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National Institute  
for Public Health  
and the Environment

Report 000201002/2010

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## Strategic Research RIVM

Annual report 2009



RIVM report 000201002/2010

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This report was commissioned by the office of the RIVM's Director-General

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## Abstract

### **Strategic Research RIVM**

Annual Report 2009

In this document, the National Institute for Public Health and the Environment (RIVM) reports on progress that was made in 2009 within its Strategic Research Programme (SOR).

The Strategic Research Programme helps the institute to anticipate upcoming research questions, to ensure the quality of its scientific expertise and to participate fully in international research networks. In 2009, about €12.9 million was allocated to work carried out within the Programme.

The current Programme runs from 2007 to 2010. Most SOR projects reached full speed in 2008, resulting in a rise in research output quantity in 2009 among a sharp increase in the number of research publications. In 2009 a mere total of 115 SOR-related papers were published or accepted for publication in international, peer-reviewed journals, another 70 papers were submitted for publication. Two thirds of the published papers had RIVM staffers as first, second and/or last author. Strategic research also produced many other products including 31 (letter)reports, 126 talks at international meetings, 10 websites, 25 data bases en 26 tools such as computer models. Progress could also be measured in terms of RIVM gaining follow-up assignments and further expanding of long-term collaboration networks with other institutes.

This annual report monitors the Programme's impact on science and society in 2009.

Compared with scientific reference journals in 4 of the 6 research themes peer-reviewed research papers were accepted or published in journals with higher-than-average impacts. To measure the Programme's impact on society, a number of indicators have recently been developed. Performance on these indicators will be monitored over the coming years. Compared to 2008 the index in 2009 has been higher mainly the result of increasing follow-up assignments, the use of the results in policy and external requests for advice.

Key words:

strategic research, future, anticipate, themes, social impact, scientific impact



## Rapport in het kort

### Strategisch Onderzoek RIVM

Jaarrapportage 2009

Dit rapport brengt verslag uit van het Strategisch Onderzoek RIVM (SOR) in 2009, het eigen onderzoeksbudget van het RIVM. Dit is het derde jaar van de vierjaarlijkse cyclus van SOR-onderzoek, die in 2007 is gestart. Het SOR-budget is bedoeld voor onderzoek om het RIVM te voorzien van de expertise en kwaliteit, zodat het nu en in de toekomst de taken voor de opdrachtgevers adequaat kan uitvoeren. In 2009 is ongeveer 12,9 miljoen euro aan SOR besteed. Het rapport geeft een indicatie van de wetenschappelijke en maatschappelijke impact van het SOR-onderzoek in het verslagjaar.

De uitvoering van de meeste projecten is vanaf 2008 goed op stoom gekomen, wat in 2009 tot een toegenomen wetenschappelijke output heeft geleid, waaronder een groot aantal publicaties. Ten opzichte van wetenschappelijke referentietijdschriften is bij 3 van de 6 speerpunten (ERF, CIL en EQH) meer dan gemiddeld goed gescoord. Er zijn in 2009 115 publicaties verschenen in peer-reviewed tijdschriften. Daarnaast zijn er nog 70 artikelen voor publicatie ingediend. Bij twee derde van de verschenen publicaties is een medewerker van het RIVM eerste, tweede of laatste auteur. Er is ook een groot aantal andere producten opgeleverd, te weten 31 (brief)rapporten, 126 lezingen op internationale congressen, 10 websites, 25 databases en 26 instrumentaria zoals modellen.

De maatschappelijke impact van de SOR-onderzoeken wordt gebaseerd op de mate waarin de onderzoeken scoren op een aantal indicatoren die de komende jaren worden gevolgd. De index voor 2009 is hoger dan in 2008, onder meer als gevolg van een groeiend aantal vervolgoopdrachten en het gebruik van de resultaten in beleid of richtlijnen. Ook wordt er meer samengewerkt met externe onderzoeksinstituten.

#### Trefwoorden:

strategisch onderzoek, toekomst, anticiperen, speerpunten, maatschappelijke impact, wetenschappelijke impact



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# 1 Introduction

## 1.1 Introduction

The National Institute for Public Health and the Environment (RIVM) in the Netherlands has a dedicated budget for initiating and carrying out strategic research. Through its Strategic Research Programme (Strategisch Onderzoek RIVM, SOR), the institute is able to anticipate upcoming research questions, to ensure the quality of its scientific expertise and to participate fully in long-term international research networks.

The Strategic Research Programme is set up using four-year programme and budget cycles. The current cycle started in 2007. The programme comprises of 6 strategic research themes, which together cover 66 individual research projects.

## 1.2 Purpose of this report

RIVM reports annually on the progress achieved within its Strategic Research Programme. This report covers activities in 2009 and provides various measures:

- Research progress within all 6 research themes;
- Research output (e.g. papers, talks, other products);
- Scientific impact of the research;
- Its impact on society;
- Finances.

This report provides measures at the research theme level. A separate Appendix to the report provides further information at individual project level (Strategic Research RIVM, Project progress, appendix to annual report 2009, RIVM report 000201003).

## 1.3 Reading guide

Chapter 2 restates why the Strategic Research Programme is of vital importance for RIVM and summarizes the scope of its current research themes.

Chapter 3 describes the progress that was made in 2009 in general terms, at the research theme level.

Chapter 4 presents and analyses qualitative measures of research output.

Chapter 5 lists the general conclusions.



## 2 2007-2010 research themes

### 2.1 The significance of strategic research for RIVM

The National Institute for Public Health and the Environment (RIVM) is the Netherlands' largest public research institute in the areas of public health, environment, safety and nutrition. Its primary task is to support the Dutch government in making science-based policy by providing sound and independent counsel. RIVM's advice typically reflects a large body of scientific evidence and often builds on full risk assessments or risk management procedures.

In addition to this, RIVM carries various executive responsibilities in the areas of national health and the environment. RIVM's other (international) clients include public organisations such as the World Health Organisation (WHO), the European Commission (EC) and various agencies of the European Union (EU).

Strategic research, as carried out within the Strategic Research Programme (SOR), serves to reinforce the institute's national and international position and to increase its scientific authority by contributing more to peer-reviewed scientific publications. For RIVM, doing scientific research means connecting with academic research and research communities.

Through its strategic research, the institute aims to anticipate research and policy questions that may arise in the (near) future. Such research, by definition, involves innovations and carries some risks.

Due to the financial structure of an agency, regular commissions prevail. Apart from the new knowledge that is acquired during this work, separate investments are needed to safeguard the institute's expertise and craftsmanship. In one sentence: SOR serves to keep RIVM scientifically well prepared for the day after tomorrow and realize its future professional skills.

The RIVM's Director-General holds the SOR budget and formally commissions all strategic research. The 2007-2010 Programme comprised in 2009 66 individual research projects grouped into six strategic research themes.

### 2.2 Research theme choice and evaluation

RIVM's strategic research must fit within a limited number of carefully chosen research themes. They serve as the Strategic Research Programme's overall framework. Research themes must align with RIVM's strategic areas and should anticipate future developments. They are chosen in close consultation with the RIVM's Scientific Advisory Board (dutch abbreviation: CvT). The six themes of the 2007-2010 Strategic Research Programme were chosen in 2006.

The 2009 review evaluated how research themes have been implemented in research projects. Most themes have grouped various projects into distinct research programmes. All research themes and programmes are summarised in the following paragraphs. Annex 1 provides a full list of programmes and projects.

Much of RIVM's research is multidisciplinary so overlaps between themes and programmes do occur. Theme coordinators meet frequently to ensure that all research keeps the right focus.

## 2.3 Risk Assessment, Perception, Consumer behaviour and understanding (RPC)

### *Theme purpose*

Studies into risk assessment, risk perception and consumer behaviour are highly relevant to many issues in society today. Research within this theme affects one of RIVM's core competences and is therefore important to most if not all of the institute's divisions. The theme offers many opportunities for interdivisional cooperation.

### *Programmes*

Research projects in this theme are grouped into two research programmes:

- Animal experimentation focussing in properly estimating risks and reduction of our dependence on laboratory animals;
- Risk information and its quality.

## 2.4 Emergency Response Functions and Safety (ERF)

### *Theme purpose*

In today's world, governments need to prepare for emergencies. Whether they involve chemical, biological or radiation exposures or other types of calamities, all such emergencies require sensible preparation for an adequate response. In recent years, bioterrorism and infectious disease outbreaks have attracted attention. Other needs include modelling of environmental risks from chemicals or radiation, and research into toxicological effects in humans as well. At least two RIVM divisions need to be fully up to date on safety and emergency response functions.

### *Programmes*

Research projects in this theme are grouped into three programmes:

- Risk assessment methods in emergencies;
- Clinical toxicology;
- Measurement and modelling.

## 2.5 INFectious diseases (INF)

### *Theme purpose*

The theme includes research into questions ranging from genetic characteristics of infectious agents to effective epidemiological interventions. Food safety issues are relevant as well. Research within this theme will help reinforce RIVM's expertise in areas such as immunology, vaccination and genetics. Given RIVM's task to coordinate the prevention and control of infectious diseases, effect studies and modelling are also highly important.

### *Programmes*

Research projects in this theme are grouped into three programmes:

- Genomics;
- Immunology;
- Modelling.

## 2.6 Chronic diseases Intervention and Lifestyle (CIL)

### *Theme purpose*

Chronic diseases and lifestyle changes constitute growing problems and require policy-making at local, national and international levels. Some knowledge about preventive interventions could be implemented more fully, and new types of prevention should be developed. High-risk groups need to be identified early on and receive special attention. Increasingly, links between life styles and health are being debated, and citizens are encouraged to adjust their behaviours. Food quality, obesity, diabetes, cancer, medical screening, and quality of life are just a few of the issues that are more and more coming together, and the trend will most likely continue. Growing expertise on these interfaces at RIVM will be needed.

### *Programmes*

Research projects in this theme are grouped into four programmes:

- Modelling chronic diseases;
- Healthy ageing;
- Quality of care;
- Economic evaluations.

## 2.7 Medicines and Functional Foods (MFF)

### *Theme purpose*

More and more, medicines and novel foods become intertwined, and RIVM needs to acquire more expertise in this area. Straightforward risk assessments are moving towards risk-versus-benefit and chain approaches. Also, it is becoming more important to understand system functions in care, and consumer behaviour and understanding need to receive proper attention.

### *Programmes*

Projects within this theme are all highly related so no separate programmes are identified.

## 2.8 Environmental Quality and Health (EQH)

### *Theme purpose*

Monitoring remains vital in many environmental areas, such as particulate matter. Risk assessments for encouraging healthy environmental conditions or evaluating economical activity are becoming increasingly important. More research needs to go into identifying behavioural scenarios and risk perceptions. Complicated risk assessments and environmental health impact assessments need to be developed. The EQH theme reflects the diversity of RIVM's Environment and Safety Division, but other divisions are involved in assessing environmental health effects.

### *Programmes*

Research projects in this theme are grouped into three programmes:

- Risk assessment;
- Environmental Health Impact Assessment (EHIA) and measurement;
- Modelling



## **3 Strategic research progress in 2009**

### **3.1 Monitoring progress**

Since 2007, progress of strategic research projects is monitored and reported to RIVM's Director-General on an annual basis. By completing yearly progress reports, project leaders provide information about the project's goals, progress, products and finances. They report changes in the objectives or approaches and make projections on work and products in the next year. The questionnaires are used by theme coordinators to produce reports at the theme level.

This chapter summarizes 2009 progress in general terms. Research output in terms of papers and reports that were published is given in the next chapter (chapter 4).

