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

Surveillance of work-related infectious diseases

Analysis 2011

RIVM Letter Report 205555003/2012
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Abstract

Surveillance of work-related infectious diseases in the Netherlands
Analysis 2011

In the Netherlands, employers have to ensure that their employees can carry out their working tasks in a safe and healthy work environment. Employees should not experience any damaging health effects from exposure or possible exposure to pathogens. In some professions, due to the nature of the work, employees may be at increased risk of coming into contact with disease-causing micro-organisms. In order to gain an impression of the type and number of infectious diseases that may be contracted at or during work, the National Institute for Public Health and the Environment (RIVM) makes an analysis of the work-related infectious diseases reported for each year. Such an analysis is commissioned by the Ministry of Social Affairs and Employment (SWZ).

High-risk work environment
In 2011 there were 337 notifications registered in the two premier registration systems for work-related infectious diseases: the registration system of the Netherlands Center for Occupational Diseases (NCvB) and the CIb registration system Osiris in which notifiable infectious diseases are registered in accordance with the Public Health Act [*Wet Publieke Gezondheid*, Wpg]. The risk of contracting an infectious disease whilst at work was found to be highest in the sectors of healthcare, education and agriculture. It is expected that nowhere near all infectious diseases contracted in the work environment have been recorded in the registration systems. In spite of this, the registrations do serve as a useful pointer.

The type and number of reported infectious diseases for 2011 largely correspond with those reported in previous years. In 2011 the work-related infectious diseases reported by laboratories and the Municipal Public Health Services (GGD) to the Osiris register affected 193 employees. These reports were mainly for whooping cough, legionella, mumps and malaria. Occupational physicians reported 141 employees with work-related infectious diseases to the NCvB register. These reports were mainly for intestinal infections, skin infections and tuberculosis (including infection with tuberculosis bacteria whereby no symptoms arose).

More insight needed into work-related infectious diseases
Further investigation of the higher risk sectors is necessary if we are to acquire better insight into the prevalence of the various types of infectious diseases in the high-risk sectors. Armed with such information, employees and employers alike will be better able to pinpoint possible exposure situations and transmission routes, and take effective preventive measures.

Keywords:
Employees, infectious disease, work, working conditions, biological agents, Osiris, NCvB, surveillance, health & safety

Rapport in het kort

Surveillance Arbeidsgerelateerde Infectieziekten
Analyse 2011

Werkgevers moeten ervoor zorgen dat hun werknemers veilig en gezond hun werk kunnen uitoefenen en dus geen nadelige gezondheidseffecten ondervinden door (mogelijke) blootstelling aan ziekteverwekkers. In bepaalde beroepen kunnen werknemers door de aard van hun werkzaamheden een verhoogde kans hebben om met ziekteverwekkende organismen in contact te komen. Om een beeld te krijgen van de infectieziekten die werknemers tijdens het werk kunnen oplopen (type en aantal), analyseert het RIVM jaarlijks het aantal gemelde arbeidsgerelateerde infectieziekten. Dit gebeurt in opdracht van het ministerie van Sociale Zaken en Werkgelegenheid (SZW).

Risicovolle werkomgeving
In 2011 zijn 337 meldingen geregistreerd in de twee belangrijkste registratiesystemen van arbeidsgerelateerde infectieziekten: het registratiesysteem van het Nederlands Centrum voor Beroepsziekten (NCvB) en het CIb-registratiesysteem Osiris waarin volgens de Wet publieke gezondheid (Wpg) meldingsplichtige infectieziekten worden geregistreerd. De kans om tijdens het werk infectieziekten op te lopen blijkt het hoogst in de gezondheidszorg, het onderwijs en de agrarische sector. Naar verwachting worden in de registratiesystemen lang niet alle infectieziekten gemeld die zijn opgelopen in de werkomgeving. Desondanks hebben de meldingen een signaalfunctie.

De gemelde infectieziekten komen in grote lijnen overeen met de registraties van de afgelopen jaren. In 2011 hebben laboratoria en GGD'en 193 werknemers met arbeidsgerelateerde infectieziekten geregistreerd in Osiris. Het gaat daarbij vooral om kinkhoest, legionella, bof en malaria. Bedrijfsartsen hebben 141 werknemers met infectieziekten gerelateerd aan het werk gemeld bij het NCvB. Het betreft voornamelijk darminfecties, huidinfecties en tuberculose (inclusief besmettingen met tuberculosebacteriën zonder ziekteverschijnselen).

Meer inzicht nodig op arbeidsgerelateerde infectieziekten
Om meer zicht te krijgen op de mate waarin uiteenlopende typen infectieziekten voorkomen, is nader onderzoek in de risicovolle sectoren nodig. Werknemers en werkgevers kunnen met deze informatie zicht krijgen op mogelijke blootstellingsmomenten en transmissieroutes, waardoor zij preventieve maatregelen kunnen nemen.

Trefwoorden:
Werknemers, infectieziekten, werk, arbeidsomstandigheden, biologische agentia, Osiris, NCvB, surveillance, arbo

Contents

Summary

Each year, at the request of the Ministry of Social Affairs and Employment, RIVM draws up an overview of work-related infectious diseases. The basis for this overview are the reports submitted to the RIVM's own registration system, Osiris, and to the database of occupational diseases operated by the Netherlands Center for Occupational Diseases (NCvB).

In terms of infectious diseases, employees form a specific group within the general population. Because of the nature of their work, employees in certain sectors can have a greater exposure to pathogenic agents. As a result, the risk of exposure for these employees can be quite different from that applicable to 'normal' social conditions and their work can have a detrimental effect on their health.

In 2011, 193 cases of employees with infectious diseases that are notifiable pursuant to the Public Health Act were reported to the Osiris registration system. This represents a slight increase in comparison with 2010, when 189 such notifications were received. Most frequently reported are whooping cough, legionella, mumps and malaria.
In the NCvB's registration system for occupational diseases, 141 new cases of employees with a work-related infectious disease were reported in 2011. This is higher than in 2010, when 89 such notifications were received. Occupational physicians reported mainly intestinal infections, skin infections and infection with tuberculosis bacteria, whether or not these resulted in actual symptoms of tuberculosis (latent or active tuberculosis).

Malaria, whooping cough and mumps have been the most frequent causes of reports to Osiris in the past five years. In the period from 2008 to 2010 there was a manifest increase in work-related Q fever cases, as a result of the Q fever outbreak. In 2011, however, there was a reduction in both the absolute number of Q fever cases and the work-related cases.
The reports to Osiris suggest that legionella also has a correlation with work. In addition, zoonoses such as Q fever, psittacosis and leptospirosis also account for a significant proportion of the work-related infectious disease notifications.

Employees in the healthcare (hospitals, ambulance, mental health), education (mainstream education and child-care) and the agricultural sector (arable and livestock farming) have been found to be the most susceptible to contracting an infectious disease in the course of their work. Working in the food processing industry or forestry, and either travelling abroad or actually working outside the Netherlands also increases the risk of contracting a work-related infectious disease (1,2,3) but risk levels have remained fairly stable in recent years.
More than half the reports submitted to the NCvB originate from the care and healthcare sector. Roughly equal numbers of cases of employees from the care sector and education sector are reported to Osiris, both accounting for approximately one quarter of all submissions. The agricultural and veterinary sectors account for another 15% of reports.
Most commonly reported from the healthcare sector are whooping cough, malaria, intestinal infections and latent or active tuberculosis, whereas whooping cough and mumps are the most reported infectious diseases in the education sector. In the agricultural and veterinary sector, psittacosis, Q fever and leptospirosis are the diseases most commonly related to work.
There is a clear difference between Osiris and the NCvB's registration system with regard to the proportion of cases reported as relating to work outside the

Netherlands. In Osiris, nearly one-third of notifications concern diseases (e.g. malaria and shigellosis) contracted during a period of working or living abroad, while only a small number of notifications to the NCvB stem from working abroad.

