National Institute for Public Health
and the Environment
Ministry of Health, Welfare and Sport

Surveillance of work-related infectious diseases

in the Netherlands in 2010

Letter report 205555001/2011
C.T. Heimeriks | M.A.J.M. Loo | A.J. Jacobi

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This investigation has been performed by order and for the account of Directorate for Working Conditions at the Ministry of Social Affairs and Employment, within the framework of 'Infectious Disease Control and Employee Health'

Abstract

Surveillance of work-related infectious diseases
Analysis of work-related infectious diseases in the Netherlands in 2010

In the Netherlands, the number of notifications of infectious diseases contracted by people at work is low. The figure represents only one to two percent of the total number of registered infectious diseases. In 2010 the number of notifications registered was 278. This has been reported by the National Institute for Public Health and the Environment (RIVM) in an analysis of work-related infectious diseases in 2010. The researchers share the opinion that nowhere near all work-related infectious diseases have been reported. The reason for this is partly due to underreporting of occupational diseases in the register at the Netherlands Center for Occupational Diseases (NCvB). In Osiris the link with work is not always registered because the source of contamination is often not known.

Employees can come into contact with pathogens whilst they are at work and thus contract an infectious disease. The sectors of health care, education, and agriculture are occupational branches where the risk of exposure to pathogens is the greatest. The two most important Dutch registration systems for work-related infectious diseases are Osiris and the NCvB register of occupational diseases. As commissioned by the Ministry of Social Affairs and Employment (SZW), each year the data from the Osiris and NCvB registers are analysed. SZW aims to increase the knowledge base on work-related infectious diseases and share this with employers, employees and occupational health professionals. Employers must ensure that employees are able to work in a safe and healthy work environment. Exposure to pathogens must be prevented as far as this is possible. If exposure cannot be prevented, then the appropriate measures have to be taken. In order to take good prevention measures, having good insight into which professional groups are likely to contract an infectious disease because of the work they do is pertinent.

In Osiris, 189 work-related infectious diseases were reported in 2010. Whooping cough, malaria, mumps and hepatitis B constituted the highest number of notifications in Osiris. At the NCvB, 89 infectious diseases related to work were registered in 2010. These were mainly intestinal infections, skin infections and zoonoses.

Keywords:
employees, occupational health, surveillance, infectious diseases, work related

Rapport in het kort

Surveillance Arbeidsgerelateerde Infectieziekten
Analyse arbeidsgerelateerde infectieziekten in Nederland in 2010

Het aantal meldingen van infectieziekten die Nederlanders tijdens hun werk oplopen is laag, een tot twee procent van het totale aantal geregistreerde infectieziekten. In 2010 werden 278 meldingen geregistreerd. Dat meldt het RIVM in een analyse van arbeidsgerelateerde infectieziekten 2010. De onderzoekers zijn van mening dat lang niet alle arbeidsgerelateerde infectieziekten worden gemeld. Dat wordt onder andere veroorzaakt doordat het Nederlands Centrum voor Beroepsziekten (NCvB) te maken heeft met een onderrapportage van alle gemelde beroepsziekten. In Osiris wordt de relatie met het werk niet altijd geregistreerd omdat bij de meldingen vaak niet bekend is wat de bron van de besmetting is.

Werknemers kunnen tijdens hun werk in contact komen met ziekteverwekkers en daardoor een infectieziekte oplopen. De gezondheidszorg, het onderwijs en de agrarische sector zijn bedrijfstakken waar de kans op blootstelling aan ziekteverwekkers het grootst is.
De twee belangrijkste Nederlandse registratiesystemen voor arbeidsgerelateerde infectieziekten zijn Osiris en de beroepsziektenregistratie van het NCvB. In opdracht van het ministerie van Sociale Zaken en Werkgelegenheid (SZW), worden jaarlijks de gegevens van Osiris en het NCvB geanalyseerd. SZW wil de kennis over arbeidsgerelateerde infectieziekten vergroten en doorgeven aan werkgevers, werknemers en arbodienstverleners.
Werkgevers moeten er voor zorgen dat werknemers kunnen werken in een veilige en gezonde werkomgeving. Blootstelling aan ziekteverwekkers moet zo veel mogelijk worden vermeden. Als blootstelling niet uit te sluiten is, moeten maatregelen worden getroffen. Om preventiemaatregelen te kunnen treffen is het belangrijk een goed inzicht te krijgen welke beroepsgroepen een infectieziekte kunnen oplopen door het werk dat zij doen.

In Osiris werden in 2010 189 arbeidsgerelateerde infectieziekten gemeld. Kinkhoest, malaria, bof en hepatitis B hebben in Osiris het grootste aandeel. Bij het NCvB werden in 2010 89 infectieziekten gerelateerd aan het werk gemeld. Het betreft voornamelijk darminfecties, huidinfecties en zoönosen.

Trefwoorden:
arbeidsgerelateerd, werknemers, arbo, surveillance, infectieziekten, werknemersgezondheid

Contents

Summary

Each year, the National Institute for Public Health and the Environment (RIVM) is commissioned by the Dutch Ministry of Social Affairs and Employment (SWZ) to carry out an analysis of the work-related infectious diseases as recorded in RIVM's own registration system for notifiable diseases (Osiris) and the registration system for occupational diseases maintained by the Netherlands Center for Occupational Diseases (NCvB).

A total of 189 work-related infectious diseases were recorded in the Osiris registration system for notifiable diseases during 2010. This is an increase compared to the previous year: in 2009 a total of 154 notifications were recorded which could have been work-related. The vast majority of these notifications concerned whooping cough (pertussis), Q fever, malaria, mumps and hepatitis B.
NCvB's database, however, shows a reduction - in absolute terms - of occupational diseases compared to the previous year. In 2010 there were 89 notifications of infectious diseases contracted at work, while the figure recorded in 2009 had been 155.
The NCvB notifications mainly concern intestinal infections, skin infections and zoonoses related to the person's work. The reduction applies not only to work-related infectious diseases, but to the reporting of occupational diseases in general.

It is employees in the healthcare and education sectors who are most often affected by work-related infectious diseases. Infections are also prevalent in the agricultural and veterinary sectors, where people are often exposed to zoonoses. A significant proportion (29%) of the work-related notifications in Osiris are connected - according to the patient - to working outside the Netherlands.

Unfortunately, it is not possible to make a standardized comparison between the data from the Osiris and NCvB registration systems. This is due to several factors: different purposes (Working Conditions Act as opposed to Public Health Act), different populations (labour force as opposed to population as a whole), difference in information recorded (organ affected as opposed to infectious disease) and the different professionals (occupational physicians as opposed to infectious disease specialist) who are involved and submit the notifications.
The notifications of work-related infectious diseases in both Osiris and the NCvB provide an insight into which infectious diseases employees can be exposed to, and under what circumstances. The under-reporting in both systems and the limitations of the registration system itself make it impossible to determine the total number of employed persons who contract an infectious disease during or because of their work. There is, however, insight into the sectors where exposure to infectious diseases is prevalent, and for which infectious diseases the working situation might be a contributing factor.

1 Introduction

Every year, as commissioned by the Ministry of Social Affairs and Employment (SZW), the Center for Infectious Disease Control (CIb) at the National Institute for Public Health and the Environment (RIVM) carries out an analysis of the work-related infectious diseases reported in the Netherlands. This surveillance report provides a good impression of the number of notifications and the type of infectious diseases contracted at or during work in 2010. One of the sources of information for this purpose is the Osiris registration system for notifiable infectious diseases operated by the RIVM in the context of the Public Health Act [Wet Publieke Gezondheid]. Another source is the database of the Netherlands Center for Occupational Diseases (NCvB), and use is also made of the Netherlands Tuberculosis Register (NTR) at the Royal Netherlands Tuberculosis Foundation (KNCV).
In submitting this report to the NCvB and the Netherlands Focal Point of the European Agency for Safety and Health at Work (EU-OSHA), our aim is to make the information in this report accessible to occupational health and safety professionals in the Netherlands and in the other European member states.

Work-related infectious diseases
The Netherlands Center for Occupational Diseases defines an occupational disease as any illness or disorder that results from some cause that either occurs primarily during working hours or is due to the working conditions. By analogy, a work-related infectious disease is an infection caused by microorganisms whereby the person is primarily in contact with those microorganisms during his working activities or because of his working conditions.

Objective
The objective of this report is to make a contribution to the development of knowledge in the domain of work-related infectious diseases and the working situations in which employees can be exposed to them.

- By making this information known to occupational health and safety services and to employers so that the level of knowledge about infectious diseases in the working environment can be improved and preventive measures can be taken in order to avoid work-related diseases.
- The information obtained from the surveillance report can be used by the government to organize risk-related supervision within the sectors that are most prone to work-related infectious diseases.
- The annual analysis of surveillance data enables trends to be identified. Health trends in the labour force can be predictive for trends among the general population.

This report provides a summary of:

- The type and number of notified work-related infectious diseases.
- The sector, the profession and the specific work that can play a role in contracting an infectious disease; this makes it easier to determine under which circumstances which employees might be exposed to infectious diseases.

Reading guide

The results from Osiris and from the NCvB registration system will be discussed in chapter 2. Chapter 3 sets out a number of recommendations. In the Appendices you will find a review of the information from Osiris (App. 1 through 5) and the NCvB (App. 6), supplemented by information from the KNCV Tuberculosis Foundation (App. 7) and data from the Royal Tropical Institute's National Reference Laboratory for Leptospirosis (App. 3).

2 Results

2.1 Osiris

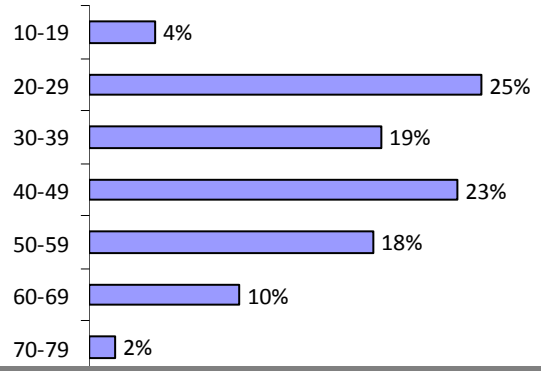
Osiris is the name of the registration system used by the Public Health Services (hereafter GGD) to record notifiable infectious diseases as required by the Dutch Public Health Act. GGDs can report a total of 43 notifiable infectious diseases in Osiris; this includes the new Influenza A H1N1, which was added to the list in 2009. Osiris data shows an increase in the number of cases that are being reported where work is a contributory factor. In 2008 and 2009 the number of work-related notifications was 94 and 154 respectively. In 2010, the number of notifications rose to 189. This rise is primarily due to the increase in the number of notifications of work-related mumps and whooping cough.
Whooping cough, Q fever, malaria, mumps, hepatitis B and shigellosis are the infectious diseases that stand out most clearly. The sectors most frequently mentioned in work-related notifications are education (16%), healthcare (13%), agriculture (11%) and the veterinary sector (7%).
A significant proportion (29%) of the work-related notifications in Osiris are connected - according to the patient - to working outside the Netherlands.

Supplementary questions in Osiris
Since 2001, the Osiris system has included a question as to whether or not the disease was contracted whilst a person was involved in occupational practice. In addition, a number of extra registration options were added to Osiris in August 2009, so as to acquire more detailed information about the working conditions in which the reported infectious disease was contracted. The more detailed questions provide additional information about the sector, the occupation and the actual work done by a patient. The resulting information provides better insight into higher risk occupations and activities.

Age and sex
Work-related infectious diseases are reported more often for men than for women. Leptospirosis (100%), mumps (84%), Q fever (83%) and malaria (73%) are reported primarily for men.
One possible explanation for this is that relatively more men are engaged in the agricultural and veterinary sectors. Another factor is that some infectious diseases cause more complications when contracted by men (e.g. mumps-associated orchitis) rather than by women.
The notifications of work-related infectious diseases are fairly equally spread across the age categories (as seen in table 1). People over the age of 70 are usually working in their own businesses in the agricultural sector. It is not known whether all the notifications concern formal contractual employees.

Table 1 Spread of work-related notifications in Osiris by age

Age	Number	Percentage (in %)
10 – 19	8	4
20 - 29	47	25
30 – 39	35	19
40 – 49	44	23
50 – 59	34	18
60 – 69	18	10
70 - 79	3	2



Hospital admission and mortality
Hospitalization followed 22 percent of the work-related notifications.
In 2010 there were no notifications of death due in whole or in part to an infectious disease that was in any way connected with work activities.

Work-related status uncertain
Curiously enough, in 6 percent of the notifications in Osiris that are marked as "work relevant", further reading of the information provides no evidence of a working relationship or throws doubt on such a relationship existing. Examples are notifications whereby the patient contracted hepatitis B by transmission from mother to child, and notifications where the answer filled in under "occupation" somewhat ambiguously says "not working".
It is possible that the question of whether the patient contracted the disease during the course of his/her work is not always answered or interpreted correctly. Since the notifications have often been submitted to Osiris months previously, it is not always possible to determine which notifications should be excluded.
Of the 189 notifications recorded in 2010, 12 can probably be excluded because it is impossible to determine from the information whether or not the infections were work-related.

Limitations of the registration
Analysis of the data from Osiris can provide no more than a summary of the incidence of those notifiable infectious diseases, as defined by the Public Health Act, which can be contracted at work.
It will not always be possible to determine whether the infectious disease is related to a person's work; this will result in under-reporting.
In addition, there are of course many more infectious diseases to which the labour force is exposed, but these are not subject to compulsory registration in Osiris.

2.2 Netherlands Center for Occupational Diseases

The Netherlands Center for Occupational Diseases (NCvB) records cases of occupational diseases through the national reporting and registration system. Under the Working Conditions Act, occupational physicians are required to report occupational diseases. There was a decrease in both the total number of instances of occupational diseases recorded by the NCvB and in the total number of reported infectious occupational diseases in 2010, but it is impossible to find any unequivocal explanation for the decrease.

