

ALERT AND SENTINEL APPROACHES TO DETECT WORK-RELATED DISEASES

SIGNAAL, Netherlands/Belgium

This article is part of a series aiming at describing alert and sentinel approaches for the early detection of work-related diseases (WRDs) in order to provide more insight into the way these systems function and into the drivers of and obstacles to the implementation of such systems. This article describes the SIGNAAL system (*Signalering Nieuwe Arbeidsgerelateerde Aandoeningen Loket* - Signaling new work-related diseases counter) in Belgium and the Netherlands and is based on EU-OSHA's project 'Alert and sentinel approaches for the identification of work-related diseases in the EU' (EU-OSHA, 2018) consisting of a literature review and an in-depth qualitative study and commissioned to a research team made of experts from the Catholic University of Leuven, the Coronel Institute, the Finnish Institute of Occupational Health, the University of Manchester and the University of Bologna.

Introduction to the approach

SIGNAAL is the acronym for *Signalering Nieuwe Arbeidsgerelateerde Aandoeningen Loket* (Signaling New Occupational Diseases Counter). It is an online service to which suspicions about new relations between health and work can be reported and reviewed by a panel of occupational health (OH) specialists.

Summary of main characteristics

- SIGNAAL is an online non-compensation-based sentinel system in place since July 2013.
- It is the result of cooperation between the Netherlands Centre for Occupational Diseases (NCvB), the Centre of Environment and Health at the Catholic University of Leuven (KU Leuven) (Belgium) and Group IDEWE (a Belgian external service for prevention and protection at work).
- SIGNAAL's main goal is to detect new OH risks and new WRDs and occupational diseases (ODs).
- OH physicians mainly report diseases they suspect to be caused by an employee's occupation.
- Strong point: every reported case is evaluated in a structured manner by at least two independent OH experts. The experts assess if the case could be a WRD and if it is a new OH problem.
- After the assessment, the reporting physician receives an expanded report. This report contains supportive literary research, the relevance to the job in question and suggestions regarding the next steps in the process.

Initiating organisation

The Netherlands Center for Occupational Diseases (NCvB) is part of the Coronel Institute, which is a department of the University of Amsterdam. The NCvB has two important tasks: the registration of ODs (OH physicians have to report ODs to the NCvB) and informing OH physicians of the newest insights into ODs. The NCvB has developed guidelines to facilitate the reporting of ODs. These guidelines can be found on the NCvB website (www.beroepsziekten.nl). They describe the clinical picture and minimal exposure criteria, and cover the most frequently occurring ODs. A disadvantage of these existing guidelines is that new ODs are not reported in daily practice. (Stakeholder 1 (owner): 'If you are working whilst focusing on guidelines, the OH physician will first check if there is a guideline. If there isn't, it can't be an occupational disease.') For this reason, the NCvB created an open, online system for the registration of new (unclear) cases of ODs: SIGNAAL. The Netherlands has no compensation system for ODs. National health insurance provides coverage for healthcare costs, regardless of the cause.

The Department of Public Health and Primary Care of KU Leuven is a multidisciplinary department that focuses on community health, best practice and health policy. Within the department, the Centre for Environment and Health (CEH) studies the impact of the environment on health and vice versa, (i.e. how health can affect individuals' interaction with the environment). The CEH has a long tradition and extensive experience in assessing exposure to environmental agents, studying the underlying mechanisms of WRD development and developing biomarkers. The research activities are mainly directed at the assessment of exposure and health effects. The assessment is based on environmental monitoring and biomonitoring. In recent years, growing emphasis has been placed on the study of biological effects (mainly carcinogenic, reprotoxic and neurotoxic effects) as well as the study of the epigenetic changes induced by environmental agents. The CEH works in close collaboration with several national and international research centres, health insurance funds and OH providers such as Group IDEWE. Group IDEWE has over 750 employees (175 of whom are OH physicians).

In Belgium, OH physicians are legally obliged to report all diseases they suspect of being caused by an employee's occupation to the Federal Agency for Occupational Risks (FEDRIS, formed by a merger of the former Fund for Occupational Diseases and the former Fund for Occupational Accidents). FEDRIS can recognise a disease as an OD and decide on compensation. There is an open and a closed (list) system for reporting ODs. In theory, the open system can be used to report a new OD, but in daily practice this is quite complicated and does not often happen, as most physicians report only when they are convinced that the disease can be compensated. In fact, in the open system, the (OH) physician or employee must prove that the cause of the disease is work related. There is currently no national system in place to specifically register and follow up new ODs.