The reports to both Osiris and to the NCvB provide only a limited view of the number of infectious diseases that are actually contracted because of or during work activities. It is not known how many employees actually contract an infectious disease through their work. The notifications do, however, indicate that a wide range of infectious diseases can be contracted by employees in the course of their work. This provides employees and employers with information about the type of infectious disease they might contract. They can also acquire better insight into possible exposure situations, transmission routes and preventive measures.

It is important to determine whether the work-related infectious diseases reported to Osiris and the NCvB are truly representative. It is recommended that more intensive surveillance be carried out in the care and healthcare, education, and agricultural/veterinary sector in order to ascertain whether the Osiris and NCvB surveillance systems provide an accurate view of the reality.

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 an impression of the number of notifications and the type of infectious diseases contracted at or during work in 2011. 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]. In addition, the Netherlands Center for Occupational Diseases (NCvB) has made available the data on infectious diseases from its own registration system.
In submitting this report to the NCvB and the Netherlands Focal Point of the European Agency for Safety and Health at Work (EU-OSHA), we are making the information in this report accessible to occupational health and safety professionals in the Netherlands and in the other European member states. The NCvB can use the information when compiling its report entitled 'Statistics on Occupational Diseases' which summarises the prevalence of occupational diseases in the Netherlands.

A large proportion of the overall man-hours lost through short-term incapacity of employees, and the resulting loss of productivity through illness or reduced deployability, can probably be attributed to infectious diseases (4). Moreover, employees who continue to work while they have an infectious disease are putting their co-workers, customers, patients and the general public at risk if the pathogen is transmissible from human to human (5).

Employers are under an obligation to provide a safe and healthy working environment for their employees. The Working Conditions Decree [*Arbobesluit*] and working conditions policy rules provide Dutch employers with guidelines to prevent their employees becoming ill from biological agents. As part of a Risk Inventory and Evaluation, employers must assess the risk of exposure to biological agents and take measures at the moment that there is a possibility of employees being exposed to them.

Employers and employees are, however, insufficiently aware of the risks of exposure to biological agents and fail to recognise the true importance of preventive measures. The consequences of exposure during work activities often only become evident at a later date; this is one of the reasons why both employers and employees fail to make the connection between work and any detrimental health effects they may experience.

It is not always possible to avoid employees being exposed to pathogens during the course of their work. Whether the employee becomes ill as a result depends on the degree of exposure and the nature of the pathogen. The type of work is another determining factor (intensive contact, air-borne particles), as is the use of protective equipment and the individual physiology of the employee. Certain groups of employees will be more vulnerable; they include pregnant women, older employees, or those who are immunocompromised.

Since August 2006, surveillance reports have been drawn up of the work-related infectious diseases registered in both Osiris and the NCvB's database.

Besides giving the statistics for 2011, the report presented here also offers a summary of data from the past five years.

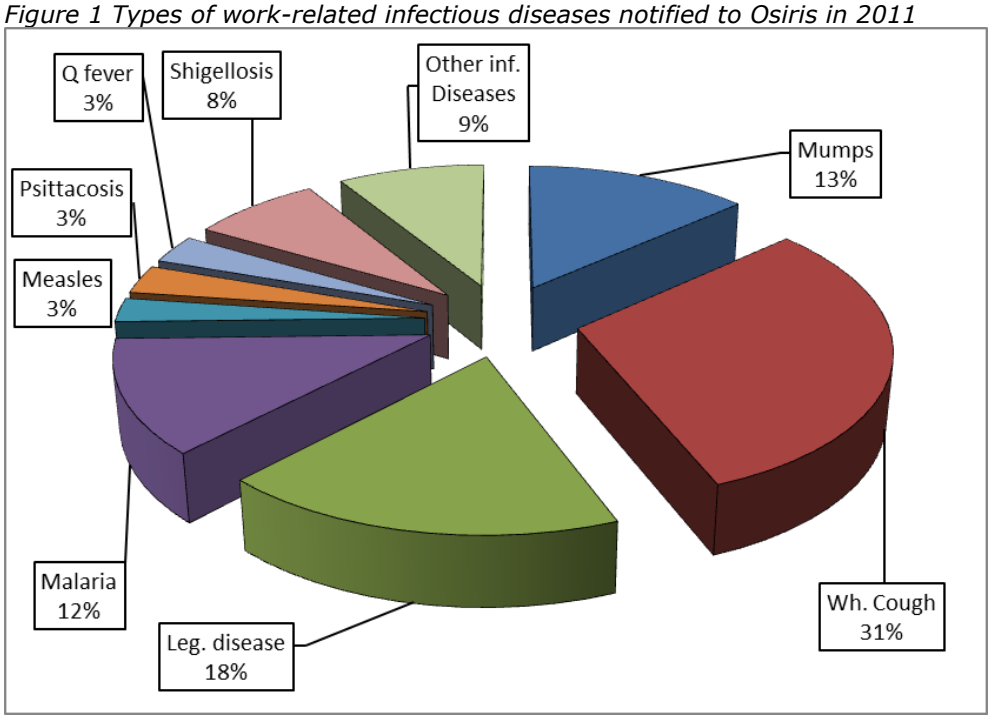
Reading guide
This report is set out as follows: The data from Osiris and from the NCvB registration system will be discussed in chapter 2. Chapter 3 looks at the trends of the past five years. Chapters 4 and 5 set out various conclusions and recommendations. In the Appendices you will find a review of the information from Osiris (App. 1 through 3) and the NCvB (App. 4), supplemented by information from the KNCV Tuberculosis Foundation (App. 5). Appendix 6 gives an overview of the literature which provided further background information.

2 Data from Osiris and from the NCvB registration system

2.1 Osiris

Osiris is the name of the registration system used by the municipal Public Health Services (hereafter GGDs) to record notifiable infectious diseases as required by the Dutch Public Health Act [*Wet Publieke Gezondheid*]. In the course of 2011, GGDs submitted reports on 42 different notifiable infectious diseases (see App. 2).
A total of 11,868 notifications were registered in Osiris in 2011. In 193 cases (1.6%), a link could be made with the patient's occupational practice. The number of notifications of infectious diseases that can be linked to work activities is increasing. In 2009 and 2010 the number of work-related notifications was 154 and 189 respectively. The increase in 2011 is primarily attributable to the number of reported cases of Legionnaires' disease, which had not been included in the registration system in previous years.
Whooping cough, legionella, mumps and malaria were the most commonly reported work-related infectious diseases in 2011 (see figure 1). Together they account for three-quarters of all work-related notifications.

Figure 1 Types of work-related infectious diseases notified to Osiris in 2011



The sectors most commonly involved are education (29%), healthcare (22%) and the agricultural/veterinary sector (11%). The high percentages in the healthcare sector and in education can partly be explained by the large number of cases of whooping cough and mumps reported in those sectors.
In contrast, in the agricultural/veterinary sector, the reports more often concerned zoonoses (psittacosis, leptospirosis and Q fever).
There was a significant decline in the number of cases of work-related Q fever infections in 2011, falling to just 6, while there had been 78 and 35 reports in 2009 and 2010 respectively.

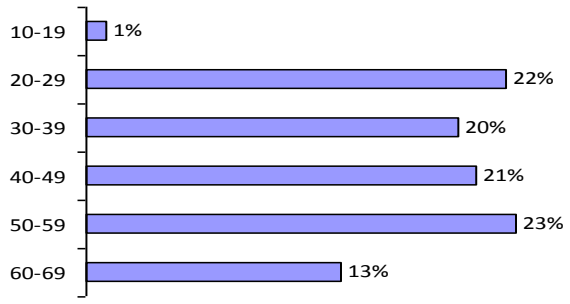
A large proportion (29%) of the work-related notifications in Osiris were connected to working or living outside the Netherlands. Malaria and shigellosis account for a large proportion of the work-related infections reported as being contracted abroad (19% altogether).