Progress reports at the project level can be found in a separate Annex to this report (Strategic Research RIVM, Project progress, appendix to annual report 2009, RIVM report 000201003)

### **3.2 Strategic Research Programme (overall)**

In 2009 five projects started and eight were completed. Most projects picked up speed during the third year of the programme cycle. Three years of effort have already led to interesting results.

### **3.3 Risk Assessment, Perception, Consumer behaviour and understanding (RPC)**

The RPC cluster comprises eight projects having a wide range of research areas including modern tools for risk assessment, like toxicogenomics and proteomics, PBPK modelling, effects of nanoparticles, development of alternative (less animal demanding) toxicity tests, consumer behaviour and development of performance indicators for quality improvement of intensive care facilities. Unfortunately, projects focussing risk perception within the general public are missing.

One project, i.e Toxicogenomics in risk assessment. was finished at the end of 2009. Important results concerning new approaches for risk assessment were developed, which might help to detect exposure to reprotoxic substances earlier and at lower doses. This was a direct spin-off of a collaborative effort between molecular researchers and risk assessors of different RIVM divisions: Environment and safety division and Nutrition, medicines and consumer safety division (abbreviation MEV and VGC). New (international) projects are expected to be funded in the near future. Extensive international collaborations were also initiated during the project period. (Among others with Organisation for economic cooperation and development (OECD), Environmental protection agency (EPA) and National institute of environmental health sciences (NIEHS) et cetera.)

Directly applicable spin off was generated by the proteomics project. For instance new protein (non-invasive) biomarkers for predicting Downs' Syndrome are close to implementation. One part of this project (detection of immunological responses to pathogens) is somewhat lagging behind owing to N1H1 emergencies. The output in terms of peer-reviewed papers is, as expected, increasing.

The project on determining toxic effects of nanoparticles is progressing reasonably well. In newly developed in vitro test systems mild toxic effects of nanoparticles were uncovered. Some delay was encountered in studies aiming to detect genotoxic effects of nanoparticles, but these technical problems



were solved during the current report period. The scientific output is good and new assignments (among others Food and consumer product safety authority, abbreviation VWA) were granted.

The project on finding alternatives to animal testing got real focus this year. Three lines of research were further explored:

- Development of hepatocytes for in vitro high throughput carcinogenicity testing
- Protocols for obtaining hepatocytes from differentiating mouse Embryonic Stem Cells
- Inventory on the use of lower species (like zebra fish) in toxicology testing.

Many important results were achieved in 2009. For instance the protocols were optimized for the type of serum used. A novel evaluation method for screening zebra fish embryo development appeared to be comparable to that commonly used in the rat whole embryo culture assay. These results are promising for the development of alternatives to current animal testing. The final year is supposed to become the 'harvest year'.

Methods for dietary exposure assessment is a very successful project. A highlight is a newly developed model which can make an improved estimation of current and future intake of iodine. This model combines a deterministic and probabilistic approach. There is high scientific output and new assignments (VWA) were obtained as were additional funding from EFSA.

The gettingBetter.nl project, dealing with eHealth, enjoys substantial international interest. The subject of eHealth is a research domain of growing importance all over the world.

### 3.4 Emergency Response Functions and Safety (ERF)

The ERF theme consists of six projects. Overall the production is good.

#### **Measuring and modelling**

The molecular and bioinformatics work, performed on *Coxiella Burnetii* has had a significant role in the assessment of the Q fever epidemic in the Netherlands. These techniques were developed in the project Biothreat DNA microarrays. Funding by the National Coordinator Counter Terrorism (NCTb) has been approved for research and implementation of screening methods for the detection of biothreat pathogens. Unfortunately, because of high priority of work on Q fever, this project shows some delay, but this will be compensated in 2010.

The progress of the QRA instrument for safety policy project is good, and has led to important collaboration with Delft University and Ineris in France. Unfortunately, there are difficulties to contract a new partner who is able to share expertise in the area of Computational fluid dynamics (CFD). This is a persistent problem which is unlikely to be solved in the near future. This may mean that this topic needs to be dropped from the project.

In the Rapid Assessments after Disasters project, two questionnaires were developed: a rapid registry questionnaire including a set of questions in modules and a physical (non-specific) symptom questionnaire for measuring nonspecific symptoms and the attribution of these symptoms. It is important that the right modules are chosen after a disaster, because situations differ. This approach helps to give quick information to provide appropriate health care, depending on the situation. Also, this information is important for assessing long term health effects.

#### **Risk assessment in emergencies**

In the Emergency Response function for radiation (ERFRAD) project, there has been progress on the development of data assimilation techniques. The results are promising to improve available quantitative risk assessments for nuclear and radiological emergencies. These assessments are needed

to choose the right countermeasures in case of emergencies. The results will be tested in a case study in 2010.

In the project From subacute to acute response two methods for testing and sampling voor volatile organic substances were tested. These appear promising, appropriate and applicable. The research was done in cooperation with two Dutch safety regions. Their cooperation is very important for the ultimate applicability of the methods.

### **Clinical toxicology**

The Research cooperation in human toxicology project is well on track. For instance, interesting results are obtained about the cellulaire effects of amphetamine and cocaine, which were contradictory to what previously had been assumed. The results of this project help to get more insight in the individual susceptibility in case of exposure to xenobiotics and the mechanism involved. This knowledge is used to improve the information supply of the poisons information centre. External requests for expert advice came from the Health Council of the Netherlands in two advice commissions and Expert judgment in a trial.

## 3.5 INFectious diseases (INF)

### **Infectious diseases**

The theme 'Infectious diseases' has – since its start in 2007 – resulted in an increased knowledge on the fields of mathematical modelling, genomics and immunology. Two projects that started in 2008 are more focussed on disease control, aiming at specific control possibilities and the detection of pathogens: Transmission intervention strategies and Ticks: trojan horses with new surprises.

### **Modelling**

The development of mathematical modelling is extremely relevant for the control of infectious diseases. Modelling can be used to estimate the chance on infection in certain populations, in relation to different intervention strategies. In 2009 the theme infectious diseases contained several modelling projects:

- Modelling the future of MRSA in the Netherlands;
- Tracking emerging epidemics;
- Epidemic modelling of molecular data;
- Chlamydia positivity and prevalence;
- Who infected whom?
- Timeliness response outbreaks.

Because the construction of mathematical modelling is still in full development, this fits very well within the Strategic Research Programme RIVM. At the same time mathematical modelling has already proven its value for policy development. An example is the following problem: for many new 'emerging' infectious diseases it is unclear beforehand on which populations the intervention and control measures should be aimed. How can we quickly find out if we can control epidemic growth better by vaccination of children (and not the elderly), or whether it is more effective to close high schools (and not day-care centres for young children)? This was one of the leading questions of the project Tracking emerging epidemics. In 2009 the investigators wanted to publish that control measures could best be aimed at the group with the highest chance on infection in order to slow down an epidemic most effectively. At that very moment the new flu appeared which could be used to test the ideas. Investigators could demonstrate at the very beginning of the epidemic that – if the target of intervention was to slow down the epidemic and to gain time – the intervention aimed at 5-19 year old group was much more effective than interventions aimed at any other age group. Pandemic surveillance data could thus be used directly to take decision in control measures.

Apart from the surveillance data molecular information of the infectious agents becomes available. The project 'Epidemic modelling of molecular data' investigates how molecular data can be used in mathematical modelling to increase our understanding of transmission and dynamics of infectious diseases. This approach appears promising and the investigators have published a paper on genetic diversity and incidence of Hepatitis B. Other institutes like Health protection agency (HPA) and Public health service (abbreviation GGD) Amsterdam have expressed their interest to start collaboration in this field.

Another modelling project Modelling the future of MRSA in the Netherlands showed that the transfer of patients between hospitals is capable of explaining much of MSRA infections in those hospitals. Hospitals with relatively many MRSA infections are not by default the ones that give less attention to the prevention and control of MRSA.

### **Genomics**

Genetic markers of pathogens may help clarifying trends in infectious diseases. Therefore in 2009 the theme Infectious Diseases also contains three projects that focus on genomics.

- Whole genome analysis of tuberculosis;
- Microarrays to map pertussis adaptation;
- *B. pertussis* adaptation to vaccination.

When this theme started in 2007 sequencing of the whole genome of (micro) organisms was quite innovative. In the SOR programme this new technique could be applied to two of the strong research lines. Nowadays sequencing is applied more regularly, so in 2007 this was a timely investment for RIVM.

Whole genomes were sequenced of *M. tuberculosis* isolates from 1993 to 2008 that belong to the large 'Harlingen outbreak'. In the project Whole genome analysis of tuberculosis many mutations were found that may indicate the tracking of transmission much better than the usual DNA typing, a finding which has been published. In the same project bacteria were sequenced of the so-called 'Beijing' genotype of *M. tuberculosis*. This Beijing genotype has an enormous and worldwide impact on treatment resistance. Because a specific subgroup in the Beijing genotype is most successful in transmission, the investigators have mapped which mutations separate this 'modern' line from the other lineages. These mutations quite often appeared to be in regulatory genes. Further investigation has to reveal through which changes these bacteria go that make them still more dangerous for humans.

In the project *B. pertussis* adaptation to vaccination the investigators could create a phylogenetic tree of *B. pertussis* strains, which showed that the *ptxP3* genotype only recently has achieved worldwide circulation. This finding supports the hypothesis of the investigators that vaccination affects the composition of circulating strains of bacteria. Because of vaccination strains start circulating against which the immunisation does not protect as effective. For immunisation programs this is a significant finding that, although many groups did not accept it for a long time, has now been published. For RIVM this implies, like the Red Queen from Lewis Carol's book says: 'it takes all the running you can do to keep in the same place'. It certainly applies to infectious diseases, because contagious agents do modify and escape to vaccines and antibiotics.

Results from the project Microarrays to map pertussis adaptation support the findings from the before mentioned pertussis project. Also by applying microarrays to 171 *B. pertussis* strains from different countries over a period ranging 60 years the investigators observed that certain genotypes are dominant in different areas. The *ptxP3* genotype is only dominant the last 15 years. This phylogenetic analysis based on microarrays has been validated by SNP based multi locus sequence typing methods.

### **Immunology**

The response of individuals to infectious agents determines to a certain extent the morbidity and mortality of these diseases. Within the theme Infectious Diseases specific attention is paid to

immunology. Immunity is raised by exposure to infectious agents or vaccines. These immunological reactions are complicated and differ from individual to individual. The theme contains the following immunological projects:

- Immunomodulation by helminth molecules / Zoonotic helminth infections and allergy;
- Host-response to RSV;
- Immune pathways in vaccinations;
- Memory immunity.

In the project Zoonotic helminth infections and allergy investigators observed that products from the parasite *Trichinella spiralis* reduced the immunological response to *E. coli*. These products may possibly be developed into drugs that suppress immune reactions, like in allergic asthma. In 2009 the knowledge gained in this project was already used to develop serological diagnostic tests for *Trichinella* infections.

Hereditary factors influence people's response to pathogens. In the project Host response to RSV we attempted to make a model that predicts which children suffering from severe RSV would in the long run still be 'wheezing'. In 2009 model studies in mice were finalized in which the mechanism resulting in an exacerbated response to vaccination was studied. The investigators assume that the same methods can be applied to study the effects of other vaccines.

It is important that the immunity induced by vaccination is strong enough to result in adequate responses following exposure to the infectious agent. So far, the immune response was determined by measuring the amount of antibodies in blood. It has been established that for measles 20 to 30 years after immunisation, the antibody titre is strongly reduced. This raises the question if these antibody titres are good indicators for protection. The project Immune pathways in vaccinations focuses on the identification of memory immunity against measles at the level of T- and B-lymphocytes. It was found that people with a critically low level of antibodies (or even in the absence of detectable levels) do have detectable memory immunity. Furthermore the effect of booster vaccination on immunity development was studied. In the experimental group the positive effect of the applied measles vaccine on the immune response appears to be limited, suggesting that extra immunisation is not effective for vaccinated people.