History of the approach

In 2009, the NCvB took the initiative to develop a system to detect new OH risks and new ODs and WRDs. No such system was available in the Netherlands at that time. The Ministry of Social Affairs and Employment was convinced of the potential benefit of a detection system and provided funding. In order to expand the pool of possible reporting parties, the Centre of Environment and Health at KU Leuven (Belgium) and Group IDEWE were asked to cooperate. After a period of development and preparation, the system went online in July 2013.

Programme's aim and objectives

The SIGNAAL reporting system is an online non-compensation-based sentinel system. It has been in place since July 2013. SIGNAAL is the result of cooperation between the Netherlands Center for Occupational Diseases (NCvB), the Centre of Environment and Health at KU Leuven (Belgium) and Group IDEWE.

The main goal of SIGNAAL is to detect new OH risks and new ODs or WRDs. Before the development of SIGNAAL, the Netherlands and Belgium had no specific system for detecting, reporting or registering new ODs and WRDs. Consequently, determining if the cause of a disease was work-related could take a long time. The initiators of SIGNAAL developed the system as an online tool. It would help collect information in a practical, quick and easy way, but at the same time provide enough information to be able to draw conclusions about a reported case. One of the strong points of SIGNAAL is that every reported case is evaluated in a structured manner by at least two independent OH experts. The experts assess if the case could be a WRD or an OD and if it is a new OH problem. After the assessment, the reporting physician receives an expanded report. This report states whether or not the SIGNAAL experts consider the case to be work-related and whether or not it is new. Consequently, it can be used by Belgian and Dutch physicians to submit a disease into the open system. Furthermore, this report contains supportive literary research, states the relevance of the disease to the job in question, and suggests the next steps in the process.

Description of the programme's workflow and reporting

Reporting parties

SIGNAAL is an online platform. Reporting parties who want to report a new OH risk or a new OD first have to register on the website www.signaal.info (Netherlands) or www.mysignal.be (Belgium). A person who wants to report a case needs to register first, give his or her title and enter his or her contact details. After this, the moderator of SIGNAAL can give this person access to the system so that he or she can report a case. So everyone whose registration on the website is accepted by the moderator can submit a report through SIGNAAL, but the system is primarily meant for physicians and only medically trained personnel can easily access the information required by SIGNAAL. Reporting parties must be able to diagnose a possible OD or WRD and to provide information on the workplace and exposure to occupational risks. Currently, almost all reporting parties are OH physicians. So far, only one other physician, a dermatologist, has reported a case.

Recruitment of reporting physicians

In the Netherlands, SIGNAAL is promoted to all OH physicians through scientific publications and various conferences. In Belgium, the IDEWE informs OH physicians of the system, and tells them that SIGNAAL might help them prepare a file for FEDRIS so that the worker can receive compensation (as previously mentioned, the reporting physician must show causality between exposure and OD). Although SIGNAAL is currently not actively promoted to OH physicians other than by IDEWE, several OH physicians working elsewhere have also reported cases.

In 2017, SIGNAAL was introduced nationwide in Belgium with the support of FEDRIS. FEDRIS has the task of detecting new ODs, and supporting the SIGNAAL system was expected to contribute to better detection of new occupational risks. On 31 March 2017, KU Leuven and FEDRIS organised a symposium to inform OH physicians of SIGNAAL and to launch the system nationally.

Physicians who want to report a case can find all the relevant information on the system on the NCVB (www.beroepsziekten.nl) and SIGNAAL (www.signaal.info) websites. In Belgium, the system can be accessed on www.mysignal.be, and information is available in Dutch and French.

Work-relatedness evaluation

Once a case is reported in SIGNAAL, the moderator decides if additional information is needed. If essential information (e.g. relevant exposure data) is still missing, the reporting physician is contacted and asked for extra details. The system has a pool of several Dutch and Belgian OH experts who can evaluate the reported cases. When possible, every case is individually and independently judged by two different experts. These experts evaluate the reports in a structured way to assess if the case could be a work-related illness and if it is a new OH problem. A literature search is performed to find scientific evidence. Meetings are organised for the experts to discuss some cases. Since SIGNAAL began, the expert group has expanded.

Reporting mechanism

Reporting parties need to register and log in to the system to be able to submit a report. Reports of both individual cases and cases concerning more than one worker can be submitted. A great deal of information can be entered into the system: demographics of the worker or workers, such as age and sex, but no other personal details; description of complaints; disease processes; and preferably clinical diagnoses, job, sector, tasks descriptions, relevant exposure data, results of diagnostic testing and actions already taken. Some information is obligatory but there are also several open fields into which reporting parties can insert as much text as they want. A reporting party can also submit documents (e.g. pictures of a skin lesion).