Age and sex

Work-related infectious diseases are reported more often for men than for women. Leptospirosis, legionella, mumps and malaria are all reported mainly for men, although no cut and dried explanation for this can be given. The reason could be that some infectious diseases cause more complications when contracted by men (e.g. mumps-associated orchitis) rather than by women and thus become more evident. Women, on the other hand, are more often reported as having contracted a work-related whooping cough infection. Such notifications often relate to employees in the healthcare and education sectors. The fact that more cases of women with a whooping cough infection are reported can perhaps be explained by the fact that relatively more women are employed in those two particular sectors.
The notifications submitted to Osiris are fairly evenly spread over the various age categories (table 1), and this corresponds with the spread of the notifications to the NCvB.

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

Age	Number	Percentage
10 – 19	2	1
20 - 29	43	22
30 – 39	38	20
40 – 49	40	21
50 – 59	44	23
60 – 69	26	13



Hospital admission and mortality

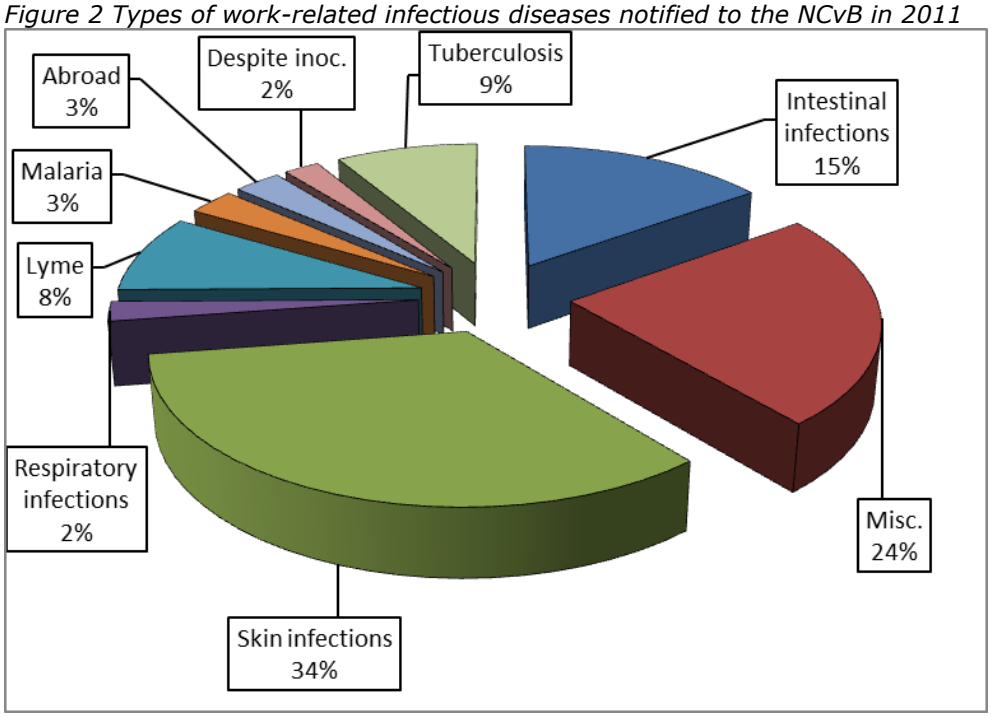
Hospitalization was necessary in 36% percent of the work-related cases reported to Osiris. No notifications of death following a reported infectious disease were submitted to Osiris in 2011.

2.2 Netherlands Center for Occupational Diseases

The Netherlands Center for Occupational Diseases (NCvB) is a centere 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 surveillance of work-related illnesses. Between 5500 and 6000 occupational diseases are reported to the NCvB each year; only a small proportion of these reports concern infectious occupational diseases.

In the course of 2011, occupational physicians reported 141 cases of infectious occupational diseases to the NCvB; this is an increase in relative terms of 36% compared to 2010 (89 cases), but much lower than 2009 (156 cases). A large part of the increase is attributable to a number of group reports: a scabies outbreak in a hospital, a norovirus outbreak in a residential home for the elderly, and complications following flu vaccinations in a hospital.
Most of the reports originate from the curative healthcare sector (62%), nursing homes (16%) and forestry (4%). The NCvB mainly registered cases of intestinal infections, skin infections and infection with tuberculosis bacteria - whether or not these resulted in actual symptoms of tuberculosis - that were connected with the patient's work (see figure 2). Most of the reports of TB and intestinal infections concern employees in the healthcare sector.
A large proportion of the reports of employees with active or latent TB arose from pre-employment medical examinations. With a view to preventing further infection, new employees in the healthcare sector are tested to see whether they have or have ever had a tuberculosis infection.

Figure 2 Types of work-related infectious diseases notified to the NCvB in 2011



Other than is the case in Osiris, the NCvB records not only a case of actual infection but also exposure to infection. This means that infections that cause no symptoms - such as MRSA carriership and latent TB - are also included in the reporting and registration system.

2.3 Comparison of Osiris and the NCvB's registration system

In 2011, no less than 193 notifications to Osiris mentioned that the disease had probably been contracted during work activities. In that same period, 141 occupational infectious diseases were reported to the NCvB.
This illustrates the differences between notifications submitted for registration in Osiris and to the NCvB. Underlying reasons include:

- Notifications are made for different reasons: infectious diseases notifiable by virtue of the Public Health Act (Osiris) versus notification on the basis of an obligation imposed by the Working Conditions Act (NCvB)
- 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 (NCvB).
- The focus of registration is different: Osiris registers diseases where the causal agent is detailed; the NCvB registers more general information, often on the basis of the organ affected rather than the disease and its potential origins.
- Any possible relationship with work is registered from a different perspective: in Osiris, an affirmative answer to a question about work is enough to flag the notification as work-related; NCvB notifications pass through a five-stage filter before they are determined as an occupational disease.

Under-reporting occurs in both systems, as illustrated by other studies carried out in particular sectors. It is known, for example, that between 13,000 and 15,000 needle stick accidents occur annually, 95% of which take place in the working environment (6). For employees, such accidents represent a risk of contracting blood-transmissible infectious diseases.
According to the results of a study carried out by Stigas (health & safety consultants for the agricultural sector), 15% of the landscape gardeners and 36% of the employees at the Nature & Forest Agency [*Bos en Natuur*] had at some time been treated for Lyme disease after a tick bite during work activities (7).
However, only a small proportion of the needle stick accidents and the cases of employees contracting Lyme disease in the course of their work are ever reported to the NCvB.

