Health Council of the Netherlands

Employees and infectious diseases

Criteria for vaccination

2014/30E

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Gezondheidsraad
Health Council of the Netherlands

To the Minister of Social Affairs and Employment

Subject : presentation of advisory report *Employees and infectious diseases - Criteria for vaccination*
Your reference : G&VW/GW/2012/4961
Our reference : I-1277/12/AvdB/KG/cn/008-A13
Enclosure(s) : 1
Date : December 15, 2014

Dear Minister,

Employees may be exposed to biological agents during their work. Employers are under an obligation to protect their employees against the possible effects of occupational exposure to such agents. They have a number of means at their disposal to this end, including vaccination – if a vaccine is available against the condition in question.

I am pleased to enclose herewith the advisory report *Employees and infectious diseases – Criteria for vaccination.* This advisory report was written by a committee set up in response to a request by the former State Secretary for Social Affairs and Employment for a decision framework concerning the vaccination of employees.

This decision framework can be used to determine whether vaccination of the employee contributes to optimal protection against the risks to which he is exposed (at-risk employee). In addition, the Committee further considered that it may also be necessary to vaccinate the employee to reduce the risk of infection he poses to vulnerable third parties (employee as source of risk). This consideration led the Committee to formulate a second decision framework. Combined use of these two decision frameworks allows employers to take all relevant factors into account when making decisions about offering vaccinations to employees.

I would like to stress two points in this connection. Firstly, a good risk assessment and evaluation is of prime importance when trying to reduce the risk of infectious diseases run by employees – and hence also by third parties who are dependent on them – since it provides a basis for decisions by employers concerning the measures to be taken to avoid or reduce the risks in question, as much as possible. In line with this, I agree with the

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Committee that the availability of a vaccine does not absolve an employer from the responsibility of working in accordance with an occupational hygiene strategy scale.

Secondly, I support the recommendation of the Committee that decisions about vaccination should be taken at a sectoral level rather than at the level of the individual company. Nevertheless, as the Committee also stated, the decisions finally taken must be tailored to take the specific characteristics of the company and the individual employee into account.

The Health Council of the Netherlands has also been asked to use the decision framework as a basis for an advisory report concerning the desirability of vaccinating employees against Q fever. I will let you know the results of their considerations in an advisory letter to be sent out in the first quarter of 2015.

When formulating the final version of this advisory report, the Committee made use of comments received on a published draft version of the report and the reactions of the Health Council's Standing Committees on Health and the Environment; Medical Ethics and Health Law; and Infection and Immunity.

In addition, I have today sent a copy of this advisory report to the Minister of Health, Welfare and Sport for her information.

Yours sincerely,

(signed)
Professor J.L. Severens
Vice President

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Criteria for vaccination

to:

the Minister of Social Affairs and Employment

No. 2014/30E, The Hague, December 15, 2014

The Health Council of the Netherlands, established in 1902, is an independent scientific advisory body. Its remit is “to advise the government and Parliament on the current level of knowledge with respect to public health issues and health (services) research...” (Section 22, Health Act).

The Health Council receives most requests for advice from the Ministers of Health, Welfare and Sport, Infrastructure and the Environment, Social Affairs and Employment, and Economic Affairs. The Council can publish advisory reports on its own initiative. It usually does this in order to ask attention for developments or trends that are thought to be relevant to government policy.

Most Health Council reports are prepared by multidisciplinary committees of Dutch or, sometimes, foreign experts, appointed in a personal capacity. The reports are available to the public.

The Health Council of the Netherlands is a member of the European Science Advisory Network for Health (EuSANH), a network of science advisory bodies in Europe.

This report can be downloaded from www.healthcouncil.nl.

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Contents

Executive summary

Employers are responsible for providing safe and healthy working conditions for their employees. One of their obligations is to protect their employees against the potential effects of exposure to biological agents. Employers have various measures at their disposal for this purpose. One such measure is vaccination. A specific decision framework can help employers make consistent and responsible decisions about whether or not to vaccinate. The State Secretary for Social Affairs and Employment has asked the Health Council of the Netherlands to develop a decision framework of this kind, analogous to the existing framework used to determine whether or not a given vaccine should be included in a public vaccination programme.

The Committee that drew up the advisory report emphasised that the availability of an effective vaccine does not discharge employers of their obligation to take source control measures and to provide protective equipment (or protective personal equipment). Firstly, in the context of their occupational hygiene strategy scale, employers are legally obliged to implement measures as far up the scale as possible. Secondly, exposure at work is rarely limited to a single agent, so implementing measures high in the occupational hygiene strategy scale also offers protection against other agents.

Employees are both ‘at risk’ and ‘sources of risk’

The Committee has determined that employee vaccination should not only be considered with the aim of protecting employees themselves (at-risk employees), but also to protect vulnerable third parties against possible contamination by employees (employees as sources of risk). After all, employers are responsible both for providing safe working conditions for their employees and for protecting vulnerable patients, for example. As the decisions involved can vary from one objective to another, the Committee has drawn up two separate decision frameworks.

Framework for the protection of employees

The framework used by employers to determine whether employee vaccination is an integral part of their duty to provide optimum protection involves four criteria:

1 Occupational exposure to infectious agents can pose an extra risk of disease to individual employees that is by no means negligible.
2 Employee vaccination leads to a substantial reduction in that extra risk of disease.
3 Any deleterious health effects associated with the vaccination in question (adverse effects) do not detract significantly from the health gains involved.
4 The health gain for employees outweighs any discomfort that they may experience as a result of vaccination.

If vaccination can be shown to be an integral part of providing optimum protection for employees, the Committee feels that this has certain implications. The Committee takes the view that employees are entitled to have access to vaccination. At the same time, employers must advise their employees to be vaccinated. If occupational exposure to a biological agent can potentially result in a serious disease, the Committee feels that a more persuasive approach is needed. In this connection, employers have a duty to fully inform their employees about the consequences of accepting or rejecting vaccination. This requires employers to check that their employees are indeed aware of the risks involved.

If an employee decides not to accept the vaccination emphasis will be on alternative measures, such as protective equipment (or personal protective equipment). If occupational exposure were to put an employee at risk of serious disease, the employer must prevent such exposure. For instance, the latter could

explore the possibility of suitable alternative work, in consultation with the employee in question.

Framework for the protection of third parties

The framework used by employers to determine whether employee vaccination is an integral part of the duty to provide optimum protection for vulnerable third-parties includes five criteria:

1 The occupational exposure of employees to infectious agents can, via transmission, lead to a substantial burden of disease in third parties.
2 By reducing transmission, employee vaccination leads to a substantial reduction in burden of disease in third parties.
3 Any deleterious health effects of the vaccination in question (adverse effects) for employees are reasonably proportional to the health gains for third parties.
4 Any discomfort experienced by employees as a result of vaccination is reasonably proportional to the health gains for third parties.
5 The relationship of costs to health gains is proportional in comparison to other means of reducing the burden of disease in third parties.

A substantial burden of disease for third parties can be the result of either an infection spread to a large group of people or an infection causing a serious disease in (vulnerable) third parties. In case vaccination of employees is required to protect a large group of third parties against an infection, employers can ask their employees to accept vaccination. If the need be (in the context of efforts to achieve optimal protection for third parties), employers are required to try to persuade employees to accept vaccination. In this connection, employers have a duty to fully inform their employees about the consequences of their actions (for third parties). This means employers must check that their employees are indeed aware of the risks involved. Although the Netherlands has no legal requirement concerning vaccination, the Committee does feel that employees have a moral responsibility to vulnerable third parties in this regard.

If this moral responsibility does not prompt employees to accept vaccination, the employer and employee must take alternative measures, such as protective equipment (or protective personal equipment) for employees, to prevent third-party exposure.

In cases where the infection of vulnerable third parties (caused by employee exposure) could result in a serious disease, the Committee emphasises the

Decision framework for the protection of the employee

1 Occupational exposure to the infectious agent can pose an extra risk of disease to the employee that is by no means negligible

Exposure

Is there a risk of relevant exposure to the infectious agent?

- *Can an infectious agent (for which a vaccine is available) occur in the workplace?*
- *Can the employee come into contact with the agent, and does exposure involve a relevant transmission route?**
- *How often does the exposure in question occur, for how long and to what extent?*

yes

Probability

Is it probable that the exposure of the employee through infection would result in disease (in the employee himself)?

- *Has the employee been vaccinated against the agent in question and, if so, does he have an adequate level of protection?*
- *Is it probable that employee exposure would lead to infection?***
- *Is it probable that employee exposure would lead to disease?***
- *How does an employee's extra risk of disease compare to the risk of disease in the general population?*

yes

Magnitude of adverse effect

Is there an adverse effect for the employee?

- *Could the disease that the employee obtains through exposure be serious?***
- *Are there any effective treatment options and are these proportional to the discomfort suffered by the employee as a result of the disease?*

yes

Reduction measures

Is it possible to include measures in the occupational hygiene strategy scale that would reduce exposure to an agent such that the additional risk of disease posed to the individual employee is reduced to an acceptable minimum?

- *Are there any measures that have been shown to restrict employee exposure or that are likely to have such an effect?*
- *Is the reduction in the extra risk of disease produced by these measures comparable to the reduction produced by vaccination?*

no

2 Employee vaccination leads to a substantial reduction in the extra risk of disease

Effective

Is vaccination likely to be effective in preventing disease or in reducing symptoms?

yes

3 Any deleterious health effects associated with the vaccination in question (adverse effects) do not detract significantly from the health gains involved

Adverse effects

Are the adverse health effects associated with the vaccination in question unlikely to detract significantly from the health gains of the employee?**

yes

4 The health gains for the employee outweigh any discomfort that he may experience as a result of vaccination

Discomfort

With a view to the health gains for the employee himself, is the discomfort associated with vaccination acceptable?

yes

Vaccination is an integral part of the optimum protection for the employee

*In this connection, focus both on exposure scenarios or high-risk procedures carried out in the context of day-to-day activities and on less common activities performed in connection with maintenance work or during breakdowns.

**In this connection, note that some employees may be more susceptible than others.

Decision framework for the protection of third parties

1 Occupational exposure of the employee to infectious agents can, via transmission, lead to a substantial burden of disease in third parties

Employee exposure

Is there a risk of the employee suffering relevant exposure to the infectious agent?

yes

- *Can the employee come into contact with the agent in the workplace or elsewhere (does exposure involve a relevant transmission route)?**

Probability of transmission to third parties

Is it probable that employee exposure would cause the infectious agent to be transferred to third parties?

yes

- *Has the employee been vaccinated against the agent in question and is this sufficient to prevent transmission to third parties?*
- *Is it probable that the exposure and infection of the employee would result in the exposure of third parties?*
- *Is it probable that the exposure of third parties would result in the infection of third parties?***

Probability of disease burden in third parties

Is it probable that transmission of the infectious agent to third parties would result in a substantial burden of disease in third parties?

yes

- *Is it probable that infection of third parties would lead to a substantial burden of disease?****
- *Have the third parties been vaccinated against the agent in question and, if so, do they have an adequate level of protection?*
- *Is it probable that infection in third parties would lead to a further spread of the agent in question?*
- *How does a third party's extra risk of disease due to transmission via an employee compare to the risk of transmission in the general population?*

Magnitude of adverse effect

Is there an adverse effect for third parties?

yes

- *Do third parties suffer a substantial burden of disease?***
- *Are there any effective treatment options for reducing the burden of disease in third parties and are these proportional to the discomfort suffered by third parties as a result of the disease?*

Reduction measures

Are there any other measures that could potentially be used to reduce the risk of transmitting the infectious disease to third parties to an acceptable minimum?

- *Are there any measures that can effectively restrict employee exposure?*
- *Are there any measures that can effectively restrict transmission to third parties?*
- *Is the reduction in transmission produced by these measures comparable to the reduction produced by employee vaccination?*

no

2 By reducing transmission, employee vaccination leads to a substantial reduction in burden of disease in third parties

Effective

Is vaccination likely to be effective in preventing or reducing the risk of infectious disease being transmitted to third parties?

yes

3 Any deleterious health effects of the vaccination in question (adverse effects) for the employee are reasonably proportional to the health gains for third parties

Adverse effects

Are the deleterious health effects of the vaccination for the employee (adverse effects) unlikely to detract significantly from third parties' health gains?

yes

4 Any discomfort experienced by the employee as a result of vaccination is reasonably proportional to the health gains for third parties

Discomfort

With the objective of health gains for third parties, is the discomfort associated with vaccination acceptable to the employee?

yes

5 The relationship of costs to health gains is proportional in comparison to other means of reducing the burden of disease in third parties

Cost

Is the cost of employee vaccination proportional to the cost of other measures that could be taken?

yes

Vaccination is an integral part of the optimum protection for third parties

*In this connection, focus both on exposure scenarios or high-risk procedures carried out in the context of day-to-day activities and on less common activities performed in connection with maintenance work or during breakdowns.

** In this connection, note that some individuals may have an increased risk of a more serious course.

*** In this connection, note that this burden of disease may be substantial in nature if the infection in question has serious consequences or if the infection affects a large group of people (third parties).

importance of employee vaccination even more forcibly. Accordingly, in cases like these, the Committee feels that employers must be even more insistent when appealing to the moral responsibility of their employees. Here too, the Committee notes the importance of effective information provision by employers, and recommends that they do everything possible to facilitate vaccination. If it is concluded that, in this case, vaccination is an integral part of the duty to provide optimum protection for vulnerable third parties, employers may attempt to achieve the highest possible level of vaccination coverage among their employees.

If the existing moral responsibility to avoid subjecting third parties to serious health risks does not prompt employees to accept vaccination, the employer and employee must take alternative measures to prevent the infection of third parties. In addition to protective equipment (or protective personal equipment), the Committee feels that such measures must include finding suitable alternative work for the employee in question. In addition, the Committee urges that, in special circumstances (e.g. in a group of patients for whom infection would pose a very serious health risk), consideration be given to the possibility of making the vaccination of employees a legal requirement.