During 2010, 89 occupational infectious diseases were reported to the NCvB by occupational physicians. In 2008 and 2009 there were 117 and 155 notifications respectively.
The NCvB notifications mainly concern intestinal infections, skin infections and zoonoses.
Other than is the case with notifications in Osiris, the reports to the NCvB are based on actual or potential exposure and thus on the risk of contracting an occupational disease. Even infections which do not give rise to illness, such as reporting of Mantoux conversions and the inclusion of MRSA carriers, are included in the notification and registration system.
A relatively large proportion of notifications (44%) comes from the healthcare sector. The other notifications are spread over a wide range of sectors.

2.3 Conclusions by disease

A total of 189 persons who contracted an infection either through or in the course of their work were registered in Osiris in 2010. For 17 different infectious diseases, a correlation could be made with the work that the patients were doing.
A total of 89 infectious occupational diseases were recorded by the NCvB in 2010. An overview of the work-related infectious diseases recorded in Osiris and by the NCvB can be found in Figures 1, 2 and 3. A more detailed overview can be found in Appendices 1, 2, 3 and 6.
The work-related infectious diseases reported to Osiris and the NCvB will be discussed briefly in the text below.

Figure 1 Number of work-related infectious diseases notified to Osiris and NCvB (2010)

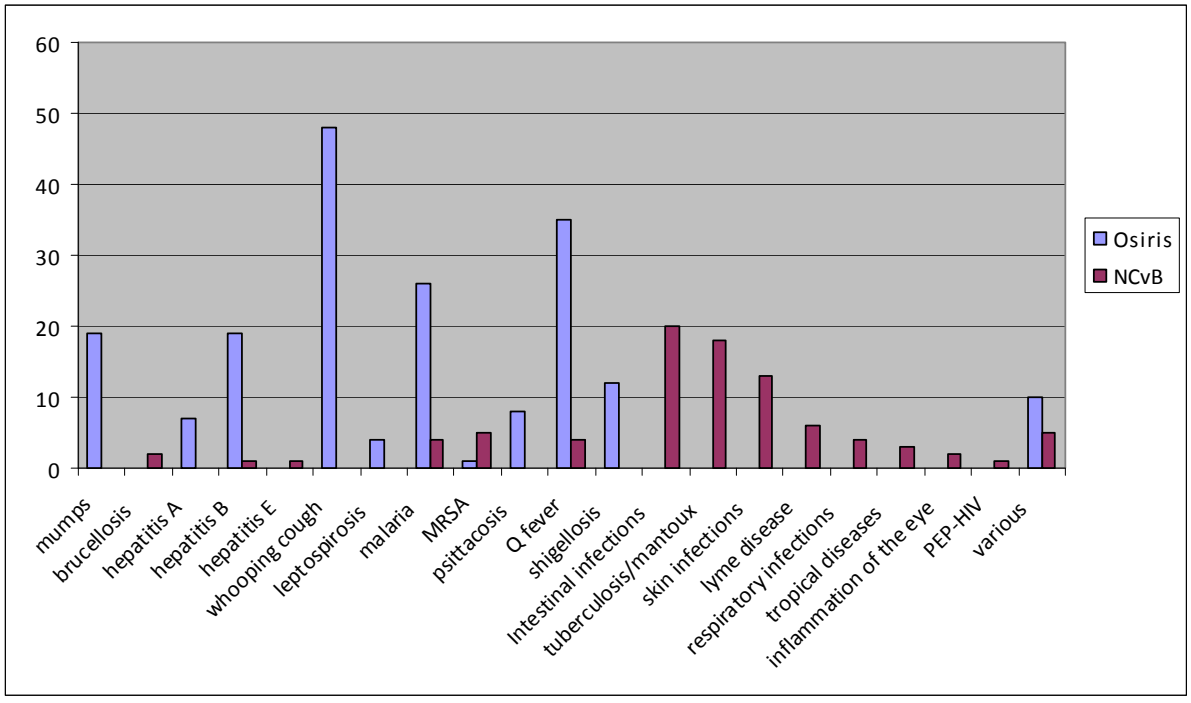


Figure 2 Types of work-related infectious diseases notified to Osiris

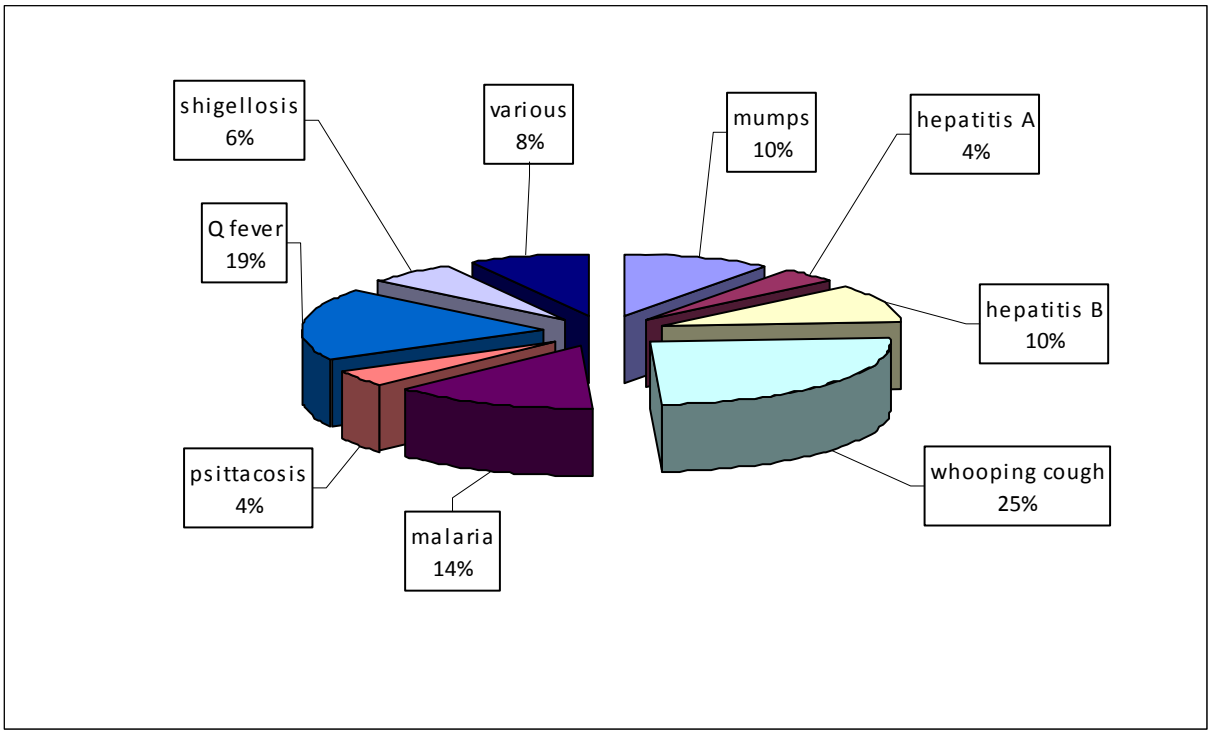
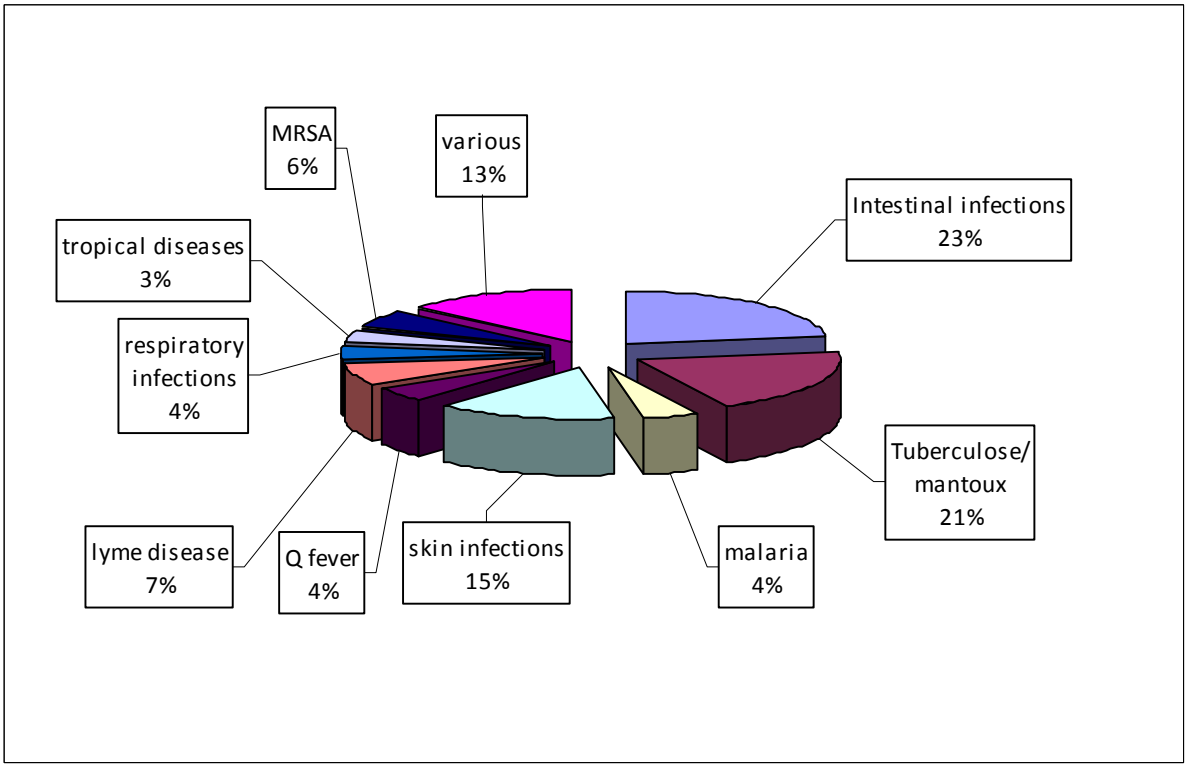


Figure 3 Types of work-related infectious diseases notified to the NCvB



Mumps, whooping cough and measles; infectious diseases included in the Netherlands' national vaccination programme

There has only been a noticeable increase in the number of work-related notifications to Osiris in the case of whooping cough (n=48) and mumps (n=19). There was only a single notification of work-related measles. Mumps, whooping cough and measles are illnesses that people can contract when they are exposed to miniscule drops of vapour that anyone with an infection can excrete while speaking, coughing or sneezing. These childhood illnesses can be prevented by vaccination, and are included in the Netherlands national vaccination programme (RVP). Employees who have not been vaccinated against these infectious diseases in childhood run an increased risk of contraction if they are exposed to them at a later age. Besides this, it remains possible that even people who have been fully vaccinated will become infected as a result of vaccine failure (the vaccine is not effective) or waning immunity (protection declines with the passage of time).

The overall increase in the number of notifications of mumps to Osiris is primarily due to the number of mumps cases reported in students, often university students who have previously been vaccinated. A large proportion (67 percent) of the cases of work-related whooping cough, and a significant proportion (32 percent) of the people with work-related mumps, contracted the disease despite being fully vaccinated.

The people most often affected by one of the above diseases were those working in the education sector.

Tetanus

This disease does not occur very often these days. Only between one and five cases are notified to Osiris each year. Of the two patients recorded as having tetanus in 2010, one had contracted the disease whilst working in the agricultural sector. People who have not been vaccinated against tetanus, or not sufficiently, and who do manual work that involves contact with the soil, run an increased risk of contracting tetanus. This is certainly the case if they frequently have wounds on their hands.

Hepatitis A and hepatitis B

Hepatitis A and hepatitis B are infectious diseases for which a safe vaccine is available. Despite the availability of a vaccine, the information recorded in Osiris shows that seven persons who were engaged in work where exposure to hepatitis A was possible had not been, or at least not completely, vaccinated against the disease. The persons concerned worked in education, waste disposal or had been on a work experience placement abroad.

Of the 19 notified cases of hepatitis B, only one person had been vaccinated. A large proportion (15 out of the 19) of the work-related hepatitis B notifications concerned patients with chronic hepatitis B. It is not possible to determine the precise source of the disease in these cases, because of the relatively long incubation period between infection and the manifestation of symptoms of the disease. Reported causes of work-related hepatitis B infections were needle stick accidents (47%) and sexual transmission (26%).

The NCvB had only one notification of a person contracting hepatitis B in the course of his work.

Leptospirosis and psittacosis
In 2010, four instances of leptospirosis (15% of the total number of leptospirosis notifications in Osiris) were recorded as having been contracted at work, along with eight infections with psittacosis (11% of the psittacosis notifications in Osiris) contracted in a work-related situation.
People who have intensive contacts with animals or surface water and mud in the course of their work can contract leptospirosis. Workers in agriculture and animal husbandry are therefore most prone to exposure and this is consistent with the occupations recorded in Osiris.
The work-related cases of psittacosis reported in Osiris primarily, of course, concern people who work with birds. Research carried out by the Office for Risk Assessment and Research (part of the Dutch Food & Consumer Product Safety Authority), has shown that there is an increasing trend in the number of people who contract work-related psittacosis infections. Preventive measures must be taken to protect those working with birds against exposure to infectious pathogens.

Q fever
Compared to 2009, there has been a significant decrease in the number of notifications of cases of Q fever (down from 2317 in 2009 to 538 in 2010). A similar decrease is also evident in the number of work-related cases of Q fever: where there were 78 notifications in 2009, this figure fell to 35, less than half, in 2010. However, in proportion to the total number of notifications in Osiris, there was an increase - in relative terms - in the number of work-related cases. The decrease in absolute terms can, for the most part, be attributed to the introduction of containment measures such as the testing of bulk tank milk, compulsory vaccination for the sheep and goats on milk-producing farms, clearance of infected farms and the Q fever information folders for employers/contractors/principals and their employees.
Notably, few notifications are made to the NCvB of employees who have contracted Q fever in the course of their work. In 2010 there were only four such notifications of Q fever; this represents a decrease in comparison with 2009, when 12 cases were reported. This low figure is probably due to the fact that relatively few agricultural businesses use the services of occupational health and safety consultants.
Research carried out jointly by RIVM, the Dutch Food & Consumer Product Safety Authority, Jeroen Bosch Hospital and Arbo Unie (the largest national occupational health and safety agency), indicated that even incidental exposure to Q fever in the course of a person's work in an infected environment can lead to a Q fever infection. This finding corresponds with the results from Osiris which demonstrated that even people in occupations that have no direct relationship with the agricultural sector, or people who have worked on a Q fever infected farm for just a short while, have also contracted Q fever. Those affected include people involved in farm clearances and people such as electricians who carry out work on infected farms under other circumstances.
That means that those groups of people who are only present in the vicinity of farms infected with Q fever for a short period of time must also be included in the risk analysis and evaluation; they must also receive information about the risks and preventive measures. "Vulnerable" employees are particularly prone to extra risk; they include people with reduced immunity, such as pregnant women. Such people have an increased risk of becoming infected with Q fever. Employees with heart valve defects are at higher risk of developing complications if they become infected with Q fever.