Also in the project Memory immunity investigators studied memory immunity, in particular against whole cell and the a-cellular *pertussis* vaccine (ACV). It appeared that the ACV induces a better B-cell memory immunity. However, it also induces a specific T-cell immunity and a higher IgE response that are both associated with allergic affections. This interpretation is strengthened by the observations that more serious local side effects have been reported after booster injections in 4 year olds that had been immunised by the ACV instead of the old, whole cell vaccine.

### 3.6 Chronic diseases Intervention and Lifestyle (CIL)

The strategic theme Chronic diseases, intervention and lifestyle has lead to knowledge on modelling, healthy ageing and quality of care. Most projects within the CIL theme made good progress in 2009.

#### **Modelling chronic diseases**

Four projects of the CIL theme contribute to RIVM chronic diseases modelling skills or use the available modelling tools at RIVM. For example, in one project RIVM cohort data were linked to data from the national hospital discharge registers (S260146). The results were used for an important contribution to new guidelines for treatment of cardiovascular diseases in the Netherlands. The new guidelines will base their criteria no longer on the risk of mortality but on the risk of morbidity.

The innovative methodological aspects of the projects were important for the position of RIVM. An example is the presentation of the Dynamo HIA model, which was developed in the (international) project about adaptable modelling, at the 2009 international Health impact assessment conference in Rotterdam ([www.hia09.nl](http://www.hia09.nl)). This has reinforced the position of the Netherlands as a country of high expertise in quantitative HIA work. The model helps us to estimate the health impact of policies. The model is already used for calculations by partners in different countries, like the UK, Italy and Spain.

Other methodological developments were important for regular RIVM tasks. For instance, it was found that the relation between health, mortality and costs of care depends strongly on the measure chosen. Health care costs correlate strongest with restrictions in daily activities. This information is important for the calculations to be carried out in the next Public health status and forecast (VTV).

### **Healthy ageing**

Two projects of the CIL theme contribute to knowledge of healthy ageing, which is an important societal issue. One project which had suffered from staff loss and related delay, managed to recover. The results of a meta-analysis revealed that 'age' is the most important influencing factor regarding the risk for coronary heart disease associated with overweight. Another project contributes to the important FP7 programme MARK-age, in which for instance biomarkers for ageing are tested.

### **Quality of care**

Three projects on quality of care made important progress. A scientific publication received press attention such as an article in *Medical care* (2010) that led to the following newspaper heading: 'Hospitals with many patients suffering from stroke have less mortality caused by stroke than hospitals with less patients of that kind. More treating experience might be an explanation'. The results of another project contributed significantly to the Public health compass and the VTV 2010.

### **Other**

The project working on General Practice (GP) registry data has managed to get access to all GP registries in the Netherlands - which has been an important breakthrough in this project. The output was in most cases as expected in terms of scientific publications and other products. The projects received ample attention from outside the RIVM and thus contributed to the status of the institute. For example, the project leader of the project on primary prevention research on obesity, cancer, and ageing received an invitation to speak about the role of overweight in the genesis of pancreatic carcinoma at an important international conference. This project has a wide range of results on quantitative relationships between risk factors (for instance life style) and the development of chronic diseases. A project that was completed in 2009 led to an invitation to participate in an expert meeting of WHO/FAO. The focus of this project was to learn about balancing health risks and benefits in food. Fish was worked out as an example. It contains n3-polyunsaturated fatty acids that lower the risk of cardiac death but they also contain contaminants such as methylmercury that affects the neurological development of newborns. Another example is the fortification of foods with folic acid. It will reduce the number of babies born with a neural tube defect but it may also increase the incidence of colon cancer in the population. These results are important for policy makers dealing with food issues.

In the CIL theme, the societal impact of the projects has been an important issue this year. Project leaders have tried to integrate this aspect in their work. The project on primary prevention research on obesity, cancer, and ageing has produced a large number of papers in scientific journals. However, now it was decided to spend part of 2010's project time on developing lay documents, to be able to explain to non-experts the value of this scientific research. One lay paper will discuss educational level and cancer and the factors playing a role in this connection. A second paper will discuss the role of fruit and vegetables in cancer prevention.

Some projects do not discuss societal impact but links are rather clear. One project discovered that children with asthma or severe headaches miss more school days than others, yet the school results seem not to suffer. A preliminary conclusion is that it takes more absence than expected to harm the

learning process. The same project yielded evidence that drinking alcohol is rather common under children: of all 11-12 year olds, 47 % drank an alcoholic beverage; 7 % drank a whole glass, 10 % has repeatedly (5 times or more) drunk sips of alcohol and 4 % regularly (10 times or more). This information is of great societal importance.

### 3.7 Medicines and Functional Foods (MFF)

The MMF clusters consists of 7 projects. Some of them started before the regular SOR 2007-2010 round and were finished at the end of 2009. In general the output of the individual projects within the MFF cluster is below average. Several valid causes are underlying this problem, i.e. severe claims related to unforeseen H1N1 emergencies, moved staff members, et cetera. More serious delays are noticed within the project Immunity of biopharmaceuticals and to a lesser extent in the projects Chronic Drug Use and Autoimmunity and Magic.

The projects Immunity of biopharmaceuticals and RISKRED were finished this year. Serious delays were encountered within Immunity of biopharceuticals. The major conflicting factor were the unforeseen H1N1 emergencies. Still a useful in vitro system for detecting immunogenicity of protein-based medicines was developed. RISKRED was completed successfully. An overview of the experience of the use of Risk Management Tools for Quality Risk Management in the pharmaceutical industry has been build up. Furthermore in-depth insight in the possibilities, limitations and pitfalls of several risk analysis methods was gained. RISKRED led to new assignments for the Health Care Inspectorate (abbreviation IGZ) and collaborations with the Food and drug administration (FDA) were reached.

In the project Chronic drug use and autoimmunity there were some interesting observations made, i.e. chronic statin use may have adverse effects on health, it may lead to rheumatoid arthritis (RA) as well as systemic lupus erythematosus (SLE). However, the production of this project is delayed and needs extra attention.

The Food pharma interface (FPI) project completed a web-based database. This database can be used as a basis for an (web-based) information platform. Although several staff members moved from the project there still seems to be considerable output. Some additional assignments were generated (VWA and EU).

Two projects started just a year ago, i.e. Biothree and Novel in vitro test for *Pertussis* toxin. The former focuses on finding new methods for determining drug uptake by the human gastrointestinal tract. Progress of Biothree is hard to measure at this time. However, additional funding for the studies were obtained from Product quality research institute (PQRI) and International pharmaceutical federation (FIP).

Novel in vitro test for *Pertussis* toxin encountered some delay in finding the right network for performing the proposed studies. This has been solved now and a fruitful collaboration with the Utrecht high laboratory school was initiated.

### 3.8 Environmental Quality and Health (EQH)

The strategic Environment quality and health (EQH) enlarges RIVM's knowledge on risk assessment, environmental impact assessment and measurement methods. Most projects within the EQH theme made very good progress in 2009. The EQH theme consists of 14 projects.

### **Risk assessment**

An important task of RIVM is assistance in assessing chemicals, according to the new EU chemical policy (REACH). Alternative methods for animal testing are urgently needed. In the project Integrating Testing Strategies the aim is to develop such methods, in an international setting (EU-project OSIRIS). In 2009 acute toxicity data were analyzed, using a probabilistic approach. This approach appeared to be successful. Analysis of complex toxicity data is ongoing. Preliminary results are very promising. The aim is to replace the existing two-generation test by a one-generation toxicity test. Implementation of this alternative test will reduce animal testing. Another project that contributes to REACH (and other regulatory lines) is Environmental impact assessment (EIA). This project addresses upcoming societal problems in environmental quality in relation to sustainability, especially of ecosystem quality and ecosystem services to man. A selection of results is mentioned here. Interim results have already been used for EU rules, regarding attention for mixtures, and by UN in disaster areas. Furthermore, because of promising results on genetically modified organisms, additional external finance was given to execute a feasibility study on the use of GIS and Earth observation systems for general surveillance of these organisms.

Interesting results were also obtained in the Project Climate and ozone change effects (COURSE). A systematic analysis of the past UV-radiation levels in Europe has been carried out and provides UV-radiation doses for eight locations in Europe. Two third of the upward trend observed in the overall analysis appeared to be attributable to cloud changes and one third to ozone changes. This might indicate that due to the countermeasures taken to protect the ozone layer, climate change has a larger impact on the changes in the European UV-radiation levels than ozones changes. Research on the role of sunlight and UV-exposure on the causes of cancer on the one hand and the beneficial production of vitamin D on the other hand, is ongoing and promising. This research is requested by the Dutch cancer society (KWF).

### **Environmental health impact assessments**

The Clean Air For Europe Programme (EU) has estimated that current exposures to ambient fine particulate air pollution in the 25 EU member states cause about 350,000 premature deaths annually. However, because scientific research indicates that the actual health risk depends on the specific characteristics of emission sources, future regulation on this topic would greatly benefit from integrated study approaches, challenging the whole pathway of emission sources. In the project Risks of Airborne Particles (RAPTES) very good progress was made on this subject. For instance, analysis results indicate that cell toxicity depends on the sampling location of as well as the size fraction. Other preliminary results are promising as well and will be published in 2010.

Information on which policy measures could lead to the largest health gain is highly significant to policy makers. In order to answer such questions, environmental health problems should be made comparable. The aim of Uncertainty in environmental burden of disease, (IQARUS) was to identify and assess uncertainties in environmental health risk estimates. This project was completed in 2009. A typology of uncertainties, a protocol that can be used as formal expert elicitation and guidelines on indicator sets have been carried out. Results on air pollution were implemented in RIVM's Chronic disease model. This will be of great value for future policy decisions.

Many EQH projects contribute to international projects, thus strengthening RIVM's international collaboration. For instance IQARUS and VAMPHIRE (Versatile assessment methodology project for health impacts and risks in the environment) contribute to the EU-project INTARESE on health risk assessment. In VAMPHIRE activities were carried out on monetization of environmental health impacts. The results are promising and potentially very important for decision makers. The results of the IQARUS project, together with insights from the VAMPHIRE project and INTARESE have led to a PhD thesis to be defended in 2010.

The small area health statistics techniques from the project SMARHAGT: Small area health analyses were used to assess the situation around CORUS, in a project commissioned by VROM. Although this

caused some delay in the SOR project itself, the use of these techniques proved pivotal for the VROM project. Moreover, valuable results were obtained which will be published in 2010.

The project PACEHR (Perception, appraisal and communication of environmental health risks) was completed in 2009, with interesting results. The results help policy makers to understand the concept of risk, being a multi-attribute concept that may be differently defined by different parties. In this project methods to assess people's perceptions and protocols to analyze information were developed. This project together with INTARESE performed an international survey on risk perception. The results will be published through INTARESE in 2010.

#### **Measurement methods**

Adequate policy depends on adequate information. RIVM invests in adequate measurement methods and instruments. An example is the Leaching Assessment Device (LAD a device to intercept the drainage flux from soil surface to the water saturated zone to the ground water), which was developed in the project NITROGEN. Due to technical improvement in the equipment, the new field campaign for ammonia deposition measurements benefits substantially from improved data coverage.