In conclusion

What is the best course of action if there is a shortage of a given vaccine? In a situation like this, which groups in the population should be prioritised for vaccination? The State Secretary wants to use these decision frameworks, together with the Dutch National Immunisation Programme framework, to resolve distribution issues. However, the Committee notes that the collective frameworks themselves will not resolve the issue of who is to be given top priority for vaccination in the event of a vaccine shortage. For example, specific circumstances (such as the characteristics of the agent in question, or the nature of the outbreak) have a major influence, and more ethical considerations are involved.

The Committee anticipates that any decision on vaccination to protect employees will primarily involve the occupational health physician. The decision regarding vaccination to protect third parties may also involve other experts. The Committee recommends that decision-making within individual companies be carried out in a coordinated manner. To ensure the uniformity of this decision-making process, the Committee recommends that it be implemented at sector and industry level. Any guidelines for professional groups (such as occupational health physicians) that are based on the decision framework can also be useful in this context.

Chapter 1

Introduction

1.1 Background

Employers are responsible for providing healthy and safe working conditions for their employees. To protect their employees against the potential effects of exposure to biological agents, they have access to various measures. One such measure involves vaccinating employees against the agent to which they possibly are exposed (provided a suitable vaccine is available). In this context, employers must decide whether vaccination helps to provide optimum protection for their employees. A specific framework for vaccination – related to working conditions – would be a welcome addition. This might help employers make such decisions consistently and responsibly. It would be analogous to the existing decision framework for vaccination from the perspective of a public vaccination programme (the National Immunisation Programme).[1]

In 2010, the Health Council of the Netherlands recommended that future animal husbandry professionals and those who are occasionally exposed to Q fever should not be vaccinated against this disease.[2] The Committee in question made its recommendation based on an approach from the perspective of a public vaccination programme. However, it stressed that an approach from the perspective of healthy and safe working conditions could potentially lead to a different outcome. The Committee, therefore, suggested that the differences between vaccination in the context of a public programme and in the context of working conditions be explored in greater detail.

1.2 Request for advice

On 26 June 2012, the Health Council received a request for advice from the State Secretary for Social Affairs and Employment (see Annex A). In essence, this involved a request that the Council develop a decision framework for vaccination in the interests of healthy and safe working conditions. In addition, the State Secretary asked the Health Council to explain how and where the decision framework to be developed differs from the framework used by the Health Council to assess whether or not a given vaccination should be included in a public vaccination programme.

Finally, the State Secretary asked the Health Council to review its recommendation on the vaccination of employees against Q fever, using the decision framework to be developed for employee vaccination.

1.3 Procedure and scope

In response to the request for advice, the President of the Health Council established the Committee on Vaccination and Working Conditions. This body is composed of experts in the field of infectious diseases and vaccines and in the field of healthy and safe working conditions. Details of this Committee's make-up are set out in Annex B.

The Committee was officially installed on 11 April 2013. The Committee has held a total of eight plenary meetings. Working groups consisting of various members of this Committee have prepared different parts of the advisory report.

Interpretation of the request for advice

The State Secretary's question addresses the situation in which vaccination is being considered in the context of protection against risks posed to employees themselves (at-risk status). In addition, the Committee notes that employee vaccination can also be considered in terms of the protection of third parties. The goal of such vaccination is to prevent transmission of the biological agent in question from employees to third parties (referred to source-of-risk status, as seen from the employee's point of view). The Committee sees such "third parties" as those with whom employers have a relationship (which may or may not be contractual in nature). The Committee defines contractual relationships as patients in a hospital, for instance, or children in a nursery. Examples of non-

contractual relationships would be a company's customers, those living in the vicinity, or the relatives of employees.

The Committee has drawn up a decision framework in this advisory report, for at-risk employees and for employees who are a source-of-risk to third parties.

Public draft round and assessment

In June 2014, the President of the Health Council released a draft version of the advisory report for a public review round. Details of the individuals and organisations that responded to this draft version are listed in Annex C. The Committee incorporated these responses into the advisory report during the final stages of its preparation.

Finally, the draft advisory report was reviewed in three of the Health Council's permanent committees of experts: the standing committees on Health and the Environment; Infection and Immunity; and Medical Ethics and Health Law.

1.4 Structure of this advisory report

In the next Chapter, the Committee provides a concise summary of the current legal framework and the policy derived from it. In Chapter 3, the Committee describes the decision frameworks for vaccination in working conditions that it has prepared. In Chapter 4, the Committee provides an explanation of these frameworks (and of their use) by means of a number of practical case studies. Finally, Chapter 5 explores the implications of the use of decision frameworks.

Chapter 2

Legal framework and health and safety policy

In this Chapter, the Committee first outlines the current legal framework in the Netherlands. The next topic is health and safety policy, as currently in effect in the Netherlands. Finally, in the last subsection, the Committee outlines ways of identifying the size of the risks of exposure to biological agents.

2.1 Legal framework

In this subsection, the Committee first outlines the current legal framework. In doing so, it explores the legal position of employers and employees with regard to vaccination, and gives attention to the employer's responsibility to third parties in this connection.

The Committee has incorporated legislation, jurisprudence and literature into its summary. It commences with a brief discussion of the various pieces of legislation that need to be taken into account, then explores the rights and obligations of employers and employees. Finally, the Committee briefly discusses the appointments procedure for future employees, as a potential opportunity to broach the subject of vaccination.

2.1.1 Which legal statutes are relevant?

The legal framework in this advisory report includes aspects both of public law and of civil or private law. From the arena of public law, health and safety

legislation (with its administrative and criminal law enforcement aspects) has a part to play here. From the arena of private law, the provisions of employment law and the obligation embodied therein to act as a "good employer" or "good employee", as embodied in the Dutch Civil Code (DCC), are also important.

The violation of public law obligations may trigger an intervention by the Inspectorate SZW (formerly the Labour Inspectorate) involving, for example, an administrative fine or penal sanctions. From the arena of private law, failure to comply with obligations deriving from a contract can lead to employment law sanctions and to the termination of a contract, or to the compensation of damages.

While the obligations of employers and employees that stem from private law and public law do not automatically overlap, they are usually connected.

2.1.2 *Employer's rights and obligations*

In terms of public law, the general duties of care (as specified in the Working Conditions Act) are of prime importance to employers.[3] Art. 3 paragraph 1 b is particularly important:

"unless this cannot reasonably be required, in the first instance the hazards and risks to the employee's safety or health shall, wherever possible, be prevented or limited at the source thereof; inasmuch as such hazards and risks cannot be prevented or limited at the source, other effective measures in that regard will be taken, whereby measures aimed at collective protection have precedence over measures aimed at individual protection; only if it cannot reasonably be required that measures aimed at individual protection be taken, should effective and appropriate personal protective equipment be made available to the employee."

The Committee has two observations concerning this general definition. The first is that the concept of "reasonably" allows a degree of latitude with regard to taking technical, operational and economic aspects into account when clarifying the duty of care. Assessing what is at present technically, operationally and economically feasible is primarily the employer's task. However, that is not a license to be remiss: the guiding principle must always be the state of science and technology, and the Inspectorate can and will intervene in an enforcement role where necessary. The second observation is that the cited provision shows that, when taking measures, employers are required to use a ranking system: the occupational health and safety strategy.[4] The Committee will revisit this issue in subsection 2.2.

To provide protection against the risks of biological agents, the employer's duty of care under public law has been crystallised into a general order in council based on the Working Conditions Act, to wit the Working Conditions Decree.[5] Here, biological agents are classified into four risk categories (see Art. 4.84). In brief, Category 1 includes agents that are unlikely to cause human disease, Category 2 agents can cause human disease but are unlikely to spread to the community, Category 3 agents can cause serious human disease and may spread to the community, while Category 4 agents can cause serious human disease, and are likely to spread to the community without effective prophylaxis or treatment.

The Working Conditions Decree also states that, in the case of categories 2, 3 or 4, a number of other articles apply. The most important of these, in the context of this advisory report, is Art. 4.91 paragraph 6:

"As far as possible, effective vaccines should be offered to all employees who are not yet immune to those biological agents to which they are, or may be, exposed. Account is also taken of Annex VII to the Directive."[5]

The Directive in question is Directive 2000/54/EC. Annex VII contains the "Recommended code of practice on vaccination".[6] The latter states that, in the event of a health risk resulting from exposure to agents against which there are effective vaccines, employers must offer vaccination; the employees must then be informed of the benefits and drawbacks of both vaccination and non-vaccination; also vaccination must be offered free of charge to employees.

The Committee notes that, according to the code of practice described above, by offering vaccination, employers have in principle fulfilled this aspect of their duty of care under public law. This is also reflected in a statement by the Dutch Equal Treatment Commission:

"an employer's obligation under health and safety legislation does not extend to a vaccination requirement, i.e. that he must ensure that employees are actually vaccinated and must exclude employees from work if that is not the case".[7]

Private law requires employers to act as a "good employer", in a general sense (Art. 7:611 DCC), in addition to more specific obligations that may have been incorporated into the employment contract.[8] With regard to health and safety at work, that legal obligation is embodied in Art. 7:658 of the Dutch Civil Code. This states that employers must take any action that is reasonably necessary to prevent employees from sustaining personal injuries/damages in the course their work. That Chapter of the law goes on to state that employers are liable for such

personal injuries/damages unless they can prove that they have fulfilled their obligations (or that the damage/injury in question was due largely to intent or recklessness on the part of the employee).

That duty of care is subject to stringent requirements. At the very least, employers must comply with the requirements imposed by public law health and safety legislation. Moreover, it can be concluded from jurisprudence relating to employer liability for accidents at work and occupational diseases that employers have an obligation to investigate potential health risks. They must also provide instruction to employees to protect their safety and health, and they must ensure that such instructions are followed (e.g. wearing a safety helmet). If employers comply with that comprehensive duty of care, they can not, in principle, be held liable, even if personal injuries/damages have been sustained (it is worth noting that matters of this kind generally depend on the circumstances of the case in question). In general, employers will still be obliged to pay sick pay throughout a period of illness resulting from a refusal to undergo vaccination. Another issue is whether employees who accept work-related vaccination and who suffer personal injuries/damages related to possible adverse effects of the vaccine, can recover these damages from their employer. In all likelihood, the answer to that question is “yes”. Even if the employers are not at fault, principles of reasonableness and fairness dictate that they must bear the costs involved. After all, these are costs that fall within the scope of their business operations.

2.1.3 Employee’s rights and obligations

In public law health and safety legislation, vaccination has a voluntary character: employees must be informed of the benefits and drawbacks of vaccination, but there is no requirement to submit to it. The government has neither wanted to impose a general vaccination requirement nor a specific requirement for certain professional groups. In the same vein, the government has avoided imposing constraints on those opting to remain unvaccinated. This view was also expressed by The Netherlands Institute for Human Rights (formerly known as the Equal Treatment Commission), in its statement referred to above. Under this legislation, therefore, employees are free to reject the offer of vaccination. While Art. 11 of the Working Conditions Act states that employees have a general obligation “to take care, to the best of their ability, of their own health and safety and that of other individuals involved”, but the further specification of what that general obligation involves makes no mention of vaccination.[3] Similarly, the Working Conditions Act does not allow for the possibility – such as that relating to submitting to an occupational health medical examination (see Art. 16

paragraphs 3 and 5) – of using a general order in council to make vaccination a mandatory condition for being allowed to perform certain types of work*.

In terms of private law, the matter is more complicated. It is an established fact that, strictly speaking, employees are always free to refuse vaccination. Employers may not compel employees to physically undergo vaccination because a medical intervention such as vaccination compromises the individual's physical integrity, which is protected under the Constitution (Art. 11). Another question is whether employers can impose constraints on employees who refuse to be vaccinated, in terms of employment or even of extending their contract of employment.

In terms of employment law, there are two starting points. Firstly, employees must comply with contractual stipulations, unless that can not reasonably be expected of them. Secondly, as with the position of the employer, employees will, in general terms, have to act as a "good employee". This means that, in their employment relationship with their employers, they must take account of the latter's legitimate interests. If the employer's requirements are reasonable and if the instruction issued is based on a careful decision, then the employee will not be able to evade it without having a good reason for doing so. Non-cooperation must be based on a justification that, given the interests at stake, can be considered to be adequate.

It is not possible to provide a definitive answer to the question of whether there will be any repercussions for employees who refuse vaccination. Aside from the previously cited statement by the Equal Treatment Commission, the Committee is not aware of any jurisprudence that has addressed this question. In addition, there is only a scant amount of literature on this issue, and this is limited to a few health law publications on vaccination against Hepatitis B in care institutions. Dute takes the view that it is permissible to "apply a degree of pressure (persuasion) to any employees who are not prepared to be vaccinated, but dismissal would be going too far" (as this would amount to a *de facto* vaccination requirement).[9] Doppegieter takes a more subtle approach, but her reasoning too only permits repercussions in terms of employment if there is a "substantial risk of infecting patients" and, at the same time, "tangible evidence that the attending physician represents a possible source of contamination".[10]

* It should be noted that the performance of certain types of work can only be made dependent on the outcome of an occupational health medical examination "inasmuch as the work in question involves special risks to the life or health of the employee himself/herself or to that of any other individual, or inasmuch as this is required for other special reasons".