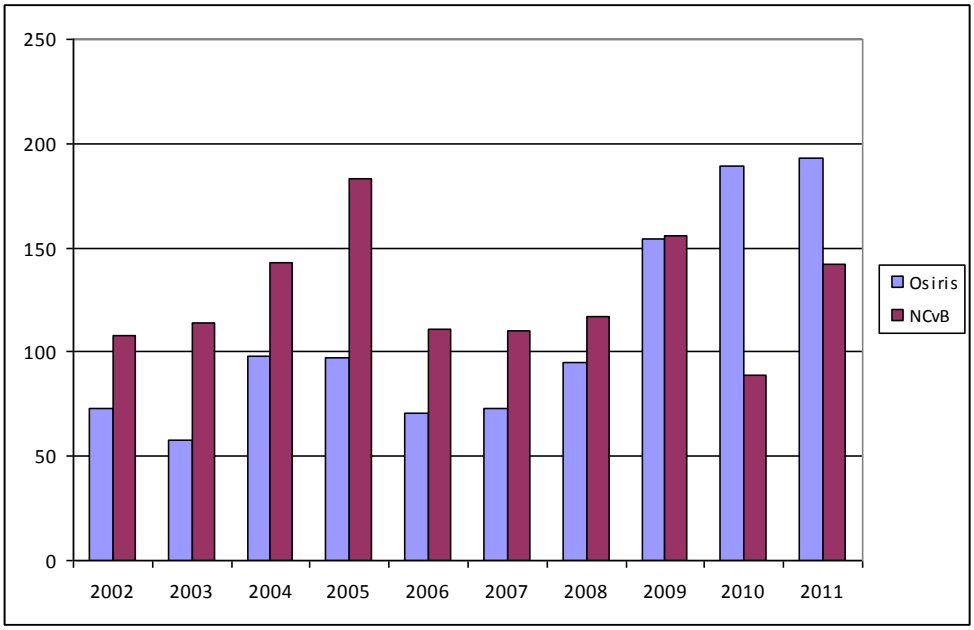
One consequence of such under-reporting is that it is impossible to obtain an accurate picture of the true number of employees who contract work-related diseases; this applies equally to the NCvB's system and to Osiris. But despite the fact that the picture may not be complete, both registration systems do provide some insight into the prevalence of infectious diseases in relation to work in the Netherlands.

3 Trends

Introduction
Since August 2006, surveillance reports have been drawn up of the work-related infectious diseases registered in both Osiris and the NCvB's database. The data collected over the past five years is collated in this chapter in order to acquire insight into possible trends. Which infectious diseases have been most prevalent in connection with work in the past five years? And in which sectors do employees typically have the greatest exposure to pathogens?
The data for the five years under review can be found in table 5 in Appendix 1 and in table 7 in Appendix 4.

The number of work-related notifications submitted to Osiris has increased steadily each year since 2006. One possible explanation for this increase is that GGDs have become more conscious of the real or at least possible relationship between work and contracting infectious diseases.
Even though more notifications were received in 2011 than in 2010, the number of notifications to the NCvB in recent years does not show such a clear upward trend (as can be seen in table 3 below).

Figure 3 Comparison of work-related notifications to Osiris and to NCvB (2002 - 2011)



The registration systems
More than 30 different infectious diseases have been reported to both registration systems over the past five years.
There is only limited overlap between the two systems, partly because Osiris records only notifiable infectious diseases pursuant to the Public Health Act and the NCvB records all infectious diseases that have any connection whatsoever to the work that a person does.
By making use of both registration systems, it is possible to acquire a broader insight into the infectious diseases that can affect the working population in the Netherlands.

Trendspotting
Both Osiris and the NCvB's occupational diseases registration system receive relatively few reports of work-related infectious diseases. The small number of reports to both registration systems makes it difficult to draw any real conclusions about outbreaks or trends.
Any increase, albeit temporary, can often be attributed to enhanced media attention. This is particularly noticeable in Osiris: a surge of media attention for Q fever and the New Influenza A virus (H1N1) prompted increases in the number of notifications. There was a noticeable increase in the number of work-related notifications during the Q fever outbreak in 2008 and again during the New Influenza A (H1N1) outbreak in 2009.
It is to be expected that there will be a larger number of employees with a work-related infectious disease than is suggested by the number of notifications. Despite the fact that there is no comprehensive picture of the number of infectious diseases contracted during work activities, the notifications can still be used as the basis for concrete actions or recommendations.

Types of infectious diseases
Both Osiris and the NCvB's registration system provide insight into the infectious diseases that might be contracted while a person is at work. In the past five years, the diseases most frequently reported to the NCvB have been gastro-intestinal infections (particularly norovirus infections) followed by skin infections (particularly MRSA and scabies), latent or active tuberculosis, and Lyme disease. In absolute terms, malaria, whooping cough and mumps have been the most frequent causes of reports to Osiris in the same period. Mumps and whooping cough have only actually been reported during the past two years. Mumps notifications to Osiris have increased in this period in absolute terms as well. The question about a connection with the patient's work has only been included in the whooping cough questionnaire since 2010.
In the period from 2008 to 2010 there was a clear increase in the number of work-related Q fever cases; this coincides with the outbreak of Q fever in the same timeframe.
The small number of notifications does, however, result in a wide spread of data for any particular year, and this makes it more difficult to draw accurate conclusions.

Number of work-related notifications
Notifications made to the Netherlands Center for Occupational Diseases (NCvB) concern, by definition, diseases contracted during or because of work activities. Osiris records only notifiable infectious diseases, in accordance with the Public Health Act, irrespective of the situation in which the disease was contracted. The percentage of notifications to Osiris whereby the disease is reported as having been contracted during work activities varies, according to the disease, between 0.1% and 15%. Zoonoses (including leptospirosis, ornithosis/psittacosis and Q fever) are relatively more often connected with work activities.
However, even a relatively large proportion (approx. 10%) of cases of diseases such as legionella and malaria occur during or are connected with the patient's work. Malaria is always contracted during work activities outside the Netherlands. Employees who contracted Legionnaire's disease in connection with their work were employed in various sectors, including transport and the maintenance of green spaces.
Relatively few cases of hepatitis B and whooping cough, only a small proportion of the total notifications, were reported as being connected with work activities. In the case of hepatitis B, the low number can be attributed to full compliance with the needle stick accident protocol and the high level of immunization

among healthcare sector employees which helps fend off infection. The fact that it is so difficult to pinpoint the source of an infection may be one of the reasons why only a small percentage of employees reported that they had contracted whooping cough during their work.

Sectors

Since August 2009, notifications to Osiris have included a section about the patient's working environment (sector, profession, work activities). This has provided a fair impression of the occupational sectors in which notifiable and other infectious diseases can play a role. Previously, such information could only be obtained - and then to a limited degree - by reviewing the possible source or location of infection.

The NCvB's registration system requires occupational physicians to report not only the infectious disease but also the sector in which the patient is employed. Work-related infectious diseases are most often reported for employees in the care and healthcare sector (hospitals, care home, addict care, asylum centres), education (schools and day nurseries), and in the agricultural/veterinary sector (including regular and intensive livestock farming, vet practices, forestry and green space maintenance). The NCvB receives relatively more notifications about employees in the healthcare sector.

Within that sector, the most frequently reported diseases are whooping cough, malaria, intestinal infections, and latent or active tuberculosis.

In the education sector, in contrast, whooping cough and mumps are the most commonly reported infectious diseases.

In the agricultural/veterinary sector, psittacosis, Q fever and leptospirosis are the diseases most commonly related to work.

Approximately one-third of all notifications in Osiris concern diseases contracted during work activities outside the Netherlands. These cases mainly relate to employees who have contracted malaria or shigellosis during or because of their work.

Notably, relatively few reports are received of infectious diseases being contracted by employees of laboratories or waste disposal facilities, even though desk research shows that employees in these sectors are frequently exposed to biological agents (1).

4 Conclusions

Trends
Given the presumed under-reporting and the selective registration in Osiris (i.e. only infectious diseases notifiable under the Public Health Act), the surveillance report can only give an incomplete impression of the prevalence of work-related infectious diseases in the Netherlands.
Nonetheless, the data itself provides a wealth of useful information. Now that notifications have been recorded for a number of years, some initial comparisons can be made, even though there are not yet enough statistics to underpin the conclusions.
It has become clear in the past few years that it is mainly employees in the care and healthcare sector, education (including day nurseries) and the agricultural sector who are at risk of contracting an infectious disease.
There has been little change in the most frequently reported infectious diseases over those years: malaria, mumps, Legionnaire's disease, skin infections, gastro-intestinal infections, latent or active tuberculosis, and Lyme disease.
Notifications for a number of infectious diseases have increased: whooping cough, Q fever (peaking in 2009) and Lyme disease.
Over the years, the total number of notifications to the Netherlands Center for Occupational Diseases has remained fairly stable, while the number of notifications to Osiris has increased slightly.