Two projects deal with climate and air quality monitoring. Climate and air quality monitoring (CESAR) aims to integrate observation strategies, climate change and parameters needed to study health related effects on aerosols. The project is well-embedded in an international network. Important progress was made, for instance on a method to estimate size and composition of aerosols from multiwavelength data. Knowledge about size and composition is important for source identification, as well as assessment of the direct and indirect climate effects. In Air quality and remote sensing (AQUIRES), an operational system for air quality smog modelling and forecasting was delivered. Another product contributed to improving satellite measurements of tropospheric NO<sub>2</sub>. In both projects RIVM collaborates with other institutes, like KNMI and TNO. This project also contributes to an international effort to estimate emissions of ships to the air, through remote sensing techniques.





## 4 2009 in numbers

### 4.1 Research quantity indicators

Research output in terms of scientific papers or reports that were published is presented below. Annex 2 contains references to published and accepted papers for each research project.

#### *The 2007-2010 Strategic Research Programme*

In 2009, a total of 116 SOR-related scientific papers were published or accepted for publication in international peer-reviewed journals. This is nearly 16 % of the total number of RIVM publications (732 scientific publications, Annual Science Report 2009 (RIVM)).

Two thirds (81) of these papers had RIVM staffers as their first, second and/or last author, signifying particular importance of the research for the institute. Another 70 papers were submitted for publication to editors of similar journals. There were no PhD theses completed in 2009.

Table 4.1 presents a breakdown of these numbers per theme.

Table 4.1 Number of research papers of SOR 2007-2010

Theme	Number of projects	Submitted for publication	Accepted for publication and Published	Total	Accepted and Published <i>1st, 2nd or last author</i>	Theses
RPC	8	8	13	21	12	
ERF	6	4	2	7	2	
INF	16	14	15	29	13	
CIL	15	19	51	70	30	
MFF	7	5	6	11	6	
EQH	14	20	28	48	18	
2009	66	70	115	186	81	
2008	67	62	78	140	52	1
2007	59	21	48	69	21	2

The number of scientific papers accepted and published in 2009 is almost 1,5 times of the number of scientific papers accepted and published in 2008 and 2,4 times of the number of scientific papers accepted and published in 2007. This demonstrates that most projects reached full speed.

#### *The 2003-2006 Strategic Research Programme*

One project from the 2003–2006 Strategic Research Programme cycle was completed in 2009 and produced two scientific publications in 2009.

### 4.2 Research quality indicators

In 2002, consultations with RIVM's Scientific Advisory Board led to the selection of quality indicators for strategic research. The indicators were based on methodology developed at the Faculty of Veterinary Medicine of Utrecht University. They were used for the 2003-2006 Strategic Research Programme and, with minor modifications, are used for the current cycle as well.

The methodology is based on the impact factors of all journals in which papers were published. It measures the quality, not the quantity of the output. For every research theme, the average impact

factor is calculated from journals that accepted and published the papers. Scores are compared to a 'standard', which is the average impact factor of all reference journals relevant for that particular theme (excluding journals with impact factors >15). The comparison leads to assessments on a five-point scale where 5 is highest, 1 is lowest and 3 represents an average acceptable score. A more detailed explanation of the methodology is given in Annex 3. A list of reference journals per theme is given in Annex 4.

A number of observations have been made on the use of this methodology:

- Assessment scores should be seen as indicative only. Impact factors vary greatly not only because scientific fields differ, but also because researchers do set the standard against which they are measured by providing the lists of reference journals;
- Assessment scores do not take into account the quantity of the output, just the quality of the journals in which output was published. One paper in a top journal may seem to outperform twenty papers in less outstanding but still highly respectable journals. Therefore, Table 4.2 should always be evaluated together with the number of papers published (Table 4.1);
- RIVM's primary purpose is helping answer policy questions. While achieving high research quality is highly valued within the institute and elsewhere, it will not always be possible. That may be true in particular for research that is aimed at developing new methods.

Table 4.2 presents average impact factors and assessment scores for all research themes.

Table 4.2 Indicators of scientific quality per theme of SOR 2007-2010: average Journal Impact Factors

Journal Impact Factor		RPC	ERF	INF	CIL	MFF	EQH
Average 2009		3.735	3.348	4.193	5.422	2.830	3.296
Standard 2008		3.946	2.915	3.957	3.846	3.492	2.390
Assessment	Class 1-5	3	4	3	5	2	5
Average 2008		3.786	2.543	5.501	8.807	2.913	3.305
Standard 2007		3.569	2.764	3.932	3.466	3.163	2.217
Assessment	Class 1-5	3	3	5	5	3	5
Average 2007		4.787		3.937	4.508		2.626
Standard 2006		3.650	2.598	3.878	3.321	3.160	2.043
Assessment	Class 1-5	5		3	5		4

Notwithstanding the observations on the use of this methodology, the overall results continued to be very good:

- CIL (70 publications) and EQH (48 publications) both combine a high number of accepted and submitted publications and again the highest assessment (Class 5). This notwithstanding the fact that the standard yearly increased between 2006 and 2008. Setting a higher goal during the next SOR cycle could be taken into consideration;
- The assessment of MFF (11 publications) falls from Class 3 to Class 2. The output in numbers of publications is also low;
- The remaining three research themes, RPC 21 publications), ERF (7 publications) and INF (29 publications) fluctuate between the assessment Class 3 and 4.

### 4.3 Other research output

#### *The 2007-2010 Strategic Research Programme*

Strategic research also produced many other tangible products. 31 (letter) reports were written, 126 talks at international meetings presented, 10 websites built, 25 data bases set up and 26 tools (such as computer models) created. Table 4.3 presents a breakdown of these numbers per theme.

Table 4.3 Other research products

Theme	Number of projects	Reports	Letter reports	Talks presented at international meetings	Tools (e.g. models)	Databases	Web sites
RPC	8	1		14	5		
ERF	6			5	2		
INF	16		4	13	4	2	
CIL	15	5	2	40	3	7	3
MFF	7	1		8			
EQH	14	16	2	46	12	16	7
2009	66	23	8	126	26	25	10
2008	67	27	9	105	22	19	14
2007	59	9	6	76	5	17	8

Apart from above mentioned products the progress reports also mention a great variety of tangible and non-tangible products, such as organization of meetings, internal reports, posterpresentations, project proposals, interviews, questionnaires and abstracts for meetings.

### 4.4 The impact of strategic research on society

According to the Scientific Advisory Board, applied research carried out at the institute should not only have strong scientific merit but should bring value for society as well. In order to properly assess that value, the Board has asked the institute to develop straightforward and cost-effective indicators by which to measure the Strategic Research Programme's impact on society, and to begin monitoring that impact as part of the 2007-2010 programme cycle.

As of yet, no general consensus exists on the best methodology by which to assess the impact of research on society. For RIVM, a definition proposed by Eijsackers (presentation WUR, 2007) seems the most applicable: Research has an impact on society when its outcomes can be used by governments, industry, non-governmental organizations or the general public because they:

- Could lead to direct applications;

- Offer solutions to social problems or address social developments;
- Answer questions that arise in society or fulfil societal needs.

Also, research should address a significant problem or issue, i.e. serve a general interest.

*RGO guidelines on health research impact indicators*

In December 2007, the Advisory Council on Health Research (De Gezondheidsraad, GR), a body advising the Dutch government on health and health services research, published a report on assessing the impact of research on society. Titled *Research that matters (Onderzoek dat ertoe doet)*, the report offered a list of indicators that gauge the impact of health research. The Council stressed the limited experience with applying such indicators and warned against putting too much emphasis on numerical values as of yet. The Council rather presented its list as a rough guide that should be experimented with. In setting up such experiments, users should select their own indicators based on the general list.

From GR's general list (see Annex 6), RIVM has selected a short list of indicators that seem most suitable to measure the impact of the institute's Strategic Research Program. In making the selection, RIVM included the following rationale:

- RIVM's strategic research has a particular focus – it is primarily targeted at demand that will most probably materialize in the future;
- Many factors contribute to measurable health impacts, and typically it will be hard to contribute such impacts directly to the strategic research program itself.

*Strategic Research RIVM impact indicators*

Obviously all RIVM research, including that carried out as part of the Strategic Research Programme, should ultimately have positive effects on society. Such effects, however, will usually become visible only at a much later time. All selected indicators may be called indirectly: we may assume that, when third parties apply RIVM research outcomes, or when RIVM is asked for advice based on the fruits of its work, there will most probably be future impact. Following the same line of thinking, follow-up assignments were added as indicators because they can be seen as clear signs of outside interest in RIVM research results.

Some indicators on the list of the Advisory Council on Health Research could indeed be very meaningful when applied to RIVM as a whole. These include, for example, contributions to professional education, informing the public through authorized websites, and references to research in public media. However, it would be very difficult to directly contribute performance on such indicators to strategic, long-term research. Therefore these indicators were not deemed suitable for measuring societal impact of the Strategic Research Programme. The Advisory Council on Health Research also presented a list of indicators for the assessment of economic impact of health research. For similar reasons, these indicators were also deemed not very suitable for measuring the impact of RIVM's strategic research.

In the end, the following process- and product-based indicators were identified. For all these indicators, performance are being assessed and quantified annually:

- Follow-up assignments from primary clients;
- Follow-up assignments from secondary clients;
- Use of outcomes in guidelines, regulation, policies and so on;
- Requests for advice from third parties;
- Participation in international bodies.

Table 4.4 Research themes and their performance on selected societal impact indicators

Theme	Number of projects	Follow-up assignments from primary clients	Follow-up assignments from secondary clients	Use of outcomes in guidelines, regulation, policies and so on.	Requests for advice from third parties	Participation in international bodies	Total
RPC	8	3	1	1		5	10
ERF	6	2		2	4	3	11
INF	16		1	4	2	4	11
CIL	15	7	3	4	14	5	33
MFF	7	4	1	6		3	14
EQH	14	4	2	19	10	6	41
2009	66	20	8	36	30	26	120
2008	67	10	14	35	31	26	116
2007	59	6	12	12	19	18	67

## 4.5 Societal impact summary scores

Within the Strategic Research Programme, the various research themes differ significantly in terms of budgets and numbers of projects. As of yet, there is no absolute standard to which a theme's performance can be compared. For now, the scores can only be used to compare individual research themes and to monitor the Strategic Research Programme's impact over the years. Some in the field have experimented with methodologies that use weighted performances. Weightings could be based on differences between areas of research, for example. At this point, no weightings have been applied to calculate scores for RIVM's Strategic Research Programme. This might change in the future, for example based on discussions within RIVM's Scientific Advisory Board. Table 4.5 presents societal impact summary scores for each of the research themes in 2009.

Table 4.5 Research themes and their societal impact summary scores

Theme	Number of projects 2009	Summary score 2009	Number of projects 2008	Summary score 2008	Number of projects 2007	Summary score 2007
RPC	8	10	7	9	7	9
ERF	6	11	7	13	7	3
INF	16	11	15	11	10	7
CIL	15	33	17	31	14	16
MFF	7	14	6	8	6	
EQH	14	41	15	44	15	32
Total number of projects	66		67		59	
Total summary score		120		116		67

Annual reports will continue to present societal impact summary scores in the future, making it easier to assess impact trends over time.

Table 4.5 shows that compared to 2008 the societal impact factor of RPC (+1), CIL (+2) and MFF (+6) rose, while ERF (-2) and EQH (-3) fell. The societal impact factor of INF (0) remained constant compared to 2008.

## 4.6 Finances

Table 4.6 presents the funds that were spent for each theme out of the DG's 2009 budget.

The table does not include expenditures that were paid using funds from external sources, such as funders who co-finance research by matching RIVM's own funds. In the table, the second column presents the amounts invested by RIVM in co-financed projects. The table's third column presents the number of hours that were put in by RIVM staff, not including hours paid from RIVM funds invested in co-financed projects (accounting rules stipulate that such hours should be reported elsewhere). Note: The RIVM has a different method for calculating budgets than universities. For this reason, a comparison is not possible.