Communication

As mentioned earlier, the administrator will contact the reporting physician if more information is needed. Exposure data, job description and diagnosis are not always described in detail. However, detailed information is essential in order to be able to make a good assessment.

After the experts have finished their evaluation, the reporting party receives an expanded report by email. This report contains supportive literary research, states the relevance of the disease to the job and suggests the next steps in the process. The experts may want to visit the workplace themselves. Sometimes, the reporting party wants to publish the reported case. This can lead to extensive collaboration between the experts and the reporting party.

Data-storage

All the data are stored in a secured database. Only three people have access to the entire system. The experts have access to the cases they are working on and all steps of the review are entered into the system. Reporting physicians have access only to their own alert.

Dissemination

- An annual report shows how many cases the researchers have handled. The SIGNAAL website (www.signaal.info) gives a brief overview of finalised cases and the results of the evaluations (new or not, work-related or not).
- Scientific articles discuss the approach, for example by Lenderink et al. (2015), Lenderink & Godderis (2016) and Agius, Lenderink & Colosio (2015).
- Some cases have been published in peer-reviewed journals, for example by Francois et al. (2015) and Lenderink, Maleszka & Godderis (2016).
- Some cases have been presented in conferences or conventions, for example at the 34e Congrès National de Médecine et Santé au Travail (Godderis and Lenderink, 2016).

Financial aspects

The development costs of SIGNAAL are estimated to be about €175,000 (including pilot, evaluation, etc.). The annual cost of reviewing cases in the last two years in the Netherlands was about €10,000 to €15,000 per case. The mean cost per case in the maintenance phase was calculated to be around €5,000.

Usage of data

Examples of data usage for informing policy and prevention

At the end of every review, the researchers think about what measures can be taken on the basis of their conclusion. Up to this point, the suggested measures have mainly been aimed at company level.

For example, in one company, a 33-year-old woman developed **thrombosis of the right subclavian vein with pain in the right shoulder in extension and abduction** and power loss to activities at or above shoulder height. She was an assembler and made window coverings (blinds, curtains). In the period preceding the illness she almost exclusively (20 hours per week) worked on sticking ribs to vertical slats. The weight she handled varied according to the length or the number of ribs. She handled the weights with her arm in external rotation, with abduction to about 60 degrees. Other possible causes for her health problems were that in addition to 20 hours of paid work per week she had two children, and used to carry the youngest child. She smoked up to 10 cigarettes a day. Since the birth of her youngest child, she had returned to using oral contraceptives. An exploratory search in the literature for the causes of this disorder, the Paget-Schrötter disease, was performed, and the findings pointed to the way in which the work was carried out. The fact that the thrombosis occurred in the subclavian vein and nowhere else in the body (in the lower legs combined with standing work, for example) suggests that there was an additional trigger, which could well have been the work. The literature contained some evidence of a link between the described exposure to repetitive work with the arm in abduction and external rotation and the origin of subclavian vein thrombosis. However, this had mainly been described

in sports and had seldom been found among workers. It was concluded that this was not an entirely new relationship between illness and work, but that it had not so far been described in this type of work. Organisational and technical measures facilitated job rotation and limited the length of the repetitive work (Dam, 2015).

Another example concerns heart problems from carbon monoxide (CO) exposure at a coffee-processing plant. A report was submitted about two employees who had worked for more than 25 years in a coffee-processing plant. They had both suffered from heart problems in recent years, which were classified as atypical. Only recently had it been discovered that, in several departments of the plant where roasting and grinding of coffee is done, the CO levels could be very high. Although the company took immediate action to lower the exposure of workers to high CO levels, the reporting party asked if the atypical heart problems could have been related to previous high levels of exposure to CO. Based on the first measurements, the average CO exposure on a typical work day for both employees could have been just below or just above the exposure limit of 25 parts per million (ppm) for years. The literature had only two articles on coffee processing and CO poisoning.

Based on the literature, it was concluded that chronic CO exposure increases the risk of cardiovascular disease for workers. CO both affects the availability of oxygen in the blood, which mainly affects the heart and brain, and has a direct negative impact on the (heart) muscle. CO exposure is an additional risk factor to the heart, as well as the known risk factors such as high blood pressure, lack of exercise, smoking and high cholesterol. CO exposure can therefore contribute to the development of cardiovascular disease. It was also considered likely that CO poisoning often leads to atypical heart conditions. Both employees had suffered from heart problems in recent years, and at a relatively young age. Although other possible risk factors existed, it was concluded that it was certainly possible that exposure both to the moderate average CO exposure and to peak exposures during certain tasks could have contributed to the onset of the workers' heart disease. Occupational health services started specific health surveillance, and a control system for exposure is currently in place.