2.1.4 *Employers, employees and third parties*

The employment law framework outlined above (which focuses on the ramifications of the employment contract and on what may be expected of a "good employer" and a "good employee"), as such, provides sufficient scope for requiring employees to cooperate with vaccination (i.e. imposing constraints on the option of refusing to cooperate with vaccination). In any request for cooperation, the employer's interests must not be restricted to protecting the health of the employees themselves, but also that of others (third parties) with whom the employer may (for example, patients in hospitals) or may not (for example, visitors, passers-by, local residents) have a contractual relationship. The employer has a duty of care to these individuals too. This duty may be legal in nature (see, for example, the obligation to provide "responsible care" set out in the Care Institutions (Quality) Act). Alternatively, it may be in the nature of a general obligation under civil law. After all, everyone is expected to behave with due diligence in social interactions. Failure to do so involves the risk of liability for any injuries/damages sustained.*

On the other hand, the requirement to undergo vaccination has a much greater impact than the requirement to wear personal protective equipment, for example. After all, vaccination involves a violation of the individual's physical integrity and it is never entirely free of risks or objections. In addition, some individuals object to vaccination on principle. The issue of reticence concerning the obligation to undergo vaccination is not restricted to public health legislation, it can also be seen in health and safety legislation. As indicated above, in Art. 16 paragraph 3 of the Working Conditions Act, that enables employees involved in particular types of work to be obliged to undergo an occupational health medical examination (although that too is possible only in special circumstances). Nor, under that Act, is it possible to oblige individuals to undergo vaccination (as a condition for being permitted to carry out certain types of work).

Basically, therefore, "good employees" should take account of their employer's legitimate interests and of any reasonable requests made by the latter. Under certain circumstances, refusing to be vaccinated will have an impact on the employee, in terms of employment but possibly also in the sense of a termination of their employment contract. This does not exclusively involve situations in

* Employers have a legal obligation (under Art. 10 of the Working Conditions Act) to take measures to avoid hazards to the health and safety of third parties within the company or in its immediate vicinity

which an employee's refusal to cooperate would pose a risk to others, although such situations would presumably be more likely to involve an obligation to cooperate (subject to certain conditions) than those in which the risk involved is limited to the employee in question. Given that vaccination is involved, this will probably always be subject to special circumstances. This means that, given both the position and activities of the individual concerned and also the nature and severity of the disease, and the risk of transmission, a significant risk is involved.

2.1.5 *Appointments procedure and pre-employment medical*

One important factor affecting the way in which the obligations of employers and employees are met is the issue of whether, during the appointments procedure, it was pointed out that the employee is expected to consent to vaccination. The first opportunity to discuss the issue of vaccination with an employee (or prospective employee) is either during the appointments procedure or during the pre-employment medical. In this context, the Committee points out that – according to the Medical Examinations Act – a pre-employment medical may only be carried out if the position in question makes special requirements of the holder's medical fitness.

The question arises of whether, in the context of an appointments procedure, an employer is entitled to ask the employee (or prospective employee) whether they are willing to undergo vaccination, with the consequence that refusal to do so may result in denial of employment. Several years ago, the Minister of Health, Welfare and Sport indicated that this might well be permissible.[11] In the literature, however, this is controversial: proponents consider it to be legally tenable[10], while opponents believe that it amounts to a vaccination requirement that lacks any statutory basis.[9] In line with the provisions of subsection 2.1.4, asking an individual whether or not they consent to vaccination will at least be possible if, under special circumstances (e.g. major risks to third parties), it is clear that refusing to cooperate with vaccination will have consequences. It is also of interest that employers probably have greater legal scope in terms of setting requirements for future employees, than when an employment contract has been concluded.

2.1.6 *Conclusion*

Based on the legislation, the Committee concludes that employers have a duty of care to their employees and to third parties. Based on this duty of care, employers must give due consideration to measures such as the vaccination of employees. If

there is sufficient reason to do so, they must also offer such vaccination. The legislation does not require employees to undergo this vaccination. Strictly speaking, they can always refuse. On the other hand, in response to a refusal to cooperate, the employer can theoretically impose constraints in terms of employment, even extending to termination of the employment contract. In answer to the question of how much scope is actually available to employers in this connection, neither the literature nor jurisprudence provide many points of reference. Because vaccination is a more drastic procedure than simply wearing personal protective equipment, for example, it will probably only take place under special circumstances. If guarantees are required that certain activities can only be carried out if the employees involved have been vaccinated, then the legislation will need to be amended. The Committee explores this issue in greater detail in Chapter 5.

2.2 Health and safety policy in the Netherlands

In this subsection, the Committee gives brief details of health and safety policy in the Netherlands and of policy that specifically addresses exposure to biological agents.

2.2.1 General health and safety policy

Health and safety policy is the policy implemented by employers, within their companies, in the area of health and safety at work. The main purpose of this policy is to provide employees with healthy and safe working conditions. Responsibility for this lies primarily with employers. The degree of protection provided to workers has been laid down by the government in health and safety legislation.

Prior to 1 January 2011, the Working Conditions Decree was crystallised into Policy Rules (guidelines followed by the Inspectorate in the course of their enforcement activities). According to Policy Rule 4.91, for example, employers must provide those employed in medical and paramedical professions (who are at risk of frequent contact with human blood) with the opportunity to be vaccinated against the Hepatitis B virus. The Policy Rules have since lapsed. It is now up to employers and employees to jointly determine how the general provisions (target requirements) of health and safety legislation should be implemented. That approach can be embedded in the various branches of industry, in a Health and Safety Catalogue, for example. In this Catalogue,

employers and employees set out details of how they plan to meet the government's target requirements for healthy and safe working practices.

Health and safety care

Employers are obliged to implement a health and safety policy. An effective health and safety policy requires companies to perform an internal risk assessment and evaluation (RA&E). This RA&E is the basis for the company's health and safety policy. In addition, each company must have a designated Health and Safety Service or occupational health physician who supervises employees who are absent through sickness. In addition, companies are required to have at least one prevention officer and at least one emergency response officer. Companies with an effective health and safety policy provide their employees with regular information and instruction sessions on healthy and safe working practices. Finally, employers must provide employees with access to a health and safety expert, such as an occupational health physician or occupational hygienist. Employees must also have the opportunity of undergoing a periodic occupational health medical examination (AGO). The nature of this examination must be tailored to the hazards and risks identified on the basis of an RA&E.

In the context of an effective health and safety policy, measures to protect employees are implemented in a set (hierarchical) sequence, referred to as the occupational hygiene strategy scale (Art. 3 of the Working Conditions Act).

Risk assessment and evaluation (RA&E)

According to the Working Conditions Act, the establishment of an RA&E is a mandatory element of an effective health and safety policy. The RA&E gives details of the risks to which employees and interns are exposed in the course of their work*. An RA&E helps employers to resolve unsafe and hazardous situations at work. This is because it involves the preparation of an action plan to address health and safety risks. In this context, the emphasis is on prevention.

* In the case of organisations or companies that handle biological agents (or hazardous substances like asbestos, explosives, or volatile substances) the Working Conditions Act draws no distinction between permanent employees and volunteers.

An RA&E should consist of the following elements[12]:

- An inventory of the hazards present and of the risk mitigation measures that have already been taken in the areas of health, safety and welfare, with a specific focus on “special categories of employees” (for example, the partially disabled, pregnant women, young people and the elderly).
- An evaluation of the risks associated with these identified hazards.
- Prioritisation of the risks.
- Determining which measures will be taken: the action plan.

Occupational hygiene strategy scale

Employers must protect the health and safety of their employees by means of an occupational hygiene strategy scale (a hierarchical system of control measures). The occupational hygiene strategy scale indicates that the first step must be to examine the source of a given problem (source control measures). These might include replacing a harmful agent with a safer alternative. If source control measures are not feasible, employers should examine other collective measures to see whether they offer an adequate solution. Finally, employers can opt for individual measures and provide employees with personal protective equipment. It can, therefore, be seen that measures at these various levels fall into a clear sequence.

According to the reasonableness principle, it is only permissible to move down to a lower level if there are sound technical, executive or economic reasons for doing so. This consideration applies to each individual level. There are some exceptions to this, such as the risks of occupational exposure to carcinogenic substances (Art. 4.17 Working Conditions Decree) and biological agents (Art. 4.87 Working Conditions Decree). Here, it is only permissible to move down one step in the hierarchy if a higher-level measure is not technically feasible. In these two groups, economic reasons may not be used to justify switching to a lower level measure (www.arboportaal.nl).

2.2.2 Health and safety policy for biological agents

As a part of the RA&E, employers must assess the risks of exposure to biological agents. Wherever possible, the measures taken should be derived from the occupational hygiene strategy scale. In the context of the Expert System on Occupational Infectious Diseases (KIZA), this prevention strategy has been further refined to cover work with biological agents, and crystallised into the Biological Occupational Hygiene (BOH) principle.[13] The strategy is, as far as

possible, based on the standard occupational hygiene strategy scale prescribed by the Working Conditions Act.

This initially involves searching for ways to eliminate the cause of the problem, although other measures may subsequently be used. These could include organisational measures, technical measures, hygienic measures, personal protective equipment, vaccination, and – finally – therapy. A detailed summary of this strategy is given in Annex D.

As the Committee stated previously, the occupational hygiene strategy scale's guiding principle is to seek to achieve effective source control measures that can guarantee the employees' health. All other measures are secondary to this. The difficulty with providing protection against biological agents is that measures taken at source are often not feasible. If these measures are feasible, however, they are often less effective than those used to deal with exposure to chemical substances. This is due to the specific properties of biological agents. These are living organisms that can multiply, grow and die, thereby producing fluctuations in exposure. The Health Council explores this issue in greater detail in an advisory letter on health-based recommended exposure limits for biological agents.[14] Another factor here is that it is difficult to measure exposure to biological agents, which complicates attempts to verify the effectiveness of the measures taken.

The occupational hygiene strategy scale and vaccination

Vaccination has a special status, relative to the control measures within the occupational hygiene strategy scale. The goal of that strategy scale, after all, is to eliminate employee exposure to an agent as effectively as possible, while the goal of vaccination is to prevent or ameliorate the effects of exposure that has already taken place. Nevertheless, particularly where the efficacy of the vaccine in question is undisputed, the Committee feels that the vaccination option should be considered at an early stage in the process. In this connection, the Committee emphasises that the availability of an effective vaccine does not, in its view, relieve employers of their obligation to take source control measures and to provide protective equipment (or personal protective equipment). Firstly, in the context of their occupational hygiene strategy, employers are legally obliged to implement measures as far up the scale as possible. Secondly, exposure at work is rarely limited to a single agent, so implementing measures high in the occupational hygiene strategy scale also offers protection against other agents.

2.3 Extra risk due to occupational exposure

With regard to employee vaccination, the health risk involved in working with biological agents for which vaccines are available is a major consideration. Accordingly, employers should use a structured approach to identify the magnitude of the risk posed by occupational exposure. Various methods are available for this purpose. One of these is the method developed by Kinney and Wiruth (1976)*. It defines the risk (R) as the product of the probability that a given event will occur (W) and the severity of the effect involved (E) and the level of exposure (B).

Expressed as a formula:

$$R = B \times W \times E$$

The individual components of this formula need to be quantified in order to determine the magnitude of the risks in the workplace. The exposure factor B indicates how often, how long and at what level an employee is exposed. Exposure can be expressed as the product of frequency of exposure, duration of exposure, and concentration. The factor W is the probability that a given effect will occur (given that exposure occurs). The effect (E) consists of physical and psychological injuries. The Committee imagines that employers will quantify risk using a model-based approach.

The decision frameworks for vaccination under working conditions are intended to support employers by determining whether the vaccination of their employees against a biological agent leads to a reduced risk of infection - not only for the employees themselves (in terms of at-risk status), but also for third parties (in terms of source-of-risk status). With regard to the protection of workers, the Committee notes that this advisory report does not address employees' day-to-day risk of infection, but rather the additional risk arising from the performance of work-related activities, and how to reduce it. Similarly, it is not about the risk of infection run by such third-parties on a day-to-day basis, but rather the additional risk arising from the transmission of an agent from employees to the third parties in question. The issue of whether an employee contracted this infection at work or elsewhere is quite irrelevant in this context.

* This is also known as the Fine/Kinney method.

Chapter 3

Criteria for employee vaccination

In Chapter 1, the Committee explained that employees who are exposed to an infectious agent can go on to develop health problems and that, by transmitting this agent, infected employees can also pose a risk to third parties. Thus, in addition to protecting the vaccinated individuals themselves (direct effect), employee vaccination can provide protection for third parties (indirect effect). Accordingly, the Committee has decided to create two decision frameworks, each with a separate objective, to support decisions regarding employee vaccination. By using both frameworks employers are able to make an integrated consideration on offering vaccination to an employee. Formal responsibility for such decisions rests with the employer. In the area of employee protection, occupational health physicians have an advisory role. In the area of third-party protection, other experts are often involved.

In this Chapter, the Committee gives details of the frameworks it has developed. The Committee begins by defining the objective that it had in mind when developing these frameworks.

3.1 Objectives in developing the frameworks

The frameworks are intended to help employers make sound and consistent decisions about whether:

- Employee vaccination falls within providing optimum protection for the employee himself against the effects of an infection acquired through

exposure to a biological agent at work (from the employee's point of view: at-risk status).
- Employee vaccination falls within providing optimum protection for third parties against the effects of an infection acquired by transmission via the employee (also from the employee's point of view: source-of-risk status).

3.2 The frameworks

In preparing the decision frameworks for vaccination in the interests of healthy working conditions, the Committee took as its starting point the decision framework for vaccination in a public vaccination programme.[1]

In 2007, the Health Council prepared a decision framework to facilitate the process of deciding whether to incorporate vaccinations in the National Immunisation Programme (NIP). The purpose of the NIP is to protect the population and the fabric of society against serious infectious diseases by means of vaccination. The decision framework consists of seven criteria (see Table 1), formulated in such a way that they can be used to determine whether vaccination against a given microorganism should be incorporated into the NIP. These criteria are based on the following ethical principles, optimum protection of the population as a whole and an equitable distribution between groups within the population, whereby protection is afforded to those groups who are in the most urgent need of it.

