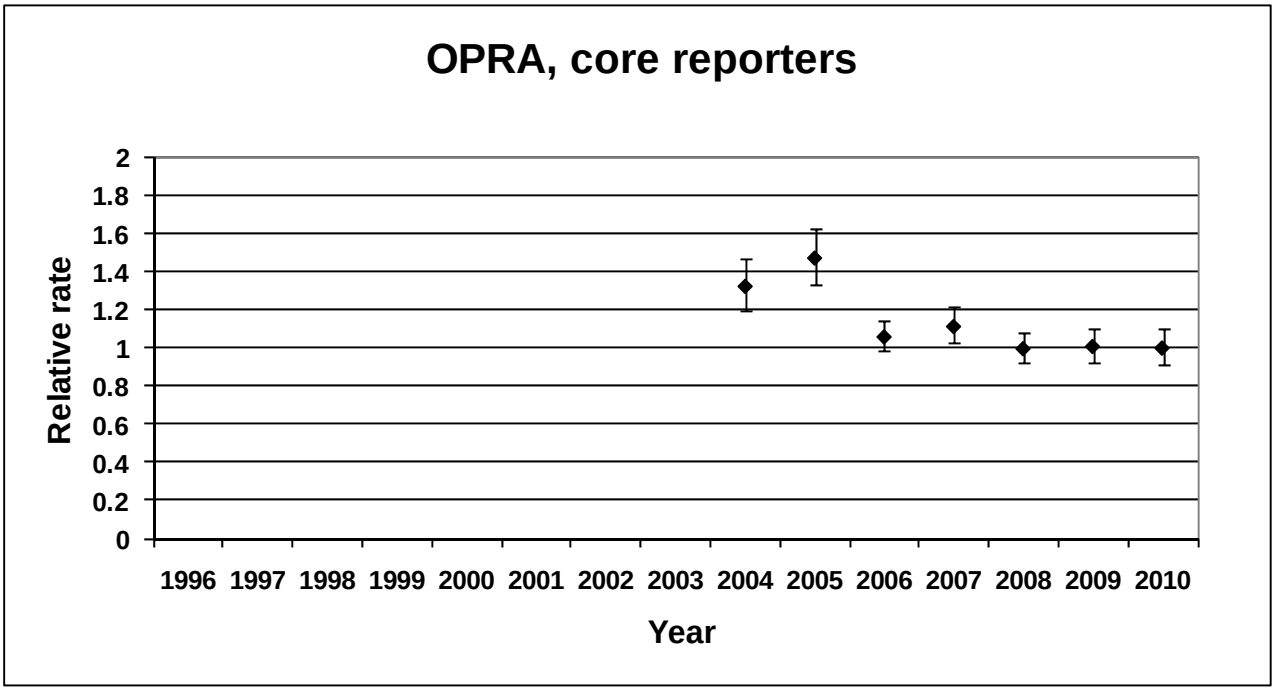
		Relative rates (95% comparison interval)	
		OPRA	**THORGP**
Reporter Group	**Year**		
All	**1996**	1.08 (0.91, 1.30)	/
	1997	0.93 (0.82, 1.06)	/
	1998	1.08 (0.96, 1.23)	/
	1999	1.14 (1.02, 1.28)	/
	2000	1.02 (0.90, 1.14)	/
	2001	1.25 (1.12, 1.40)	/
	2002	1.27 (1.14, 1.42)	/
	2003	1.17 (1.04, 1.32)	/
	2004	1.27 (1.17, 1.38)	/
	2005	1.31 (1.22, 1.42)	/
	2006	1.03 (0.96, 1.12)	1.40 (1.32, 1.48)
	2007	1.03 (0.95, 1.11)	1.12 (1.08, 1.16)
	2008	1.00 (0.92, 1.08)	1.04 (1.01, 1.08)
	2009	0.98 (0.90, 1.07)	0.85 (0.82, 0.89)
	2010	1.00 (0.91, 1.09)	1.00 (0.86, 1.17)
Core	**1996**	/	/
	1997	/	/
	1998	/	/
	1999	/	/
	2000	/	/
	2001	/	/
	2002	/	/
	2003	/	/
	2004	1.32 (1.19, 1.46)	/
	2005	1.47 (1.33, 1.63)	/
	2006	1.06 (0.98, 1.14)	1.36 (1.27, 1.45)
	2007	1.11 (1.02, 1.21)	1.09 (1.03, 1.15)
	2008	1.00 (0.92, 1.08)	1.01 (0.95, 1.07)
	2009	1.01 (0.92, 1.10)	0.83 (0.77, 0.89)
	2010	1.00 (0.91, 1.10)	1.00 (0.85, 1.18)
Sample	**1996**	0.98 (0.83, 1.18)	/
	1997	0.85 (0.75, 0.95)	/
	1998	0.98 (0.87, 1.10)	/
	1999	1.04 (0.93, 1.16)	/
	2000	0.93 (0.83, 1.04)	/
	2001	1.14 (1.02, 1.27)	/
	2002	1.15 (1.04, 1.28)	/
	2003	1.07 (0.95, 1.20)	/
	2004	1.17 (1.04, 1.32)	/
	2005	1.11 (0.98, 1.26)	/
	2006	0.98 (0.85, 1.12)	/
	2007	0.84 (0.73, 0.97)	/
	2008	1.00 (0.86, 1.16)	/
	2009	0.91 (0.77, 1.07)	/
	2010	1.00 (0.84, 1.19)	/

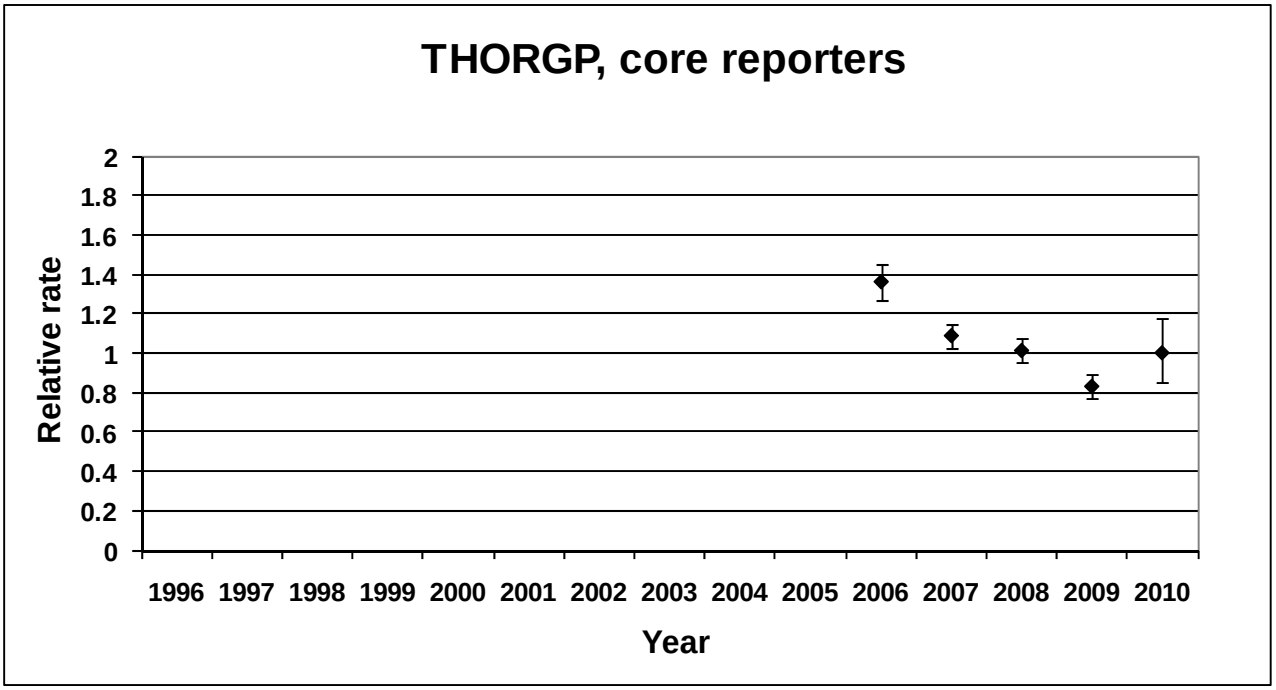
Models adjusted for reporter type (where appropriate), season and harvesting Population offset included in the model

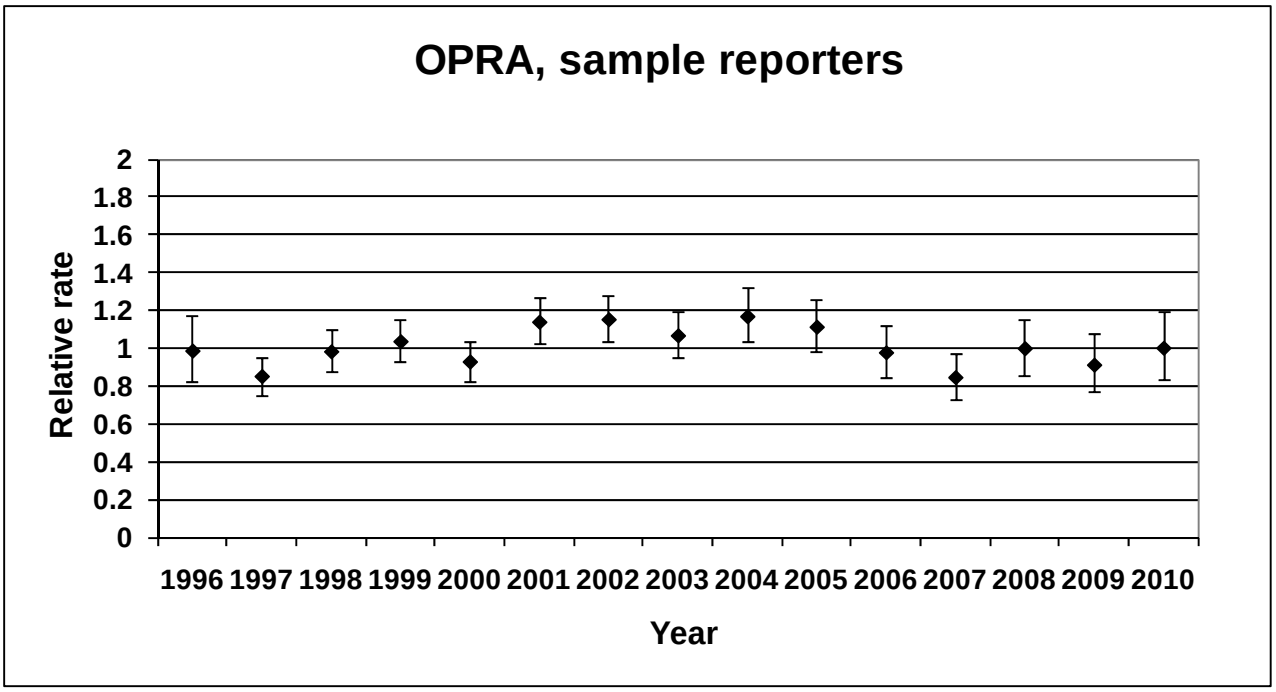
Figure 1 **Relative rates by year, with 95% comparison intervals, total work-related ill-health (2010 estimate = 1)**






OPRA, core reporters
Relative rate
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010
Year


THORGP, core reporters
Relative rate
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010
Year


OPRA, sample reporters
Relative rate
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010
Year

3.2.2 WORK-RELATED SKIN DISEASE

The average annual percentage change in risk of work-related skin disease, as reported by dermatologists (EPIDERM), OPs (OPRA) and GPs (THOR-GP) is shown in Table 5 whilst the relative rates by year are shown in Tables 6 to 13 and Figures 2 to 9. For the period 1996-2010, data from both dermatologists and OPs suggested a downward trend in the incidence of work-related skin disease, with a steeper decrease reported by the latter group. The graphs showing relative rates by year suggested that for both dermatologists and OPs much of the decrease occurred in the earlier part of the study period (<2005) with a comparative levelling out in later years (circa 2006 onwards). In particular, for OPs the data suggested a large drop in incidence between 1996 and 1997. Restricting the data to the period 2006-2010 (enabling a direct comparison between dermatologists, OPs and GPs) suggested a steeper decrease for THOR-GP compared to EPIDERM and OPRA. The graph of relative rates by year for THOR-GP showed a relatively flat trend for the period 2006-2008 followed by a fall in incidence in 2009 and then a slight increase in 2010. However, any apparent trend should be viewed with caution as results are based on relatively few cases (confidence intervals are overlapping for all years). There was little variation between the core and sample reporter groups.

The predicted trend for contact dermatitis (CD) was very similar to that observed for total work-related skin disease (unsurprising given that this diagnosis forms the vast majority of the skin reports). Further analyses by type of CD (for dermatologists only) showed some variation with a steeper decrease observed for allergic CD compared to irritant or mixed CD. Restricting the analyses to cases reported by core reporters had little effect on the observed trend for these CD sub-categories. However, when the analyses were restricted to data from dermatologists reporting on a sample basis, the average annual percentage decrease in incidence of irritant and mixed CD increased in magnitude to become more in line with that observed for allergic CD (4-5%).

The trend in incidence of both urticaria and neoplasia (dermatologists only) also suggested a fall in incidence over the study period. Of interest, some variation was

observed between the reporter types for these two categories, with significant downward trends predicted by the core reporters and either significant positive (neoplasia) or relatively flat (urticaria) trends predicted by the sample reporters.

For the purpose of this study, the group ‘other’ skin referred to all non CD cases (and therefore included all of the groups already discussed, other then CD). As expected from the individual group analyses, an overall downward trend was predicted for this group which was steeper for OPs compared to dermatologists. Some variation between core and sample reporters was observed for EPIDERM, but this was probably largely driven by the (already discussed) core and sample differences for neoplasia.

Table 5 Average annual percentage change in reported incidence in work-related skin disease

a) All reporters

		ESTIMATED % CHANGE (95% CONFIDENCE INTERVAL)		
	Year (continuous)	EPIDERM	OPRA	THOR-GP
Total skin	**1996-2010**	-3.4 (-4.0, -2.8)	-8.5 (-10.2, -6.7)	N/A
	2006-2010	0.4 (-2.4, 3.2)	0.1 (-7.4, 8.3)	-5.3 (-12.9, 2.8)
Contact dermatitis (CD)	**1996-2010**	-3.4 (-4.0, -2.8)	-8.4 (-10.3, -6.4)	N/A
	2006-2010	2.3 (-0.7, 5.4)	0.3 (-7.7, 9.1)	-4.8 (-13.3, 4.6)
Allergic CD	**1996-2010**	-5.5 (-6.4, -4.6)	N/A	N/A
Irritant CD	**1996-2010**	-1.5 (-2.4, -0.6)	N/A	N/A
Mixed CD	**1996-2010**	-2.4 (-3.8, -1.0)	N/A	N/A
Urticaria	**1996-2010**	-5.3 (-7.3, -3.2)	N/A	N/A
Neoplasia	**1996-2010**	-3.0 (-4.6, -1.5)	N/A	N/A
Other* skin	**1996-2010**	-3.1 (-4.3, -1.9)	-8.9 (-12.8, -4.9)	N/A

Models adjusted for reporter type (where appropriate), season and harvesting
***Other than contact dermatitis**

b) Core reporters

		ESTIMATED % CHANGE (95% CONFIDENCE INTERVAL)		
	Year (continuous)	EPIDERM	OPRA	THOR-GP
Total skin	**1996-2010**	-3.5 (-4.1, -2.9)	N/A	N/A
	2004-2010	-2.5 (-4.2, -0.8)	-5.4 (-11.3, 0.9)	N/A
	2006-2010	0.5 (-2.4, 3.5)	0.4 (-9.1, 10.9)	-4.2 (-11.9, 4.2)
Contact dermatitis (CD)	**1996-2010**	-3.2 (-3.9, -2.6)	N/A	N/A
	2004-2010	-1.6 (-3.5, 0.3)	-5.7 (-11.8, 0.9)	N/A
	2006-2010	2.3 (-0.9, 5.6)	2.2 (-8.0, 13.5)	-4.5 (-13.1, 5)
Allergic CD	**1996-2010**	-5.7 (-6.7, -4.8)	N/A	N/A
Irritant CD	**1996-2010**	-1.1 (-2.1, -0.1)	N/A	N/A
Mixed CD	**1996-2010**	-2.2 (-3.6, -0.7)	N/A	N/A
Urticaria	**1996-2010**	-5.6 (-7.7, -3.5)	N/A	N/A
Neoplasia	**1996-2010**	-4.5 (-6.1, -2.8)	N/A	N/A
Other* skin	**1996-2010**	-4.1 (-5.4, -2.9)	N/A	N/A
	2004-2010	-6.0 (-9.8, -2.1)	-2.6 (-17.4, 14.8)	N/A

Models adjusted for reporter type (where appropriate), season and harvesting
***Other than contact dermatitis**

c) Sample reporters

		ESTIMATED % CHANGE (95% CONFIDENCE INTERVAL)	
	Year (continuous)	**EPIDERM**	**OPRA**
Total skin	**1996-2010**	-2.6 (-4.5, -0.7)	-8.7 (-10.6, -6.8)
Contact dermatitis (CD)	**1996-2010**	-4.9 (-6.9, -2.8)	-8.6 (-10.6, -6.5)
Allergic CD	**1996-2010**	-3.9 (-6.7, -1.0)	N/A
Irritant CD	**1996-2010**	-4.8 (-7.8, -1.7)	N/A
Mixed CD	**1996-2010**	-5.2 (-9.9,-0.2)	N/A
Urticaria	**1996-2010**	0.0 (-8.0, 8.6)	N/A
Neoplasia	**1996-2010**	5.6 (1.5, 9.8)	N/A
Other* skin	**1996-2010**	3.2 (-0.1, 6.6)	-9.3 (-13.3, -5.2)

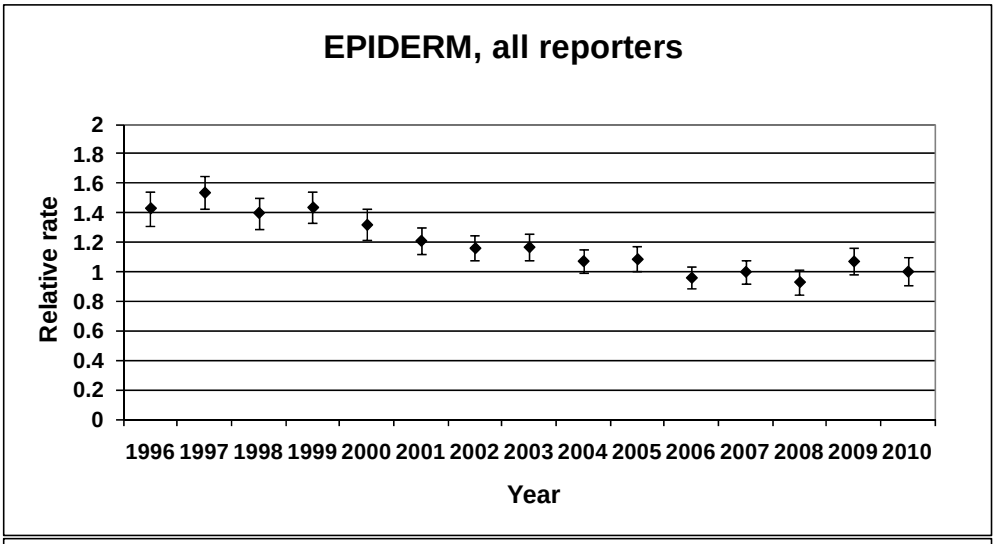
Models adjusted for reporter type (where appropriate), season and harvesting
***Other than contact dermatitis**

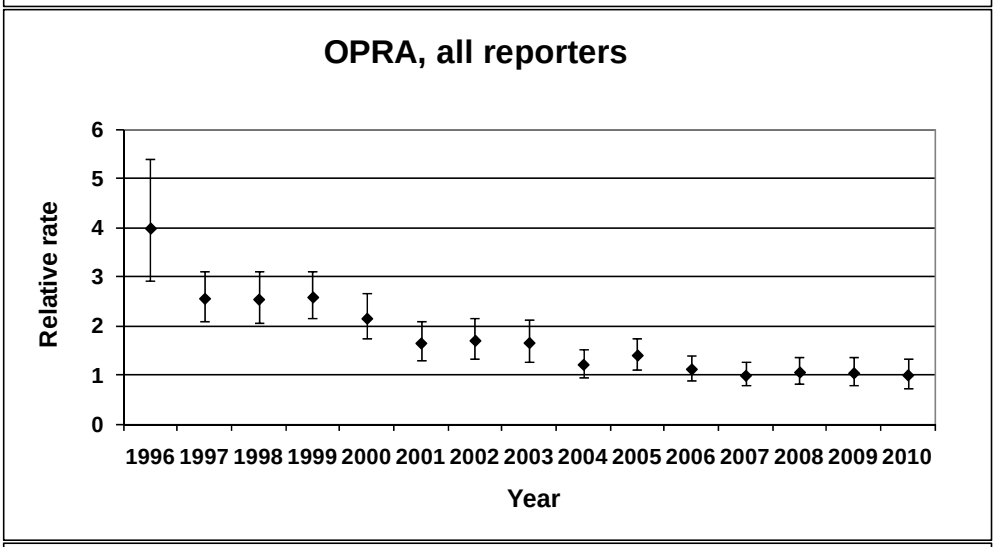
Table 6 Relative rates by year, with 95% comparison intervals, total skin disease (2010 estimate =1)

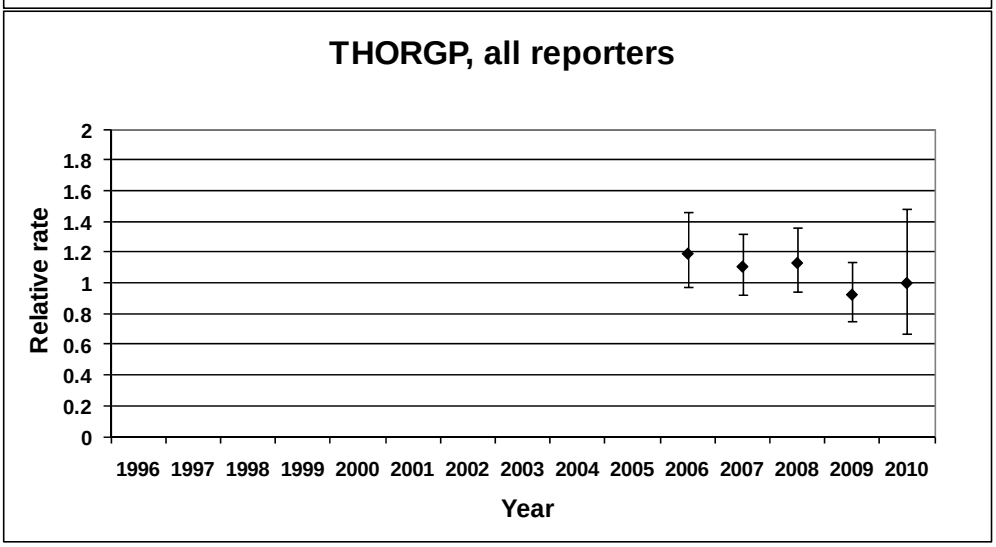
		Relative rates (95% comparison interval)		
		EPIDERM	**OPRA**	**THORGP**
Reporter Group	**Year**			
All	**1996**	1.43 (1.32, 1.55)	3.98 (2.93, 5.39)	/
	1997	1.53 (1.43, 1.65)	2.55 (2.11, 3.10)	/
	1998	1.40 (1.30, 1.51)	2.54 (2.07, 3.11)	/
	1999	1.43 (1.33, 1.54)	2.58 (2.15, 3.10)	/
	2000	1.32 (1.22, 1.42)	2.15 (1.74, 2.66)	/
	2001	1.21 (1.12, 1.30)	1.65 (1.29, 2.10)	/
	2002	1.16 (1.07, 1.25)	1.70 (1.34, 2.16)	/
	2003	1.17 (1.08, 1.26)	1.65 (1.29, 2.13)	/
	2004	1.07 (0.99, 1.15)	1.21 (0.96, 1.53)	/
	2005	1.08 (1.00, 1.17)	1.40 (1.12, 1.76)	/
	2006	0.96 (0.89, 1.04)	1.12 (0.90, 1.40)	1.19 (0.97, 1.46)
	2007	1.00 (0.92, 1.08)	0.99 (0.78, 1.26)	1.11 (0.93, 1.32)
	2008	0.93 (0.85, 1.02)	1.06 (0.82, 1.36)	1.13 (0.94, 1.36)
	2009	1.07 (0.98, 1.17)	1.04 (0.80, 1.36)	0.93 (0.75, 1.14)
	2010	1.00 (0.91, 1.10)	1.00 (0.75, 1.34)	1.00 (0.67, 1.48)
Core	**1996**	1.46 (1.34, 1.59)	/	/
	1997	1.54 (1.43, 1.66)	/	/
	1998	1.41 (1.30, 1.52)	/	/
	1999	1.44 (1.33, 1.56)	/	/
	2000	1.35 (1.24, 1.47)	/	/
	2001	1.21 (1.12, 1.31)	/	/
	2002	1.16 (1.07, 1.25)	/	/
	2003	1.20 (1.11, 1.29)	/	/
	2004	1.07 (0.99, 1.16)	1.33 (0.96, 1.85)	/
	2005	1.09 (1.00, 1.18)	1.77 (1.28, 2.45)	/
	2006	0.94 (0.86, 1.02)	1.21 (0.93, 1.58)	1.07 (0.87, 1.31)
	2007	1.01 (0.93, 1.11)	1.13 (0.85, 1.51)	1.00 (0.83, 1.20)
	2008	0.95 (0.87, 1.05)	1.21 (0.91, 1.62)	1.01 (0.85, 1.21)
	2009	1.07 (0.98, 1.17)	1.17 (0.86, 1.59)	0.84 (0.67, 1.05)
	2010	1.00 (0.90, 1.11)	1.00 (0.69, 1.44)	1.00 (0.65, 1.53)
Sample	**1996**	1.03 (0.76, 1.39)	3.30 (2.44, 4.46)	/
	1997	1.47 (1.14, 1.91)	2.13 (1.78, 2.56)	/
	1998	1.30 (1.03, 1.64)	2.12 (1.73, 2.60)	/
	1999	1.39 (1.13, 1.70)	2.16 (1.79, 2.61)	/
	2000	1.10 (0.87, 1.38)	1.80 (1.47, 2.20)	/
	2001	1.21 (0.97, 1.50)	1.38 (1.09, 1.75)	/
	2002	1.20 (0.96, 1.52)	1.43 (1.13, 1.81)	/
	2003	0.88 (0.68, 1.15)	1.39 (1.08, 1.78)	/
	2004	1.02 (0.81, 1.29)	1.05 (0.78, 1.41)	/
	2005	1.03 (0.81, 1.30)	1.10 (0.82, 1.49)	/
	2006	1.17 (0.94, 1.45)	0.99 (0.70, 1.39)	/
	2007	0.88 (0.68, 1.13)	0.79 (0.54, 1.15)	/
	2008	0.75 (0.55, 1.01)	0.84 (0.56, 1.26)	/
	2009	1.04 (0.79, 1.37)	0.86 (0.57, 1.31)	/
	2010	1.00 (0.75, 1.34)	1.00 (0.65, 1.54)	/

Models adjusted for reporter type (where appropriate), season and harvesting
Population offset included in the model

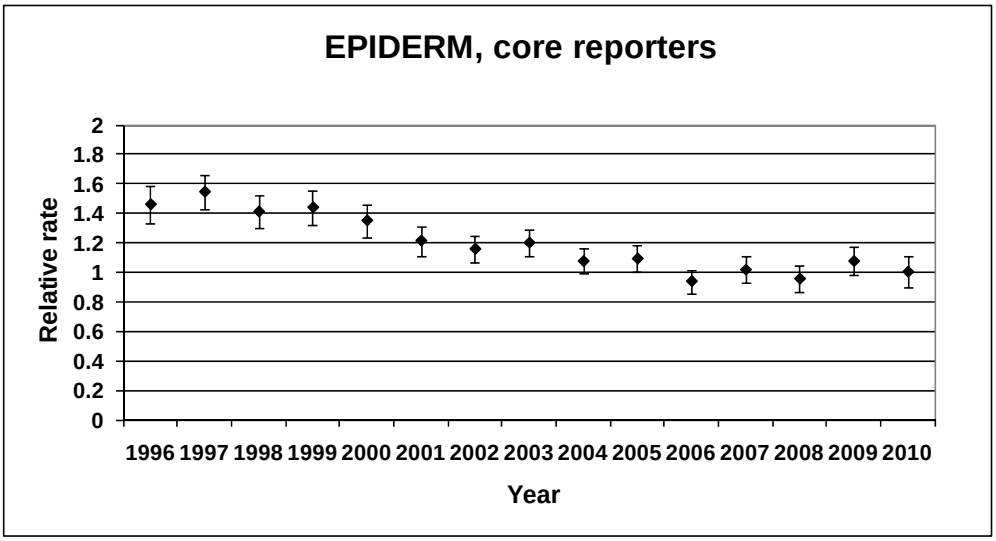
Figure 2 **Relative rates by year (2010 estimate = 1), with 95% comparison intervals, total skin**

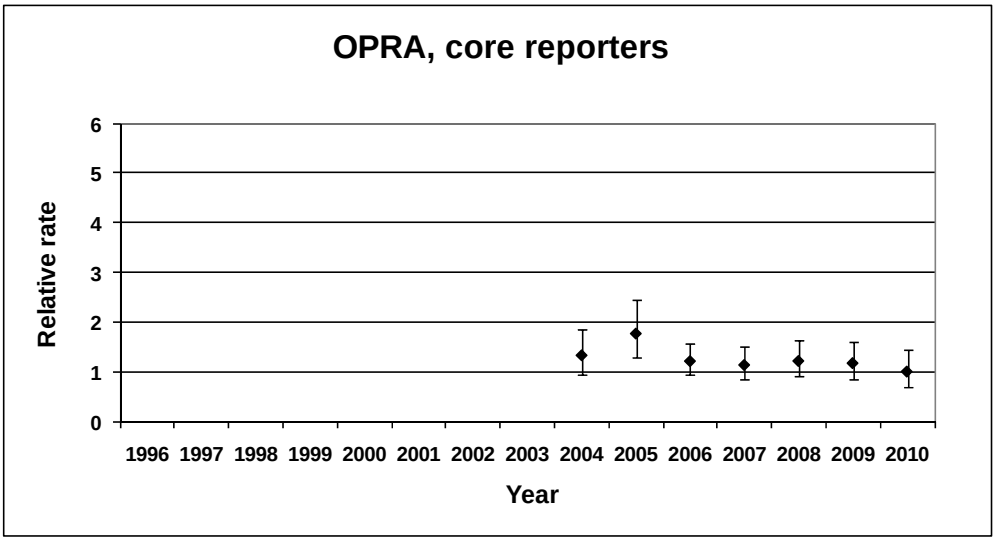


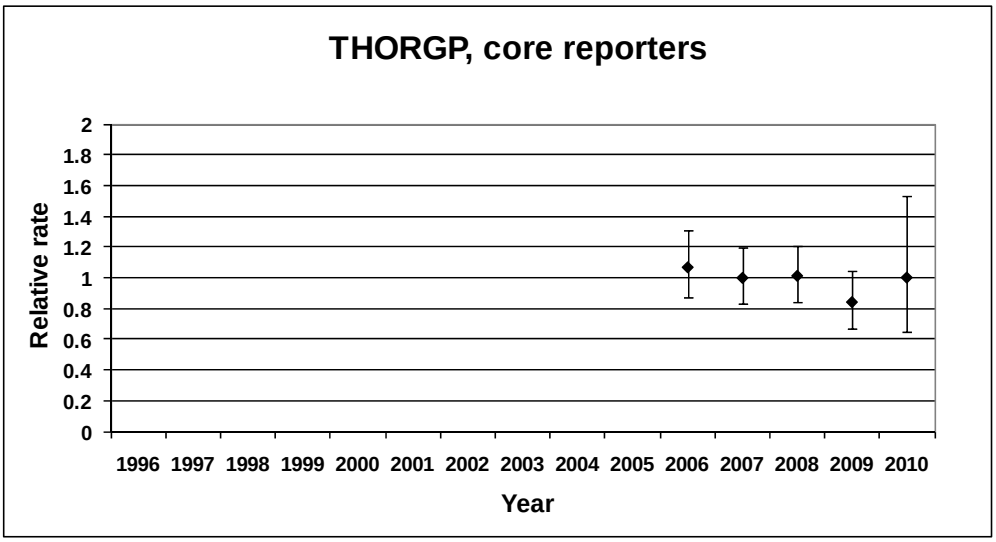




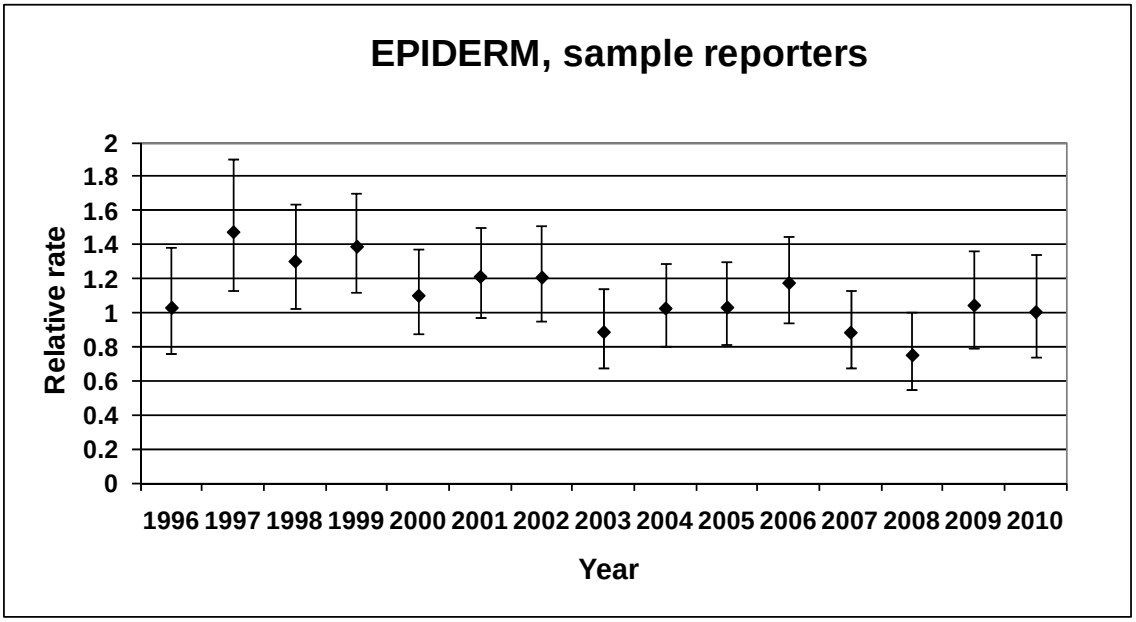
NOTE: OPRA figure has different y-axis scale

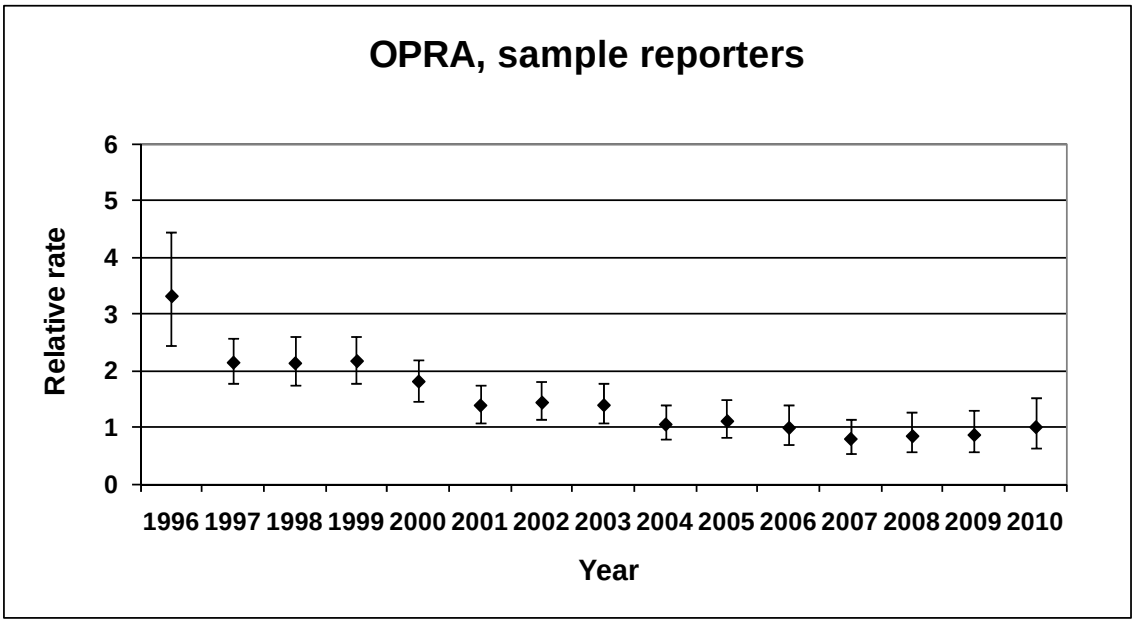






NOTE: OPRA figure has different y-axis scale





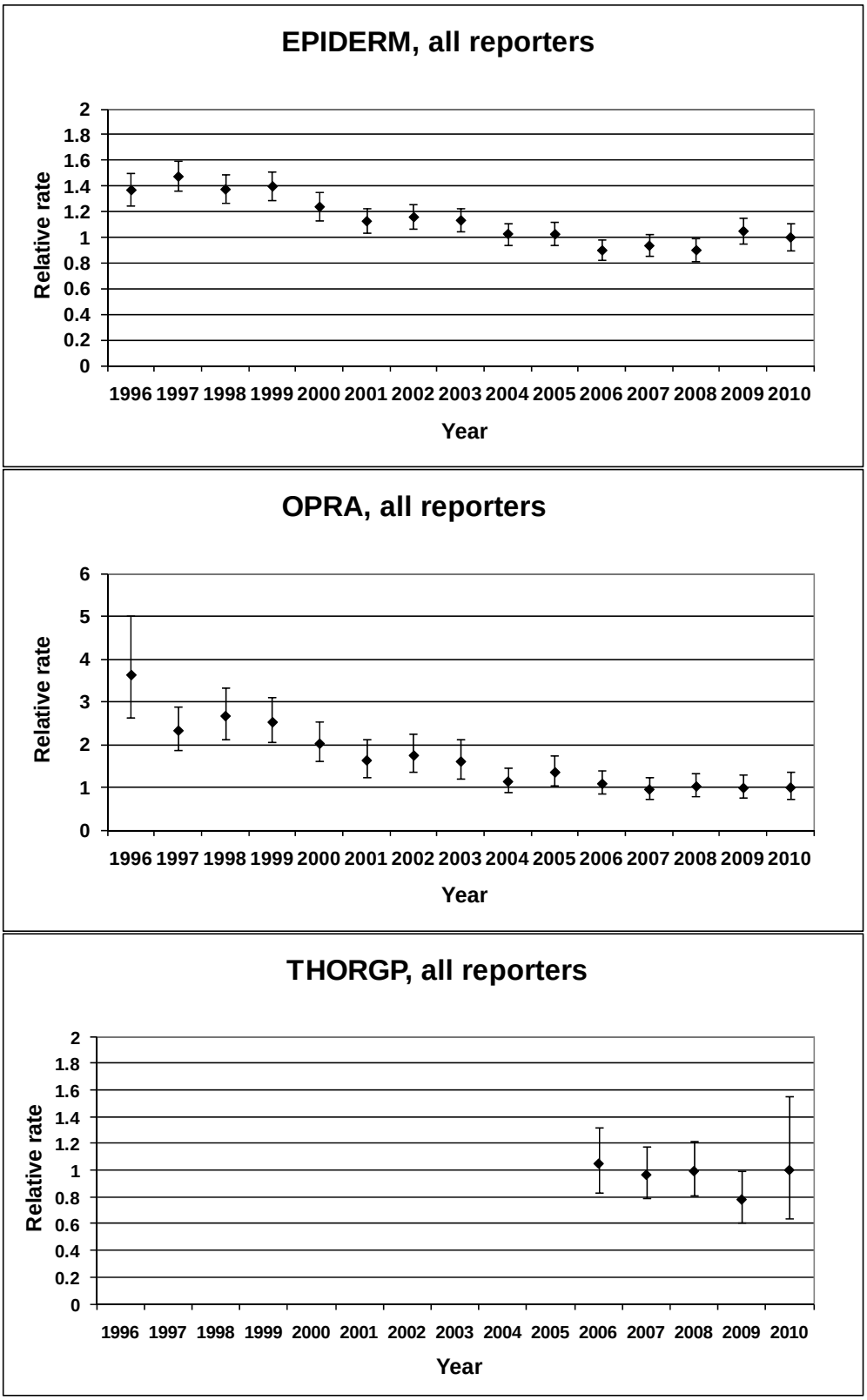
NOTE: OPRA figure has different y-axis scale

Table 7 Relative rates by year, with 95% comparison intervals, all contact dermatitis (2010 estimate =1)

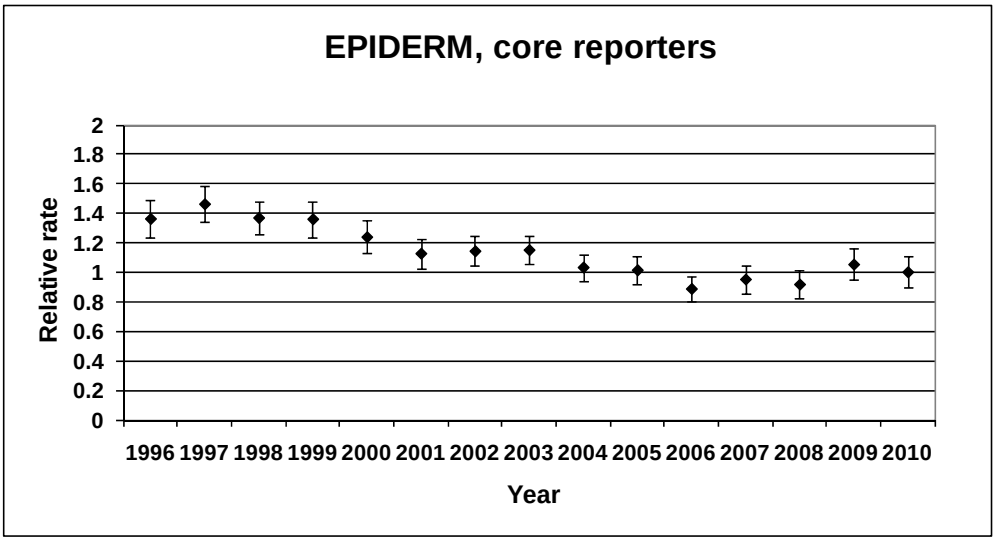
		Relative rates (95% comparison interval)		
		EPIDERM	**OPRA**	**THORGP**
Reporter Group	**Year**			
All	**1996**	1.37 (1.25, 1.50)	3.63 (2.62, 5.02)	/
	1997	1.48 (1.36, 1.60)	2.33 (1.88, 2.89)	/
	1998	1.38 (1.27, 1.49)	2.67 (2.14, 3.32)	/
	1999	1.40 (1.29, 1.52)	2.53 (2.05, 3.11)	/
	2000	1.24 (1.14, 1.35)	2.03 (1.61, 2.54)	/
	2001	1.13 (1.04, 1.23)	1.63 (1.25, 2.14)	/
	2002	1.16 (1.07, 1.26)	1.75 (1.35, 2.27)	/
	2003	1.13 (1.04, 1.23)	1.61 (1.22, 2.12)	/
	2004	1.03 (0.95, 1.12)	1.14 (0.89, 1.47)	/
	2005	1.03 (0.94, 1.12)	1.36 (1.06, 1.74)	/
	2006	0.90 (0.82, 0.98)	1.09 (0.86, 1.39)	1.05 (0.83, 1.32)
	2007	0.94 (0.85, 1.03)	0.96 (0.74, 1.24)	0.96 (0.79, 1.18)
	2008	0.90 (0.82, 0.99)	1.03 (0.79, 1.34)	0.99 (0.81, 1.22)
	2009	1.05 (0.95, 1.15)	0.99 (0.75, 1.31)	0.78 (0.61, 0.99)
	2010	1.00 (0.90, 1.11)	1.00 (0.74, 1.36)	1.00 (0.64, 1.55)
Core	**1996**	1.36 (1.24, 1.50)	/	/
	1997	1.46 (1.34, 1.59)	/	/
	1998	1.37 (1.26, 1.49)	/	/
	1999	1.36 (1.24, 1.48)	/	/
	2000	1.24 (1.13, 1.36)	/	/
	2001	1.13 (1.03, 1.23)	/	/
	2002	1.14 (1.05, 1.24)	/	/
	2003	1.15 (1.05, 1.25)	/	/
	2004	1.03 (0.95, 1.12)	1.23 (0.88, 1.72)	/
	2005	1.01 (0.92, 1.11)	2.02 (1.43, 2.86)	/
	2006	0.89 (0.81, 0.98)	1.10 (0.83, 1.46)	0.98 (0.78, 1.23)
	2007	0.95 (0.86, 1.05)	1.03 (0.76, 1.41)	0.89 (0.72, 1.10)
	2008	0.92 (0.83, 1.02)	1.19 (0.88, 1.61)	0.94 (0.77, 1.14)
	2009	1.05 (0.95, 1.16)	1.11 (0.80, 1.52)	0.71 (0.55, 0.91)
	2010	1.00 (0.90, 1.11)	1.00 (0.68, 1.47)	1.00 (0.62, 1.61)
Sample	**1996**	1.34 (0.96, 1.85)	2.95 (2.13, 4.08)	/
	1997	1.73 (1.31, 2.29)	1.91 (1.56, 2.33)	/
	1998	1.58 (1.22, 2.05)	2.19 (1.77, 2.70)	/
	1999	1.89 (1.53, 2.35)	2.07 (1.69, 2.54)	/
	2000	1.35 (1.06, 1.72)	1.66 (1.33, 2.08)	/
	2001	1.23 (0.95, 1.58)	1.35 (1.04, 1.75)	/
	2002	1.42 (1.10, 1.82)	1.45 (1.12, 1.86)	/
	2003	1.00 (0.75, 1.33)	1.32 (1.01, 1.73)	/
	2004	0.99 (0.75, 1.32)	0.97 (0.70, 1.36)	/
	2005	1.16 (0.89, 1.51)	0.91 (0.65, 1.29)	/
	2006	1.10 (0.84, 1.43)	1.04 (0.73, 1.48)	/
	2007	0.80 (0.59, 1.09)	0.81 (0.55, 1.20)	/
	2008	0.75 (0.53, 1.05)	0.78 (0.51, 1.21)	/
	2009	1.01 (0.73, 1.38)	0.80 (0.50, 1.27)	/
	2010	1.00 (0.72, 1.40)	1.00 (0.64, 1.57)	/

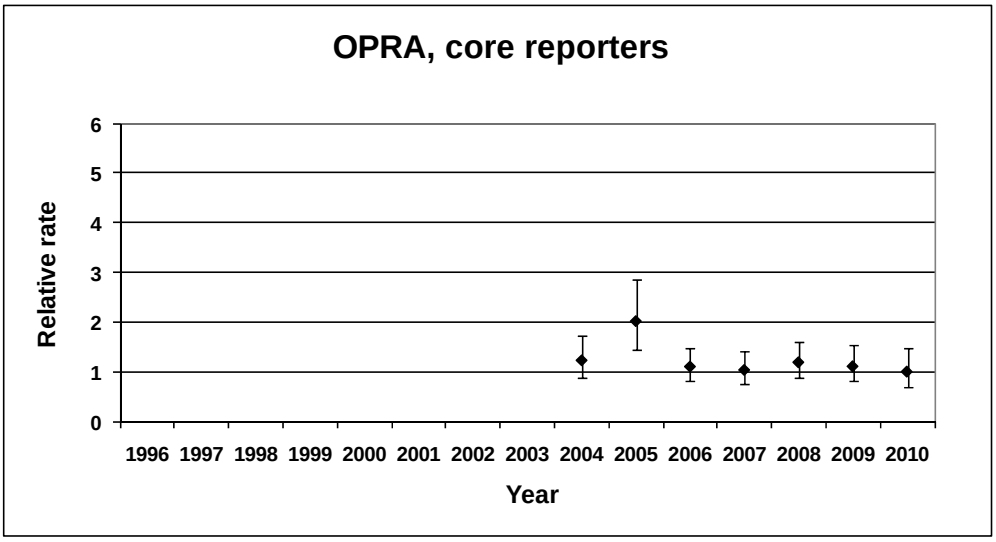
Models adjusted for reporter type (where appropriate), season and harvesting
Population offset included in the model

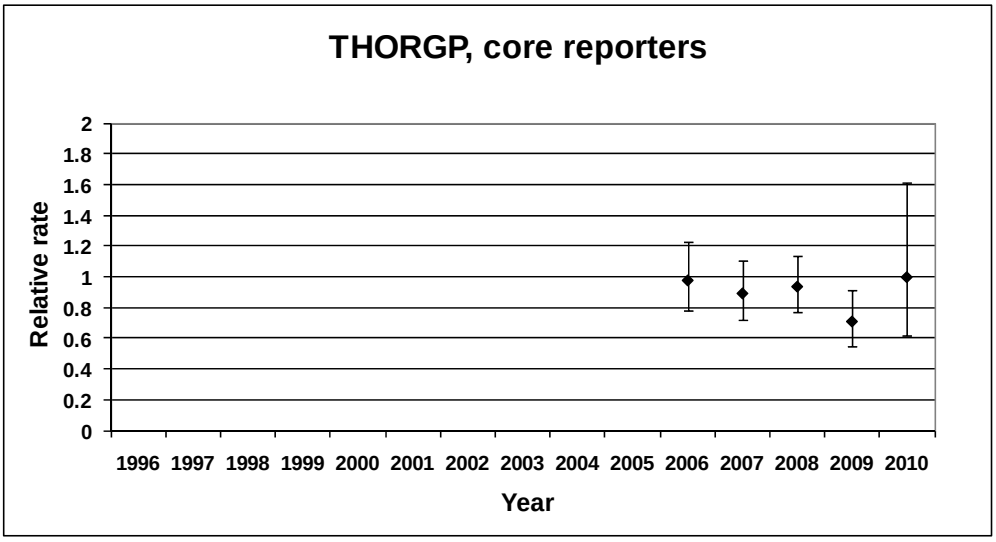
Figure 3 **Relative rates by year (2010 estimate = 1), with 95% comparison intervals, contact dermatitis**



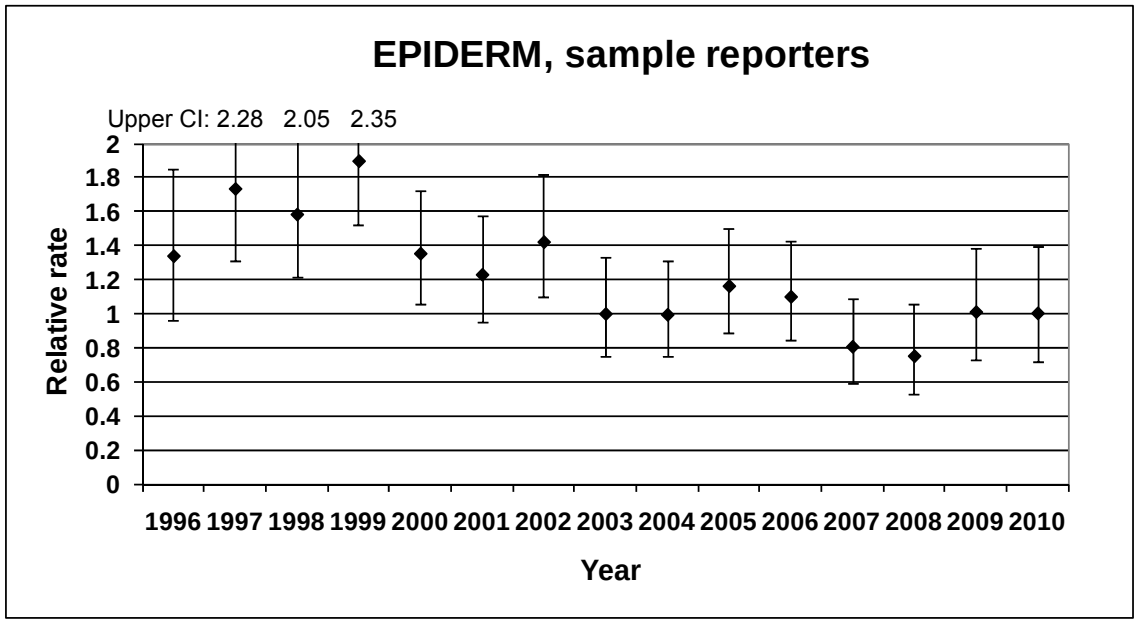
NOTE: OPRA figure has different y-axis scale