Table 4.6 Budget 2009 spent per theme

Theme	Total [€]	Of which co-financing [€]	Hours spent exclusive hours co-financing [h]
RPC (8)	1,974,885	96,666	10,593
ERF (6)	1,331,409	0	6,893
INF (16)	2,335,874	113,324	13,884
CIL (15)	2,408,542	420,730	10,671
MFF (7)	1,103,937	0	7,494
EQH (14)	3,618,098	477,467	18,001
2003-2006 (1)	73,475	0	226
Total	12,846,220	1,108,187	67,536

## 5 Conclusion and outlook for 2010

### 5.1 General assessment 2007-2010 Programme

In 2010 most of the projects will be brought to an end. In 2011 a new four year cycle will start so there is no need for adjusting research themes at present.

By late 2009 all the projects from the 2003-2006 Programme cycle had been completed.

### 5.2 Progress in 2009

Generally speaking, research output from RIVM's Strategic Research Programme increased markedly between 2007 and 2009. (An increase was to be expected, however, since most research projects were launched in 2007.) On the whole, papers were accepted or published in journals with higher-than-average impact. Average societal impact index scores rose slightly since 2008. In conclusion, 2009 was a good year for RIVM's strategic research.

### 5.3 Midterm review

All projects that were halfway by late 2008, i.e. four-year projects that started in 2007, were subject to a midterm review in 2009. The midterm review serves to test the quality and the progress of individual projects. Evaluations were carried out by theme coordinators based on a list of questions drawn up by RIVM's Director-General. The original plans as well as 2007 and 2008 progress reports were taken into account. Independent experts inside and outside the institute were consulted. Based on the midterm review, theme coordinators presented recommendations for each project to the Director-General.

The majority of midterm reviews displayed positive progression and quality. However, poor progression of eleven projects was ground for further agreements. This was the case with one or more projects in every strategic theme. In some projects poor progression was caused by unexpected personal situations concerning the project leader or his team.

In all cases specific agreements were made between commissioner, theme coordinator and project leader in order to ensure successful completion, for instance on extra guidance or involvement of external expertise.

### 5.4 Preview: New projects in 2010 and finish of projects in 2010

In the first six months of 2010, twelve additional research projects were launched as part of the 2007-2010 Strategic research programme. Seven of these are part of the EQH theme, one in the ERF theme and two in the INF theme. Two of these fall within the INF theme, one in the RPC theme and one in the MFF theme. Annex 7 lists full titles and project leaders. Outside review was applied to assess these projects' proposals.

In 2010 most of the projects that started in 2007 will be completed. A number of projects will continue, partly because of delays and partly because of the initially planned duration of more than four years. Quite a number of projects launched after 2007 will continue in 2011 and beyond. These ongoing projects are marked with 'O' in Annex 1.





## Annex 1 Research programmes and projects

- S = Projects started in 2009  
 C = Projects completed in 2009  
 O = Ongoing projects in 2011

### Theme: RPC

Programme		Division	Project nr.	Project leader	Title
Experimental (animal) studies in risk assessment		Clb	230126	Ing. J.H.J. Reimerink	Proteomics for population screening
	S	VGC	320001	Dr. P.M.J. Bos	Population Based Biokinetic Modelling
	C	VGC	340010	Mw. Dr. M. Luijten	Toxicogenomics in risk assessment
		VGC	350010	Dr. Ir. M. C. Ocké	Methods for dietary exposure assessment
		VGC	340050	Dr. L.T.M. van de Ven	Alternatives for animal testing
	O	VGC	340030	Dr. W. H de Jong	Nanotechnology, potential risks
Information to consumers	O	VenZ	270136	Drs. H.C. Ossenbaard	gettingBetter.nl
	O	VenZ	260196	Prof. Dr. G.P. Westert	Effective use performance indicators

### Theme: ERF

Programme		Division	Project nr.	Project leader	Title
Measuring and modelling		Clb	330006	Dr. B.J. van Rotterdam	Biothreat DNA micro-arrays
	O	MEV	620001	Dr. P.A.M. Uijt de Haag	QRA
		MEV	630007	Mw Drs. F.S.M. Stom	Rapid assessments after disasters
Risk assessment in emergencies		MEV	610003	Dr. C.J.W. Twenhöfel	ERFRAD
		MEV	609002	Drs. Ing. N.J.C. van Belle	From sub acute to acute response
Clinical toxicology	O	MEV	660001	Prof. Dr. J. Meulenbelt	Research cooperation in human toxicology

## Theme: INF

Programme		Division	Project nr.	Project leader	Title
Modelling	O	Clb	210026	Dr. H. Grundmann	Modelling the future of MRSA in NL
		Clb	210036	Dr. J. Wallinga	Tracking emerging epidemics
	C	Clb	210046	Dr. J. Wallinga	Epidemic modelling of molecular data
		Clb	210056	Mw. Dr. M. E.E. Kretzschmar	Chlamydia positivity and prevalence
Immunology	S/O	Clb	210066	Dr. J. Wallinga	Who infected whom
	S/O	Clb	210076	Mw. Dr. M. E.E. Kretzschmar	Timeliness response during outbreaks
	O	Clb	230426	Mw Dr. A.M. Buisman	Memory immunity
		Clb	230146	Mw Dr. B. Pinelli <sup>1</sup> Ortiz	Immunomodulation by helminth molecules
	O	Clb	230166	Mw Dr. B. Pinelli Ortiz	Zoonotic helminth infections and allergy
	O	VGC	230406	Dr. C.M. Janssen	Host-response to RSV (Respiratory Syncytial Virus)
		Clb	230416	Dr. R.S. Van Binnendijk	Immune pathways in vaccination
Genomics	O	Clb	230136	Dr. D. v. Soolingen	Whole-genome analysis of <i>M. tuberculosis</i>
		Clb	230436	Dr. A.J. King	Microarrays to map pertussis adaptation
	O	Clb	230446	Dr. F.R. Mooi	<i>B. pertussis</i> adaptation to vaccination
	O	Clb	330116	Dr. H. Sprong	Ticks: Trojan horses with new surprises
INF - other	O	Clb	230156	Dr. E. Duizer	Transmission intervention strategies

## Theme: CIL

Programme		Division	Project nr.	Project leader	Title
Modelling chronic diseases	O	VenZ	260146	Mw. Dr. Ir. W.M.M. Verschuren	Primary prevention research on cardiovascular diseases and diabetes
		VenZ	210116	Dr. S.D. Mylius	Adaptable chronic diseases modelling
	O	VenZ	260166	Mw. Dr. P.C.A. Droomers	Modelling SES disparities in health
Healthy ageing	C	VGC	350040	Dr. Ir. N. de Jong	Modelling health effects of nutrition
	O	VenZ	260156	Dr. Ir. W.J.E. Bemelmans	Healthy ageing: overweight/underweight
	O	VGC	340020	Dr. M.E.T. Dollé	Healthy ageing: gene diet interactions
Quality of care		VenZ	260116	Dr. G.P. Westert	Health system performance Neth and CAN
	S/O	V&Z	270166	Dr.J.Polder	Healthy Ageing & Health Care Expenditure

<sup>1</sup> As of 2009, projects 230146 and 230166 are combined

Programme		Division	Project nr.	Project leader	Title
		VenZ	270116	Dr. C.H. van Gool	Are diseases becoming less disabling?
Economic evaluations		VenZ	260176	Dr. T.L. Feenstra	Communicating uncertainty in econ evals*
Other		VGC	350020	Dr. H.B. Bueno de Mesquita	Primary prevention research on obesity, cancer and ageing
	O	VenZ	270126	Mw. Dr. A.J. Schuit	Knowledge transfer in public health
	O	VenZ	260126	Mw. Dr. A.H. Wijga	Lifestyle from childhood to adolescence
		VenZ	260136	Mw. Dr. A.H. Wijga	Chronic diseases in childhood*
	O	VenZ	270146	Mw. Dr.Ir. F. H.G.M. Hoeymans	Validation of data from general practise registries

### Theme: MFF

Programme		Division	Project nr.	Project leader	Title
Not applicable	O	VGC	340040	Dr. Ir. R.J. Vandebriel	Chronic drug use and autoimmunity
	O	VGC	350030	Dr. Ing. H.J. v. Kranen	The food pharma interface
	S/O	VGC	360001	Dr. Ing. A.M. Akkermans	Novel in vitro for pertussis toxin
	O	VGC	370020	Drs. D. A. v. Riet-Nales	MAGIC
	C	VGC	360020	Dr. M.H.N. Hoefnagel	Immunogeniteit eiwitgeneesmiddelen
	C	VGC	370010	Dr. D.M. Barends	RISKRED
		VGC	370030	Dr. D.M. Barends	BIOTHREE

### Theme: EQH

Programme		Division	Project nr.	Project leader	Title
Risk assessment		MEV	607001	Dr. L. Posthuma	EIA: environmental impact assessment
	O	MEV	607002	Prof. Dr. A.M. Breure	RICIERA: research cooperation in ecological risk assessment
		MEV	601001	Dr. T.G.Vermeire	ITS: integrated testing strategies
		MEV	630006	Mw. Drs. C.M.A.G. van Wiechen	SMARAGHT: small area health analyses, a geographic toolkit
		MEV	610002	Dr. H. Slaper	COURSE: climate and ozone change effects

<b>Programme</b>		<b>Division</b>	<b>Project nr.</b>	<b>Project leader</b>	<b>Title</b>
Interface risk assessment and EHIA		MEV	610001	Dr. H. Bijwaard	MIRACLE: modelling ionizing radiation and cancer for low dose effects
Environmental Health impact assessment	O	MEV	630001	Prof. Dr. Ir. E. Lebret	IRAS: environmental health collaboration
		MEV	630002	Mw. Dr. N. Janssen	RAPTES: risks of airborne particles
		MEV	630003	Mw. Dr. A.B.Knol	VAMPHIRE: versatile assessment methodology project for health impacts and risks in the environment
	C	MEV	630004	Mw. Dr. A. B. Knol	IQARUS: uncertainty in environmental BOD
	C	MEV	630005	Dr. R. van Poll	PACEHR: perception, appraisal and communication of environmental risks
Measurement methods	O	MEV	680001	Dr. Ir. W.A.J. van Pul	NITROGEN: Relating ground water + air quality for N
	O	MEV	680002	Dr. A. Apituley	CESAR: climate and air quality monitoring
		MEV	680003	Drs. D.P.J. Swart	AQURES: air quality and remote sensing

## Annex 2 Papers from SOR projects in 2009

- Listed are scientific papers published or accepted in international peer-reviewed journals;
- RIVM staff is printed in bold; papers with RIVM staffers as their first, second and/or last author are marked with a checkmark (✓);
- For project titles, see Annex 1.