The existing NIP decision framework differs from the frameworks to be created by the Committee for the vaccination of employees in terms of its guiding principle and purpose. Accordingly, the Committee has identified elements of the existing decision framework that can be retained and those that require modification, in addition to any elements that need to be added to the decision frameworks that it is developing. The Health Council has previously adopted a similar approach, for an advisory report in which the NIP framework was expanded to deal with other situations.[15]

The Committee has summarised its findings in Table 1. The majority of the criteria can be retained (possibly in a modified form). The Committee has dropped NIP decision framework criteria 5 and 7, as these are not applicable to decisions concerning vaccination under working conditions. After all, this involves individual decisions taken under specific circumstances. In addition, criterion 6 has been dropped from the decision framework for at-risk status. In this criterion, the cost of the health gains derived from vaccination should be

Table 1 Vaccination criteria.

NIP framework with the objective of protecting the population and the fabric of society against serious infectious diseases by means of vaccination	Framework with the objective of providing optimum protection for the employee against infectious diseases by means of vaccination	Framework with the objective of providing optimum protection for third parties against infectious diseases by means of vaccination of the employee
Severity of the burden of disease		
1 The infectious disease leads to a substantial burden of disease in the general population.[a]	The occupational exposure to the infectious agent can pose an extra risk of disease to the employee that is by no means negligible.[b]	The exposure of the employee to infectious agents can, via transmission, lead to a substantial burden of disease in third parties.
Effectiveness and safety of the vaccination		
2 The vaccination leads to a substantial reduction in the burden of disease in the general population.	Employee vaccination leads to a substantial reduction in the extra risk of disease.	By reducing transmission, employee vaccination leads to a substantial reduction in burden of disease in third parties.
3 Any deleterious health effects associated with the vaccination in question (adverse effects) do not detract significantly from the health gains in the population at large.	Any deleterious health effects associated with the vaccination in question (adverse effects) do not detract significantly from the health gains involved.[c]	Any deleterious health effects of the vaccination in question (adverse effects) for the employee are reasonably proportional to the health gains for third parties.
Acceptability of the vaccination		
4 The discomfort experienced by subjects as a result of their individual vaccination is reasonably proportional to the health gains for the subjects in question and for the population as a whole.	The health gains for the employee outweigh any discomfort that he may experience as a result of vaccination.	Any discomfort experienced by the employee as a result of vaccination is reasonably proportional to the health gains for third parties.
5 The discomfort experienced by subjects as a result of the vaccination programme as a whole is reasonably proportional to the health gains for the subjects in question and for the population as a whole.	*Not applicable*	*Not applicable*
Efficiency of the vaccination		
6 The relationship of costs to health gains is favourable in comparison to other means of reducing the burden of disease.	*Not applicable*	The relationship of costs to health gains is proportional in comparison to any other means the employer may have for reducing the burden of disease in third parties.
Prioritisation of the burden of disease		
7 The decision to proceed with vaccination addresses a potentially urgent public health problem.	*Not applicable*	*Not applicable*

[a] Disease burden is defined as the level of health impairment in a population caused by diseases.[16]
[b] For a definition of "extra risk", see subsection 2.3.
[c] Any adverse effects of vaccination should be reported to the Netherlands Center for Occupational Diseases.

weighed against the cost of health gains from other measures that employers can implement to reduce the extra risk of disease. However, the selection of measures must not be influenced by economic considerations (see subsection 2.1.1). The Committee therefore believes that it is impossible to make allowance for cost considerations when deciding between vaccination and occupational hygiene measures, even though vaccination does not feature in the occupational hygiene strategy scale.

According to the Committee, no additional criteria are required.

In searching for decision frameworks for vaccination in the interests of healthy working conditions, the Committee has looked beyond the borders of the Netherlands. Although other countries also view the vaccination of employees as a measure for protecting employees (and third parties) against the effects of exposure to biological agents, the Committee does not know whether a standardised decision framework is used for this purpose.

3.3 Operationalisation of the frameworks

Like the decision framework for vaccination in a public vaccination programme, the decision frameworks for vaccination in the interests of healthy and safe working conditions feature a high level of abstraction. One important difference is that the framework for vaccination in a public vaccination programme is exclusively used by the Health Council's Committee on Vaccinations, while the frameworks for vaccination in working conditions are intended for use by the individual employer, in consultation with the employee. Accordingly, the Committee on Vaccination and Working Conditions has decided to develop a guide to facilitate the use of these decision frameworks in practice. The Committee has included details in Annex E concerning all vaccines currently registered in the Netherlands.

The Committee has decided against including in this advisory report a summary of all those groups of employees who are at risk of contamination with microorganisms, of the microorganisms involved, and whether or not vaccination should be made available. This consideration remains the responsibility of employers. Furthermore, the Committee is aware of the fact that implementing vaccination policy within companies is primarily the responsibility of occupational health physicians. In this advisory report, however, the Committee is primarily focusing on employers, as it is they who are responsible for providing healthy and safe working conditions.

3.3.1 *Operationalisation of the framework for the protection of the employee*

To facilitate use of the decision framework for the protection of the employee in practice, the Committee has prepared a series of questions. The answers to these questions should enable the employer to determine whether employee vaccination falls within providing optimum protection for the employee against the effects of an infection acquired through exposure to a biological agent at work. Here, the Committee presents the questions per criterion.

1 Occupational exposure to the infectious agent can pose an extra risk of disease to the employee that is by no means negligible.*

Is there a risk of relevant occupational exposure (B) to the infectious agent?

- Can an infectious agent (for which a vaccine is available) occur in the workplace? Can the employee come into contact with that agent, and does exposure involve a relevant transmission route? In this connection, focus both on exposure scenarios or high-risk procedures carried out in the context of day-to-day activities and on less common activities performed in connection with maintenance work or during breakdowns.
- How often does the occupational exposure in question occur, for how long and to what extent?

In this connection, the Committee notes that there is no standard method for identifying occupational exposure to infectious agents. Expert opinions are often obtained and used for this purpose.

Is it probable (W) that the occupational exposure of the employee through infection would result in disease (in the employee himself)?

- Has the employee already been vaccinated against the agent in question (via the NIP, for example) and, if so, does he have (or still has) an adequate level of protection?
- Is it probable that employee exposure would lead to infection?
- Is it probable that employee exposure would lead to disease? In this connection, note that some employees may be more susceptible than others.
- How does an employee's extra risk of disease due to workplace exposure compare to the risk of disease in the general population?

* Extra Risk = Occupational Exposure (B) * Probability (W) * Effect (E) (see Chapter 2).

Is there an adverse effect (E) for the employee?

- Could the disease that the employee obtains through exposure be serious? In this connection, note that some employees might be more susceptible than others.
- Are there any effective treatment options (such as post-exposure prophylaxis) for reducing the burden of disease and are these proportional to the discomfort suffered by the employee as a result of the disease?

Is it possible to include measures in the occupational hygiene strategy scale that would reduce exposure to an agent such that the additional risk of disease posed to the individual employee is reduced to an acceptable minimum?

- Are there any measures that have been shown to restrict employee exposure or that are likely to have such an effect?
- Is the reduction in the extra risk of disease produced by these measures comparable to the reduction produced by vaccination?

2 Employee vaccination leads to a substantial reduction in the extra risk of disease.

Is vaccination likely to be effective in preventing disease or in reducing symptoms?

3 Any deleterious health effects associated with the vaccination in question (adverse effects) do not detract significantly from the health gains involved.

Are the adverse health effects associated with the vaccination in question unlikely to detract significantly from the health gains of the employee? In this connection, note that some employees may be more susceptible to adverse effects than others.

4 The health gains for the employee outweigh any discomfort that he may experience as a result of vaccination.

With a view to the health gains for the employee himself, is the discomfort associated with vaccination acceptable?

Decision framework for the protection of the employee

1 Occupational exposure to the infectious agent can pose an extra risk of disease to the employee that is by no means negligible

Exposure

Is there a risk of relevant exposure to the infectious agent?

- *Can an infectious agent (for which a vaccine is available) occur in the workplace?*
- *Can the employee come into contact with the agent, and does exposure involve a relevant transmission route?**
- *How often does the exposure in question occur, for how long and to what extent?*

yes

Probability

Is it probable that the exposure of the employee through infection would result in disease (in the employee himself)?

- *Has the employee been vaccinated against the agent in question and, if so, does he have an adequate level of protection?*
- *Is it probable that employee exposure would lead to infection?***
- *Is it probable that employee exposure would lead to disease?***
- *How does an employee's extra risk of disease compare to the risk of disease in the general population?*

yes

Magnitude of adverse effect

Is there an adverse effect for the employee?

- *Could the disease that the employee obtains through exposure be serious?***
- *Are there any effective treatment options and are these proportional to the discomfort suffered by the employee as a result of the disease?*

yes

Reduction measures

Is it possible to include measures in the occupational hygiene strategy scale that would reduce exposure to an agent such that the additional risk of disease posed to the individual employee is reduced to an acceptable minimum?

- *Are there any measures that have been shown to restrict employee exposure or that are likely to have such an effect?*
- *Is the reduction in the extra risk of disease produced by these measures comparable to the reduction produced by vaccination?*

no

2 Employee vaccination leads to a substantial reduction in the extra risk of disease

Effective

Is vaccination likely to be effective in preventing disease or in reducing symptoms?

yes

3 Any deleterious health effects associated with the vaccination in question (adverse effects) do not detract significantly from the health gains involved

Adverse effects

Are the adverse health effects associated with the vaccination in question unlikely to detract significantly from the health gains of the employee?**

yes

4 The health gains for the employee outweigh any discomfort that he may experience as a result of vaccination

Discomfort

With a view to the health gains for the employee himself, is the discomfort associated with vaccination acceptable?

yes

Vaccination is an integral part of the optimum protection for the employee

*In this connection, focus both on exposure scenarios or high-risk procedures carried out in the context of day-to-day activities and on less common activities performed in connection with maintenance work or during breakdowns.

**In this connection, note that some employees may be more susceptible than others.

3.3.2 *Operationalisation of the framework for the protection of third parties*

The Committee has also prepared a series of questions to facilitate the use of the decision framework for the protection of third parties. This is intended to help employers determine whether employee vaccination falls within providing optimum protection for third parties against the transmission of an infection via the employee. Here, too, the Committee presents the questions per criterion.

1 Occupational exposure of the employee to infectious agents can, via transmission, lead to a substantial burden of disease in third parties.

Is there a risk of the employee suffering relevant exposure to the infectious agent?

- Can the employee be exposed to the agent in the workplace or elsewhere (does exposure involve a relevant transmission route)? In this connection, focus both on exposure scenarios or high-risk procedures carried out in the context of day-to-day activities and on less common activities performed in connection with maintenance work or during breakdowns.

Is it probable that employee exposure would cause the infectious agent to be transferred to third parties?

- Has the employee been vaccinated against the agent in question (via the NIP, for example) and is this sufficient to prevent transmission to third parties?
- Is it probable that the exposure and infection of the employee would result in the exposure of third parties?
- Is it probable that the exposure of third parties would result in the infection of third parties?

Is it probable that transmission of the infectious agent to third parties would result in a substantial burden of disease in third parties?

- Is it probable that infection of third parties would lead to a substantial burden of disease? Disease burden is defined as the level of health impairment in a population caused by the infection. The Committee notes that this burden of disease may be substantial in nature if the infection in question produces severe effects, or if the infection affects a large group of people (third parties).

- Have the third parties been vaccinated against the agent in question (via the NIP, for example) and, if so, do they have (or still have) an adequate level of protection?
- Is it probable that infection in third parties would lead to a further spread of the agent in question?
- How does a third party's extra risk of disease due to transmission via an employee compare to the risk of transmission in the general population?

Is there an adverse effect for third parties?
- Do third parties suffer a substantial burden of disease?
- Are there any effective treatment options for reducing the burden of disease in third parties and are these proportional to the discomfort suffered by third parties as a result of the disease?

Are there any other measures that could potentially be used to reduce the risk of transmitting the infectious disease to third parties to an acceptable minimum?
- Are there any measures that can effectively restrict employee exposure?
- Are there any measures that can effectively restrict transmission to third parties?
- Is the reduction in transmission produced by these measures comparable to the reduction produced by vaccination?

2 By reducing transmission, employee vaccination leads to a substantial reduction in burden of disease in third parties.

Is vaccination likely to be effective in preventing or reducing the risk of infectious disease being transmitted to third parties?

3 Any deleterious health effects of the vaccination in question (adverse effects) for the employee are reasonably proportional to the health gains for third parties.

Are the deleterious health effects of the vaccination for the employee (adverse effects) unlikely to detract significantly from third-parties' health gains?

Decision framework for the protection of third parties

1 Occupational exposure of the employee to infectious agents can, via transmission, lead to a substantial burden of disease in third parties

Employee exposure

Is there a risk of the employee suffering relevant exposure to the infectious agent?

yes

- *Can the employee come into contact with the agent in the workplace or elsewhere (does exposure involve a relevant transmission route)?**

Probability of transmission to third parties

Is it probable that employee exposure would cause the infectious agent to be transferred to third parties?

yes

- *Has the employee been vaccinated against the agent in question and is this sufficient to prevent transmission to third parties?*
- *Is it probable that the exposure and infection of the employee would result in the exposure of third parties?*
- *Is it probable that the exposure of third parties would result in the infection of third parties?***

Probability of disease burden in third parties

Is it probable that transmission of the infectious agent to third parties would result in a substantial burden of disease in third parties?

yes

- *Is it probable that infection of third parties would lead to a substantial burden of disease?****
- *Have the third parties been vaccinated against the agent in question and, if so, do they have an adequate level of protection?*
- *Is it probable that infection in third parties would lead to a further spread of the agent in question?*
- *How does a third party's extra risk of disease due to transmission via an employee compare to the risk of transmission in the general population?*

Magnitude of adverse effect

Is there an adverse effect for third parties?

yes

- *Do third parties suffer a substantial burden of disease?***
- *Are there any effective treatment options for reducing the burden of disease in third parties and are these proportional to the discomfort suffered by third parties as a result of the disease?*

Reduction measures

Are there any other measures that could potentially be used to reduce the risk of transmitting the infectious disease to third parties to an acceptable minimum?