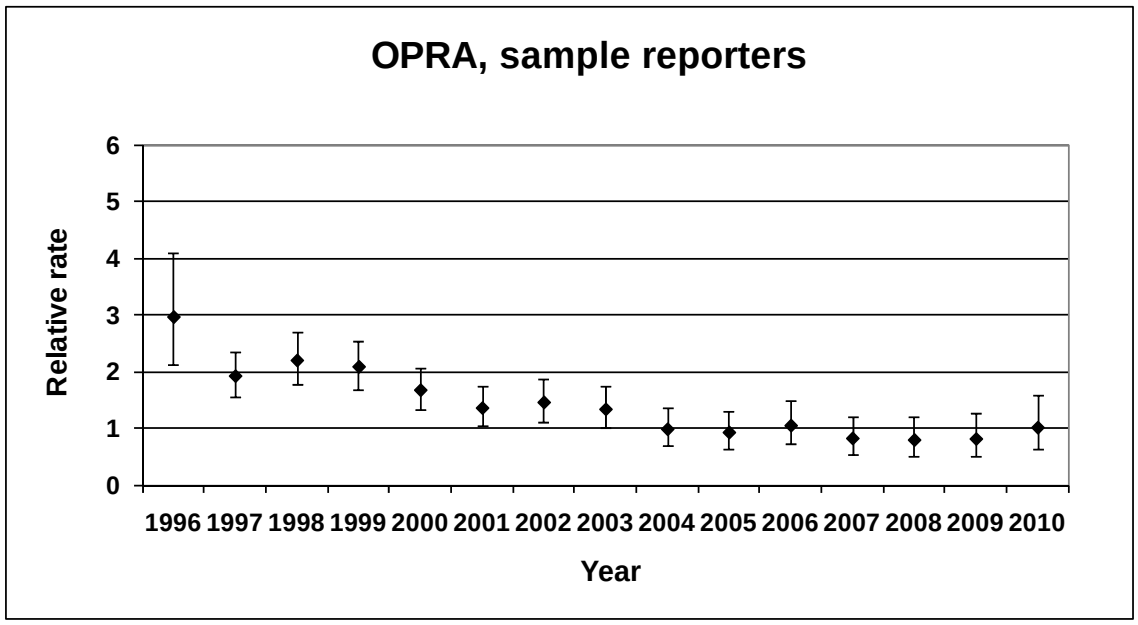






NOTE: OPRA figure has different y-axis scale





NOTE: OPRA figure has different y-axis scale

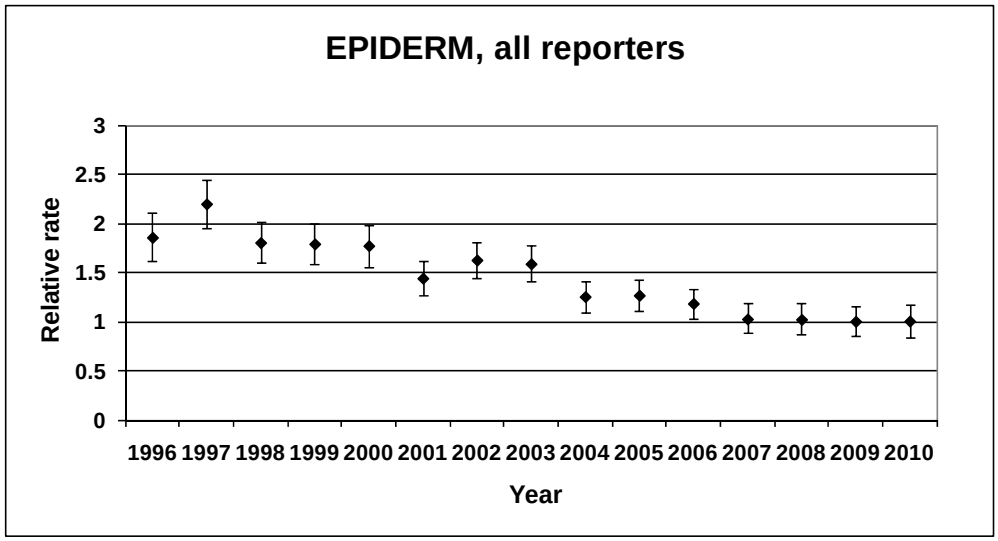
Table 8 Relative rates by year, with 95% comparison intervals, allergic contact dermatitis (2010 estimate =1)

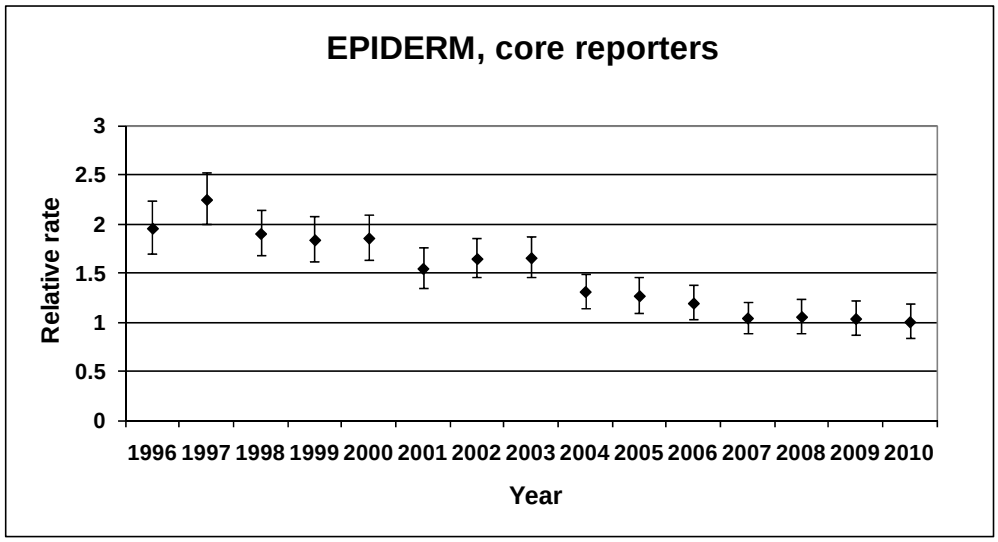
		Relative rates (95% comparison interval)
		EPIDERM
Reporter Group	**Year**	
All	**1996**	1.85 (1.62, 2.11)
	1997	2.19 (1.96, 2.44)
	1998	1.79 (1.60, 2.02)
	1999	1.78 (1.59, 2.00)
	2000	1.76 (1.56, 1.99)
	2001	1.43 (1.26, 1.63)
	2002	1.62 (1.44, 1.81)
	2003	1.58 (1.41, 1.78)
	2004	1.25 (1.10, 1.41)
	2005	1.26 (1.11, 1.44)
	2006	1.18 (1.03, 1.34)
	2007	1.02 (0.88, 1.18)
	2008	1.02 (0.87, 1.18)
	2009	1.00 (0.85, 1.17)
	2010	1.00 (0.85, 1.18)
Core	**1996**	1.95 (1.71, 2.24)
	1997	2.25 (2.01, 2.52)
	1998	1.90 (1.68, 2.15)
	1999	1.84 (1.62, 2.08)
	2000	1.85 (1.64, 2.10)
	2001	1.54 (1.35, 1.76)
	2002	1.64 (1.46, 1.86)
	2003	1.65 (1.46, 1.87)
	2004	1.31 (1.15, 1.49)
	2005	1.27 (1.10, 1.46)
	2006	1.19 (1.03, 1.37)
	2007	1.04 (0.89, 1.21)
	2008	1.05 (0.89, 1.24)
	2009	1.03 (0.87, 1.22)
	2010	1.00 (0.84, 1.19)
Sample	**1996**	1.29 (0.83, 2.01)
	1997	1.86 (1.29, 2.68)
	1998	1.17 (0.78, 1.75)
	1999	1.53 (1.09, 2.16)
	2000	1.30 (0.93, 1.83)
	2001	0.81 (0.53, 1.22)
	2002	1.53 (1.10, 2.14)
	2003	1.16 (0.80, 1.68)
	2004	0.88 (0.58, 1.34)
	2005	1.25 (0.88, 1.77)
	2006	1.13 (0.78, 1.62)
	2007	0.92 (0.61, 1.39)
	2008	0.82 (0.52, 1.29)
	2009	0.78 (0.47, 1.28)
	2010	1.00 (0.62, 1.61)

Models adjusted for reporter type (where appropriate), season and harvesting

Population offset included in the model

Figure 4 Relative rates by year (2010 estimate = 1), with 95% comparison intervals, allergic contact dermatitis





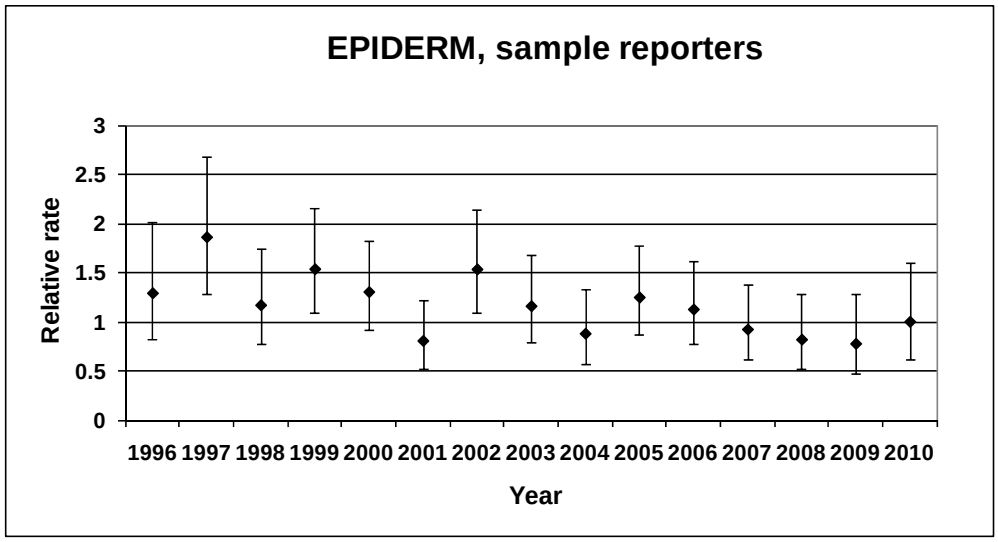


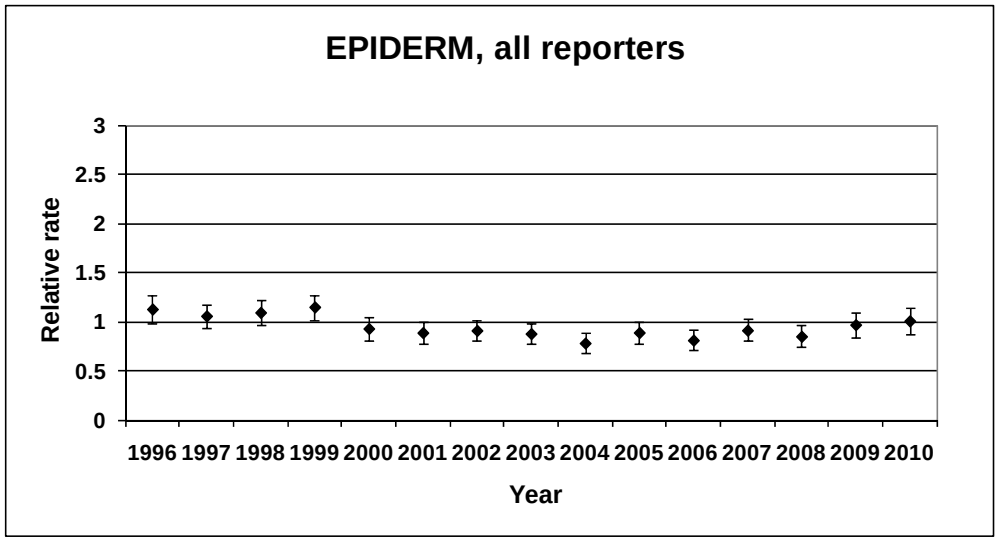
Table 9 Relative rates by year, with 95% comparison intervals, irritant contact dermatitis (2010 estimate =1)

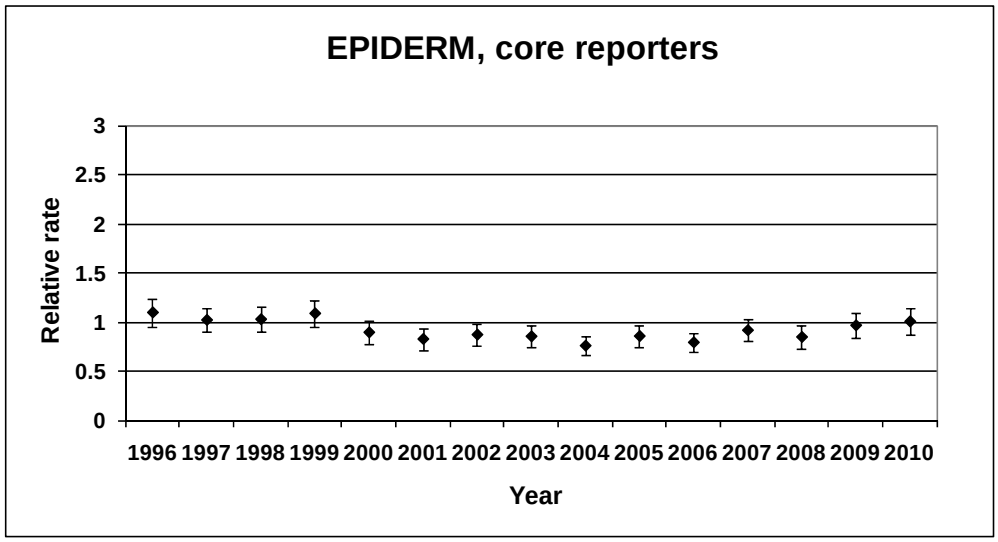
		Relative rates (95% comparison interval)
		EPIDERM
Reporter Group	**Year**	
All	**1996**	1.12 (0.98, 1.27)
	1997	1.05 (0.93, 1.18)
	1998	1.08 (0.97, 1.22)
	1999	1.14 (1.01, 1.28)
	2000	0.92 (0.81, 1.05)
	2001	0.88 (0.78, 1.00)
	2002	0.91 (0.80, 1.02)
	2003	0.87 (0.77, 0.99)
	2004	0.78 (0.69, 0.88)
	2005	0.88 (0.78, 1.00)
	2006	0.81 (0.71, 0.92)
	2007	0.91 (0.80, 1.03)
	2008	0.85 (0.74, 0.97)
	2009	0.96 (0.85, 1.09)
	2010	1.00 (0.88, 1.14)
Core	**1996**	1.09 (0.96, 1.25)
	1997	1.02 (0.90, 1.15)
	1998	1.02 (0.91, 1.15)
	1999	1.08 (0.96, 1.22)
	2000	0.89 (0.77, 1.02)
	2001	0.82 (0.72, 0.94)
	2002	0.87 (0.76, 0.98)
	2003	0.85 (0.75, 0.96)
	2004	0.75 (0.66, 0.86)
	2005	0.85 (0.75, 0.97)
	2006	0.79 (0.69, 0.90)
	2007	0.91 (0.80, 1.03)
	2008	0.84 (0.73, 0.97)
	2009	0.96 (0.84, 1.10)
	2010	1.00 (0.87, 1.14)
Sample	**1996**	1.11 (0.61, 2.00)
	1997	1.53 (0.93, 2.52)
	1998	2.19 (1.53, 3.14)
	1999	2.12 (1.50, 2.98)
	2000	1.55 (1.06, 2.27)
	2001	2.01 (1.43, 2.81)
	2002	1.65 (1.10, 2.45)
	2003	1.30 (0.84, 2.01)
	2004	1.20 (0.78, 1.87)
	2005	1.43 (0.95, 2.16)
	2006	1.38 (0.91, 2.08)
	2007	0.89 (0.55, 1.46)
	2008	0.94 (0.55, 1.62)
	2009	0.95 (0.54, 1.65)
	2010	1.00 (0.57, 1.74)

Models adjusted for reporter type (where appropriate), season and harvesting

Population offset included in the model

Figure 5 Relative rates by year (2010 estimate = 1), with 95% comparison intervals, irritant contact dermatitis





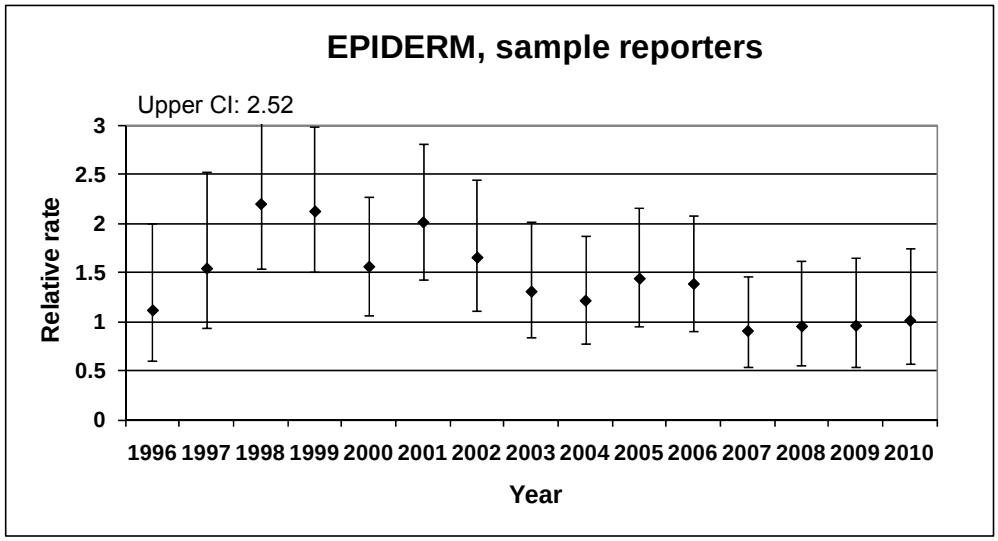


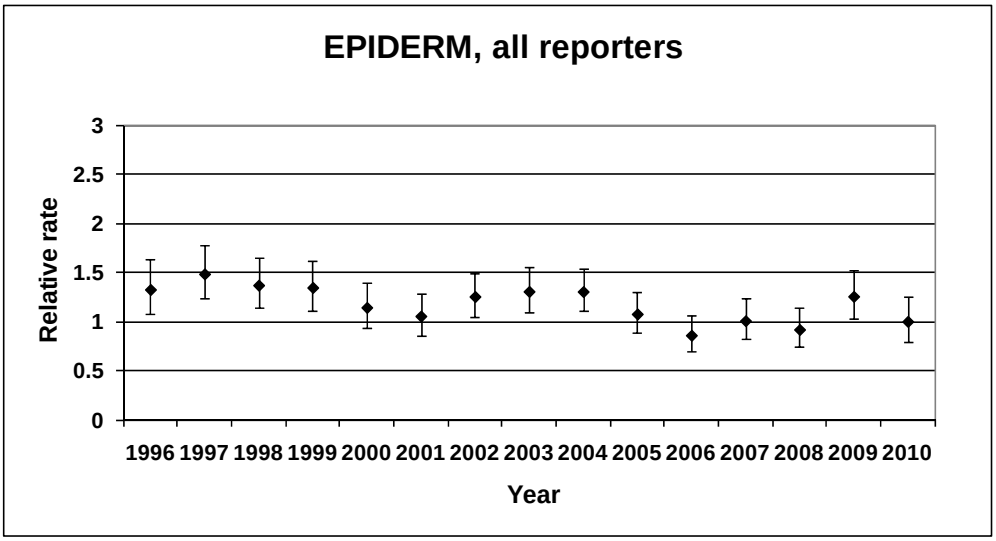
Table 10 Relative rates by year, with 95% comparison intervals, mixed contact dermatitis (2010 estimate =1)

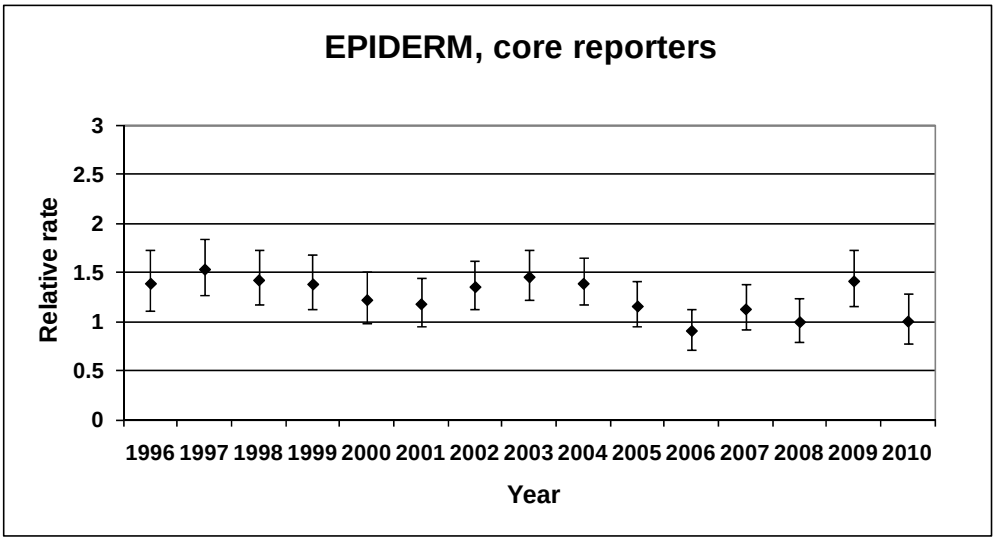
		Relative rates (95% comparison interval)
		EPIDERM
Reporter Group	**Year**	
All	**1996**	1.32 (1.07, 1.63)
	1997	1.48 (1.24, 1.77)
	1998	1.37 (1.14, 1.65)
	1999	1.34 (1.12, 1.62)
	2000	1.14 (0.93, 1.40)
	2001	1.05 (0.86, 1.29)
	2002	1.25 (1.05, 1.50)
	2003	1.30 (1.10, 1.55)
	2004	1.30 (1.11, 1.54)
	2005	1.08 (0.89, 1.30)
	2006	0.86 (0.70, 1.06)
	2007	1.01 (0.82, 1.23)
	2008	0.92 (0.74, 1.14)
	2009	1.25 (1.03, 1.53)
	2010	1.00 (0.80, 1.26)
Core	**1996**	1.39 (1.11, 1.73)
	1997	1.53 (1.27, 1.85)
	1998	1.42 (1.17, 1.73)
	1999	1.38 (1.13, 1.69)
	2000	1.22 (0.98, 1.51)
	2001	1.18 (0.96, 1.45)
	2002	1.35 (1.13, 1.62)
	2003	1.45 (1.22, 1.73)
	2004	1.39 (1.17, 1.64)
	2005	1.15 (0.95, 1.41)
	2006	0.90 (0.72, 1.13)
	2007	1.12 (0.91, 1.38)
	2008	0.99 (0.79, 1.24)
	2009	1.41 (1.15, 1.73)
	2010	1.00 (0.78, 1.28)
Sample	**1996**	0.74 (0.33, 1.67)
	1997	1.22 (0.65, 2.29)
	1998	1.01 (0.56, 1.81)
	1999	1.07 (0.64, 1.79)
	2000	0.63 (0.33, 1.19)
	2001	0.37 (0.16, 0.89)
	2002	0.64 (0.32, 1.25)
	2003	0.34 (0.14, 0.82)
	2004	0.74 (0.41, 1.36)
	2005	0.60 (0.31, 1.15)
	2006	0.67 (0.36, 1.24)
	2007	0.27 (0.10, 0.70)
	2008	0.40 (0.17, 0.91)
	2009	0.25 (0.08, 0.76)
	2010	1.00 (0.53, 1.90)

Models adjusted for reporter type (where appropriate), season and harvesting

Population offset included in the model

Figure 6 Relative rates by year (2010 estimate = 1), with 95% comparison intervals, mixed contact dermatitis





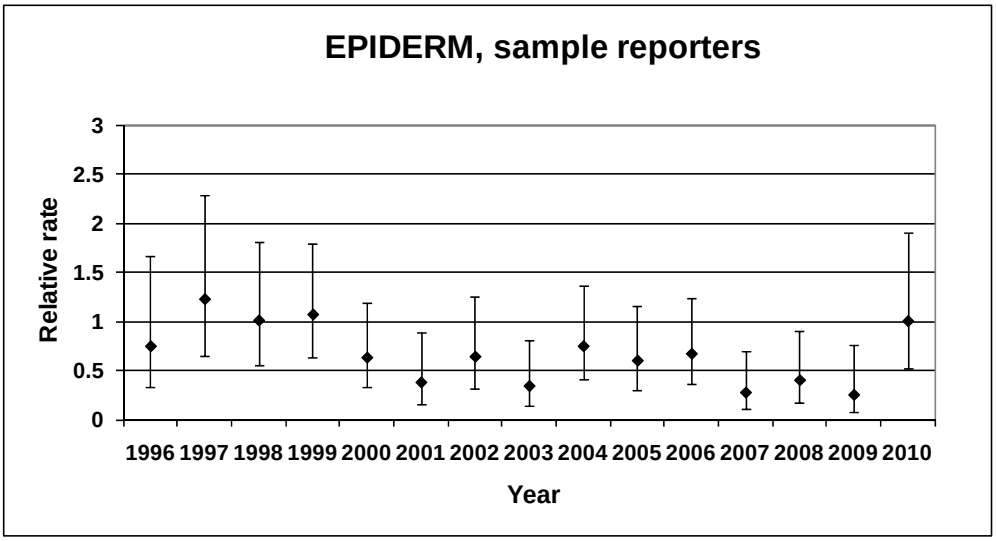


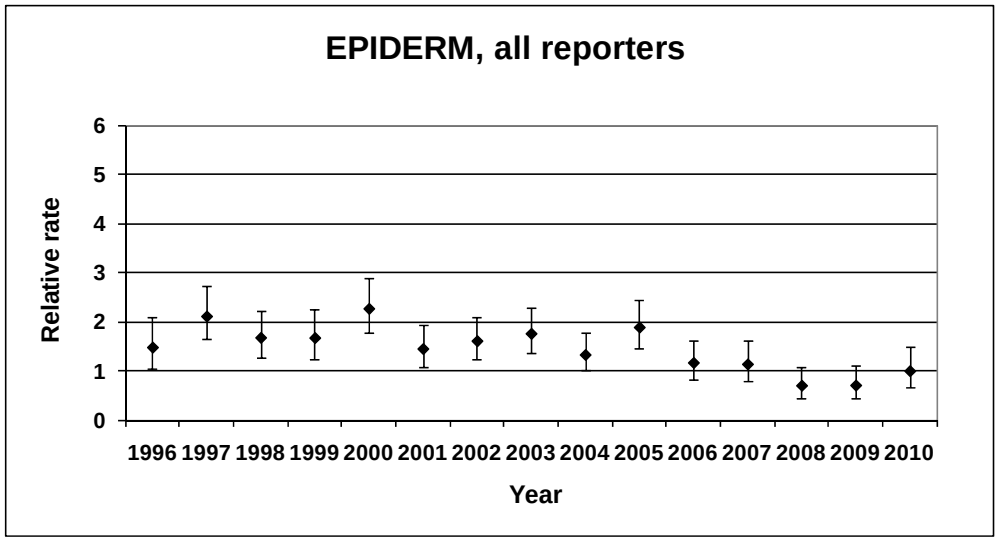
Table 11 Relative rates by year, with 95% comparison intervals, contact urticaria (2010 estimate =1)

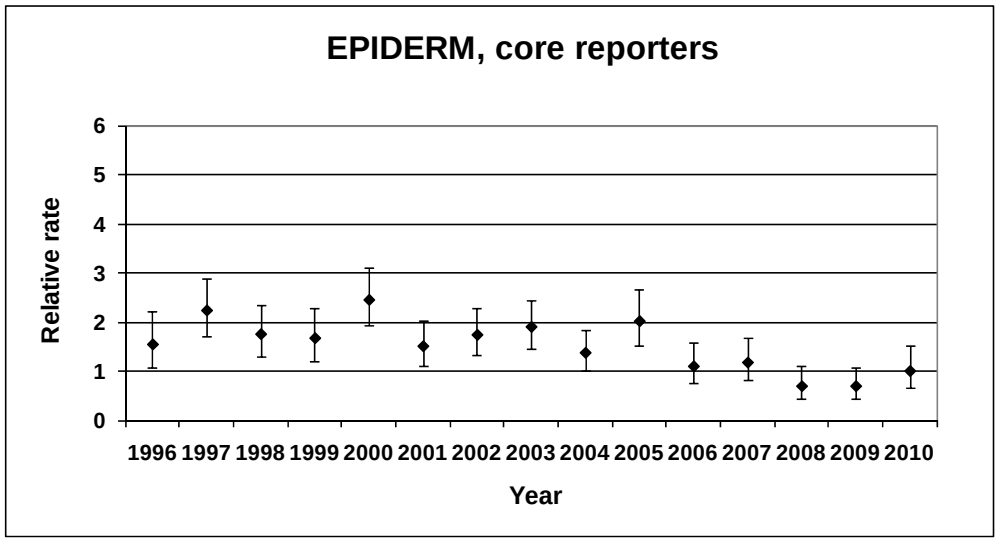
		Relative rates (95% comparison interval)
		EPIDERM
Reporter Group	**Year**	
All	**1996**	1.48 (1.04, 2.10)
	1997	2.11 (1.64, 2.72)
	1998	1.68 (1.26, 2.23)
	1999	1.67 (1.25, 2.25)
	2000	2.27 (1.77, 2.90)
	2001	1.45 (1.09, 1.93)
	2002	1.61 (1.23, 2.10)
	2003	1.76 (1.36, 2.27)
	2004	1.33 (1.00, 1.77)
	2005	1.89 (1.45, 2.46)
	2006	1.17 (0.84, 1.63)
	2007	1.14 (0.80, 1.61)
	2008	0.70 (0.45, 1.09)
	2009	0.71 (0.46, 1.10)
	2010	1.00 (0.67, 1.48)
Core	**1996**	1.54 (1.08, 2.21)
	1997	2.23 (1.73, 2.88)
	1998	1.75 (1.31, 2.34)
	1999	1.67 (1.21, 2.30)
	2000	2.45 (1.93, 3.10)
	2001	1.50 (1.12, 2.03)
	2002	1.74 (1.33, 2.27)
	2003	1.90 (1.47, 2.46)
	2004	1.37 (1.02, 1.84)
	2005	2.01 (1.52, 2.66)
	2006	1.10 (0.76, 1.57)
	2007	1.17 (0.82, 1.68)
	2008	0.69 (0.43, 1.10)
	2009	0.69 (0.44, 1.09)
	2010	1.00 (0.66, 1.51)
Sample	**1996**	0.99 (0.24, 4.16)
	1997	0.98 (0.23, 4.10)
	1998	1.11 (0.35, 3.55)
	1999	1.93 (0.83, 4.46)
	2000	0.83 (0.26, 2.64)
	2001	0.88 (0.28, 2.82)
	2002	0.36 (0.05, 2.59)
	2003	0.33 (0.04, 2.36)
	2004	0.98 (0.31, 3.12)
	2005	0.79 (0.19, 3.18)
	2006	2.85 (1.36, 6.00)
	2007	1.10 (0.34, 3.51)
	2008	0.76 (0.18, 3.17)
	2009	1.11 (0.27, 4.60)
	2010	1.00 (0.24, 4.18)

Models adjusted for reporter type (where appropriate), season and harvesting

Population offset included in the model

Figure 7 Relative rates by year (2010 estimate = 1), with 95% comparison intervals, contact urticaria





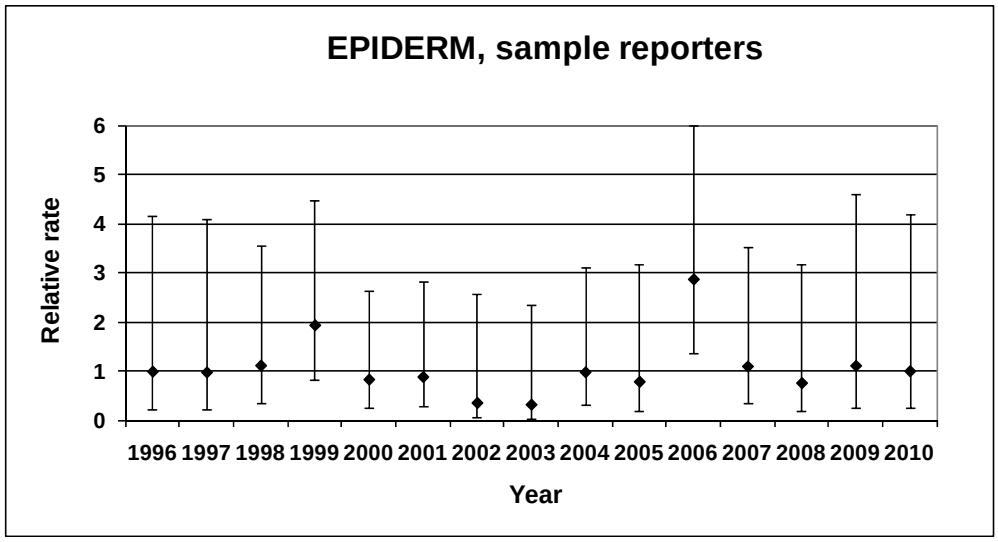


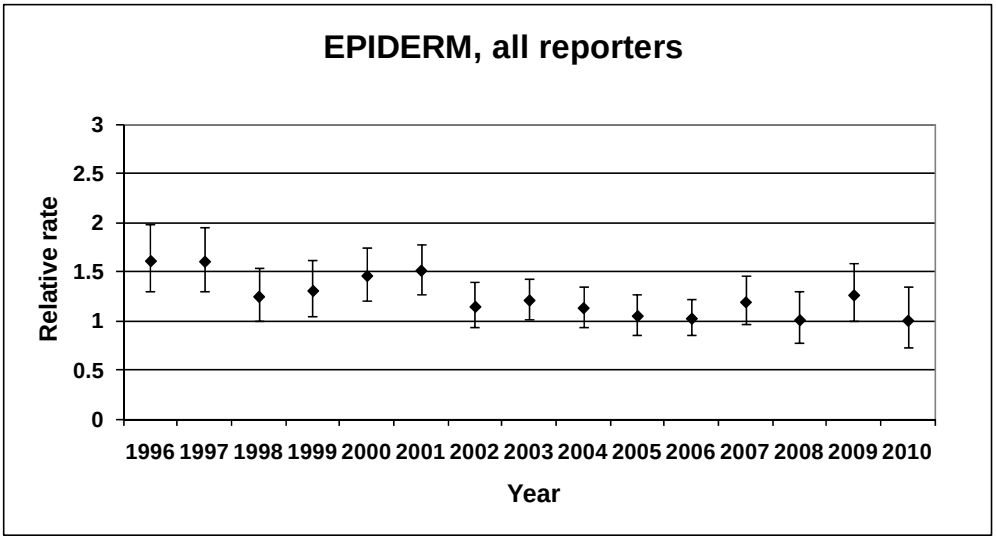
Table 12 Relative rates by year, with 95% comparison intervals, neoplasia (2010 estimate =1)

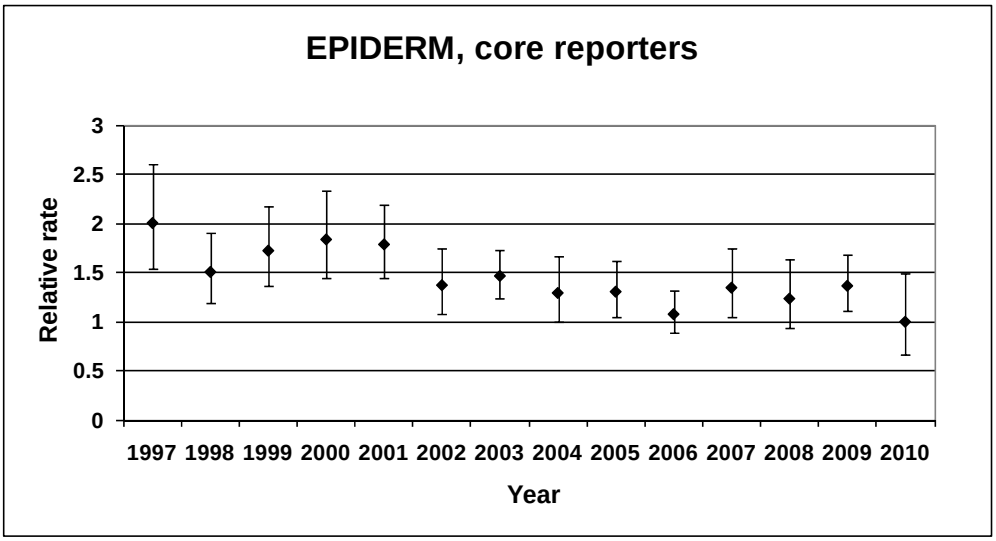
		Relative rates (95% comparison interval)
		EPIDERM
Reporter Group	**Year**	
All	**1996**	1.60 (1.29, 1.98)
	1997	1.59 (1.30, 1.95)
	1998	1.24 (1.00, 1.55)
	1999	1.30 (1.05, 1.62)
	2000	1.45 (1.20, 1.75)
	2001	1.50 (1.27, 1.78)
	2002	1.14 (0.94, 1.39)
	2003	1.20 (1.01, 1.43)
	2004	1.13 (0.94, 1.35)
	2005	1.05 (0.86, 1.28)
	2006	1.02 (0.85, 1.22)
	2007	1.19 (0.96, 1.46)
	2008	1.01 (0.78, 1.30)
	2009	1.26 (1.00, 1.58)
	2010	1.00 (0.74, 1.36)
Core*	**1996**	/
	1997	2.00 (1.54, 2.60)
	1998	1.50 (1.18, 1.91)
	1999	1.72 (1.36, 2.17)
	2000	1.83 (1.44, 2.34))
	2001	1.78 (1.45, 2.20)
	2002	1.37 (1.08, 1.75)
	2003	1.46 (1.24, 1.74)
	2004	1.29 (1.00, 1.660
	2005	1.30 (1.05, 1.62)
	2006	1.08 (0.88, 1.32)
	2007	1.35 (1.04, 1.74)
	2008	1.23 (0.93, 1.63)
	2009	1.36 (1.11, 1.68)
	2010	1.00 (0.67, 1.50)
Sample	**1996**	0.30 (0.12, 0.74)
	1997	0.82 (0.45, 1.48)
	1998	0.57 (0.32, 1.01)
	1999	0.40 (0.21, 0.75)
	2000	0.58 (0.34, 0.99)
	2001	0.99 (0.64, 1.55)
	2002	0.65 (0.37, 1.13)
	2003	0.62 (0.36, 1.08)
	2004	0.83 (0.52, 1.32)
	2005	0.52 (0.29, 0.92)
	2006	1.14 (0.77, 1.67)
	2007	1.03 (0.66, 1.59)
	2008	0.66 (0.37, 1.18)
	2009	1.13 (0.68, 1.89)
	2010	1.00 (0.59, 1.70)

Models adjusted for reporter type (where appropriate), season and harvesting
Population offset included in the model

***For this model there appeared to be significant interaction between year and some other variable(s) which was causing problems with the calculation of the comparison intervals. As an interim measure, data for 1996 has been omitted from the model. However, this may require further investigation.**

Figure 8 Relative rates by year (2010 estimate = 1), with 95% comparison intervals, neoplasia





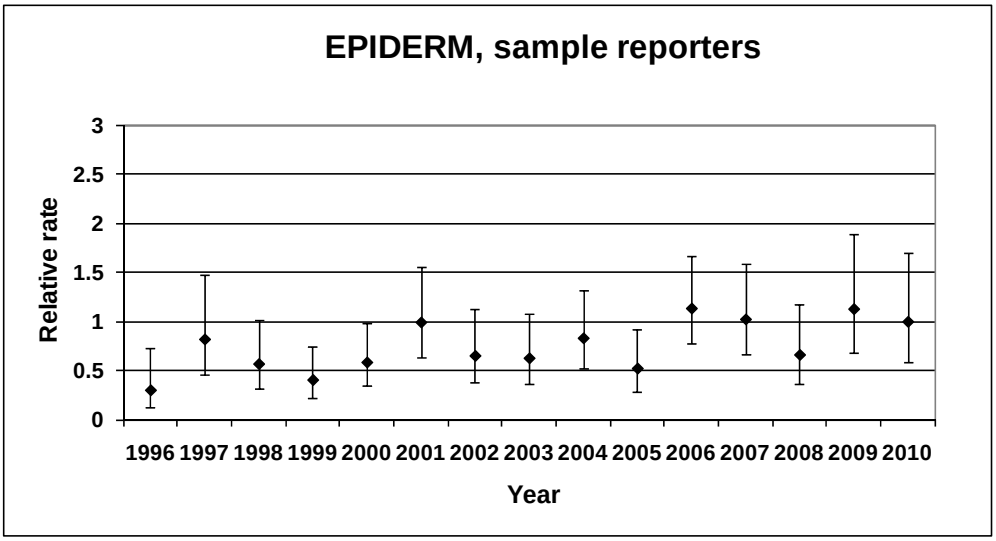


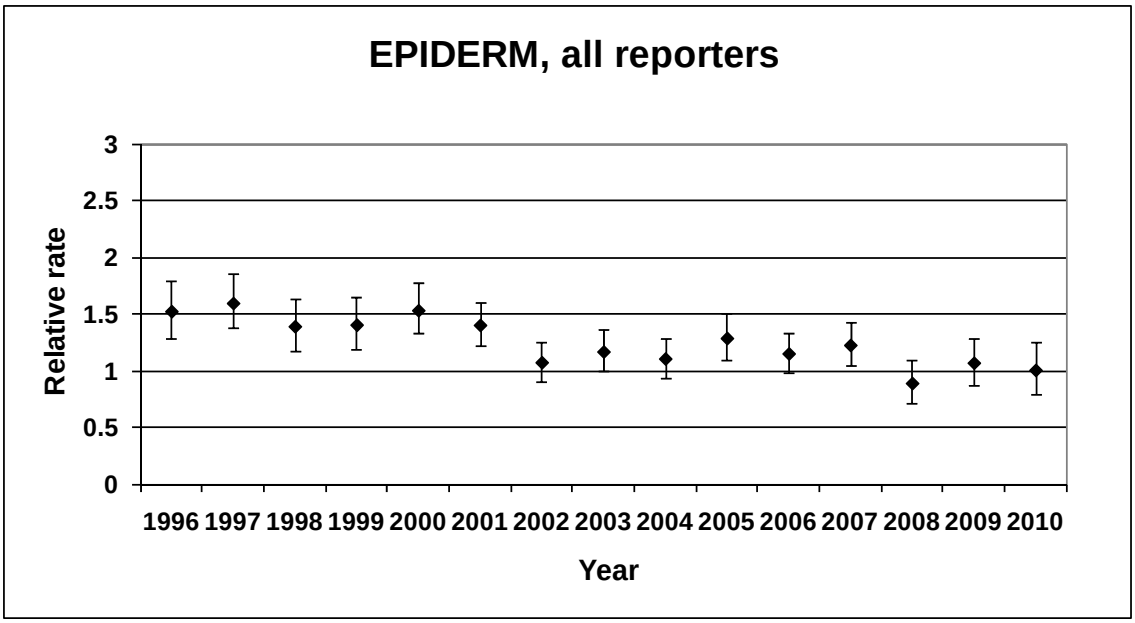
Table 13 Relative rates by year, with 95% comparison intervals, other* skin (2010 estimate =1)

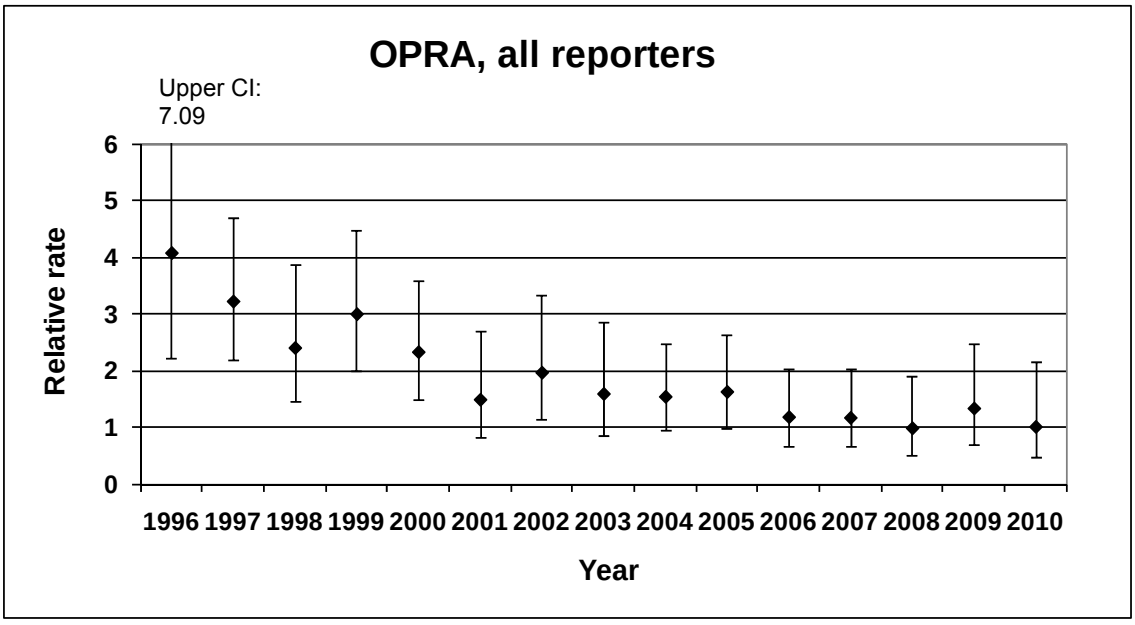
		Relative rates (95% comparison interval)	
		EPIDERM	**OPRA**
Reporter Group	**Year**		
All	**1996**	1.52 (1.29, 1.80)	4.06 (2.23, 7.40)
	1997	1.60 (1.37, 1.86)	3.21 (2.18, 4.71)
	1998	1.39 (1.18, 1.64)	2.39 (1.47, 3.89)
	1999	1.40 (1.19, 1.66)	2.98 (1.99, 4.48)
	2000	1.53 (1.33, 1.77)	2.31 (1.49, 3.60)
	2001	1.40 (1.23, 1.60)	1.48 (0.81, 2.69)
	2002	1.07 (0.91, 1.26)	1.95 (1.14, 3.33)
	2003	1.17 (1.00, 1.36)	1.58 (0.87, 2.87)
	2004	1.10 (0.94, 1.29)	1.53 (0.95, 2.46)
	2005	1.29 (1.10, 1.51)	1.62 (1.00, 2.62)
	2006	1.15 (0.99, 1.33)	1.17 (0.67, 2.05)
	2007	1.22 (1.04, 1.44)	1.16 (0.66, 2.05)
	2008	0.88 (0.72, 1.09)	0.98 (0.50, 1.90)
	2009	1.06 (0.88, 1.29)	1.32 (0.70, 2.49)
	2010	1.00 (0.80, 1.25)	1.00 (0.46, 2.17)
Core	**1996**	1.83 (1.53, 2.17)	/
	1997	1.78 (1.52, 2.09)	/
	1998	1.54 (1.29, 1.82)	/
	1999	1.68 (1.42, 1.98)	/
	2000	1.83 (1.56, 2.14)	/
	2001	1.54 (1.31, 1.80)	/
	2002	1.18 (0.99, 1.39)	/
	2003	1.32 (1.12, 1.55)	/
	2004	1.17 (0.99, 1.38)	1.54 (0.74, 3.19)
	2005	1.47 (1.26, 1.72)	0.96 (0.43, 2.13)
	2006	1.11 (0.94, 1.32)	1.31 (0.67, 2.54)
	2007	1.31 (1.10, 1.56)	1.55 (0.79, 3.04)
	2008	0.95 (0.76, 1.19)	0.84 (0.31, 2.25)
	2009	1.07 (0.87, 1.31)	1.50 (0.69, 3.26)
	2010	1.00 (0.78, 1.28)	1.00 (0.37, 2.71)
Sample	**1996**	0.51 (0.27, 0.95)	3.93 (2.18, 7.09)
	1997	1.05 (0.66, 1.67)	3.09 (2.13, 4.48)
	1998	0.83 (0.55, 1.27)	2.31 (1.46, 3.66)
	1999	0.58 (0.37, 0.91)	2.89 (1.94, 4.28)
	2000	0.61 (0.40, 0.95)	2.24 (1.45, 3.46)
	2001	0.96 (0.65, 1.41)	1.41 (0.80, 2.51)
	2002	0.71 (0.44, 1.12)	1.89 (1.14, 3.16)
	2003	0.59 (0.36, 0.95)	1.51 (0.84, 2.73)
	2004	0.90 (0.61, 1.32)	1.41 (0.75, 2.64)
	2005	0.62 (0.39, 0.97)	2.12 (1.23, 3.68)
	2006	1.35 (0.98, 1.85)	0.93 (0.39, 2.26)
	2007	0.99 (0.68, 1.45)	0.74 (0.28, 1.96)
	2008	0.69 (0.42, 1.13)	1.12 (0.46, 2.72)
	2009	1.18 (0.76, 1.83)	1.09 (0.40, 2.91)
	2010	1.00 (0.62, 1.62)	1.00 (0.32, 3.15)

Models adjusted for reporter type (where appropriate), season and harvesting
Population offset included in the model

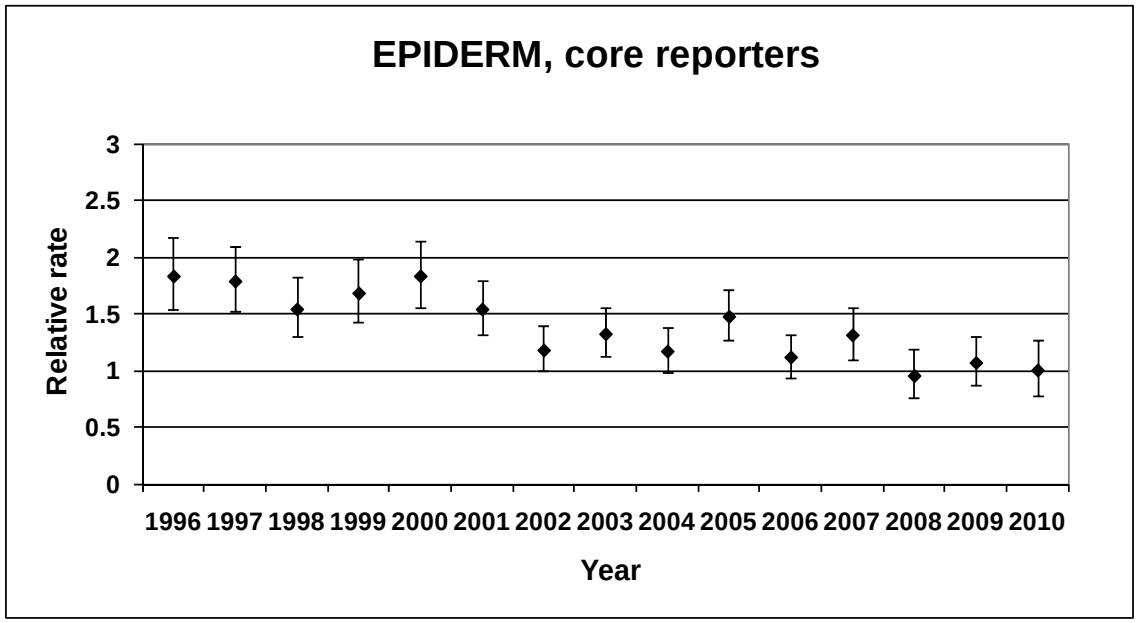
***Other than contact dermatitis**

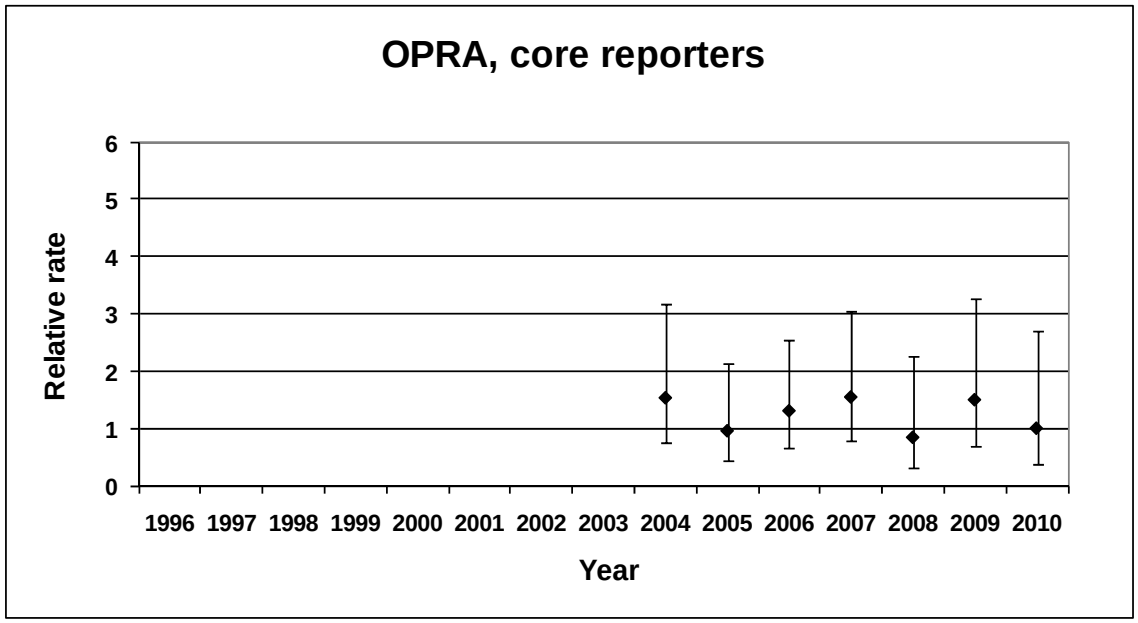
Figure 9 **Relative rates by year (2010 estimate = 1), with 95% comparison intervals, other (other than contact dermatitis) skin**



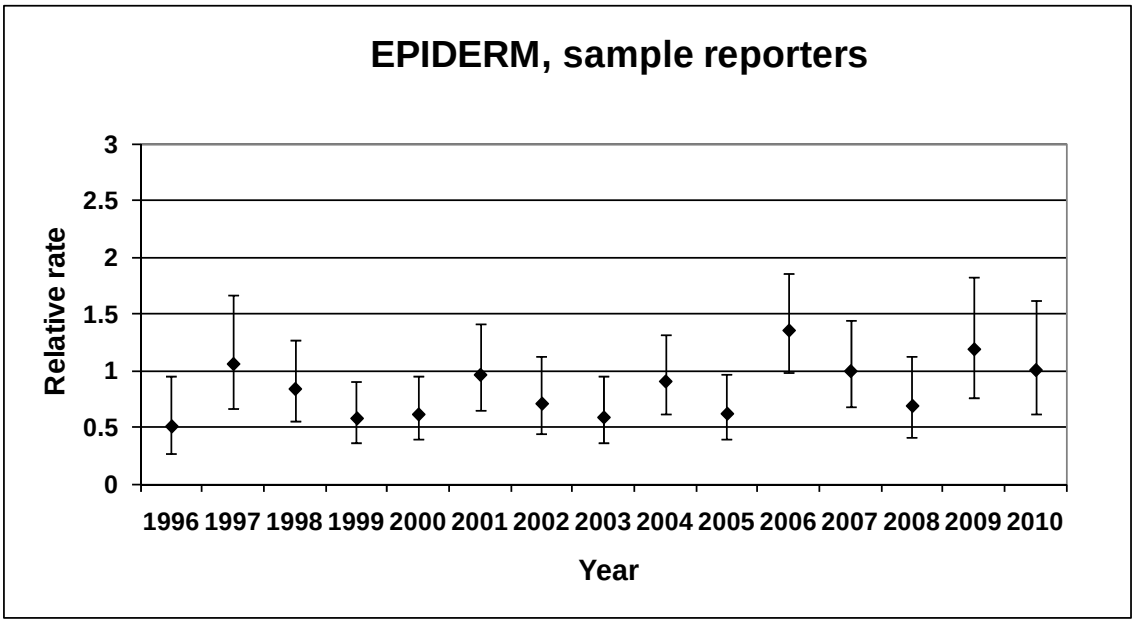


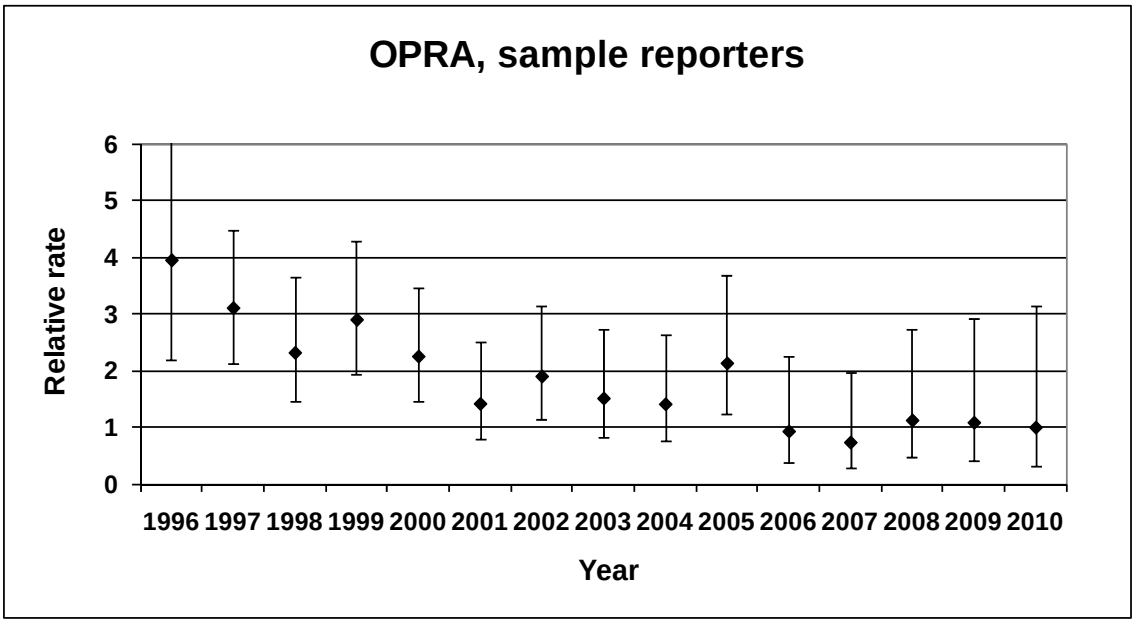
NOTE: OPRA figure has different y-axis scale





NOTE: OPRA figure has different y-axis scale





NOTE: OPRA figure has different y-axis scale

3.2.3 WORK-RELATED RESPIRATORY DISEASE

The average annual percentage change in risk of work-related respiratory disease, as reported by chest physicians (SWORD) and OPs (OPRA) is shown in Table 14 whilst the relative rates by year are shown in Tables 15 to 20 and Figures 10 to 15. Overall, the trend for total respiratory disease was similar to that observed for total skin disease, with data from both chest physicians and OPs suggesting a significant, annual decrease in incidence, with a larger decrease suggested by OPs compared to chest physicians. The graph showing relative rates by year suggests an initial fairly flat trend for chest physicians, followed by a fall in incidence between 2004-2007 after which the trend appears to level out. In contrast, the equivalent graph for OPs suggests more of a constant fall in incidence throughout the time period. For chest physicians, restricting the analyses to data from core reporters or sample reporters had little impact on the trend. For OPs, the annual average decrease in incidence was similar for both all reporters and sample reporters with a steeper decrease observed for core reporters (but the latter was based on a different time period, 2004-2010).