Providing information for employees
Employers are responsible for providing a safe and healthy working environment. Before they can put effective measures in place to prevent work-related infectious diseases, they must first have insight into possible pathogens, specific exposure situations and transmission routes.
Thanks to this insight into the type of infectious diseases that employees could contract, employers can deploy the most appropriate measures by means of an action plan. Such a plan can include providing specific information and personal protection equipment (and ensuring correct use), end registering all cases of work-related infectious diseases.

Monitoring the prevalence of work-related infectious diseases within high-risk professions or sectors can also provide useful pointers for health among the population at large.

Trendspotting
Both the NCvB system and Osiris suffer from under-reporting of the number of employees who contract an infectious disease during their work activities, but the data that does become available can be used as a pointer.
Increased awareness of this matter has been achieved thanks to communiqués about the importance of detailed registration via the GGDs and occupational physicians. As a result, both employers and employees can be more conscious of the risks of contracting infectious diseases during or because of work activities, and they are able to accrue more information about possible exposure situations, transmission routes and prevention options.
Occupational physicians and occupational health specialists with expertise in the domain of infectious diseases have been invited to join expert groups such as the Working Party on Infectious Diseases and Work (known by its Dutch abbreviation: WIZA). In addition, knowledge about outbreaks of infectious diseases and their relevance for work can be disseminated via the Arbo-Inf@ct

electronic message service. This will encourage occupational physicians to broaden their knowledge and pursue a more pro-active reporting strategy.

Most prevalent work-related infectious diseases
The diseases most often reported to Osiris are malaria, whooping cough, mumps and Legionnaire's disease. In the case of the NCvB's registration system, the most commonly reported diseases are skin infections (including MRSA), gastro-intestinal infections (mainly norovirus infections), latent and active tuberculosis, and Lyme disease.
These thus constitute the infectious diseases to which employers should pay extra attention. Using a sector-oriented approach, occupational health and safety consultants could provide employers with specific sector-information and support.

Malaria
In the past five years, malaria has frequently been found to be work-related; between 24 and 38 cases have been reported to Osiris every year. This is approximately 10% of the total number of malaria notifications. Only four to nine cases of malaria that has been contracted in the course of employment are reported to the NCvB per year.
All these people contracted the disease during a stay (for whatever reason) in areas where malaria was endemic. There is often no direct link between the infection and the type of work done, but the patient has often been abroad because of his work. Here a variety of professions is involved, including airline staff, sailors, dredgers, healthcare workers and teachers. The burden of disease is high: two-thirds of the notifications involved hospitalization.
Only limited use is made of malaria prophylactics: less than half of the people involved had taken preventive medication in the prescribed manner. The reason for this 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.

Skin infections
The type of skin infection most frequently reported to the NCvB was scabies. Other skin infections included impetigo, varicella zoster (chicken pox) and eczema. Skin infections are not reported to Osiris.
Scabies is a contagious skin infection that is caused by the Sarcoptes scabeii mite. Reports most often concern employees at healthcare institutions. Infection can spread quickly and easily within such an institution, also to and among the staff. Good information about the symptoms and preventive measures is important to patients and employees alike, as is the possibility of quick and specific treatment.

Intestinal infections
Gastro-intestinal infections come just below skin infections in the ranking of infectious diseases reported to the NCvB. For the most part, these are norovirus infections. This type of infection is not notifiable to Osiris. Caliciviruses - which includes the norovirus - are capable of surviving outside a human host for quite long periods. Moreover, they are resistant to many disinfectants. Outbreaks occur at frequent intervals. Any employee can contract a norovirus infection in the course of his work activities, and some subsequently become a source for its further transmission (carrier).
Employees in the care and healthcare sectors and in day nurseries can be exposed to the virus; airline staff, travelling businessmen, cleaners and sewage workers also have an increased risk.

Whooping cough and mumps
The past two years have seen an increase in the number of notifications of mumps and whooping cough related to the work situation. A large proportion of the cases of work-related whooping cough, and a significant proportion 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.
For an adult, the infection often runs its course without causing any notable symptoms, but in some cases the disease is more serious. Accompanying symptoms or complications can lead to other health problems and short- or long-term incapacity for work.

Lyme disease
Approximately ten cases of Lyme disease among employees are reported to the NCvB each year. The Public Health Act does not specify Lyme disease as notifiable, and it is therefore not registered in Osiris.
Any person who works in or around green spaces (ranging from forests to city parks) can be bitten by a tick and contract Lyme disease. A study carried out by Stigas (health & safety consultants for the agricultural sector), showed that no less than 15% of independent landscape gardeners and 36% of employees at the Nature & Forest Agency [Bos en Natuur] had at some time been treated for Lyme disease after a tick bite during work activities(7).
Employees who carry out some or all of their work in green spaces must receive adequate information and be aware of the risk of tick bites, Lyme disease, and the measures that can be taken to prevent the disease.
Recent years have seen an increase in the number of infected ticks: in the Netherlands, between 5 and 35% of the ticks that bite humans are infected with the bacteria that cause Lyme disease. Between twenty and thirty thousand people contract Lyme disease each year.

Professions and sectors giving rise to greatest number of notifications
Exposure to biological agents can occur in various ways: directly (from working with microorganisms, as happens in laboratories) or indirectly (from unintentional contact with microorganisms). Unintentional contact with microorganisms can arise through work-related contact with waste products, at a waste disposal facility for example, through contact with animals or animal products for people working in agriculture or the food processing industry, through contacts with children (in schools and day nurseries) or with patients in the healthcare sector.
Both Osiris and the NCvB's registration system receive the majority of notifications from the agricultural/veterinary sector and those of education and healthcare.

<u>Work-related contact with animals and animal products, etc.:</u>
Employees in the agricultural and veterinary sector can contract various zoonotic infectious diseases during their work as a result of animal to human transmission. The infectious diseases notified to Osiris and the NCvB concerned, among others, tetanus and the zoonoses Q fever, leptospirosis, psittacosis and Lyme disease.
<u>Children:</u>
As a result of their often intensive contact with children, teachers and assistants at schools and children's day nurseries are continuously exposed to possible pathogens.

Patients:
Employees in the care and healthcare sector are exposed to a large number of pathogens in the course of their work. The employee himself is at risk of contracting a disease, but as a carrier he can also become a source for the transmission of the disease to the often vulnerable people he is caring for.
Work-related contact with waste products, etc.:
Few notifications are received with regard to employees in laboratories or the waste disposal sector, while desk research shows that employees in these sectors are at increased risk of infection (1).

As it is impossible to eradicate all sources of infection in these sectors, preventive measures are aimed at reducing the risk of further transmission.

5 Recommendations

5.1 Filling in the gaps

It is not known how many people become ill in the Netherlands each year as a result of exposure to biological agents in the course of their work. Better registration and more intensive surveillance would provide more clarity about this for the sectors where exposure is the highest.
A number of sectors already feature rather prominently in the registration systems: care and healthcare, education (schools and day nurseries) and the agricultural/veterinary sector. 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.
Under-reporting may be the explanation for why only a small proportion of employees who contract an infectious disease during their work are ever registered in one of the systems.
The question here then is whether that small proportion is representative enough, or whether a broader information base is necessary? More intensive surveillance could be carried out in the above-mentioned sectors in order to gain more information on the prevalence of infectious diseases in those sectors. Specific perspectives have been formulated within the 'Infectious Disease Control and Employee Health ' project to this end.
Opportunities for linking up with existing research programmes have been identified, and these could facilitate a closer study of the employed population. Likely candidates in this respect are the PIENTER project (see below) and the KIzSS surveillance system.