- *Are there any measures that can effectively restrict employee exposure?*
- *Are there any measures that can effectively restrict transmission to third parties?*
- *Is the reduction in transmission produced by these measures comparable to the reduction produced by employee vaccination?*

no

2 By reducing transmission, employee vaccination leads to a substantial reduction in burden of disease in third parties

Effective

Is vaccination likely to be effective in preventing or reducing the risk of infectious disease being transmitted to third parties?

yes

3 Any deleterious health effects of the vaccination in question (adverse effects) for the employee are reasonably proportional to the health gains for third parties

Adverse effects

Are the deleterious health effects of the vaccination for the employee (adverse effects) unlikely to detract significantly from third parties' health gains?

yes

4 Any discomfort experienced by the employee as a result of vaccination is reasonably proportional to the health gains for third parties

Discomfort

With the objective of health gains for third parties, is the discomfort associated with vaccination acceptable to the employee?

yes

5 The relationship of costs to health gains is proportional in comparison to other means of reducing the burden of disease in third parties

Cost

Is the cost of employee vaccination proportional to the cost of other measures that could be taken?

yes

Vaccination is an integral part of the optimum protection for third parties

*In this connection, focus both on exposure scenarios or high-risk procedures carried out in the context of day-to-day activities and on less common activities performed in connection with maintenance work or during breakdowns.

** In this connection, note that some individuals may have an increased risk of a more serious course.

*** In this connection, note that this burden of disease may be substantial in nature if the infection in question has serious consequences or if the infection affects a large group of people (third parties).

4 Any discomfort experienced by the employee as a result of vaccination is reasonably proportional to the health gains for third parties.

With the objective of health gains for third parties, is the discomfort associated with vaccination acceptable to the employee?

5 The relationship of costs to health gains is proportional in comparison to other means of reducing the burden of disease in third parties.

Is the cost of employee vaccination proportional to the cost of other measures that could be taken?

3.4 In conclusion

In this Chapter, the Committee examines the criteria to be used for an integrated determination of whether the vaccination of an employee contributes to the optimum protection against the effects of infection of the employee himself and/or of third parties. In the following Chapter, the Committee illustrates the use of these frameworks by means of a number of practical case studies. Finally, in Chapter 5, the Committee explores the implications of the use of frameworks in greater detail.

Chapter 4

Practical examples

In Chapter 3 of this advisory report, the Committee gives details of two decision frameworks that are intended to indicate whether, with regard to the effects of infection acquired through exposure to biological agents, employee vaccination helps to provide optimum protection for the employee himself, or for third parties with whom this employee comes into contact. In this Chapter, the Committee illustrates both frameworks by means of a number of case studies.* The case studies have been selected to illustrate the importance of the various components of these decision frameworks.

4.1 Case study 1: A surgeon and hepatitis B virus

4.1.1 Is vaccination an integral part of the duty to provide optimum protection for the employee?

In the course of their work, surgeons may be exposed to hepatitis B virus (HBV) through contact with infected patients**. In the Netherlands, between 40,000 and 120,000 individuals are chronically infected by HBV. The main transmission

* For the sake of readability, the Committee has only presented the main points of each case study here. The exact decision process is shown in Annex F.

** For the purposes of this case study, the Committee has used the National guidelines on preventing transmission of Hepatitis B from medical staff to patients.[17]

route for surgeons involves accidental cuts and needle-stick injuries where there is blood-to-blood contact. The Committee estimates that general surgeons have at least four accidents per year in which blood transfer can take place.

In procedures on patients who have tested HBV positive, the risk of infection following needle-stick injuries can be up to about 30 percent, depending on the stage of the disease.[18] The disease that the employee can acquire through exposure can have a serious course. After 5 to 25 years, 15 to 25 percent of patients with chronic active Hepatitis B will develop liver cirrhosis and/or hepatocellular carcinoma.[19]

The Committee believes that vaccination against HBV virus may be an effective protective measure. However, a number of alternative measures could be considered. These include the use of robotic surgery, wearing (several pairs of) gloves, or suturing incisions using blunt needles in some procedures. The measure that is most effective in protecting surgeons must be determined at both individual and group level. Accordingly, the effectiveness of wearing gloves is dependant on the percentage of surgeons that actually do so in practice. The level of vaccination coverage determines the effectiveness of vaccination at group level. For an individual surgeon, wearing gloves still involves a degree of risk, as a result of tearing, for example. Nor, indeed, does vaccination offer equally effective protection to each and every surgeon.

4.1.2 Is vaccination an integral part of the duty to provide optimum protection for third parties?

Surgeons may be exposed to HBV. Such exposure can result in infection, causing the employee to become a carrier. Their status as carriers can then lead to situations in which patients are exposed and suffer infection. This was highlighted by an incident in the Netherlands, where a surgeon who is an HBV carrier infected a substantial number of patients.[20] In healthy adults, HBV infection leads to acute hepatitis in 40 percent of cases. Following HBV transmission, newborn infants have a 90 percent risk of developing a chronic HBV infection. The corresponding figure for children below the age of five is 25 to 30 percent. In adults, it is less than 5 percent.[21] Patients with concomitant liver disease are at greater risk of developing the disease.

While there are measures that can prevent employee exposure and transmission to patients, the Committee believes that employee vaccination is the most effective measure in terms of protecting vulnerable patients.

4.1.3 *The Committee's recommendation*

The Committee concludes that employee vaccination contributes to healthy working conditions for the employee himself and that it also helps to provide better protection for patients. According to the Committee, no other measures are capable of achieving the same level of safety. The Committee notes that the authors of the National guidelines on preventing transmission of Hepatitis B from medical staff to patients reached the same conclusion.[17]

4.2 Case study 2: A nurse on a children's ward and *Neisseria meningitidis* serogroup C (meningococcal serogroup C)

4.2.1 *Is vaccination an integral part of the duty to provide optimum protection for the employee?*

A nurse on a children's ward can be exposed to meningococcal serogroup C via aerosols. The Committee notes that while the extra risk to the nurse of acquiring an infection has increased relative to the risk of acquiring an infection in the general population, it is still very small. For instance, from 1982 to 1996, in England and Wales, just three cases were identified in which meningococcal disease had been transmitted from patients to nurses.[22] On that basis, the Committee estimates that, in the Netherlands, a nurse will acquire meningococcal disease by contamination from a patient no more than once every ten years. Now that vaccination against meningococcal serogroup C has been included in the NIP, the risk that this serogroup will be involved is virtually zero.[23]

Measures found elsewhere in the occupational hygiene strategy scale are still required to provide protection against other types of meningococci. These include having nurses wear surgical masks during the first 24 hours of the patients' course of antibiotic treatment (after which, patients are no longer contagious).[24] If exposure has still occurred, post-exposure prophylaxis can substantially reduce or negate the burden of disease.

4.2.2 *Is vaccination an integral part of the duty to provide optimum protection for third parties?*

The Committee estimates that a third party's extra risk of disease due to transmission via an employee is very small. There are only a few individual

reports of hospital-acquired meningococcal disease in which a nurse may have been involved in transmission.[25] Here too, according to the Committee, now that vaccination against meningococcal serogroup C has been included in the NIP, the risk that this serogroup will be involved is virtually zero.[23]

4.2.3 The Committee's recommendation

The Committee concludes that the risk of a nurse being occupational exposed to meningococcal serogroup C and the risk of this meningococcal disease being transmitted from nurse to patient are both are so small that there is no need to consider vaccination.

4.3 Case study 3: A sewer worker and hepatitis A virus

4.3.1 Is vaccination an integral part of the duty to provide optimum protection for the employee?

In the course of their work, sewer workers can come into contact with various biological agents, including hepatitis A virus. The virus is mainly ingested as a result of poor hygiene, from contaminated hands or clothing, by hand-to-mouth contact (when eating, smoking, drinking, or by touching the mouth). Airborne transmission is also possible, through the inhalation of contaminated aerosols.

Whether or not sewer workers in the Netherlands are at increased (extra) risk of acquiring a hepatitis A viral infection can not be determined from the available literature. The picture is not consistent. A 2001 systematic review found no increased risk of hepatitis A among sewer workers.[26] In that review, however, it was not possible to differentiate between the various tasks carried out by sewer workers. There have been no studies into the levels of hepatitis A virus in Dutch waste water.

Exposing employees to hepatitis A virus can result in infection. In adults, infection is often accompanied by a general malaise, flu-like symptoms, fever, loss of appetite, nausea and abdominal discomfort. The older the patient, the greater the duration and severity of the disease. Most patients with a hepatitis A viral infection eventually recover and do not experience any residual symptoms.

In addition to the hepatitis A virus, sewer workers can be exposed to other biological agents.[27] Accordingly, it is important to take measures aimed at reducing exposure in general, rather than focusing purely on reducing people's exposure to the hepatitis A virus. This can be achieved, for example, by means of

good personal hygiene during and after the work in question. However, it is up to employers to ensure that employees comply with the specific measures that have been put in place to ensure proper hygiene. The Committee notes that it can not exclude the possibility that some sewer workers may experience much higher exposures to hepatitis A virus when performing specific tasks. If that is indeed the case, then it would be worth considering vaccination.

4.3.2 Is vaccination an integral part of the duty to provide optimum protection for third parties?

A 2001 systematic review found no increased risk of Hepatitis A among sewer workers.[26] The Committee is not aware of any data on the transmission of hepatitis A virus from sewer workers to third parties. With the optimum protection of third parties in mind, it is also important to take measures aimed at reducing exposure to biological agents in general, rather than focusing purely on reducing the risk of hepatitis A.

4.3.3 The Committee's recommendation

The Committee concludes that it is not appropriate to vaccinate sewer workers against hepatitis A virus. It is more important to take measures to reduce exposure, as these will also prevent contamination with other biological agents.

4.4 Conclusion

The case studies described in this Chapter illustrate the importance of different components of the decision frameworks. For instance, the case study on vaccination against hepatitis B virus illustrates the importance of allowing for the perspective of employee protection and the perspective of third party protection in the decision-making process. The case study on vaccination against meningococci shows that the level of exposure is an important element in the decision process. The importance of finding the right balance between vaccination and measures in the occupational hygiene strategy scale is highlighted by the case concerning the vaccination of sewer workers against hepatitis A virus.

Based on its detailed case studies, the Committee concludes that the decision frameworks can be used to determine whether employee vaccination is part of providing optimum protection for the employee himself, or for third parties with

whom the employee comes into contact. In this connection, the Committee has found that it is sometimes difficult to determine whether exposure to infectious agents can pose a substantial extra risk of disease.

Chapter 5

Implications for use

In the previous two Chapters, the Committee has identified the criteria for vaccination in the interests of healthy and safe working conditions. It has also illustrated the use of these criteria on the basis of a number of case studies. In this Chapter, the Committee places the use of the criteria and the outcome of the appraisal in a broader context.

5.1 Consequences of a decision

If application of the decision framework shows that vaccination is part of the process of providing optimal protection for the employee and/or for third parties, the Committee is of the opinion that this outcome must have certain implications. In this subsection, the Committee explores that issue in greater detail. In doing so, it draws a distinction between vaccination for the purpose of protecting the employee himself and vaccination to protect third parties.

5.1.1 Vaccination for the purpose of protecting the employee himself

If it appears that vaccination is a part of the process of providing optimal protection for the employee, the Committee feels that obtaining a vaccination should feature among the workers' rights. At the same time, the Committee feels that it is appropriate for the employer to recommend vaccination to the employee. Where there is a risk of serious disease following contamination, the

Committee takes the view that the employer should be even more insistent in recommending vaccination. That is the case, for example, with biological agents in risk categories 3 and 4 of the Working Conditions Decree (see subsection 2.1.2), such as rabies.* The effective provision of information by the employer has an important part to play here.

Any employee who accepts the offer and undergoes vaccination will be protected optimally. In the Netherlands, there is no legal obligation to accept vaccination, so the employee here has the right to decide not to be vaccinated. In such cases, there is an even greater emphasis on measures to protect against exposure, such as protective equipment (and personal protective equipment). In the event of a risk of serious disease, the employer can be expected – by virtue of their duty of care – to make every effort to convince the employee of the importance of vaccination. This means that the employer must take steps such as checking that the employee is indeed aware of the risks involved. Whatever the case, if there is a risk of serious disease, the employer must prevent employee exposure. This could for instance imply that the employer, in consultation with the employee, explores the possibility of suitable alternative work.

Table 2 The employee as an at-risk individual.

Outcome of the consideration	Employer's duty with respect to vaccination	When vaccination does not take place
Vaccination is one of the safe working conditions required to prevent an extra risk of disease	Inform the employee and recommend vaccination	Even greater emphasis on measures to protect against exposure.
Vaccination is one of the safe working conditions required to prevent an extra risk of *serious* disease	Inform the employee and be insistent in recommending vaccination. Check that the employee is aware of the risks involved.	Employer must prevent employee exposure by means of protective measures or by exploring the possibility of suitable alternative work, in consultation with the employee.

5.1.2 *Vaccination for the protection of third parties*

The Committee has previously pointed out that the concept of "disease burden" comprises two elements, namely the severity of the disease in question and the size of the group (third parties) affected by the infection (see subsection 3.3.2).[16]

* Category 4 includes agents that are capable of causing serious human disease, that pose a great hazard to the health and safety of employees, and that are highly likely to spread through the population. However, as there is usually *no* effective prophylaxis against, or treatment for, these agents, they are beyond the scope of this advisory report.