Malaria
In 2010 there were 26 notifications of people who had contracted malaria in the course of their work (10% of the total number of notifications in Osiris); all of them had been to places where malaria was endemic. This infectious disease is not normally linked directly to the type of work, but to a period of working outside the Netherlands. The burden of disease is high: 69 percent of the patients had to be hospitalized.
Notable is the limited use of malaria prophylactics: only three of the 26 people who had contracted malaria in the course of working abroad had taken preventive medication in the prescribed manner. The reason is perhaps that employees are insufficiently aware of the risks and/or have received insufficient information about preventive measures, including the use of preventive medication.
Only four incidents of malaria that had been contracted in the course of employment were reported to the NCvB in 2010.

Tuberculosis
In the Netherlands, all cases of tuberculosis are registered in the Netherlands Tuberculosis Register (NTR) at the Royal Netherlands Tuberculosis Foundation (KNCV). Additional information about the work activities, occupation and sector in which a patient works are therefore not registered in Osiris. Screening carried out by the GGD showed that eight people had contracted tuberculosis in the course of their work during 2009. A larger group, 70 people, had become infected in the course of their work but had not actually developed the disease. No statistics are currently available about the number of employees who contracted tuberculosis in 2010.
A large proportion (n=18) of notifications of infectious diseases recorded by the NCvB concern cases of tuberculosis, including Mantoux conversions that do not result in active tuberculosis. Of the cases notified, four persons actually contracted tuberculosis.
The increase of multiresistant tuberculosis and the cessation of the overall downward trend combine to make tuberculosis a disease that must continue to receive attention in the future.

Legionella
Although a specific question about a possible connection with the patient's work had been included in the Osiris registration form in the past, this question no longer appears on the 2010 version for the form. As a result, we have no evidence of a possible increase or decrease in legionella infection that occurs during work activities. No legionella cases were reported to the NCvB in 2010.

Other infectious diseases notified to the NCvB
Besides notifications of the infectious diseases notifiable by virtue of the Public Health Act, the NCvB also receives notifications for other infectious diseases. Intestinal infections (n-20), particularly norovirus infections, and skin infections (n=13), represent a large proportion of the total number of notifications to the NCvB. The overall reduction in the number of notifications to the NCvB can mainly be attributed to the reduction in the number of intestinal infections reported. There were nearly three times as many notifications in 2009 (then 57) as in the year under review.
Notably, only a few notifications (6) were received of employees who contracted Lyme disease in the course of their work. Nonetheless, Lyme has the largest share among the 13 zoonoses notified. A notification of infection with hepatitis E was received for the first time this year; this is a zoonose that can be transmitted through wild game and pigs.

2.4 Vaccination

As part of their occupational health strategy, and with the aid of a specialized service, employers need to consider which measures could be taken to reduce or eliminate workers' exposure to biological agents; this should be combined with information from experts. In addition, an employer should offer his employees vaccination if there is any possibility of them being exposed to any biological agent and a safe and effective vaccine is available. Such safe and effective vaccines are available for a wide range of infectious diseases.
Children have been vaccinated as part of the RVP since 1957; the programme currently includes 12 infectious diseases: diphtheria, whooping cough (pertussis), tetanus, polio, Hib disease, hepatitis B, pneumococci, mumps, measles, German measles (rubella), meningococcal C, and cervical cancer.
The take-up rate for all vaccines is quite high; the specific take-up rate for the working population is, however, unknown.

2.5 Comparison of work-related notifications to Osiris and to NCvB

Both the NCvB's registration system for occupational diseases and the Osiris registration system for notifiable infectious diseases (by virtue of the Public Health Act), contain relevant information about infectious diseases and any connection with the patient's work situation.
However, standardized comparison of the Osiris and NCvB registration data is not possible:

- Notifications are made for different reasons: infectious diseases notifiable by virtue of the Public Health Act versus notification on the basis of an obligation imposed by the Working Conditions Act.
- The notifying professional sees different populations: GPs and specialists see patients from the general population, occupational physicians see only the employed portion of the population. Unfortunately, many infectious diseases remain invisible to occupational physicians because they only become involved at a fairly late stage for purposes of absentee monitoring; absenteeism due to infection often ends within two or three weeks.
- The focus of registration is different: Osiris registers diseases, with the causal agent as detail; the NCvB registers more general information, often on the basis of the organ affected instead of the disease and its potential origins.
- The degree of certainty about a correlation with work differs: in the Osiris system, a positive answer to a question about work is enough to flag the case as work-related; in the NCvB system, occupational health research is concerned with the actual relationship between exposure during work and infection prior to the notification.

The comparison that is attempted here should therefore be seen as an opportunity to view and identify the developments in the prevalence of infectious diseases from multiple perspectives.

Type of infectious disease

In 2010, whooping cough, Q fever, malaria, mumps, hepatitis B and shigellosis all represented a large share in the overall number of work-related notifications. In the NCvB registration system, the most prevalent work-related diseases were intestinal infections, skin infections and zoonoses.

Work activities and infectious diseases
A large percentage of the work-related infectious diseases recorded in both registration systems are contracted in the healthcare sector. The NCvB shows 44 percent of all infections as being contracted in the course of work in the healthcare sector. In Osiris, slightly fewer notifications of work-related infections concern employees in the healthcare sector (13%) as compared to the education sector (16%). A significant percentage of notifications concern employees in the agriculture and veterinary sectors (11% and 7% respectively). This difference is largely due to the type of infectious disease that is reported to Osiris and to the NCvB. Almost a third (29%) of the work-related infections reported to Osiris are contracted during a stay outside the Netherlands. It is not known how high this percentage is for the infectious diseases reported to the NCvB.

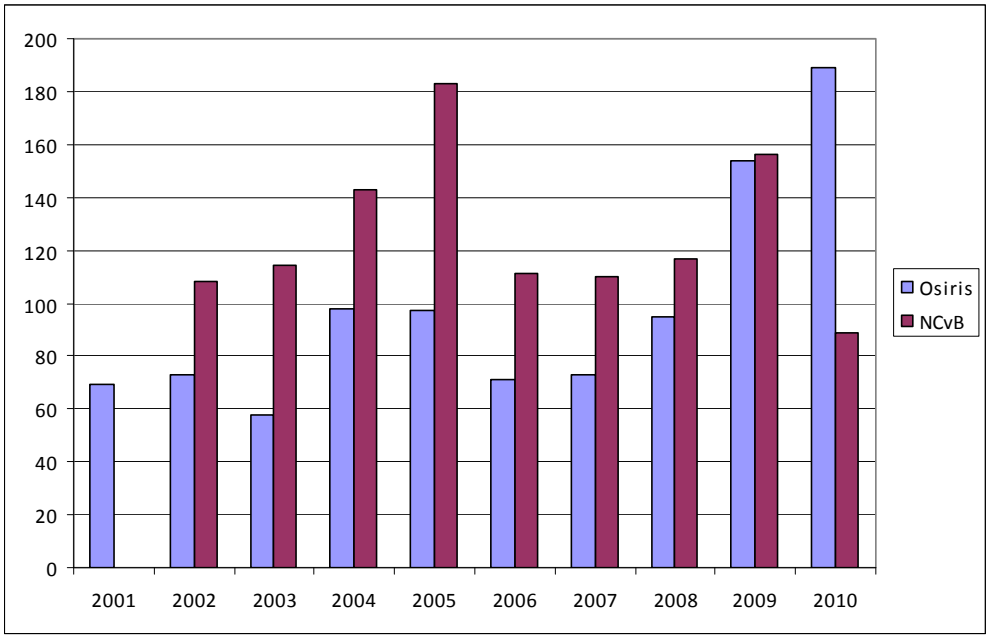
Under-reporting
Both registration systems provide insight into the prevalence of infectious diseases in the workplace. Osiris only provides insight into infectious diseases that are notifiable under the Public Health Act; the NCvB system provides insight into the infectious diseases that occupational physicians encounter in their populations. It must be said that both systems suffer from under-reporting, a point that we also raised in our report over 2009. As a result, this surveillance report cannot provide a full picture of work-related infectious diseases in the Netherlands, but it does provide some insight into the tip of the iceberg. It shows the sectors in which workers are commonly at risk of acquiring a work-related infectious disease, and which infectious diseases should prompt more detailed questioning of the patient as to any possible correlation with work; this is because certain work activities seem more likely to lead to infection and illness.

2.6 Trends

Notifications to Osiris and to the NCvB
Since 2006 there has been a continuous annual increase in the number of work-related notifications sent to Osiris. One possible explanation for this increase is that GGDs are more conscious of the relationship between work and contracting infectious diseases.
Despite the reduction in the number of notifications of Q fever and legionella in 2010, the overall number of notifications of work-related infections was still higher. The infectious diseases reported in 2010 correspond with the list of infectious diseases reported in previous years. The increase in the number of work-related infectious diseases in Osiris in 2010 can primarily be attributed to reports of mumps and whooping cough.

There was a substantial drop in the number of infectious diseases reported to the NCvB database (89 in 2010 compared to 155 in 2009).
Compared with 2010, there had been much more attention (including media attention) for work-related infectious diseases during 2009 due, among other things, to the outbreaks of New Influenza A (H1N1) and Q fever. This is one of the hypotheses put forward by the NCvB to explain the reduction in the number of cases of occupational infectious diseases reported to them by occupational physicians in 2010.
The figure below gives an overview of the number of notifications to Osiris and the NCvB for the years from 2001 to 2010.

Figure 4 Work-related notifications to Osiris and to the NCvB (2001 through 2010)



Osiris notifications in 2010 covered 18 different notifiable infectious diseases whereby exposure occurred during work activities.
Whooping cough, Q fever and malaria were the most frequently reported infectious diseases. The same infectious diseases had also had the largest share in the total number of work-related notifications to Osiris in previous years.
In contrast, most of the NCvB notifications were for intestinal infections, followed by zoonoses, (including Q fever and Lyme disease), tuberculosis and skin infections. The number of intestinal infections fell significantly, with 57 notifications in 2009 compared to 20 in 2010. The number of notifications of Q fever and respiratory tract infections also fell.

Work activities with risk of exposure
Since 2010 the online form for notifications to Osiris has included an explicit question about the work situation (sector, occupation and activities) of any patient who contracts an infectious disease in the course of his work. This provides a fair impression of the occupational sectors in which notifiable infectious diseases can play a role. Most notifications come from the education sector (16%), healthcare (13%), agriculture (11%) and the veterinary sector (7%).
When the notification concerns a work-related infectious disease, the system automatically asks whether the disease was contracted during a stay in the Netherlands or abroad.
A significant proportion (29%) of the work-related notifications in Osiris were connected - according to the patient - to working outside the Netherlands. In comparison with the previous year, 2010 saw a decrease in the proportion of notifications that were linked to working abroad. This can, in part, be explained by the decrease in the number of malaria notifications (34 in 2009, 26 in 2010) but since no data was previously collected in Osiris about the work situation, it is not yet possible to make a useful comparison. For 2010, information about the work situation has been extrapolated from the answers given to the question about the possible source or place of infection. Unfortunately, in 20 percent of

the notifications that did concern a work-related infection there was no information provided about the work situation in which the infection had been contracted. In 2010, only five percent of the notifications lacked details of the sector in which the patient had contracted a work-related infectious disease. In previous years, too, the veterinary sector (7%), healthcare (6%), and education (4%) have been the sectors most often mentioned by patients as the source of exposure.
Just as in previous years, most notifications to the NCvB come from the healthcare and welfare sectors.

Zoonoses
Zoonoses such as Q fever, psittacosis and leptospirosis account for a significant proportion of the infectious diseases notifications to both Osiris and the NCvB. With today's intensive livestock farming practices, world-wide trading contacts and the ease of travel, it is to be expected that zoonoses will continue to account for a significant proportion of work-related infectious diseases in the future.

3 Recommendations

3.1 Sectors, risks

A number of sectors feature rather prominently in the registration systems. The nature of the work activities and the contact with potential sources of infection, means that employees in these sectors have an increased risk of exposure. For these sectors we offer, below, a few specific recommendations. These are no more than examples, they do not represent a comprehensive list of points that deserve attention.

The underlying principle of any occupational health and safety strategy aimed at preventing and managing infectious diseases is that of biological hygiene: the general occupational hygiene strategy adapted to the specific characteristics of biological pathogens. In the first place, identify potential sources of infection and take whatever technical measure are needed; then take organizational measures and, finally, measures aimed at personal protection. Hygienic measures provide an essential basis in this respect, and make a significant contribution towards preventing and halting the spread (or further spread) of infectious diseases. Moreover, employees in all sectors - whether or not mentioned here - who run a real risk of exposure to an infectious disease should be offered preventive vaccination if a safe and effective vaccine is available. All sectors should pay more attention to preventive measures with regard to work-related infections. Employees in the healthcare sector and in children‘s day care centers already make allowance for the fact that they are going to be affected by infectious diseases more than other employees, simply because that is a fact of life in those working environments. Agricultural workers and veterinarians also accept that they can become ill because of diseases affecting the animals they deal with. But this attitude towards the risk of infectious diseases, held by employers and employees alike, hinders effective prevention. What they often fail to see is that it is not only their own health that is in danger, but also the health of their customers, their products and the wider environment.

Healthcare sector
Employees in the healthcare sector are exposed to a large number of pathogens in the course of their work. This is, in itself, a risk, but in addition the employee himself can represent a risk to the patients he is caring for. Hepatitis B and whooping cough are examples of infectious diseases that were contracted by healthcare workers during the registration year of 2010.
Recommendations:

- The Dutch Working Party on Infection Prevention (WIP) publishes guidelines on infection prevention for the entire healthcare sector. Given the exposure risks for this group of professionals, it could be useful to review and adapt the current guidelines to include indirect risks; the emphasis in the current guidelines is to prevent transmission from employee to patient, and from patient to patient via the employee.
- Employees in the healthcare sector can come into contact with blood as a result of needle stick, bite, cuts and splash accidents; as a result they are exposed to biological agents such as the hepatitis B virus, HIV, and the hepatitis C virus. The people notified to Osiris as having contracted hepatitis B in the workplace all had only a low immunization level; nine employees (out of 19 work-related notifications in Osiris) attributed their illness to a needle stick incident. Only one of these people had been vaccinated.