Restricting the analyses to cases of asthma, a steeper (than for total respiratory disease) annual average decrease in incidence was observed (with this decrease again bigger for OPs compared to chest physicians). Figure 12 shows that for both chest physicians and OPs, the biggest drop in incidence appeared to occur between the years 1999 and 2000. The impact on the asthma trend estimate of restricting the analyses to core or sample data was similar to that observed for total respiratory disease.

Analyses of data from chest physicians reporting to SWORD suggested a smaller (than asthma), but still significant downward trend in the incidence of mesothelioma over the study period. Relative rates by year (Figure 13) show a relatively flat trend for the initial period after which the incidence seemed to fall slightly before exhibiting a slight increase followed by a further fall (although it should be noted that confidence intervals are overlapping for all years). Similar patterns were observed

when restricting the data to core or sample reporters only. For benign pleural plaques and pneumoconiosis there appears to have been a relatively stable but flat trend over the study period. A similar pattern was observed for the category ‘other respiratory disease’ which includes rhinitis, allergic alveolitis, lung cancer, inhalation accidents and other respiratory diagnoses not already specified.

Table 14 Average annual percentage change in risk in work-related respiratory disease

a) All reporters

		ESTIMATED CHANGE (95% CONFIDENCE INTERVAL)	
		SWORD	OPRA
	Year (continuous)	% change	% change
Total respiratory	**1996-2010**	N/A	-7.7 (-10.2, -5.1)
	1999-2010	-3.6 (-4.5, -2.6)	-7.4 (-10.7, -4.1)
Asthma	**1996-2010**	N/A	-9.6 (-13.0, -6.1)
	1999-2010	-7.7 (-9.3, -6.1)	-11.3 (-15.7, -6.7)
Mesothelioma	**1999-2010**	-2.7 (-4.4, -0.9)	N/A
Benign pleural plaques	**1999-2010**	-0.8 (-2.2, 0.6)	N/A
Pneumoconiosis	**1999-2010**	-2.0 (-4.8, 0.8)	N/A
Other respiratory*	**1996-2010**	N/A	-4.5 (-8.2, -0.8)
	1999-2010	0.2 (-2.0, 2.5)	-2.8 (-7.5, 2.2)

Models adjusted for reporter type (where appropriate), season and harvesting
***Other than those specified above**

b) Core reporters

		ESTIMATED CHANGE (95% CONFIDENCE INTERVAL)	
		SWORD	OPRA
	Year (continuous)	% change	% change
Total respiratory	**1999-2010**	-3.8 (-5.0, -2.7)	N/A
	2004-2010	-7.7 (-10.1, -5.3)	-12.3 (-20.4, -3.3)
Asthma	**1999-2010**	-7.5 (-9.3, -5.7)	N/A
	2004-2010	-14.6 (-18.6, -10.4)	-14.9 (-26.4, -1.5)
Mesothelioma	**1999-2010**	-1.5 (-4.0, 1.0)	N/A
Benign pleural plaques	**1999-2010**	-1.8 (-3.4, -0.1)	N/A
Pneumoconiosis	**1999-2010**	-0.8 (-4.0, 2.6)	N/A
Other respiratory*	**1999-2010**	0.8 (-1.8, 3.5)	N/A
	2004-2010	-3.3 (-8.4, 2.2)	-9.1 (-19.9, 3.3)

Models adjusted for reporter type (where appropriate), season and harvesting
***Other than those specified above**

c) Sample reporters

		ESTIMATED CHANGE (95% CONFIDENCE INTERVAL)	
SAMPLE REPORTERS		**SWORD**	**OPRA**
	Year (continuous)	**% change**	**% change**
Total respiratory	**1996-2010**	N/A	-7.3 (-10.0, -4.6)
	1999-2010	-2.9 (-4.6, -1.1)	-6.7 (-10.2, -3.0)
Asthma	**1996-2010**	N/A	-9.2 (-12.7, -5.5)
	1999-2010	-8.6 (-12.5, -4.6)	-10.8 (-15.5, -5.8)
Mesothelioma	**1999-2010**	-3.8 (-6.3, -1.2)	N/A
Benign pleural plaques	**1999-2010**	1.7 (-1.1, 4.6)	N/A
Pneumoconiosis	**1999-2010**	-6.7 (-11.7, -1.4)	N/A
Other respiratory*	**1996-2010**	N/A	-4.2 (-8.0, -0.2)
	1999-2010	-1.1 (-5.4, 3.4)	-1.8 (-7.0, 3.7)

Models adjusted for reporter type (where appropriate), season and harvesting
***Other than those specified above**

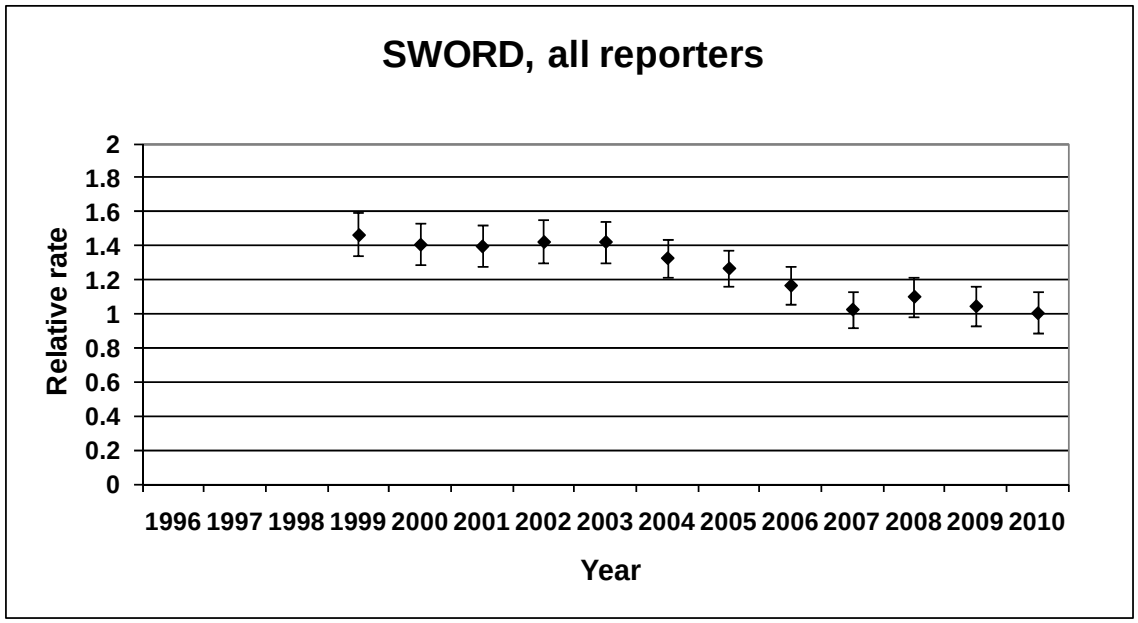
Table 15 Relative rates by year, with 95% comparison intervals, total respiratory disease (2010 estimate = 1)

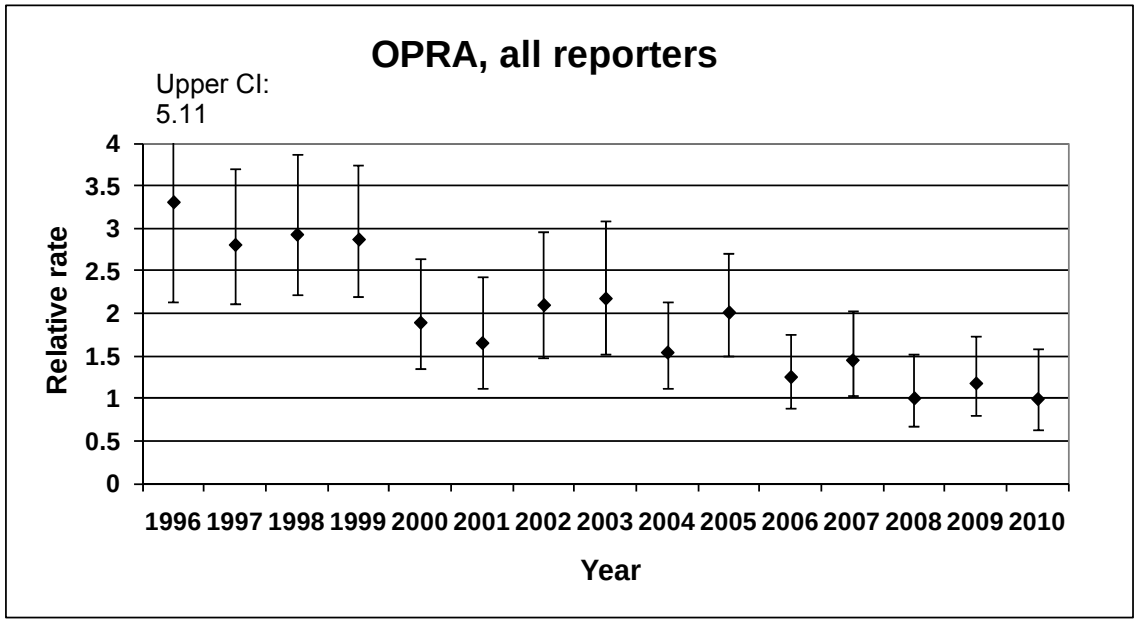
		Relative rates (95% comparison interval)	
		SWORD	**OPRA**
Reporter Group	**Year**		
All	**1996**	/	3.31 (2.14, 5.11)
	1997	/	2.80 (2.12, 3.71)
	1998	/	2.93 (2.21, 3.87)
	1999	1.46 (1.34, 1.60)	2.87 (2.19, 3.76)
	2000	1.41 (1.29, 1.53)	1.89 (1.35, 2.65)
	2001	1.40 (1.28, 1.52)	1.66 (1.12, 2.44)
	2002	1.42 (1.30, 1.55)	2.10 (1.49, 2.96)
	2003	1.42 (1.30, 1.55)	2.18 (1.53, 3.10)
	2004	1.33 (1.22, 1.44)	1.54 (1.12, 2.13)
	2005	1.27 (1.16, 1.38)	2.01 (1.50, 2.70)
	2006	1.16 (1.06, 1.28)	1.26 (0.90, 1.76)
	2007	1.02 (0.92, 1.14)	1.45 (1.04, 2.02)
	2008	1.10 (0.99, 1.22)	1.01 (0.67, 1.51)
	2009	1.04 (0.93, 1.17)	1.18 (0.80, 1.74)
	2010	1.00 (0.89, 1.13)	1.00 (0.63, 1.58)
Core	**1996**	/	/
	1997	/	/
	1998	/	/
	1999	1.42 (1.28, 1.58)	/
	2000	1.41 (1.27, 1.55)	/
	2001	1.44 (1.31, 1.59)	/
	2002	1.51 (1.37, 1.67)	/
	2003	1.54 (1.40, 1.70)	/
	2004	1.44 (1.31, 1.58)	2.06 (1.25, 3.39)
	2005	1.28 (1.16, 1.41)	3.60 (2.40, 5.42)
	2006	1.14 (1.03, 1.27)	1.84 (1.22, 2.78)
	2007	0.97 (0.85, 1.10)	2.60 (1.79, 3.76)
	2008	1.04 (0.91, 1.19)	1.31 (0.76, 2.24)
	2009	0.99 (0.86, 1.14)	1.74 (1.08, 2.78)
	2010	1.00 (0.87, 1.16)	1.00 (0.52, 1.94)
Sample	**1996**	/	2.15 (1.40, 3.30)
	1997	/	1.85 (1.41, 2.43)
	1998	/	1.92 (1.45, 2.55)
	1999	1.67 (1.41, 1.96)	1.89 (1.44, 2.48)
	2000	1.48 (1.25, 1.76)	1.24 (0.90, 1.71)
	2001	1.28 (1.07, 1.54)	1.09 (0.75, 1.58)
	2002	1.23 (1.02, 1.48)	1.38 (0.99, 1.93)
	2003	1.07 (0.87, 1.31)	1.42 (1.01, 2.01)
	2004	1.04 (0.85, 1.26)	1.14 (0.77, 1.70)
	2005	1.29 (1.08, 1.54)	1.17 (0.78, 1.77)
	2006	1.26 (1.05, 1.50)	0.83 (0.49, 1.38)
	2007	1.18 (0.98, 1.42)	0.70 (0.40, 1.22)
	2008	1.21 (1.01, 1.46)	0.78 (0.44, 1.37)
	2009	1.17 (0.96, 1.42)	0.74 (0.40, 1.39)
	2010	1.00 (0.80, 1.25)	1.00 (0.55, 1.82)

Models adjusted for reporter type (where appropriate), season and harvesting

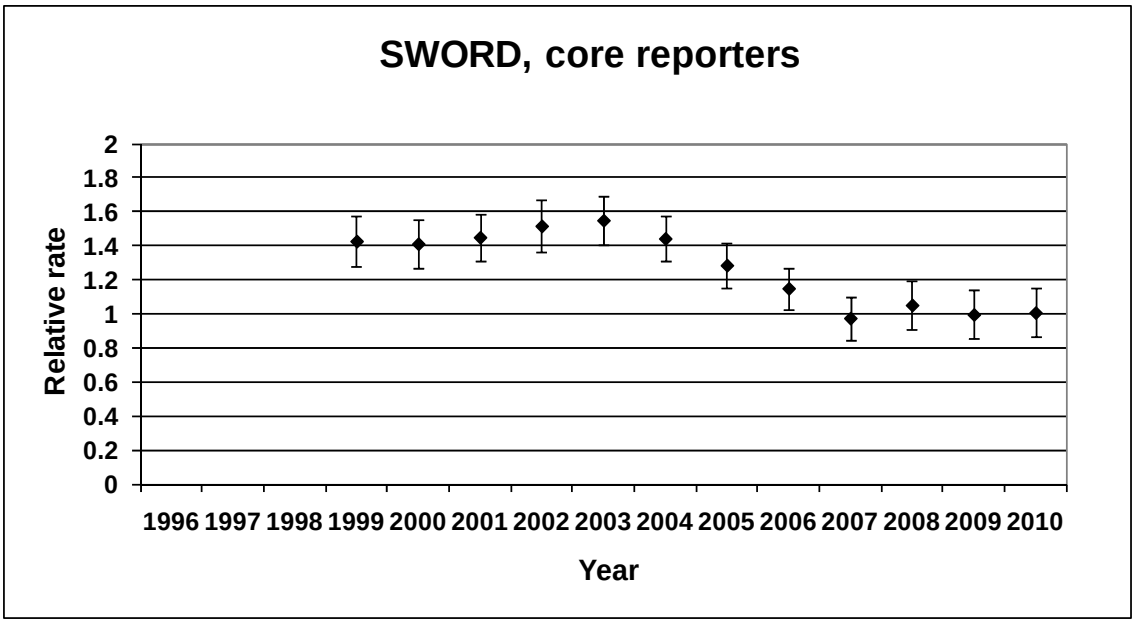
Population offset included in the model

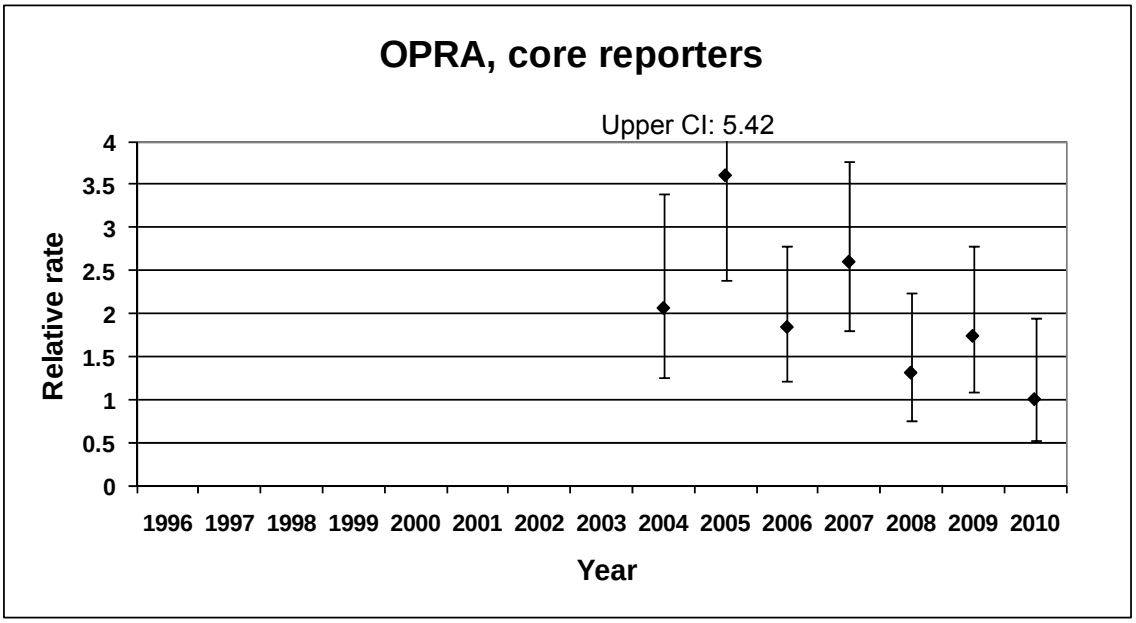
Figure 10 Relative rates by year (2010 estimate = 1), with 95% comparison intervals, total respiratory disease



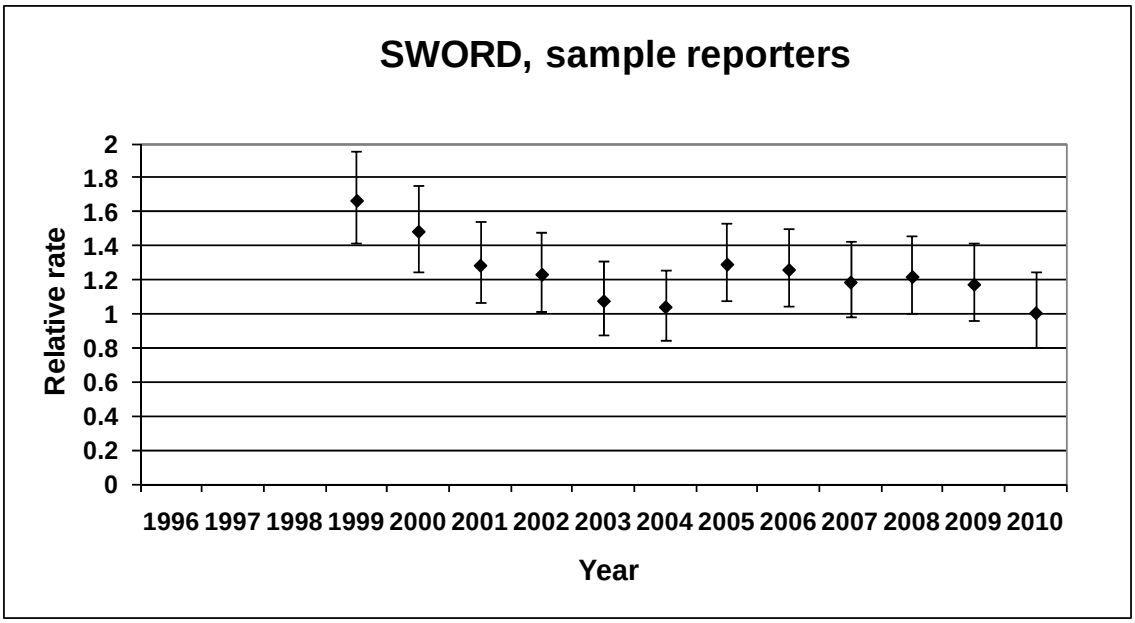


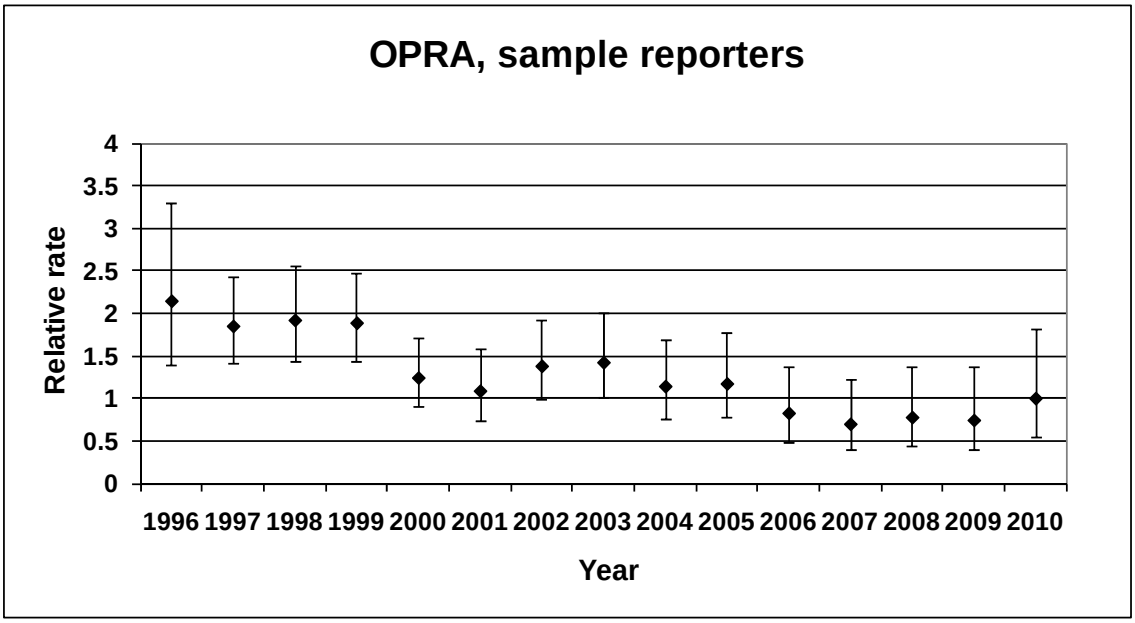
NOTE: y-axis scale change between SWORD and OPRA figures.





NOTE: y-axis scale change between SWORD and OPRA figures.





NOTE: y-axis scale change between SWORD and OPRA figures.

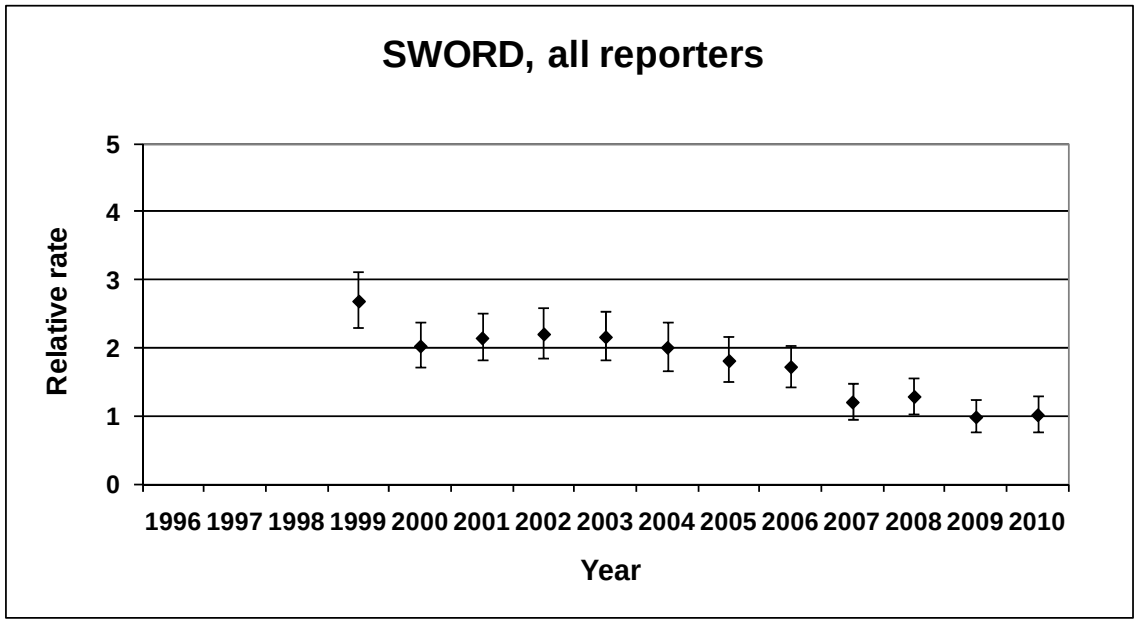
Table 16 Relative rates by year, with 95% comparison intervals, asthma (2010 estimate = 1)

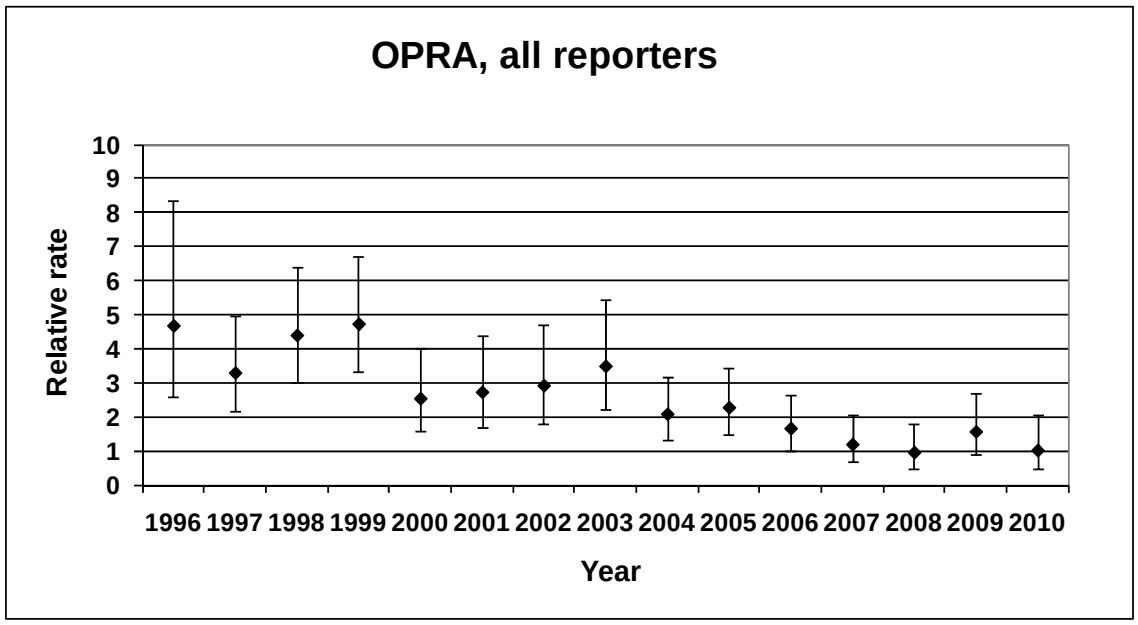
		Relative rates (95% comparison interval)	
		SWORD	OPRA
Reporter Group	Year		
All	1996	/	4.67 (2.61, 8.35)
	1997	/	3.28 (2.16, 4.98)
	1998	/	4.39 (3.00, 6.43)
	1999	2.68 (2.31, 3.12)	4.72 (3.33, 6.70)
	2000	2.02 (1.71, 2.37)	2.53 (1.58, 4.04)
	2001	2.14 (1.82, 2.50)	2.71 (1.67, 4.41)
	2002	2.19 (1.85, 2.60)	2.91 (1.80, 4.71)
	2003	2.15 (1.82, 2.54)	3.48 (2.23, 5.43)
	2004	2.00 (1.67, 2.39)	2.07 (1.35, 3.18)
	2005	1.80 (1.50, 2.17)	2.26 (1.48, 3.45)
	2006	1.71 (1.43, 2.04)	1.65 (1.02, 2.66)
	2007	1.19 (0.96, 1.47)	1.18 (0.67, 2.06)
	2008	1.27 (1.03, 1.57)	0.94 (0.49, 1.82)
	2009	0.97 (0.76, 1.24)	1.55 (0.89, 2.69)
	2010	1.00 (0.78, 1.28)	1.00 (0.49, 2.06)
Core	1996	/	/
	1997	/	/
	1998	/	/
	1999	2.59 (2.18, 3.07)	/
	2000	1.93 (1.61, 2.32)	/
	2001	2.25 (1.90, 2.66)	/
	2002	2.32 (1.93, 2.78)	/
	2003	2.32 (1.94, 2.77)	/
	2004	2.18 (1.81, 2.63)	4.70 (2.41, 9.16)
	2005	1.87 (1.52, 2.29)	8.11 (4.77, 13.80)
	2006	1.68 (1.38, 2.04)	3.34 (1.72, 6.50)
	2007	1.20 (0.95, 1.52)	3.93 (2.10, 7.38)
	2008	1.26 (1.00, 1.59)	2.24 (0.93, 5.43)
	2009	0.98 (0.75, 1.29)	4.92 (2.68, 9.03)
	2010	1.00 (0.76, 1.32)	1.00 (0.25, 4.05)
Sample	1996	/	2.12 (1.20, 3.77)
	1997	/	1.51 (1.01, 2.26)
	1998	/	2.03 (1.40, 2.94)
	1999	3.12 (2.25, 4.34)	2.19 (1.57, 3.08)
	2000	2.31 (1.58, 3.36)	1.18 (0.75, 1.84)
	2001	1.44 (0.89, 2.33)	1.26 (0.79, 2.02)
	2002	1.52 (0.94, 2.45)	1.35 (0.85, 2.15)
	2003	1.24 (0.75, 2.07)	1.61 (1.03, 2.50)
	2004	1.05 (0.60, 1.84)	1.06 (0.61, 1.83)
	2005	1.40 (0.88, 2.24)	0.79 (0.41, 1.53)
	2006	1.82 (1.16, 2.85)	1.02 (0.54, 1.91)
	2007	1.10 (0.63, 1.91)	0.31 (0.10, 0.96)
	2008	1.32 (0.78, 2.21)	0.49 (0.19, 1.31)
	2009	0.84 (0.44, 1.64)	0.42 (0.14, 1.30)
	2010	1.00 (0.53, 1.88)	1.00 (0.44, 2.25)

Models adjusted for reporter type (where appropriate), season and harvesting

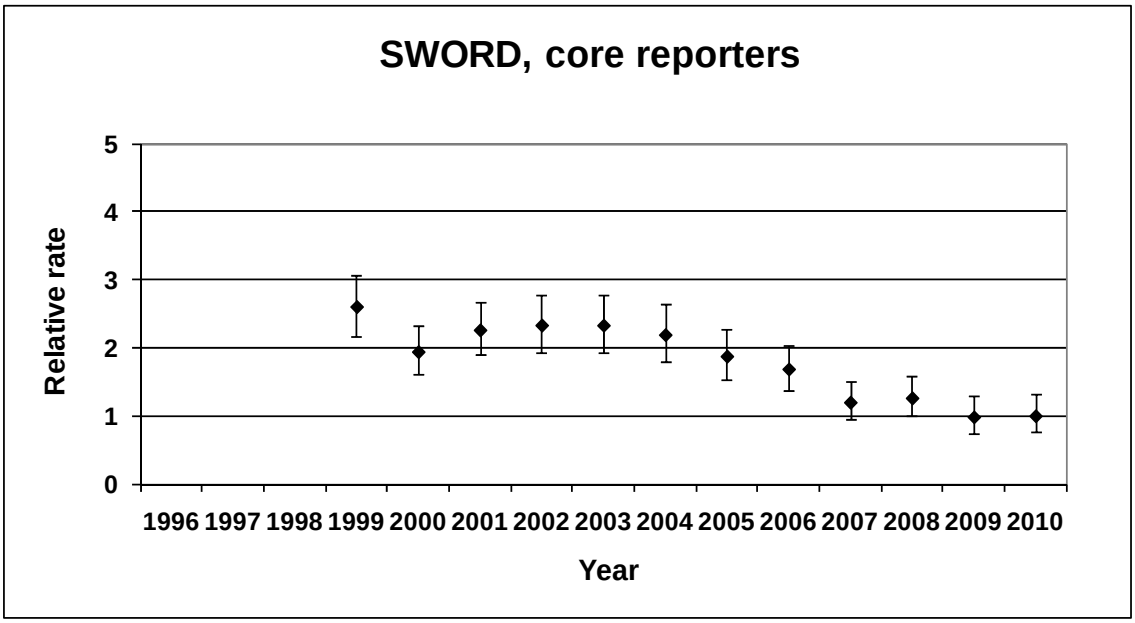
Population offset included in the model

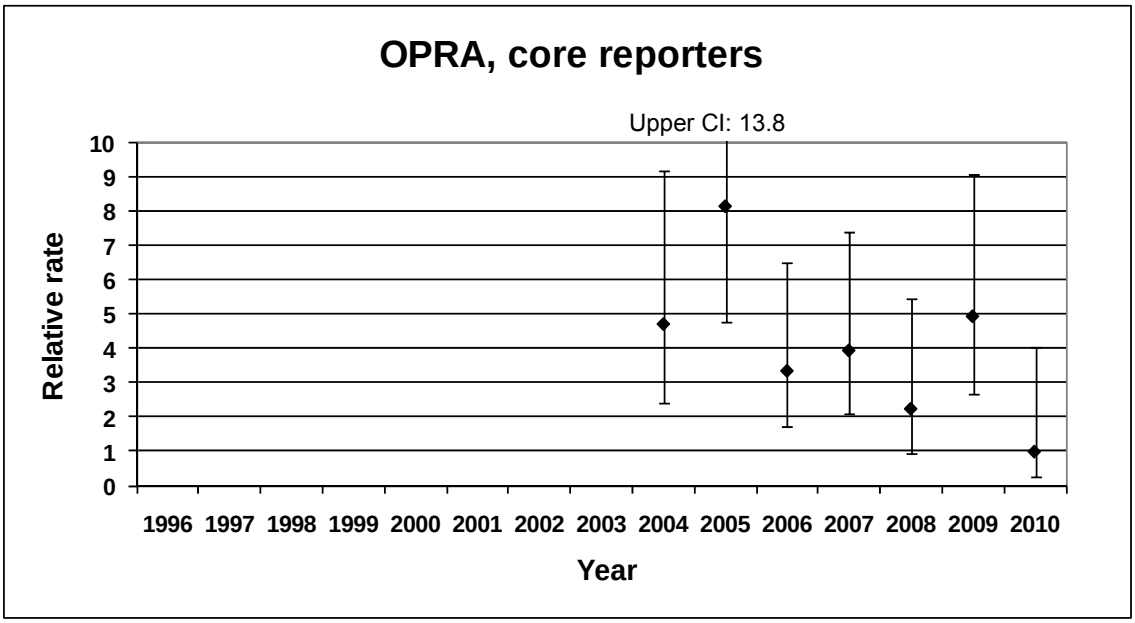
Figure 11 Relative rates by year (2010 estimate = 1), with 95% comparison intervals, asthma



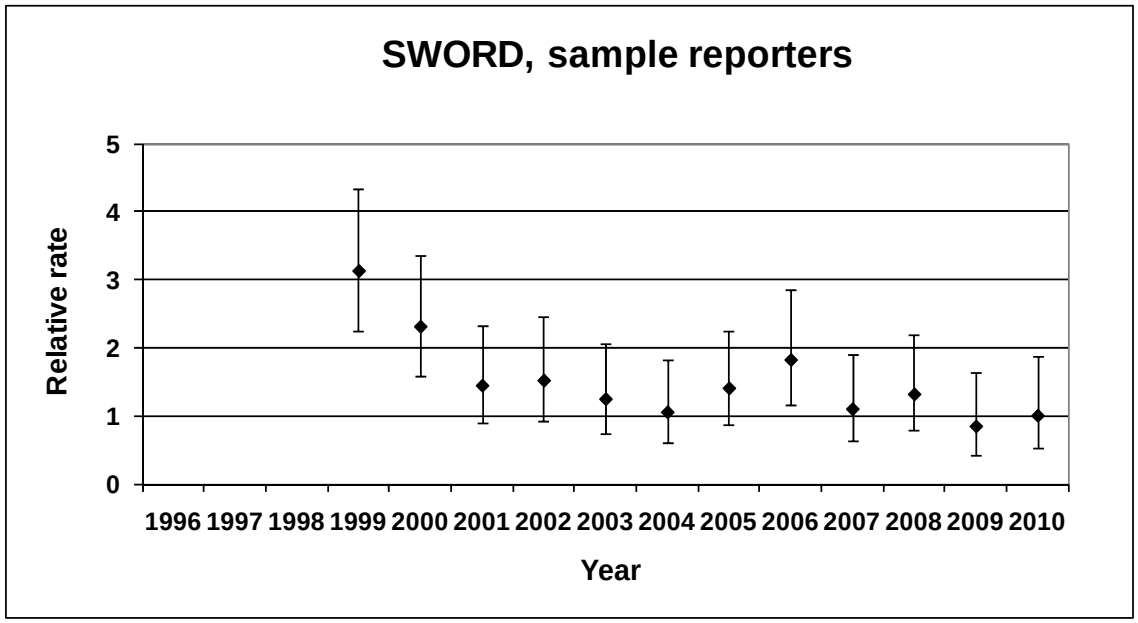


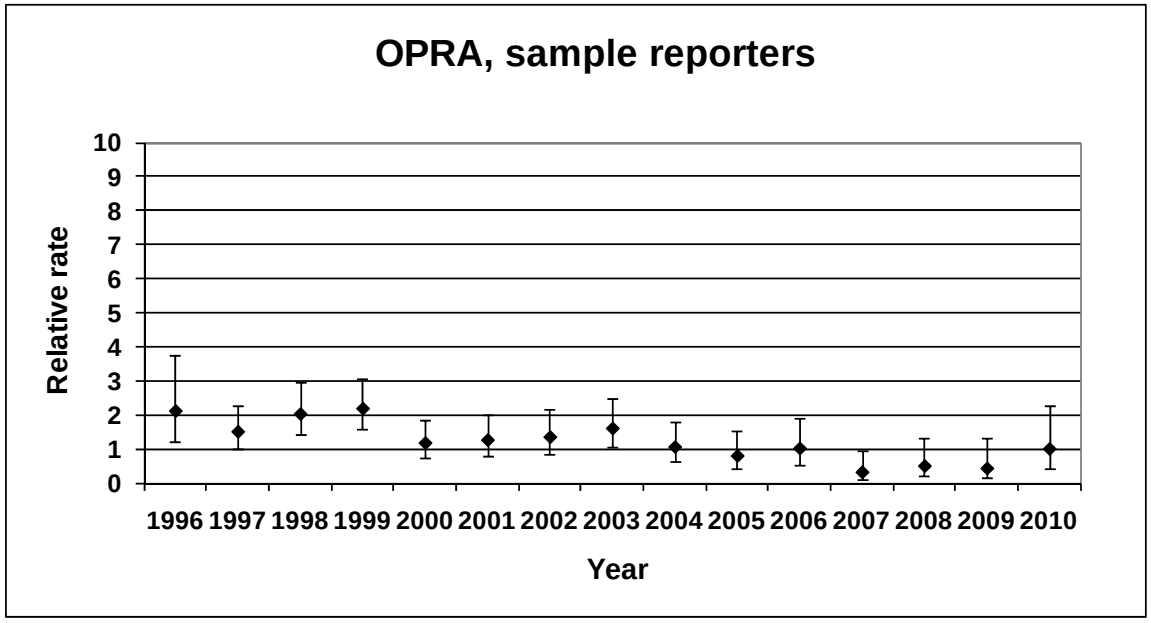
NOTE: y-axis scale change between SWORD and OPRA figures.





NOTE: y-axis scale change between SWORD and OPRA figures.





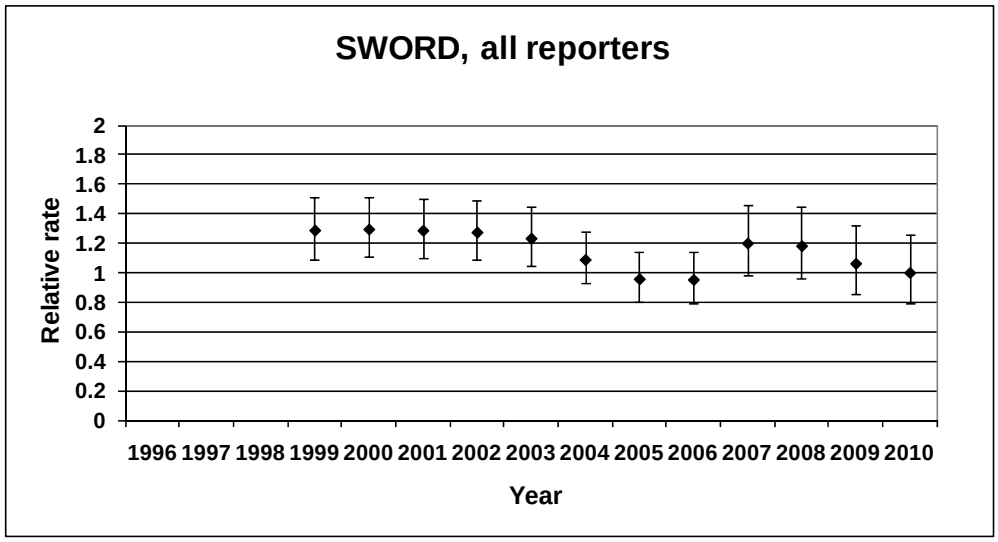
NOTE: y-axis scale change between SWORD and OPRA figures.

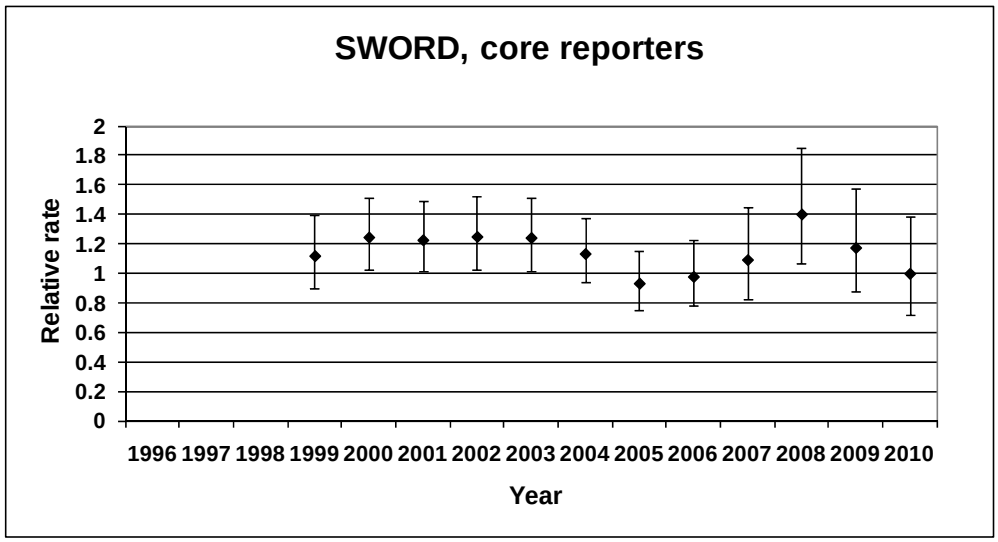
Table 17 Relative rates by year, with 95% comparison intervals, mesothelioma (2010 estimate = 1)

		Relative rates (95% comparison interval)
		SWORD
Reporter Group	**Year**	
All	**1999**	1.29 (1.09, 1.52)
	2000	1.30 (1.11, 1.51)
	2001	1.29 (1.10, 1.50)
	2002	1.27 (1.09, 1.49)
	2003	1.23 (1.05, 1.45)
	2004	1.09 (0.93, 1.28)
	2005	0.96 (0.81, 1.14)
	2006	0.95 (0.79, 1.14)
	2007	1.20 (0.99, 1.46)
	2008	1.18 (0.96, 1.45)
	2009	1.06 (0.85, 1.32)
	2010	1.00 (0.79, 1.26)
Core	**1999**	1.12 (0.90, 1.40)
	2000	1.25 (1.02, 1.52)
	2001	1.23 (1.01, 1.49)
	2002	1.25 (1.03, 1.52)
	2003	1.24 (1.02, 1.51)
	2004	1.13 (0.94, 1.37)
	2005	0.93 (0.75, 1.16)
	2006	0.98 (0.78, 1.23)
	2007	1.09 (0.82, 1.45)
	2008	1.40 (1.06, 1.85)
	2009	1.18 (0.87, 1.58)
	2010	1.00 (0.72, 1.38)
Sample	**1999**	1.47 (1.15, 1.88)
	2000	1.32 (1.01, 1.71)
	2001	1.33 (1.03, 1.71)
	2002	1.24 (0.94, 1.64)
	2003	1.13 (0.86, 1.49)
	2004	0.93 (0.69, 1.26)
	2005	0.96 (0.71, 1.28)
	2006	0.88 (0.65, 1.20)
	2007	1.29 (0.99, 1.69)
	2008	0.94 (0.70, 1.28)
	2009	0.93 (0.67, 1.30)
	2010	1.00 (0.72, 1.39)

Models adjusted for reporter type (where appropriate), season and harvesting
Population offset included in the model

Figure 12 Relative rates by year (2010 estimate = 1), with 95% comparison intervals, mesothelioma





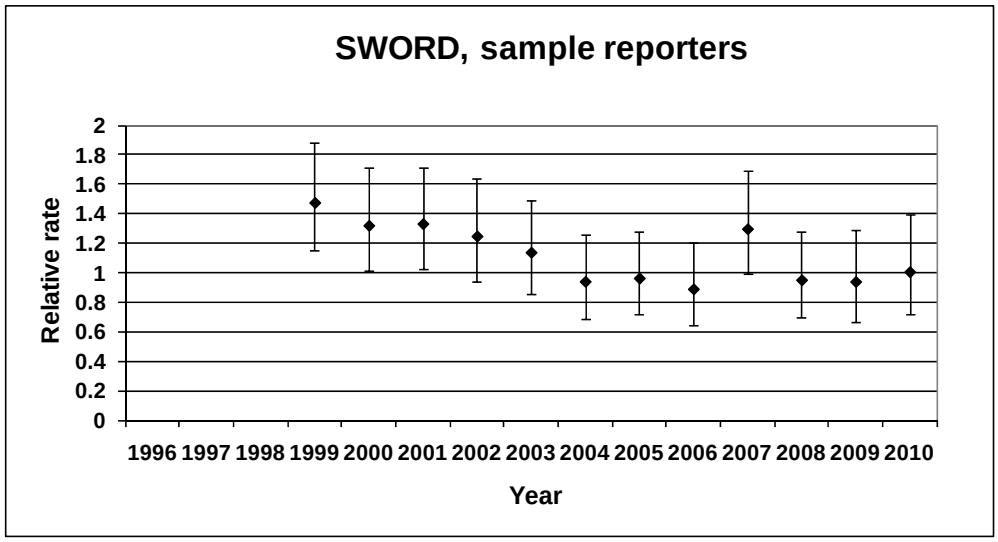
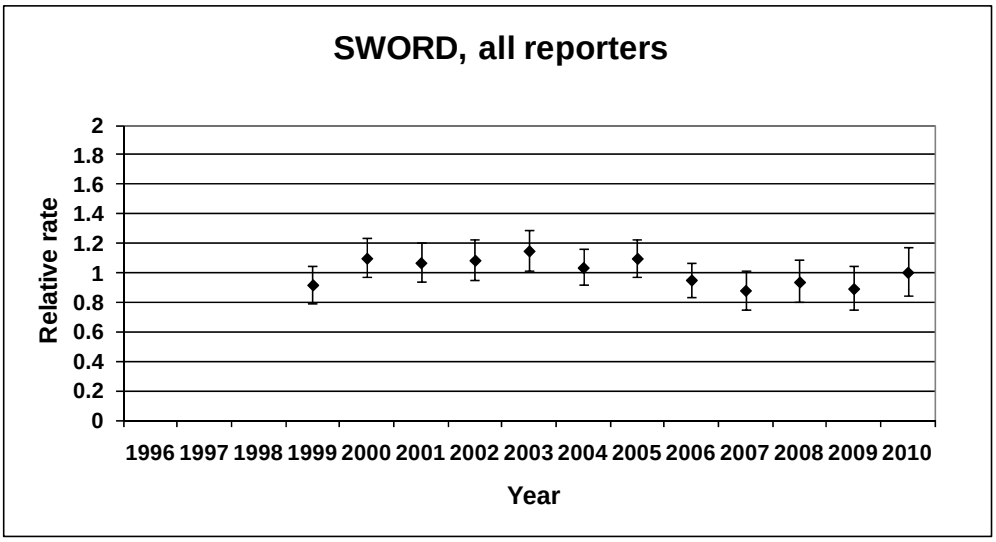


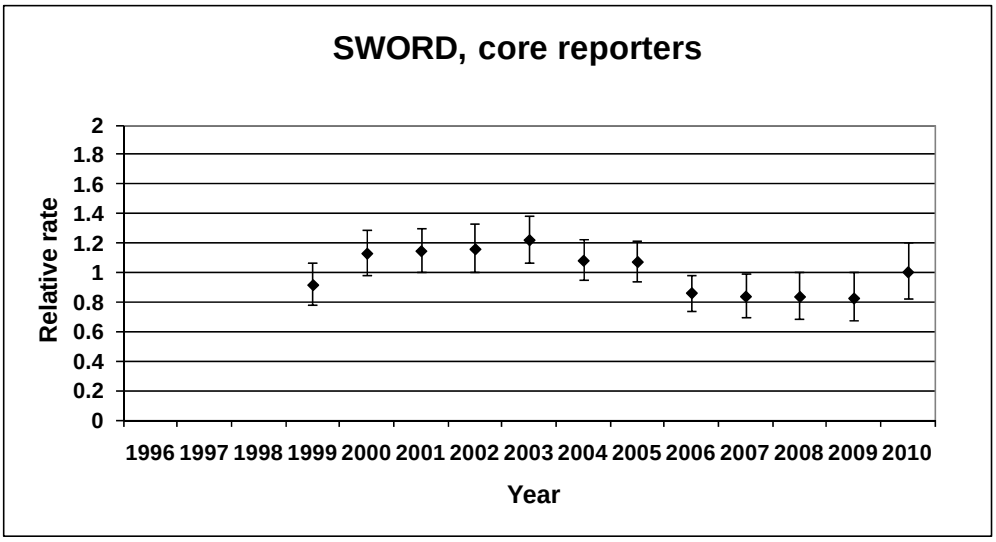
Table 18 Relative rates by year, with 95% comparison intervals, benign pleural plaques (2010 estimate = 1)

		Relative rates (95% comparison interval)
		SWORD
Reporter Group	**Year**	
All	**1999**	0.91 (0.80, 1.05)
	2000	1.10 (0.97, 1.24)
	2001	1.06 (0.94, 1.20)
	2002	1.08 (0.95, 1.23)
	2003	1.15 (1.02, 1.29)
	2004	1.03 (0.92, 1.16)
	2005	1.09 (0.98, 1.23)
	2006	0.95 (0.84, 1.07)
	2007	0.88 (0.76, 1.02)
	2008	0.93 (0.80, 1.09)
	2009	0.89 (0.75, 1.05)
	2010	1.00 (0.85, 1.18)
Core	**1999**	0.91 (0.78, 1.06)
	2000	1.13 (0.98, 1.29)
	2001	1.14 (1.01, 1.30)
	2002	1.16 (1.01, 1.33)
	2003	1.22 (1.07, 1.38)
	2004	1.08 (0.95, 1.22)
	2005	1.07 (0.94, 1.21)
	2006	0.86 (0.74, 0.99)
	2007	0.83 (0.70, 0.99)
	2008	0.83 (0.69, 1.00)
	2009	0.82 (0.67, 1.01)
	2010	1.00 (0.83, 1.21)
Sample	**1999**	1.09 (0.81, 1.47)
	2000	1.08 (0.81, 1.44)
	2001	0.81 (0.57, 1.13)
	2002	0.85 (0.61, 1.20)
	2003	0.88 (0.63, 1.21)
	2004	0.90 (0.66, 1.23)
	2005	1.38 (1.07, 1.78)
	2006	1.39 (1.08, 1.79)
	2007	1.05 (0.78, 1.41)
	2008	1.25 (0.96, 1.63)
	2009	1.07 (0.80, 1.44)
	2010	1.00 (0.72, 1.38)