### Publications 2009

#### Theme RPC

##### **RPC, S/230126, Proteomics for population screening**

- ✓ **Koster MPH, Pennings JLA, Imholz S, Rodenburg W**, Visser GH, **Vries A de, Schielen PC**  
Bead-based multiplexed immunoassays to identify new biomarkers in maternal serum to improve first trimester Down syndrome screening  
Prenat Diagn 2009; 29(9):857-62
- ✓ **Pennings JLA**, Koster MPH, **Rodenburg W, Schielen PCJI, Vries A de**  
Discovery of novel serum biomarkers for prenatal Down syndrome screening by integrative data mining  
PLoS One 2009; 24, 4(11):e8010
- ✓ **Rodenburg W, Pennings JLA, Oostrom CTM van, Roodbergen M, Kuiper RV, Luijten M, Vries A de**  
Identification of breast cancer biomarkers in transgenic mouse models: a proteomics approach  
Proteom Clin Appl 2009; accepted

##### **RPC, S/270136, gettingBetter.nl**

- ✓ **Ossebaard HC**, Gemert-Pijnen JEW van, Sorbi MJ, Seydel ER  
A study of a Dutch on line decision aid for parents of children with ADHD  
J Telemed Telecare 2009; 16(1): 15-9
- ✓ **Kelders SM**, Gemert-Pijnen JEW van, Werkman A, Seydel ER  
Evaluation of a web-based lifestyle coach designed to maintain a healthy bodyweight  
J Telemed Telecare 2009; 16(1): 3-7

##### **RPC, S/340010, Toxicogenomics in risk assessment**

- ✓ **Hernández LG, Steeg H van, Luijten M; Benthem J van**  
Mechanisms of non-genotoxic carcinogens and importance of a weight of evidence approach  
Mutat Res 2009; 682(2-3):94-109
- ✓ Jonker MJ, Bruning O, Itersen M van, **Schaap M**, Hoeven TV van der, Vrieling H, **Beems RB, Vries A de, Steeg H van**, Breit TM, **Luijten M**  
Finding transcriptomics biomarkers for in vivo identification of (non-)genotoxic carcinogens using wild-type and Xpa/p53 mutant mouse models  
Carcinogenesis 2009; 30(10):1805-12

### **RPC, S/340030, Nanotechnology, potential risks**

- ✓ Park MVDZ, **Lankveld DPK, Loveren H van, Jong WH de**  
The status of in vitro toxicity studies in the risk assessment of nanomaterials  
Nanomedicine 2009; 4(6):669-85
- ✓ **Park MVDZ, Annema W**, Salvati A, Lesniak L, Elsaesser A, Barnes C, McKerr G;  
Howard CV, Lynch I, Dawson KA, **Piersma AH, Jong WH de**  
In vitro developmental toxicity test detects inhibition of stem cell differentiation by silica nanoparticles  
Toxicol Appl Pharmacol 2009; 240(1):108-16
- ✓ Hoecke K van, **Quik JTK**, Mankiewicz-Boczek J, Schamphelaere KAC de, Elsaesser A;  
Meeren P, Barnes C, McKerr G, Howard CV, **Meent van de**, Ryzdzyński C de, Dawson KA,  
Salvati A, Lesniak A, Lynch I, Silversmit G, Samber B de, Vincze L, Janssen CR  
Fate and effects of CeO<sub>2</sub> nanoparticles in aquatic ecotoxicity tests  
Environ Sci Technol 2009; 43(12):4537-46

### **RPC, S/350010, Methods for dietary exposure assessment**

- ✓ **Slob W**, Boer WJ, Voet HV  
Can current dietary exposure models handle aggregated intake from different foods? A simulation study for the case of two foods  
Food Chem Toxicol 2009; [Epub ahead of print]
- Ferrari P, Roddam A, Fahey MT, Jenab M, Bamia C, **Ocké M**, Amiano P, Hjartåker A;  
Biessy C, Rinaldi S, Huybrechts I, Tjønneland A, Dethlefsen C, Niravong M;  
Clavel-Chapelon F, Linseisen J, Boeing H, Oikonomou E, Orfanos P, Palli D;  
Santucci de Magistris M, **Bueno de Mesquita HB**, Peeters PH, Parr CL, Braaten T,  
Dorransoro M, Berenguer T, Gullberg B, Johansson I, Welch AA, Riboli E, Bingham S;  
Slimani N  
A bivariate measurement error model for nitrogen and potassium  
intakes to evaluate the performance of regression calibration in the European  
Prospective Investigation into Cancer and Nutrition study  
Eur J Clin Nutr 2009; 63 (4):179-87
- ✓ Verkaik-Kloosterman J, Veer P van 't, Ocké MC  
Simulation model accurately estimates total dietary iodine intake  
J Nutr 2009; 139(14):19-25

### **Theme ERF**

#### **ERF, S/630007, Rapid assessments after disasters**

- ✓ Scheepers PTJ, **Bos PMJ**, Konings J, **Janssen NAH, Grievink L**  
Application of biological monitoring for exposure assessment following chemical incidents,  
a procedure for decision-making  
J Expo Sci Env Epid 2009; accepted

**ERF, S/660001, Research cooperation in human toxicology**

- ✓ Hondebrink L, **Meulenbelt J**, Timmerman JG, Berg M van den, Westerink RH  
Amphetamine reduces vesicular dopamine content in dexamethasone-differentiated PC12 cells only following L-DOPA exposure  
J Neurochem 2009; 111(2):624-33

**Theme INF**

**INF, S/210036, Tracking emerging epidemics**

- ✓ Forsberg White L, **Wallinga J**, Finelli L, Reed C, Riley S, Lipsitch M, Pagano M  
Estimation of the reproductive number and the serial interval in early phase of the 2009 influenza the current influenza A/H1N1 pandemic in the USA  
Influenza and Other Respiratory Viruses 2009; 3(6):267-76
- ✓ Goldstein E, Apolloni A, Lewis B, Miller JC, Macauley M, Eubank S, Lipsitch M;  
**Wallinga J**  
Distribution of vaccine/antivirals and the 'least spread line' in a stratified population  
J R Soc Interface 2009; [Epub ahead of print]
- ✓ Hahne S, **Donker T**, **Meijer A**, **Timen A**, **Steenbergen J van**, Osterhaus A, **Sande M van der**, **Koopmans M**, **Wallinga J**, **Coutinho R**  
Epidemiology and control of influenza A(H1N1)v in the Netherlands: the first 115 cases Euro Surveill 2009; 14(27) 1-14

Farrington CP, Whitaker HJ, **Wallinga J**, Manfredi P  
Measures of disassortativeness and their application to directly transmitted infections  
Biom J 2009; 51(3):387-407

- ✓ **Wallinga J**, Boven M van, Lipsitch M  
Optimizing infectious disease interventions during an emerging epidemic  
Proc Natl Acad Sci USA 2009; accepted

**INF, S/210046, Epidemic modelling of molecular data**

Bruijne J de, Schinkel J, Prins M, Koekkoek SM, Aronson S, **Ballegooijen WM van**;  
Reesink HW, Molenkamp R, Laar TJW van de  
Emergence of hepatitis C virus genotype 4: phylogenetic analysis reveals three distinct epidemiological profiles  
J Clin Microbiol 2009; E-pub doi:10.1128/JCM.01146-09

- ✓ **Ballegooijen WM van**, Houdt R van, Bruisten S, **Boot HJ**, **Coutinho R**, **Wallinga J**  
Molecular sequence data of hepatitis B virus reveals sudden change in transmission after vaccination  
Am J Epidemiol 2009; 170(12):1455-63

**INF, S/210056, Chlamydia positivity and prevalence**

- ✓ **Kretzschmar M**, Turner KM, Barton PM, Edmunds WJ, Low N  
Predicting the population impact of chlamydia screening programmes: comparative mathematical modelling study



Sex Transm Infect 2009; 85(5):359-66

**INF, S/230136, Whole-genome analysis of *M. tuberculosis***

- ✓ **Schürch AC, Kremer K, Kiers A, Daviena O, Boeree MJ, Siezen R; Smith NH; Soolingen D van**  
The tempo and mode of molecular evolution of *Mycobacterium tuberculosis* at patient-to-patient scale  
Infect Genet Evol 2009; [Epub ahead of print]

**INF, S/230146/S/230166, Immunomodulation by helminth molecules/  
Zoonotic helminth infections and allergy**

- ✓ **Langelaar M, Aranzamendi C, Franssen F, Giessen J van der, Rutten V, Ley P van der, Pinelli E**  
Suppression of dendritic cell maturation by *Trichinella spiralis* excretory/secretory products  
Parasite Immunol 2009; 31(10):641-5

**INF, S/230416, Immune pathways in vaccination**

- ✓ **Buisman AM, Rond CGH de, Öztürk K, Hulscher HI ten, Binnendijk RS van**  
Long-term presence of memory B-cells specific for different vaccine components  
Vaccine 2009; 28(1):179 -86

**INF, S/230426, Memory immunity**

- ✓ **Hendrikx LH, Berbers GA, Veenhoven RH, Sanders EA, Buisman AM**  
IgG responses after booster vaccination with different pertussis vaccines in Dutch children 4 years of age: effect of vaccine antigen content  
Vaccine 2009; 27(47):6530-6

**INF, S/230446, *B. pertussis* adaptation to vaccination**

- ✓ **Mooi FR, Loo IHM van, Gent M van, He Q, Heuvelman CJ, Bart MJ, Greeff SC de ; Diavatopoulos DA, Teunis PF, Nagelkerke NJF, Mertsola J**  
*Bordetella pertussis* strains with increased toxin production associated with pertussis resurgence  
Emerg Infect Dis 2009; 15(8):1206-13
- ✓ **Mooi FR**  
*Bordetella pertussis* and vaccination: the persistence of a genetically monomorphic pathogen.  
Infect Genet Evol 2009 [E-pub ahead of print]

**INF, S/330116, Ticks: Trojan horses with new surprises**

- ✓ **Sprong H, Wielinga P, Fonville M, Reusken C, Brandenburg A, Borgsteede F; Gaasenbeek C, Giessen J van der**  
*Ixodes ricinus* ticks are reservoir hosts for *Rickettsia helvetica* and potentially carry flea-borne *Rickettsia* species  
Parasites Vectors 2009; accepted

**Theme CIL**

**CIL, S/210116, Adaptable chronic diseases modelling**

- ✓ **Lhachimi S**, Nusselder W, **Boshuizen H**, Mackenbach J Standard tool for quantification in health impact assessment, a review  
Am J Prev Med 2010; 38(1):78-84

**CIL, S/260116, Health system performance Neth and CAN**

- ✓ **Ogbu UC, Slobbe LC**, Arah OA, de Bruin A, Stronks K, **Westert GP**  
Hospital stroke volume and case-fatality revisited  
Med Care 2010; 48:149-56

**CIL, S/260126, Lifestyle from childhood to adolescence**

- Bottema RW, Postma DS, Reijmerink NE, Thijs C, Stelma FF, **Smit HA**, Schayck CP van, Brunekreef B, Koppelman GH, Kerkhof M  
Interaction of T-cell and antigen presenting-cell co-stimulatory genes in childhood IgE  
Eur Respir J 2009; Jul 2 [Epub ahead of print]
- ✓ Caudri D, **Wijga A, Schipper CMA**, Hoekstra M, Postma DS, Koppelman GH, Brunekreef B, **Smit HA**, Jongste JC de  
Predicting the long-term prognosis of children with symptoms suggestive of asthma at preschool age  
J Allergy Clin Immunol; 2009, 124(5):903-10
  - ✓ Caudri D, **Wijga A**, Scholtens S, Kerkhof M, Gerritsen J, Ruskamp JM, Brunekreef B, **Smit HA**; Jongste JC de  
Early daycare is associated with an increase in airway symptoms in early childhood but is no protection against asthma or atopy at 8 years  
Am J Respir Crit Care Med 2009; 180(6):491-8
- Gehring U, Oldenwening M, Brunekreef B, Wieringa MH, Kerkhof M, **Smit HA**, Ent CK van der, Jongste JC de  
The impact of ambient NO on online measurements of exhaled and nasal NO: the PIAMA study  
Pediatr Allergy Immunol 2009; 20(7):665-72
- ✓ Gehring U, **Wijga AH**, Brauer M, **Fischer P**, Jongste JC de, Kerkhof M, Oldenwening M, **Smit HA**, Brunekreef B  
Traffic-related air pollution and the development of asthma and allergies during the first 8 years of life  
Am J Respir Crit Care Med 2009; Dec 3 [Epub ahead of print]
  - ✓ Jansen H, **Wijga AH, Smit HA**, Scholtens S, Kerkhof M, Koppelman GH, Jongste JC de; Stolk RP  
HbA(1c) levels in non-diabetic Dutch children aged 8-9 years: the PIAMA birth cohort study  
Diabet Med 2009; 26(2):122-7
  - ✓ Kerkhof M, **Wijga AH**, Brunekreef B, **Smit HA**, Jongste JC de, Aalberse RC, Hoekstra MO,