Infection and illness resulting from diseases that can be transmitted through blood can be prevented if suitable protection measures are taken, not least the use of safe needle systems, the use of adequate personal protection, hepatitis B vaccination, proper instruction and supervision.

- Whooping cough is extremely contagious. In a healthy adult, whooping cough usually progresses as an annoying infection in the upper respiratory tract, but it can also be asymptomatic. Over the years, the protection provided by vaccination during childhood loses its effectiveness, and people can contract new infections throughout their entire life. After an infection, the body once again builds up antibodies which provide protection for a good length of time. Infants who have not been vaccinated, or not fully, do however run an increased risk of complications, and can even die. The Dutch National Health Council is currently considering a revaccination programme for this disease. Employees in the healthcare sector who work with insufficiently vaccinated infants (younger than 12 months), could be offered revaccination in order to prevent the spread of infection in other babies and infants who are insufficiently vaccinated. Employees at children's day care centers, mother and baby clinics, and employees on the maternity, obstetrics and paediatric wards of hospitals could also be eligible.

Education

As a result of their often intensive contact with children, teachers and assistants at schools and children's day care centers are continuously exposed to infectious diseases. Since the sources cannot be eliminated, prevention will have to be aimed primarily at reducing the chance of transmission. Hygiene measures play an important role in this respect. Employees in these sectors are often themselves young women who want to have children, and the prevention of exposure to infectious diseases during the critical phase of pregnancy is therefore very important. Childhood diseases such as parvovirus B19 (a.k.a. 5th disease), cytomegalovirus, and varicella zoster (chicken pox) can cause damage to an unborn child if the mother becomes infected during pregnancy. Employees, employers, and their professional support organizations (GGDs, occupational health professionals) must bear this specific sensitivity, and the risk of exposure, in mind.

The notifications to Osiris from the education sector primarily concerned mumps, hepatitis A and whooping cough.

Recommendations:

- The Working Conditions Act was simplified in 2007. Targets have been set, but employers and employees must together decide how those targets will be met. The measures can be set out in what is known as an OSH catalogue. In an OSH catalogue, employers and employees take the initiative to describe how they are going to meet the target requirements set by the government for safety and health in the workplace. The 2010 OSH catalogue for the children’s day care sector, however, lacked a section on the risks of exposure to biological agents. When this section is added, we recommend intensifying the cooperation between public health and occupational health and safety with a view to combating and preventing infectious diseases in this sector. Children’s day care centers are subject to regular visits and checks by the GGDs, and a great deal of attention is paid to the prevention of infectious diseases. In addition, special infectious diseases manuals have been developed for day care centers and schools. The information they contain is, however, primarily aimed at protecting children against infectious diseases as far as possible. An integration of the points from both perspectives would lead to wider acceptance and implementation of the recommendations by employers.

- Employees in this sector have a greater chance of contracting a hepatitis A infection through exposure to the virus via the faecal-oral route. Besides the implementation of preventive measures, such as hygiene measures, vaccination against the hepatitis A virus should be considered for employees at children's day care centers and in the first years of primary school.

In this sector it is also the case that it is not only the employee's health that is at risk. There is always the chance that they will themselves become a potential source of infection for the population they care for: non-vaccinated or incompletely vaccinated children whose natural defence mechanisms are not yet fully developed.

Agricultural and veterinary sectors

Employees in the agricultural and veterinary sectors can contract various zoonotic infectious diseases during their work as a result of animal to human transmission. Avian influenza and Q fever have been the most obvious examples in recent times. Livestock-related MRSA carriership affects pig farmers, transporters and abattoir personnel more than the remainder of the population. The infectious diseases notified to Osiris and the NCvB concerned, among others, tetanus and the zoonoses Q fever, leptospirosis and psittacosis.

Recommendations:

- People who have contact with animals (domesticated or wild), surface water and/or mud in the course of their work can contract leptospirosis. It is essential that information be provided to these occupational groups about the prevention of these diseases and their spread through infection; they must be reminded of the importance of general hygiene measures and the wearing of protective clothing such as rubber boots and gloves. In addition, the importance of early treatment should be emphasized.
- Gardeners, livestock farmers, market gardeners, veterinarians and people who often work with horses can come into contact with Clostridium tetani bacteria through bites and other wounds; this can lead to a tetanus infection. Other occupational groups, outside those just mentioned, also have an increased risk: waste and refuse collectors (especially of biological refuse and waste), those who work with the soil, and street cleaners. On entering service, new employees should be tested to ascertain whether they have sufficient immunity against tetanus. In addition, a booster vaccination should be given every ten years.
- Employees who have a lot of contact with birds can contract psittacosis. Psittacosis , or "parrot fever", has received some attention in the past six months as a result of the advisory report submitted to the Ministries of Public Health, Welfare & Sport and Economic Affairs, Agriculture & Innovation by the Office for Risk Assessment and Research (part of the new Dutch Food & Consumer Product Safety Authority, nVWA). The report indicated that a large number of people contract pneumonia each year as a result of this disease. The preventive measures recommended in this and similar reports and letters, which include the measure to test birds for psittacosis, should be implemented.
- There is still no certainty about the issue of exposure in work situations on farms that are now, or have previously tested positive for Q fever. The notifications to Osiris in recent years show that a large proportion of the employees who have contracted Q fever had not previously worked on a farm with goats or sheep. Notifications concerned, for example, electricians, a journalist and employees who had been cleaning the mobile toilet units and/or shower cubicles used on infected farms. This means that employees who are only temporarily carrying out work activities on a Q fever infected farm, and new employees and/or students on work experience placements,

must also be properly informed about the risks and the preventive measures that apply. That should also include instructions as to how personal protection clothing and devices can be used effectively. Employees who have been exposed to Coxiella burnetii bacteria for some length of time are often immune to the disease because they have had a previous infection with the bacteria. Employers should ensure that vulnerable employees, e.g. those with cardiac and vascular conditions, with reduced immune resistance, and pregnant women, are excluded from high-risk work activities on farms infected with Q fever.
In Australia, Q fever is primarily an occupational disease that affects slaughtermen and meat processors. It is not known how many employees from this occupational group have become infected in the Netherlands. There has only been one notification to Osiris of a patient who contracted Q fever during his work in an abattoir. Employees in the meat processing industry, assisted by their occupational health and safety consultants, should also take preventive measures against Q fever, whereby particular attention should be given to employees with an increased vulnerability for the consequences of Q fever.

Abroad
A large part (29%) of the work-related infections reported to Osiris are contracted during a stay outside the Netherlands. Notifications concern infectious diseases such as malaria, hepatitis A and B, typhoid fever, and shigellosis. Employees who travel abroad as part of their work should be properly informed about the infectious diseases they could contract and what they can do by way of prevention and control.
It is remarkable that only a small percentage of the employees who contracted malaria had taken any prophylactic measures; 66 percent of the work-related malaria patients used no malaria medication to prevent infection. The attention of employers, occupational health and safety consultants and professionals alike must be drawn to the risks of contracting malaria and the limited use of prophylactic medication in the past, so that they can properly inform employees. Depending on the destination, vaccinations and malaria prophylactic medication should be offered. In addition, employees should be informed about good hygiene measures and other ways in which they can avoid contracting diseases.

Educate GGDs
The answers given to the supplementary questions on the sector, occupation and work activities of patients can provide relevant information about the source of work-related infectious diseases.
In a large proportion of the notifications in Osiris, it is unknown whether the work situation could have been a factor in contracting an infection. Further clarification could possibly by obtained by educating GGDs about the correlation between work and infectious diseases and the importance of reporting relevant details. In a number of cases notified to Osiris, no direct link could be found with the patient's work after the patient details had been studied. It is therefore to be expected that the number of notifications erroneously marked as work-related can be reduced.

"Pienter" project
One future option for obtaining more certainty as to whether a particular occupational group has an increased risk of contracting a particular disease, would be to analyse the data from the "Pienter" project to evaluate the national vaccination programme (RVP) in order to appraise the effect of immunization in the Netherlands ("Pienter" is an acronym of the project's title in Dutch). With the

aid of the data from this programme, it will be possible to compare the seroprevalence in any occupational group with that in the Dutch population as a whole. Doing so will allow the data from Osiris to be objectified further.

Appendix 1 Summary of Osiris data 2010

Osiris is the name of the registration system used by the Public Health Services (GGDs) to record notifiable infectious diseases as required by the Dutch Public Health Act. The GGDs receive this information from the doctors and laboratories that also have an obligation to report them under the Public Health Act. The Act currently lists 43 notifiable infectious diseases (see Appendix 4). On registration, the GGD decides whether there is an indication for supplementary measures. The aim of this is to counter the transmission of the infectious disease from human to human, so as to prevent the further spread of the disease among the population.

Since 2001, the Osiris system has included a question as to whether or not the disease was contracted whilst a person was involved in occupational practice. Since August 2009, it has also been possible to record additional details. Appendices 1 through 5 present the information stored in Osiris. In 2010, Osiris recorded 10 417 notifications. In 189 cases (1.81%), a link could be made with the patient's occupational practice. There is, however, an expectation that not all work-related cases are notified as such, and that the actual number is in fact much higher.
The figures and tables below set out the data from Osiris in schematic form.

Figure 5 Summary of number of work-related notifications per infectious disease

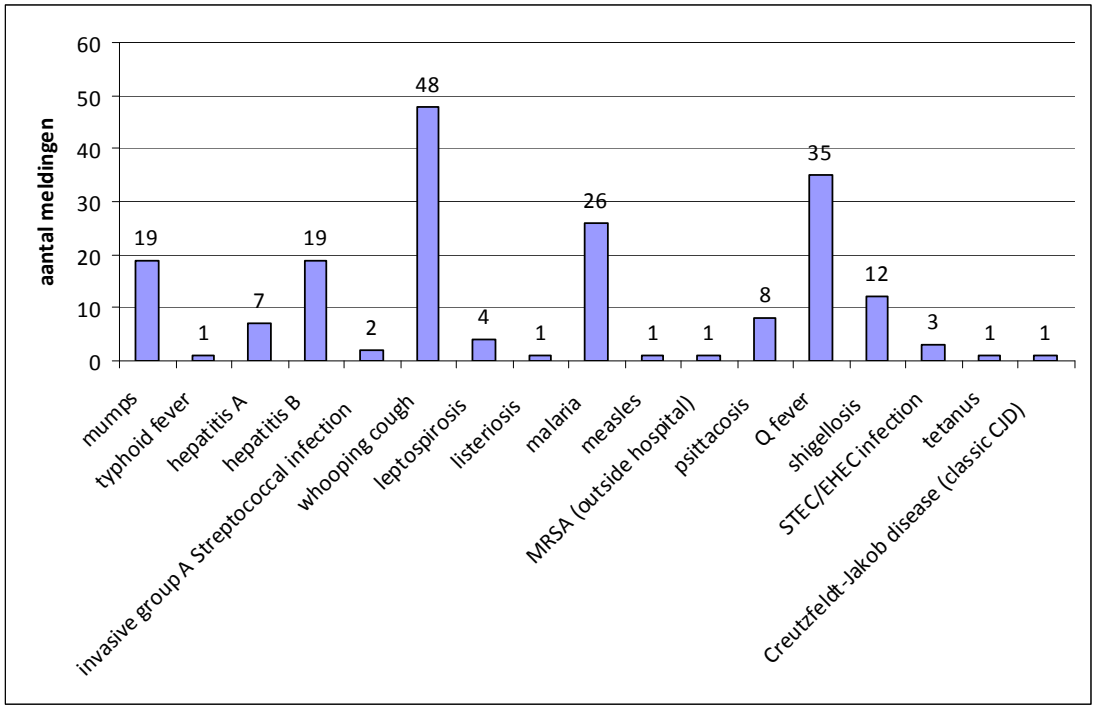


Figure 6 Percentage of the 189 work-related notifications per infectious disease

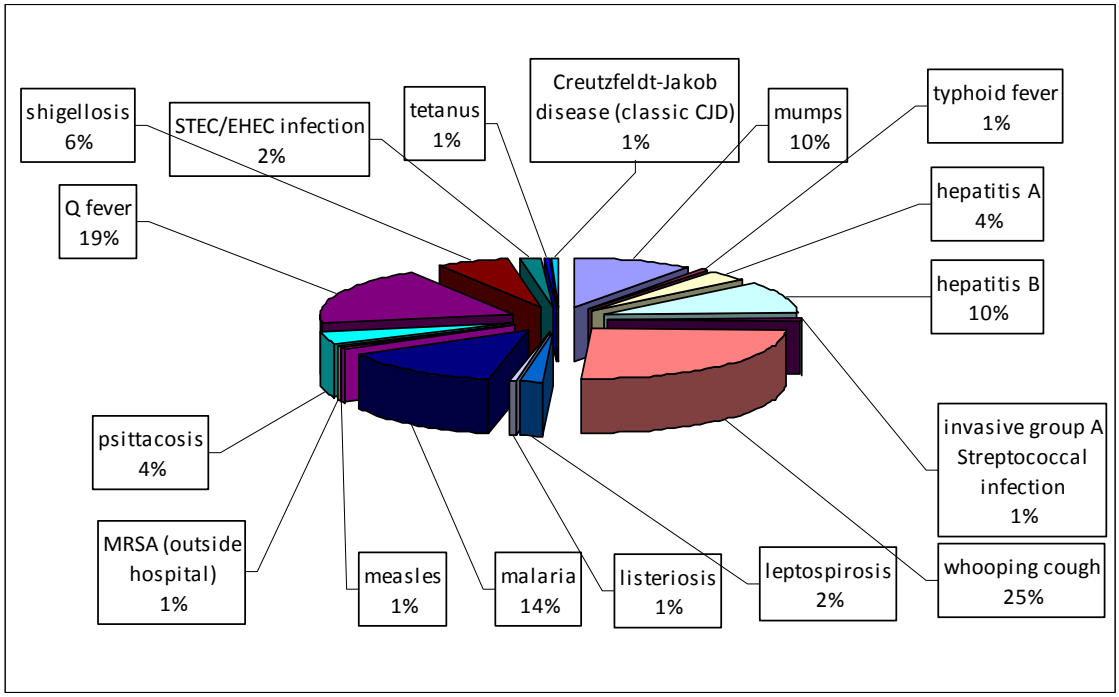


Table 2 Was the disease contracted in the Netherlands or abroad?