Models adjusted for reporter type (where appropriate), season and harvesting
Population offset included in the model

Figure 13 Relative rates by year (2010 estimate = 1), with 95% comparison intervals, benign pleural plaques





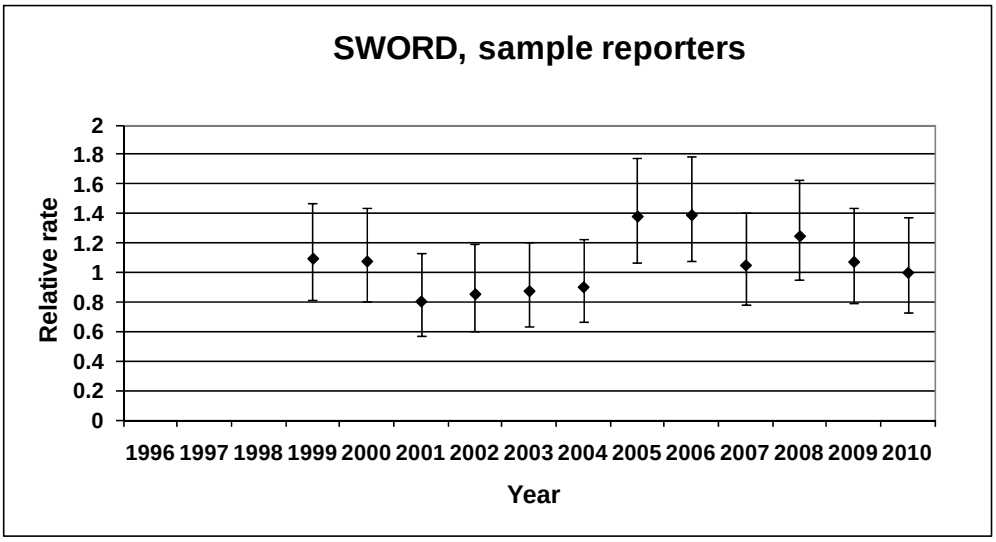
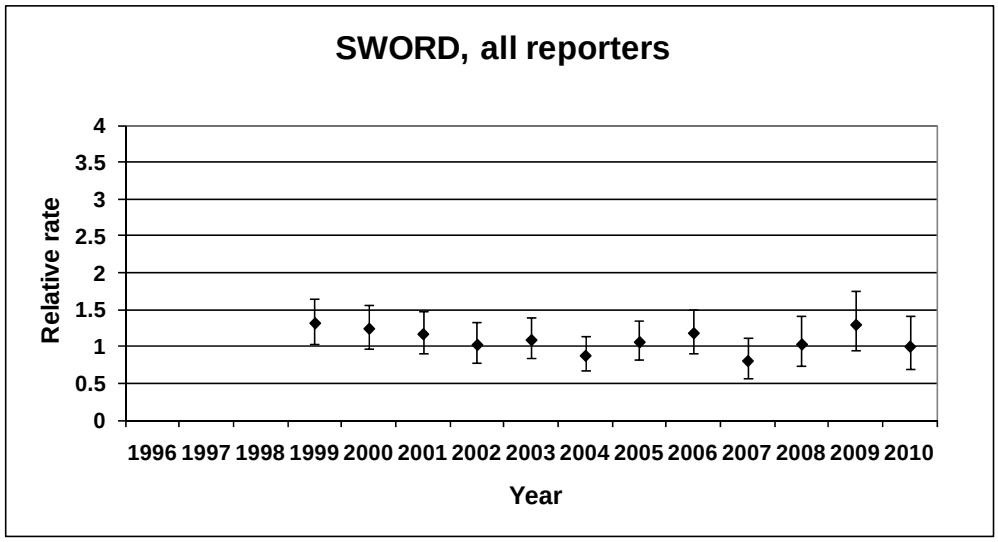


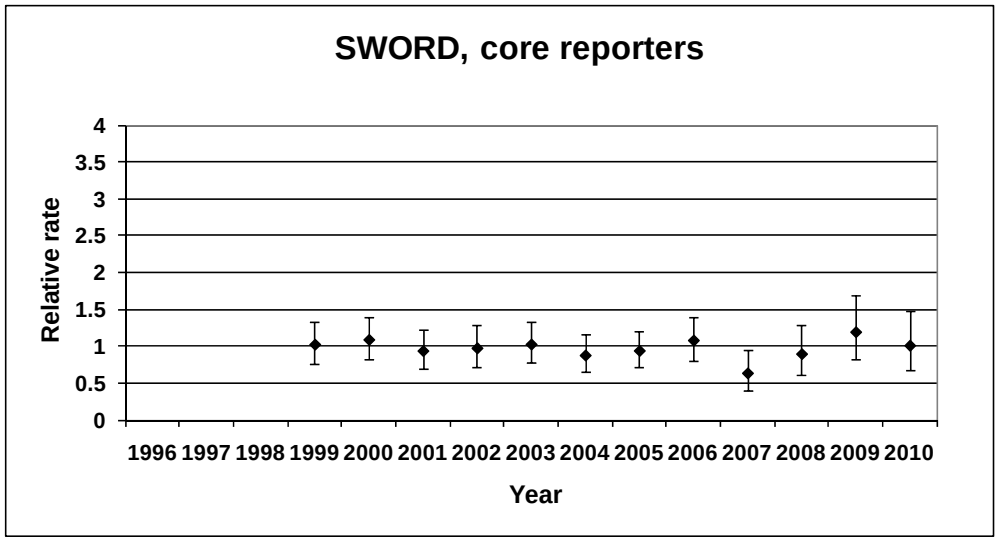
Table 19 Relative rates by year, with 95% comparison intervals, pneumoconiosis (2010 estimate = 1)

		Relative rates (95% comparison interval)
		SWORD
Reporter Group	**Year**	
All	**1999**	1.31 (1.04, 1.66)
	2000	1.24 (0.98, 1.56)
	2001	1.17 (0.92, 1.48)
	2002	1.02 (0.78, 1.34)
	2003	1.09 (0.84, 1.40)
	2004	0.88 (0.67, 1.15)
	2005	1.06 (0.83, 1.35)
	2006	1.18 (0.92, 1.51)
	2007	0.81 (0.58, 1.13)
	2008	1.03 (0.75, 1.41)
	2009	1.29 (0.95, 1.75)
	2010	1.00 (0.71, 1.42)
Core	**1999**	1.01 (0.77, 1.34)
	2000	1.08 (0.83, 1.40)
	2001	0.93 (0.70, 1.23)
	2002	0.96 (0.73, 1.28)
	2003	1.02 (0.78, 1.33)
	2004	0.87 (0.65, 1.16)
	2005	0.93 (0.71, 1.21)
	2006	1.07 (0.81, 1.41)
	2007	0.62 (0.41, 0.94)
	2008	0.89 (0.61, 1.29)
	2009	1.18 (0.83, 1.70)
	2010	1.00 (0.68, 1.47)
Sample	**1999**	3.84 (2.45, 5.99)
	2000	2.23 (1.26, 3.95)
	2001	3.04 (1.87, 4.95)
	2002	1.17 (0.53, 2.61)
	2003	1.35 (0.64, 2.85)
	2004	0.66 (0.25, 1.78)
	2005	2.01 (1.12, 3.59)
	2006	1.89 (1.04, 3.46)
	2007	1.95 (1.09, 3.47)
	2008	1.84 (1.03, 3.31)
	2009	1.84 (1.01, 3.36)
	2010	1.00 (0.44, 2.27)

Models adjusted for reporter type (where appropriate), season and harvesting
Population offset included in the model

Figure 14 Relative rates by year (2010 estimate = 1), with 95% comparison intervals, pneumoconiosis





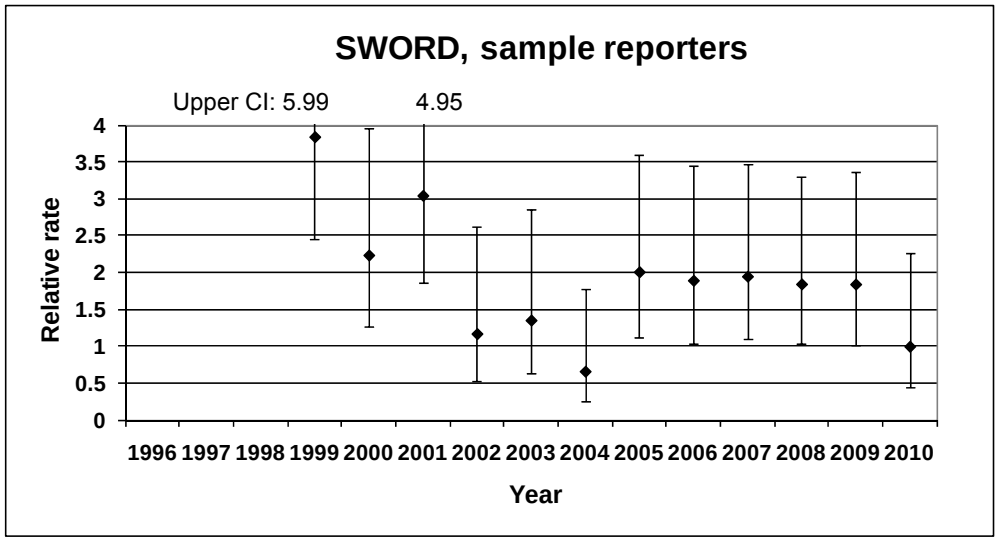
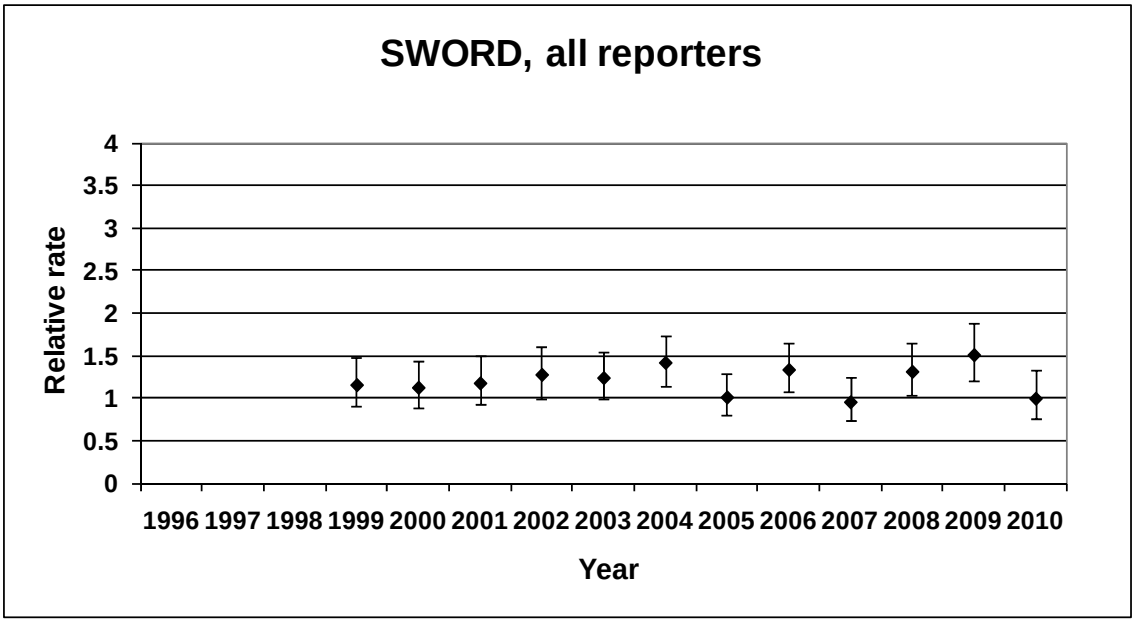


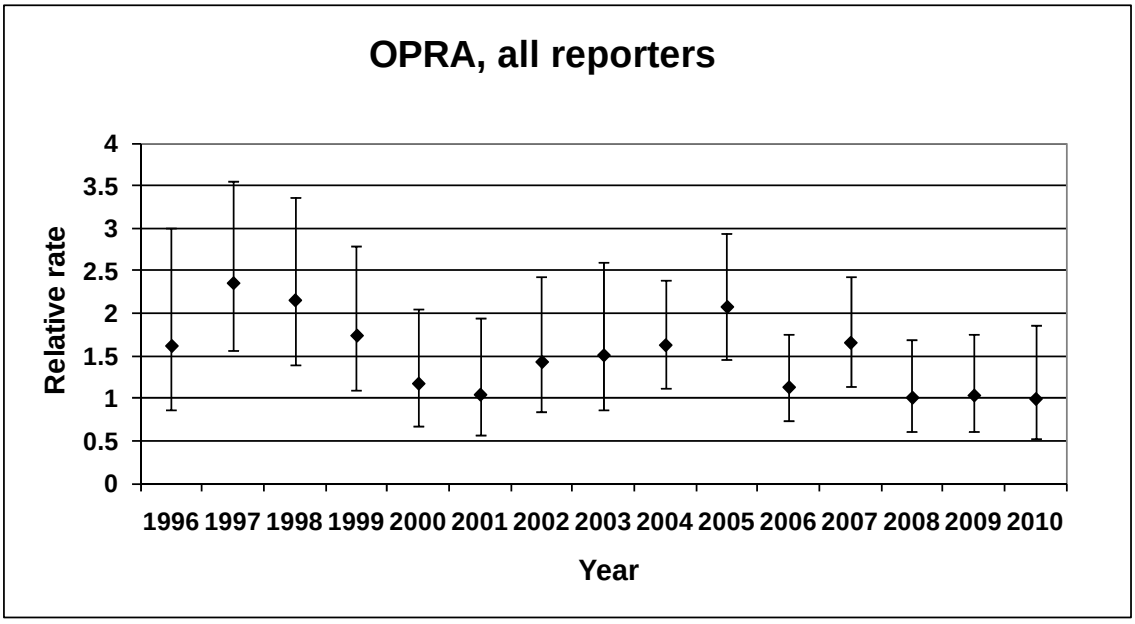
Table 20 Relative rates by year, with 95% comparison intervals, other* respiratory disease (2010 estimate = 1)

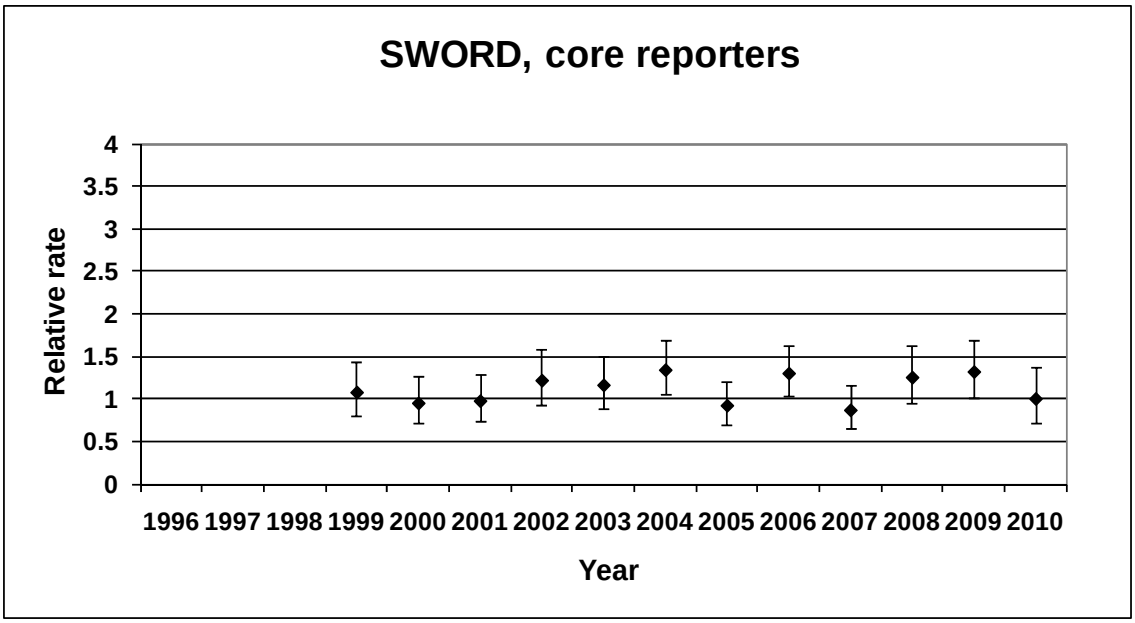
		Relative rates (95% comparison interval)	
		SWORD	**OPRA**
Reporter Group	**Year**		
All	**1996**	/	1.62 (0.88, 3.00)
	1997	/	2.36 (1.57, 3.55)
	1998	/	2.16 (1.39, 3.36)
	1999	1.16 (0.90, 1.48)	1.74 (1.09, 2.79)
	2000	1.13 (0.89, 1.43)	1.18 (0.68, 2.05)
	2001	1.18 (0.93, 1.49)	1.05 (0.57, 1.94)
	2002	1.27 (1.00, 1.62)	1.43 (0.84, 2.44)
	2003	1.24 (0.99, 1.55)	1.51 (0.88, 2.61)
	2004	1.41 (1.15, 1.74)	1.63 (1.12, 2.39)
	2005	1.02 (0.80, 1.29)	2.08 (1.47, 2.95)
	2006	1.33 (1.08, 1.64)	1.14 (0.74, 1.76)
	2007	0.96 (0.74, 1.24)	1.66 (1.13, 2.43)
	2008	1.31 (1.03, 1.66)	1.02 (0.61, 1.68)
	2009	1.50 (1.20, 1.88)	1.04 (0.61, 1.76)
	2010	1.00 (0.75, 1.33)	1.00 (0.54, 1.86)
Core	**1996**	/	/
	1997	/	/
	1998	/	/
	1999	1.08 (0.81, 1.43)	/
	2000	0.95 (0.71, 1.26)	/
	2001	0.97 (0.73, 1.30)	/
	2002	1.22 (0.93, 1.59)	/
	2003	1.16 (0.90, 1.50)	/
	2004	1.34 (1.06, 1.69)	1.38 (0.75, 2.56)
	2005	0.92 (0.70, 1.21)	1.86 (1.02, 3.40)
	2006	1.30 (1.04, 1.62)	1.49 (0.91, 2.43)
	2007	0.87 (0.65, 1.16)	1.94 (1.18, 3.19)
	2008	1.25 (0.96, 1.63)	0.88 (0.42, 1.84)
	2009	1.32 (1.02, 1.70)	0.95 (0.47, 1.90)
	2010	1.00 (0.73, 1.37)	1.00 (0.47, 2.13)
Sample	**1996**	/	1.71 (0.93, 3.14)
	1997	/	2.56 (1.77, 3.70)
	1998	/	2.31 (1.53, 3.49)
	1999	1.44 (0.86, 2.41)	1.86 (1.19, 2.89)
	2000	1.88 (1.20, 2.97)	1.25 (0.74, 2.12)
	2001	2.04 (1.31, 3.16)	1.12 (0.62, 2.02)
	2002	1.43 (0.86, 2.38)	1.52 (0.91, 2.54)
	2003	1.47 (0.87, 2.48)	1.61 (0.94, 2.77)
	2004	1.70 (1.07, 2.70)	2.07 (1.26, 3.41)
	2005	1.46 (0.88, 2.42)	2.50 (1.54, 4.06)
	2006	1.39 (0.84, 2.31)	0.62 (0.23, 1.66)
	2007	1.34 (0.80, 2.26)	1.43 (0.74, 2.76)
	2008	1.64 (1.00, 2.68)	1.29 (0.61, 2.72)
	2009	2.26 (1.47, 3.47)	1.24 (0.55, 2.80)
	2010	1.00 (0.52, 1.92)	1.00 (0.37, 2.70)

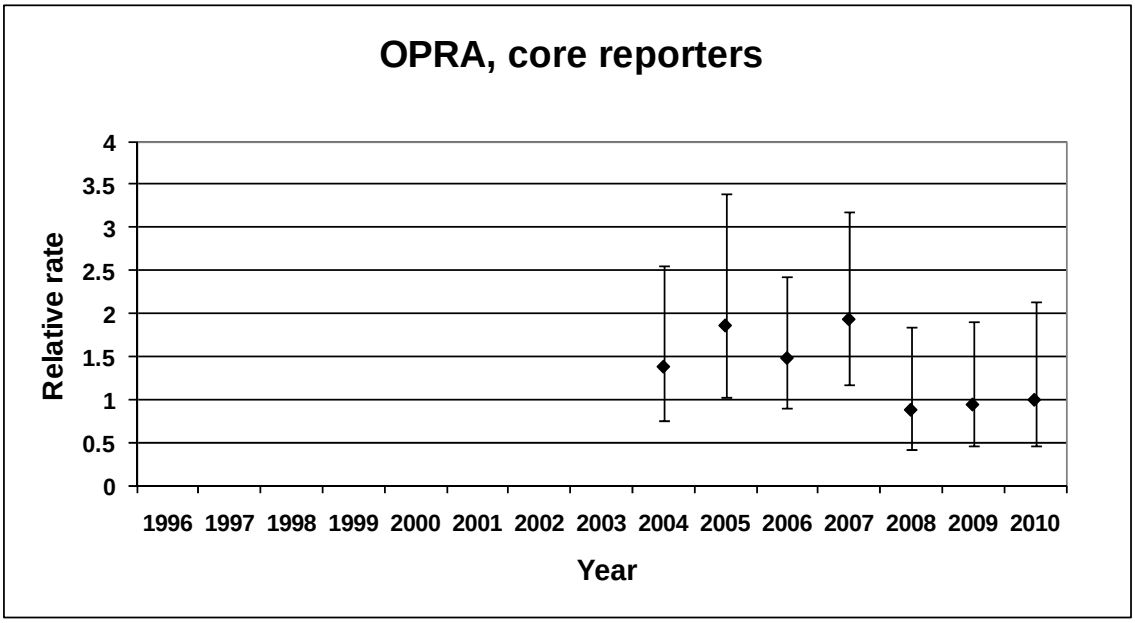
Models adjusted for reporter type (where appropriate), season and harvesting
Population offset included in the model
***Other than those specified above**

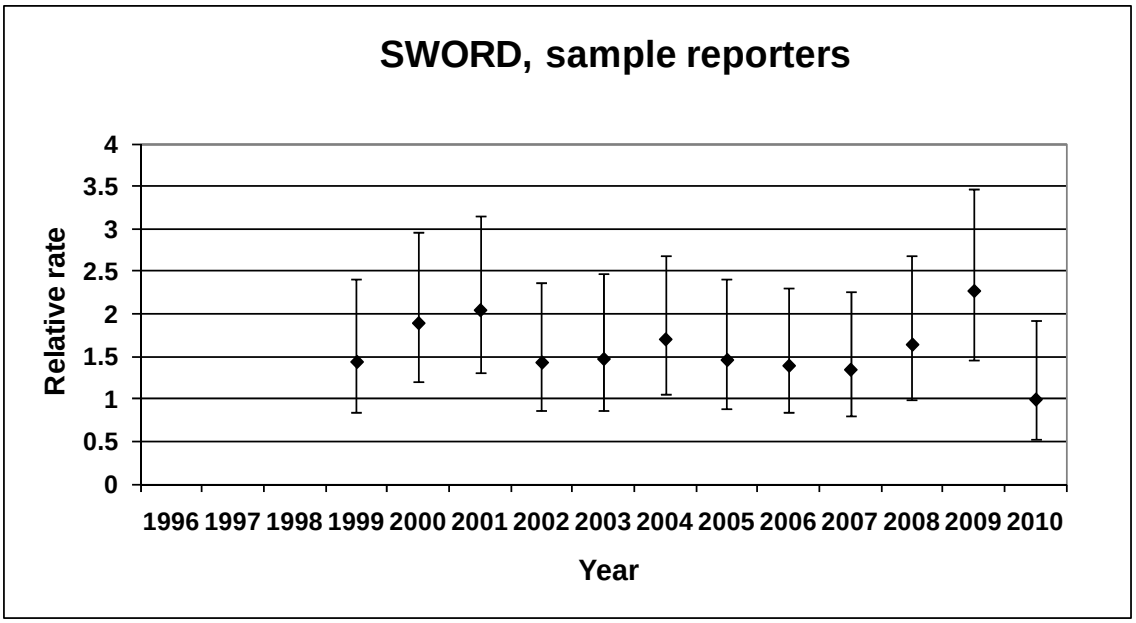
Figure 15 **Relative rates by year (2010 estimate = 1), with 95% comparison intervals, other respiratory disease**

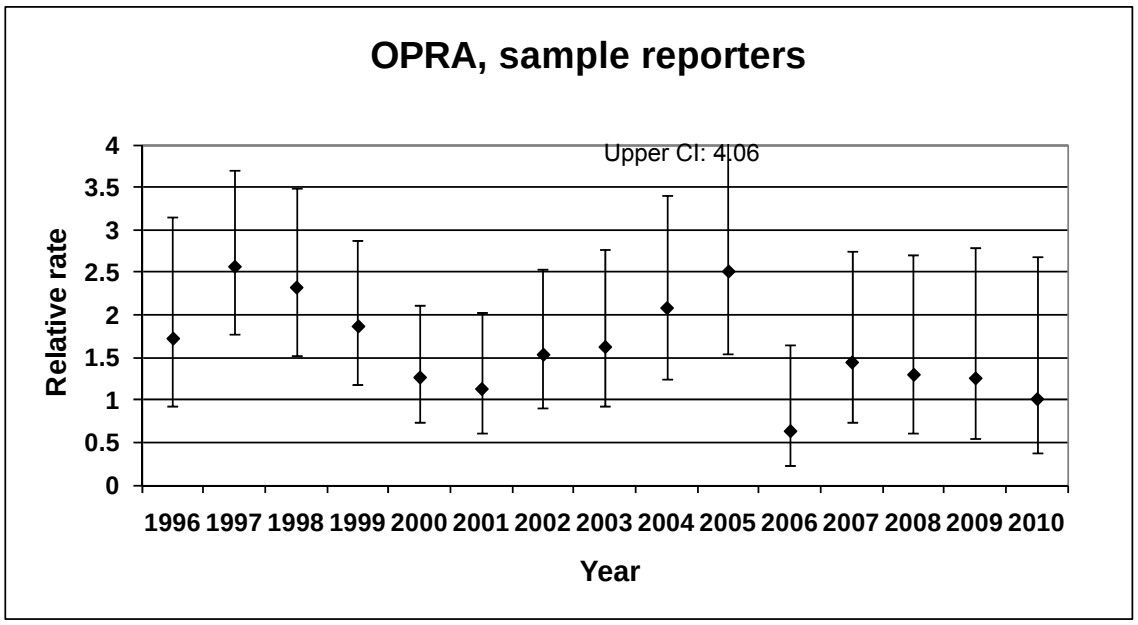





SWORD, core reporters
Relative rate
4
3.5
3
2.5
2
1.5
1
0.5
0
1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010
Year


OPRA, core reporters
Relative rate
4
3.5
3
2.5
2
1.5
1
0.5
0
1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010
Year


SWORD, sample reporters
Relative rate
4
3.5
3
2.5
2
1.5
1
0.5
0
1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010
Year


OPRA, sample reporters
Upper CI: 4.06
Relative rate
4
3.5
3
2.5
2
1.5
1
0.5
0
1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010
Year

3.2.4 MUSCULOSKELETAL DISORDERS

The average annual percentage change in reported incidence of work-related musculoskeletal disorders (MSDs), as reported by OPs (OPRA) and GPs (THOR-GP) is shown in Table 21 whilst the relative rates by year are shown in Tables 22 to 25 and Figures 16 to 19. Data from both OPs and GPs suggested a downward trend in the incidence of work-related MSDs with a much larger annual average decrease in incidence suggested by GPs compared to OPs. The graph showing relative rates by year shows a sharp drop in incidence for THOR-GP between 2006 and 2007 with rates continuing to fall thereafter. Similarly, the equivalent graph for OPRA also suggests that much of the fall in incidence has occurred later on in the study period (from 2006 onwards). The pattern for upper limb disorders was very similar to that observed for total MSDs, whilst for spine/back disorders generally a steeper annual decrease was observed. A downward trend in the incidence of lower limb disorders was also observed (although this was not statistically significant). For OPs, the average annual percentage change in incidence was generally bigger when analyses were based on data from core reporters only whilst for GPs, restricting the data to core data only had little impact on the estimates.

Table 21 Average annual percentage change in risk in work-related musculoskeletal disorders

a) All reporters

		ESTIMATED CHANGE (95% CONFIDENCE INTERVAL)	
		OPRA	THOR-GP
	Year (continuous)	% change	% change
Total musculoskeletal	**1996-2010**	-3.3 (-4.5, -2.1)	N/A
	2006-2010	-5.8 (-9.3, -2.2)	-15.2 (-18.5, -11.8)
Upper limb	**1996-2010**	-3.2 (-4.6, -1.8)	N/A
	2006-2010	-3.7 (-8.3, 1.2)	-14.2 (-18.7, -9.5)
Spine/back	**1996-2010**	-4.3 (-6.0, -2.6)	N/A
	2006-2010	-9.9 (-15.3, -4.0)	-19.3 (-24.2, -14.1)
Lower limb	**2006-2010**	N/A	-8.6 (-17.4, 1.1)

b) Core reporters

		ESTIMATED CHANGE (95% CONFIDENCE INTERVAL)	
		OPRA	THOR-GP
	Year (continuous)	% change	% change
Total musculoskeletal	**2004-2010**	-12.1 (-14.7, -9.5)	N/A
	2006-2010	-7.0 (-11.0, -2.9)	-15.1 (-18.4, -11.6)
Upper limb	**2004-2010**	-11.3 (-14.7, -7.7)	N/A
	2006-2010	-4.0 (-9.3, 1.7)	-13.8 (-18.4, -9.0)
Spine/back	**2004-2010**	-15.0 (-19.2, -10.6)	N/A
	2006-2010	-13.4 (-19.8, -6.4)	-19.6 (-24.6, -14.4)
Lower limb	**2006-2010**	N/A	-7.9 (-16.9, 2.0)

c) Sample reporters

		ESTIMATED CHANGE (95% CONFIDENCE INTERVAL)
		OPRA
	Year (continuous)	% change
Total musculoskeletal	**1996-2010**	-1.7 (-3.0, -0.4)
Upper limb	**1996-2010**	-2.0 (-3.5, -0.4)
Spine/back	**1996-2010**	-2.8 (-4.6, -0.9)

Upper limb = Hand/wrist/arm, shoulder and elbow
Spine back = Neck/thoracic spine, lumbar spine/trunk
Lower limb = Hip/knee, ankle/foot

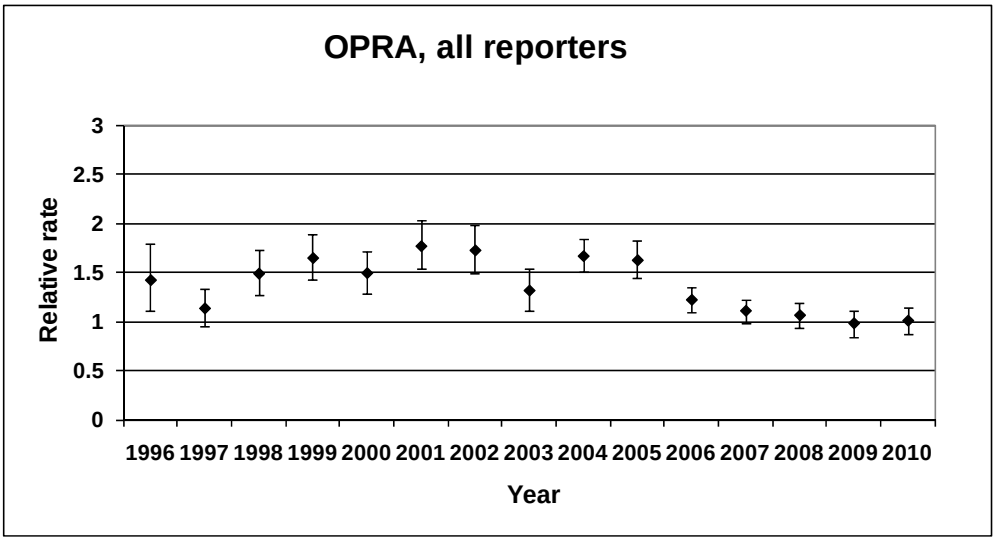
Table 22 Relative rates by year, with 95% comparison intervals, total musculoskeletal disorders (2010 estimate = 1)

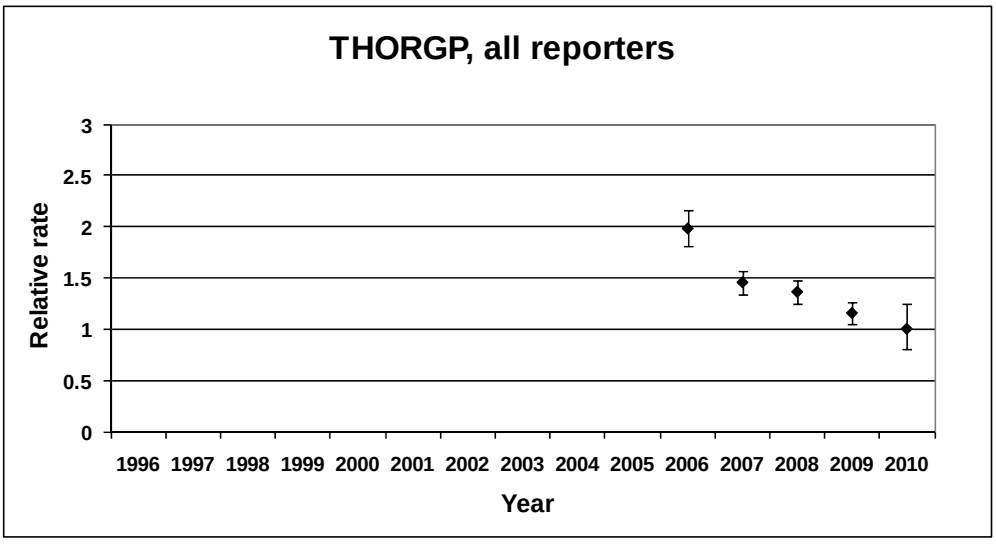
		Relative rates (95% comparison interval)	
		OPRA	**THORGP**
Reporter Group	**Year**		/
All	**1996**	1.42 (1.12, 1.80)	/
	1997	1.13 (0.95, 1.34)	/
	1998	1.48 (1.27, 1.74)	/
	1999	1.64 (1.42, 1.90)	/
	2000	1.49 (1.29, 1.72)	/
	2001	1.77 (1.53, 2.03)	/
	2002	1.72 (1.49, 1.99)	/
	2003	1.31 (1.12, 1.54)	/
	2004	1.66 (1.51, 1.84)	/
	2005	1.62 (1.45, 1.82)	/
	2006	1.21 (1.10, 1.35)	1.98 (1.81, 2.16)
	2007	1.10 (0.99, 1.23)	1.45 (1.34, 1.57)
	2008	1.06 (0.94, 1.19)	1.36 (1.25, 1.48)
	2009	0.97 (0.85, 1.12)	1.15 (1.05, 1.27)
	2010	1.00 (0.87, 1.15)	1.00 (0.80, 1.25)
Core	**1996**	/	/
	1997	/	/
	1998	/	/
	1999	/	/
	2000	/	/
	2001	/	/
	2002	/	/
	2003	/	/
	2004	1.85 (1.58, 2.17)	/
	2005	2.01 (1.75, 2.31)	/
	2006	1.31 (1.17, 1.47)	1.91 (1.75, 2.09)
	2007	1.22 (1.08, 1.38)	1.41 (1.30, 1.52)
	2008	1.09 (0.96, 1.25)	1.32 (1.21, 1.44)
	2009	1.00 (0.87, 1.16)	1.11 (1.01, 1.23)
	2010	1.00 (0.85, 1.17)	1.00 (0.78, 1.28)
Sample	**1996**	1.15 (0.91, 1.46)	**/**
	1997	0.93 (0.79, 1.10)	**/**
	1998	1.22 (1.05, 1.42)	**/**
	1999	1.36 (1.18, 1.56)	**/**
	2000	1.24 (1.08, 1.42)	**/**
	2001	1.46 (1.28, 1.67)	**/**
	2002	1.43 (1.25, 1.64)	**/**
	2003	1.09 (0.94, 1.27)	**/**
	2004	1.37 (1.18, 1.59)	**/**
	2005	1.17 (0.99, 1.37)	**/**
	2006	1.04 (0.86, 1.25)	**/**
	2007	0.89 (0.73, 1.08)	**/**
	2008	0.97 (0.78, 1.20)	**/**
	2009	0.92 (0.72, 1.17)	**/**
	2010	1.00 (0.78, 1.29)	**/**

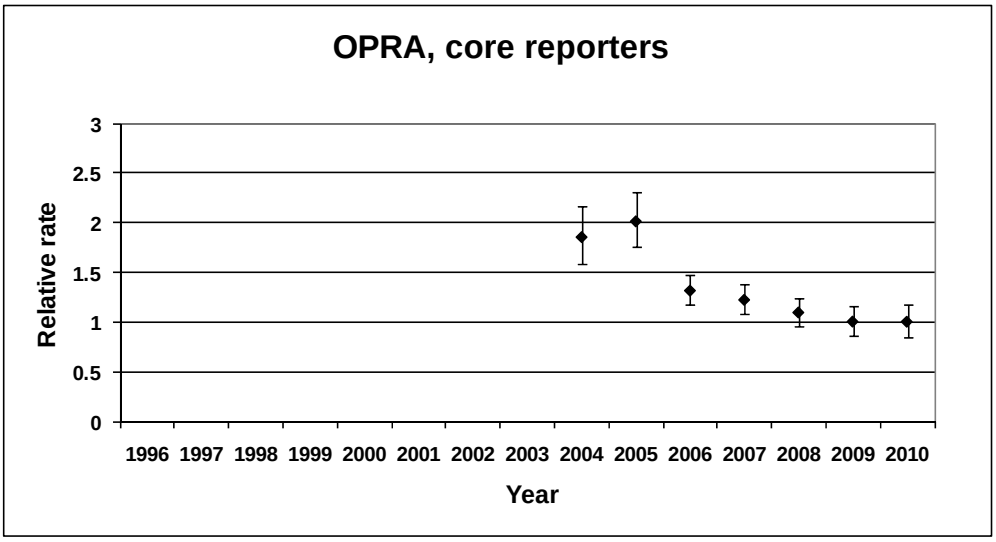
Models adjusted for reporter type (where appropriate), season and harvesting

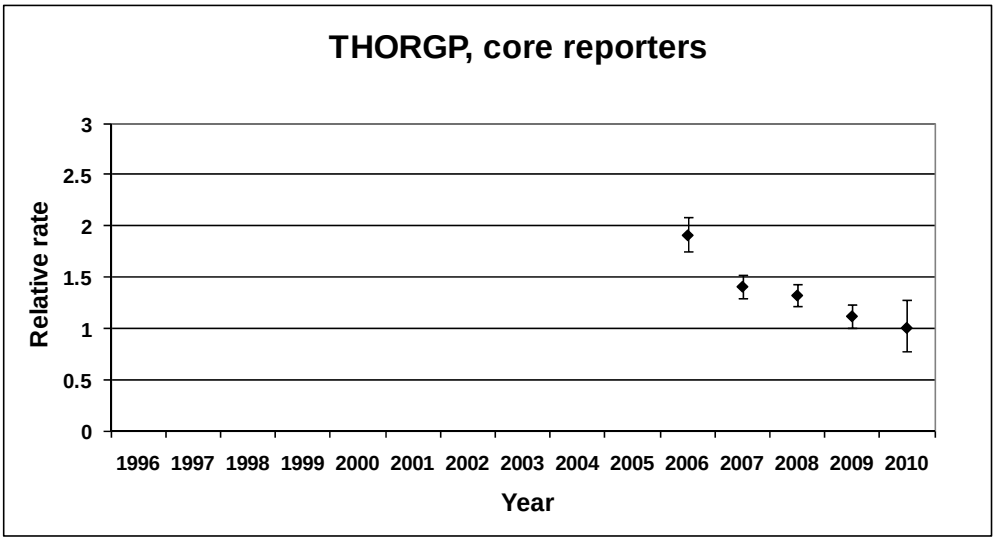
Population offset included in the model

Figure 16 Relative rates by year (2010 estimate = 1), with 95% comparison intervals, total musculoskeletal disorders






OPRA, core reporters
Relative rate
3
2.5
2
1.5
1
0.5
0
1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010
Year


THORGP, core reporters
Relative rate
3
2.5
2
1.5
1
0.5
0
1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010
Year

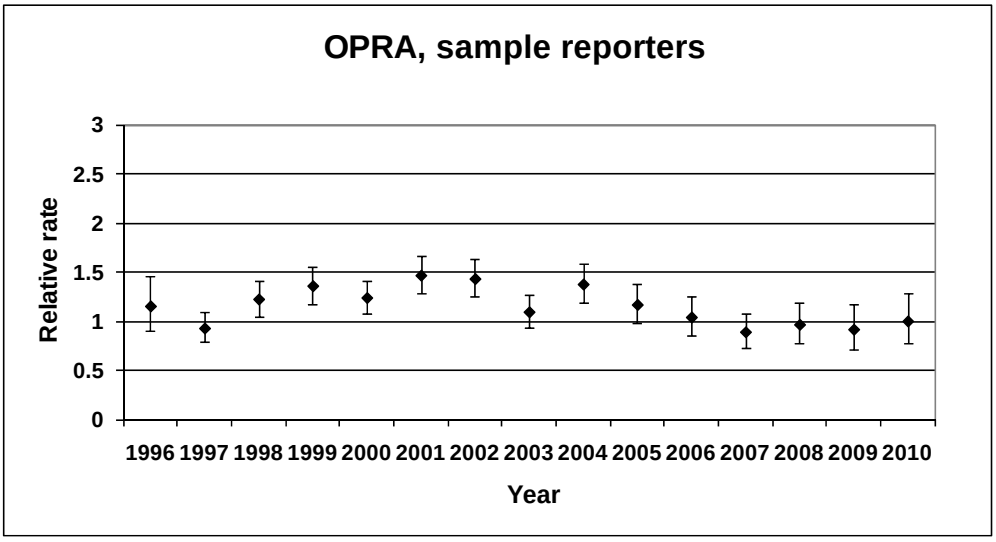

OPRA, sample reporters
Relative rate
3
2.5
2
1.5
1
0.5
0
1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010
Year

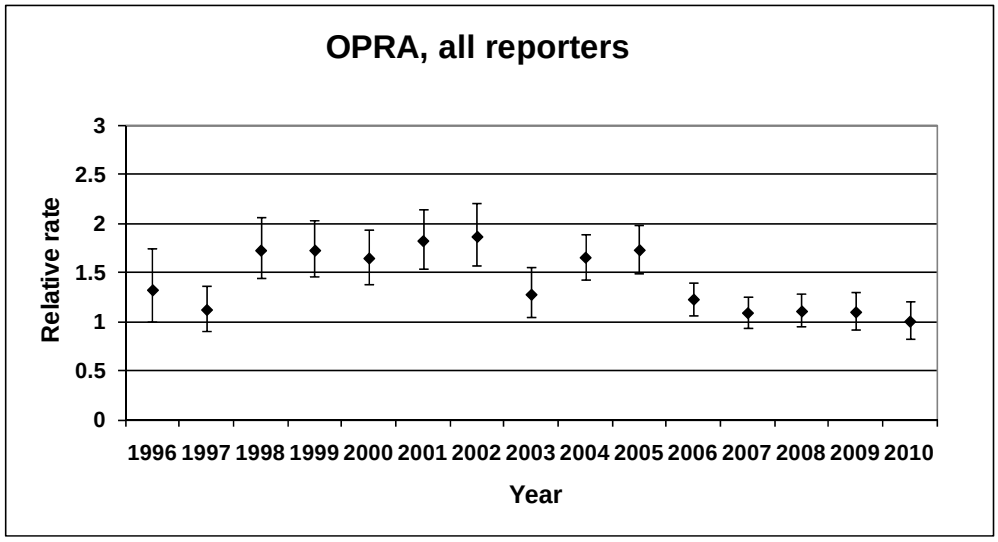
Table 23 Relative rates by year, with 95% comparison intervals, upper limb disorders (2010 estimate = 1)

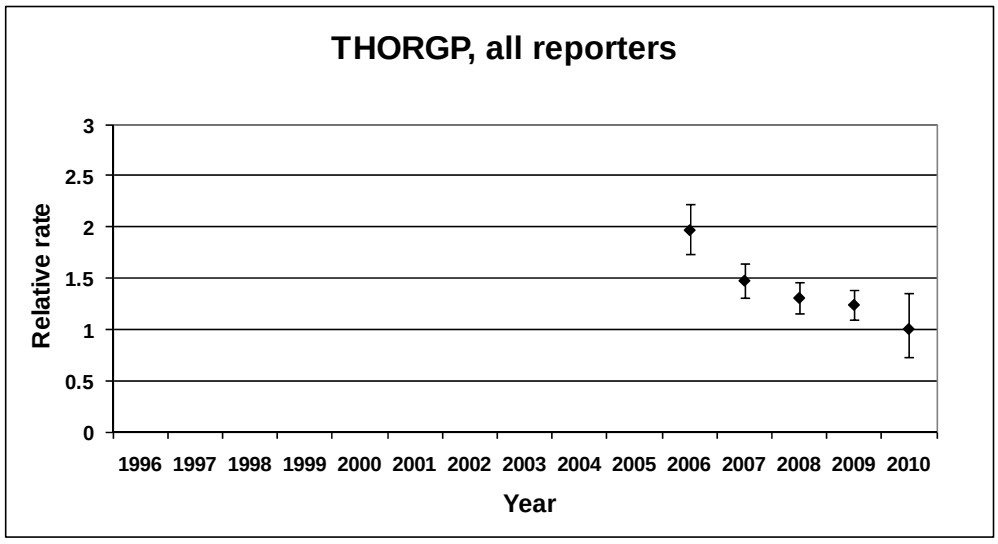
		Relative rates (95% comparison interval)	
		OPRA	**THORGP**
Reporter Group	**Year**		/
All	**1996**	1.32 (0.99, 1.75)	/
	1997	1.12 (0.91, 1.37)	/
	1998	1.72 (1.44, 2.06)	/
	1999	1.72 (1.46, 2.03)	/
	2000	1.64 (1.39, 1.94)	/
	2001	1.82 (1.54, 2.15)	/
	2002	1.86 (1.57, 2.20)	/
	2003	1.27 (1.04, 1.55)	/
	2004	1.65 (1.43, 1.90)	/
	2005	1.72 (1.50, 1.99)	/
	2006	1.22 (1.07, 1.40)	1.97 (1.74, 2.22)
	2007	1.09 (0.94, 1.26)	1.47 (1.31, 1.65)
	2008	1.10 (0.95, 1.29)	1.30 (1.16, 1.46)
	2009	1.09 (0.92, 1.29)	1.24 (1.10, 1.39)
	2010	1.00 (0.83, 1.20)	1.00 (0.74, 1.36)
Core	**1996**	/	/
	1997	/	/
	1998	/	/
	1999	/	/
	2000	/	/
	2001	/	/
	2002	/	/
	2003	/	/
	2004	1.74 (1.39, 2.18)	/
	2005	2.09 (1.77, 2.47)	/
	2006	1.20 (1.03, 1.41)	1.84 (1.63, 2.08)
	2007	1.15 (0.98, 1.35)	1.39 (1.25, 1.55)
	2008	1.11 (0.94, 1.32)	1.23 (1.09, 1.38)
	2009	1.07 (0.89, 1.30)	1.16 (1.02, 1.33)
	2010	1.00 (0.81, 1.23)	1.00 (0.72, 1.38)
Sample	**1996**	1.17 (0.88, 1.54)	**/**
	1997	1.01 (0.82, 1.23)	**/**
	1998	1.54 (1.30, 1.83)	**/**
	1999	1.55 (1.31, 1.82)	**/**
	2000	1.48 (1.26, 1.74)	**/**
	2001	1.64 (1.40, 1.93)	**/**
	2002	1.68 (1.43, 1.97)	**/**
	2003	1.15 (0.96, 1.39)	**/**
	2004	1.48 (1.23, 1.78)	**/**
	2005	1.31 (1.07, 1.60)	**/**
	2006	1.26 (1.01, 1.57)	**/**
	2007	0.95 (0.74, 1.22)	**/**
	2008	1.07 (0.82, 1.39)	**/**
	2009	1.12 (0.84, 1.51)	**/**
	2010	1.00 (0.72, 1.39)	**/**

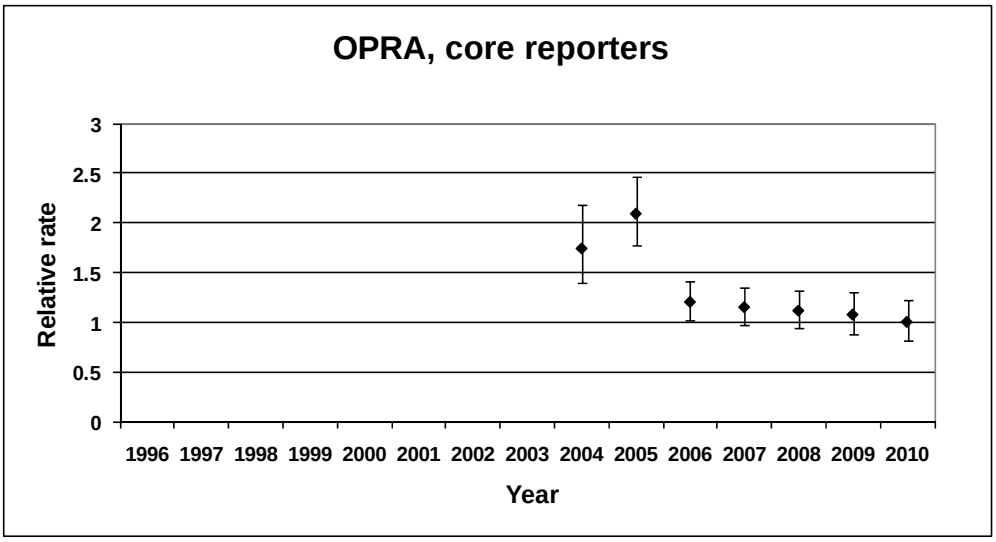
Models adjusted for reporter type (where appropriate), season and harvesting

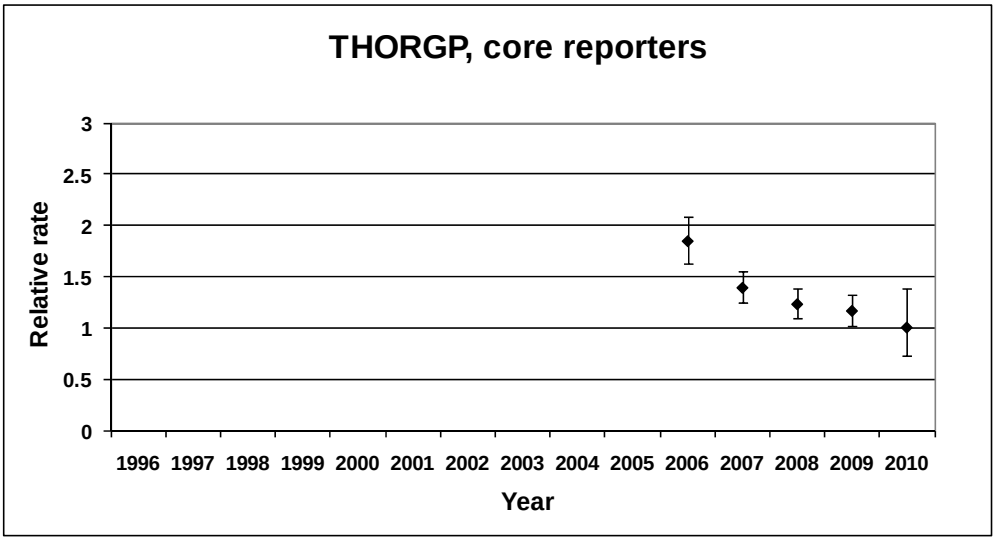
Population offset included in the model

Figure 17 Relative rates by year (2010 estimate = 1), with 95% comparison intervals, upper limb disorders






OPRA, core reporters
Relative rate
3
2.5
2
1.5
1
0.5
0
1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010
Year


THORGP, core reporters
Relative rate
3
2.5
2
1.5
1
0.5
0
1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010
Year

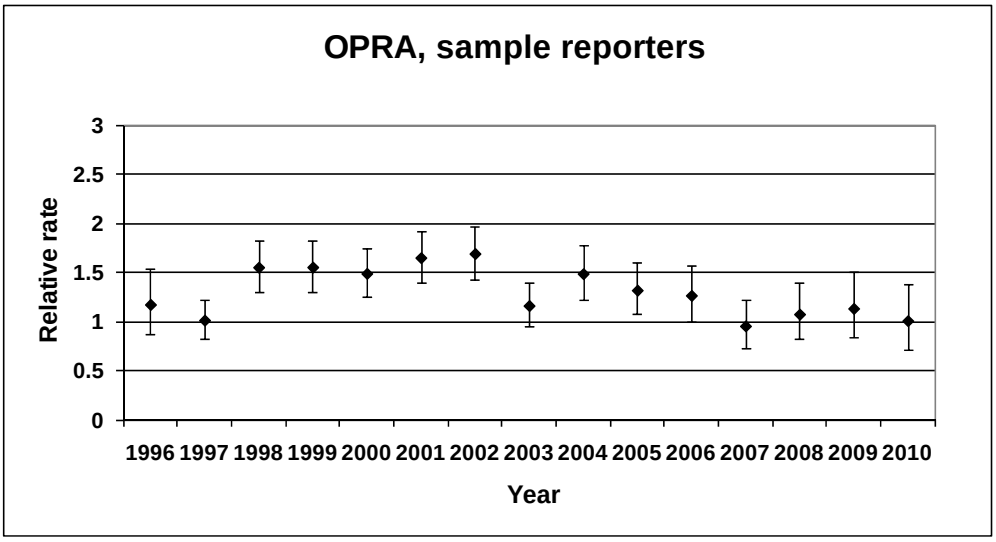

OPRA, sample reporters
Relative rate
3
2.5
2
1.5
1
0.5
0
1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010
Year