PIENTER study
Data collected in the PIENTER study (to appraise the effect of immunization in the Netherlands, "Pienter" is an acronym of the project's title in Dutch) could be used to obtain a better idea of whether particular professions or trades can be linked to an increased risk for people contracting infectious diseases.
For the purposes of the PIENTER study, blood samples have been taken from a large group of people (over 5600); these samples are tested for the presence of antibodies against the infectious diseases covered by the immunization programme as well as for other infectious diseases. The data collected from these people includes details of their trade or profession and their contacts through that work. Data from the PIENTER study, relating to a selected professional group, could e.g. be compared with data for the Dutch population as a whole.

KIzSS
KIzSS is the acronym of the Dutch name of a surveillance system for infectious diseases within day nurseries; data is recorded about the structure and organization of the day nursery, the number of children who are or become ill each week, the symptoms that arise, how long the children are absent, whether they are given antibiotics, are seen by their GP or admitted to hospital.
This data could be used to ascertain whether there is a correlation between illness among the children and possibly increased illness-induced absence rates among staff.

Agricultural and veterinary sector
Employees in the agricultural and veterinary sector can contract a variety of zoonotic infectious diseases. 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.
At the moment there is inadequate insight into the prevalence of such diseases and the resulting absenteeism through illness in these sectors. A study is being made into ways of improving this insight, and a number of concrete proposals have already been formulated.

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. From August 2009, further work-related questions have been added to the Osiris questionnaire that GGDs have to complete when reporting that a patient has contracted a notifiable infectious disease in the course of his work activities. These extra questions provide more information about the sector in which the patient is employed, about his trade or profession, and about the actual work involved. This will help identify risk situations.
It may be possible, in the future, to ask about the patient's working conditions as a matter of course. Adding standard questions to Osiris notifications about the possible link to work activities and the sector involved will provide better insight into whether a specific infectious disease is more prevalent within particular occupations or sectors.

5.2 Information

Employers must be aware of the infectious diseases which could affect their employees in the course of their work. Employees must then receive information about the risks and the protective measures that can be taken to avoid exposure to such diseases. Information on this subject is available on various websites and employers and occupational health and safety consultants alike ought to be able to find enough relevant information from existing sources.

Work-related stay outside the Netherlands
A large part (29%) of the work-related infections reported to Osiris are contracted during a stay outside the Netherlands. These notifications concern infectious diseases such as malaria, legionella, hepatitis 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 treatment.
The attention of employers and occupational health and safety professionals must be drawn to the risks of contracting malaria, and the limited use of prophylactic medication observed in the past, so that they can properly inform employees. Information, vaccinations and preventive medication (including malaria prophylactics), appropriate to the area to or in which the employee will be travelling, should be offered by the employer.
In order to reduce the number of employees who contract malaria, they must be given full information about supplementary preventive measures and the most effective malaria prophylactic must be prescribed. Information on malaria can be found on the RIVM's website (http://www.rivm.nl/Onderwerpen/Ziekten_Aandoeningen/M/Malaria - some English information available); the national Coordination Center for Travel

Advice also suggests useful measures to prevent malaria (http://www.lcr.nl/Bestanden/Malaria%20folder.pdf - only available in Dutch).

Intestinal infections and skin infections
A large proportion of the notifications to the Netherlands Center for Occupational Diseases concern intestinal and skin infections. It is important to provide information about how to avoid such infections during or as a result of work activities. Employers can make use of information material that is already available from organizations such as RIVM or KIZA (the expertise center for infectious diseases and work). A film about preventing norovirus infection can be found on the RIVM website; this is intended for care staff in nursing homes who might have to deal with a norovirus outbreak. The film shows how the virus spreads and what the staff can do to protect themselves and others; the most important preventive measure is hand washing. (see: www.rivm.nl/Onderwerpen/Ziekten_Aandoeningen/N/Norovirus/Voorlichtingsfilm_over_norovirus - in Dutch)

Scabies
Employees in residential care institutions must receive information on scabies on a regular basis. Employers and occupational health and safety consultants must know where they can find relevant information, for example, on the websites of Stigas, the RIVM and KIZA. In addition, RIVM has a toolkit available on scabies which includes information which can be used by third parties.

Lyme disease
There is a clear link between Lyme disease and working in green spaces. Information about the work-related risk, the circumstances of exposure and preventive measures can be found on the websites of Stigas, the RIVM and KIZA. In addition, RIVM also has a practical toolkit with information about the prevention of tick bites and the symptoms of Lyme disease. The information on the website (http://toolkits.loketgezondleven.nl/toolkits/?page_id=82 - in Dutch) can be used by employers "as is" in their communications with employees.

Whooping cough and mumps
Whooping cough and mumps are highly contagious diseases that are readily transmissible and can be contracted in any work situation where interpersonal contact occurs. As whooping cough often progresses mildly or without any symptoms at all in adults, preventive vaccination is not automatically indicated. Offering inoculation against whooping cough can be considered for those employees at increased risk of exposure who are more likely than others to develop complications from the disease. This includes pregnant women, older employees and employees who also have a heart condition or suffer from diabetes or COPD (8).

Appendix 1 Summary of Osiris data 2011

The figures and tables below set out the data from Osiris in schematic form.

Figure 4 Summary of number of work-related notifications in 2011

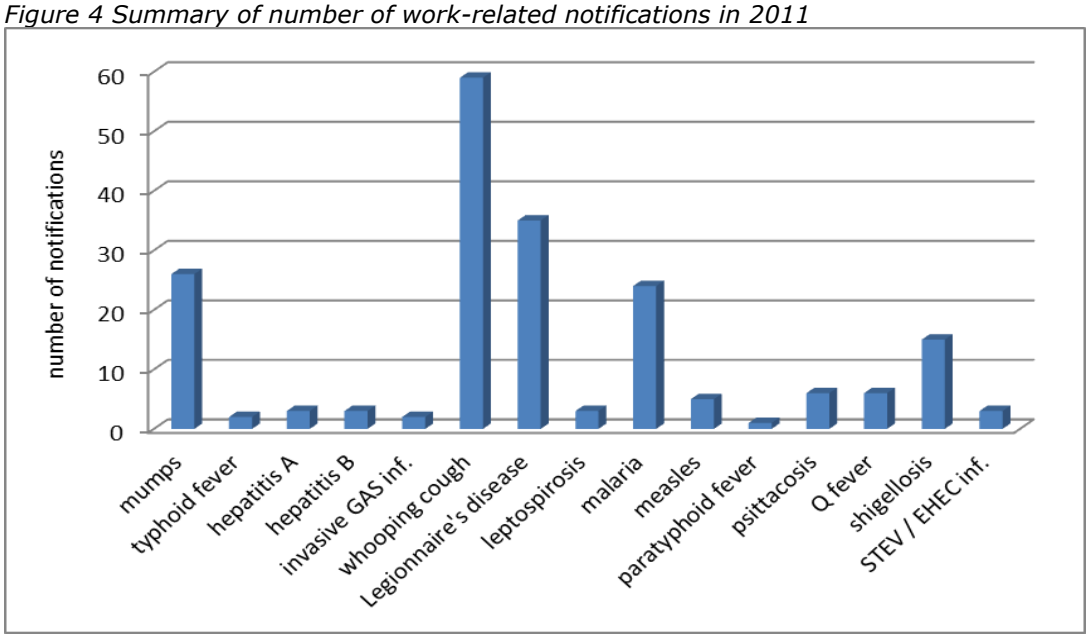


Table 2 Location where the disease was contracted (2011)