Where contracted	Number	Percentage
the Netherlands	134	71
abroad	55	29

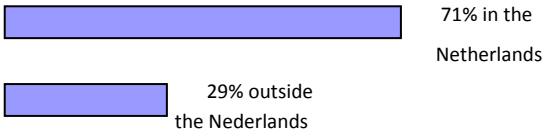


Table 3 Breakdown of notifications by sex

Sex	Number	Percentage
Male	116	61
Female	73	39

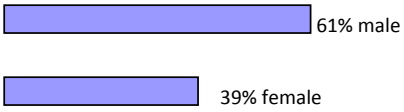


Table 4 Age distribution

Age	Number	Percentage
10 – 19	8	4
20 - 29	47	25
30 – 39	35	19
40 – 49	44	23
50 – 59	34	18
60 – 69	18	10
70 - 79	3	2

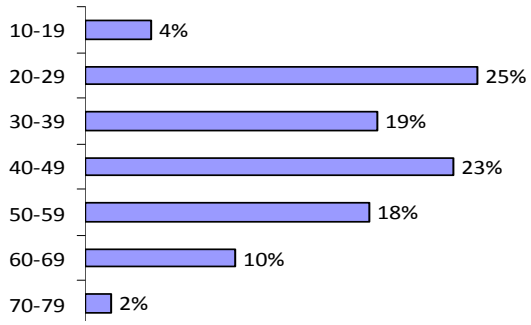


Table 5 Hospitalized

In hospital	Number	Percentage
Yes	42	22
No	142	75
Unknown	5	3

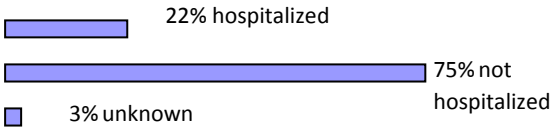
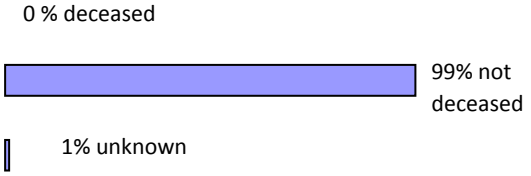


Table 6 Deceased

Deceased	Number	Percentage
Yes	0	
No	188	99
Unknown	1	1



Appendix 2 Notifications in Osiris for 2010

In accordance with the Public Health Act [Wet Publieke Gezondheid], all doctors, heads of laboratories and similar institutions must report an infectious disease to their regional GGD's disease prevention center as soon as they encounter a patient with such a disease.
These notifiable infectious diseases are diseases which call for control measures. The infectious diseases in question are divided into three categories: group A, group B 1/2 and group C diseases. The classification indicates the urgency of action and the entity responsible for controlling and combating the disease.

Table 7 Notifications in 2010, in absolute terms and in terms of work-related notifications

Infectious disease	**Absolute number of notifications**	**Work-related notifications**
Anthrax	0	0
Mumps	513	19
Botulism	0	0
Brucellosis	6	0
Typhoid fever	33	1
Cholera	1	0
Diphtheria	0	0
Yellow fever	0	0
Hantavirus infection	18	0
Hepatitis A	269	7
Chronic hepatitis B	1697	15
Acute hepatitis B	207	4
Acute hepatitis C	47	0
Human infection with avian influenza virus	0	0
Invasive group A Streptococcal infection	217	2
Invasive haemophilus influenzae type b infection	45	0
Childhood invasive pneumococcal disease (up to 5 years of age)	55	0
Polio	0	0
Whooping cough	4303	48
Legionnaire's disease	456	0
Leptospirosis	27	4
Listeriosis	74	1
Malaria	249	26
Measles	19	1
Meningococcal disease	144	0
MRSA infection (clusters outside hospitals)	15	1
New Influenza A (H1N1) 2009	541	0
Paratyphoid A fever	24	0
Paratyphoid B fever	17	0
Paratyphoid C fever	0	0
Plague (bubonic)	0	0
Smallpox	0	0

Infectious disease	Absolute number of notifications	Work-related notifications
Psittacosis	70	8
Q fever	538	35
Rabies	0	0
German measles (rubella)	0	0
Severe acute respiratory syndrome (SARS)	0	0
Shigellosis	358	12
STEC / EHEC infection	396	3
Tetanus	1	1
Trichinosis	0	0
Viral hemorrhagic fever	0	0
Food poisoning	49	0
West Nile virus	1	0
Creutzfeldt-Jakob disease (classic)	26	1
Variant Creutzfeldt-Jakob disease	1	0

Appendix 3 Work-related notifications per infectious disease

Appendix 3 gives a summary of work-related notifications in Osiris per infectious disease in 2010. The list below shows infectious diseases with a work-related connection registered in Osiris in 2010:

- Mumps
- typhoid fever
- Hepatitis A
- Hepatitis B (chronic)
- Hepatitis B (acute)
- Invasive group A Streptococcal infection
- Whooping cough
- Leptospirosis
- Listeriosis
- Malaria
- Measles
- MRSA infection (clusters outside hospitals)
- Psittacosis
- Q fever
- Shigellosis
- STEC / EHEC infection
- Tetanus
- Creutzfeldt-Jakob disease (classic)

Following text describes the relation with work of these work-related notifications.

Mumps

Total number of notifications in Osiris in 2010	513		
Work-related notifications	19	(3.7%)	
Contracted in the Netherlands or abroad?	the Netherlands	19	
Sex	Male Female	16 3	
Age distribution	10 – 19 20 – 29 30 – 39 40 – 49 50 – 59 60 – 69	1 11 5 2 - -	
Hospitalized	Yes No Unknown	0 17 2	
Deceased	Yes No	0 19	
Vaccinated	Yes No	13 6	If vaccinated: 6 persons, 2 doses; 6 persons, 1 dose; 1 Unknown
Sector / occupation	5 university/college 4 students 3 administrative and support staff 3 hotel & catering industry 1 wholesale and retail trade 1 art, amusement and recreation 1 education (dance school) 1 foodstuffs industry		

Burden of disease and transmission route

Mumps (parotitis) is a highly contagious disease that is caused by the mumps virus. It is an infectious disease in which the salivary gland near the ear becomes swollen. The symptoms of mumps are generally quite mild. A person can be infected without developing any symptoms, and consequently unknowingly infect others. It is estimated that around a third of all mumps infections are asymptomatic. The infection can occur at any age, but the chance of complications is greater for adults than for children.
The infection is spread form person to person through respiratory droplets that are released into the air when the patient coughs or sneezes or through coming directly into contact with objects that have been contaminated with infected saliva.

Vaccination

A single-dose MMR vaccination has been included in the Netherlands' national vaccination programme since 1976. From 1987 the MMR vaccine has been given in two doses. The seroprevalence of mumps is high in the Netherlands (95%), and that is one reason why mumps hardly occurs in the Netherlands any more. There has, however, been an increase in the number of mumps patients since 2009; they are mainly students in the larger university towns. Students are particularly susceptible, because they often have intensive contacts with each

other. Many cases concern youngsters who have either not been vaccinated, or not fully, or who have lost their resistance to the mumps. Even those vaccinated can contract the infection and become ill as a result of vaccine failure (whereby the vaccine is not sufficiently effective) or waning immunity (whereby protection declines with the passage of time).
One-third of the patients contracts the disease in spite of being fully vaccinated.

Work-related infection
A substantial part (9 of the 19) persons who contracted mumps in the course of their work, either work directly with students (teachers) or work in an environment where many students are present, such as the chef at a student union, a DJ at student parties, and the manager of a students' clubhouse.
Four of the 19 notifications concerned students, and were therefore not work-related.

Recommendation
There was a noticeable increase in the number of mumps notifications in 2010. In 2009 and 2009 this increase could mainly be attributed to an elevated student population. People who carry out work activities in close proximity to students can also be exposed to and contract mumps.
If there is a possibility of employees being exposed to the mumps virus in the course of their work, the employer should take measures to reduce the chance of exposure. Employees must be informed about the risk of exposure, about symptoms, possible complications and how transmission can be prevented (through good hand hygiene and cough etiquette). As mumps often progresses in a mild form or without any symptoms at all, preventive vaccination is not automatically indicated. One possibility - in the larger student towns - would be for new employees in higher education to be offered the option of vaccination against mumps if they have not been vaccinated in the past (or not fully).

Typhoid fever

Total number of notifications in Osiris in 2010	33	
Work-related notifications	1	(3.0%)
Contracted in the Netherlands or abroad?	abroad	1
Sex	Male Female	1 0
Age distribution	20 – 29	1
Hospitalized	Yes No	1 0
Deceased	Yes No	0 1
Vaccinated	Yes No	0 1
Sector / occupation	commercial shipping	

Burden of disease and transmission route
Typhoid fever is a contagious intestinal disease, caused by *Salmonella typhi* bacteria. The disease can be very serious. People who have had typhoid fever do enjoy a degree of natural protection against the virus for a short while afterwards. A person can have the disease multiple times.
The disease occurs almost exclusively outside the Netherlands, in areas with poorer hygiene. The bacteria can be found in the faeces, urine and blood of people who are infected.

Work-related infection
People who travel to areas where the hygienic conditions are poorer than at home run the risk of infection. For example: a seaman on an ocean-going vessel could be exposed to typhoid fever at a port of call.

Recommendation
Typhoid fever occurs in Africa, South America and in Asia. Employees who have to travel to these areas for work purposes should be informed about what hygienic measures they can take to avoid contracting the disease.
Vaccination against typhoid fever is recommended if an employee is to spend more than two weeks working in a country where there is a high risk of contracting the disease. Vaccination is also recommended if an employee is to spend more than three months in other areas of Africa, South America and Asia.

Hepatitis A

Total number of notifications in Osiris in 2010	269	
Work-related notifications	7	(2.6%)
Contracted in the Netherlands or abroad?	the Netherlands abroad	5 2
Sex	Male Female	4 3
Age distribution	10 – 19 20 – 29 30 – 39 40 – 49 50 – 59 60 – 69	- 4 2 1 - -
Hospitalized	Yes No	2 5
Deceased	Yes No	0 7
Vaccinated	Yes No	1 6
Sector / occupation	1 waste disposal (waste water) 2 education 2 work experience placement / au pair outside the Netherlands 1 construction 1 food preparation (restaurant)	

Burden of disease and transmission route
Hepatitis A (previously: infectious hepatitis) is an inflammation of the liver, caused by the hepatitis A virus. Hepatitis A is fairly common in the Netherlands. The disease is highly contagious and is usually spread by the faecal-oral route. For most patients, the symptoms are mild. Children, in particular, often have very few symptoms so that the disease is hardly noticeable. However, both the duration and severity of the disease increase with age. Adults usually suffer more symptoms, which can also be more serious and are sometimes followed by a lengthy period of recuperation (several months) during which they feel tired and listless.

Work-related infection
The risk of infection with the hepatitis A virus is higher in nurseries, children's day care centers, playgroups, schools and institutions for people with an intellectual impairment. Employees in the waste disposal, sewage and cleaning sectors can also be exposed to the virus.
So, too, can Dutch employees who travel to or work for any length of time in areas where the virus is endemic.

Vaccination
Despite the availability of a safe vaccine and the fact that the occupational groups involved in the Osiris notifications run a clear risk of exposure, most of the patients had not been vaccinated. Vaccination against hepatitis A is apparently not automatically offered to all groups of workers at risk.

Recommendation

Employees in the above-mentioned occupations should receive information about risky situations, the symptoms of the disease and the preventive measures - such as hygienic behaviour and the use of personal protection clothing and devices - they can take. The use of personal protection depends, of course, on the situation. For example: suitable liquid-tight gloves and working attire should be made available for waste disposal workers.

Any employees who might have an increased risk of developing severe symptoms from the disease - such as people with a chronic liver disorder and older people - must be suitably informed.

Employees who for work purposes have to travel to parts of the world where hepatitis A is endemic, should be informed about which hygienic measures they can take to avoid contracting the disease.

In addition, all employees who carry out work activities whereby they are frequently in contact with, or can come into contact with human faeces, are eligible for vaccination against hepatitis A. Also eligible for vaccination are those employees who for work purposes have to travel to parts of the world where the disease is endemic.

The Dutch National Hepatitis Center has developed the "Hepatitis A Risk Assessment for Occupational Groups", a risk assessment model which uses a flow chart to help assess whether a particular employee is eligible for vaccination.

Hepatitis B

Total number of notifications in Osiris in 2010	Acute: 207 Chronic: 1697 Total: 1904	
Work-related notifications	19	(1.0%)
Contracted in the Netherlands or abroad?	the Netherlands abroad	8 11
Sex	Male Female	11 8
Acute or chronic	Acute Chronic	4 15
Age distribution	10 – 19 20 – 29 30 – 39 40 – 49 50 – 59 60 – 69	1 4 2 4 6 2
Hospitalized	Yes No	3 16
Deceased	Yes No	0 19
Vaccinated	Yes No	1 18
Sector / occupation	- 5 sexually transmitted (2 prostitution, lorry driver, actor, civil servant) - 5 vertical transmission (mother – child) - 9 needle stick accidents (4 healthcare, 2 security, 1 each laboratory, cleaning, education)	

Burden of disease and transmission route

In 60 percent of the cases, hepatitis B is asymptomatic. The hepatitis B virus is the most infectious of all viruses that can be transmitted through the blood. If, as a result of a needle stick accident, an employee comes into contact with blood infected with the hepatitis B virus, there is a 3 to 30 percent chance that he himself will become infected.

If the virus can be detected in the blood for more than six months, we speak of a chronic infection. The virus is then not being cleared from the body. In the case of a chronic infection, there is an increased risk of cirrhosis of the liver and of developing liver cancer.