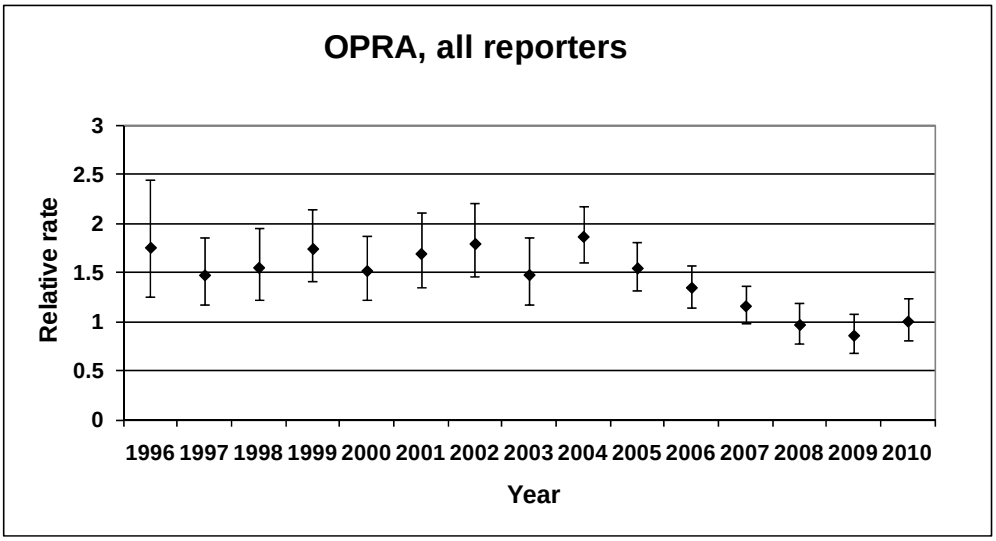
Table 24 Relative rates by year, with 95% comparison intervals, spine/back disorders (2010 estimate = 1)

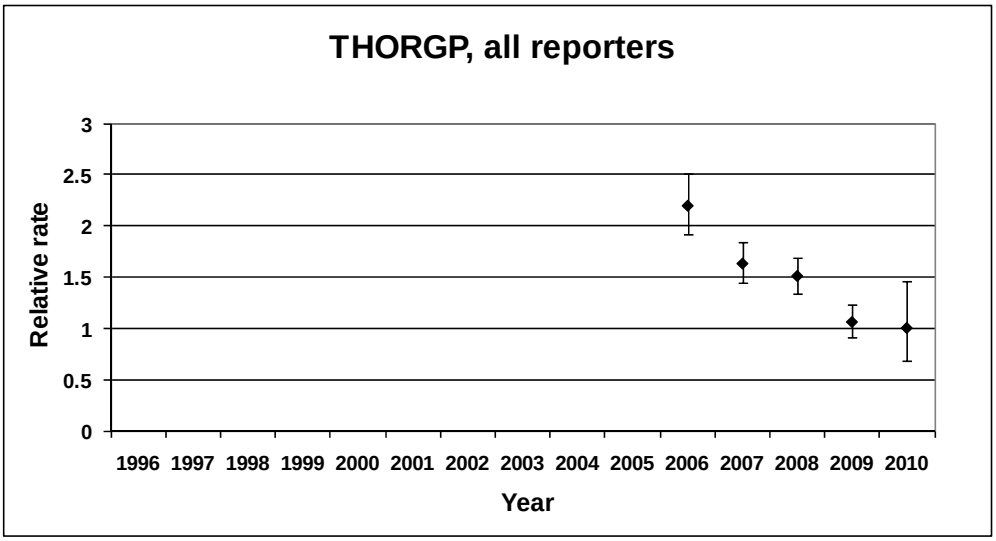
		Relative rates (95% comparison interval)	
		OPRA	**THORGP**
Reporter Group	**Year**		/
All	**1996**	1.75 (1.26, 2.44)	/
	1997	1.47 (1.17, 1.86)	/
	1998	1.55 (1.23, 1.95)	/
	1999	1.74 (1.41, 2.15)	/
	2000	1.52 (1.22, 1.88)	/
	2001	1.69 (1.35, 2.11)	/
	2002	1.79 (1.45, 2.21)	/
	2003	1.47 (1.17, 1.86)	/
	2004	1.86 (1.60, 2.17)	/
	2005	1.54 (1.31, 1.81)	/
	2006	1.34 (1.15, 1.58)	2.19 (1.92, 2.51)
	2007	1.16 (0.98, 1.36)	1.63 (1.44, 1.84)
	2008	0.97 (0.78, 1.19)	1.51 (1.34, 1.69)
	2009	0.86 (0.68, 1.08)	1.06 (0.91, 1.24)
	2010	1.00 (0.80, 1.24)	1.00 (0.68, 1.46)
Core	**1996**	/	/
	1997	/	/
	1998	/	/
	1999	/	/
	2000	/	/
	2001	/	/
	2002	/	/
	2003	/	/
	2004	2.05 (1.60, 2.63)	/
	2005	2.07 (1.64, 2.61)	/
	2006	1.65 (1.38, 1.97)	2.27 (1.95, 2.63)
	2007	1.32 (1.08, 1.61)	1.69 (1.47, 1.95)
	2008	0.91 (0.71, 1.16)	1.56 (1.44, 1.68)
	2009	0.96 (0.75, 1.22)	1.09 (0.92, 1.29)
	2010	1.00 (0.76, 1.31)	1.00 (0.64, 1.55)
Sample	**1996**	1.38 (0.99, 1.93)	**/**
	1997	1.17 (0.95, 1.45)	**/**
	1998	1.23 (0.98, 1.54)	**/**
	1999	1.39 (1.14, 1.71)	**/**
	2000	1.21 (0.99, 1.48)	**/**
	2001	1.35 (1.09, 1.66)	**/**
	2002	1.44 (1.17, 1.76)	**/**
	2003	1.19 (0.95, 1.49)	**/**
	2004	1.52 (1.23, 1.89)	**/**
	2005	1.10 (0.85, 1.42)	**/**
	2006	0.93 (0.69, 1.24)	**/**
	2007	0.92 (0.68, 1.23)	**/**
	2008	1.01 (0.74, 1.37)	**/**
	2009	0.68 (0.46, 1.01)	**/**
	2010	1.00 (0.68, 1.47)	**/**

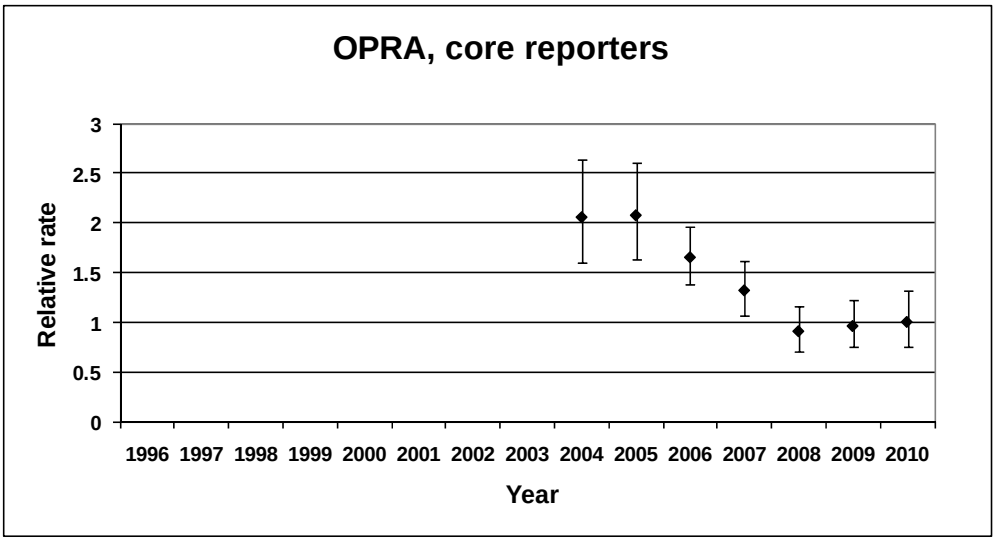
Models adjusted for reporter type (where appropriate), season and harvesting

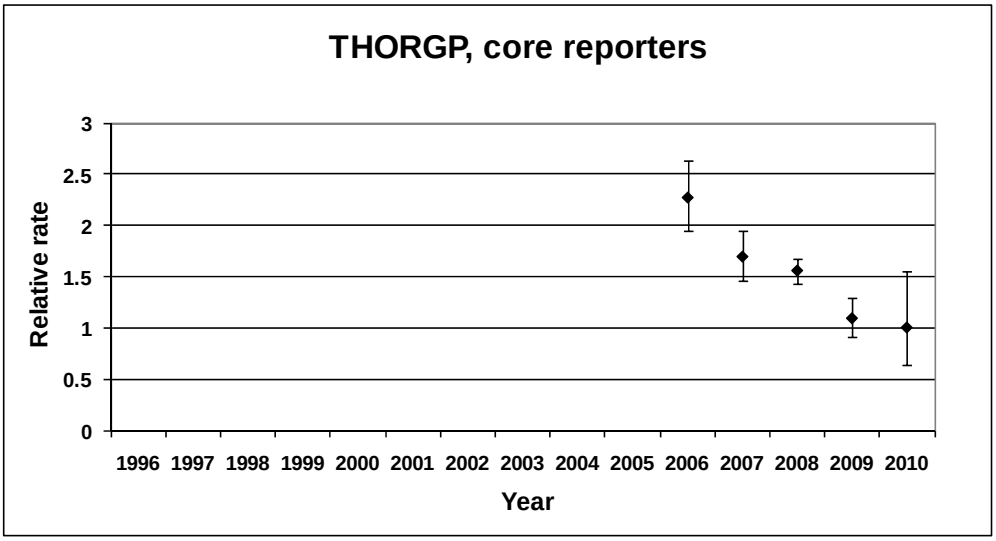
Population offset included in the model

Figure 18 Relative rates by year (2010 estimate = 1), with 95% comparison intervals, spine/back disorders






OPRA, core reporters
Relative rate
3
2.5
2
1.5
1
0.5
0
1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010
Year


THORGP, core reporters
Relative rate
3
2.5
2
1.5
1
0.5
0
1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010
Year

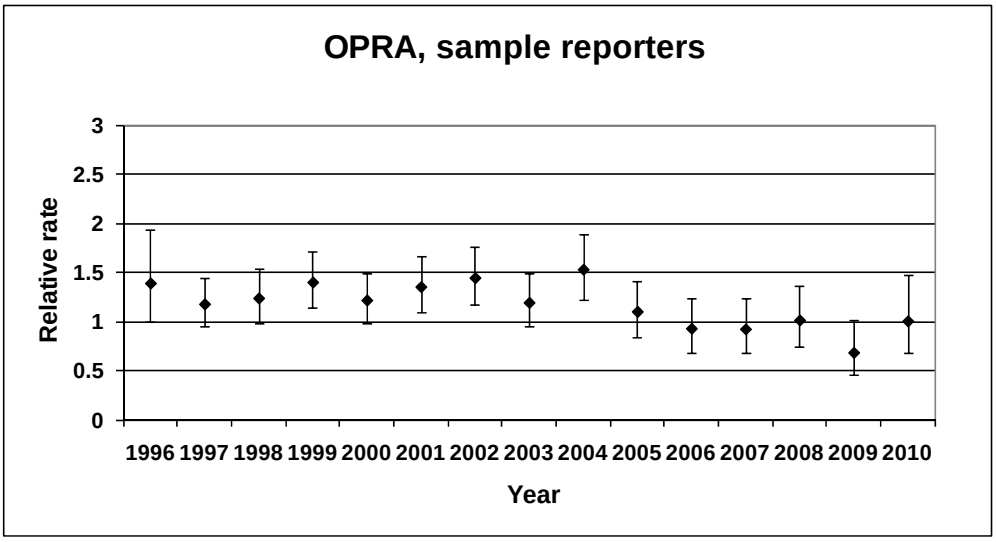
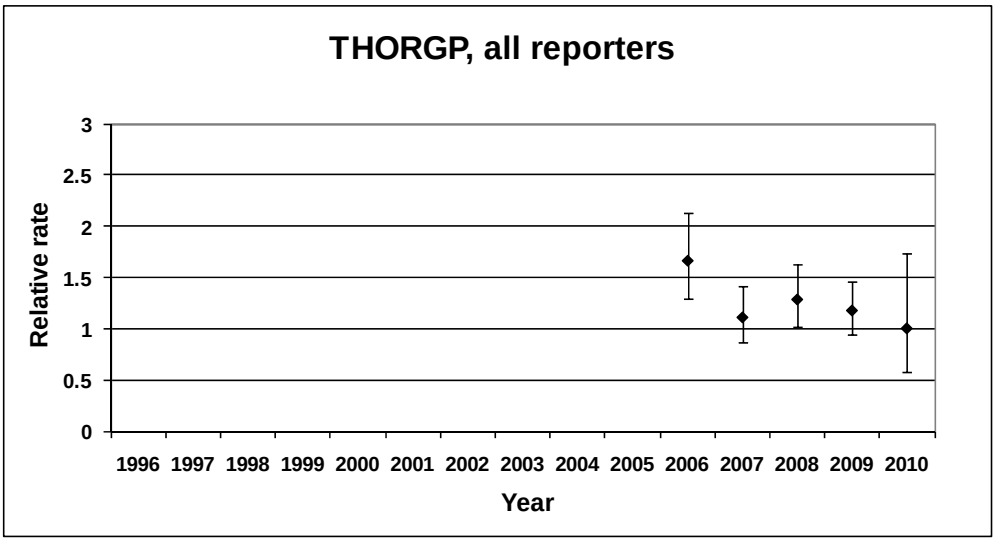

OPRA, sample reporters
Relative rate
3
2.5
2
1.5
1
0.5
0
1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010
Year

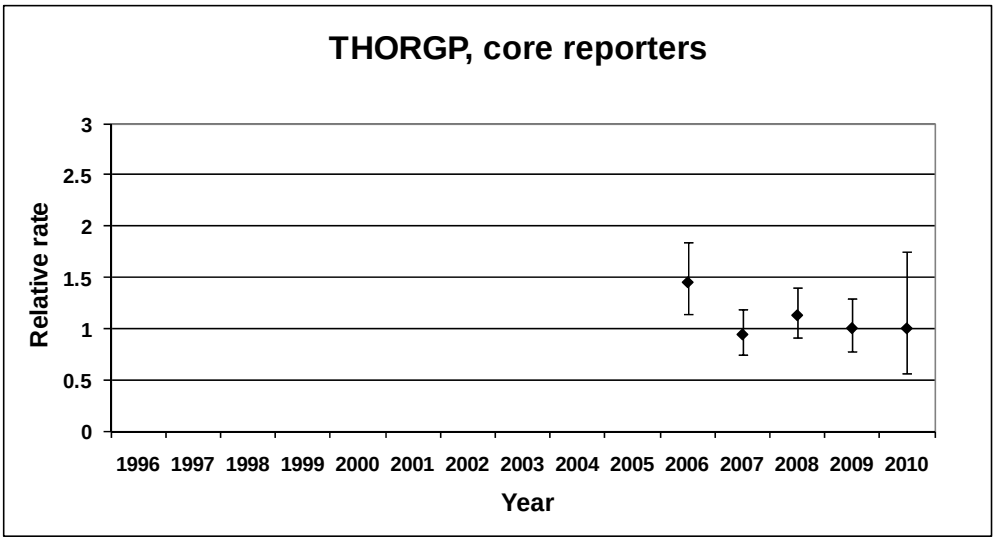
Table 25 Relative rates by year, with 95% comparison intervals, lower limb disorders (2010 estimate = 1)

		Relative rates (95% comparison interval)
		THORGP
Reporter Group	**Year**	/
All	**2006**	1.66 (1.30, 2.13)
	2007	1.11 (0.87, 1.41)
	2008	1.28 (1.01, 1.63)
	2009	1.17 (0.94, 1.47)
	2010	1.00 (0.58, 1.74)
Core	**2006**	1.45 (1.15, 1.84)
	2007	0.94 (0.74, 1.19)
	2008	1.13 (0.91, 1.40)
	2009	1.00 (0.78, 1.29)
	2010	1.00 (0.57, 1.76)

Models adjusted for reporter type (where appropriate), season and harvesting
Population offset included in the model

Figure 19 Relative rates by year (2010 estimate = 1), with 95% comparison intervals, lower limb disorders





3.2.5 MENTAL ILL-HEALTH

The average annual percentage change in reported incidence of work-related mental ill-health, as reported by OPs (OPRA) and GPs (THOR-GP) is shown in Table 26 whilst the relative rates by year are shown in Tables 27 to 29 and Figures 20 to 22. For the period 1996-2010, data from OPs suggested an increase in the incidence of total mental ill-health. This pattern persists when the sub-categories of anxiety and depression and other work stress are analysed separately, with a larger annual increase in incidence observed for other work stress compared to anxiety and depression. For anxiety and depression, the graph of relative rates by year shows a gradual increase in incidence between 1996 and 2000, followed by a sharp rise between 2000 and 2001. Rates then continue to rise before reaching a plateau circa 2004 after which they fall slightly then flatten out. In contrast, the incidence of other work stress, as reported by OPs to OPRA, appears to have been increasing gradually throughout the study period. For OPs, analyses based on data from core reporters only suggested a smaller increase in incidence per year (as expected as these analyses are based on data from 2004 onwards only) whilst analyses based on sample reporters only suggested a larger increase in incidence per year (compared to those based on all reporters).

For the period 2006-2010, a significant, decreasing trend in the incidence of mental ill-health was observed for THOR-GP, which remained relatively unchanged whether data from all reporters or from core reporters only were included in the analyses. However, the graphs showing relative rates by year typically suggest a higher incidence in 2010 compared to earlier years (although it must be noted that the confidence intervals for the 2010 estimate overlap the other years). Restricting the OP data to the same time period as the GP data (2006-2010) also resulted in a suggested decrease (but not a statistically significant one) in the incidence of anxiety and depression but for other work stress, the trend remained positive (although no longer statistically significant).

Table 26 Average annual percentage change in risk in work-related mental ill-health

a) All reporters

		ESTIMATED CHANGE (95% CONFIDENCE INTERVAL)	
		OPRA	THOR-GP
	Year (continuous)	% change	% change
Total mental ill-health	**1996-2010**	5.7 (4.5, 7.0)	N/A
	2006-2010	-0.1 (-3.1, 3.0)	-8.8 (-13.1, -4.1)
Anxiety and depression	**1996-2010**	3.5 (1.9, 5.0)	N/A
	2006-2010	-2.7 (-6.6, 1.3)	-7.1 (-13.7, 0.0)
Other work stress	**1996-2010**	9.5 (7.7, 11.3)	N/A
	2006-2010	4.5 (-0.1, 9.4)	-10.6 (-15.9, -5.1)

b) Core reporters

		ESTIMATED CHANGE (95% CONFIDENCE INTERVAL)	
		OPRA	THOR-GP
	Year (continuous)	% change	% change
Total mental ill-health	**2004-2010**	-2.6 (-5.0, -0.2)	N/A
	2006-2010	-1.5 (-5.0, 2.0)	-8.9 (-13.4, -4.2)
Anxiety and depression	**2004-2010**	-6.6 (-9.5, -3.6)	N/A
	2006-2010	-5.2 (-9.4, -0.8)	-7.4 (-14.1, -0.2)
Other work stress	**2004-2010**	5.3 (1.5, 9.3)	N/A
	2006-2010	5.4 (-0.2, 11.2)	-10.9 (-16.2, -5.3)

c) Sample reporters

		ESTIMATED CHANGE (95% CONFIDENCE INTERVAL)
		OPRA
	Year (continuous)	% change
Total mental ill-health	**1996-2010**	8 (6.5, 9.4)
Anxiety and depression	**1996-2010**	5.9 (4.2, 7.7)
Other work stress	**1996-2010**	10.6 (8.5, 12.6)

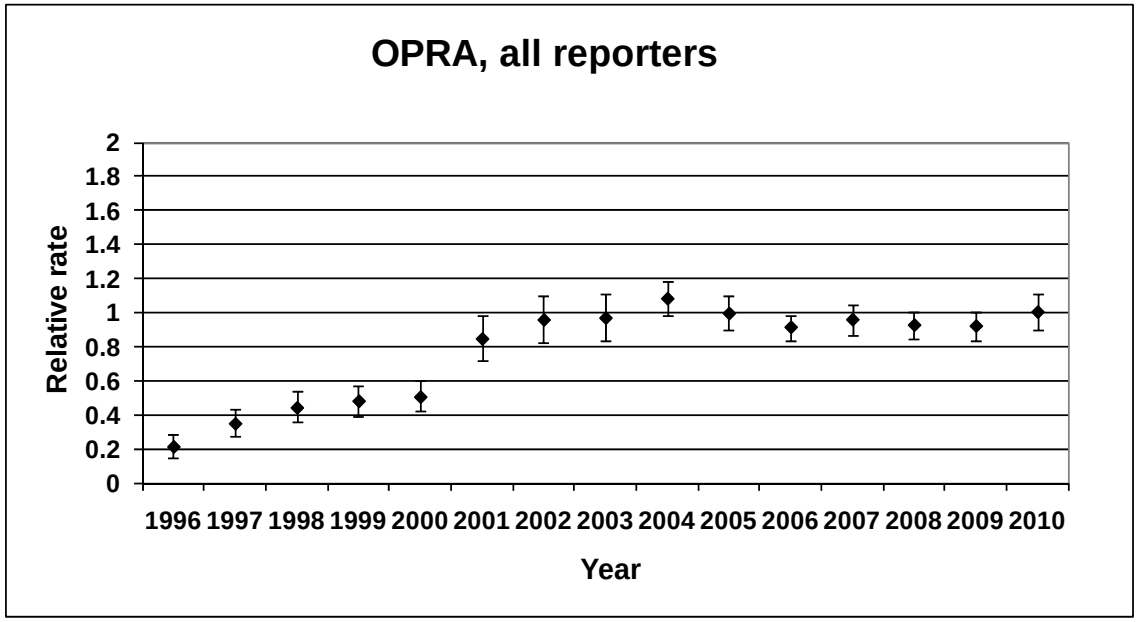
Table 27 Relative rates by year, with 95% comparison intervals, total mental ill-health (2010 estimate = 1)

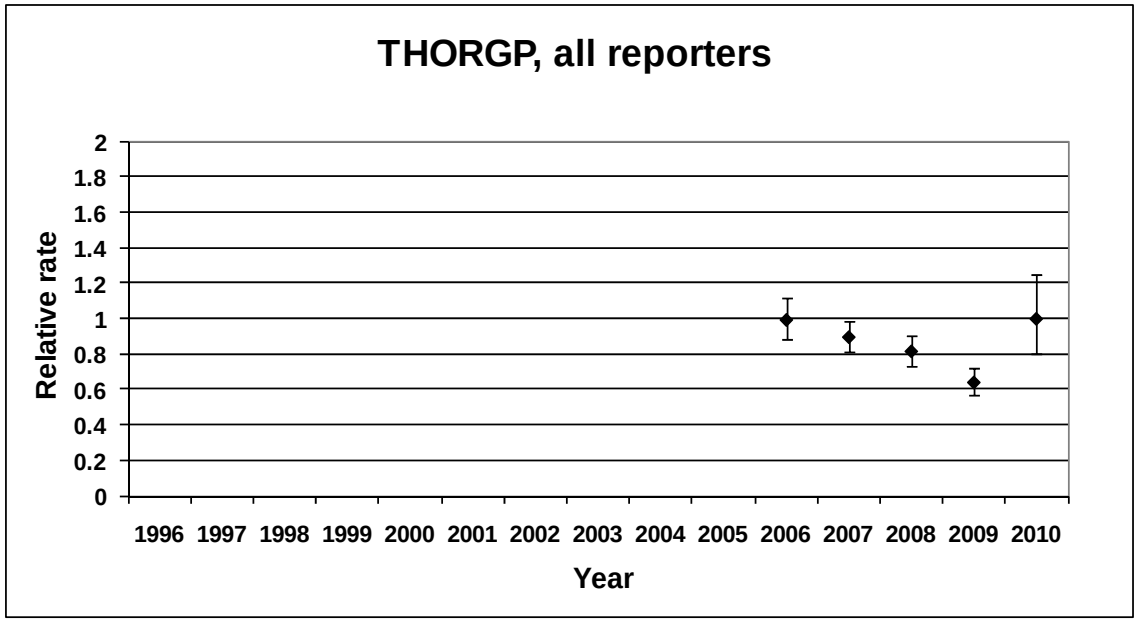
		Relative rates (95% comparison interval)	
		OPRA	**THORGP**
Reporter Group	**Year**		/
All	**1996**	0.21 (0.15, 0.29)	/
	1997	0.34 (0.28, 0.43)	/
	1998	0.44 (0.36, 0.54)	/
	1999	0.48 (0.40, 0.57)	/
	2000	0.50 (0.42, 0.60)	/
	2001	0.84 (0.72, 0.98)	/
	2002	0.95 (0.83, 1.10)	/
	2003	0.96 (0.84, 1.11)	/
	2004	1.08 (0.98, 1.18)	/
	2005	0.99 (0.90, 1.10)	/
	2006	0.91 (0.84, 0.99)	0.99 (0.88, 1.12)
	2007	0.96 (0.87, 1.05)	0.90 (0.81, 0.99)
	2008	0.92 (0.85, 1.01)	0.82 (0.73, 0.91)
	2009	0.92 (0.83, 1.01)	0.64 (0.57, 0.72)
	2010	1.00 (0.90, 1.11)	1.00 (0.80, 1.25)
Core	**1996**	/	/
	1997	/	/
	1998	/	/
	1999	/	/
	2000	/	/
	2001	/	/
	2002	/	/
	2003	/	/
	2004	1.16 (1.02, 1.32)	/
	2005	1.11 (0.97, 1.28)	/
	2006	0.93 (0.84, 1.03)	1.01 (0.90, 1.14)
	2007	1.02 (0.92, 1.13)	0.93 (0.83, 1.03)
	2008	0.90 (0.81, 1.00)	0.84 (0.76, 0.92)
	2009	0.95 (0.85, 1.06)	0.67 (0.59, 0.75)
	2010	1.00 (0.89, 1.13)	1.00 (0.77, 1.30)
Sample	**1996**	0.20 (0.14, 0.27)	**/**
	1997	0.32 (0.25, 0.41)	**/**
	1998	0.41 (0.33, 0.50)	**/**
	1999	0.44 (0.37, 0.53)	**/**
	2000	0.47 (0.39, 0.55)	**/**
	2001	0.78 (0.68, 0.91)	**/**
	2002	0.89 (0.78, 1.01)	**/**
	2003	0.90 (0.78, 1.02)	**/**
	2004	0.98 (0.85, 1.12)	**/**
	2005	0.86 (0.74, 0.99)	**/**
	2006	0.87 (0.75, 1.02)	**/**
	2007	0.83 (0.71, 0.98)	**/**
	2008	0.97 (0.83, 1.14)	**/**
	2009	0.85 (0.70, 1.02)	**/**
	2010	1.00 (0.82, 1.22)	**/**

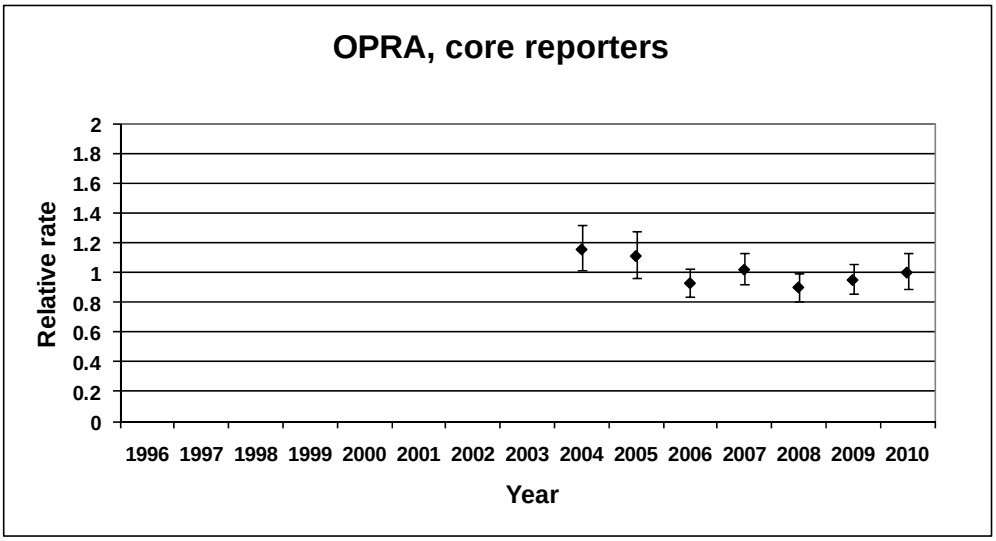
Models adjusted for reporter type (where appropriate), season and harvesting

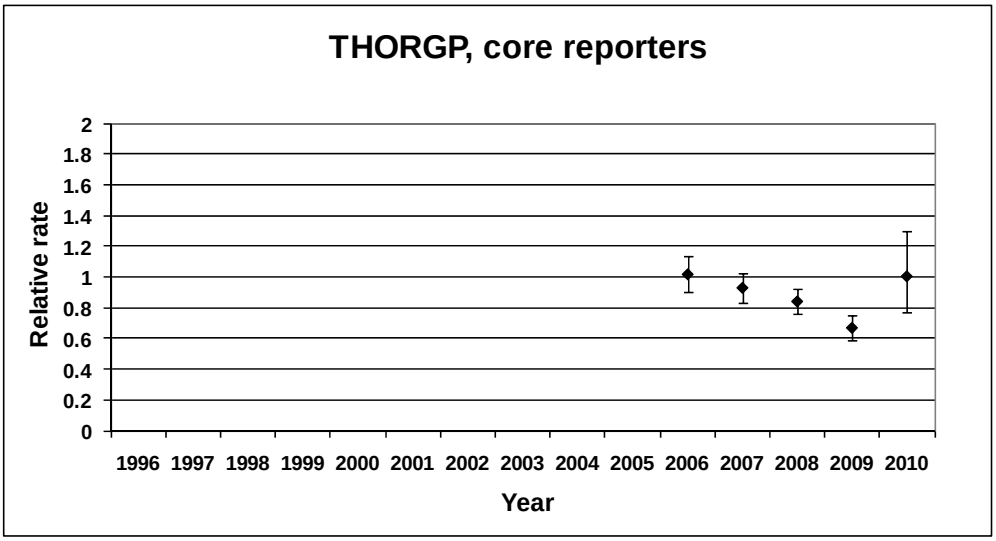
Population offset included in the model

Figure 20 Relative rates by year (2010 estimate = 1), with 95% comparison intervals, total mental ill-health






OPRA, core reporters
Relative rate
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010
Year


THORGP, core reporters
Relative rate
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010
Year

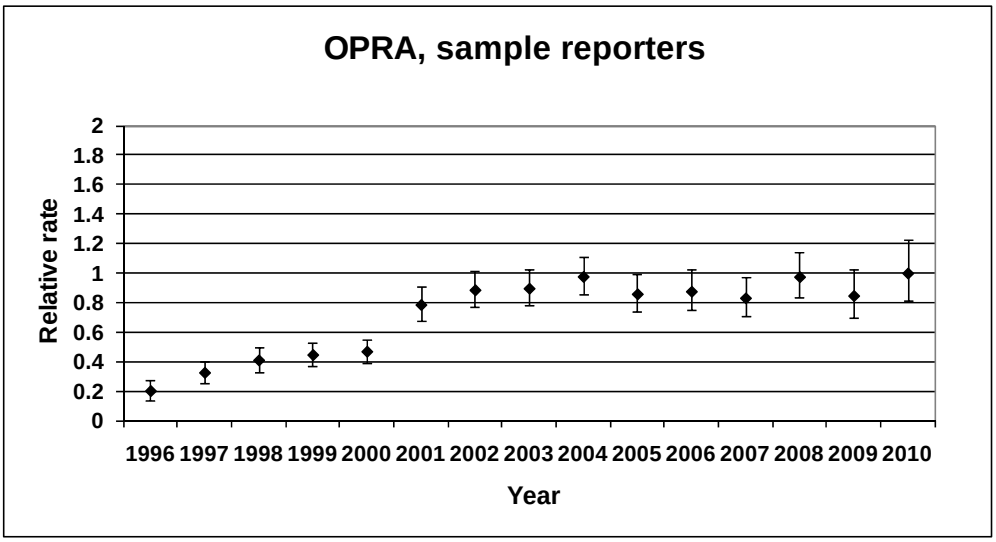

OPRA, sample reporters
Relative rate
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010
Year

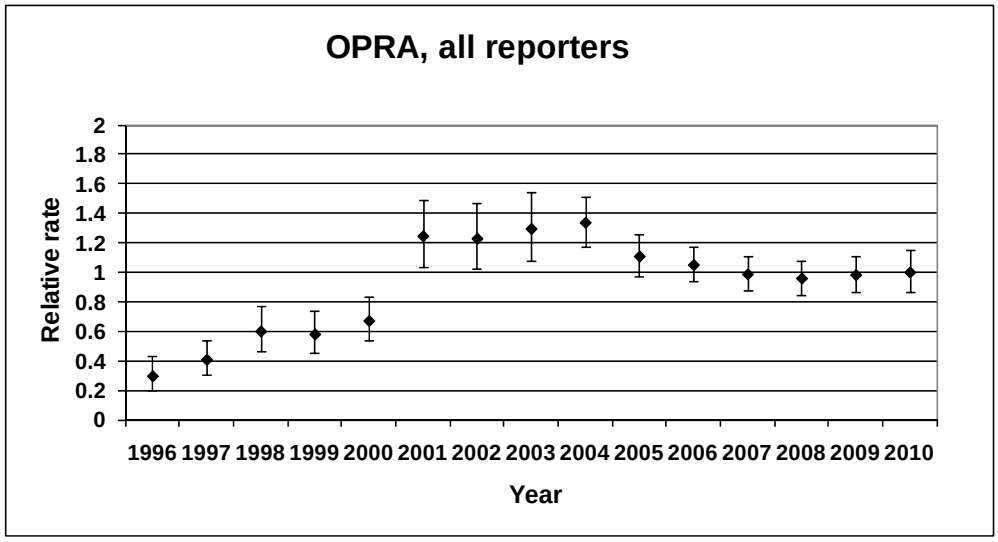
Table 28 Relative rates by year, with 95% comparison intervals, anxiety and depression (2010 estimate = 1)

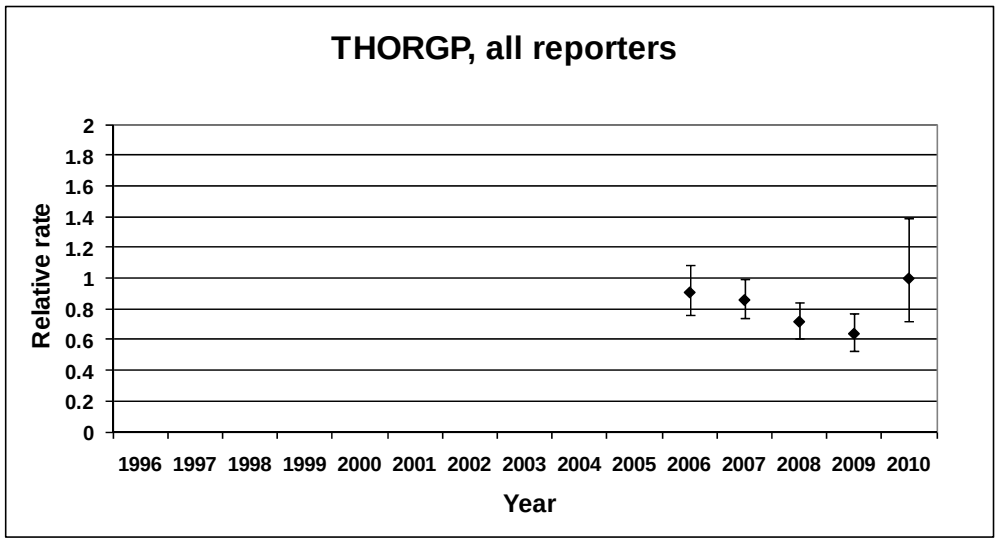
		Relative rates (95% comparison interval)	
		OPRA	**THORGP**
Reporter Group	**Year**		/
All	**1996**	0.30 (0.20, 0.44)	/
	1997	0.41 (0.31, 0.54)	/
	1998	0.60 (0.47, 0.77)	/
	1999	0.58 (0.46, 0.74)	/
	2000	0.67 (0.54, 0.83)	/
	2001	1.24 (1.04, 1.49)	/
	2002	1.23 (1.03, 1.47)	/
	2003	1.29 (1.08, 1.55)	/
	2004	1.34 (1.18, 1.51)	/
	2005	1.11 (0.98, 1.26)	/
	2006	1.05 (0.94, 1.18)	0.91 (0.76, 1.09)
	2007	0.99 (0.88, 1.11)	0.86 (0.74, 0.99)
	2008	0.96 (0.85, 1.08)	0.72 (0.61, 0.84)
	2009	0.98 (0.87, 1.11)	0.64 (0.53, 0.77)
	2010	1.00 (0.87, 1.15)	1.00 (0.72, 1.39)
Core	**1996**	/	/
	1997	/	/
	1998	/	/
	1999	/	/
	2000	/	/
	2001	/	/
	2002	/	/
	2003	/	/
	2004	1.54 (1.32, 1.81)	/
	2005	1.34 (1.11, 1.61)	/
	2006	1.13 (1.00, 1.28)	0.95 (0.79, 1.14)
	2007	1.12 (0.99, 1.27)	0.93 (0.80, 1.07)
	2008	1.00 (0.87, 1.15)	0.76 (0.64, 0.90)
	2009	1.06 (0.91, 1.23)	0.69 (0.57, 0.83)
	2010	1.00 (0.84, 1.19)	1.00 (0.69, 1.45)
Sample	**1996**	0.25 (0.17, 0.37)	**/**
	1997	0.34 (0.26, 0.45)	**/**
	1998	0.50 (0.39, 0.64)	**/**
	1999	0.48 (0.38, 0.61)	**/**
	2000	0.56 (0.45, 0.69)	**/**
	2001	1.03 (0.88, 1.22)	**/**
	2002	1.02 (0.87, 1.20)	**/**
	2003	1.07 (0.91, 1.26)	**/**
	2004	1.06 (0.89, 1.27)	**/**
	2005	0.85 (0.70, 1.04)	**/**
	2006	0.91 (0.74, 1.13)	**/**
	2007	0.75 (0.60, 0.94)	**/**
	2008	0.87 (0.69, 1.08)	**/**
	2009	0.84 (0.65, 1.10)	**/**
	2010	1.00 (0.77, 1.30)	**/**

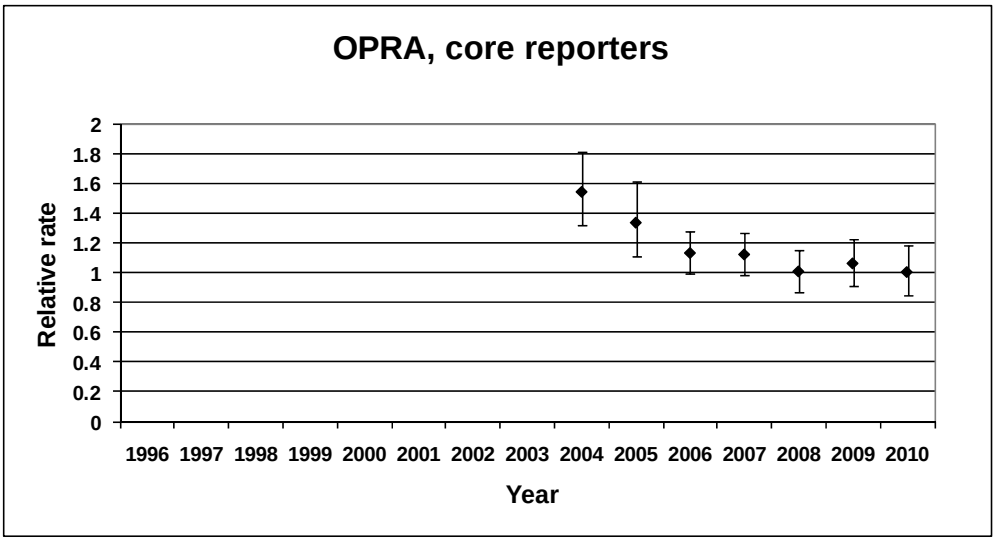
Models adjusted for reporter type (where appropriate), season and harvesting

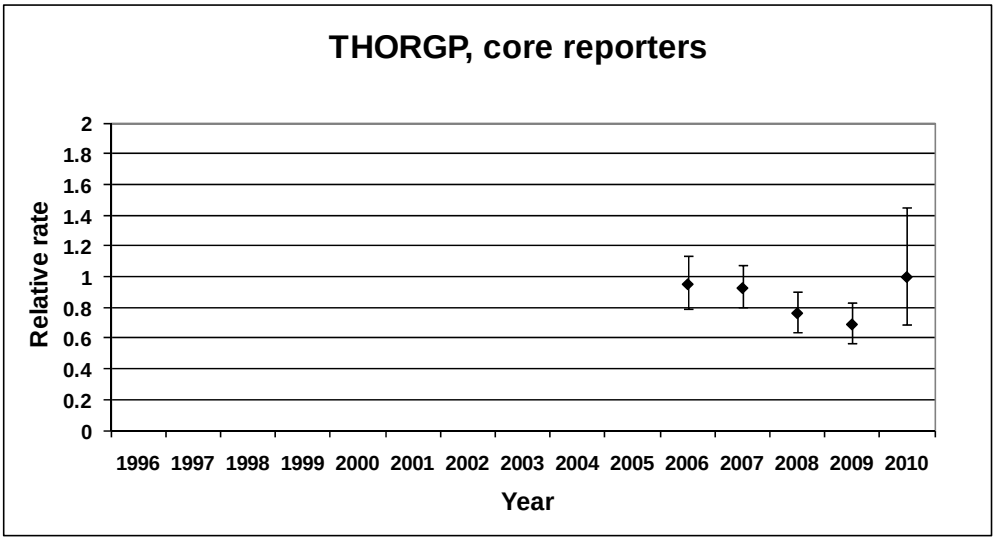
Population offset included in the model

Figure 21 Relative rates by year (2010 estimate = 1), with 95% comparison intervals, anxiety and depression






OPRA, core reporters
Relative rate
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010
Year


THORGP, core reporters
Relative rate
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010
Year

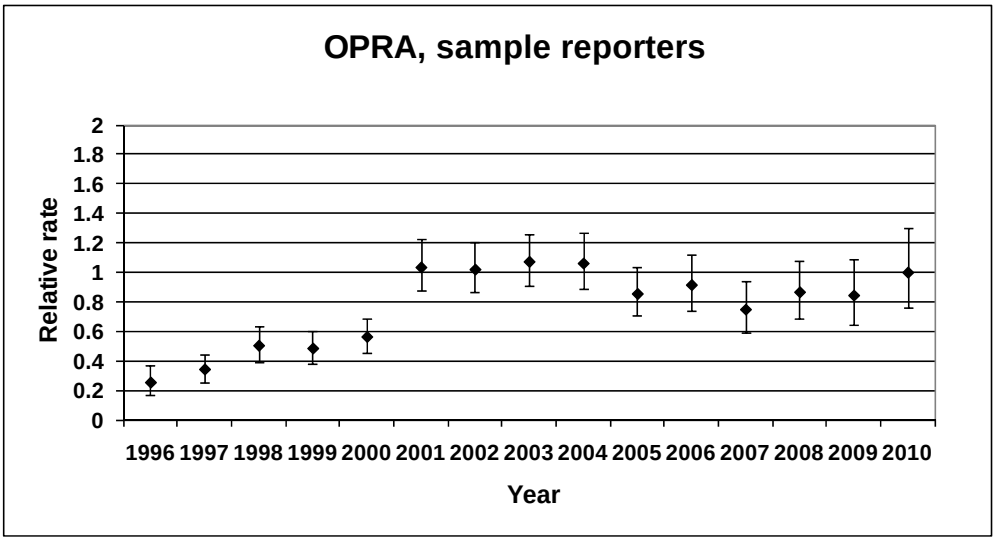

OPRA, sample reporters
Relative rate
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010
Year

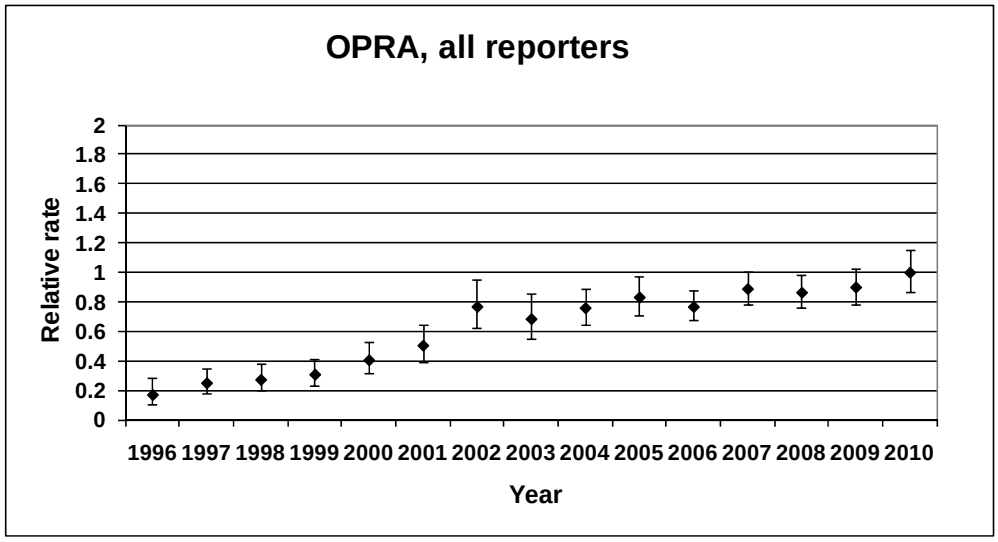
Table 29 Relative rates by year, with 95% comparison intervals, other work stress (2010 estimate = 1)

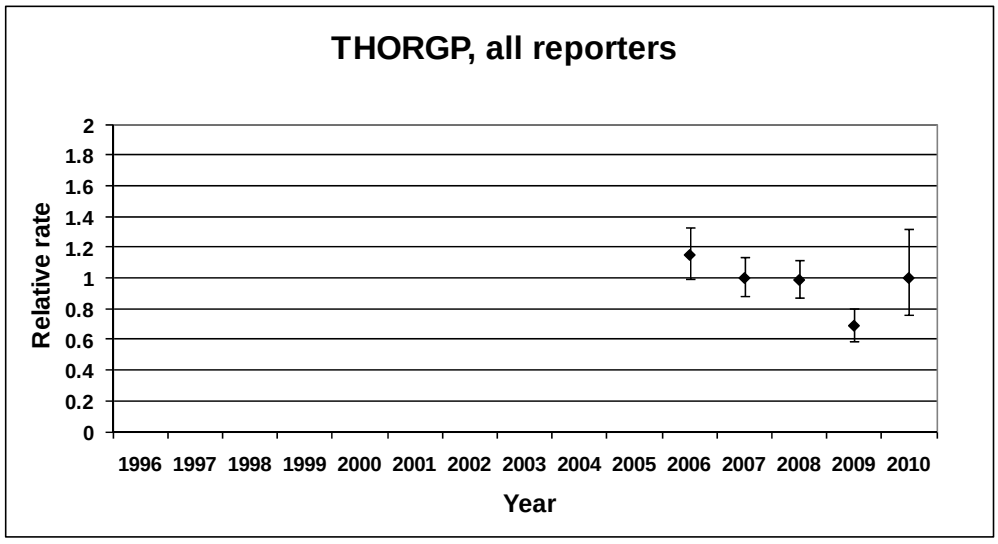
		Relative rates (95% comparison interval)	
		OPRA	**THORGP**
Reporter Group	**Year**		/
All	**1996**	0.17 (0.11, 0.28)	/
	1997	0.25 (0.18, 0.35)	/
	1998	0.27 (0.20, 0.38)	/
	1999	0.31 (0.23, 0.41)	/
	2000	0.41 (0.31, 0.53)	/
	2001	0.51 (0.40, 0.65)	/
	2002	0.77 (0.62, 0.95)	/
	2003	0.69 (0.55, 0.86)	/
	2004	0.76 (0.65, 0.89)	/
	2005	0.83 (0.71, 0.98)	/
	2006	0.77 (0.67, 0.88)	1.15 (1.00, 1.33)
	2007	0.89 (0.79, 1.01)	1.00 (0.88, 1.14)
	2008	0.86 (0.76, 0.98)	0.99 (0.87, 1.12)
	2009	0.90 (0.79, 1.03)	0.69 (0.59, 0.80)
	2010	1.00 (0.87, 1.15)	1.00 (0.76, 1.32)
Core	**1996**	/	/
	1997	/	/
	1998	/	/
	1999	/	/
	2000	/	/
	2001	/	/
	2002	/	/
	2003	/	/
	2004	0.69 (0.55, 0.86)	/
	2005	0.84 (0.68, 1.04)	/
	2006	0.71 (0.60, 0.84)	1.16 (1.00, 1.34)
	2007	0.92 (0.79, 1.07)	1.01 (0.89, 1.14)
	2008	0.80 (0.68, 0.94)	1.00 (0.88, 1.13)
	2009	0.92 (0.79, 1.07)	0.68 (0.58, 0.80)
	2010	1.00 (0.85, 1.18)	1.00 (0.73, 1.37)
Sample	**1996**	0.18 (0.11, 0.30)	**/**
	1997	0.27 (0.19, 0.37)	**/**
	1998	0.29 (0.21, 0.40)	**/**
	1999	0.33 (0.25, 0.44)	**/**
	2000	0.43 (0.34, 0.56)	**/**
	2001	0.54 (0.43, 0.69)	**/**
	2002	0.82 (0.66, 1.01)	**/**
	2003	0.73 (0.59, 0.90)	**/**
	2004	0.87 (0.70, 1.07)	**/**
	2005	0.86 (0.69, 1.06)	**/**
	2006	0.89 (0.71, 1.11)	**/**
	2007	0.84 (0.67, 1.05)	**/**
	2008	1.03 (0.82, 1.30)	**/**
	2009	0.85 (0.65, 1.11)	**/**
	2010	1.00 (0.76, 1.32)	**/**

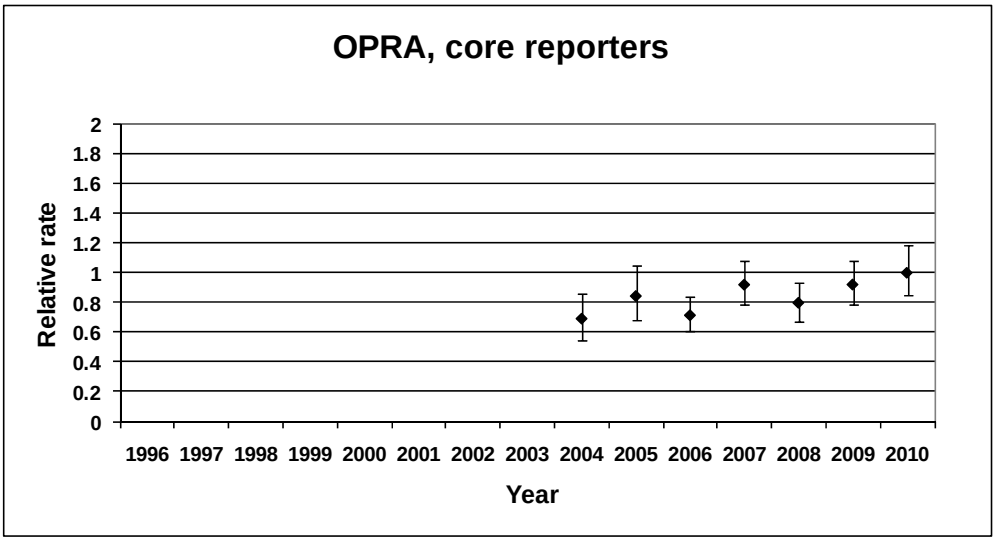
Models adjusted for reporter type (where appropriate), season and harvesting

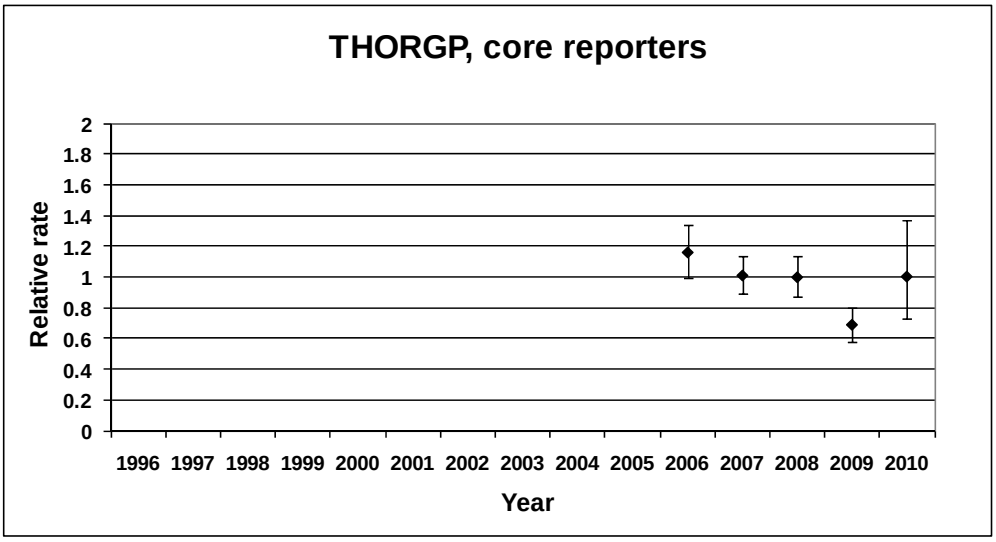
Population offset included in the model

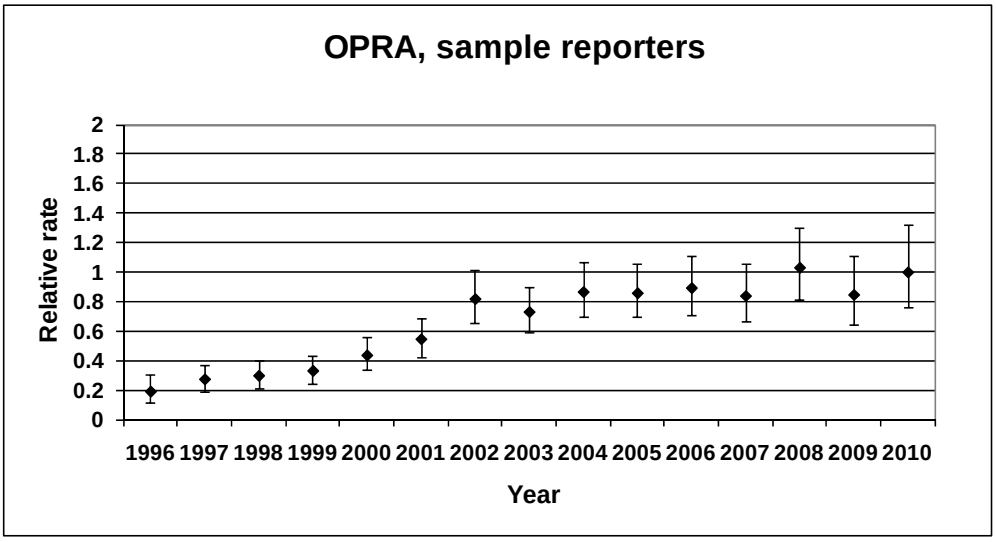
Figure 22 Relative rates by year (2010 estimate = 1), with 95% comparison intervals, other work stress






OPRA, core reporters
Relative rate
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010
Year


THORGP, core reporters
Relative rate
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010
Year


OPRA, sample reporters
Relative rate
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010
Year

3.3 SENSITIVITY ANALYSES

Tables 30 to 33 show the effect of including yearly estimates of the UK working population in the MLM on the annual average percentage change in incidence of WRI. The results show that for the specialist schemes, including population in the model lowers the percentage annual change by approximately 0.8%. For THOR-GP, the impact on the overall trend estimate of including population in the model is slightly less (lowering the overall trend estimate by approximately 0.2%).