If application of the decision framework shows that employee vaccination is part of the process of providing optimal protection for third parties against a substantial burden of disease resulting from an infection in a large group (third parties), the Committee feels that the employer – by virtue of their duty of care to third parties – can ask the employee to undergo vaccination. In the Committee's view, if need be (in the context of efforts to achieve optimal protection for third parties against this substantial burden of disease), the employer is required to check that the employee is aware of the risks involved and – if it should prove necessary – the employer is required to persuade the employee to undergo vaccination.

As stated in the previous subsection, the Netherlands has no legal requirement concerning accepting vaccination, yet the Committee feels in this case that vaccination is a moral responsibility of the employee to vulnerable third parties. If this moral responsibility fails to persuade the employee to undergo vaccination, then the employer and the employee must take alternative measures. In this connection, the Committee envisages protective equipment (and personal protective equipment) for the employee that will prevent transmission of the infection to third parties.

If the substantial burden of disease is caused by an infection that results in a serious disease in vulnerable third parties, then the Committee emphasises the importance of employee vaccination even more forcibly. Accordingly, in cases like these, the Committee feels that the employer must be even more insistent when appealing to the employee's sense of responsibility. In such situations, the employers may attempt to achieve the highest possible level of vaccination coverage among the employees. Here too, the Committee notes the importance of effective information provision by the employer, and recommends that they do everything possible to facilitate vaccination.

The Committee feels that there is an existing moral responsibility in this situation. However, if this fails to persuade the employee to undergo vaccination, then employer and employee must take alternative measures. In addition to protective equipment (or personal protective equipment), the Committee feels that such measures must include finding suitable alternative work. In addition, the Committee urges that, in special circumstances (e.g. in a group of patients for whom infection would involve a very serious disease), consideration be given to the possibility of making the vaccination of employees a legal requirement. These proposals involve the use, in special situations, of a certain degree of pressure (and, in the case of a legal obligation, even compulsion), which could theoretically be justified on the basis of the harm principle.[28,29]

Table 3 The employee as a source-of-risk.

Outcome of the consideration	Employer's duty with respect to vaccination	When vaccination does not take place
Vaccination is part of the process of providing optimum protection against a substantial burden of disease due to an infection affecting a large group (third parties)	Inform the employee and check that he is aware of the risks involved. Recommend vaccination and, if necessary, persuade the employee by appealing to his sense of moral responsibility.	The employer must provide protective measures for the employee to avoid third-party exposure.
Vaccination is part of the process of providing optimum protection against a substantial burden of disease as the infection can cause serious disease in third parties.	Inform the employee and check that he is aware of the risks involved. Recommend vaccination and, if necessary, be even more insistent in persuading the employee by appealing to his sense of moral responsibility. Attempt to achieve the highest possible level of vaccination coverage.	The employer must prevent third party exposure by means of protective measures for the employee or by exploring the possibility of suitable alternative work, in consultation with the employee.
Vaccination is part of the process of providing optimum protection against a substantial burden of disease as the infection can cause a very serious disease in third parties.	Inform the employee and check that he is aware of the risks involved. Recommend vaccination and, if necessary, be even more insistent in persuading the employee by appealing to his sense of moral responsibility. Attempt to achieve the highest possible level of vaccination coverage.	Explore the possibility of a legal obligation.

In practice, employers appear to have the means to persuade their employees to accept vaccination, for example, by making agreements with employees when they first join the organisation. Alternatively, the practical consequences of not undergoing vaccination may be such that employees decide to be vaccinated anyway. For instance, source-of-risk health service employees who refuse to be vaccinated against the hepatitis B virus can be required to undergo three-monthly blood tests for the presence of the virus.[17] Anyone refusing to comply would then be banned from performing risky procedures by the Health Care Inspectorate. In this connection, however, the Committee notes that this has never happened in the Netherlands.

5.2 Using the frameworks to resolve distribution issues

In his request for advice, the State Secretary indicates that he wants to use the framework for employee vaccination, in addition to the NIP framework, whenever the government has to deal with a distribution issue in times of scarcity of a vaccin. However, the Committee notes that – for various reasons – the NIP framework in combination with its own frameworks will not resolve the issue of who is to be given top priority for vaccination in the event of a vaccine shortage. For example, the specific circumstances pertaining at the time (the characteristics of the agent in question, or the nature of the outbreak) have a major influence, and other, more ethical issues are important. Issues such as the intended purpose of the vaccination will then have to be addressed. Should it be used to protect those at high risk of mortality or to reduce viral transmission as much as possible? The World Health Organization has drawn up a discussion report on this issue.[30] Providing a clarification of the ethical issues affecting the distribution of vaccines in the event of shortage is beyond the scope of this advisory report.

5.3 Using the frameworks for vaccines that are not registered for use in the Netherlands

Medicinal products (such as vaccines) that are not registered for use in the Netherlands cannot be obtained through formal channels. Before these medical products can be administered, the responsible physician must sign an awareness statement and the individual to whom the vaccine is to be administered must sign an informed consent. As mentioned in the previous subsection, data relating to the properties of a vaccine are sometimes incomplete or difficult to interpret. This applies to an even greater extent for this group of vaccines. Objective information can be difficult to obtain.

Nevertheless, the Committee can well imagine that, while such vaccines are not registered for use in the Netherlands, their use may sometimes be required to ensure healthy and safe working conditions. This might, for example, involve the use of an unregistered replacement when a licensed vaccine is in short supply. The Committee feels that employers are primarily responsible for making such decisions. In this connection, it emphasises the importance of uniformity (referred to in the previous subsection). In addition, the Committee proposes that – with regard to these vaccines too – employers should be able to consult independent experts, such as those at the Centre for Infectious Disease Control,

which is part of the National Institute for Public Health and the Environment (RIVM).

Any decisions regarding vaccination with a non-registered vaccine on a larger scale than that of an individual company should, in the Committee's view, take place at government level (through the Health Council, for example). This is in line with the State Secretary's request that a 2010[31] Health Council advisory report on Q fever be supplemented. Based on the new framework, the Health Council will draw up a separate advisory report to address the advisability of vaccinating groups of employees against Q fever.

5.4 Using the frameworks at an integrated level

The Committee has designed the frameworks to enable each individual employer to decide whether vaccination falls within providing optimal protection for individual employees or third parties. The Committee is cognisant of the fact that the practical application of the criteria can be difficult, as it found when describing the case studies. Incomplete or difficult to interpret data relating to exposure to the biological agent, to the effect of different measures, or to the properties of the vaccine may make it more difficult to reach a decision.

Accordingly, the Committee has determined that, in many cases, the employer will have to seek the advice of experts in the field of biological agents. Any decision on the use of vaccination to protect the employee will primarily involve occupational health physicians, but in decisions on the use of vaccination to protect third parties others may be involved.* The Committee, therefore, recommends that a coordinated approach be taken when making decisions on vaccination within companies. It anticipates that this approach will facilitate the uniform decision-making that it favours.

As a further boost to the uniformity of the advisory process, the Committee firstly urges that, wherever possible, companies should organise information gathering in support of decisions on vaccination at an integrated level (e.g. branch or sector level). Secondly, the Committee recommends that the occupational health physicians' association (The Netherlands Society of Occupational Medicine) make use of the assessment criteria when drawing up guidelines. The final consideration regarding vaccination depends on the specific characteristics of the employee and on conditions within the company in question.

* In this connection, the Committee envisages the involvement of experts in the field of infectious disease prevention.

The Committee points out that, despite efforts to achieve uniformity, there are still a variety of sources from which employees can obtain information (which may not be consistent) on the usefulness and necessity of vaccination. The Committee anticipates that the effectiveness of company vaccination policy would be enhanced by the timely involvement of the employee in the decision-making process.

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Annexes

Annex **A**

Request for advice

On 26 June 2012, the acting President of the Health Council received a request from the State Secretary for Social Affairs and Employment for an advisory report on vaccination and employee health. The State Secretary wrote (letter G&VW/GW/2012/4961):

Recent research by the Netherlands Organisation for Health Research and Development shows that 1 in 9 individuals in dairy farming families have recently suffered an infection, and that evidence of chronic infections is regularly found. Based on this finding, RIVM's Centre for Infectious Disease Control recommends that an investigation be carried out to determine whether vaccination is appropriate for those living and working on dairy goat farms.

In the advisory letter entitled *Human vaccination against Q fever*, second advisory report (I-381/10/KG/db/859-I December 2010) the Health Council suggested that the differences between vaccination in the contexts of a public programme and of the Working Conditions Act be explored in greater detail.
The Council notes that it has approached the issue of vaccinating professionals from the perspective of a public vaccination programme. According to the advisory report, an approach from the point of view of the relationship between employers and employees might well lead to a different outcome. However, there are no decision frameworks specifically designed for vaccination related to working conditions.
Under normal conditions (i.e. where vaccine is freely available), a decision framework of this kind

could serve as a useful tool for employers (and their Health and Safety Service or occupational health physicians) in reaching a decision on whether or not to offer vaccination to their employees.

In recent years, however, there have been occasions on which, at the outbreak of an infectious disease, a vaccine was not available in sufficient quantity and/or was not registered. If a vaccine is not routinely available, this creates a distribution issue for the government, and the Health Council becomes involved in an advisory capacity. The Health Council can take a working-conditions-based decision framework into account, in addition to the usual criteria for public vaccination programmes.

I would, therefore, ask you to

- develop *a decision framework for vaccination related to working conditions* and, in addition, give details of how this supplements/differs from the criteria to be applied to the vaccination of workers with respect to the criteria applied in the public health arena. This could help to clarify the similarities and differences with regard to public vaccination programmes. This decision framework could also be used when the government is confronted with a distribution issue. Especially in situations involving tight deadlines, such as a crisis, it is useful to have relevant guiding principles already in place.
- make a recommendation (based on the working-conditions decision framework) concerning the advisability of *vaccinating groups of workers against Q fever*, to supplement your 2010 Q fever advisory report. The situation regarding Q fever is more complicated, as it involves an unregistered vaccine that is known to have several drawbacks.

It is important that, in addition to members with expertise in infectious diseases and vaccines, the Committee should include individuals with an understanding of working conditions. Please submit your advice on this matter to me before 1 July 2013.

Yours sincerely,
The State Secretary for Social Affairs and Employment
(signed)
P. de Krom

Annex **B**

The Committee

- Prof. E.J. Ruitenberg, *chairperson*
  Emeritus Professor of Immunology, Utrecht University; Professor of International Public Health, VU University Amsterdam
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- Prof. T. Smid
  Endowed Professor of Working Conditions, VU University Medical Center Amsterdam; Working Conditions Consultant, KLM Health Services, Schiphol-Oost, Amsterdam
- Prof. M.F. Verweij
  Professor of Philosophy, Wageningen University
- Prof. H.L. Zaaijer
  Professor of Blood-borne Infections, Academic Medical Center and Sanquin, Amsterdam
- Prof. J.T. van Dissel, *advisor*
  Professor of Internal Medicine, with special reference to infectious diseases, Leiden University Medical Center; Director of the National Institute for Public Health and the Environment's Centre for Infectious Disease Control (CIB), Bilthoven
- Dr. J.E. van Steenbergen, *observer*
  Physician/Epidemiologist, National Coordination Centre for Communicable Disease Control (LCI); National Institute of Public Health and the Environment (RIVM), Bilthoven
- Dr. P.B. Wulp, *observer*
  Occupational Health Physician and Medical Advisor, Inspectorate SZW, Utrecht
- Dr. A.S.A.M. van der Burght, *scientific secretary*
  Health Council of the Netherlands, The Hague
- Dr. K. Groeneveld, *scientific secretary*
  Health Council of the Netherlands, The Hague

The Health Council and interests

Members of Health Council Committees are appointed in a personal capacity because of their special expertise in the matters to be addressed. Nonetheless, it is precisely because of this expertise that they may also have interests. This in itself does not necessarily present an obstacle for membership of a Health Council Committee. Transparency regarding possible conflicts of interest is

nonetheless important, both for the chairperson and members of a Committee and for the President of the Health Council. On being invited to join a Committee, members are asked to submit a form detailing the functions they hold and any other material and immaterial interests which could be relevant for the Committee's work. It is the responsibility of the President of the Health Council to assess whether the interests indicated constitute grounds for non-appointment. An advisorship will then sometimes make it possible to exploit the expertise of the specialist involved. During the inaugural meeting the declarations issued are discussed, so that all members of the Committee are aware of each other's possible interests.

Annex **C**

Comments on the public review draft

In June 2014, the President of the Health Council released a draft version of this advisory report for a public comment round. The following individuals and institutions responded to the draft advisory report:

- J. Bouwmans and F. van Kolck, Occupational Health and Safety Service, Rotterdam
- H. Koppenaal, West Brabant municipal medical and health service
- M. de Gier and R.W. van Olden, GlaxoSmithKline BV, Zeist
- E. van Broekhoven-Grutters, ZZG Zorggroep, Groesbeek
- H. Stinis, Saint-Amans-du-Pech, France
- I. Speller, ArboVitale, Utrecht
- A. de Rooij, STIGAS, Leiden
- A. Verkammen, HollandBIO, Leidschendam.

The Committee incorporated these comments into this advisory report during the final stages of its preparation. Details of the Committee's comments and responses can be found at the Health Council's website (www.gr.nl).

Annex **D**

Occupational hygiene strategy scale for biological agents

See Table 4.

Table 4 Occupational hygiene strategy scale for biological agents.