In the Netherlands, policy-makers were informed of a new risk that was detected in the SIGNAAL reporting system. Nosebleeds due to exposure to formaldehyde (and other aldehydes) in an aluminium company were described for the first time in SIGNAAL. The Netherlands National Institute for Public Health and the Environment (RIVM) has written about this newly detected health risk in the report *Prioritization of new and emerging chemical risks for workers and follow-up actions* (Palmen & Verbist, 2015). RIVM was asked by the Ministry of Social Affairs and Employment to make a priority list of the reported potential new and emerging risks of chemicals, with the intention of taking further action concerning the substances with the highest priority. RIVM classified formaldehyde as a substance with the highest priority (direct action required). Commissioned by the Ministry of Infrastructure and Environment, RIVM also carried out the following inventory: Initial inventory of alternatives to biocidal products containing formaldehyde or formaldehyde releasers (Wezenbeek, Janssen & Scheepmaker, 2015). This inventory shows that sufficient chemical alternatives are available for most disinfectants and preservatives (biocides) that contain formaldehyde (e.g. for the disinfection of stables and animal housing). For some applications using formaldehyde, only a very limited number of alternatives are available (e.g. preservatives used in lubricants and metalworking fluids).

Because of the limited number of reported cases so far (about 25 in total), statistical analysis is not yet possible. The stakeholders hope that a larger number of reported cases in the future will lead to more useful advice for policy-makers concerning prevention.

Examples of data usage for detecting new/emerging WRDs

Until the time of writing, only one real new work-related disease has been detected by SIGNAAL: nosebleeds due to exposure to aldehydes in an aluminium company.

Other reported cases have been not real new ODs or WRDs, but ODs or WRDs that were already described in other work environments. For example, a 31-year-old man was hospitalised with respiratory symptoms and fever. He recovered rapidly after treatment with antibiotics. The man worked as a kitchen help and had cleaned the drain of the dishwasher using high pressure a couple of hours before his admission to hospital. The OH physician thought that this was a case of inhalation fever

caused by the inhalation of aerosols during the cleaning of the drain. The literature review found several publications that described exposure to aerosolised endotoxins in other work environments (e.g. seaweed massages in a spa centre, biologically contaminated water pool in a building used for testing scientific equipment) that caused similar symptoms. The SIGNAAL researchers concluded that this was probably a case of inhalation fever caused by exposure to the endotoxin of the drain during high-pressure cleaning.

Stakeholders' views

This article is partly based on qualitative, in-depth face-to-face or telephone interviews with three stakeholders of the system. The interviews reflect the views of different actors in the system (e.g. owner of the system, workplace actor reporting it, and researcher or other stakeholder using the resulting data from the system) on the drivers and obstacles (Table 1), the quality of data and the transferability to other countries of the system or approach.

Drivers and obstacles

Drivers	Obstacles
System is easy to use for both reporting parties and assessors. <i>Stakeholder 2 (reporting party): 'It's basically an online platform ... So that's actually relatively easy. There are no real major obstacles.'</i>	Registration (before a physician can report) may be a possible barrier. <i>Stakeholder 2 (reporting party): 'Sometimes it can take up to a day before a reporting physician is admitted to the system.'</i>
Cases are evaluated systematically by two different experts.	Evaluation of the reported cases can be time-consuming. <i>Stakeholder 2 (reporting party): 'I think it's important to get feedback faster as a reporter. ... Or yes, because it takes a very long time before there is a final evaluation and you already forget about the report. So I think you can definitely improve this.'</i>
Reporting parties receive an expanded assessment.	Physicians lack awareness about new and emerging risks. <i>Stakeholder 2 (reporting party): 'Sometimes there is a certain blindness to occupational exposure. You sometimes forget to look at occupational hazards.'</i>
OH experts contact the reporting physicians personally.	Physicians lack knowledge, mainly concerning exposure. <i>Stakeholder 3 (researcher): 'But yes, you do need to know some things about exposure, and more often than not, that is not the case.'</i>
	OH physicians today are overburdened. <i>Stakeholder 3 (researcher): 'OH physicians have to do a lot of it in their spare time, and not everyone can be bothered doing that.'</i>

While discussing possible thresholds of reporting in SIGNAAL, all stakeholders agreed that it is not easy to overcome these problems. The researchers need enough information in the system to be able to evaluate a case, but the reporting of cases must not be too demanding for the reporting physician. At present, reporting physicians already have to submit relatively large quantities of data, so increasing the data that need to be entered into the system may lead to less reporting. This is why one of the

stakeholders suggested that the reporting parties submit only the mandatory data, and that the SIGNAAL researchers collect the rest.