Table 30 Effect of including population offset in model on the average annual percentage change in risk in work-related skin disease, EPIDERM, 1996-2010

		POPULATION OFFSET	NO POPULATION OFFSET
	Year (continuous)	% change	% change
Total skin	**1996-2010**	-3.4 (-4.0, -2.8)	-2.6 (-3.2, -2.0)
Contact dermatitis (CD)	**1996-2010**	-3.4 (-4.0, -2.8)	-2.6 (-3.2, -1.9)
Allergic CD	**1996-2010**	-5.5 (-6.4, -4.6)	-4.7 (-5.6, -3.8)
Irritant CD	**1996-2010**	-1.5 (-2.4, -0.6)	-0.7 (-1.6, 0.2)
Mixed CD	**1996-2010**	-2.4 (-3.8, -1.0)	-1.6 (-3.0, -0.2)
Urticaria	**1996-2010**	-5.3 (-7.3, -3.2)	-4.5 (-6.5, -2.4)
Neoplasia	**1996-2010**	-3.0 (-4.6, -1.5)	-2.2 (-3.7, -0.6)
Other* skin	**1996-2010**	-3.1 (-4.3, -1.9)	-2.3 (-3.5, -1.1)

*Other than contact dermatitis

Table 31 Effect of including population offset in model on the average annual percentage change in risk in work-related respiratory disease, SWORD, 1999-2010

		POPULATION OFFSET	NO POPULATION OFFSET
	Year (continuous)	Estimated % change (95% Confidence Interval)	Estimated % change (95% Confidence Interval)
Total respiratory	**1999-2010**	-3.6 (-4.5, -2.6)	-2.9 (-3.8, -1.9)
Asthma	**1999-2010**	-7.7 (-9.3, -6.1)	-7.1 (-8.7, -5.5)
Mesothelioma	**1999-2010**	-2.7 (-4.4, -0.9)	-2.0 (-3.7, -0.1)
Benign pleural plaques	**1999-2010**	-0.8 (-2.2, 0.6)	-0.1 (-1.5, 1.3)
Pneumoconiosis	**1999-2010**	-2.0 (-4.8, 0.8)	-1.3 (-4.0, 1.5)
Other*	**1999-2010**	0.2 (-2.0, 2.5)	0.8 (-1.4, 3.1)

*Other than asthma, mesothelioma, benign pleural plaques or pneumoconiosis

Table 32 Effect of including population offset in model on the average annual percentage change in risk in work-related ill-health, OPRA, 1996-2010

		POPULATION OFFSET	NO POPULATION OFFSET
	Year (continuous)	Estimated % change (95% Confidence Interval)	Estimated % change (95% Confidence Interval)
Total cases	**1996-2010**	-0.9 (-1.8, 0.0)	-0.3 (-1.2, 0.6)
Total skin	**1996-2010**	-8.5 (-10.2, -6.7)	-7.8 (-9.5, -5.9)
Contact dermatitis	**1996-2010**	-8.4 (-10.3, -6.4)	-7.6 (-9.6, -5.7)
Other skin[a]	**1996-2010**	-8.9 (-12.8, -4.9)	-8.2 (-12.0, -4.1)
Total respiratory	**1996-2010**	-7.7 (-10.2, -5.1)	-6.9 (-9.5, -4.3)
Asthma	**1996-2010**	-9.6 (-13.0, -6.1)	-8.9 (-12.3, -5.3)
Other respiratory[b]	**1996-2010**	-4.5 (-8.2, -0.8)	-3.8 (-7.5, 0.0)
Total musculoskeletal	**1996-2010**	-3.3 (-4.5, -2.1)	-2.6 (-3.8, -1.5)
Upper limb disorders[c]	**1996-2010**	-3.2 (-4.6, -1.8)	-2.5 (-4.0, -1.1)
Spine/back disorders[d]	**1996-2010**	-4.3 (-6.0, -2.6)	-3.6 (-5.3, -1.9)
Total mental ill-health	**1996-2010**	5.7 (4.5, 7.0)	6.3 (5.0, 7.5)
Anxiety and depression	**1996-2010**	3.5 (1.9, 5.0)	4.0 (2.5, 5.6)
Other work stress	**1996-2010**	9.5 (7.7, 11.3)	10.0 (8.2, 11.9)

[a]Other than contact dermatitis

[b]Other than asthma, mesothelioma, benign pleural disease or pneumoconiosis

[c]Hand/wrist/arm, shoulder and elbow

[d]Neck/thoracic spine, lumbar spine/trunk

Table 33 Effect of including population offset in model on the average annual percentage change in risk in work-related ill-health, THOR-GP, 2006-2010

		POPULATION OFFSET	NO POPULATION OFFSET
	Year (continuous)	Estimated % change (95% Confidence Interval)	Estimated % change (95% Confidence Interval)
Total cases	**2006-2010**	-12.3 (-14.8, -9.7)	-12.5 (-15.0, -9.9)
Total skin	**2006-2010**	-5.3 (-12.9, 2.8)	-5.6 (-13.1, 2.6)
Contact dermatitis	**2006-2010**	-4.8 (-13.3, 4.6)	-5.0 (-13.5, 4.3)
Total musculoskeletal	**2006-2010**	-15.2 (-18.5, -11.8)	-15.4 (-18.7, -12.0)
Upper limb[a]	**2006-2010**	-14.2 (-18.7, -9.5)	-14.4 (-18.9, -9.7)
Spine/back[b]	**2006-2010**	-19.3 (-24.2, -14.1)	-19.5 (-24.3, -14.3)
Lower limb[c]	**2006-2010**	-8.6 (-17.4, 1.1)	-8.8 (-17.6, 0.8)
Total mental	**2006-2010**	-8.8 (-13.1, -4.1)	-9.0 (-13.4, -4.4)
Anxiety and depression	**2006-2010**	-7.1 (-13.7, 0.0)	-7.3 (-13.9, -0.2)
Other work stress	**2006-2010**	-10.6 (-15.9, -5.1)	-10.9 (-16.1, -5.3)

[a]Hand/wrist/arm, shoulder and elbow
[b]Neck/thoracic spine, lumbar spine/trunk
[c]Hip/knee, ankle/foot

The results investigating excess zeros within the THOR data are presented and discussed in full in Appendix A.

4 DISCUSSION

This report builds and expands upon previous reports in describing the temporal trends in the incidence of WRI in the UK as reported to the THOR specialist schemes and to THOR-GP. For the current report, data from the EPIDERM (skin) and SWORD (respiratory), surveillance schemes of NHS hospital based specialist consultants and from OPRA and THOR-GP, consisting of specialist OPs (only some of whom work in the NHS) and GPs, respectively, were used to estimate the trend in the incidence of medically diagnosed WRI in the UK over the period 1996-2010 (EPIDERM and OPRA), 1999-2010 (SWORD) and 2006-2010 (THOR-GP). Unlike previous reports, this report does not include a comparison of trends in incidence of musculoskeletal disorders or mental ill-health between the non-clinical specialists (OPs and GPs) and the clinical specialists (rheumatologists and psychiatrists). HSE funding for data collection from rheumatologists (MOSS) and psychiatrists (SOSMI) stopped at the end of 2008 and whilst the COEH continued data collection for a further year, data collection for these two schemes has now ceased through lack of funds.

The methodology employed has been discussed fully in reports previously submitted to the HSE [6-10]. The main change to the methodology for the present analyses related to the inclusion of estimates representing the UK working population (for each year) in the MLM. This is discussed further in the section discussing the results of the sensitivity analyses. An additional (minor) methodological change was the changing of the reference year (for the categorical analyses) from the first year common to all datasets (2006) to the last year common to all datasets (2010). It was agreed (with the HSE) that 2010 would be the most useful reference year as it would enable a variety of comparisons of change over different time scales to be made.

In addition to specific changes to the trends methodology outlined above, there has been a recent, substantial change to the THOR-GP sampling methodology that warrants some discussion here. As described in Section 2.3.4, prior to 2010, the majority (>90%) of the physicians reporting to THOR-GP reported on a monthly (core) basis. However, in 2010, this reversed with the proportion of sample (reporting

one randomly chosen month per year) reporters increasing to 78% (as per the original contract). Initial investigations of case reporting in THOR-GP suggested that sample reporters, on average, reported three times as many cases (in any one month) as core reporters [17]. This phenomenon is not unique to THOR-GP. As described in Section 2.3.3, a randomised crossover trial was set up in OPRA to specifically investigate the impact of core reporting in OPRA (all of whom had previously reported on a sample basis). The results of this trial also suggested that physicians reporting on a sample basis reported more cases per month than core reporters [12]. However, in this instance the ratio of sample to core reporting was found to be much less than that observed for THOR-GP (1.26 compared to 3.02). Whilst for OPRA there was some suggestion that the observed ratio might be due to underreporting by core physicians (due to reporter fatigue), for THOR-GP the reasons behind the discrepancy between core and sample reporting require additional investigation with further work currently underway to address this.

The impact of moving to predominantly sample reporting in 2010 on the estimate of trend for THOR-GP is yet to be fully determined. The approach adopted in the MLM analyses was to treat a physician as a new reporter if they changed from core to sample (or vice versa). Thus, GPs reporting for the first time as sample reporters in 2010 will only have had one data point (2010) and will therefore have contributed less to the overall trend. This does appear to be the case as the estimates from the THOR-GP MLM in which sample data were excluded are very similar to those in which all data were included. In view of this, until this issue is more fully understood, the 2010 trend estimates for THOR-GP should be interpreted with caution.

The effect of reporting ‘fatigue’ (membership time) of the participating physicians on the estimates of trend has always been considered an important issue in the investigation of trends using THOR data and has been reported on extensively in two reports submitted to HSE in 2007 [18, 19]. Initial investigations to look for evidence of reporting fatigue in THOR-GP have also been reported on previously [6, 7]. Investigations to date have mainly focused on determining whether the proportion of responses that are zero returns (i.e. declaring I have nothing to report) or the proportion of non-response has increased over time. In brief, for the specialist schemes, results suggested some evidence that the proportion of both non-response

and zero returns increased with membership time, whilst for THOR-GP, the proportion of zero returns but not non-response increased with membership time.

Although the work outlined above identified that the participating physicians may be exhibiting reporting fatigue, it was recognised that further work in this area was required, and as such, additional HSE funding was secured to address this and other issues relating to THOR trends and incidence. The results of this body of work will be reported on in due course, but the present report provides an overview of one of the 'work packages' which investigated whether there was evidence of fatigue (manifesting as an excess of zeros) in the THOR data and if so, how this could best be modelled. This is fully discussed in Appendix A. It was agreed with the HSE, that for the present report, the estimates of trend presented in Section 3.2 would not be adjusted in light of the findings presented in Appendix A but that there would be an attempt to link the two bodies of work in the discussion. This is discussed further under the section discussing the results of the sensitivity analyses.

An abridged commentary by category of illness is provided in the following sections. There follows a discussion of some of the important issues that might impact on these trend estimates (e.g. fatigue and the inclusion of population estimates in the models).

SKIN (EPIDERM, OPRA and THOR-GP)

Data on work-related skin disease is available from all three of the different groups of physicians reporting to THOR (dermatologists, OPs and GPs), thus enabling a comparison of the trends in incidence between these different levels of the 'severity pyramid'. Overall, the annual average change in incidence of work-related skin disease was little changed by the inclusion of a further year of data with data from all three groups of physicians continuing to suggest a downward trend for this category of ill-health. However, if the graphs showing relative rates by year are considered, it appears that this fall in incidence was largely driven by a decrease during the earlier part of the study period, with (for dermatologists and OPs) a relatively flat trend since 2006. This is further illustrated by the analyses based on data for the period 2006-

2010 in which the annual average change in incidence became slightly positive (but not statistically significant). Similarly, although data from THOR-GP suggest an overall fall (but not statistically significant) in incidence of work-related skin disease over this time period, the relative rates by year suggest that this was largely driven by a drop in incidence between 2008 and 2009, with a relatively flat trend before and after this date. However, as discussed earlier it is important to be cautious when interpreting the trend estimates for THOR-GP, not only because of the relatively short timescale for which data is available, but also because of recent changes in sampling frequency (i.e. the move from predominantly core to predominantly sample reporting), the impact of which on the trend estimate is yet to be fully understood. For skin disease, there is also the added caution that this category comprises a relatively small proportion of the total cases reported to THOR-GP (10% for the period 2006-2009), as reflected by the wide, overlapping comparison intervals for the yearly estimates.

One issue that has been discussed previously is that if the data period is taken as a whole (1996-2010), the average annual percentage decrease in reported incidence of skin disease as suggested by analyses based on OP data was approximately double that suggested by analyses based on data from dermatologists. One possible explanation for this discrepancy (which has been discussed previously) is that OPs tend to work in larger industries with progressive reduction in exposure to agents causing skin disease, whereas dermatologists would see cases from small and medium enterprises (SMEs), such as hairdressers, who do not have access to OPs and in whose workplaces there has perhaps not been the hoped for reduction in exposure. However, one area of work where there has been a reduction in case reporting in EPIDERM for both large employers (healthcare) and SMEs is in cases of allergic contact dermatitis associated with latex exposure; downward trends within SMEs having a probable association with industry specific (i.e. hairdressing) initiatives relating to hand care [20, 21]. It is apparent from the plots showing the relative rates by year, that the largest drop in incidence for OPs was between 1996 and 1997. Although this might reflect a true decrease in incidence, it is also likely that it is an artefact of the way in which OPs commenced reporting. Prior to 1996 OPs could report skin disease to EPIDERM (and respiratory disease to SWORD). In 1996 OPRA was set up to enable OPs to report any case of WRI, with OPs who had

previously reported to SWORD and EPIDERM, then reporting to OPRA instead. It is possible that on first reporting to OPRA, OPs tended to favour reporting skin and respiratory diagnoses (over other diagnoses) as a legacy from reporting to SWORD and EPIDERM. This argument would suggest that there would be a similar fall in incidence for respiratory disease reported to OPRA between 1996 and 1997, which does not appear to be the case. However, this could partly reflect the fact that cases of respiratory disease comprise a small proportion of the cases seen by OPs (4%). The equivalent OPRA graphs for musculoskeletal and mental ill-health do not exhibit this drop between 1996 and 1997, which would be as expected if this argument were true.

The majority of the occupational skin disease cases reported to EPIDERM, OPRA and THOR-GP during this period were contact dermatitis (CD) and as such, it is not surprising that the trend in incidence for this skin sub-category is similar to that for skin disease overall. In addition to investigating total CD, it was also possible to investigate the sub-categories of CD (allergic, irritant and mixed) using data from dermatologists. As reported previously [6-10], a downward trend was observed for all three sub-categories although this was steeper for allergic CD compared to irritant or mixed CD. The steeper decrease for allergic CD could reflect steps such as the reduction in use of powdered latex gloves following Government interventions (introduced between 1996 and 1998) aiming to reduce exposure to latex. Of interest, as the data reported to THOR increases in both quality and quantity, it has been possible to begin to investigate trends in incidence for specific industrial sectors or related to specific agents. For example, recent studies investigated whether there had been any change in the incidence of work-related skin disease in relation to the introduction of legislation to regulate the use of latex and chromate (CRVI) [20, 22].

Data from dermatologists were also investigated separately for urticaria and for neoplasia. Although an overall, significant downward trend was observed for urticaria, this appeared to be largely driven by a fall in recent years (2006 onwards) with a fairly flat trend prior to this. Similarly, overall, a significant downwards trend was predicted for neoplasia. However, this result exhibited a marked difference when data from core and sample reporters were analysed separately, with data from the former suggesting a decrease in incidence but data from the latter suggesting an

increase in incidence. This may be because core EPIDERM reporters' main area of expertise has historically been and probably still is in occupational contact dermatitis, so skin neoplasia referrals may be triaged to other (sample) reporters. Additionally, there is some indication that recruitment of new consultant dermatologists may be being directed towards the sub-specialty of skin neoplasia, in accordance with NHS targets for waiting times for cancer diagnoses.

RESPIRATORY (SWORD AND OPRA)

Trends in work-related respiratory disease were investigated for chest physicians (SWORD) and OPs (OPRA) only since at present, the number of cases of respiratory disease reported to THOR-GP is considered too small to enable a meaningful investigation of trends. A similar pattern was seen for total respiratory disease as seen for total skin disease, with both chest physicians and OPs showing a downward trend but with a steeper trend modelled by data from OPs than chest physicians. Also, as seen for skin disease, much of the fall in incidence seemed to occur in the earlier part of the study period with a relatively flat trend over the past few years. A statistically significant downward trend was also observed for asthma, again larger for OPs compared to chest physicians, and again levelling out in recent years. This decrease in incidence may, in part, reflect the introduction of Government (and others) initiatives targeting this disease category.

Data from chest physicians showed an overall, statistically significant decrease in the annual average incidence of mesothelioma with the annual plots suggesting a relatively flat trend for the first part of the study period, followed by a gradual decrease, after which rates rose again before once again decreasing. These results are not consistent with the findings from epidemiological studies by Peto et al [23], which do not suggest an imminent fall in mesothelioma incidence or mortality (mesothelioma deaths are expected to increase to a peak around the year 2016) or data from the mesothelioma death certificates which show a steady increase in mesothelioma deaths over the study period [24]. In view of the other evidence, it is possible that this decrease reflects changes in referral patterns/case mix rather than a true decrease in incidence. Consultations with our key SWORD reporters has

suggested a possible shift in referral patterns such that a proportion of these cases are now being referred to oncologists rather than exclusively to chest physicians as used to be the case. Further work is underway to externally benchmark THOR data with cancer registry data/death certificates.

The addition of a further year of data has little altered the observed trends for benign pleural plaques and pneumoconiosis, with trends in incidence for both these groups remaining relatively flat. Although one would expect the incidence of benign pleural plaques to still be increasing, the flat, slightly negative trend observed for the SWORD data probably reflects the fact that individuals presenting with this disease are no longer financially compensated and therefore, referrals to chest physicians are less common. Recent consultation with members of the SWORD Academic Advisory Committee suggested that it would be interesting to examine whether a different trend was apparent if analyses were restricted to data for Scotland (where compensation is still available), and numbers permitting, future analyses will consider this. Similarly, members of the SWORD Academic Advisory Committee suggested it would be of interest to analyse the trend in incidence of pneumoconiosis separately according to the attributing agent (e.g. asbestos, silica and coal), and this is being investigated. It is also planned to benchmark the THOR other asbestos related data with national registers.

MUSCULOSKELETAL (OPRA AND THOR-GP)

Unlike previous reports to the HSE investigating trends in incidence using data reported to THOR, for reasons already explained, this report does not include a comparison of OP and GP musculoskeletal data with data from rheumatologists. Data from OPs was available for the period 1996 to 2010, and taking this period as a whole, the data suggested a significant average annual percentage decrease in the incidence of total work-related musculoskeletal disorders. The plots showing relative rates by year suggest a flat trend prior to 2005, after which there may have been a gradual decrease in incidence (although the 2010 estimate suggests some levelling out). Restricting the data to the time period common to both OPs and GPs (2006-2010), resulted in a steeper annual percentage decrease in incidence for OPs (as

one would expect from the yearly plots) but this is still less than half the magnitude of the annual percentage decrease in incidence observed for THOR-GP over the same period. The plots showing relative rates by year for GPs indicate that the biggest drop in incidence occurred between 2006 and 2007, but with rates continuing to decrease thereafter. In addition to analysing musculoskeletal disorders as a whole, trends in incidence were also investigated for upper limb disorders (hand/wrist/arm, shoulder, and elbow), spine/back disorders (neck/thoracic spine, lumbar spine/trunk) and (for GPs only) lower limb disorders (hip/knee, ankle/foot). Overall, for both OPs and GPs, a downward trend in the incidence of upper limb disorders, similar in size to that observed for total musculoskeletal disorders was observed, whilst the annual average percentage decrease in the incidence of spine/back disorders was slightly larger. GP data also suggested a decrease in the incidence of lower limb disorders but this was much smaller than for the other categories of MSDs.

It is not yet clear whether this large downward trend in GP reported incidence is a 'true' change in incidence or whether it is due to other factors, for example, reporter fatigue. This is discussed further in the section discussing the results of the sensitivity analyses. However, if true, one explanation (which has been discussed previously) is that it may be a result of a change in how a patient presents their illness i.e. in previous years a patient may have presented with 'back pain' as a 'generic' illness when seeking time off work whereas in more recent times, the combination of mental ill-health becoming more 'acceptable' and the policy of generally no longer prescribing long periods of rest for MSDs, may mean that such cases are more likely to present as 'stress' rather than back pain. Additional analyses to investigate whether the observed trends for MSDs show any correlation with those for mental ill-health are in progress and the results of these will be reported on in due course.

Previous comparisons [6, 25] between THOR-GP incidence rates and incidence rates generated from data reported as part of the Self-reported Work-related Illness and Injury (SWI) survey, suggested some consistency between the two data sources, with both suggesting a fall in incidence over the time period studied (2006-2008). However, recent data from the SWI suggest that incidence rates have remained relatively stable over the last couple of years [26].

MENTAL ILL-HEALTH (OPRA AND THOR-GP)

In contrast to the other categories of WRI studied, the direction of the predicted trend in incidence of work-related mental ill-health showed some variation between OPs and GPs, although this variation was less apparent when analyses were restricted to the time period common to both groups of physicians (2006-2010). Taking the data period as a whole (1996-2010), data reported by OPs to OPRA suggested a statistically significant annual average percentage increase in the incidence of work-related mental ill-health. Prior to the inclusion of the 2010 data, the graph showing relative rates by year suggested that incidence increased during the earlier part of the study period until it peaked in 2004, after which it decreased slightly. In view of this apparent non-linearity, the report submitted to the HSE in 2010, also included results from two additional approaches taken to model (OP) trends in total mental ill-health: a log quadratic model and a 5-knot spline model, the former of which suggested the maximum incidence occurred in 2005 whilst the latter suggested it occurred in 2003. In agreement with the HSE, these alternative modelling approaches were viewed as 'one off' additional investigations and have therefore not been repeated for the current round of analyses. Interestingly, the graph showing relative rates by year based on data up to and including 2010 shows a further increase in incidence in 2010 compared to the previous few years, suggesting that the incidence of OP reported work-related mental ill-health may be yet to peak. It will be interesting to see whether with the addition of the 2011 data, incidence continues to rise.

Data from GPs suggest a significant decrease in the incidence of work-related mental ill-health for the period 2006-2010 (but OP data restricted to the same time period shows no statistically significant trend). Although the graph showing relative rates by year for THOR-GP shows a slight increase in incidence in 2010 compared to other years, it is important to reserve judgement on the estimates for 2010 until the impact of the move to predominantly sample reporting in 2010 is fully understood.

A similar pattern was observed for anxiety and depression with an overall increase in incidence suggested by OPs and a decrease in incidence suggested by GPs. The graph showing relative rates by year for OPs exhibits a similar pattern as seen for total mental ill-health with an increase in the earlier part of the series reaching an apparent maximum around 2004 then falling slightly. However, unlike the graph for total mental ill-health, the data do not suggest an increase in incidence of anxiety and depression in 2010. The equivalent graph for THOR-GP does suggest an increased incidence in 2010 compared to other years, but again this result must be interpreted with caution.

For THOR-GP, the pattern for the category other work stress is similar to that observed for both total mental ill-health and anxiety and depression, with a decrease in incidence between 2006 and 2009 followed by a possible increase in 2010. For OPs, a bigger annual average percentage increase in incidence was observed for the category other work stress compared to both total mental ill-health and anxiety and depression. Furthermore, the relative rates by year suggest a continuous, steady increase in incidence with little evidence that incidence has peaked. This would fit with evidence, anecdotal and otherwise, that the incidence of perceived stress is increasing, with mental ill-health problems such as ‘stress’ now being the most common reason for time off work. However, this is not borne out in data from the SWI, which suggest the incidence of work-related mental ill-health has remained fairly stable over the last few years [26].

Additional analyses have been carried out to investigate whether the observed trends for mental ill-health vary between industrial sectors or between gender, and whether there is any correlation between observed trends for mental ill-health and those for MSD, the results of which are currently being prepared for publication and will be reported on in due course [27].

SENSITIVITY ANALYSES

One of the main methodological changes undertaken in the present round of analyses was the inclusion of estimates representing the UK working population (obtained from the LFS) in the MLM. The rationale behind this is discussed in Section 2.7. The results indicated that including population in the MLM decreased the resulting annual average percentage change per year by about 0.8% for the specialist schemes and 0.2% for THOR-GP. By including estimates of changes in the UK working population in the MLM, we have made some allowance for population growth, thus producing more realistic estimates of trend. This is particularly important as we begin to look at trends for different subsets of the THOR data (e.g. by industry or job), which may exhibit greater variation in population change over the study period.

One issue that arose in relation to the denominator was whether it was appropriate to use data from the LFS to estimate the population covered by OPs reporting to OPRA, since we know that only a limited proportion of the UK working population have access to an OP and this access is heavily biased towards the public sector and larger employers in general. To determine the population covered by OPs reporting to OPRA, three-year rolling denominator surveys have been undertaken. However, as discussed in Section 2.7, it was felt that further investigations into the data collected by these surveys was required before they could be accurately applied to the THOR numerator data, and as such, for the present round of analyses, using data from the LFS would suffice. However, this approach makes the assumption that the proportion of the UK workforce with access to an OP has remained constant throughout the study period, which may not be the case. Work is ongoing to address this matter. Similarly, although it was deemed appropriate to use data from the LFS as the denominator for SWORD and EPIDERM, which are considered relatively ‘stable’ schemes (in terms of reporter mix) with high participation rates it may be less appropriate to use data from the LFS as the denominator for THOR-GP which can be considered less stable in terms of reporter mix with (by design) only a small proportion of UK GPs participating. However, an extensive exercise which aimed to accurately determine the population covered by

THOR-GPs is nearing completion, the results of which will be able to be used to inform the correct population denominator for future trends analyses.

The analyses of trends reported to date have provided estimates of relative changes in incidence of specialist diagnosed disease in the UK over time. However, it is anticipated that future analyses will present the findings in terms of changes in *absolute incidence* over time. As such, it will be important to accurately determine the population covered by each of the THOR schemes. The THOR specialist schemes aim to 'capture' as many incident cases as possible of specialist-diagnosed WRI in the UK, by recruiting as many as possible of those consultants who see work-related ill-health whilst THOR-GP (by design) aims to include a sample of UK GPs. Importantly, participation rates within THOR are likely to fluctuate, over time. To estimate total incidence at any one time point, some inference about the characteristics of omitted reporters - including their number and case density (e.g. high, medium or low) – would have to be made. Any set of assumptions about the make-up of the true total population, or a standard population, could then be combined with information from the MLM analysis - sampling error and inter-year variation – to produce standardised estimates of absolute incidence for each year.

Further investigation is needed regarding the applicability of using LFS data for the period 1996-2010 to estimate the UK working population for long latency diseases such as neoplasia, mesothelioma, pneumoconiosis, benign pleural plaques and lung cancer (the latter of which is not analysed as a separate group but does form part of the other respiratory disease category). For these groups it would possibly be more appropriate to use lagged population data. However, at present, it is not clear what the "optimum" lag should be. In view of this, it was agreed with the HSE that for the present analyses it would be best to include estimates of the working population covering the study period (1996-2010), which would at least adjust for some growth in population. However, it may be that this is an area which could be investigated further in the future.

As discussed previously, this report also includes an overview of further work carried out to investigate whether there was evidence of fatigue, manifesting as an increase in zero returns over time, in the THOR data (Appendix A). The results of this

exercise (which are fully discussed in Appendix A) suggested evidence of zero-inflation in some schemes/reporter groups (EPIDERM both core and sample reporters and OPRA sample reporters only) but not others (THOR-GP, SWORD, and OPRA core reporters). However, an excess of zeros would only impact on the trends analysis if there was further evidence that the percentage of false zeros changed over time and such evidence was found for EPIDERM sample reporters only. For this group of reporters, adjusting the trend for excess zeros changed the incidence rate ratio from 0.98 (95% CI: 0.96, 1.00) to 1.02 (95% CI: 0.99, 1.05). Thus, apart from this group of reporters (EPIDERM, sample) there was no evidence of fatigue, as manifested by an increase of excess zeros over time, in the THOR data. However, it is premature to draw firm conclusions regarding the presence or absence of fatigue in the THOR data. Further work is underway (forming part of the remaining work packages of this body of work) and will be reported on in due course.

5 CONCLUSION

The THOR surveillance schemes continue to provide an invaluable source of data on the incidence and burden of occupational disease / work-related illness in the UK. THOR is almost unique in its comprehensiveness and in its reporting by specialist physicians, or by GPs with specialist training. Many of the observed trends are in accordance with those expected either as a result of Government initiatives (for example, the decline in incidence of asthma and contact dermatitis) or according to other evidence (for example, the increase in the incidence of other work stress). Other of the observed trends may, at least in part, reflect a change in management and referral patterns rather than a true trend (for example, the observed trends for asbestos related diseases, neoplasia and MSDs). Furthermore, trends in incidence suggested by data reported to THOR-GP need to be interpreted with caution until other issues such as reporter fatigue and the impact of reporting frequency on trends are better understood. However, continued efforts are being taken to further improve the THOR trends methodology to enable these and other partially resolved issues to be investigated further. Furthermore, as the quality and quantity of the THOR data increases, it is becoming possible to begin to investigate trends at a more resolved level, for example in relation to specific industries or specific causal agents.

ACKNOWLEDGMENTS

THOR is partially funded by the Health and Safety Executive and has also received funding from other sources. We are grateful to the physicians who report to THOR for their continuing support. The authors would also particularly like to thank John Hodgson (HSE) for his advice to enable the revised presentation of the statistical uncertainty (comparison intervals) in the graphs illustrating time trends and in his continuing assistance in implementing this spreadsheet.

REFERENCES

1 The THOR website. Available at: http://www.medicine.manchester.ac.uk/oeh/thor

2 Meredith SK, Taylor VM, McDonald JC. Occupational respiratory disease in the United Kingdom 1989: a report to the British Thoracic Society and the Society of Occupational Medicine by the SWORD project group. Br J Ind Med 1991; 48(5):292-298.

3 Cherry, N, Meyer, J.D, Adisesh, A, Brooke, R, Owen-Smith, V, Swales, C & Beck, M,H. Surveillance of occupational skin disease: EPIDERM and OPRA. *Br J Derm*, 2000: **142**: 1128-1134

4 Cherry NM, Meyer JD, Holt DL, Chen Y, McDonald JC. Surveillance of work-related diseases by occupational physicians in the UK: OPRA 1996-1999. Occup Med (Lond) 2000; **50**(7):496-503.

5 Hussey, L, Turner, S, Thorley, K, McNamee, R and Agius, R. Work-related ill-Health in general practice, as reported to a UK-wide surveillance scheme, *British Journal of General Practice*, 2008, **58**, p.637-640

6 Carder M, McNamee R, Hussey L, Money A and Agius R. Time trends in the incidence of work-related disease in the UK, 1996-2009: estimation from THOR surveillance data. Report to HSE submitted September 2010.

7 Carder M, McNamee R, Hussey L, Money A and Agius R. Time trends in the incidence of work-related disease in the UK, 1996-2008: estimation from THOR surveillance data. Report to HSE submitted September 2009

8 McNamee R, Carder M, Money A, Agius R. Time trends in the incidence of work-related disease in the UK, 1996-2007: estimation from ODIN/THOR surveillance data. Report to HSE submitted September 2008.

9 McNamee R, Carder M, Chen Y, Agius R. Time trends in the incidence of work-related disease in the UK, 1996-2006: estimation from ODIN/THOR surveillance data. Report to HSE submitted September 2007.

10 McNamee R, Carder M, Chen Y, Agius R. Time trends in the incidence of work-related disease in the UK, 1996-2004: estimation from ODIN/THOR surveillance data. Available at http://www.hse.gov.uk/statistics/pdf/trendsinthor.pdf. Last accessed September 2007.

11 McNamee R, Carder M, Chen Y, Agius R. Measurement of trends in incidence of work-related skin and respiratory diseases, UK 1996–2005 *Occup Environ Med* 2008; 65: 808-814

12 McNamee R, Chen Y, Hussey L, Agius R. Randomised Controlled Trial comparing time-sampled versus continuous time reporting for measuring incidence. *Epidemiology*, 2010; 21(3): 376-378

13 Office for National Statistics. Labour Force Survey 1996-2010: The Stationery Office, 2011.

14 McDonald JC. The estimated workforce served by occupational physicians in the UK. Occup Med (Lond) 2002; 52:401–6.

15 McNamee R, Agius R. Statistical methods to address incidence and trends in work-related disease using surveillance data from THOR (THOR-GP): A research proposal submitted to HSE, February 2010.

16 Firth D and De Menezes RX. Quasi-variances. Biometrika (2004); 91 (1): 65-80.

17 Hussey L. Calculating incidence rates from core and sample reporters in THOR-GP (briefing and discussion document for the HSE led THOR steering committee), 25th July 2011

18 McNamee R. Fatigue discussion. Document sent to HSE via email 12th March 2007.

19 McNamee R. Surveillance and reporter fatigue. Report sent to HSE via email 8th May 2007

20 Evaluating interventions aiming to reduce occupational exposure to "latex and related substances" S Turner, SJ Stocks, R McNamee, SM Wilkinson, M Carder, R Agius. Submitted to BJD, July 2011.

21 Health and Safety Executive.'Bad Hand Day?' Campaign. 2006; available at http://www.hse.gov.uk/hairdressing/bad-hand.htm [accessed on 14 June 2011].

22 Stocks SJ, McNamee R, Turner S, Carder M, and Agius RM. Has European Union legislation to reduce exposure to chromate in cement been effective in reducing the incidence of allergic contact dermatitis attributed to chromate in the UK? OEM Online First, published on August 17, 2011 as 10.1136/oemed-2011-100220

23 Peto J, Hodgson J, Matthews F, Jones J (1995). Continuing increase in mesothelioma mortality in Britain. The Lancet 1995; 345:535-539.

24 Health and Safety Executive. Deaths from asbestos-related and other occupational lung diseases. Table MESO01: Death certificates mentioning mesothelioma, 1968-2008. Available at: http://www.hse.gov.uk/statistics/tables/index.htm [accessed on July 6th 2011].

25 Money A, Hussey L, Carder M, Turner S, & Agius R. A comparative analysis of self-reported and medically certified incidence data on work-related illness. Report submitted to HSE, August 2010.

26 Health and Safety Executive. Self-reported work-related illness (SWI) and workplace injuries: Results from the Labour Force Survey (LFS). Table SWIT6W12 Estimated incidence and rates of self-reported illness caused or made worse by work, by type of illness, for people working in the last 12 months, 2009/10. Available at: http://www.hse.gov.uk/statistics/tables/index.htm [accessed on July 6th 2011].

27 Carder M, McNamee R, Turner S, Agius RM. Time trends in the incidence of work-related musculoskeletal disorders and mental ill-health in the UK, 1999-2009: estimation from THOR surveillance data. In preparation.

APPENDIX A SUMMARY OF ANALYSIS OF ZERO-INFLATED COUNT DATA FOR EPIDERM, OPRA, THOR-GP AND SWORD

Holland F, McNamee R
The University of Manchester

Introduction

In the trends analyses, all reported zero cases are being treated as "genuine" i.e., there are no new incident cases for that month. However, if a proportion of zeros are false (perhaps because a reporter is not reporting actual cases due to "fatigue") this could cause underestimation of incidence. If the rate of false zeros increases over time this could cause bias in estimating change in incidence over time.

When data has disproportionately many more zeros than would be expected under standard distributional assumptions then standard count models may not fit the data well since more zero observations are observed than is consistent with the Poisson or the Negative Binomial (NB) model. At present, excess zeros models fall into two broad categories: zero-inflated (ZI) mixture models and conditional hurdle models. In this report we only consider the former.

Methods

Zero-Inflated count data models

Zero-inflated Poisson (ZIP) and zero-inflated negative binomial (ZINB) models assume that there is an underlying binary process leading to either a positive outcome i.e., individuals who do report the true number of cases, or a negative outcome i.e., individuals who report zero cases because they are fatigued. The distribution of cases in the positive group is assumed to be either Poisson (in ZIP) or Negative Binomial (in ZINB). A Negative Binomial model can be thought of as a more sophisticated version of a Poisson model allowing for more variability. For these ZI models the observed zeros are seen as a **mixing** of two types: one part of the observed zero counts is due to the false zeros and the other is from what would be expected from a count distribution.

The ZI models comprise two regression sub-models: a logistic model for predicting the probability of excess zeros, and a count model to predict the mean cases given a positive binary outcome (i.e., a 'true' report). The ZI models estimate the proportion of false zeros. Covariates can be included in each sub-model. For the question of whether there are trends in true incidence of disease over time, the covariate 'calendar year' was included in the count part. To allow adequately for any tendency for false zero reports to increase with membership time – as might happen if there is reporting fatigue, the covariate 'membership time (years) was included in the logistic sub-model. Although not of direct interest here, both logistic and count parts of the models also included month of the year as a covariate.

For each of the 4 schemes – EPIDERM, OPRA, THOR-GP and SWORD, data were analysed separately for core and sample reporters as their behaviour was expected to be different.

In other reports we have favoured Random Effects models to allow for the correlation between returns from the same reporter. Unfortunately we are not currently able to fit zero inflated RE models. However, for comparison, we include (uninflated) RE Poisson and RE NB models in some analyses. RE models explicitly model variation in incidence between reporters.

Results

Models with no covariates

The models were initially fitted with only intercept terms for the count and logistic parts; these are the no covariates or "null" models. Table 1 shows the observed proportion of zero returns and the estimated percentages of true and false zeros from the ZIP and ZINB models for the schemes. For EPIDERM and OPRA sample data the overall predicted proportion of zeros from the two model types were the same as the observed values and in the other schemes observed and overall predicted zeros were very close. For all schemes the two models gave different estimates of the false zero probability e.g., for EPIDERM sample this is 0.58 under the ZIP model and 0.32 for the ZINB model; expressed as percentages out of all predicted zeros, over 90% were predicted as false zeros for the Poisson model and approximately 50% for the NB model. Under ZINB, five analyses had no false zeros predicted.

Goodness of fit

Tables 2-5 address the goodness of fit of four models (ZIP, ZINB and the basic Poisson and NB models allowing for correlation within reporter) to each data set. They contrast the observed and predicted proportions of all returns according to the no of cases reported (0,1,2,3,…etc). To avoid small numbers in the chi-squared goodness of fit test, returns with very high counts were aggregated into one group. The first of two approaches in deciding which model is "best" is a goodness of fit test, measured by the X^2 statistic (degrees of freedom=total number of cells minus number of parameters). Out of the 4 EPIDERM models (Tables 2a and 2b) the ZINB model provided the best fit to both the core and sample data (smallest X^2 and largest P-value) with the basic Poisson model giving the worst fit (highest X^2 and smallest P-value). It can be seen that, under the ZINB models, the predicted proportions were very similar to the observed proportions. The ZINB model was also best for OPRA sample data (Table 3b).

For OPRA core, THOR-GP core and sample and SWORD core and sample, the NB and ZINB models gave the same predicted proportions for each number of cases; the P value was smallest for the NB model showing that it was the best fitting model. As a second measure of goodness of fit, the Akaike Information Criterion (AIC) was used to select the best model from six alternatives: the basic Poisson and NB, random effects (RE) Poisson and NB, plus ZIP and ZINB models. In terms of fit, the preferred model is the one with smallest AIC; AIC discourages overcomplicated models by including a penalty term equal to twice the number of parameters in the

model . For all schemes, across sample and core, the best fitting model was the RE NB (Table 6).

Covariate Models

These analyses are confined to Zero Inflation type models only (ZIP and ZINB). Where the null models suggested that the ZINB model was no better than the NB model (5 out of 8 sets of data) only ZIP covariate analysis was performed. For Tables 7-10 calendar year is used to predict the count part of the ZIP/ZINB model whereas membership year is entered for the logistic part of the model. In the Tables, we refer to the logistic sub-model as the 'inflate' model.

For EPIDERM core data, regardless of whether a ZIP or ZINB model is used, the incident rate ratio (IRR) estimate from the count part of the model is 0.97, corresponding to a decrease of 3% in incidence for each calendar year. In the inflate part of the model, the odds of an excess zero among core was predicted to increase by 4.8% (ZIP) or 5.7% (ZINB) for each membership year but the increases were not statistically significant.

However, for EPIDERM sample data, both ZIP and ZINB showed evidence that the odds of excess zeros increased with membership time. The incident rate ratio (IRR) estimate from the count part of the model was around 1.02 per calendar year for both ZIP and ZINB but the increase was not statistically significant.

For OPRA sample, the IRRs for calendar year were 0.995 and 1.010 from ZIP and ZINB respectively: neither was significantly different from one. The estimates from both models suggested a decrease in excess zeros with membership time (ORs of 0.988 and 0.980 from ZIPand ZINB) but neither trend was statistically significant.

From the ZIP model, a significantly decreasing trend in incidence per year was predicted for OPRA core (IRR= 0.954, 95% CI: 0.913, 0.996). The estimated trends in incidence from the ZIP models for THOR-GP core (IRR= 0.877, 95% CI: 0.817, 0.942) and THOR-GP sample (IRR= 0.860, 95% CI: 0.698, 1.058), were of a similar magnitude, but only the former was statistically significant, perhaps reflecting the smaller amount of data available on THOR-GP sample reporters. In both core and sample THOR-GP data, there was no statistically significant evidence that excess zeros increased with membership time.

The ZIP model for SWORD core suggested a downward trend in incidence with calendar year (IRR= 0.963, 95% CI: 0.906, 1.024) but it was not statistically significant; for SWORD sample the corresponding figure was 1.002, 95% CI: 0.979, 1.026. There was no evidence that membership time increased excess zeros in SWORD core data (OR=0.997) and only weak evidence (OR=1.022, 95% CI: 0.995, 1.049) in SWORD sample data.

Summary

1. Is there evidence of zero-inflation?

Zero-inflated count models have been fitted to four reporting schemes (eight sets of data) to explore the possibility of excessive zero counts. These models estimate the proportion of excess zeros. The attributed proportion of excess zeros depends on whether one uses a ZIP or ZINB model because the NB part of the ZINB model is

able to explain more variability than the Poisson part of the ZIP. Therefore in general, ZINB attributes less 'excess zeros' than ZIP. In five out of eight data sets (THOR-GP, SWORD, and OPRA core), the ZINB model finds no excess zeros.

As shown, the evidence for zero inflation depends on the degree of inbuilt variability in the corresponding 'base' model (Poisson or NB). Therefore it is possible that, even in EPIDERM core and sample, and OPRA sample data - where ZINB found evidence of excess zeros, a zero-inflated model built on a different base might not find evidence of excess zeros. The base model which has been used in the main trends analyses is the Random Effects NB model. We have not fitted a zero-inflated version of this model because (STATA) software is not available.

Another way of assessing the evidence, for or against zero-inflation, is through 'goodness of fit' of models including those with and without zero inflation components. Goodness of fit was assessed for 'null models' with no covariates. If attention is confined to Poisson, ZIP, NB and ZINB models, the goodness of fit evidence was found to be entirely consistent with the conclusions above, i.e., based on a X^2 test or the AIC criterion, the ZINB model was the best model for EPIDERM core and sample data and OPRA sample. For the 5 groups with no predicted false zeros under ZINB, the best model was the basic NB with no zero inflation component.

However when the RE models are included in the comparison, the RE NB model was found to provide the best fit for each scheme and reporting type when using the AIC criterion. For seven out of eight data sets, the next best was the RE Poisson model. This implies that the RE NB model, which allows for 'extra' variation (or heterogeneity) compared to the other models, might have absorbed what was regarded as 'extra zeros' under the ZI models. The question of whether a zero-inflated RE NB model would fit the data even better than RE NB has not been answered.

2. What is the degree of zero inflation, if any?

The ZINB models showed evidence of excess zeros for three sets of data For EPIDERM core and sample reporters a total of 9% and 31% respectively were attributed as false zeros and for OPRA sample, 18% were attributed as false zeros.

3. Does zero inflation change with membership time?

From the ZINB models fitted to EPIDERM sample data there was evidence that the odds of an excess zero increased by 8% with each year of membership time. There was no evidence that the odds of excess zeros changed with membership time for the other schemes and reporter type.

4. What should be the estimate of trend in incidence after adjustment for zero-inflation (if necessary)?

If there is no evidence of excess zeros, then the best estimate of trends in incidence remain from the main analyses. This is also true if there is no evidence that excess zeros prevalence change with membership time. But we might expect the IRR for calendar year to change when the logistic/inflate part is significantly related to membership time; the only scheme with a significant relationship is EPIDERM

sample. The IRR for trend adjusted for excess zeros is 1.02 (95% CI: 0.99, 1.05) whereas it is 0.98 (95% CI: 0.96, 1.00) based on the main analysis approach.

Table 1 **Percent observed zeros and estimated true and false zeros from models with only intercepts for the count and inflated parts of the ZIP and ZINB models.**

	EPIDERM		OPRA		THOR-GP		SWORD	
	Sample	Core	Sample	Core	Sample	Core	Sample	Core
Observed Zeros	**62.9**	**16.3**	**51.2**	**23.0**	**29.0**	**59.2**	**72.1**	**28.8**
ZIP true Zeros	4.9	1.0	1.1	1.4	8.7	23.5	11.0	0.7
ZIP false Zeros	58.0	15.3	50.1	21.5	20.3	35.7	61.1	28.1
Total predicted Zeros	**62.9**	**16.3**	**51.2**	**23.0**	**29.0**	**59.2**	**72.1**	**28.8**
ZINB true Zeros	31.3	7.5	33.0	24.2	29.9	59.4	72.2	32.2
ZINB false Zeros	31.6	8.7	18.2	1.05e-06	3.35e-06	3.20e-06	2.73e-05	6.86e-07
Total predicted Zeros	**62.9**	**16.3**	**51.2**	**24.2**	**29.9**	**59.4**	**72.2**	**32.2**

Table 2a) Observed and predicted proportions for 0,1,…, 7 and 8 or higher counts of cases reported to the EPIDERM scheme for core reporters

Model	Pr(false zero)	Total Pr(y=0)	pr(y=1)	pr(y=2)	pr(y=3)	pr(y=4)	pr(y=5)	pr(y=6)	pr(y=7)	pr(y=8 or more)	X^2	P-value
Observed	_	0.163	0.122	0.135	0.122	0.115	0.089	0.066	0.057	0.132	-	-
Poisson	_	0.022	0.085	0.161	0.204	0.194	0.148	0.094	0.051	0.040	3881	<0.0001
NB	_	0.135	0.159	0.149	0.127	0.103	0.081	0.063	0.048	0.135	77	<0.001
ZIP	0.153	0.163	0.043	0.096	0.143	0.161	0.145	0.108	0.070	0.073	853	<0.0001
ZINB	0.087	0.163	0.121	0.135	0.127	0.110	0.089	0.070	0.053	0.132	3.94	>0.1

Table 2b) Observed and predicted proportions for 0,1,…, 3 and 4 or higher counts of cases reported to the EPIDERM scheme for sample reporters

Model	Pr(false zero)	Total Pr(y=0)	pr(y=1)	pr(y=2)	pr(y=3)	pr(y=4 or more)	X^2	P-value
Observed	_	0.629	0.157	0.088	0.054	0.074	-	-
Poisson	_	0.404	0.366	0.166	0.050	0.014	1104	<0.0001
NB	_	0.625	0.171	0.083	0.046	0.074	5.34	>0.01
ZIP	0.580	0.629	0.105	0.113	0.081	0.072	83	<0.001
ZINB	0.313	0.629	0.157	0.088	0.051	0.076	0.40	>0.5

Table 3a) Observed and predicted proportions for 0,1,…, 7 and 8 or higher counts of cases reported to the OPRA scheme for core reporters

Model	Pr(false zero)	Total Pr(y=0)	pr(y=1)	pr(y=2)	pr(y=3)	pr(y=4)	pr(y=5)	pr(y=6)	pr(y=7)	pr(y=8 or more)	X^2	P-value
Observed	_	0.230	0.204	0.144	0.101	0.070	0.063	0.050	0.038	0.101	-	-
Poisson	_	0.043	0.134	0.212	0.223	0.176	0.111	0.058	0.026	0.016	3360	<0.0001
NB	_	0.242	0.183	0.138	0.105	0.080	0.061	0.046	0.035	0.111	13.9	<0.1
ZIP	0.215	0.229	0.057	0.114	0.152	0.153	0.123	0.083	0.048	0.041	1308	<0.0001
ZINB	1.05e-08	0.242	0.183	0.138	0.105	0.080	0.061	0.046	0.035	0.111	13.9	<0.05

Table 3b) Observed and predicted proportions for 0,1,…, 4 and 5 or higher counts of cases reported to the OPRA scheme for sample reporters

Model	Pr(false zero)	Total Pr(y=0)	pr(y=1)	pr(y=2)	pr(y=3)	pr(y=4)	pr(y=5)	Pr (y=6 or more)	X^2	P-value
Observed	_	0.512	0.136	0.101	0.068	0.045	0.035	0.104	-	-
Poisson	_	0.147	0.282	0.270	0.172	0.082	0.032	0.014	7186	<0.0001
NB	_	0.507	0.159	0.092	0.061	0.043	0.031	0.107	33.2	<0.005
ZIP	0.501	0.512	0.041	0.079	0.101	0.097	0.075	0.095	1615	<0.0001
ZINB	0.182	0.512	0.146	0.091	0.063	0.045	0.033	0.110	12.6	<0.025

Table 4a) Observed and predicted proportions for 0,1,…, 4 and 5 or higher counts of cases reported to the THOR-GP scheme for core reporters

Model	Pr(false zero)	Total	Pr(y=0)	pr(y=1)	pr(y=2)	pr(y=3)	pr(y=4)	pr(y=5 or more)	X^2	P-value
Observed	_		0.592	0.258	0.094	0.036	0.012	0.008	-	-
Poisson	_		0.524	0.339	0.110	0.024	0.004	0.001	1277	<0.0001
NB	_		0.594	0.253	0.097	0.036	0.013	0.007	3.4	>0.1
ZIP	0.357		0.592	0.236	0.119	0.040	0.010	0.002	172	<0.0001
ZINB	3.20e-08		0.594	0.253	0.097	0.036	0.013	0.007	3.4	>0.1

Table 4b) Observed and predicted proportions for 0,1,…, 3 and 4 or higher counts of cases reported to the THOR-GP scheme for sample reporters

Model	Pr(false zero)	Total	Pr(y=0)	pr(y=1)	pr(y=2)	pr(y=3)	pr(y=4 or more)	X^2	P-value
Observed	_		0.290	0.275	0.171	0.119	0.145	-	-
Poisson	_		0.172	0.303	0.267	0.157	0.103	28	<0.005
NB	_		0.300	0.258	0.177	0.111	0.155	0.55	>0.5
ZIP	0.203		0.290	0.193	0.214	0.157	0.146	10	<0.025
ZINB	3.35E-08		0.300	0.258	0.177	0.111	0.155	0.55	>0.5

Table 5a) Observed and predicted proportions for 0,1,…, 6 and 7 or higher counts of cases reported to the SWORD scheme for core reporters

Model	Pr(false zero)	Total Pr(y=0)	pr(y=1)	pr(y=2)	pr(y=3)	pr(y=4)	pr(y=5)	pr(y=6)	pr(y=7 or more)	X^2	P-value
Observed	_	0.288	0.214	0.144	0.098	0.055	0.034	0.030	0.138	-	-
Poisson	_	0.036	0.119	0.198	0.220	0.183	0.122	0.068	0.053	5721	<0.0001
NB	_	0.322	0.165	0.112	0.082	0.063	0.049	0.039	0.168	111	<0.001
ZIP	0.281	0.288	0.033	0.075	0.116	0.134	0.124	0.096	0.134	3145	<0.0001
ZINB	6.68e-09	0.322	0.165	0.112	0.082	0.063	0.049	0.039	0.168	111	<0.001

Table 5b) Observed and predicted proportions for 0,1,…, 3 and 4 or higher counts of cases reported to the SWORD scheme for sample reporters

Model	Pr(false zero)	Total Pr(y=0)	pr(y=1)	pr(y=2)	pr(y=3)	pr(y=4 or more)	X^2	P-value
Observed	_	0.721	0.166	0.063	0.026	0.023	-	-
Poisson	_	0.612	0.300	0.074	0.012	0.002	1592	<0.0001
NB	_	0.722	0.164	0.063	0.027	0.024	0.47	>0.5
ZIP	0.612	0.721	0.139	0.088	0.037	0.015	80	<0.001
ZINB	2.73e-07	0.722	0.164	0.063	0.027	0.024	0.47	>0.5

Table 6 Selection of best fitting model* based on Akaike Information Criterion (AIC) for six "null" (without covariates) models by scheme and reporter type

Scheme	"Null" Model Type	AIC Sample	AIC Core
EPIDERM	Poisson	6530.4	21987.4
	NB	5190.8	18745.2
	RE Poisson	5009.3	17337.5
	RE NB	**4825.2**	**16679.1**
	ZIP	5406.6	20131.0
	ZINB	5186.5	18663.2
OPRA	Poisson	34926.2	13701.8
	NB	21942.0	10277.9
	RE Poisson	23430.3	9071.0
	RE NB	**20274.5**	**8786.9**
	ZIP	26402.3	12371.0
	ZINB	21930.0	10279.9
THOR-GP	Poisson	754.6	19605.5
	NB	695.4	18870.1
	RE Poisson	695.1	17005.3
	RE NB	**693.0**	**16959.3**
	ZIP	728.6	19062.8
	ZINB	697.4	18872.1
SWORD	Poisson	8882.1	20097.8
	NB	7790.8	11748.0
	RE Poisson	7541.9	9990.1
	RE NB	**7340.9**	**9469.1**
	ZIP	8012.1	17362.0
	ZINB	7792.8	11750.0

*Best fitting model (random effects negative binomial) has the smallest AIC and is shown in bold for each scheme.