1 Control at source	ALWAYS perform this at every level
A Control the agent (such as the eradication of smallpox)	I Provide information
B Prevent transmission of the agent to a host (e.g. controlling vectors, DEET, prophylaxis, repellents).	II Give instructions
C Prevent disease spread in the event of a (potential) infection (post-exposure prophylaxis, antibiotics, culling of animals)	III Monitor
D Disinfect (using ultraviolet light, or chemicals)	IV Work hygienically: 1. Behaviour 2. Hand washing, showering 3. Avoid contacts
2 Technical measures	
A Seal off the source (isolation, quarantine)	V Vaccination: always do so immediately after a potential exposure has occurred or if there is a risk of one occurring.
B Avoid touching contaminated surfaces (automatic “no touch” taps and doors)	
C Use of paper towels	
D Use of HEPA filters, airlocks, overpressure, underpressure, etc.	VI PEP (post-exposure prophylaxis): administer medicinal products preventively, regardless of whether the existence of disease can already be demonstrated (HIV, Hepatitis B). Please note that these agents may have adverse effects on the unborn child, check that first!
E Use of Biological Safety Cabinets	
F Use of non-porous or biocide materials (copper)	
3 Organisational measures	
A Restrict access to the sources as much as possible	VII In the event of disease 1. Perform (or arrange for) a rapid diagnosis. If employees know what warning signs to watch out for, they can quickly put the attending physician on the right track 2. Initiate therapy ASAP
B Set up clean/dirty zones	
C Limiting the number of workers in a given location	
D Social distancing (people keep their distance from each other)	
E Exclusion of pregnant women from the danger zone	
F Exclusion of employees with heightened medical vulnerability	
4 Personal protective equipment	
A Shielding the skin: gloves, clothing, apron, hair cap, shoes	
B Shield the eyes: safety goggles, face shields	
C Shielding the respiratory system: masks (mouth/nose)	

Source: J.J. Maas. *Infectieziekten op de werkvloer: De rol van arbodeskundige en GGD nader toegelicht* (Infectious diseases in the workplace: Detailed explanation of the role of health and safety experts and that of the municipal medical and health service). *Infectieziekten Bulletin* 2013; 24(7).

Annex **E**

Registered vaccines

In this annex, the Committee lists the vaccines registered for use in the Netherlands. The Committee based the list on data supplied by the Medicines Evaluation Board. The Committee distinguishes between vaccines that have been included in the National Immunisation Programme and those that have not (Table 2). For each vaccine, details are given of the disease that can result from infection, together with the identity of the pathogen involved.

Table 5 Vaccines currently registered for use in the Netherlands.

Vaccine in National Immunisation Programme	
Bacterial diseases	Viral diseases
whooping cough (*Bordetella pertussis*)	mumps (mumps virus)
tetanus (*Clostridium tetani*)	hepatitis B (Hepatitis B virus)
diphtheria (*Corynebacterium diphtheriae*)	cervical cancer (human papilloma virus)
Hib diseases (*Haemophilus influenzae type b*)	measles (measles virus)
meningococcal disease (*Neisseria meningitidis serogroup C*)	poliomyelitis (polio virus)
invasive pneumococcal disease (*Streptococcus pneumoniae*)	German measles (rubella)
Vaccine not in National Immunisation Programme	
Bacterial diseases	Viral diseases
meningococcal disease (Meningococcal serogroups A, B, W135, Y)	flu (influenza virus)

tuberculosis[a] (*Mycobacterium tuberculosis*)	yellow fever (yellow fever virus)
typhoid (*Salmonella typhi*)	hepatitis A (Hepatitis A virus)
cholera (*Vibrio cholerae*)	chickenpox, shingles (*Varicella zoster* virus)
	Japanese encephalitis (Japanese encephalitis virus)
	rotavirus infections (rotavirus)
	tick-borne encephalitis (tick-borne meningoencephalitis virus)
	genital and anogenital warts (human papillomavirus)
	rabies (rabies virus)

[a] Vaccination against tuberculosisis offered to specific target groups in a public vaccination programme.

Annex **F**

Case studies

F.1 A surgeon and the Hepatitis B virus

Can employee vaccination help to provide optimal protection for the employee?

1 Occupational exposure to the infectious agent can pose an extra risk of disease to the employee that is by no means negligible.[a]

Is there a risk of relevant exposure (B) to the infectious agent?	The infectious agent can occur in the workplace. In 2011, for example, there were 157 reported cases of acute Hepatitis B infection in the Netherlands (an incidence of 0.9 per 100,000 inhabitants).[32] Estimates of the prevalence of chronic Hepatitis B range from 0.2 percent to 0.6 percent.[33,34] This means that between 40,000 and 120,000 individuals in the Netherlands are chronically infected. HBV infection is more common in specific population groups. For instance, studies performed in the ZuidOost district of Amsterdam revealed that nearly nine percent of pregnant women from Ghana carry HBV.[35] Employees can come into contact with the agent. The main transmission route in the workplace involves accidental cuts and needle-stick injuries (blood-to-blood contact). An estimated 13,000 to 15,000 accidental cuts and needle-stick injuries are reported in the Netherlands each year.[36] About half of these occur in hospitals. Each surgeon probably has several such accidents each year. Studies among trainee surgeons indicate levels in excess of four accidents per year.[37] Accordingly, employee exposure occurs reasonably frequently.

Is it probable (W) that the exposure of the employee through infection would result in disease (in the employee himself)?	Vaccination against the Hepatitis B virus has been part of the National Immunisation Programme since 2011.[38] Thus, no currently practising surgeons have yet been vaccinated against Hepatitis B through the NIP. Employee exposure can result in infection. In procedures on patients who have tested HBV positive, the risk of infection following an accidental cut or needle-stick injury can be up to about 30 percent, depending on the stage of the disease.[18] It is estimated that general surgeons experience at least four accidental cuts or needle-stick injuries each year. In certain subspecialisms (such as thoracic surgery) or specific procedures, that number may be much higher. Infections in the employee can result in disease.[18] In healthy adults, infection with the Hepatitis B virus leads to acute Hepatitis in 40 percent of cases.[39] In adults, there is a 5 percent risk that an infection will become chronic.[21] The disease has more severe consequences for men, for obese people, and for those suffering from liver disease.
Is there an adverse effect (E) for the employee?	The disease that an employee can acquire through exposure can have a serious course. Individuals with concomitant liver disease have an increased risk of a more serious course. In cases where acute HBV infection has a serious course, a liver transplant may be required.[18] There are two treatment options for chronic HBV infection. One is a limited duration immunomodulatory treatment with PEG-interferon, the other involves a long-term (perhaps lifelong) course of maintenance therapy with a virus-inhibiting agent (HBV polymerase inhibitor).[18] The interferon treatment achieves lasting success in 30 percent of patients, but it also has serious adverse effects. Oral maintenance therapy with a modern antiviral drug (tenofovir or entecavir) is very well tolerated and almost always leads to complete suppression of the virus. After 5 to 25 years, 15 to 25 percent of patients with chronic active Hepatitis B will develop liver cirrhosis and/or hepatocellular carcinoma.[19] Following a needle-stick injury, post-exposure prophylaxis with immunoglobulins is effective in unvaccinated individuals and in non-responders.[40] However, some needle-stick injuries may pass unnoticed.
Is it possible to include measures in the occupational hygiene strategy scale that would reduce exposure to an agent such that the additional risk of disease posed to the employee is reduced to an acceptable minimum?	There are various alternative measures, however, such as robotic surgery, wearing several pairs of gloves, or suturing incisions using blunt needles.[41,42] While these measures lead to a reduced risk of infection and disease, vaccination against Hepatitis B is more effective. Wearing gloves does have the advantage that the wearer is also protected from other biological agents.[18]

2 Employee vaccination leads to a substantial reduction in the extra risk of disease.

Yes, vaccination is effective.[18] In some groups of people (smokers, individuals with a high BMI index, the elderly, and men) the vaccine is less effective. After the vaccination, the employer should arrange for the antibody levels to be measured, as a check of the vaccine's effectiveness. Also, the vaccinated employee should be given a vaccination card showing the date of vaccination and titre testing, and the antibody titre.

3 Any deleterious health effects associated with the vaccination in question (adverse effects) do not detract significantly from the health gains involved.	
	The deleterious health effects of the vaccination for the employee (adverse effects) are unlikely to detract significantly from the health gains involved. After many years of experience with these vaccines, all available data on the adverse effects of Hepatitis B vaccination indicate that it is safe.[43] Adverse effects are very infrequent. Those adverse effects that do occur are almost always mild and transient in nature.
4 The health gains for the employee outweigh any discomfort that he may experience as a result of vaccination.	
	Yes. Vaccination involves four visits to a physician over a period of seven months, the first three of which are for an actual vaccination. The final visit is for a blood test to monitor the effect of the vaccination.

[a] Extra Risk = Occupational Exposure (B) * Probability (W) * Effect (E) (see Chapter 2).

Can employee vaccination help to provide optimal protection for third parties?

1 The occupational exposure of the employee to infectious agents can, via transmission, lead to a substantial burden of disease in third parties.	
Is there a risk of the employee suffering relevant exposure (B) to the infectious agent?	The infectious agent can occur in the workplace. In 2011, for example, there were 157 reported cases of acute Hepatitis B infection in the Netherlands (an incidence of 0.9 per 100,000 inhabitants).[32] Estimates of the prevalence of chronic Hepatitis B range from 0.2 percent to 0.6 percent.[33,34] This means that between 40,000 and 120,000 individuals in the Netherlands have chronic infections. HBV infection is more common in specific population groups. For instance, studies performed in the ZuidOost district of Amsterdam revealed that nearly nine percent of pregnant women from Ghana carry HBV.[35] Employees can come into contact with the agent. The main transmission route in the workplace involves accidental cuts or needle-stick injuries (blood-to-blood contact). An estimated 13,000 to 15,000 needle-stick injuries are reported in the Netherlands each year.[36] About half of these occur in hospitals. Each surgeon probably has several accidental cuts or needle-stick injuries each year. Studies among trainee surgeons indicate levels in excess of four accidents per year.[37] Accordingly, employee exposure occurs reasonably frequently.
Is it probable that employee exposure would cause the infectious agent to be transferred to third parties?	In the case of an employee who has direct contact with third parties, the exposure leads – via infection – to the exposure of third parties. This only applies to “source-of-risk” employee. For example, an infected cleaner is not a potential source of infection for patients, whereas an infected thoracic surgeon certainly would be.

Is it probable (W) that transmission of the infectious agent to third parties would result in a substantial burden of disease in third parties?	In procedures on patients who have tested HBV positive, the risk of infection following needle-stick injuries can be up to about 30 percent, depending on the stage of the disease.[18] Exposure of third parties can lead to the infection of third parties. This was highlighted by an incident at Veghel, in the Netherlands, where a surgeon who is an HBV carrier infected a substantial number of patients.[20] Vaccination against the Hepatitis B virus has been part of the National Immunisation Programme since 2011.[38] Thus, most patients have not yet been vaccinated against Hepatitis B through the NIP. Infections in patients can result in disease.[18] In healthy adults, infection leads to acute Hepatitis in 40 percent of cases.[39] Newborn infants have a 90 percent risk of developing a chronic infection. The corresponding figure for children below the age of five is 25 percent to 30 percent. In adults, it is less than 5 percent.[21] Patients with concomitant liver disease are at greater risk of developing the disease.
Is there an adverse effect (E) for third parties (patients)?	The disease that patients can acquire through exposure can have a serious course. In cases where acute HBV infection has a serious course, a liver transplant may be required.[18] There are two treatment options for chronic HBV infection. One is a limited duration immunomodulatory treatment with PEG-interferon, the other involves a long-term (perhaps lifelong) course of maintenance therapy with a virus-inhibiting agent (HBV polymerase inhibitor).[18] The interferon treatment achieves lasting success in 30 percent of patients, but it also has serious adverse effects. Oral maintenance therapy with a modern antiviral drug (tenofovir or entecavir) is very well tolerated and almost always leads to complete suppression of the virus. After 5 to 25 years, 15 to 25 percent of patients with chronic active Hepatitis B will develop liver cirrhosis and/or hepatocellular carcinoma.[19] Individuals with concomitant diseases have an increased risk of a more serious course. Following a needle-stick injury, post-exposure prophylaxis with immunoglobulins is effective in unvaccinated individuals and in non-responders.[40] However, some needle-stick injuries may pass unnoticed.
Are there any other measures that could potentially be used to reduce the risk of transmitting the infectious disease to third parties to an acceptable minimum?	There are measures that can prevent employee exposure and transmission to patients, such as robotic surgery or wearing double gloves. However, some of these are still very expensive. Employee vaccination is more effective. While these measures lead to a reduced risk of transmission, however, vaccination against Hepatitis B is more effective.[18]

2 By reducing transmission, employee vaccination leads to a substantial reduction in burden of disease in third parties.

Yes, vaccination is effective.[18] In some groups of people (smokers, individuals with a high BMI index, the elderly, and men) the vaccine is less effective. After the vaccination, the employer should arrange for the antibody levels to be measured, as a check of the vaccine's effectiveness. Also, the vaccinated employee should be given a vaccination card showing the date of vaccination and titre testing, and the antibody titre.

3 Any deleterious health effects of the vaccination in question (adverse effects) for the employee are reasonably proportional to the health gains for third parties.

The deleterious health effects of the vaccination for the employee (adverse effects) are unlikely to detract significantly from the health gains involved. After many years of experience with these vaccines, all available data on the adverse effects of Hepatitis B vaccination indicate that it is safe.[43] Adverse effects are very infrequent. Those adverse effects that do occur are almost always mild and transient in nature.

4 Any discomfort experienced by the employee as a result of vaccination is reasonably proportional to the health gains for third parties.

The discomfort associated with the vaccination is acceptable to the employee. Vaccination involves four visits to a physician over a period of seven months, the first three of which are for an actual vaccination. The final visit is for a blood test to monitor the effect of the vaccination.