Work-related infection

During 2010, 19 cases of persons who had been infected with hepatitis B in the course of their work were recorded in Osiris. Of these, 15 patients had a chronic infection and 4 had an acute infection. Chronic infections have often been contracted some time previously, and this makes it more difficult to trace the cause of the disease.

Transmission in the work environment is most commonly the result of a needle stick accident. Hepatitis B can also be transmitted sexually, for example via prostitutes. For people who travel for business, there is also a risk of contracting hepatitis B through a blood transfusion given in a local hospital following a road accident, for example, or through contact with prostitutes who themselves are infected. More than half the cases recorded in Osiris were thought to have been contracted outside the Netherlands.

Notably, 5 of the 19 notifications report that transmission of the disease was vertical, i.e. the virus passed from mother to child. Any work-related connection can be excluded in such cases, and the notification to Osiris calls registration into question.
Only one person appeared to have been vaccinated, or at least partially.

Recommendation
Preventive measures, such as the use of safe needle systems and the offer of personal protection clothing and devices, should be taken to avoid needle stick accidents; such accidents also involve the risk of contracting hepatitis C and HIV. Information about the needle stick accident protocol, which sets out what should be done in such an event, about the risks involved in such accidents, about safe behaviour (always put the needle back in its safety cap), possible preventive measures and the correct way to deal with the aftermath of a needle stick accident.
An infection with the hepatitis B virus can be prevented by prophylactic vaccination.
Each year, around 15 000 needle stick accidents are recorded; these primarily occur in the work situation. If a needle stick accident is, or could be, a risk for an employee, the employer should always offer that employee vaccination.
Vaccination against hepatitis B is being offered to people in high-risk groups such as employees in the sex industry as part of a special nation-wide hepatitis B vaccination campaign.
The National Hepatitis Center has published a practical guide to the government's hepatitis B vaccination policy for people with a work-related risk of contracting the disease (the guide is only available in Dutch).

Invasive group A Streptococcal infection

Total number of notifications in Osiris in 2010	217	
Work-related notifications	2	(0.9%)
Contracted in the Netherlands or abroad?	the Netherlands	2
Sex	Male Female	0 2
Age distribution	10 – 19 20 – 29 30 – 39 40 – 49 50 – 59 60 – 69	- - - 2 - -
Hospitalized	Yes No	2 0
Deceased	Yes No	0 2
Sector / occupation	Healthcare sector Administrative work	

Burden of disease and transmission route
Group A streptococcal infections are caused by the group A *Streptococcus* bacteria. This bacteria only occurs in humans. Everyone will in fact be infected with this bacteria several times during their lifetime. Most people carry the bacteria (for a shorter or longer duration) in their nose or throat, or on their skin, without becoming ill.
The infection can spread via droplet infection (from the throat) and via direct or indirect contact, especially via wounds on the hands.
A wide range of symptoms can occur, depending on a variety of factors. Doctors make a distinction between invasive infections (infections that affect internal organs) and non-invasive infections (that only affect the skin and skin organs). An unfavourable combination of bacterial and host factors can be conducive to an invasive infection.

Work-related infection
Healthcare employees who have intensive contact with patients and employees who work in situations where crowding occurs in combination with poor hygiene, have an increased risk of exposure. Clusters of invasive infections have been found in hospitals, nursing homes, children's day care centers and even in a professional rugby team.

Recommendation
It is difficult to avoid infection, but the risk of spreading the bacteria can be reduced by imposing general hygiene measures for coughing, sneezing and wound care.

Whooping cough

Total number of notifications in Osiris in 2010	4303	
Work-related notifications	48	(1.1%)
Contracted in the Netherlands or abroad?	the Netherlands abroad	46 2
Sex	Male Female	17 31
Age distribution	10 – 19 20 – 29 30 – 39 40 – 49 50 – 59 60 – 69	4 15 12 7 7 3
Hospitalized	Yes No	0 48
Deceased	Yes No	0 48
Vaccinated	Yes No Unknown	37 > 3 doses: 32 3 2 doses: 1 8 unknown: 4
Sector / occupation	- 6 children's day care center - 11 education (9 primary school) - 11 healthcare (4 mental healthcare) - 4 food industry (2 hotel & catering) - 16 other sectors (7 unknown, others: lawyer, receptionist, fire service, police, clothes shop, commerce, bus driver, armed forces, garage)	

Burden of disease and transmission route

Whooping cough is a highly contagious disease that affects the throat, windpipe and nose. It is usually caused by the *Bordetella pertussis* bacteria, less frequently by *Bordetella parapertussis* bacteria. The human body forms the reservoir for whooping cough; transmission takes place via droplets that have been coughed up from the patient's throat. Whooping cough still occurs regularly in the Netherlands, despite vaccination. In adults, an infection often takes the form of a mild upper airways infection or it can even be symptom-free. Infants under the age of 12 months, who have not - or not completely - been vaccinated, have an increased risk of developing complications.

Vaccination

Most of the working population in the Netherlands who were born after the introduction of the national vaccination programme in 1953 will have been vaccinated against whooping cough. But neither survived infection nor vaccination provide lifelong protection, although after an infection or vaccination, any subsequent whooping cough infection will be milder. Two-thirds of the patients notified to Osiris who had contracted whooping cough in the work situation had become infected in spite of being fully vaccinated.

Work-related infection
In 1.1% of the total number of notifications, it was reported that the illness had probably been contracted at work. A substantial proportion (58%) of the work-related notifications concern employees in the education sector and in healthcare.

Recommendation
Whooping cough is a highly contagious disease that can easily be transmitted in any work situation. As whooping cough in adults often progresses mildly or without any symptoms at all, preventive vaccination is not automatically indicated.
One option would be to offer booster vaccinations to any employees with an increased risk of developing more severe symptoms; these include pregnant women, the elderly, and employees with other underlying conditions such as heart trouble, diabetes or COPD[1].
Only infants under the age of twelve months who have not - or not completely - been vaccinated, have an increased risk of developing serious complications. Because of the seriousness of the complications in incompletely vaccinated children of this age, it is recommended that people who work with such young children are offered vaccination.

[1] Serres G, Shadmani R, Duval B, Boulianne N, Déry P, Douville M. Morbidity of Pertussis in adolescents and adults. Journ Infect Diseases 2000; 182: 174-9

Leptospirosis

Total number of notifications in Osiris in 2010	27	
Work-related notifications	4	(14.8 %)
Contracted in the Netherlands or abroad?	the Netherlands	4
Sex	Male Female	4 0
Age distribution	10 – 19 20 – 29 30 – 39 40 – 49 50 – 59 60 – 69 70 – 79	- - 1 - 2 - 1
Hospitalized	Yes No	4 0
Deceased	Yes No	0 4
Sector / occupation	2 Agriculture (incl. contact with ditch water) Fish farm Zoo keeper and animal trader (breeding mice/rats, work in zoo)	

In 2010, the National Reference Laboratory at the Royal Tropical Institute (KIT) diagnosed 7 patients who had probably contracted leptospirosis during work activities. The reason for the discrepancy between the number of notifications to Osiris and the Reference Lab's diagnoses is unknown.

Summary of work-related leptospirosis infections contracted in the Netherlands diagnosed by KIT, 2010
• wounded while cutting reeds, patient is resource manager at a lake • commercial fish breeder, brown rat infestation • working at family-owned fish nursery • farmer/livestock farmer • working with sheep • in ditch behind own farm • working with mice and foxes in zoo

Burden of disease and transmission route

Leptospira infections are zoonoses; they can be caused by more than two hundred different leptospira serovars. Most infections progress in a mild to moderate form; milder forms of leptospirosis are often not even recognized as such. The symptoms range from flu-like to a severe attack resulting in death. Weil's disease and mud fever are the types most commonly found in the Netherlands.

In principle, nearly every mammal can be a source of infection (or reservoir), but this applies most especially to rodents and insectivores. Humans can become infected through direct contact with the host (whether alive or dead) or its urine. Infection can also take place indirectly, via any environment contaminated by such urine (especially surface water, marsh plants and mud). Transmission is effected via wounds or mucous membranes. It is also possible

for transmission to occur via softened skin or by inhaling droplet aerosols contaminated with urine. Intensive contact with animals is a potential risk of infection. Human to human transmission can occur via the urine of leptospirosis patients. Providing intensive care to leptospirosis patients also therefore represents a risk.
Pregnant women have an increased risk of developing a severe infection; miscarriage, intrauterine foetal death and congenital leptospirosis have all been recorded. No vaccine for humans is available in the Netherlands.

Work-related infection
The work situation can be an important cause of this infection. Livestock and arable farmers, market gardeners, veterinarians, pest controllers (e.g. muskrat catchers), sewer workers, butchers, zoo keepers, hunters and gamekeepers can all become infected in the course of their work. The same applies to other employees who frequently come into contact with animals (domesticated or wild) and/or surface water or mud as part of their work.

Recommendation
For the occupational groups named above, information on the prevention and spread of the disease, the ways in which infection can be transmitted and the importance of personal hygiene can have a preventive effect. In addition, the importance of early treatment should be emphasized. Persons at risk should be informed about symptoms such as fever, muscular aches, headaches, cold shivers, diarrhoea, vomiting and reduced urine production.
Prevention is primarily aimed at avoiding contact with infected animals and the contaminated environment; workers in an infected area should, for example, wear rubber boots and gloves.
The general principles of hygiene, especially for the hands, should be borne in mind. In the healthcare sector, employees should be especially careful when handling the urine of leptospirosis patients.
In connection with the serious course of the illness during pregnancy, extra attention should be paid to pregnant employees.

Listeriosis

Total number of notifications in Osiris in 2010	74	
Work-related notifications	1	(1.4%)
Contracted in the Netherlands or abroad?	the Netherlands	1
Sex	Male Female	0 1
Age distribution	10 – 19 20 – 29 30 – 39 40 – 49 50 – 59 60 – 69	- - - 1 - -
Hospitalized	Yes No	1 0
Deceased	Yes No	0 1
Sector / occupation	Not employed (?)	

Burden of disease and transmission route
Listeriosis is an infection that is caused by the *Listeria monocytogenes* bacteria, which can occur in food such as unpasteurized cheeses and pâté. The infection can be asymptomatic, but it is just as likely to lead to severe illness such as encephalitis, meningitis or blood poisoning (septicaemia). Infection with the Listeria bacteria is particularly dangerous for unborn babies, newborns and people with reduced resistance. The disease is rare in the Netherlands.
Infections are usually contracted from food that is infected with Listeria, or from direct contact with contaminated material such as the faeces of infected animals or humans, or from working in infected soil. Groups with a high risk of invasive listeriosis are pregnant women and immuno-compromised patients (because, for example, of reduced resistance caused by antirejection medication following a transplant, or antirheumatic drugs).

Work-related infection
Skin infections have been observed in veterinarians.
The notification to Osiris, however, appears to have been erroneously reported as work-related; the answer given in the section asking for the occupation and the sector in which the patient worked was "not employed".

Malaria

Total number of notifications in Osiris in 2010	249	
Work-related notifications	26	(10.4%)
Contracted in the Netherlands or abroad?	abroad	26
Sex	Male Female	19 7
Age distribution	10 – 19 20 – 29 30 – 39 40 – 49 50 – 59 60 – 69	0 4 5 9 2 6
Hospitalized	Yes No	18 8
Deceased	Yes No	0
Prophylactic used	Yes No Unknown	9* 16 1
		*If prophylactic used: 6 incompletely 3 according to prescription
Sector / occupation	5 healthcare sector 1 foodstuffs industry 3 agriculture / forestry 2 field sales (representatives) 1 education 1 commercial shipping 1 journalist 2 transport/aviation 2 commercial sector 2 technological sector 1 geological sector 2 sanitary facilities sector 3 unknown	

Burden of disease and transmission route

Malaria is caused by malaria parasites that enter the body after a mosquito bite. It is one of the gravest infectious diseases in the tropics and subtropics. Malaria manifests in various forms; malaria tropica is the most common type of malaria and, at the same time, the most serious. Patients who are diagnosed early, and treated effectively, can make a full recovery. People who do not receive treatment can develop severe complications that can even result in death. Pregnant women, children and people who have had their spleen removed are more at risk of catching malaria. Employees who work in malaria-endemic areas can contract the disease.

Malaria is seen regularly in the Netherlands. These cases are people who have contracted the disease in the tropics or subtropics and "import" it to the Netherlands. In 2010 there were 249 notifications of malaria in Osiris, 26 of them recorded as work-related.

Work-related infection
Notifications for employees with malaria generally concern men who all contracted the disease outside the Netherlands. They were engaged in a variety of different work activities. Half of the notifications were for people working in the healthcare sector, agriculture or transport.
In all cases, contracting the disease was linked to travel; they had all been abroad in the context of their work. Compared to 2009, there was a decrease in the number of work-related cases.

Prophylaxis
Notable is the limited use of malaria prophylactics by these employees: only 3 of the 26 persons who contracted malaria in the course of their work had taken prophylactic measures as prescribed.

Recommendation
If the number of employees who contract malaria in the course of their work outside the Netherlands is to be reduced, it is essential that employers and occupational health and safety services are aware of the risks of becoming infected and the limited use of prophylactics.
Employees should be given comprehensive information about the severity of the disease and the efficacy of additional preventive measures such as wearing skin-covering clothing, the use of an impregnated bed net, and protecting exposed areas of skin (face, hands and ankles) with insect repellent. Depending on the destination, vaccinations and malaria prophylactic medication should be offered.

Measles

Total number of notifications in Osiris in 2010	19	
Work-related notifications	1	(5.3%)
Contracted in the Netherlands or abroad?	the Netherlands	1
Sex	Male Female	0 1
Age distribution	10 – 19 20 – 29 30 – 39 40 – 49 50 – 59 60 – 69	- - - 1 - -
Hospitalized	Yes No	0 1
Deceased	Yes No	0 1
Vaccinated	Yes No	0 1
Sector / occupation	education	

Burden of disease and transmission route

Measles is a highly contagious disease that brings the patient out in a rash; it is caused by the measles virus. The disease is accompanied by high fever and a skin rash. It can give rise to serious complications such as pneumonia and meningitis. The disease has hardly occurred in the Netherlands since the introduction of the national vaccination programme (RVP).