Table 7 EPIDERM Results. Covariates are centred calendar year and month, plus first active report for sample, for count part, and centred membership, month, plus first active report for sample, for the inflatory part of model.

a) **Core**	**Cal Year** IRR	**Membership Year** OR	95% CI	P-value	P-value (X^2_{11}) for Seasonality
ZIP - Count	0.971	-	0.954, 0.989	0.001	<0.001
- Inflate	-	1.048	0.955, 1.151	0.322	0.046
ZINB – Count	0.970	-	0.951, 0.990	0.003	<0.001
- Inflate	-	1.057	0.910, 1.228	0.465	0.869
b) **Sample** data	**Cal Year** IRR	**Membership Year** OR	95% CI	P-value	P-value (X^2_{11}) for Seasonality
ZIP – Count	1.017	-	0.991, 1.043	0.208	0.257
- Inflate	-	1.048	1.011, 1.087	0.010	0.181
ZINB – Count	1.021	-	0.990, 1.053	0.183	0.246
- Inflate	-	1.082	1.014, 1.155	0.017	0.749

Table 8 OPRA Results. Covariates are centred calendar year and month, plus first active report for sample, for count part, and centred membership, month, plus first active report for sample, for the inflatory part of model.

a) **Core**	Cal Year IRR	Membership Year OR	95% CI	P-value	P-value (X^2_{11}) for Seasonality
ZIP - Count	0.954	-	0.913, 0.996	0.033	0.0134
- Inflate	-	1.055	0.938, 1.186	0.374	<0.001
b) **Sample** data	Cal Year IRR	Membership Year OR	95% CI	P-value	P-value (X^2_{11}) for Seasonality
ZIP – Count	0.995	-	0.980, 1.009	0.469	0.175
- Inflate	-	0.988	0.968, 1.008	0.247	0.002
ZINB – Count	1.010	-	0.989, 1.031	0.358	0.259
- Inflate	-	0.980	0.898, 1.069	0.646	0.864

Table 9 THOR-GP Results. Covariates are centred calendar year and month, plus First1-First5 report for core and First1-2 for sample, for the count part. For the inflatory part of the model centred membership is included along with month for the core data.

a) **Core**	Cal Year IRR	Membership Year OR	95% CI	P-value	P-value (X^2_{11}) for Seasonality
ZIP - Count	0.877	-	0.817, 0.942	< 0.001	0.009
- Inflate	-	1.021	0.892, 1.168	0.766	0.480
b) **Sample**	Cal Year IRR	Membership Year OR	95% CI	P-value	P-value (X^2_{11}) for Seasonality
ZIP – Count	0.860	-	0.698, 1.058	0.154	0.043
- Inflate	-	1.076	0.797, 1.453	0.631	n/a

Table 10 SWORD Results. Covariates are centred calendar year and month, plus first active report for sample, for the count part, and centred membership, month, plus first active report for sample, for the inflatory part of model.

a) **Core**	**Cal Year** IRR	**Membership Year** OR	95% CI	P-value	P-value (X^2_{11}) for Seasonality
ZIP - Count	0.963	-	0.906, 1.024	0.231	<0.001
- Inflate	-	0.997	0.930, 1.069	0.935	0.0002
b) **Sample** data	**Cal Year** IRR	**Membership Year** OR	95% CI	P-value	P-value (X^2_{11}) for Seasonality
ZIP – Count	1.002	-	0.979, 1.026	0.869	0.836
- Inflate	-	1.022	0.995, 1.049	0.107	0.842

IRR= Incident Rate Ratio, OR=Odds Ratio, CI=Confidence Interval

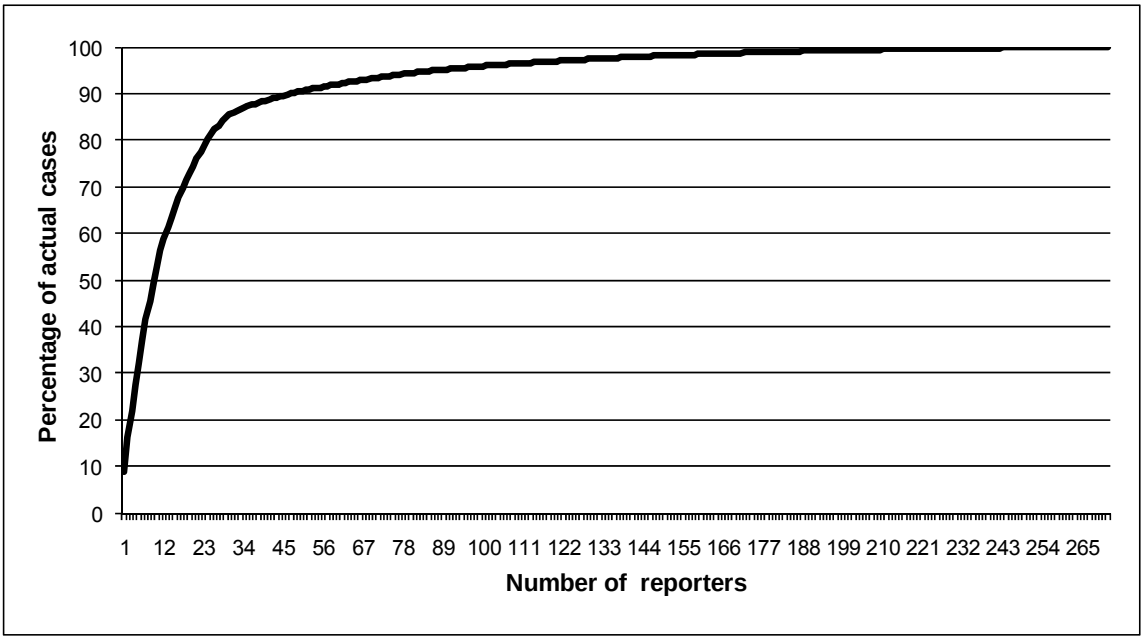
APPENDIX B DESCRIPTIVE ANALYSES

Table B1 Reporting activity of reporters in EPIDERM, 1996-2010

	CORE	SAMPLE
Total reporters ever in 1996-2010	47	366
Total active* reporters in 1996-2010	46	334
Response rate**	91%	77%
% of returns that are blank	16%	63%
Number of reporters who responded at least once but never returned a case	0	108
Number of reporters who have never responded	1	32

* Active reporter is someone who returns a card
**Response rate = cards returned/cards sent out

Figure B1 Percentage of actual cases by reporters*, EPIDERM, 1996-2010



*Based on those reporters who returned cases (i.e. non-responders and 'zero returns' excluded)

Figure B2 Number of reporters in EPIDERM by year and reporter type

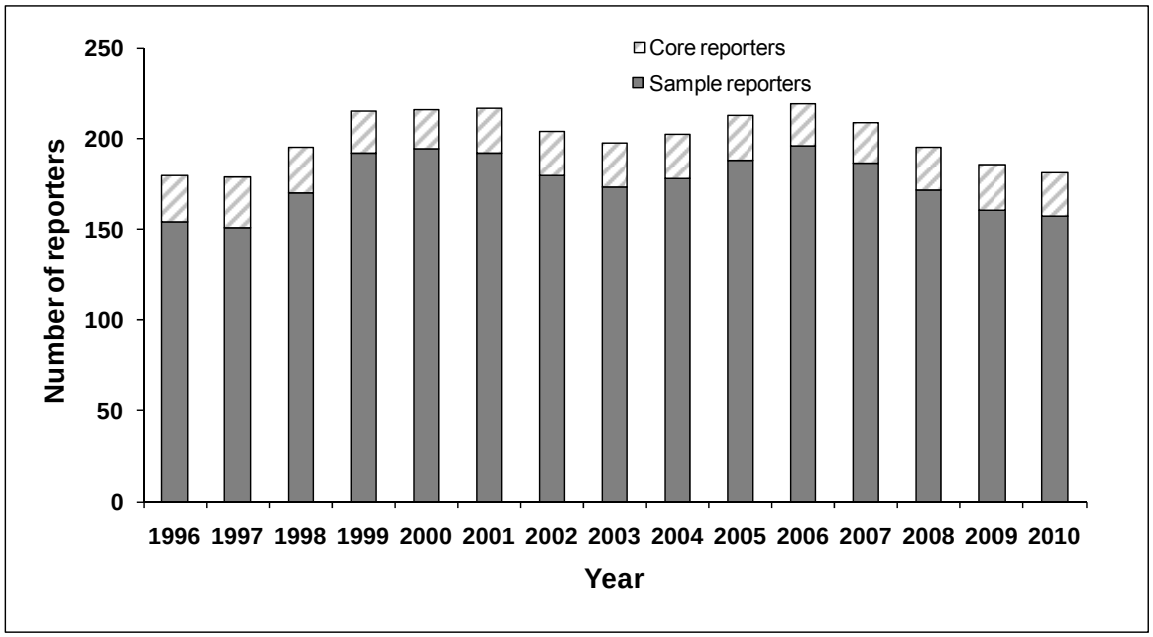


Figure B3 Number of active reporters per month – EPIDERM

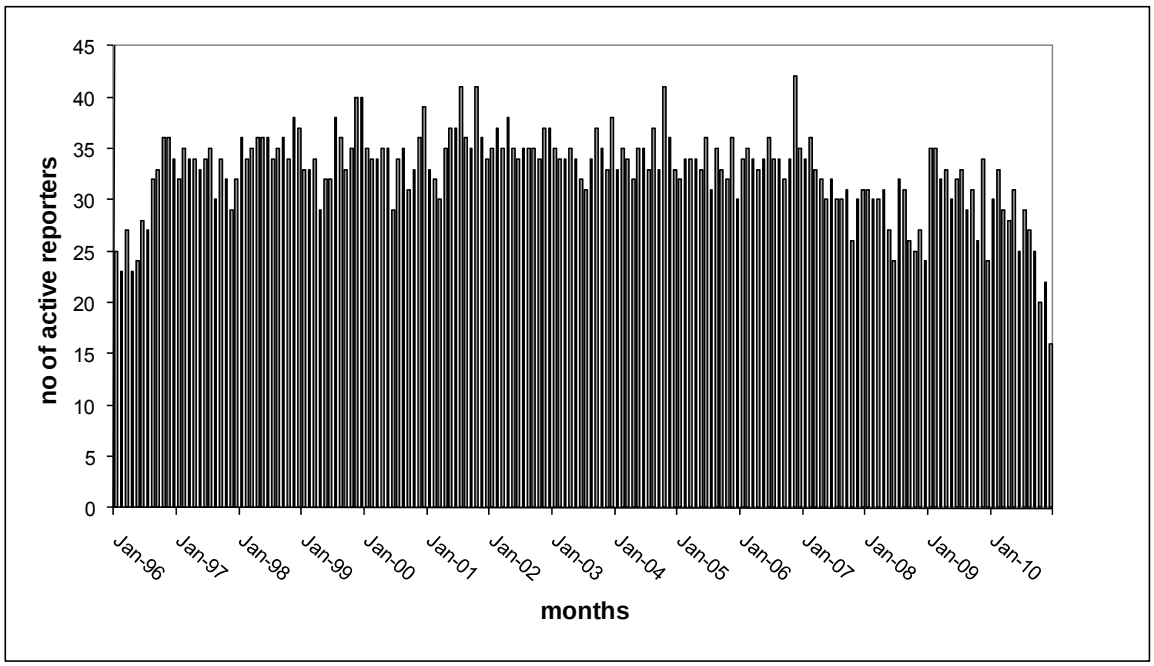
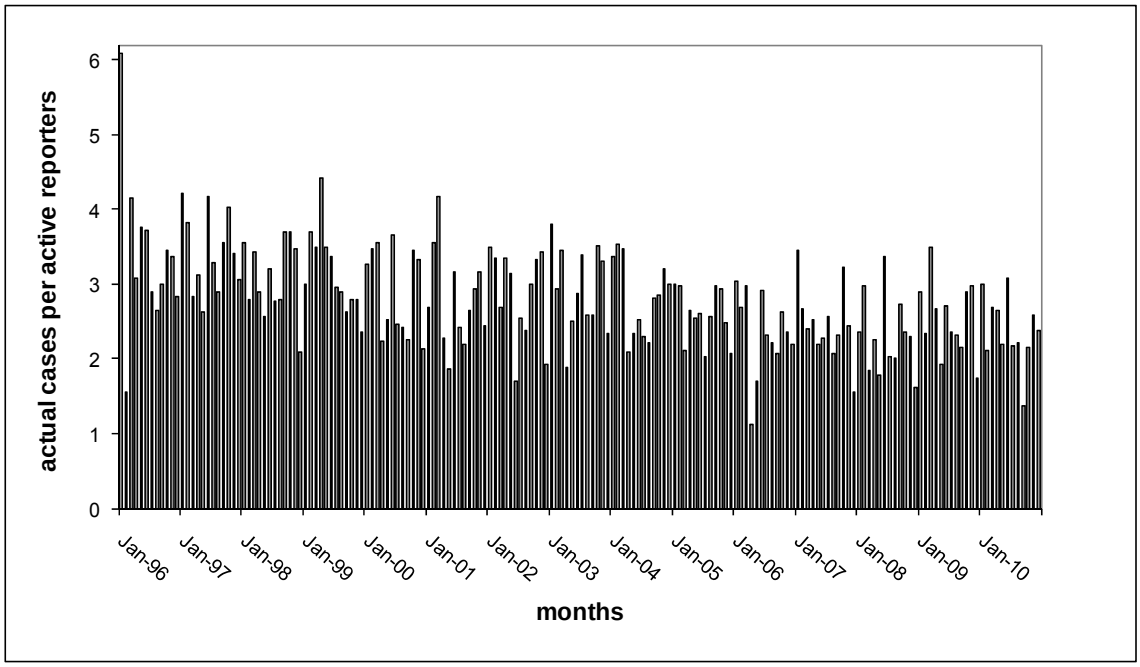
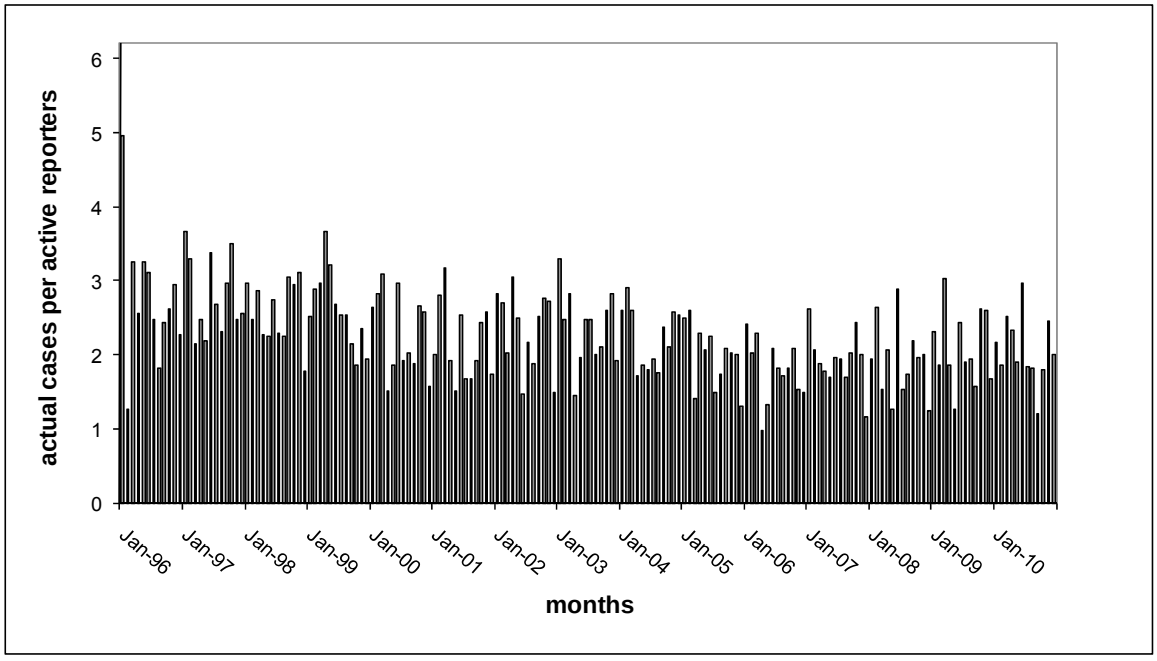


Figure B4 Cases per active reporter per month - EPIDERM

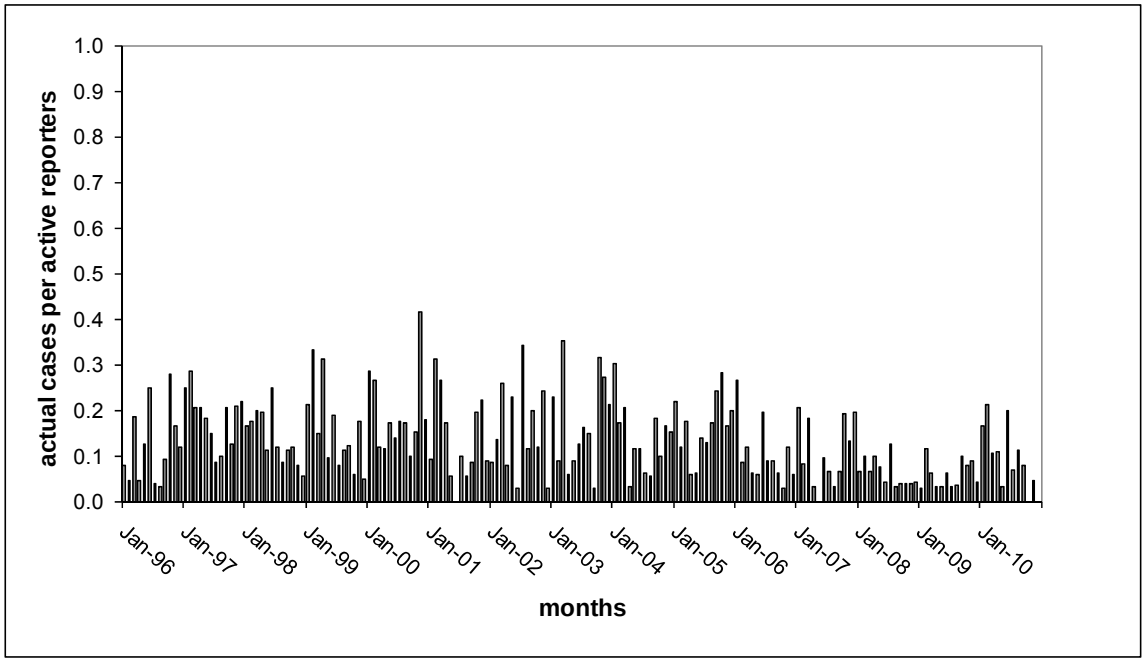
a) Total cases



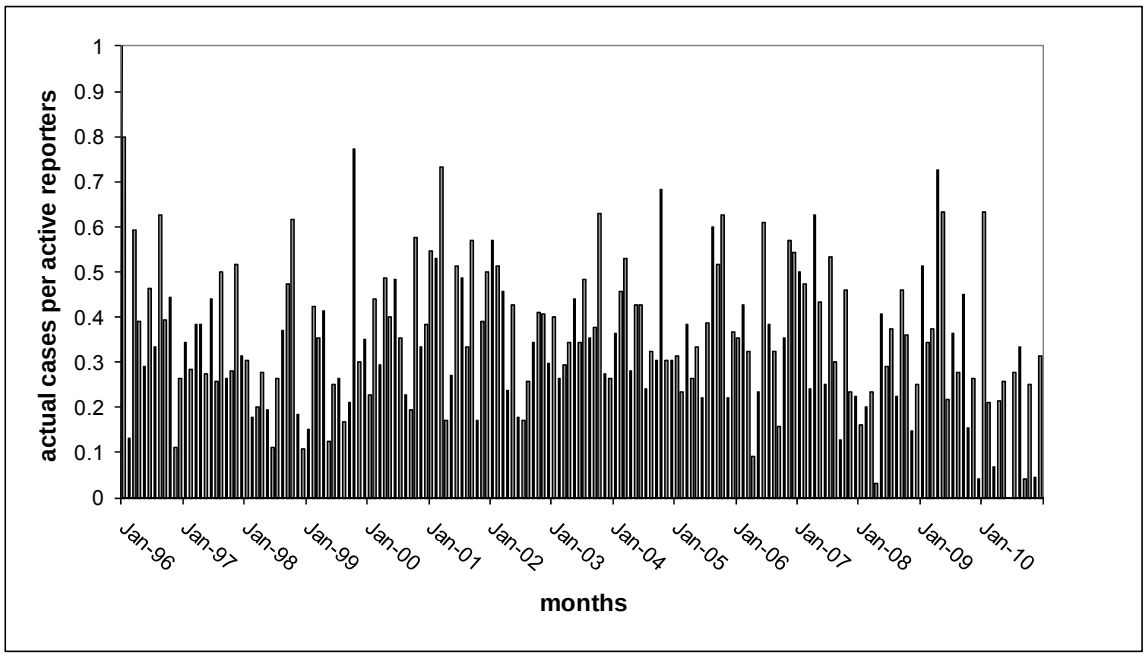
b) Contact dermatitis



c) Contact urticaria (note scale change)



d) Neoplasia



e) Other skin

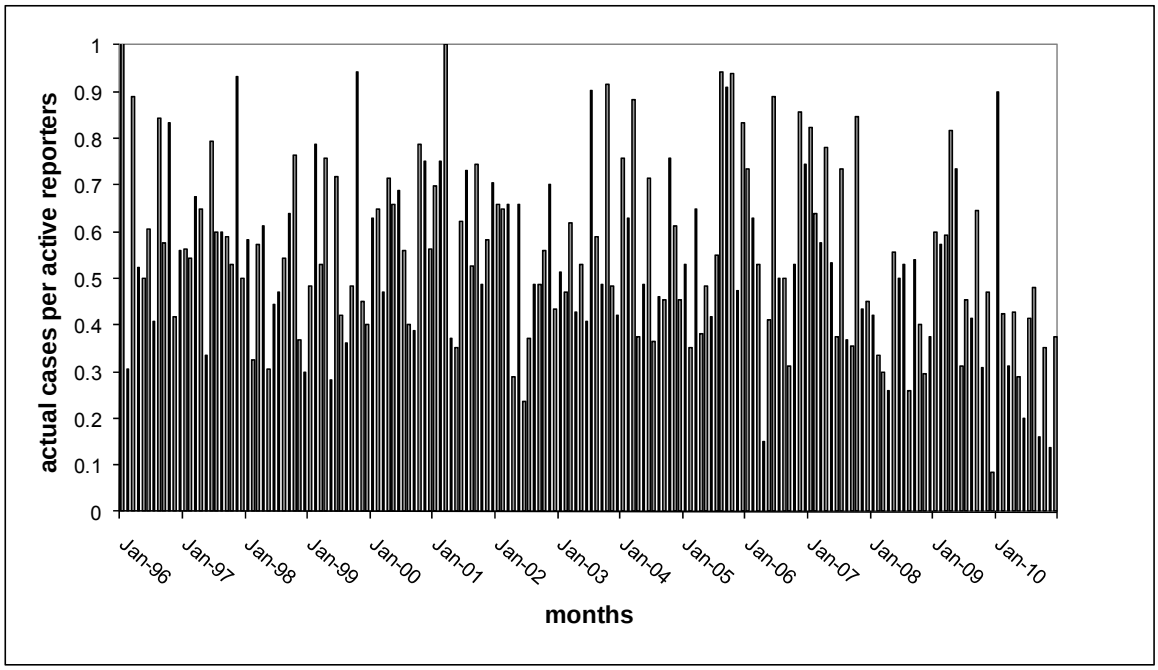

actual cases per active reporters
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
months

Table B2 Cases reported per month by disease category and type of reporter, EPIDERM, 1996-2010

		All Reporters				Core reporters				Sample reporters			
	Statistic		**Min**	**Max**	**SD**		**Min**	**Max**	**SD**		**Min**	**Max**	**SD**
	Total active reporters ever in 1996-2010	380				46				334			
	Mean no. of active* reporters per month	32.76	16	42	4.02	21.44	13	26	2.38	11.31	3	20	2.94
Disease group													
All cases	Total cases	16515				14680				1852			
	Mean cases per month	91.75	34	152	23.74	81.56	30	150	22.25	10.29	0	33	6.47
	Mean cases per active reporter per month	2.80	1.12	6.08	0.66	3.79	1.57	7.89	0.93	0.91	0	3.13	0.52
Contact dermatitis (CD)	Total cases	13329				12073				1274			
	Mean cases per month	74.05	29	124	20.37	67.07	25	122	19.17	7.08	0	23	4.73
	Mean cases per active reporter per month	2.26	0.97	4.96	0.58	3.12	1.35	6.42	0.81	0.62	0	2	0.39
Allergic CD	Total cases	4984				4419				565			
	Mean cases per month	27.69	6	58	10.21	24.55	6	54	9.34	3.14	0	12	2.73
	Mean cases per active reporter per month	0.84	0.25	1.68	0.29	1.14	0.38	2.44	0.40	0.28	0	1.2	0.24
Irritant CD	Total cases	5887				5427				460			
	Mean cases per month	32.71	13	58	9.27	30.15	10	58	9.11	2.56	0	12	2.23
	Mean cases per active reporter per month	1.01	0.41	2.32	0.29	1.41	0.61	3.05	0.41	0.23	0	0.8	0.19
Mixed CD	Total cases	2051				1898				153			
	Mean cases per month	11.39	2	27	5.01	10.54	1	25	4.84	0.85	0	5	1.08
	Mean cases per active reporter per month	0.35	0.07	0.92	0.15	0.49	0.05	1.21	0.22	0.08	0	0.63	0.10
Other* cases	Total cases	3253				2667				584			
	Mean cases per month	18.07	2	36	6.75	14.82	1	28	5.63	3.24	0	15	3.40

		All Reporters				Core reporters				Sample reporters			
	Statistic		**Min**	**Max**	**SD**		**Min**	**Max**	**SD**		**Min**	**Max**	**SD**
	Mean cases per active reporter per month	0.55	0.08	1.12	0.19	0.69	0.08	1.50	0.25	0.29	0	1.67	0.30
Contact urticaria	Total cases	793				750				43			
	Mean cases per month	4.41	0	15	2.87	4.17	0	14	2.81	0.24	0	3	0.54
	Mean cases per active reporter per month	0.13	0	0.42	0.08	0.19	0	0.78	0.13	0.02	0	0.33	0.05
Neoplasia	Total cases	2064				1632				432			
	Mean cases per month	11.47	0	28	5.33	9.07	0	20	4.12	2.40	0	15	3.07
	Mean cases per active reporter per month	0.35	0	0.80	0.16	0.42	0	1.05	0.19	0.21	0	1.38	0.27

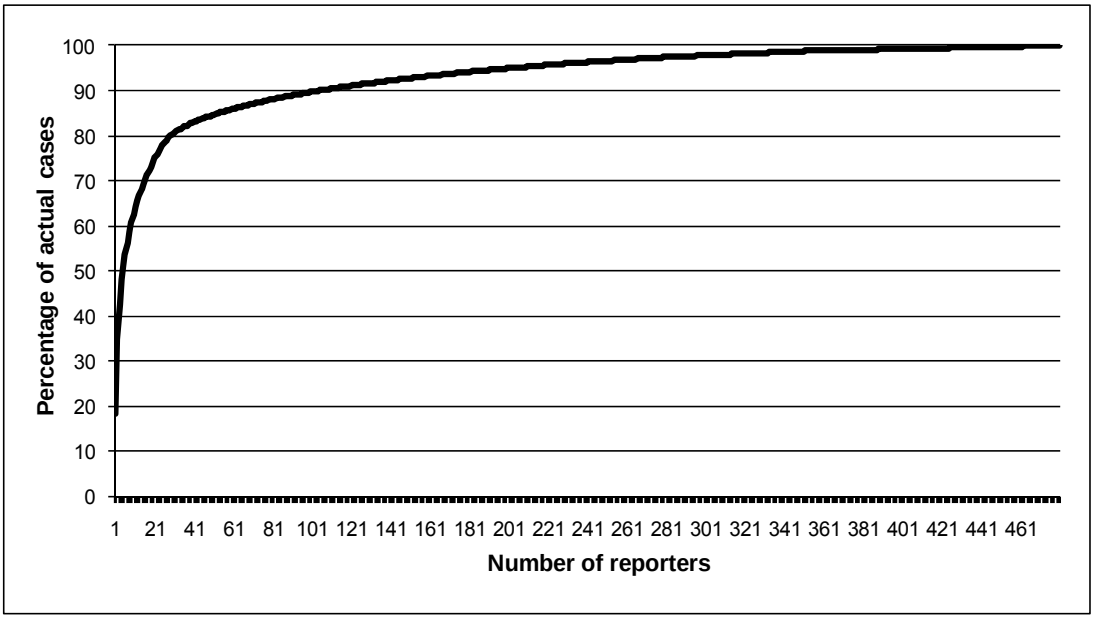
*other than contact dermatitis

Table B3 Reporting activity of reporters in SWORD, 1999-2010

	CORE	SAMPLE
Total reporters ever in 1999-2010	43	735
Total active* reporters in 1999-2010	40	693
Response rate**	86%	77%
% of returns that are zero returns (i.e. no cases to report)	29%	71%
Number of reporters who responded at least once but never returned a case	1	239
Number of reporters who have never responded	3	41

* Active reporter is someone who returns a card
**Response rate = cards returned/cards sent out

Figure B5 Percentage of actual cases by reporters*, SWORD, 1999-2010



*Based on those reporters who returned cases (i.e. non-responders and 'zero returns' excluded)

Figure B6 Number of reporters in SWORD by year and reporter type

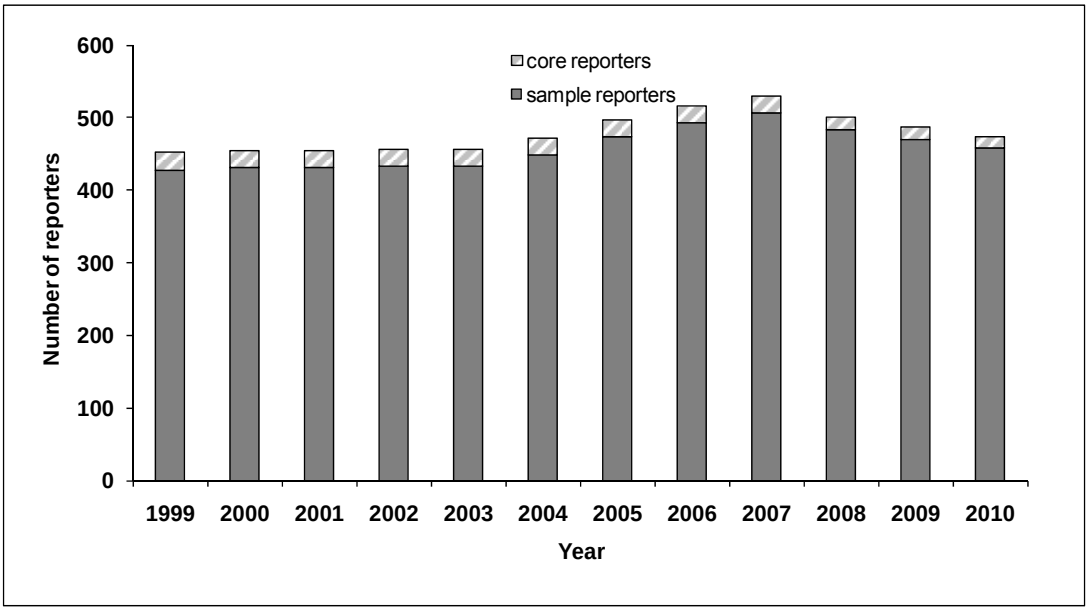


Figure B7 Number of active reporters per month – SWORD

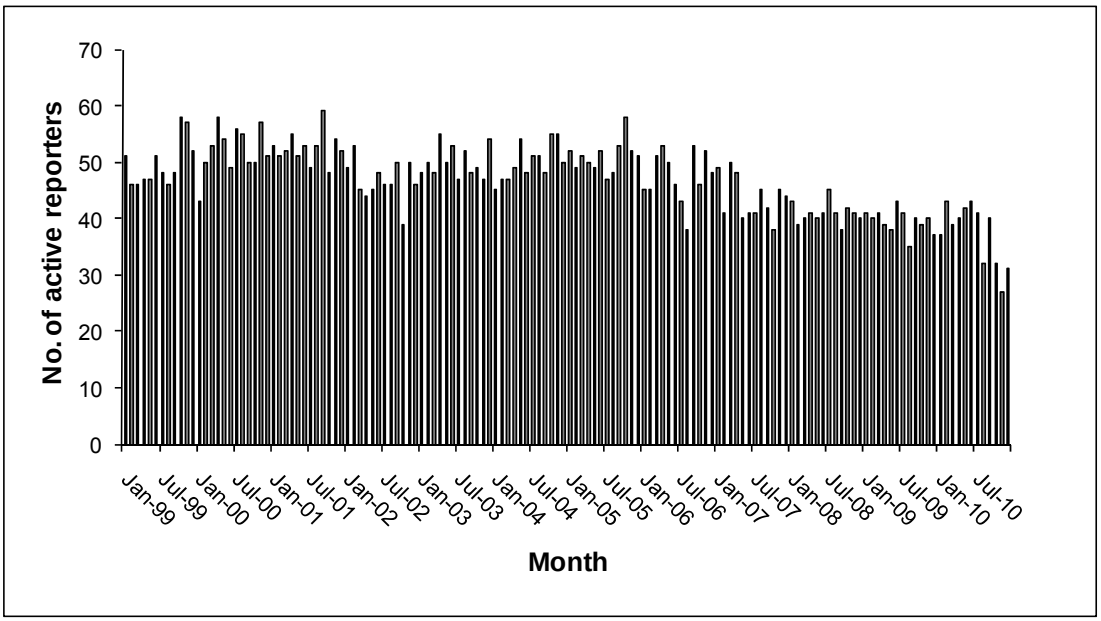
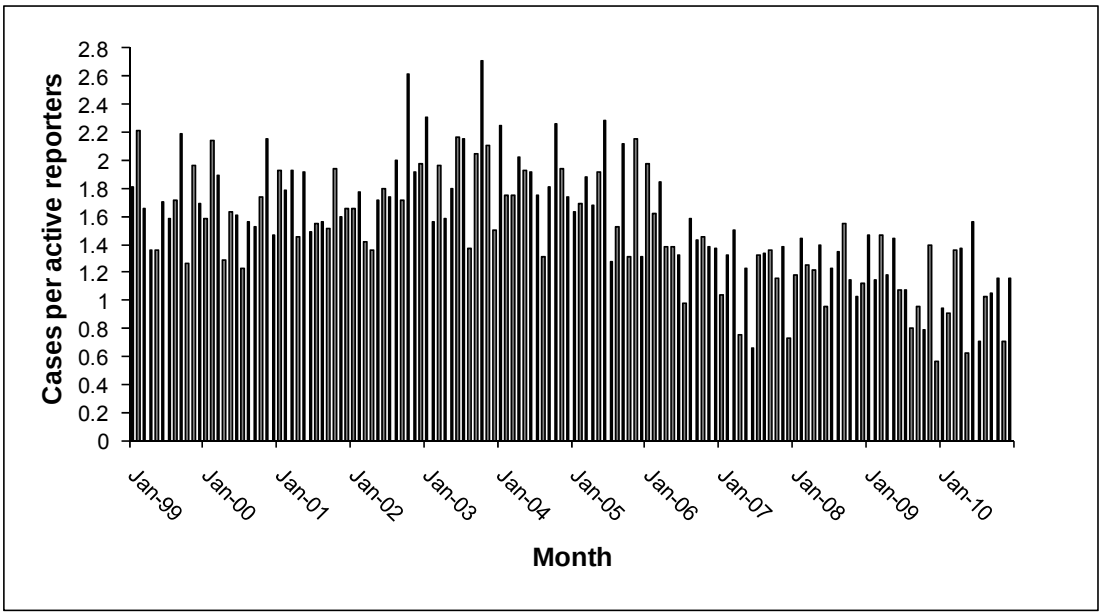
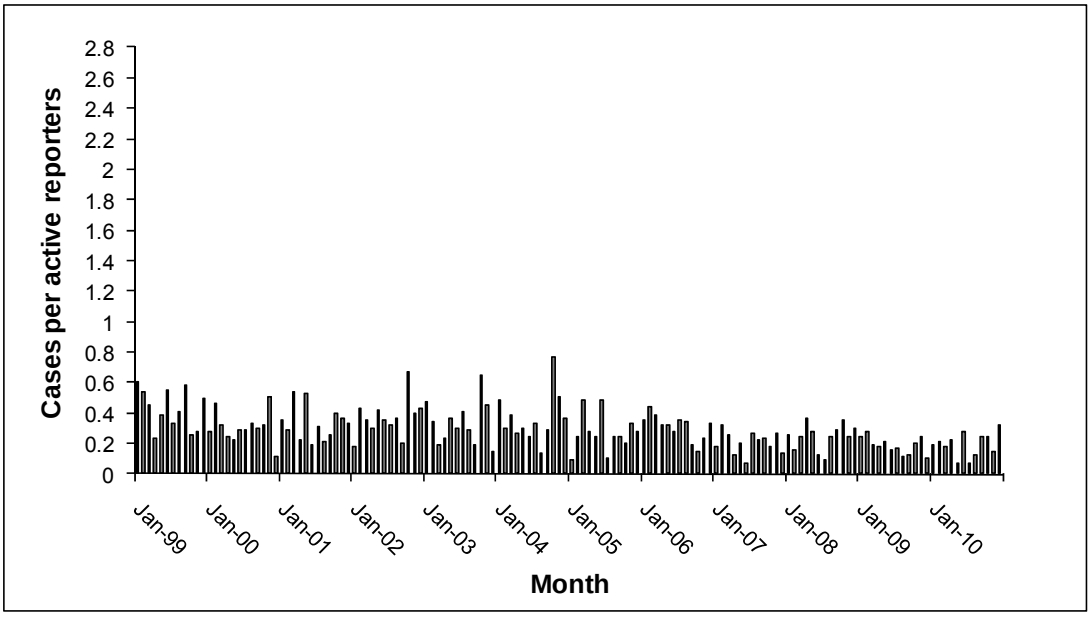


Figure B8 Cases per active reporter per month - SWORD

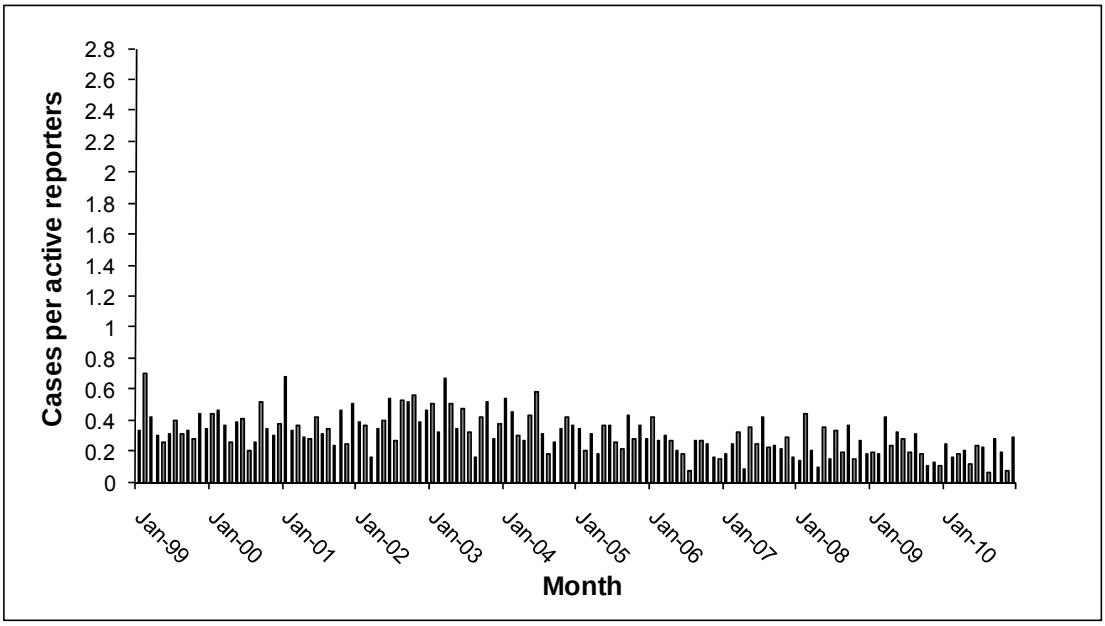
a) Total cases



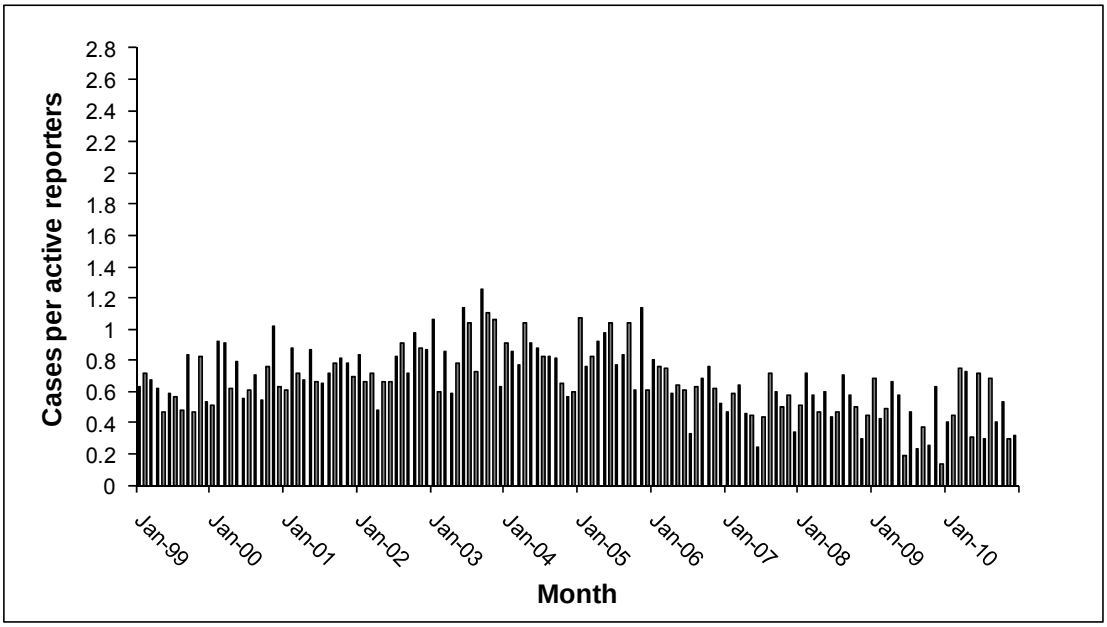
b) Asthma



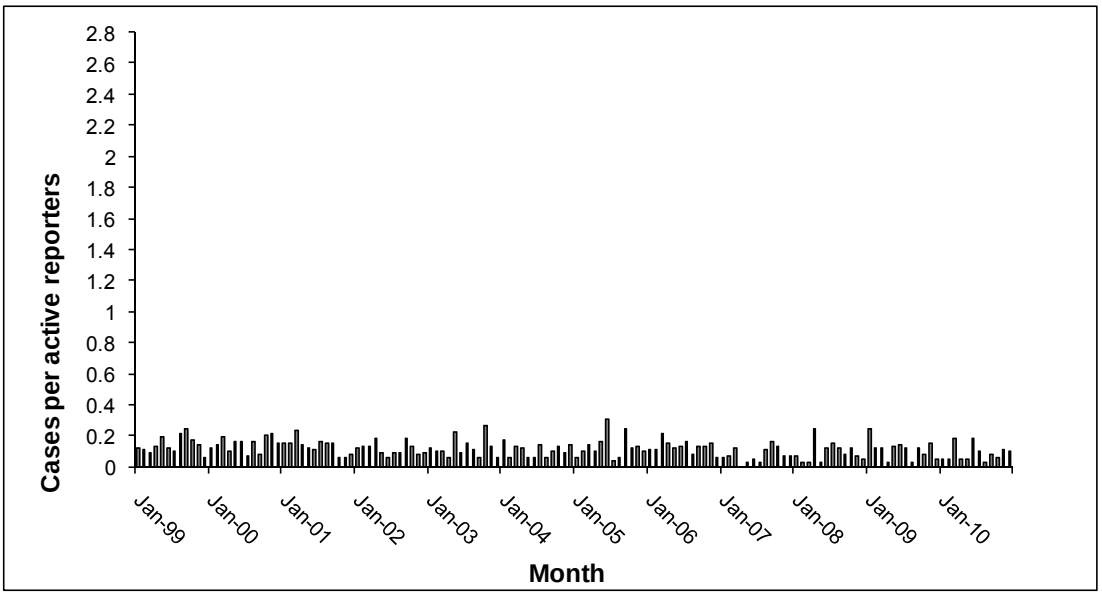
c) Mesothelioma



d) Non-malignant pleural disease



e) Pneumoconiosis



f) Other respiratory

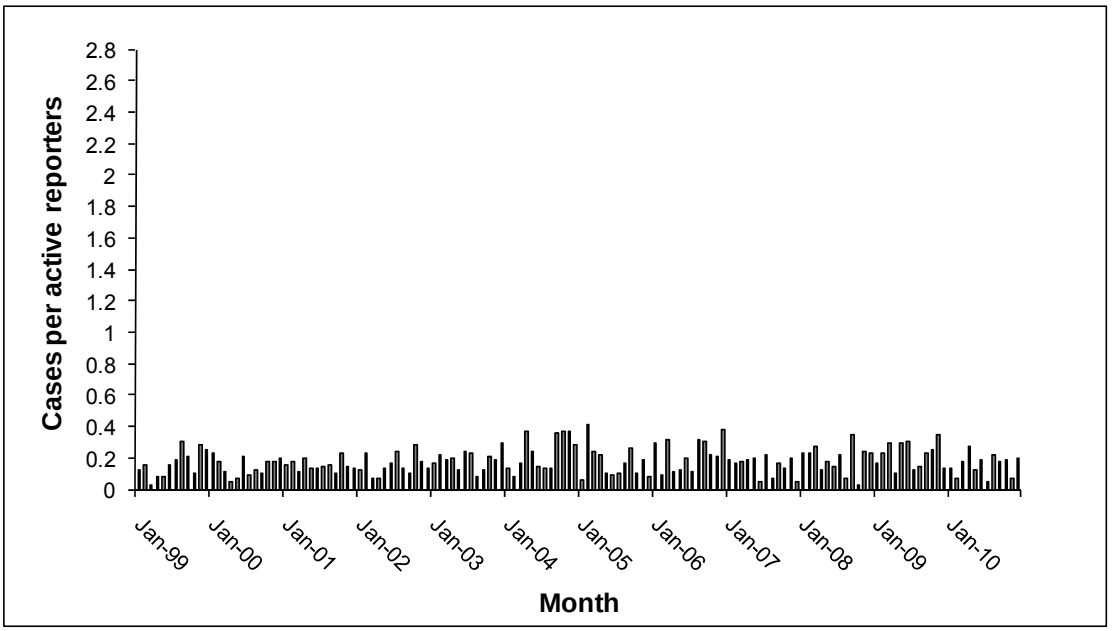


Table B4 Cases reported per month by disease category and type of reporter, SWORD, 1999-2010

		All Reporters				Core reporters				Sample reporters			
	Statistic		**Min**	**Max**	**SD**		**Min**	**Max**	**SD**		**Min**	**Max**	**SD**
	Total active reporters ever in 1999-2010	733				40				693			
	Mean no. of active* reporters per month	46.76	27	59	6.08	17.55	10	23	3.17	29.21	16	38	3.95
Disease group													
All cases	Total cases	10514				8450				2064			
	Mean cases per month	73.01	19	133	24.33	58.68	11	112	23.15	14.33	3	35	6.34
	Mean cases per active reporter per month	1.54	0.57	2.71	0.41	3.26	0.92	5.83	0.99	0.49	0.09	1.03	0.19
Asthma	Total cases	2024				1794				230			
	Mean cases per month	14.06	3	42	6.82	12.46	3	42	6.21	1.60	0	9	1.57
	Mean cases per active reporter per month	0.30	0.07	0.76	0.13	0.70	0.16	2.33	0.31	0.05	0.00	0.28	0.05
Mesothelioma	Total cases	2110				1432				678			
	Mean cases per month	14.65	2	36	6.66	9.94	0	27	5.80	4.71	0	11	2.61
	Mean cases per active reporter per month	0.31	0.06	0.70	0.13	0.55	0.00	1.69	0.30	0.16	0.00	0.39	0.09
Non malignant pleural plaques	Total cases	4576				3808				768			
	Mean cases per month	31.78	5	60	12.08	26.44	3.00	59.00	12.09	5.33	0	17	3.48
	Mean cases per active reporter per month	0.67	0.14	1.25	0.21	1.46	0.25	2.84	0.53	0.18	0.00	0.63	0.11
Pneumoconiosis	Total cases	793				652				141			

	Statistic	All Reporters				Core reporters				Sample reporters			
			Min	Max	SD		Min	Max	SD		Min	Max	SD
	Mean cases per month	5.51	0	16	2.91	4.53	0	13	2.53	0.98	0	5	1.15
	Mean cases per active reporter per month	0.12	0.00	0.31	0.06	0.25	0.00	0.62	0.13	0.03	0.00	0.15	0.04
Other cases*	Total cases	1197				947				250			
	Mean cases per month	8.31	1	20	3.96	6.58	1	20	3.53	1.74	0	13	1.90
	Mean cases per active reporter per month	0.18	0.02	0.41	0.08	0.38	0.05	1.11	0.20	0.06	0.00	0.45	0.06

*Other than those specified above i.e SWORD categories: inhalation accidents, allergic alveolitis, bronchitis/emphysema, infectious disease, lung cancer and 'other' (the latter includes rhinitis).