5 The relationship of costs to health gains is proportional in comparison to other means of reducing the extra risk of disease in third parties.

The cost of employee vaccination is small in comparison to the cost of other measures that could be taken. Vaccination provides a high degree of protection at relatively low cost, but it is more difficult to pinpoint the effect of other measures.

F.2 A nurse on a children's ward and *Neisseria meningitidis* serogroup C (meningococcal serogroup C)

Can employee vaccination help to provide optimal protection for the employee?

1 Occupational exposure to the infectious agent can pose an extra risk of disease to the employee that is by no means negligible.[a]

Is there a risk of relevant exposure (B) to the infectious agent?

The infectious agent can occur in the workplace. It is also fairly common for people to be carriers of *Neisseria meningitidis.* It is estimated that, at any given time, ten to twenty percent of the general population are carrying these bacteria.[24] This applies to all of the serogroups that commonly occur in the Netherlands. Ever since vaccination against meningococcal serogroup C was included in the NIP, that serogroup has been encountered much less frequently in patients with meningococcal disease.[23] Studies in other countries show that the introduction of vaccination against meningococcal serogroup C also leads to a decrease in the number of individuals carrying the bacteria.[44] As a result, the exposure of a nurse to meningococcal serogroup C will also have dropped significantly. Those hospital employees who are at greater risk of coming into contact with unvaccinated patients who have just entered the country run a relatively greater risk of exposure to meningococcal serogroup C. The employee may come into contact with the agent through the unprotected exposure of mouth or nose to patients' respiratory secretions, via coughing, mouth-to-mouth resuscitation, or intubation.[24] Following the administration of antibiotics for a period of 24 hours, patients are no longer infectious.[24]

	In 2012, meningococcal strains isolated from 81 patients were sent to the National Reference Laboratory. Two of these belonged to meningococcal serogroup C.[23] Allowing for under-diagnosis and under-reporting, the Committee has based its further calculations on a maximum of 200 cases in the Netherlands. It is estimated that 40 of those 200 cases involve strains against which vaccination would be effective. In this connection, the Committee notes that this would not be restricted to vaccination against meningococcal serogroup C, but also against other types of meningococci. Taking all of the hospitals in the Netherlands together, that could involve a single case each year, with a worst case scenario of four cases per year. The conclusion is that the risk is small, but that exposure may occur often enough for vaccination to be considered.
Is it probable (W) that the exposure of the employee through infection would result in disease (in the employee himself)?	Vaccination against meningococcal serogroup C has been part of the National Immunisation Programme since 2002.[38] The current situation, therefore, is that most nurses have not been vaccinated against meningococcal serogroup C. The exposure of the health service employee can result in infection. Gilmore *et al* identified three cases in which meningococcal disease was transmitted from patients to nurses in England and Wales from 1982 to 1996.[22] Based on these figures, these researchers estimate the risk of meningococcal disease in health service workers who have contact with meningococcal disease patients at 0.8 per 100,000 employees.[22] According to the researchers, that risk is 25 times greater than the risk of meningococcal disease in the general adult population, but much lower than the risk to the patient's housemates. In absolute terms, it is very slight indeed. By 2012, the incidence of meningococcal disease in the Netherlands had fallen to 0.3 per 100,000 people.[23] It is estimated that, in the Netherlands as a whole, up to 10,000 hospital staff work in children's wards. Extrapolating from the British risk assessment, this means that, in the Netherlands, approximately once every ten years a nurse will acquire meningococcal disease by contamination from a patient. Given the decline of meningococcal serogroup C in the Netherlands, there is now a much lower probability that such cases will be caused by this serogroup.
Is there an adverse effect (E) for the employee?	The disease that the employee can acquire through exposure can be serious. People without a spleen (or without a functional spleen) are at greater risk of more serious disease.
Is it possible to include measures elsewhere in the occupational hygiene strategy scale that would reduce exposure to an agent such that the additional risk of disease posed to the employee is reduced to an acceptable minimum?	In the case of patients suspected of having meningococcal disease, protective measures (such as wearing surgical masks) should be taken during the first 24 hours of the patients' course of antibiotic treatment.[24] Despite the measures taken elsewhere, there is still a residual risk, albeit a very small one. In the event of unprotected exposure, post-exposure prophylaxis can substantially reduce or negate the burden of disease, provided that it is started on time (preferably within 24 hours of diagnosis).

[a] Extra Risk = Occupational Exposure (B) * Probability (W) * Effect (E) (see Chapter 2).

Can employee vaccination help to provide optimal protection for third parties?

1 The occupational exposure of the employee to infectious agents can, via transmission of the infectious disease, lead to a substantial burden of disease in third parties.

Is there a risk of the employee suffering relevant exposure (B) to the infectious agent?	See Chapter on at-risk status.
Is it probable that employee exposure would cause the infectious agent to be transferred to third parties?	There are a few individual reports of patients with hospital-acquired meningococcal disease in which a nurse may have been involved in transmission.[25] It is estimated that, at any given time, ten to twenty percent of the general population (which includes the staff of children's wards) are carrying these bacteria.[24]
Is it probable (W) that transmission of the infectious agent to third parties would result in a substantial burden of disease in that group?	There are individual reports of hospital-acquired meningococcal disease in which a nurse may have been involved in transmission.[25] Vaccination against meningococcal serogroup C has been part of the National Immunisation Programme since 2002.[38] A large proportion of the patients in children's wards are likely to have been vaccinated against meningococcal serogroup C. At hospitals in certain regions (such as the "Bible Belt"), however, this proportion may be smaller. The Committee estimates that a third party's extra risk of disease due to the transmission of meningococcal serogroup C via an employee is very small. In the case of meningococcal disease, that very slight additional risk of transmission involved means that – based on source-of-risk status – vaccination need not be considered. In addition, the Committee expresses the view that the risk of transmitting meningococcal serogroups A, W135, and Y is also very slight, given their low prevalence in the Netherlands. In the Committee's view, there is no need to consider vaccination against these serogroups.

F.3 A sewer worker and Hepatitis A virus

Can employee vaccination help to provide optimal protection for the employee?

1 Occupational exposure to the infectious agent can pose an extra risk of disease to the employee that is by no means negligible.[a]

Is there a risk of relevant exposure (B) to the infectious agent?	The infectious agent can occur in the workplace, if waste water is polluted by stool contaminated with the Hepatitis A virus. The virus is mainly transmitted through minor skin wounds or via the oral route, as a result of poor hygiene. The agent can then be ingested from contaminated hands or clothing by hand-to-mouth contact (when eating, smoking, drinking, or by touching the mouth). Airborne transmission is also possible, through the inhalation of contaminated aerosols. In the Netherlands, about ten percent of young adults have experienced a Hepatitis A virus infection at some time. Every year there are between 500 and 1000 new cases of Hepatitis A in the Netherlands.

Is it probable (W) that the exposure of the employee through infection would result in disease (in the employee himself)?	Vaccination against the Hepatitis A virus is not part of the National Immunisation Programme.[38] Several studies of the prevalence of Hepatitis A among sewer workers have been published. The picture is not consistent. Some studies show that sewer workers are at increased risk of infection, while other studies are unable to confirm this relationship. A 2001 systematic review confirmed this impression, by finding no increased risk of Hepatitis A among sewer workers.[26] Nevertheless, the seroprevalence studies do show a slight increase in subclinical Hepatitis A. None of the published studies measure the concentration of Hepatitis A virus in the waste water. Moreover, none of these studies differentiates between the various possible tasks carried out by sewer workers. • The following groups are susceptible to Hepatitis A[45]: • individuals with chronic, active Hepatitis B • individuals with chronic Hepatitis C • individuals with another chronic liver disease • individuals using immunosuppressive agents • the elderly (the greater their age, the higher their risk of mortality)
Is there an adverse effect for the employee?	Exposing employees can result in infection. In adults, infection is often accompanied by a general malaise, fever, loss of appetite, nausea and abdominal discomfort. The older the patient, the greater the duration and severity of the disease. Most Hepatitis A patients eventually recover and do not experience any residual symptoms.
Is it possible to include measures elsewhere in the occupational hygiene strategy scale that would reduce exposure to an agent such that the additional risk of disease posed to the individual employee is reduced to an acceptable minimum?	Sewer workers are not only exposed to the Hepatitis A virus. Other biological agents present in waste water include bacteria (e.g. species of *Leptospira*), viruses (enterovirus or polio virus), protozoa, yeasts, moulds (*Mucor*, *Rhizopus*, etc.), endotoxins (high concentrations), exotoxins, and glucans (from moulds).[27] Accordingly, while measures that reduce the risk of Hepatitis A should be taken, it is important to take other measures as well. Exposure to other biological agents should also be limited. After they have completed their work, it is very important for workers to maintain good personal hygiene by avoiding hand-to-mouth contact wherever possible, for example, to prevent oral ingestion. The Waste Industry's Health and Safety Catalogue also indicates that any materials, work clothing and personal protective equipment used should be thoroughly cleaned.[46] It is up to the employer to ensure that the employee complies with the specific measures that have been put in place to ensure proper hygiene.

2 Employee vaccination leads to a substantial reduction in the extra risk of disease.

Yes, vaccination is effective. If adequate protective measures are taken against other biological agents, however, the question is whether or not this will substantially reduce the extra risk of Hepatitis A.

3 Any deleterious health effects associated with the vaccination in question (adverse effects) do not detract significantly from the health gains involved.

Yes, this vaccine does have very few adverse effects.

4 The health gains for the employee outweigh any discomfort that he may experience as a result of vaccination.

Not applicable: other measures are to preferred.

[a] Extra Risk = Occupational Exposure (B) * Probability (W) * Effect (E) (see Chapter 2).

Can employee vaccination help to provide optimal protection for third parties?

1 The occupational exposure of the employee to infectious agents can, via transmission of the infectious disease, lead to a substantial burden of disease in third parties.

Is there a risk of the employee suffering relevant exposure (B) to the infectious agent?	The infectious agent can occur in the workplace, if waste water is polluted by stool contaminated with the Hepatitis A virus. The virus is mainly transmitted through minor skin wounds or via the oral route, as a result of poor hygiene. The agent can then be ingested from contaminated hands or clothing by hand-to-mouth contact (when eating, smoking, drinking, or by touching the mouth). Airborne transmission is also possible, through the inhalation of contaminated aerosols. In the Netherlands, about ten percent of young adults have experienced a Hepatitis A virus infection at some time. Every year there are between 500 and 1000 new cases of Hepatitis A in the Netherlands.
Is it probable that employee exposure would cause the infectious agent to be transferred to third parties?	None of the published studies found evidence that the agent is transmitted by sewer workers to third parties. The Committee notes, however, that an employee who becomes infected by the hepatitis A virus can infect other members of their family, for example. The municipal medical and health service lists hepatitis A is a notifiable infectious disease.
Is it probable (W) that transmission of the infectious agent to third parties would result in a substantial burden of disease in third parties?	Vaccination against the hepatitis A virus is not part of the National Immunisation Programme.[38] There are no studies published in which the transmission of the agent via sewer workers to third parties was demonstrated.
Is there an adverse effect for third parties?	In adults, infection is often accompanied by a general malaise, fever, loss of appetite, nausea and abdominal discomfort. The older the patient, the greater the duration and severity of the disease. Most hepatitis A patients eventually recover and do not experience any residual symptoms.
Are there any other measures that could potentially be used to reduce the risk of transmitting the infectious diseases to third parties to an acceptable minimum?	Sewer workers are not only exposed to the hepatitis A virus. Other biological agents present in waste water include bacteria (e.g. species of *Leptospira*), viruses (enterovirus or polio virus), protozoa, yeasts, moulds (*Mucor*, *Rhizopus*, etc.), endotoxins (high concentrations), exotoxins, and glucans (from moulds).[27] Accordingly, while measures that reduce the risk of hepatitis A should be taken, it is important to take other measures as well. Exposure to other biological agents should also be limited. After they have completed their work, it is very important for workers to maintain good personal hygiene by avoiding hand-to-mouth contact wherever possible, for example, to prevent oral ingestion. The Waste Industry Health and Safety Catalogue also indicates that any materials, work clothing and personal protective equipment used should be thoroughly cleaned.[46] It is up to employer to ensure that the employee complies with the specific measures that have been put in place to ensure proper hygiene.

2 By reducing transmission, employee vaccination leads to a substantial reduction in burden of disease in third parties.

Yes, vaccination is effective. If adequate protective measures are taken against other biological agents, however, the question is whether or not this will substantially reduce the extra risk of Hepatitis A.

3 Any deleterious health effects of the vaccination in question (adverse effects) for the employee are reasonably proportional to the health gains for third parties.

Yes, this vaccine does have very few adverse effects.

4 Any discomfort experienced by the employee as a result of vaccination is reasonably proportional to the health gains for third parties.

No transmission of the virus.

5 The relationship of costs to health gains is proportional in comparison to other means of reducing the extra risk of disease in third parties.

No transmission of the virus.

Health Council of the Netherlands

Advisory Reports

The Health Council's task is to advise ministers and parliament on issues in the field of public health. Most of the advisory opinions that the Council produces every year are prepared at the request of one of the ministers.

In addition, the Health Council issues unsolicited advice that has an 'alerting' function. In some cases, such an alerting report leads to a minister requesting further advice on the subject.

Areas of activity

Optimum healthcare
What is the optimum result of cure and care in view of the risks and opportunities?

Prevention
Which forms of prevention can help realise significant health benefits?

Healthy nutrition
Which foods promote good health and which carry certain health risks?

Environmental health
Which environmental influences could have a positive or negative effect on health?

Healthy working conditions
How can employees be protected against working conditions that could harm their health?

Innovation and the knowledge infrastructure
Before we can harvest knowledge in the field of healthcare, we first need to ensure that the right seeds are sown.

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