Stakeholder 2 (reporting party): 'If you could do the mandatory reporting in a really simple, accessible way by filling out an A4 page on the spot, and if you could put that A4 page online, then I think it would be even simpler, and the complete follow-up would be taken over by the system.'

Data quality

The researchers conclude that overall, the quality of the reported data is sufficient to evaluate cases and form conclusions. The quality of the case review is also considered high. The fact that the evaluation is structured and performed by two different reviewers (experts in their field) contributes to the quality of the review, according to the stakeholders.

Stakeholder 1 (owner): 'The quality is good, in comparison with systems that are less structured, because you are obliged to go over all the questions. And because you have two reviewers, you can compare the differences and have a discussion on how to form a conclusion.'

Transferability to other countries

All stakeholders agree that SIGNAAL can be transferred to other countries. However, translating the system itself is not enough. A team of experts is needed to transfer SIGNAAL to other countries.

Stakeholder 1 (owner): 'You just need to have a team in that country that can deal with the alerts and has access to its own workplaces and doctors.'

References

- Agius, R., Lenderink, A. F. and Colosio, C., 2015. 'Finding "new" occupational diseases and trends in "old" ones', *Occupational Medicine*, 65(8), pp. 607-609.
- Dam, H., 2015. 'Syndroom van Paget-Schrötter bij een assembleur', *Tijdschrift voor Bedrijfs en Verzekeringsgeneeskunde*, 23(2), pp. 93-95.
- EU-OSHA (European Agency for Safety and Health at Work), 2018, *Alert and sentinel approaches for the identification of work-related diseases in the EU*. Available at: <https://osha.europa.eu/en/tools-and-publications/publications/alert-and-sentinel-approaches-identification-work-related/view>
- Francois, H. M. A., Vantrappen, L., Van Rompaey, V. and Godderis, L., 2015. 'Ear and vestibular symptoms in train operators after sudden air pressure changes in trains', *BMJ Case Reports*, 2015, pp. 1-3. Available at: <http://www.ncbi.nlm.nih.gov/pubmed/26678694>
- Godderis, L. and Lenderink, A. 2016. 'SIGNAAL: Outil en ligne pour la déclaration et l'évaluation de nouveaux risques professionnels pour la santé aux Pays-Bas et en Belgique', *Archives des Maladies Professionnelles et de l'Environnement*, 77(3), p. 436.
- Lenderink, A. F. F., Keirsbilck, S., van der Molen, H. F. and Godderis, L., 2015. 'Online reporting and assessing new occupational health risks in SIGNAAL', *Occupational Medicine*, 65(8), pp. 638-641. Available at: <http://occmed.oxfordjournals.org/lookup/doi/10.1093/occmed/kqv061>
- Lenderink, A. and Godderis, L., 2016. 'SIGNAAL, nieuwe gezondheidsrisico's uit de praktijk', *Tijdschrift voor Bedrijfs en Verzekeringsgeneeskunde*, 24(2), pp. 92-94.
- Lenderink, A. F., Maleszka, S. and Godderis, L., 2016. 'Ruik je dat niet? Reukstoornissen door blootstelling in het werk', *Tijdschrift voor Bedrijfs en Verzekeringsgeneeskunde*, 24(4), pp. 186-189.
- Palmen, N. G. M. and Verbist, K. J. M., 2015. 'Prioritization of new and emerging chemical risks for workers and follow-up actions', RIVM. Available at: <https://rivm.openrepository.com/rivm/handle/10029/559415>
- Wezenbeek, J. M., Janssen, M. P. M. and Scheepmaker, J. W. A., 2015. *Initial inventory of alternatives to biocidal products containing formaldehyde or formaldehyde releasers*, RIVM

report, National Institute for Public Health and the Environment. Available at:
<https://www.rivm.nl/bibliotheek/rapporten/2015-0186.pdf>

- **Links for further reading**

The [literature review report](#), the [final report](#) and [summary report](#) of the EU-OSHA's project 'Alert and sentinel approaches for the identification of work-related diseases in the EU', as well as two summaries of two seminars ([18 May 2017 in Brussels \(BE\)](#); and [31 January 2018 in Leuven \(BE\)](#)) and the presentations given at the seminars are available from :

<https://osha.europa.eu/en/themes/work-related-diseases/alert-and-sentinel-systems-osh>