Humans are the only natural host of the measles virus, which spreads to other hosts through droplets excreted into the air when an infected person coughs, sneezes or speaks. Transmission can also be indirect, for example via infected surfaces.

The disease can be more serious for babies, pregnant women, persons with an immune disorder and adults; the older the patient, the more chance there is that complications will develop.

The number of measles cases in the Netherlands is increasing. Non-vaccinated employees working at schools where there is a low level of immunization, such as humanistic and other alternative schools, have the highest risk of contracting measles. In the hospital environment, given the seriousness of the symptoms, its highly contagious nature and the presence of a vulnerable population, measles can present a problem for non-vaccinated employees, in terms of both contracting and carrying the disease.

The incidence of measles is currently on the rise in Europe and the number of cases reported by various EU member states remains high.

Vaccination

Over 90 percent of the Dutch population have been immunized against measles. Most children in the Netherlands are protected against measles as part of the RVP. However, at schools with low immunization levels, such as humanistic and other alternative schools, and in the Dutch "bible belt" (an area spreading from the west of the province of Overijssel in the east to Zeeland in the south-west, where many adherents of the Dutch Reformed Church live), the increased risk of

infection coupled with intensive social contacts enable the disease to spread more easily.

Recommendation
Vaccination should be offered to people such as businessmen, members of the armed forces and airline staff who travel to areas where measles is prevalent in the course of their work.
Non-vaccinated employees working in the healthcare sector or at schools with a low immunization level are at more risk of contracting the disease; they should also be offered vaccination.
Immuno-compromised employees and non-immune pregnant employees are more likely to be seriously ill with measles.
Alongside standard measures such as good hand hygiene and cough etiquette, vaccination should also be offered to non-vaccinated employees who work with people at increased risk of developing a severe form of measles.

MRSA (outside hospital)

Total number of notifications in Osiris in 2010	15	
Work-related notifications	1	(6.7%)
Contracted in the Netherlands or abroad?	the Netherlands	1
Sex	Male Female	0 1
Age distribution	10 – 19 20 – 29 30 – 39 40 – 49 50 – 59 60 – 69	- - - - 1 -
Hospitalized	Yes No Unknown	- - 1
Deceased	Yes No	0 1
Sector / occupation	beautician	

Burden of disease and transmission route

Methicillin resistant *Staphylococcus aureus* is the full name for MRSA and belongs to the staphylococcus family of bacteria; it causes a staphylococcal infection. Staphylococci are bacteria that are widespread among healthy humans, usually without ever causing any problems. Around 30 percent of all humans are asymptomatic carriers of *Staphylococcus aureus*, but less than 1 percent of the Dutch population is a carrier of MRSA. MRSA is an abnormal staphylococcus because it is insensitive to treatment with most commonly used antibiotics.

MRSA can cause infections such as boils. In rare cases, blood poisoning, osteomyelitis (bone infection) or respiratory infections can occur. In psychosocial terms, carriership of MRSA creates problems whenever hospital care is needed. Hospitals now use screening tests for MRSA, and anyone found to be infected is nursed in isolation. This is because the risk of the disease spreading and infecting other people is greater than it would be out in the community due to the fact that there are more sources (carriers and infected persons) and more potential "gateways" (wounds, catheters, etc.).

Infection with MRSA usually occurs through direct skin contact, primarily via the hands. MRSA can sometimes be inhaled, after becoming airborne on flakes of skin or sneeze droplets. Humans and animals (including dogs, cats, horses, poultry, cattle and pigs) serve as natural reservoirs for the bacteria.

Work-related infection

Pigs and calves also act as reservoirs for MRSA, known in the Netherlands as "pig MRSA". Since infection with MRSA chiefly occurs through direct skin contact, primarily via the hands, pig farmers, livestock transporters and abattoir staff can become exposed to the infection in the course of their work.

People who already have a skin condition are extra susceptible and can act as "superspreaders" if they become infected.

Recommendation
People who have intensive contact with other humans or animals in the course of their work must take appropriate hygiene measures such as washing and disinfecting their hands, and use suitable protective clothing, such as gloves. It must be borne in mind that employees with a skin condition are more susceptible to this disease.

Psittacosis

Total number of notifications in Osiris in 2010	70	
Work-related notifications	8	(11.4 %)
Contracted in the Netherlands or abroad?	the Netherlands	8
Sex	Male Female	5 3
Age distribution	10 – 19 20 – 29 30 – 39 40 – 49 50 – 59 60 – 69	- 1 1 3 2 1
Hospitalized	Yes No	5 3
Deceased	Yes No	0 8
Sector / occupation	- Work with animals or animal products (pet shop, veterinary clinic, duck slaughterhouse, bird sanctuary) - Children's day care center - Agricultural sector (landscape gardener)	

Burden of disease and transmission route

Psittacosis is a zoonose caused by the Chlamydophila psittaci bacteria.
The disease can be contracted by breathing in airborne particles that contain the bacteria. These particles come from the dried droppings, nasal discharges and aqueous humor of infected birds.
The infection can progress without symptoms, but can also manifest itself as a flu-like disorder. The disease can also take on a more severe form, such as pneumonia or septicaemia (blood poisoning), which can result in damage to the body's organs.
Pregnant women and immuno-compromised persons are at greater risk of developing a more severe infection.

Work-related infection

The disease is found primarily among people who work with birds, such as bird traders, zoo keepers, pet shop staff, veterinarians, pigeon breeders and employees in the poultry processing industry.
At the beginning of 2011, prompted by an increase in the incidence of psittacosis, the Office for Risk Assessment and Research (BuRO, part of the new Dutch Food & Consumer Product Safety Authority, nVWA) published recommendations about the health risks associated with psittacosis. They estimated that 300 people suffer severe pneumonia each year as a result of a psittacosis infection, corresponding to over 1000 infections a year in the Netherlands. Further information can be found at: www.kiza.nl/content/voorkom-papegaaienziekte-door-inademen-stof (only available in Dutch).

Recommendation

People who come into contact with birds in the course of their work must be made aware of the risks so that they can take sufficiently effective preventive measures to protect themselves.

The occupational health and safety strategy must be aimed at preventing employees coming into contact with infected birds or their excretions. Preventive measures that must be taken include wearing gloves, protective clothing and an FFP2 surgical mask during contact with potentially infected birds. It is recommended that employees always use respiratory protection during any work activities that could create dust. Good ventilation is also important during the cleaning of sheds or cages where birds (healthy or infected) are housed. Damping down dry flooring surfaces will help reduce the amount of dust created.

Q fever

Total number of notifications in Osiris in 2010	538	
Work-related notifications	35	(6.5%)
Contracted in the Netherlands or abroad?	the Netherlands abroad	34 1
Sex	Male Female	29 6
Age distribution	10 – 19 20 – 29 30 – 39 40 – 49 50 – 59 60 – 69	2 3 6 10 10 4
Hospitalized	Yes No Unknown	5 29 1
Deceased	Yes No	0 35
Vaccinated	Yes No	0 35
Sector / occupation	8 agricultural sector (including clearances: 2, work experience placements:) 2) 1 meat processing industry (abattoir) 4 fitters (mechanic, electrician) 1 journalist 2 healthcare (supervision of intellectually disabled patients) 1 local council 1 milking machine construction 4 parks and gardens department 1 non-commercial smallholder ("hobby farmer") 2 transport (catering, shower cubicles) 4 cleaning sector (mobile toilets, haulage of culled goats, shower cubicles) 3 animal care / veterinarian 1 builder (livestock stalls) 1 painter (in the vicinity of infected farms) 1 education	

Burden of disease and transmission route

Q fever is a zoonose caused by the *Coxiella burnetii* bacteria. The principal sources of infection for humans in the Netherlands are goats and sheep, but other animals such as cows, dogs, cats, rodents and birds can also be a source of infection. Ticks are considered the prime vector for transmission of infection from one animal to another.

In around 60 percent of cases, a Q fever infection progresses without any symptoms or illness. The remaining 40 percent of cases have symptoms that vary from a mild attack of flu to a far more serious illness (in 2 to 5 percent of cases). The onset of an acute Q fever infection is sudden and symptoms occur quickly. In cases of chronic infection symptoms can occur up to ten years after the initial infection. Chronic Q fever develops in one to three percent of cases

and can follow either an acute Q fever infection or an asymptomatic (i.e. without symptoms) infection.
Infection can occur after breathing in infected dust particles from livestock stalls, meadows, unprocessed wool and animal hides, and through direct contact with infected animals. The amniotic fluid and placenta of an infected animal contain particularly large quantities of bacteria. The bacteria can also occur in milk (pasteurized or unprocessed), excrement and urine, and can survive for months or even years. Airborne particles of dry matter can spread the disease over large distances.

Work-related infection
Q fever is an occupational disease that affects those who come into contact with livestock in the course of their work, e.g. livestock farmers, veterinarians and laboratory staff who work with infected animals and tissue cultures. Infections are not, however, limited to these occupational groups. The notifications in Osiris include people who have contracted the disease in the course of their work, even though their various occupations have no direct link with the agricultural sector. The *Coxiella burnetii* bacteria is highly contagious; even people who only work on or in the vicinity of an infected farm for a short period of time can contract Q fever. Example cases are those of journalists who make a brief visit to a farm, and people who are involved in farm clearances. Studies have shown that 17.5 percent of the employees involved in farm clearances became infected[2].
In comparison with 2009, there has been a noticeable reduction in the number of work-related Q fever cases. In 2009 there were 78 notifications of employees who had contracted Q fever in the course of their work; notifications fell to below half that number in 2010. The overall number of notifications also fell significantly in comparison with 2009 (from 2317 to 538). This reduction can be attributed to the control measures taken after the Q fever outbreak, including compulsory vaccination of sheep and goats kept for milk, and the clearance of farms testing positive for Q fever. Despite the reduction in the absolute number of notifications, there were relatively more notifications of work-related infections.

Recommendation
From the notifications in Osiris and from the result of research carried out jointly by the RIVM, the Dutch Food & Consumer Product Safety Authority, Jeroen Bosch Hospital and Arbo Unie (the largest national occupational health and safety agency), it appears that even incidental exposure to Q fever in the course of a person's work in an infected environment can lead to a Q fever infection. This means that employees who are only temporarily carrying out work activities on a Q fever infected farm, new employees and/or students on work experience placements, must be properly informed about the risks and about preventive measures. In such cases, effective personal protection is the primary consideration.
Employers need to know which employees are particularly vulnerable to a Q fever infection; these include employees with cardiac and vascular conditions, employees with reduced immune resistance, and pregnant women. These groups should not be expected to carry out high-risk work on farms that have tested positive for Q fever, even if that work is of short duration and/or they will only be in the vicinity of such a farm.

[2] Q Fever among Culling Workers, the Netherlands, 2009–2010, Whelan et al., Emerging Infectious Diseases.

Further information on this point can be found in the folders of practical and background information for entrepreneurs/employers/principals and employees on healthy work practices and the prevention of Q fever, available (only in Dutch) from:
http://toolkits.loketgezondleven.nl/infectieziekten/?page_id=29#link_2888
and: http://www.kiza.nl/content/q-koorts-praktische-folder-ondernemers-werknemers-en-stagiares

Shigellosis

Total number of notifications in Osiris in 2010	358	
Work-related notifications	12	(3.4%)
Contracted in the Netherlands or abroad?	the Netherlands abroad	1 11
Sex	Male Female	7 5
Age distribution	20 – 29 30 – 39 40 – 49 50 – 59 60 – 69	3 1 3 3 2
Hospitalized	Yes No	0 12
Deceased	Yes No	0 12
Sector / occupation	3 aviation 3 industry / business trip 1 healthcare sector 1 children's day care center 1 transport (international lorry driver) 1 air force 1 police 1 unemployed; infection contracted in the Netherlands	

Burden of disease and transmission route
Shigellosis is a serious intestinal infection caused by one of the Shigella bacteria, of which there are several types. Cases that manifest themselves in the Netherlands are usually the result of infections contracted abroad. Exposure occurs through direct contact with the faeces of infected persons, but may also be contracted indirectly through food or drink contaminated by an infected person. Transmission can also occur via contaminated articles. The infection is spread via the faecal-oral route, and even the smallest dose can be enough to make a person ill.

Work-related infection
People who travel to areas where the hygienic conditions are poorer than at home run the risk of infection during their work activities or during their stay in those areas. The work-related infections were contracted outside the Netherlands. The people concerned had very diverse working environments.

Recommendation
Employees who travel to parts of the world where hygienic conditions are poor must be made aware of the infectious diseases they might contract. Employees should be provided with proper information about the severity of the disease, the necessity of taking good hygiene measures and the use of supplementary preventive measures.

STEC/EHEC infection

Total number of notifications in Osiris in 2010	396	
Work-related notifications	3	(0.8%)
Contracted in the Netherlands or abroad?	the Netherlands abroad	2 1
Sex	Male Female	2 1
Age distribution	10 – 19 20 – 29 30 – 39 40 – 49 50 – 59 60 – 69	0 1 0 1 1 0
Hospitalized	Yes No	0 3
Deceased	Yes No	0 3
Sector / occupation	Veterinarian Hospitality/catering industry (chef) Healthcare (student nurse during work experience placement)	

Burden of disease and transmission route
Shiga toxin producing *E. coli* strains (STEC) can cause hemorrhagic colitis in humans. Hemorrhagic colitis is a type of gastroenteritis in which certain strains of the *Escherichia coli* (E. coli) bacteria infect the large intestine, producing a toxin that causes the sudden onset of bloody diarrhoea and in some cases other serious complications. An infection with STEC can also progress without symptoms, or with only mild diarrhoea.
There was a recent outbreak of this bacteria in Germany (May, June 2011).

Work-related infection
People are at risk of becoming infected following contact with infected livestock and their excrement, through eating insufficiently heated or raw beef, or drinking unpasteurized milk. Contact with, or the consumption of, products that have been in contact with livestock excrement can also lead to infection.
Employees who might be exposed include zoo keepers and other staff, veterinarians, farmers, abattoir workers and meat processors.
Employees in the healthcare sector can also become infected through their intensive contact with patients.

Recommendation
Employees who might be exposed to infected livestock and their excrement or to infected foodstuffs should be informed about the risks and the correct hygiene measures (hand and toilet hygiene) that need to be taken. They must also be provided with appropriate personal protection (gloves, aprons, etc.).