Gerritsen J, Postma DS  
Effects of pets on asthma development up to 8 years of age: the PIAMA study  
Allergy 2009; 64(8):1202-8

- ✓ **Pinelli E**, Willers SM, Hoek D, **Smit HA**, **Kortbeek LM**, **Hoekstra M**, Jongste J de ; Knapen F van, Postma D, Kerkhof M, Aalberse R, Giessen JW van der, Brunekreef B Prevalence of antibodies against *Ascaris suum* and its association with allergic manifestations in 4-year-old children in The Netherlands: the PIAMA birth cohort study  
Eur J Clin Microbiol Infect Dis 2009; 28(11):1327-34

Reijmerink NE, Bottema RW, Kerkhof M, Gerritsen J, Stelma FF, Thijs C, Schayck CP van, **Smit HA**, Brunekreef B, Koppelman GH, Postma DS  
TLR-related pathway analysis: novel gene-gene interactions in the development of asthma and atopy  
Allergy 2009; Nov 25 [Epub ahead of print]

Reijmerink NE, Kerkhof M, Koppelman GH, Gerritsen J, Jongste JC de, **Smit HA**, Brunekreef B, Postma DS  
Smoke exposure interacts with ADAM33 polymorphisms in the development of lung function and hyperresponsiveness  
Allergy 2009; 64(6):898-904

Ruskamp JM, Hoekstra MO, Postma DS, Kerkhof M, Bottema RW, Koppelman GH, Rovers MM, **Wijga AH**, Jongste JC de, Brunekreef B, Sanders EA  
Exploring the role of polymorphisms in ficolin genes in respiratory tract infections in children  
Clin Exp Immunol 2009; 155(3):433-40

- ✓ Scholtens S, **Wijga AH**, Brunekreef B, Kerkhof M, Hoekstra MO, Gerritsen J, Aalberse R, Jongste JC de, **Smit HA**  
Breast feeding, parental allergy and asthma in children followed for 8 years. The PIAMA birth cohort study  
Thorax 2009; 64(7):604-9
- ✓ Scholtens S, **Wijga AH**, Brunekreef B, Kerkhof M, Postma DS, Oldenwening M, Jongste JC de, **Smit HA**  
Maternal overweight before pregnancy and asthma in offspring followed for 8 years  
Int J Obes (Lond) 2009; Sep 29 [Epub ahead of print]
- ✓ Scholtens S, **Wijga AH**, Seidell JC, Brunekreef B, Jongste JC de, Gehring U, Postma DS, Kerkhof M, **Smit HA**  
Overweight and changes in weight status during childhood in relation to asthma symptoms at 8 years of age  
J Allergy Clin Immunol 2009; 123(6):1312-18
- ✓ Scholtens S, **Wijga AH**, **Smit HA**, Brunekreef B, Jongste JC de, Gerritsen J, Seidell JC Long-chain polyunsaturated fatty acids in breast milk and early weight gain in breast-fed infants  
Br J Nutr 2009; 101(1):116-21

Schuttelaar ML, Kerkhof M, Jonkman MF, Koppelman GH, Brunekreef B, Jongste JC de, **Wijga AH**, McLean WH, Postma DS

Filaggrin mutations in the onset of eczema, sensitization, asthma, hay fever and the interaction with cat exposure  
Allergy 2009; 64(12):1758-65

- ✓ **Wijga AH, Scholtens S, Wieringa MH, Kerkhof M, Gerritsen J, Brunekreef B, Smit HA**  
Adenotonsillectomy and the development of overweight  
Pediatrics 2009; 123(4):1095-101

**CIL, S/260146, Primary prevention research on cardiovascular diseases and diabetes**

- ✓ **Dis I van, Kromhout D, Geleijnse JM, Boer JMA, Verschuren WMM**  
Body mass index and waist circumference predict both 10-year nonfatal and fatal cardiovascular disease risk: study conducted in 20 000 Dutch men and women aged 20–65 years  
Eur J Cardiovasc Prev Rehabil 2009; 16(6):729–34

- ✓ **Bot M, Spijkerman AMW, Twisk JWR, Verschuren WMM**  
Weight change over five-year periods and number of components of the metabolic syndrome in a Dutch cohort  
Eur J Epidemiol 2009; accepted

**CIL, S/260176, Communicating uncertainty in econ evals**

- ✓ **Attema AE, Lugnér AK, Feenstra TL**  
Investment in antiviral drugs: a real options approach  
Health Econ 2009; Oct 8 [Epub ahead of print]

**CIL, S/340020, Healthy ageing: gene diet interactions**

- ✓ **Berg SW van den, Dollé ME, Imholz S, A DL van der, Slot R van 't, Wijmenga C, Verschuren WM, Strien C, Siezen CL, Hoebee B, Feskens EJ, Boer JM**  
Genetic variations in regulatory pathways of fatty acid and glucose metabolism are associated with obesity phenotypes: a population-based cohort study  
Int J Obes 2009; 33(10):1143-52

Garinis GA, Uittenboogaard LM, Stachelscheid H, Fousteri M, Ijcken W van, Breit TM ; **Stegg H van**, Mullenders LH, Horst GT van der, Brüning JC, Niessen CM, Hoeijmakers JH, Schumacher B  
Persistent transcription-blocking DNA lesions trigger somatic growth attenuation associated with longevity  
Nat Cell Biol 2009; 11(5):604-15

Lu Y, Feskens EJM, **Boer JMA**, Müller M  
The potential influence of genetic variants in genes along bile acid and bile metabolic pathway on blood cholesterol levels in the population  
Atherosclerosis 2009; [Epub ahead of print]

Heidema AG, Wang, Rossum CTM van, Feskens EJM, **Boer JMA**, Bouwman FG, Veer P van 't, Mariman ECM  
Sex-specific effects of CNTF, IL6 and UCP2 polymorphisms on weight gain  
Physiol Behav 2010; 99(1):1-7

Heidema AG, Thissen U, **Boer JMA**, Bouwman FG, Feskens EJM, Mariman ECM  
The association of 83 plasma proteins with CHD mortality, BMI, HDL-, and total-cholesterol  
in men: applying multivariate statistics to identify proteins with prognostic value and  
biological relevance  
J Proteome Res 2009; 8(6):2640-9

- ✓ Merry AH, **Boer JMA**, Schouten LJ, Feskens EJM, **Verschuren WMM**, Gorgels AP,  
Brandt PA van den  
Validity of coronary heart diseases and heart failure based on hospital discharge and mortality  
data in the Netherlands using the cardiovascular registry Maastricht cohort study  
Eur J Epidemiol 2009; 24(5):237-47

Kamenisch Y, Fousteri M, Knoch J, Thaler AK von, Fehrenbacher B, **Dollé M**, **Kuiper R**;  
Majora M, Schaller M, **Stegg H van**, Röcken M, Krutmann J, Mullenders LH, Berneburg M  
Proteins of nucleotide and base excision repair pathways interact in mitochondria to protect  
from loss of subcutaneous fat, a hallmark of aging  
J Exp Med; accepted

- ✓ **Povel CM**, Feskens EJM, **Imholz S**, Blaak EE, **Boer JMA**, **Dollé MET**  
Glucose levels and genetic variants across transcriptional pathways: interaction effects with  
BMI  
Int J Obes; accepted

- ✓ Vijg J, Garcia AM, Calder B, **Dollé MET**  
Comparative genomics of aging  
Comparative Biology of Aging; accepted

#### **CIL, S/350020, Primary prevention research on obesity, cancer and ageing**

- ✓ Rohrmann S, Linseisen J, **Vrieling A**, Boffetta P, Stolzenberg-Solomon RZ, Lowenfels AB,  
Jensen MK, Overvad K, Olsen A, Tjønneland A, Boutron-Ruault MC, Clavel-Chapelon F,  
Fagherazzi G, Misirli G, Lagiou P, Trichopoulou A, Kaaks R, Bergmann MM, Boeing H,  
Bingham S, Khaw KT, Allen N, Roddam A, Palli D, Pala V, Panico S ; Tumino R, Vineis P,  
Peeters PH, Hjartåker A, Lund E, Redondo Cornejo ML, Agudo A, Arriola L, Sánchez MJ,  
Tormo MJ, Barricarte Gurrea A, Lindkvist B, Manjer J, Johansson I, Ye W, Slimani N, Duell  
EJ, Jenab M, Michaud DS, Mouw T, Riboli E ; **Bueno de Mesquita HB**  
Ethanol intake and the risk of pancreatic cancer in the European prospective investigation into  
Cancer and Nutrition (EPIC)  
Cancer Causes Control 2009; 20(5):785-94
- ✓ **Duijnhoven FJ van**, **Bueno de Mesquita HB**, Ferrari P, Jenab M, Boshuizen HC, **Ros MM**,  
Casagrande C, Tjønneland A, Olsen A, Overvad K, Thorlacius-Ussing O, Clavel-Chapelon F,  
Boutron-Ruault MC, Morois S, Kaaks R, Linseisen J, Boeing H, Nöthlings U, Trichopoulou A,  
Trichopoulos D, Misirli G, Palli D, Sieri S, Panico S, Tumino R ; Vineis P, Peeters PH, Gils  
CH van, Ocké MC, Lund E, Engeset D, Skeie G, Suárez LR ; González CA, Sánchez MJ,  
Dorronsoro M, Navarro C, Barricarte A, Berglund G, Manjer J, Hallmans G, Palmqvist R,  
Bingham SA, Khaw KT, Key TJ, Allen NE, Boffetta P ; Slimani N, Rinaldi S, Gallo V, Norat  
T, Riboli E  
Fruit, vegetables, and colorectal cancer risk: the European Prospective Investigation  
into Cancer and Nutrition  
Am J Clin Nutr 2009; 89(5):1441-52

- ✓ Beulens JW, Monninkhof EM, Verschuren WM, Schouw YT van der, Smit J, **Ocke MC**, Jansen EH, Dieren S van, Grobbee DE, Peeters PH, **Bueno de Mesquita HB**  
Cohort Profile: The EPIC-NL study  
Int J Epidemiol 2009; Jul 8 [Epub ahead of print]
  
- ✓ Lynch SM, **Vrieling A**, Lubin JH, Kraft P, Mendelsohn JB, Hartge P, Canzian F ; Steplowski E, Arslan AA, Gross M, Helzlsouer K, Jacobs EJ, LaCroix A, Petersen G ; Zheng W, Albanes D, Amundadottir L, Bingham SA, Boffetta P, Boutron-Ruault MC ; Chanock SJ, Clipp S, Hoover RN, Jacobs K, Johnson KC, Kooperberg C, Luo J, Messina C, Palli D, Patel AV, Riboli E, Shu XO, Rodriguez Suarez L, Thomas G, Tjønneland A ; Tobias GS, Tong E, Trichopoulos D, Virtamo J, Ye W, Yu K, Zeleniuch-Jacquette A ;  
**Bueno de Mesquita HB**, Stolzenberg-Solomon RZ  
Cigarette smoking and pancreatic cancer: a pooled analysis from the pancreatic cancer cohort consortium  
Am J Epidemiol 2009; 170(4):403-13
  