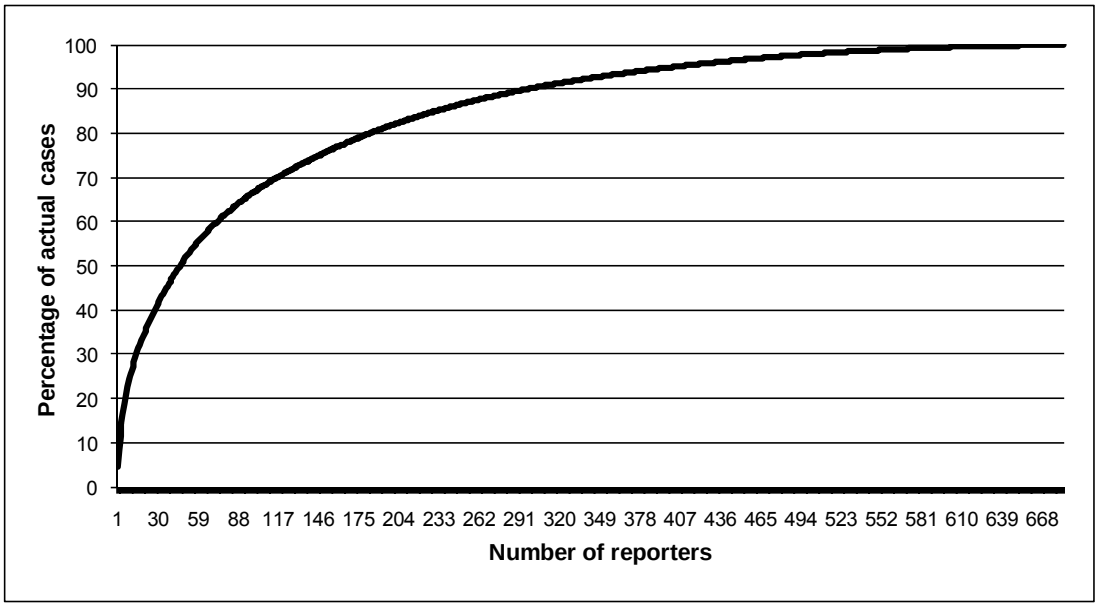
NOTE: A case may have more than one diagnosis

Table B5 Reporting activity of reporters in OPRA, 1996-2010

	CORE	SAMPLE
Total reporters ever in 1996-2010	64	969
Total active* reporters in 1996-2010	64	934
Response rate**	86%	81%
% of returns that are blank	23%	51%
Number of reporters who responded at least once but never returned a case	1	252
Number of reporters who have never responded	0	35

* Active reporter is someone who returns a card
**Response rate = cards returned/cards sent out

Figure B9 Percentage of actual cases by reporters*, OPRA, 1996-2010



*Based on those reporters who returned cases (i.e. non-responders and 'zero returns' excluded)

Figure B10 Number of reporters in OPRA by year and reporter type

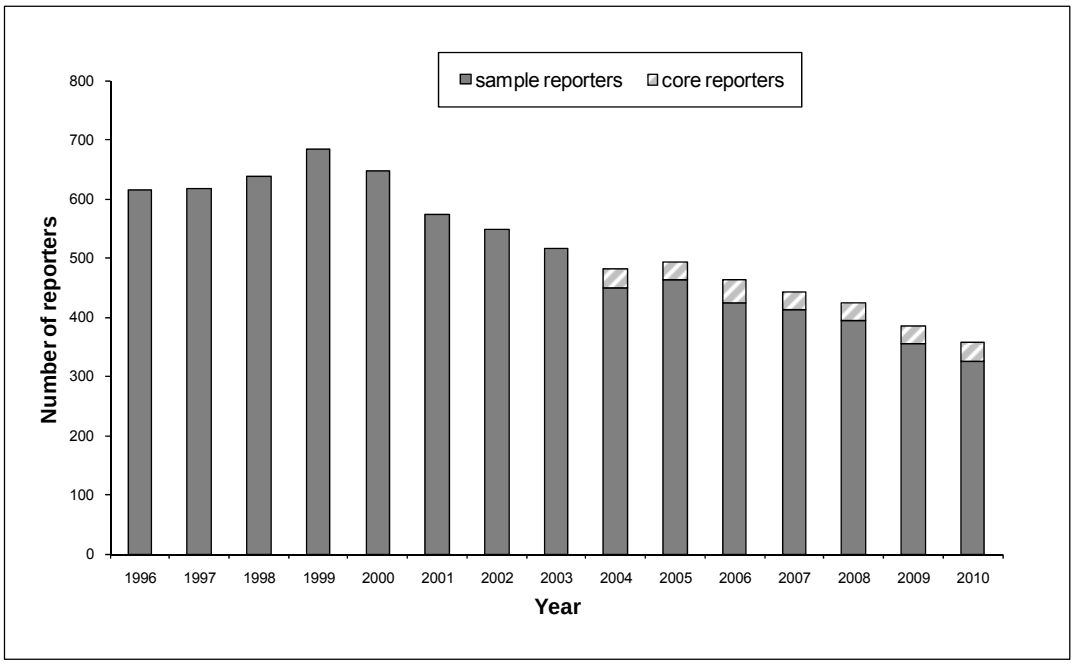


Figure B11 Number of active reporters per month – OPRA

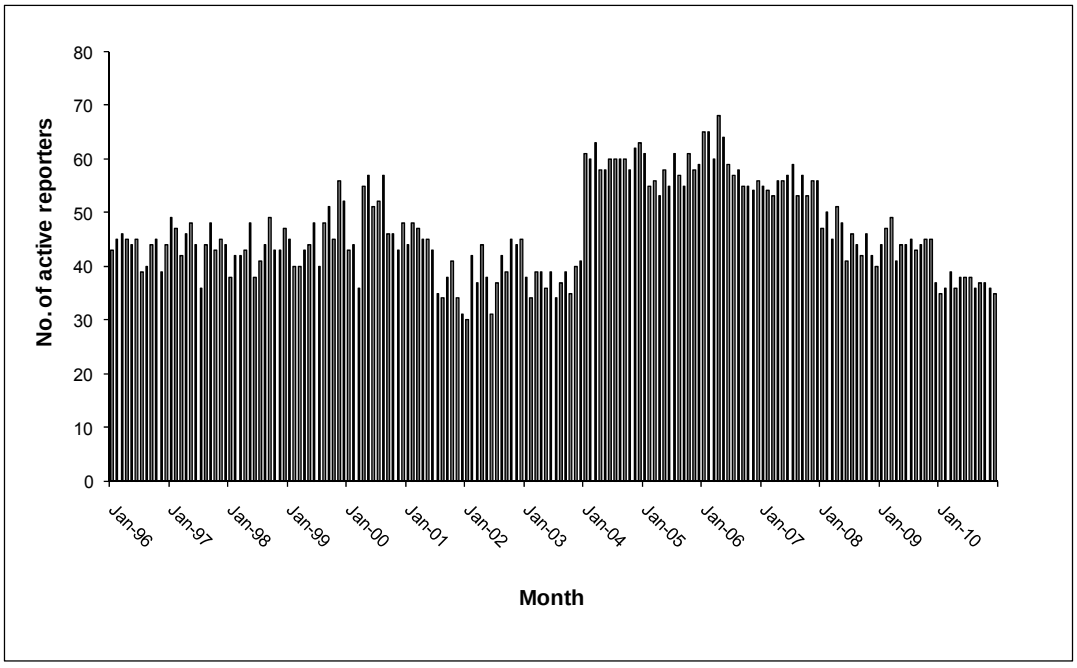
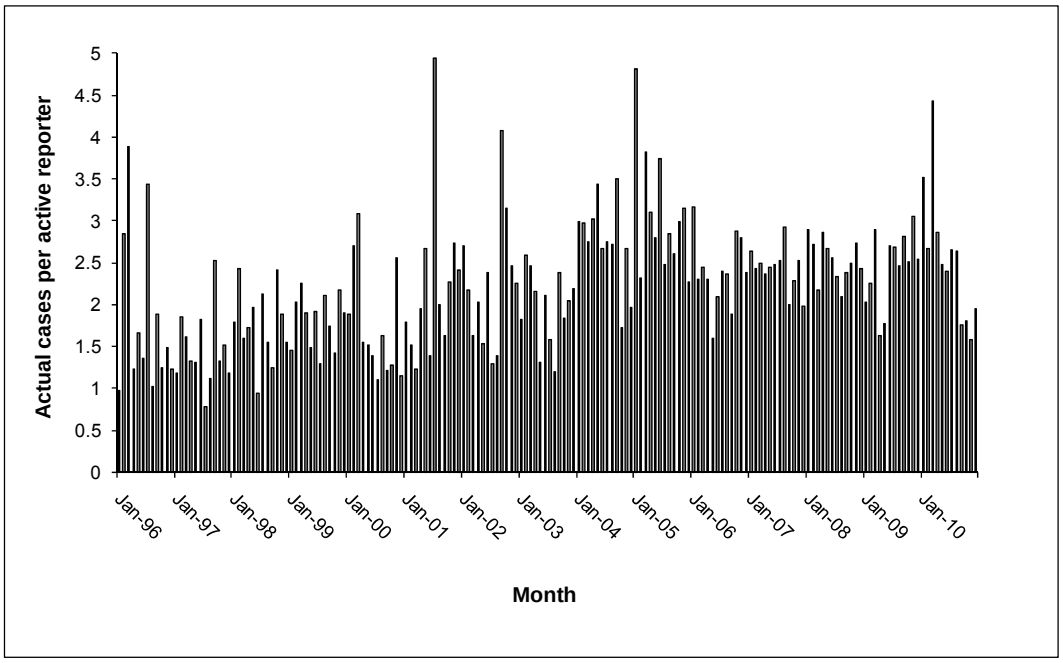
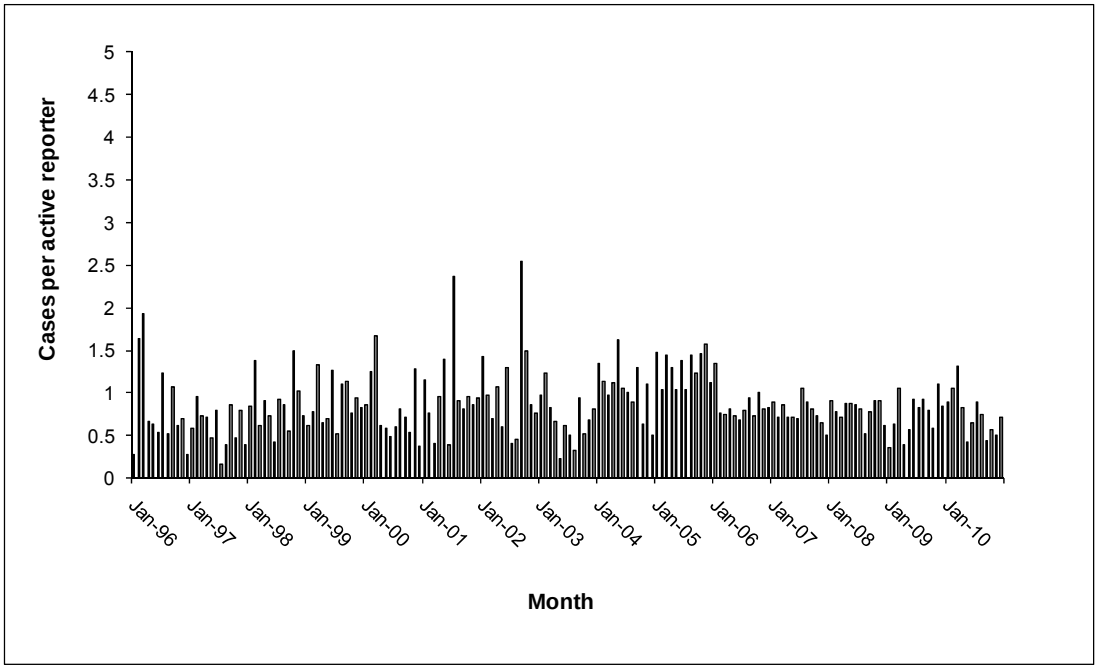


Figure B12 Cases per active reporter per month – OPRA

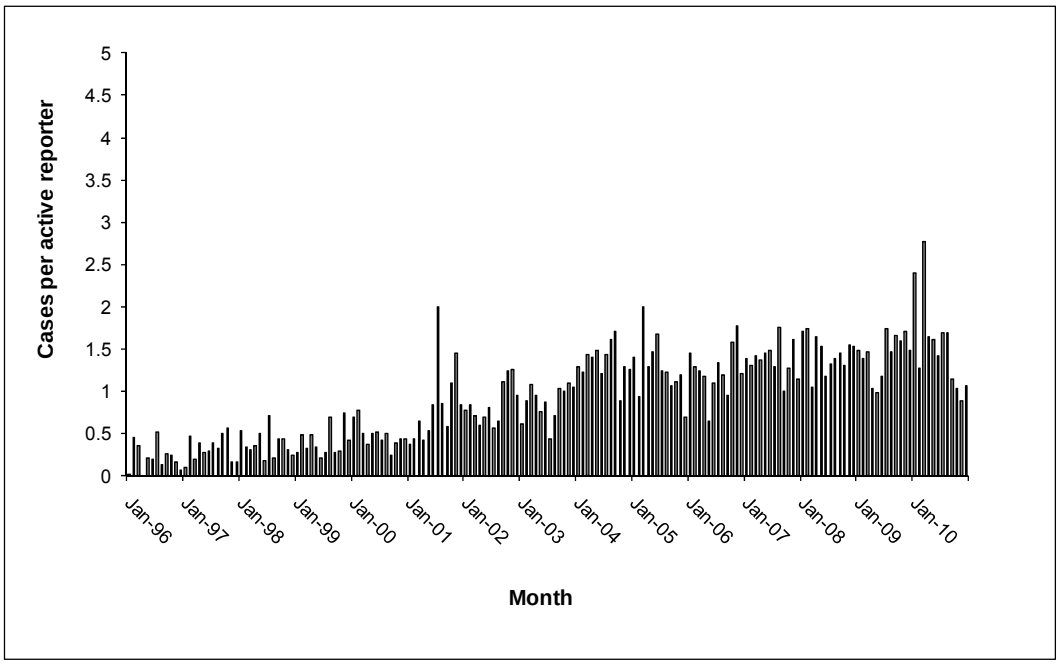
a) Total cases



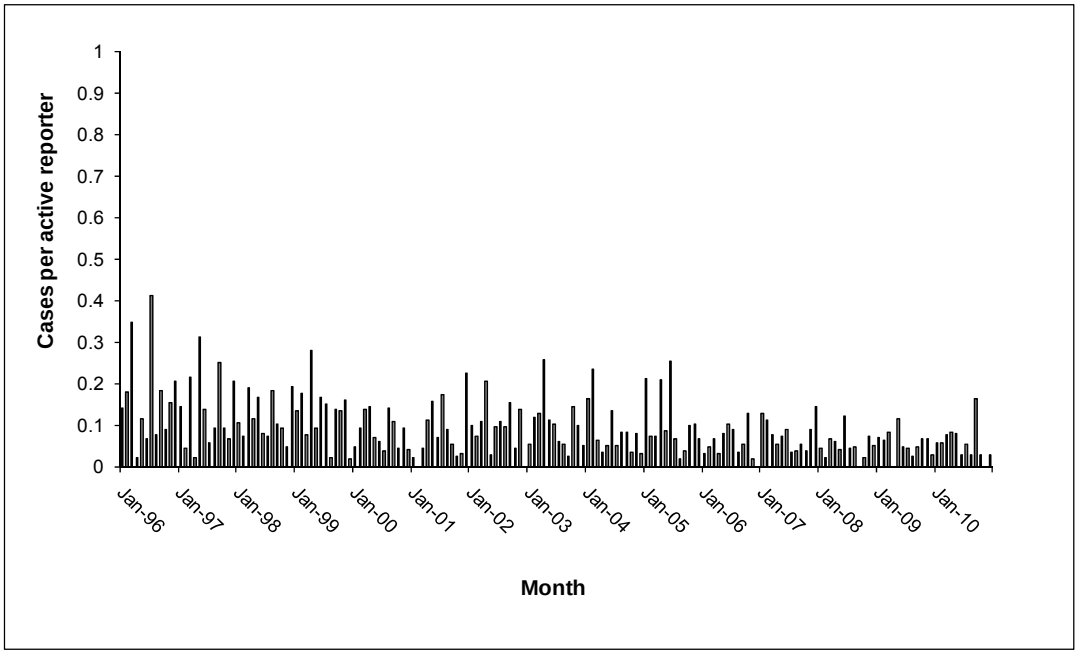
b) Total musculoskeletal



c) Total mental ill-health



d) Total respiratory (note scale change)



e) Total skin

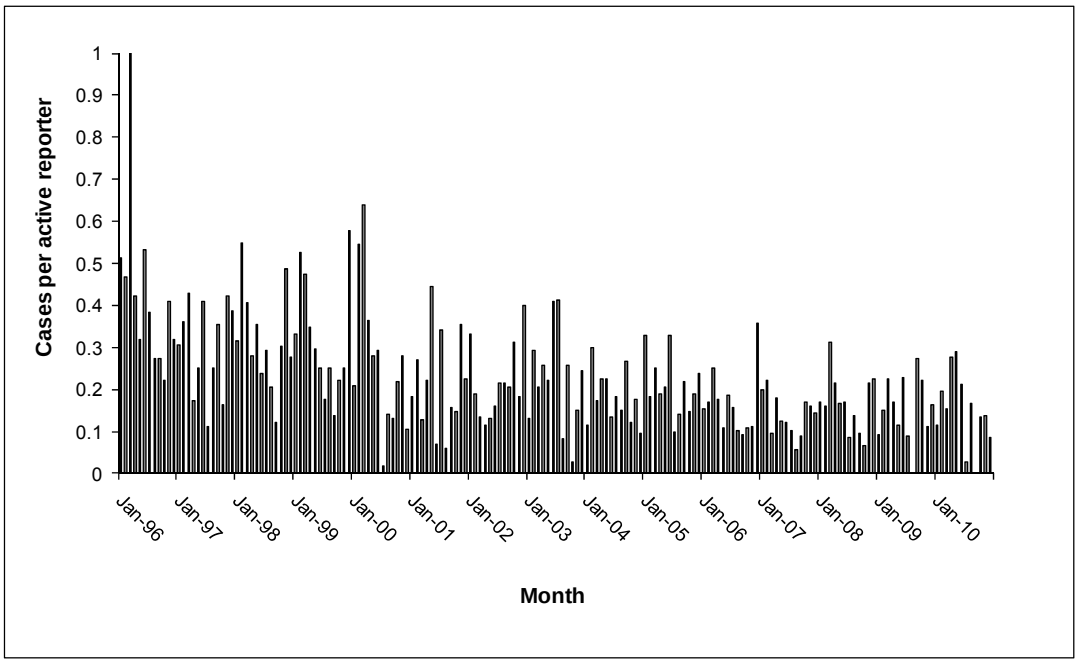

Cases per active reporter
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Month

Table B6 Cases reported per month by disease category and type of reporter, OPRA, 1996-2010

		All Reporters				Core reporters				Sample reporters			
	Statistic		**Min**	**Max**	**SD**		**Min**	**Max**	**SD**		**Min**	**Max**	**SD**
	Total active reporters ever in 1996-2010[a]	8417				2240				6177			
	Mean no. of active* reporters per month	46.76	30	68	8.43	26.67	15	37	3.83	34.32	11	57	10.83
Disease group													
All cases	Total cases	18893				7070				11823			
	Mean cases per month	104.96	28	294	43.14	84.17	30	163	24.51	65.68	12	179	29.51
	Mean cases per active reporter per month	2.22	0.78	4.94	0.73	3.14	1.89	5.89	0.76	1.95	0.69	5.13	0.71
All respiratory	Total cases	776				175				601			
	Mean cases per month	4.31	0	16	3.18	2.08	0	10	1.91	3.34	0	16	3.12
	Mean cases per active reporter per month	0.09	0	0.41	0.07	0.08	0	0.36	0.07	0.09	0	0.41	0.07
Asthma	Total cases	358				71				287			
	Mean cases per month	1.99	0	9	1.69	0.85	0	5	1.08	1.59	0	9	1.73
	Mean cases per active reporter per month	0.04	0	0.23	0.04	0.03	0	0.16	0.04	0.04	0	0.23	0.04
Mesothelioma	Total cases	16				5				11			
	Mean cases per month	0.09	0	2	0.30	0.06	0	2	0.28	0.06	0	1	0.24
	Mean cases per active reporter per month	/	/	/	/	/	/	/	/	/	/	/	/
Non-malignant	Total cases	26				4				22			
Pleural disease	Mean cases per month	0.14	0	2	0.38	0.05	0	1	0.21	0.12	0	2	0.36
	Mean cases per active reporter per month	/	/	/	/	/	/	/	/	/	/	/	/
Pneumoconiosis	Total cases	16				1				15			
	Mean cases per month	0.09	0	2	0.36	0.01	0	1	0.11	0.08	0	2	0.35
	Mean cases per active reporter per month	/	/	/	/	/	/	/	/	/	/	/	/
Other respiratory[b]	Total cases	382				99				283			
	Mean cases per month	2.12	0	12	2.10	1.18	0	5	1.38	1.57	0	12	1.85

		All Reporters				Core reporters				Sample reporters			
	Statistic		**Min**	**Max**	**SD**		**Min**	**Max**	**SD**		**Min**	**Max**	**SD**
	Mean cases per active reporter per month	0.05	0	0.26	0.04	0.04	0.	0.18	0.05	0.04	0.	0.26	0.05
All skin	Total cases	1907				416				1491			
	Mean cases per month	10.59	0	47	6	4.95	0	14	2.66	8.28	0	47	6.84
	Mean cases per active reporter per month	0.23	0	1.02	0.13	0.18	0	0.50	0.09	0.22	0	1.02	0.15
Contact dermatitis	Total cases	1582				353				1229			
	Mean cases per month	8.79	0	40	5.09	4.20	0	11	2.22	6.83	0	40	5.79
	Mean cases per active reporter per month	0.19	0	0.87	0.11	0.16	0	0.37	0.08	0.18	0.	0.87	0.12
Other skin[c]	Total cases	326				66				260			
	Mean cases per month	1.81	0	8	1.83	0.79	0	8	1.18	1.44	0	8	1.78
	Mean cases per active reporter per month	0.04	0	0.18	0.04	0.03	0	0.29	0.04	0.04	0	0.20	0.04
All musculoskeletal	Total cases	7388				2402				4986			
	Mean cases per month	41.04	6	99	18.97	28.60	9	71	12.81	27.70	3	99	17.11
	Mean cases per active reporter per month	0.87	0.17	2.54	0.36	1.06	0.41	2.52	0.43	0.79	0.17	2.54	0.40
Upper limb[d]	Total cases	4146				1334				2812			
	Mean cases per month	23.03	3	66	11.27	15.88	5	44	7.99	15.62	1	66.	10.23
	Mean cases per active reporter per month	0.49	0.08	1.69	0.22	0.59	0.19	1.54	0.28	0.44	0.06	1.69	0.24
Spine/back[e]	Total cases	2494				770				1724			
	Mean cases per month	13.86	2	44	7.68	9.17	1	30	5.16	9.58	0	44	7.07
	Mean cases per active reporter per month	0.29	0.05	1.06	0.15	0.34	0.05	1.11	0.18	0.27	0	1.06	0.17
All mental ill-health	Total cases	8041				3884				4157			
	Mean cases per month	44.67	0	112	28.00	46.24	15	79	11.91	23.09	0	70	11.28
	Mean cases per active reporter per month	0.93	0	2.77	0.53	1.73	1.00	2.93	0.39	0.75	0	3.20	0.44
Anxiety/depression	Total cases	4536				2156				2380			

		All Reporters				Core reporters				Sample reporters			
	Statistic		**Min**	**Max**	**SD**		**Min**	**Max**	**SD**		**Min**	**Max**	**SD**
	Mean cases per month	25.20	0	68	15.96	25.67	9	44	8.35	13.22	0	46	7.92
	Mean cases per active reporter per month	0.53	0	1.31	0.29	0.95	0.44	1.52	0.25	0.42	0	1.47	0.26
Post traumatic	Total cases	226				90				136			
stress disorder	Mean cases per month	1.26	0	7	1.45	1.07	0	6	1.40	0.76	0	6	1.07
	Mean cases per active reporter per month	0.03	0	0.14	0.03	0.04	0	0.21	0.05	0.02	0	0.33	0.04
Other work stress	Total cases	3740				1856				1884			
	Mean cases per month	20.78	0	68	14.76	22.10	6	47	7.39	10.47	0	27	6.21
	Mean cases per active reporter per month	0.44	0	1.74	0.30	0.84	0.34	1.96	0.30	0.35	0	1.40	0.25
Other mental	Total cases	258				144				114			
ill-health[f]	Mean cases per month	1.43	0	7	1.58	1.71	0	5	1.41	0.63	0	5	0.95
	Mean cases per active reporter per month	0.03	0	0.14	0.03	0.07	0	0.21	0.06	0.02	0	0.19	0.03

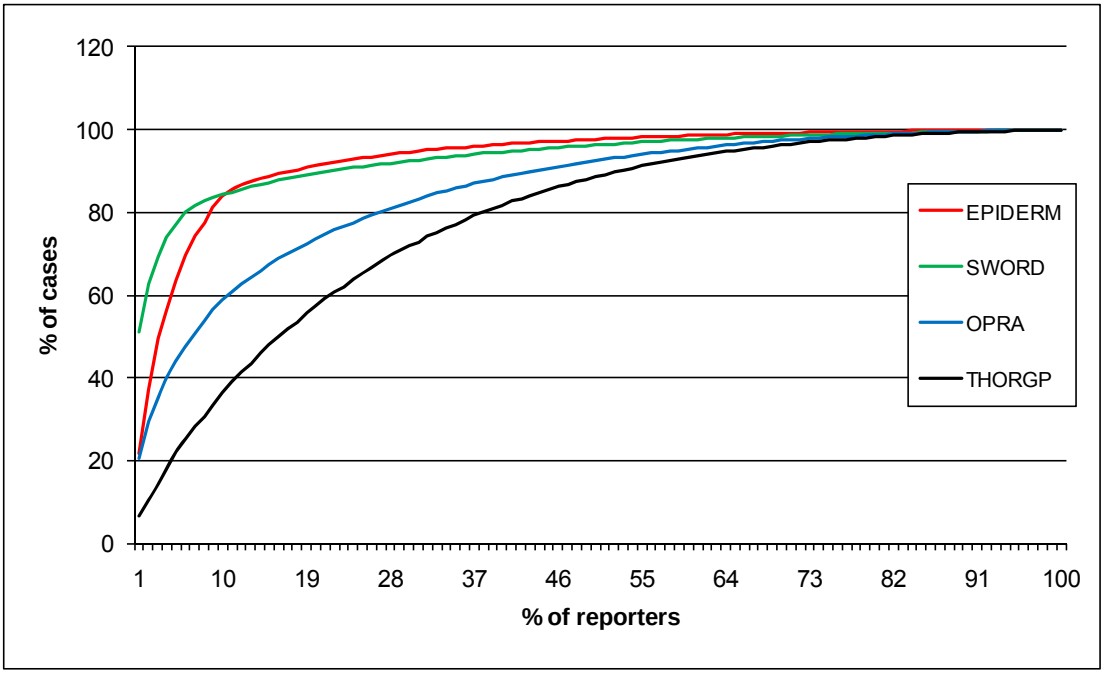
[a]If a reporter changed between reporter type (i.e. core, sample) they were assigned a new centre number and treated as a separate reporter
[b]Other than asthma, mesothelioma, non-malignant pleural disease, and pneumoconiosis
[c]Other than contact dermatitis
[d]Upper limb = hand/wrist/arm, elbow and shoulder
[e]Spine/back = neck/thoracic spine and lumbar spine/trunk
[f]Other than anxiety and depression, post traumatic stress disorder and other work-related stress

Table B7 Reporting activity of reporters in THOR-GP, 2006-2010

	CORE	SAMPLE
Total reporters ever in 2006-2010	442	211
Total active* reporters in 2006-2010	332	159
Response rate**	58%	74%
% of returns that are zero returns (i.e. no cases to report)	60%	29%
Number of reporters who responded at least once but never returned a case	46	41
Number of reporters who have never responded	110	52

* Active reporter is someone who returns a card
**Response rate = cards returned/cards sent out

Figure B13 Percentage of actual cases by reporters*, SWORD (1999-2010), EPIDERM and OPRA (1996-2010) and THOR-GP (2006-2010)



*Based on those reporters who returned cases (i.e. non-responders and 'zero returns' excluded)

Figure B14 Number of reporters in THOR-GP by year and reporter type, 2006-2010

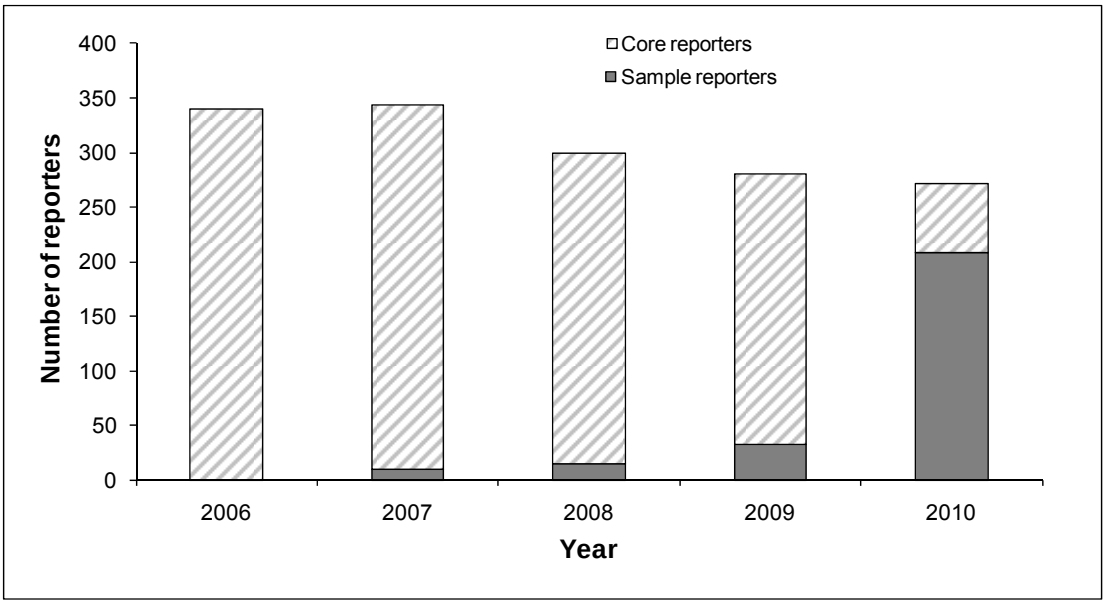


Figure B15 Number of active reporters per month – THOR-GP, 2006-2010

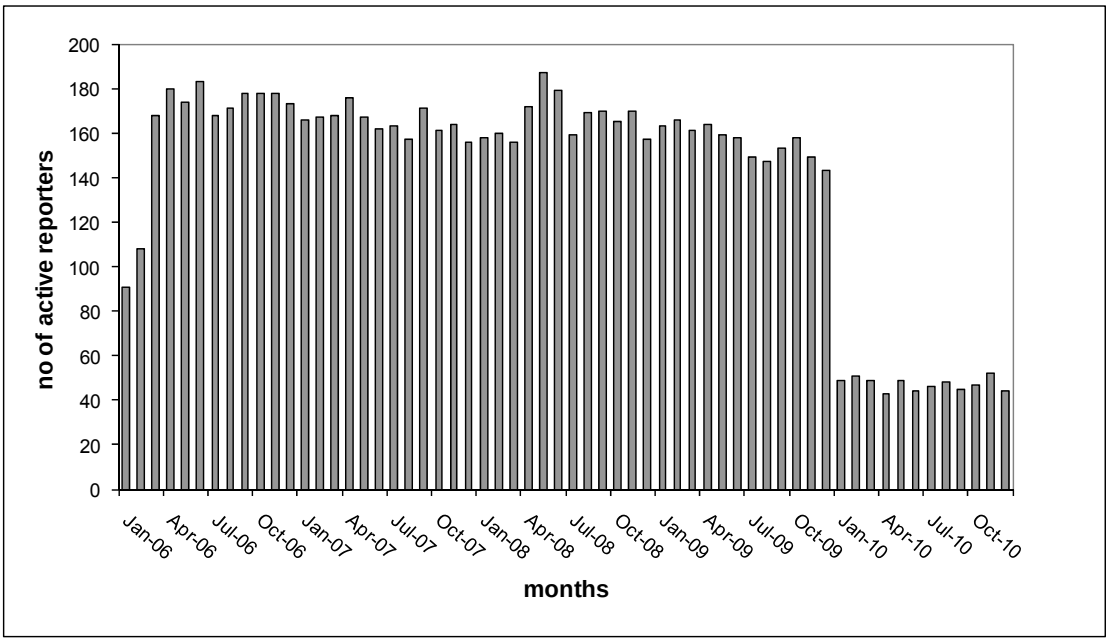
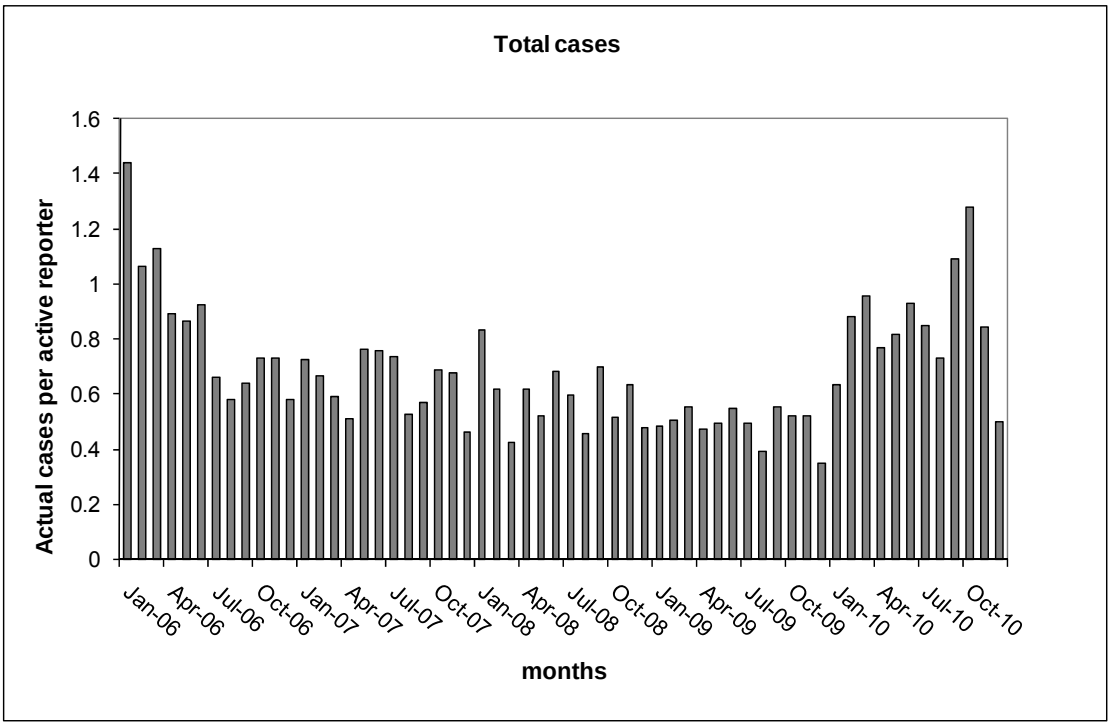
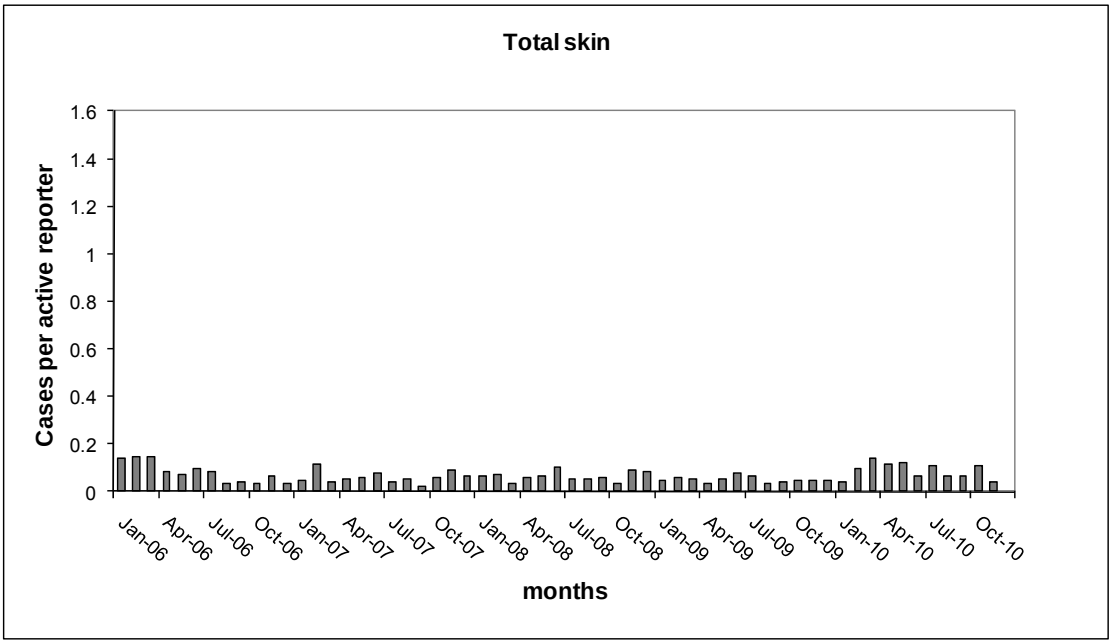


Figure B16 Cases per active reporter per month – THOR-GP, 2006-2010

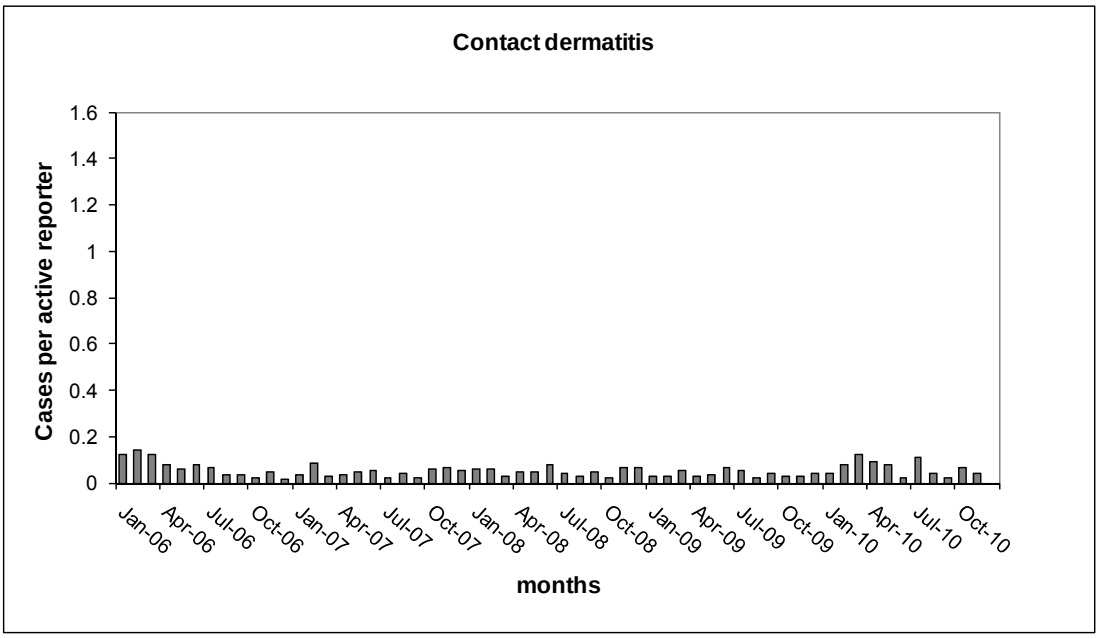
a) Total cases



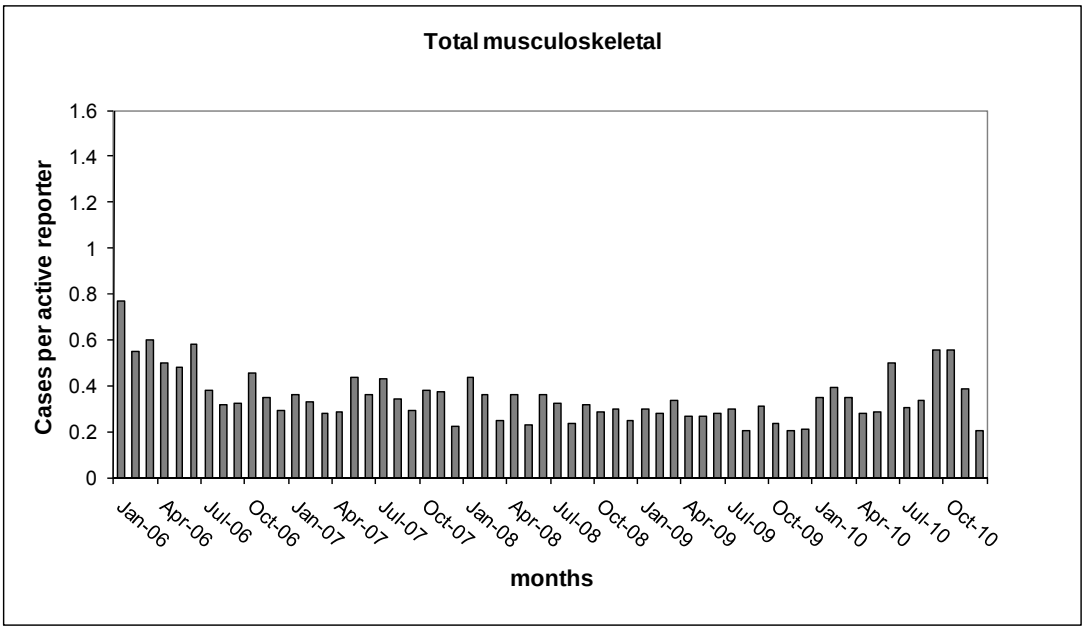
b) Total skin cases



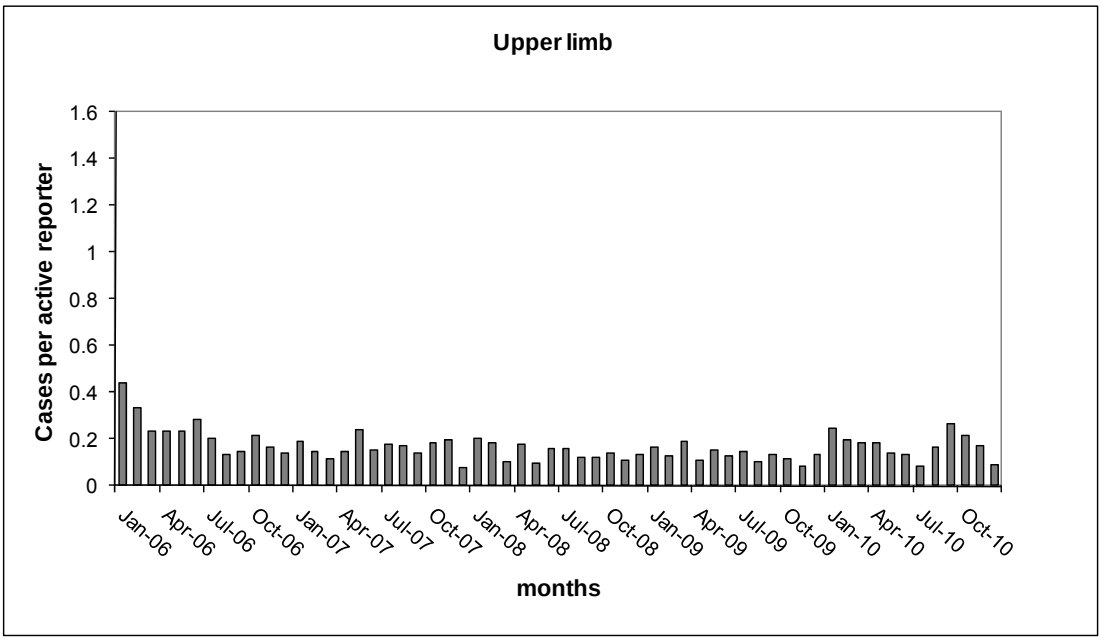
c) Contact dermatitis



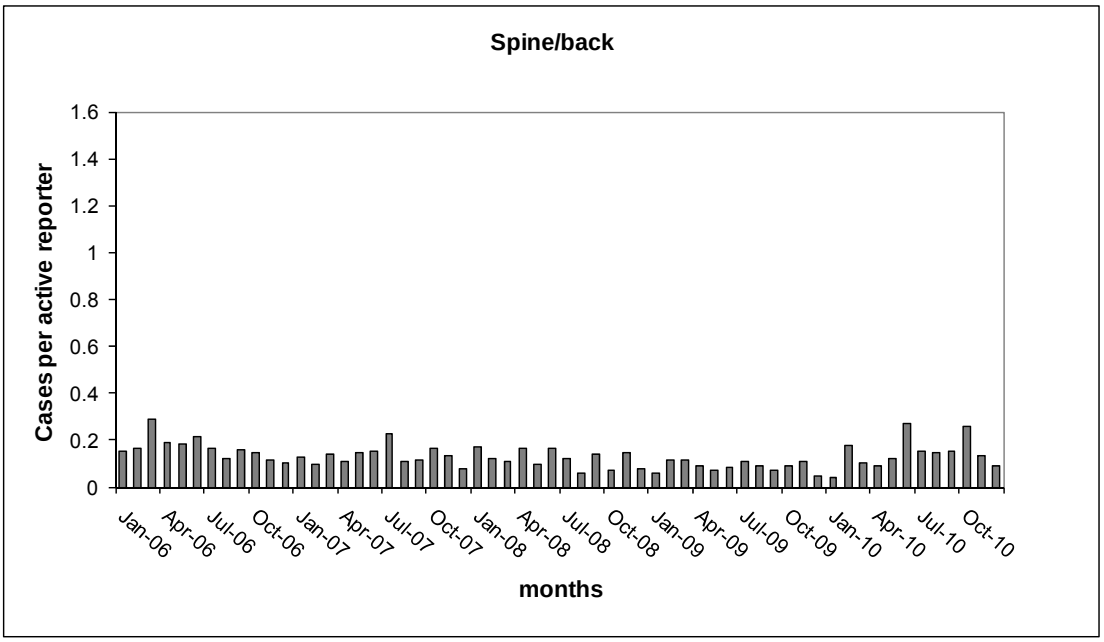
d) Total musculoskeletal



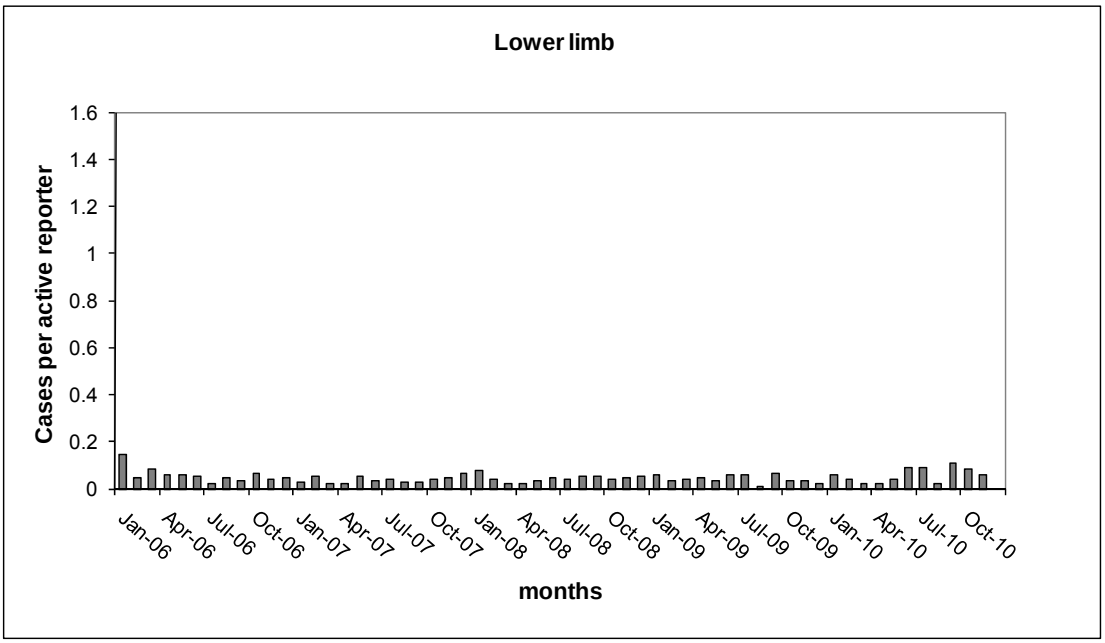
e) Upper limb



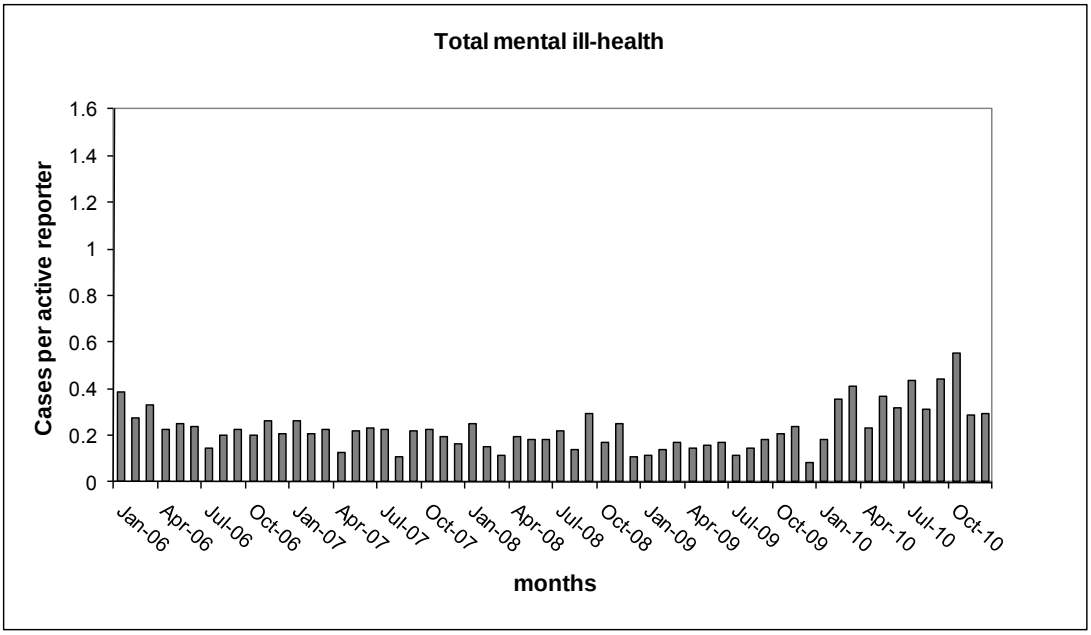
f) Spine/back



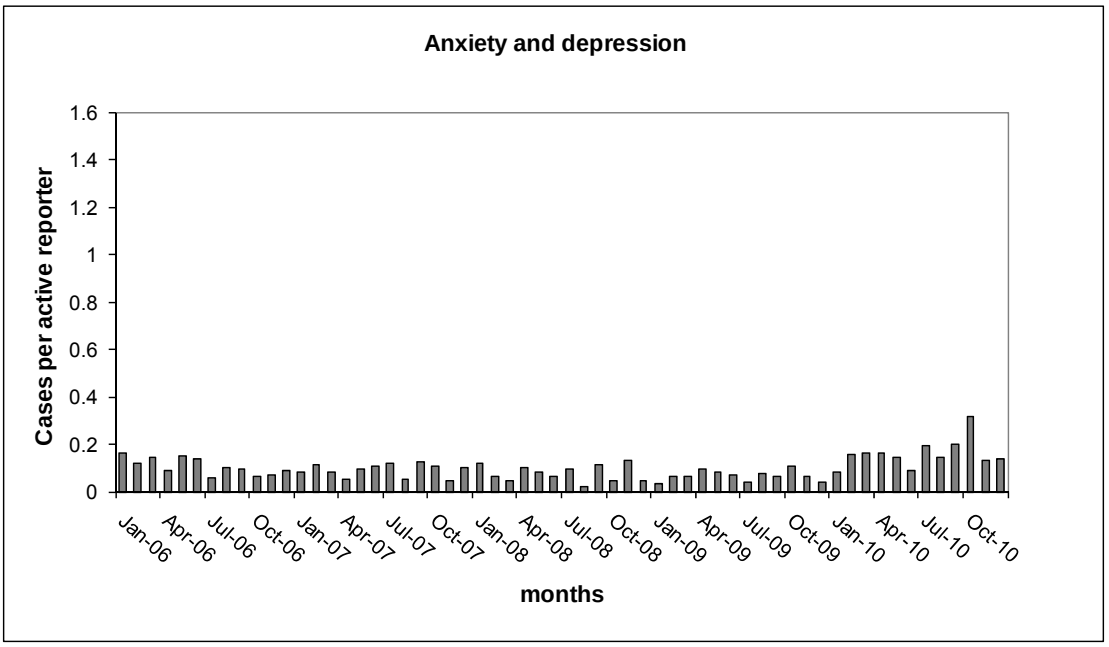
g) Lower limb



h) Total mental ill-health



i) Anxiety and depression



j) Other work stress

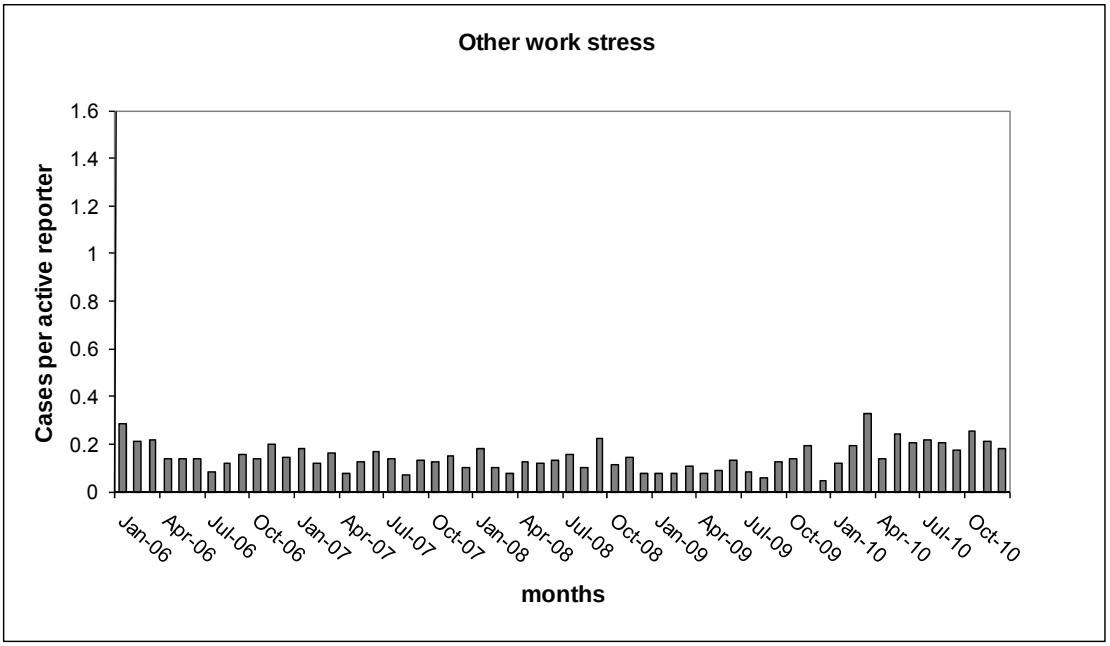


Table B8 Cases reported per month by disease category and type of reporter, THOR-GP, 2006-2010

		All Reporters				Core reporters				Sample reporters			
	Statistic		**Min**	**Max**	**SD**		**Min**	**Max**	**SD**		**Min**	**Max**	**SD**
	Total active reporters ever in 2006-2010	653				442				211			
	Mean no. of active* reporters per month	139.45	43	187	48.77	136.23	31	185	53.33	4.02	0	17	5.26
Disease group													
All cases	Total cases	5455				5115				340			
	Mean cases per month	90.92	22	190	36.15	85.25	11	190	42.39	7.08	0	34	9.59
	Mean cases per active reporter per month	0.69	0.35	1.44	0.22	0.62	0.33	1.44	0.20	1.85	0	7	1.73
All skin	Total cases	538				508				30			
	Mean cases per month	8.97	0	25	4.69	8.47	0	25	5.06	0.63	0	3	1.00
	Mean cases per active reporter per month	0.07	0	0.15	0.03	0.06	0	0.17	0.03	0.21	0	2	0.41
Contact dermatitis	Total cases	418				400				18			
	Mean cases per month	6.97	0	21	4.02	6.67	0	21	4.25	0.38	0	3	0.67
	Mean cases per active reporter per month	0.05	0	0.14	0.03	0.05	0	0.14	0.03	0.11	0	1	0.25
All musculoskeletal	Total cases	2880				2713				167			
	Mean cases per month	48.00	9	106	21.50	45.22	5	106	24.53	3.48	0	17	4.74
	Mean cases per active reporter per month	0.35	0.20	0.77	0.11	0.32	0.15	0.77	0.12	0.94	0	5	1.07
Upper limb[b]	Total cases	1377				1304				73			
	Mean cases per month	22.95	4	52	10.63	21.73	1	52	11.87	1.52	0	8	2.06
	Mean cases per active reporter per month	0.17	0.08	0.44	0.06	0.15	0.03	0.44	0.07	0.41	0	2	0.48
Spine/back[c]	Total cases	1079				1007				72			

		All Reporters				Core reporters				Sample reporters			
	Statistic		**Min**	**Max**	**SD**		**Min**	**Max**	**SD**		**Min**	**Max**	**SD**
	Mean cases per month	17.98	2	49	9.48	16.78	0	49	10.67	1.50	0	10	2.47
	Mean cases per active reporter per month	0.13	0.04	0.29	0.05	0.11	0	0.29	0.05	0.37	0	2	0.46
Lower limb[d]	Total cases	378				356				22			
	Mean cases per month	6.30	0	14	3.22	5.93	0	14	3.52	0.46	0	4	0.90
	Mean cases per active reporter per month	0.05	0	0.14	0.02	0.04	0	0.14	0.02	0.15	0	2	0.37
All mental ill-health	Total cases	1733				1604				129			
	Mean cases per month	28.88	9	56	10.79	26.73	3	56	13.03	2.69	0	15	4.09
	Mean cases per active reporter per month	0.23	0.08	0.55	0.09	0.20	0.08	0.44	0.07	0.55	0	3	0.58
Anxiety/depression	Total cases	756				700				56			
	Mean cases per month	12.60	4	26	5.51	11.67	1	26	6.33	1.17	0	9	2.19
	Mean cases per active reporter per month	0.10	0.02	0.32	0.05	0.09	0.02	0.21	0.04	0.16	0	2	0.31
Other work stress	Total cases	1131				1051				80			
	Mean cases per month	18.85	6	38	7.92	17.52	0	38	9.26	1.67	0	8	2.37
	Mean cases per active reporter per month	0.15	0.05	0.33	0.06	0.13	0	0.29	0.05	0.37	0	1	0.36

[a]Trends in respiratory disease not analysed separately as <250 cases
[b]Upper limb = hand/wrist/arm, elbow and shoulder
[c]Spine/back = neck/thoracic spine and lumbar spine/trunk
[d]Lower limb = ankle/knee/foot
NOTE: A case may have more than one diagnosis