Where contracted	Number	Percentage
the Netherlands	137	71%
abroad	56	29%

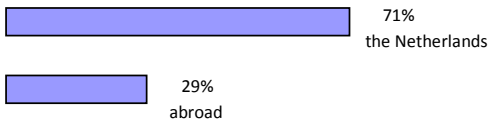


Table 3 Breakdown of notifications by sex (2011)

Sex	Number	Percentage
Male	131	68%
Female	61	32%

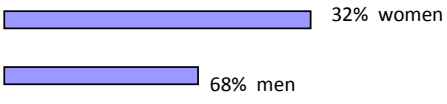


Table 4 Hospitalizations (2011)

Hospitalized	Number	Percentage
Yes	69	36%
No	124	64%

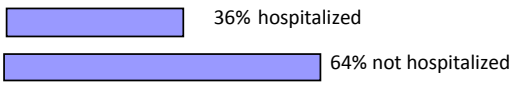
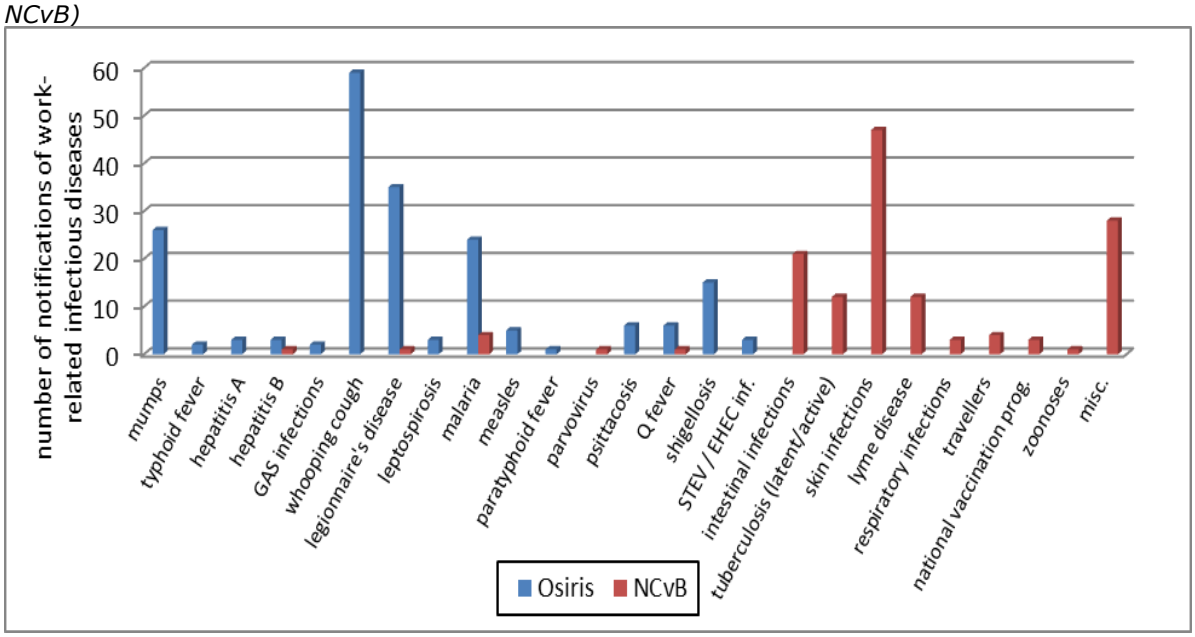


Table 5 Type and number of notified work-related infectious diseases from 2007 to 2011

Infectious disease	2007	2008	2009	2010	2011
Mumps	0	0	0	19	26
Typhoid fever	1	1	0	1	2
Hepatitis A	1	7	8	7	3
Hepatitis B	8	7	14	19	3
Hepatitis C	1	1	0	0	0
Group A streptococcal infections (GAS)	0	0	0	2	2
Whooping cough	-	-	-	48	59
Legionnaire's disease	11	-	-	-	35
Leptospirosis	5	2	4	4	3
Listeriosis	0	0	0	1	0
Malaria	28	28	34	26	24
Measles	3	1	1	1	5
MRSA (outside hospital environment)	0	0	0	1	0
Paratyphoid fever	0	0	0	0	1
Meningococcosis	0	0	1	0	0
Psittacosis	2	3	5	8	6
Q fever	0	31	78	35	6
Shigellosis	10	10	9	12	15
Shiga toxigenic E.coli (STEC)	0	0	0	3	3
Tetanus	0	0	0	1	0
Creutzfeldt-Jakob disease (classic CJD)	0	0	0	1	0
Food poisoning	3	4	0	0	0
Total	**73**	**95**	**154**	**189**	**193**

Figure 5 Work-related infectious diseases in 2011 (as notified to Osiris and the NCvB)



Appendix 2 Notifications in Osiris in 2011

The table below provides a summary of the overall number of notifications to Osiris in 2011 and the number of notifications that were said to be related to work.

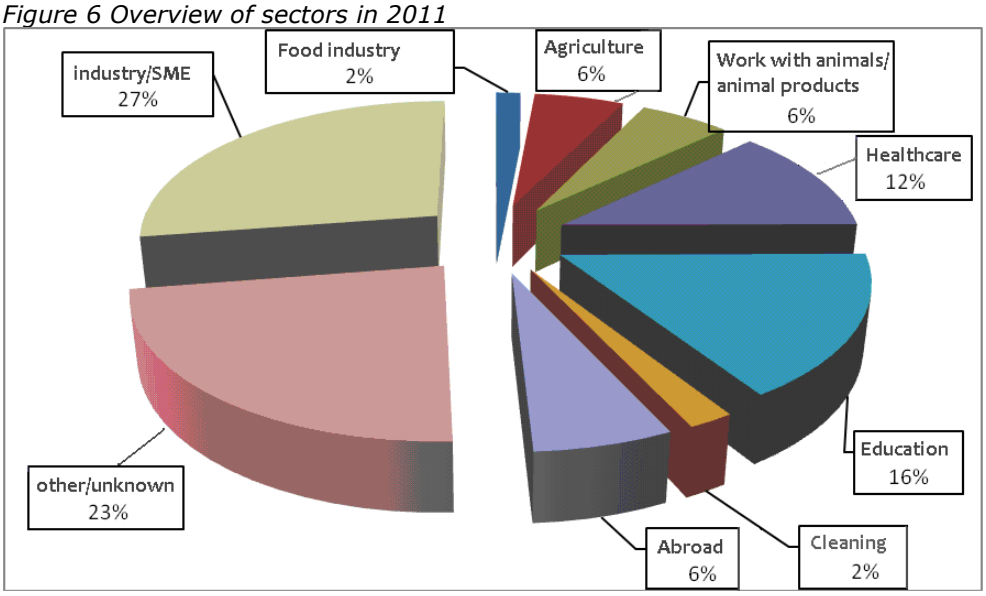
Table 6 Notifications to Osiris in 2011 (overall total and work-related)