Tetanus

Total number of notifications in Osiris in 2010	2	
Work-related notifications	1	(50%)
Contracted in the Netherlands or abroad?	the Netherlands	1
Sex	Male Female	1 0
Age distribution	70 – 79	1
Hospitalized	Yes No	1 0
Deceased	Yes No	0 1
Vaccinated	Yes No	0 1
Sector / occupation	Working with animals or animal products (sheep farmer)	

Burden of disease and transmission route
Tetanus is a serious infectious disease that can be fatal if left untreated. The disease causes muscular cramps and can lead to severe respiratory problems. Tetanus is caused by the *Clostridium tetani* bacteria. The source of a *C. tetani* infection is usually dust, street refuse or animal excrement (especially horse manure). Spores or bacteria enter the body via wounds on the skin or the mucous membranes. Tetanus can also be contracted through tiny accidental pinpricks, such as those that happen when gardening, and many cases of tetanus occur precisely because such minor prick wounds are not taken seriously. People with larger wounds usually ask for a tetanus vaccination or booster. An animal bite can also lead to a tetanus infection.
The risk of contracting tetanus is greater if the host's immunity is reduced. Full recovery is possible if effective treatment is given promptly.

Vaccination
Immunization against tetanus is part of the national vaccination programme in the Netherlands, whereby children receive a cocktail of vaccines against diphtheria, whooping cough, tetanus and polio. An initial vaccination or booster with tetanus toxoid provides almost 100 percent protection for at least ten years, probably longer.

Work-related infection
People whose work involves more risk of incurring wounds and coming into contact with tetanus spores - e.g. waste and refuse collectors (especially of biological refuse and waste), street cleaners, those who work in the soil, landscape gardeners, farmers and market gardeners, veterinarians and people who have intensive contact with horses - have a greater risk of contracting the disease.

Recommendation
Vaccinations should be offered alongside appropriate personal protective measures for avoiding wounds. On entering service, new employees should be tested to ascertain whether they have sufficient immunity against tetanus. In addition, a ten-yearly booster vaccination should be offered to employees with an increased risk of infection.

Creutzfeldt-Jakob disease (classic CJD)

Total number of notifications in Osiris in 2010	26	
Work-related notifications	1	(3.8%)
Contracted in the Netherlands or abroad?	the Netherlands	1
Sex	Male Female	0 1
Age distribution	70 – 79	1
Hospitalized	Yes No Unknown	0 0 1
Deceased	Yes No Unknown	0 0 1
Sector / occupation	Worked as a cashier in adolescence	

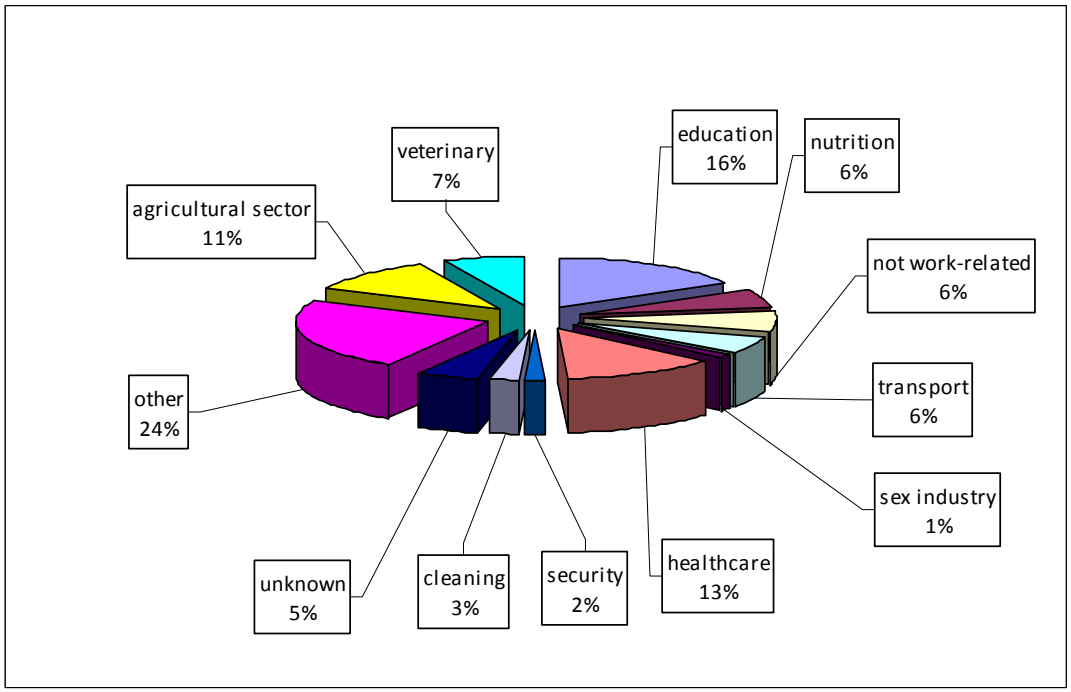
Burden of disease and transmission route
In most cases (85%) it is impossible to pinpoint the cause of CJD Classic. In addition, the disease tends to run in families (10-15%) and it can occur as the result of infection during medical treatment (2-5%).
It is therefore unlikely that this patient contracted the disease during her work as a cashier.

Conclusion
It is possible that the question of whether the patient contracted the disease during the course of his/her work is not always answered or interpreted correctly.

Appendix 4 Sectors in Osiris

In August 2009, extra questions were added to Osiris about the occupation, the work activities and the sector in which the patient was engaged. The pie chart above provides an overview of the various sectors in which employees were active.

Figure 7 Overview of sectors



Work-related notifications particularly concern four sectors: education (16%), healthcare (13%), agriculture (11%) and the veterinary sector (7%).
The infectious diseases most commonly contracted by employees in healthcare are:

- Hepatitis B (e.g. employees involved in needle stick accidents)
- Whooping cough (e.g. employees in GP surgeries, mother and baby clinics, mental healthcare and children's wards in hospitals)
- Malaria (e.g. aid worker, nurse)

The diseases contracted more often in the education sector are:

- Mumps (e.g. by people working in an environment where there are many students)
- Hepatitis A
- Whooping cough

The infectious diseases contracted in the agricultural sector include:

- Q fever (e.g. employees at sheep and goat farms, employees supervising clearances)
- Malaria (e.g. forestry, wood industry, arable farming)
- Leptospirosis (e.g. arable farming)

Infectious diseases contracted during work related to animals:

- Psittacosis (e.g. employees of bird sanctuary, pet shop, veterinary clinic)
- Q fever (e.g. veterinarians)
- Leptospirosis (e.g. employees at fish farm, zoo keeper).

Appendix 5 Work-related notifications in Osiris (2007-2010)

Table 7 Work-related notifications in Osiris for the period 2007 through 2010

Infectious disease	2007	2008	2009	2010
Anthrax	-	-	-	-
Mumps	-	-	2	19
Botulism	-	-	-	-
Brucellosis	-	-	-	-
Typhoid fever	1	1	-	1
Cholera	-	-	1	-
Diphtheria	-	-	-	-
Yellow fever	-	-	-	-
Hantavirus infection	-	-	3	-
Hepatitis A	1	7	8	7
Chronic hepatitis B	8	5	-	15
Acute hepatitis B	-	2	14*	4
Acute hepatitis C	1	1	-	-
Human infection with avian influenza virus	-	-	-	-
Invasive group A Streptococcal infection	-	-	2	2
Invasive haemophilus influenzae type b infection	-	-	-	-
Childhood invasive pneumococcal disease (up to 5 years of age)	-	-	-	-
Polio	-	-	-	-
Whooping cough	-	-	29	48
Legionnaire's disease	-	-	13	-
Leptospirosis	5	2	4	4
Listeriosis	-	-	-	1
Malaria	28	28	34	26
Measles	3	1	1	1
Meningococcal disease	-	-	1	-
MRSA infection (clusters outside hospitals)	-	-	-	1
New Influenza A (H1N1) 2009	-	-	-	-
Paratyphoid A fever	-	-	-	-
Paratyphoid B fever	-	-	-	-
Paratyphoid C fever	-	-	1	-
Plague (bubonic)	-	-	-	-
Smallpox	-	-	-	-
Psittacosis	2	3	5	8
Q fever	-	31	78	35
Rabies	-	-	-	-
German measles (rubella)	-	-	-	-
Severe acute respiratory syndrome (SARS)	-	-	-	-
Shigellosis	10	10	9	12
STEC / EHEC infection	-	-	4	3
Tetanus	-	-	1	1
Trichinosis	-	-	-	-
Viral hemorrhagic fever	-	-	-	-
Food poisoning	3	4	-	-
West Nile virus	-	-	-	-
Creutzfeldt-Jakob disease (classic)	-	-	-	1
Variant Creutzfeldt-Jakob disease	-	-	-	-

* acute and chronic hepatitis

Appendix 6 Infectious diseases in 2010 - NCvB

The Netherlands Center for Occupational Diseases (NCvB) is a center of expertise for occupational health and safety professionals, associations of employers and employees, government agencies and policy makers. One of the tasks of the NCvB is to record and monitor occupational diseases by means of the national reporting and registration system. Occupational physicians must report occupational diseases to the NCvB by virtue of Article 9 of the Working Conditions Act. The aim of the registration system is to use the resulting overview to improve the quality of prevention, early diagnosis, treatment and patient counselling in work-related situations.

The system provides information on the incidence and spread of occupational diseases and highlights associated trends. It can also highlight new occupational diseases. Between 5500 and 6000 reports are submitted to the NCvB each year. Occupational infectious diseases represent only a small proportion of all reported occupational diseases. In the ten years up to the end of 2010, a yearly average of 110 notifications of work-related infectious diseases were reported. The total of 89 reports submitted in 2010 was lower than in previous years.

Table 8 Reports of occupational diseases in NCvB's national registration system from 2002 to 2010

	2002	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Intestinal infections	11	16	26	72	21	18	40	57	20
Tuberculosis #	42	25	19	21	24	12	15	20	18
Malaria	9	1	9	6	8	0	5	8	4
Skin infections	11	18	39	37	9	10	13	13	13
Zoonoses **	5	11	4	4	0	26	10	1	2
Q fever								12	4
Lyme disease	3		16	12	6		10	8	6
HIV	0	1	5	4	0	0	5	1	0
Hepatitis B	3	2	5	0	4	1	2	4	1
Respiratory infections	2	10	0	3	6	1	0	11	4
Hepatitis A					1	1			0
Legionnaire's disease	2	2	1		1		1	1	0
Hepatitis C	1		1		2		5		0
Hepatitis E									1
Tropical diseases									3
Inflammation of the eye									2
MRSA &									5
PEP-HIV $									1
Various									5
	108	114	143	183	111	110	117	156	89

Including Mantoux conversions and positive Interferon Gamma Release Assay results** Zoonoses, other (2 x Brucellosis)
& MRSA carriership; No disease
$ anti-HIV post-exposure prophylaxis

Table 9 Notifications of infectious diseases registered in 2010, by economic sector

Sector	**Notifications**	
	N	**%**
Human healthcare	39	43.8
Civil engineering (roads and hydraulic engineering)	8	9.0
Public administration and armed forces	7	7.9
Veterinary service	6	6.7
Homes/Hostels	4	4.5
Extraterritorial organizations and bodies	4	4.5
Foodstuffs production	3	3.4
Construction (buildings)	3	3.4
Education	3	3.4
Crop cultivation, livestock breeding, hunting and services associated with such activities	2	2.2
Specialized construction work	2	2.2
Associations and clubs	2	2.2
Manufacture of metal products, excluding machinery and equipment	1	1.1
Manufacture of machinery, equipment and tools (not covered elsewhere)	1	1.1
Aviation	1	1.1
Accommodation provider	1	1.1
Computer programming, consultancy and related activities	1	1.1
Other independent professionals and other scientific and technical activities	1	1.1
Total	89	100.0

Appendix 7 Registrations of tuberculosis at the KNCV

Besides Osiris and the registration system operated by the NCvB, there is also a specific registration system for the infectious disease tuberculosis. Tuberculosis is a notifiable disease pursuant to the Dutch Public Health Act. Unlike the other notifiable infectious diseases, cases of tuberculosis are not registered in Osiris but in the Netherlands Tuberculosis Register (NTR) maintained by the Royal Netherlands Tuberculosis Foundation (KNCV).

The regional Public Health Services (GGDs) have their own tuberculosis prevention and control programmes. Each year the various GGD departments screen approximately 10 000 - 12 000 workers who come into contact with people from tuberculosis risk groups in the course of their work. They are screened for the presence of an active or latent tuberculosis infection. Notifications of tuberculosis patients reported to Osiris by the regional GGDs are passed on to the KNCV Tuberculosis Register.

Since 2005, the registrations have been divided into four categories of professionals whose work brings them into regular contact with people from the risk groups. These occupational categories are: employees in the healthcare sector, employees in the welfare sector, employees (and volunteers) in refugee work, asylum seeker reception and the administration of justice sector, and employees in other affected sectors.

Table 10 Occupational contact with risk groups

	Occupational contact with risk groups (KNCV)*		**Occupational infection with tuberculosis reported to NCvB**
	with active TB	**with latent TB infection (LTBI)**	
2005	12	105	20
2006	3	76	23
2007	9	94	12
2008	11	83	9
2009	8	70	15
2010	**	**	4

Source:

** surveillance reports from the KNCV on the tuberculosis situation in the Netherlands*

***Tuberculosis in the Netherlands 2010 is not yet been published*

A total of 1157 TB patients were reported to the NTR during 2009. That figure is 16 percent higher than in 2008. Of the 8 employees who contracted tuberculosis in the course of their work activities, 6 were employed in healthcare, 1 in welfare and 1 in the asylum seeker reception chain.
According to the KNCV's surveillance reports, between 3 and 19 employees who work with risk groups contract tuberculosis each year. However, far more employees are exposed to the disease, and far more infections are contracted that do not lead to full-blown tuberculosis. This can be seen from the number of latent tuberculosis infections found under the occupational contacts with risk groups. The increase of multiresistant tuberculosis and the cessation of the overall downward trend combine to make tuberculosis a disease that must continue to receive attention in the future.

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