Infectious disease	**Overall total**	**Work-related**
Anthrax	0	-
Mumps	652	26
Botulism	0	-
Brucellosis	1	-
Typhoid fever	18	2
Cholera	3	-
Diphtheria	1	-
Yellow fever	0	-
Hantavirus infection	7	-
Hepatitis A	128	3
Hepatitis B	1700	3
Hepatitis C	186	-
Human infection with avian influenza virus	0	-
Invasive group A streptococcal infection	199	2
Invasive haemophilus influenzae type b infection	21	-
Childhood invasive pneumococcal disease (up to 5 years of age)	56	-
Polio	0	-
Whooping cough	6390	59
Legionnaire's disease	341	35
Leptospirosis	31	3
Listeriosis	89	-
Malaria	262	24
Measles	51	5
Meningococcal disease	108	-
MRSA infection (clusters outside hospitals)	10	-
Paratyphoid fever	41	1
Plague (bubonic)	0	-
Smallpox	0	-
Psittacosis	81	6
Q fever	89	6
Rabies	0	-
German measles (rubella)	3	-
Severe acute respiratory syndrome (SARS)	0	-
Shigellosis	595	15
STEC / EHEC infection	654	3
Tetanus	6	-
Trichinosis	1	-
Viral hemorrhagic fever	0	-
Food poisoning	52	-
West Nile virus	1	-
Creutzfeldt-Jakob disease (classic)	35	-
Creutzfeldt-Jakob disease (variant)	0	-

Appendix 3 Sectors in Osiris

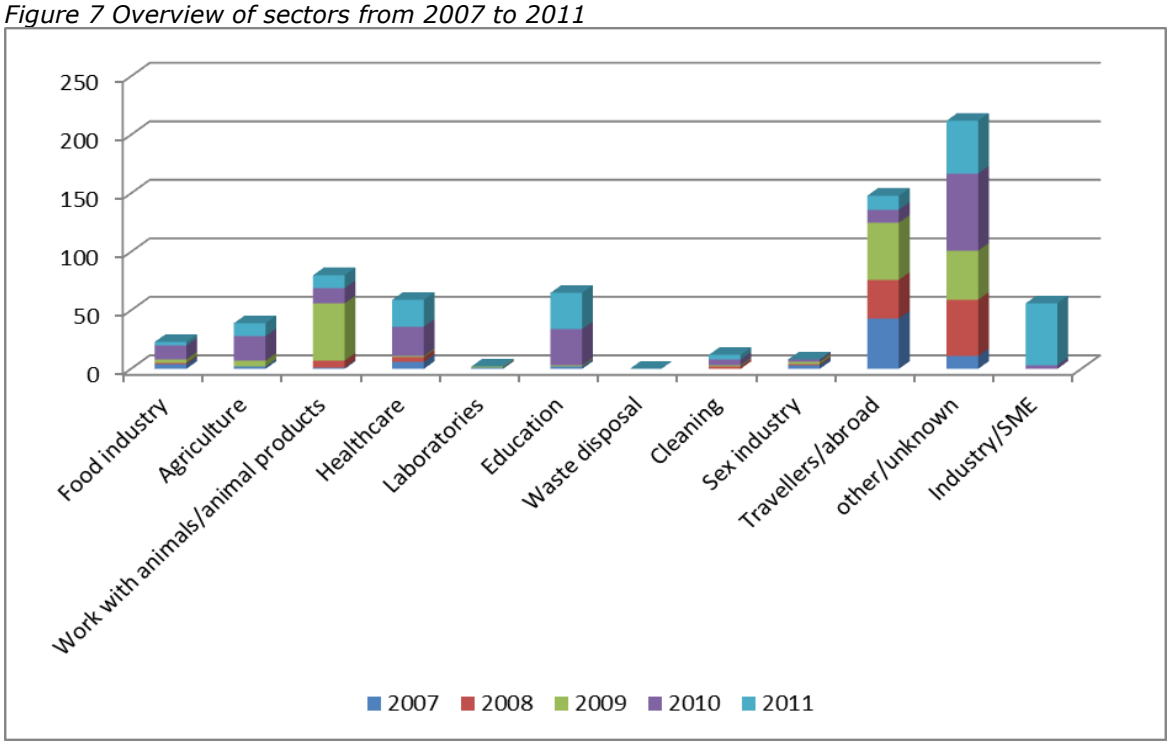
In August 2009, extra questions were added to Osiris about the occupation, the type of work activities and the sector in which the patient was engaged. The figure below gives a schematic representation of the various sectors.

Figure 6 Overview of sectors in 2011



Work-related notifications particularly concern three sectors: education (16%), healthcare (12%), and the agricultural and veterinary sector (12%).

Figure 7 Overview of sectors from 2007 to 2011



Appendix 4 Infectious diseases registered by the NCvB

The table below provides a summary of the work-related infectious diseases reported to the NCvB from 2002 to 2011.

Table 7 Notifications of infectious diseases to the NCvB from 2002 to 2011

Disease	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Intestinal infections[1]	11	16	26	72	21	18	40	57	20	21
Misc.[2]	19	28	18	24	29	41	11	20	5	28
Hepatitis A					1	1				
Hepatitis B	3	2	5		4	1	2	4	1	1
Hepatitis C	1		1		2		5			
Hepatitis E									1	
HIV		1	5	4			5	1		
Skin diseases[3]	11	18	39	37	9	10	13	13	12	47
Legionnaire's disease	2	2	1		1		1	1		1
Airway disorders[4]	2	10		3	6	1		11	3	4
Lyme disease	3		16	12	6		10	8	6	12
Malaria	9	1	9	6	8		5	8	4	4
Parvovirus										1
Q fever								12	4	1
Travellers, misc.[5]										4
Despite inoculation[6]										3
Tuberculosis[7]	42	25	19	21	24	12	15	20	18	13
Zoonoses[8]	5	11	4	4		26	10	1	15	1
Total	**108**	**114**	**143**	**183**	**111**	**110**	**117**	**156**	**89**	**141**

1 21 x norovirus infections

2 25 x local complications after the annual seasonal flu vaccination, 2 x MRSA and 1 x post-prophylactic treatment with antiretroviral medication after a high-risk needle stick incident

3 41 x scabies, 2 x impetigo, 1 x chicken pox (varicella zoster), 2 x fungal infections and 1 x eczema prompted by allergy to biological agents

4 Allergic pulmonary symptoms caused by biological agents

5 2 x dengue fever, 1 x fever and 1 x tropical diarrhoea

6 Diseases contracted despite inoculation as part of the national vaccination programme: 2 x measles and 1 x whooping cough

7 11 x latent TB (mantoux conversion) and 1 x active TB infection

8 Brucellosis

Table 8 Notifications of infectious diseases registered by the NCvB in 2011, by economic sector

Economic sector 2011	N	%
Human healthcare	88	62.0
Homes/Hostels	22	15.5
Forestry and forestry products	6	4.2
Aviation	4	2.8
Education	4	2.8
Public administration and armed forces	4	2.8
Construction, general	3	2.1
Specialized construction work	2	1.4
Research and development, scientific	2	1.4
Manufacture of metal products, excluding machinery and equipment	2	1.4
Security and investigative services	1	0.7
Welfare work not involving the provision of accommodation	1	0.7
Other personal services	1	0.7
Crop cultivation, livestock breeding, hunting and services associated with such activities	1	0.7
Production of pharmaceutical raw materials and products	1	0.7
Total	141	100

Appendix 5 Registrations of tuberculosis at 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 PublicHhealtS 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 cases 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 9 Occupational contact with risk groups.

	Occupational contact with risk groups (KNCV) With latent TB infection (LTBI)*	**Occupational infection with tuberculosis reported to NCvB**
2005	105	20
2006	76	23
2007	94	12
2008	83	9
2009	70	15
2010	76	4
2011	**	

** Surveillance reports on the TB situation in the Netherlands (KNCV Tuberculosis Foundation)*

*** Tuberculosis in the Netherlands 2011 (TiN 2011) has not yet been published*

A total of 1073 TB patients were reported to the NTR during 2011. This amounts to 7% fewer cases than in 2009, but the number of latent TB infections (76 notifications) increased in comparison with 2009. Employees working in the healthcare and welfare sectors, working with refugees and in reception centres, and those in the administration of justice sector are eligible for screening. Employees who work in countries with a high incidence of TB can also be exposed to the disease during or because of their work but there is no standard screening programme for this group.

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