- Romaguera D, Norat T, Mouw T, **May AM**, Bamia C, Slimani N, Travier N, Besson H, Luan J, Wareham N, Rinaldi S, Couto E, Clavel-Chapelon F, Boutron-Ruault MC, Cottet V, Palli D, Agnoli C, Panico S, Tumino R, Vineis P, Agudo A, Rodriguez L, Sanchez MJ, Amiano P, Barricarte A, Huerta JM, Key TJ, Spencer EA, **Bueno de Mesquita HB**, **Büchner FL**, Orfanos P, Naska A, Trichopoulou A, Rohrmann S, Kaaks R, Bergmann M, Boeing H, Johansson I, Hellstrom V, Manjer J, Wirfält E, Jacobsen UM, Overvad K, Tjønneland A, Halkjaer J, Lund E, Braaten T, Engeset D, Odysseos A, Riboli E, Peeters PH  
Adherence to the Mediterranean diet is associated with lower abdominal adiposity in European men and women  
J Nutr 2009; 139(9):1728-37
  
- Jenab M, McKay J, **Bueno de Mesquita HB**, **Duijnhoven FJ van**, Ferrari P ; Slimani N ; Jansen EH, Pischon T, Rinaldi S, Tjønneland A, Olsen A, Overvad K, Boutron-Ruault MC, Clavel-Chapelon F, Engel P, Kaaks R, Linseisen J, Boeing H, Fisher E, Trichopoulou A, Dilis V, Oustoglou E, Berrino F, Vineis P, Mattiello A, Masala G, Tumino R, Vrieling A, Gils CH van, Peeters PH, Brustad M, Lund E, Chirlaque MD, Barricarte A, Suárez LR, Molina E, Dorronsoro M, Sala N, Hallmans G, Palmqvist R, Roddam A, Key TJ ; Khaw KT, Bingham S, Boffetta P, Autier P, Byrnes G, Norat T, Riboli E  
Vitamin D receptor and calcium sensing receptor polymorphisms and the risk of colorectal cancer in European populations  
Cancer Epidemiol Biomarkers Prev 2009; 18(9):2485-91
  
- Travier N, Agudo A, **May AM**, Gonzalez C, Luan J, Besson H, Wareham NJ, Slimani N ; Rinaldi S, Clavel-Chapelon F, Boutron-Ruault MC, Palli D, Agnoli C, Mattiello A, Tumino R, Vineis P, Rodriguez L, Sanchez MJ, Dorronsoro M, Barricarte A, Tormo MJ, Norat T, Mouw T, Key TJ, Spencer EA, **Bueno de Mesquita HB**, **Vrieling A**, Orfanos P, Naska A, Trichopoulou A, Rohrmann S, Kaaks R, M Bergmann M, Boeing H, Hallmans G, Johansson I, Manjer J, Lindkvist B, Jakobsen MU, Overvad K, Tjønneland A, Halkjaer J, Lund E, Braaten T, Odysseos A, Riboli E, Peeters PH  
Smoking and body fatness measurements: a cross-sectional analysis in the EPIC-PANACEA study  
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## Annex 3 Research quality methodology

### Introduction

In 2002, in consultation with the Scientific Advisory Board a set of quality indicators for strategic research was chosen. The following principles and plans were formulated:

- The diversity of research in the Strategic Research Programma calls for differentiated criteria and standards;
- Per theme or research field (if fields vary significantly within themes) a bibliometric quality standard is established;
- Research quality per theme will be scored against the quality standard as part of the annual reporting cycle for strategic research; additional performance criteria, such as quantity of research output, will be used;
- Outcomes of the annual review will be reported to the Scientific Advisory Board.

### Methodology for determining indicators

The methodology was described previously in a note to the Commission on Implementation, titled: Implementation of Indicators for the scientific quality of the Strategic Research RIVM (trial 2002) of May 2002. The approach was based on a methodology developed at the Faculty of Veterinary Medicine of Utrecht University.

The methodology includes the following steps:

- Establish, in consultation with the researchers, a list of relevant reference journals;
- Calculate the standard, i.e. the average Journal Impact Factor (in 2009) of all reference journals (not counting 'high standard journals' with impact factors greater than 15);
- Calculate the average Journal Impact Factor (in 2009) of the research output;
- Compare the average Journal Impact Factor (in 2009) of the research output to the average Journal Impact Factor (in 2009) of all reference journals using a five-point scale.

After consulting with project leaders, theme coordinators provided a list of reference journals at the start of the programme. Using the most recent Journal Impact Factors (2008), standards were set. Actual output was compared against the standard and subsequently rated on a five-point scale following a table taken from the Utrecht University methodology.

Class 5	well above 110 % of the standard <sup>2</sup>
Class 4	higher than 110 % of the standard
Class 3	between 90 % and 110 % of the standard ('acceptable')
Class 2	between 70 % and 90 % of the standard
Class 1	lower than 70 % of the standard

<sup>2</sup> In practice: higher than 130 % of the standard.





## Annex 4 Reference journals 2009

### Legend

THR = Threshold, lowest impact factor of a major journal.

HSJ = *High standard journal* (impact factor >15), excluded from the average impact.

### Theme: CIL

Journal name	Journal Impact Factor (in 2009)
Allergy	6.204
American Journal of Clinical Nutrition	6.740
American Journal of Epidemiology	5.454
American Journal of Preventive Medicine	3.766
American Journal of Public Health	4.241
American Journal of Respiratory and Critical Care Medicine	9.792
Age and Ageing	3.052
Annals of Oncology	4.935
Archives of Disease in Childhood	3.011
Archives of Internal Medicine	9.110
British Journal of Cancer	4.846
British Journal of General Practice	2.278
British Journal of Nutrition	2.764
British Medical Journal	12.827
Cancer Causes and Control	3.690
Cancer, Epidemiology, Biomarkers and Prevention	4.770
Cancer research	7.514
Carcinogenesis	4.930
Clinical and Experimental Allergy	3.556
Clinical Infectious Diseases	8.266
Computer Methods and Programmes in Biomedicine	1.220
Cost Effectiveness and Resource Allocation	
Disability and Rehabilitation	1.395
Drugs	4.128
Endocrine-Related Cancer	5.236
Environmental Health	
Epidemiology	5.406
Epidemiology and Infection	2.360
European Journal of Ageing	
European Journal of Clinical Nutrition	2.686
European Journal of Epidemiology	2.572
European Journal of Gastroenterology and Hepatology	2.080
European Journal of General Practice	
European Journal of Pharmaceutics and Biopharmaceutics	3.344
European Journal of Public Health	2.176
European Respiratory Journal	5.545
Eurosurveillance	
Expert Opinion on Pharmacotherapy	2.077
Family Practice	1.630
FEMS Microbiology Reviews	7.963

Journal name	Journal Impact Factor (in 2009)	
Health Care Management Science		
Health Economics	1.994	
Health Policy	1.334	
Health Services Research	2.713	
Huisarts & wetenschap		
Infectieziekten Bulletin		
Infection Control Hospital Epidemiology	2.834	
Informatics in primary care		
International Immunology	3.181	
International Journal of Cancer	4.734	
International Journal of Epidemiology	5.838	
International Journal of Medical Informatics <sup>3</sup>	2.754	
International Journal of Microsimulation		
International Journal of Obesity	3.640	
International Journal for Quality in Health Care	1.561	
International Journal of Tuberculosis and Lung Disease	2.304	
Journal of Allergy and Clinical Immunology	9.773	
Journal of the American Medical Association	31.718	HSJ
Journal of Clinical Endocrinology and Metabolism	6.325	
Journal of Clinical Epidemiology	2.896	
Journal of Clinical Microbiology	3.945	
Journal of Clinical Virology	3.323	
Journal of Epidemiology and Community Health	3.186	
Journal of Family Practice	1.400	
Journal of Gerontology; Biological & Medical sciences	4.003	
Journal of Gerontology; Psychological & Social sciences	2.016	
Journal of Intellectual Disability Research		
Journal of the National Cancer Institute	14.933	
Journal of Nutrition	3.647	
Journal of Nutrition Health and Ageing	2.321	
Journal of Pharmaceutical Sciences	1.887	
Journal of Public Health	1.109	
Journal of the American Geriatrics Society	3.805	
Lancet	28.409	HSJ
Medical Decision Making	2.929	
Medicine and Science in Sports and Exercise	3.399	
Molecular Microbiology	5.213	
Nederlands Tijdschrift voor Geneeskunde		
Nederlands Tijdschrift voor Medische Microbiologie		
Nephrology Dialysis Transplantation	3.568	
Netherlands Journal of Medicine, The	1.541	
New England Journal of Medicine	50.017	HSJ
Obesity	2.762	
Obesity Reviews	5.569	
Obesity Research		
OMICS A Journal of Integrative Biology	3.167	

<sup>3</sup> Formerly known as International Journal of Bio-medical Computing

<b>Journal name</b>	<b>Journal Impact Factor (in 2009)</b>	
Pediatric Allergy and Immunology	2.723	
Pediatric Pulmonology	1.883	
Pediatrics	4.789	
Pharmaceutisch Weekblad		
Pharmacoeconomics	2.516	
Pharmeuropa		
Population Health Metrics		
Preventive Medicine	2.757	
Primary Care	0.558	THR
Public Health	1.204	
Public Health Nutrition	2.123	
Quality of Life Research	2.169	
Risk Analysis	1.831	
Scandinavian Journal of Primary Health Care	1.724	
Sexually Transmitted Infections	2.571	
Simulation: Transactions of the Society for Modelling and Simulation international	0.783	
Social Science and Medicine	2.604	
Thorax	7.069	
Tijdschrift voor Gezondheidswetenschappen		
Tijdschrift Gerontologie en Geriatrie		
Vaccine	3.298	
Value in Health	3.009	
Voeding Nu		
Voedingsmiddelentechnologie		
	Average impact:	3.846
	Threshold:	0.558

## Theme: EQH

Journal name	Journal Impact Factor (in 2009)	
Acta Acustica United with Acustica	0.538	THR
Applied Soil Ecology	2.247	
Applied Optics	1.763	
Archives Environmental Contamination Toxicology	1.864	
Atmospheric Chemistry and Physics	4.927	
Atmospheric Environment	2.890	
Basic and Applied Ecology	2.584	
Biology and Fertility of Soils	1.446	
Bodem		
British Journal of Radiology	2.366	
Chemosphere	3.054	
Communication Research		
Ecological Complexity	1.455	
Ecotoxicology and Environmental Safety	2.590	
Ecotoxicology	2.355	
Environment International	3.516	
Environmental Biosafety Research		
Environmental Microbiology	4.707	
Environmental Monitoring and Assessment	1.035	
Environmental Pollution	3.135	
Environmental Science and Pollution Research	2.492	
Environmental Science and Technology	4.458	
Environmental Toxicology and Chemistry	2.420	
Environment and Health		
Environmental Health Perspectives	6.123	
Environmental Research Letters	1.719	
Environmental Research, Section A	3.038	
Environmental Science and Policy	1.945	
Environmetrics	0.719	
Epidemiology	5.406	
European Journal of Soil Biology	0.888	
European Journal of Epidemiology	2.572	
FEMS Microbiology Ecology	3.335	
Functional Ecology	3.699	
Geophysical Research Letters	2.959	
H <sub>2</sub> O		
Health Physics	0.869	
Human and Ecological Risk Assessment	1.290	
Inhalation Toxicology	2.403	
Integrated Environmental Assessment and Management		
International Journal of Health Geographics		
International Journal of Radiation Biology	2.178	
Journal of Environmental Monitoring	1.989	
Journal of Environmental Quality	2.098	
Journal of Exposure Science and Environmental Epidemiology	2.196	
Journal of Soils and Sediments	2.797	

<b>Journal name</b>	<b>Journal Impact Factor (in 2009)</b>
Journal of Toxicology and Environmental Health	1.676
Journal of Decision Making	
Journal of Geophysical Research D: Atmospheres	3.147
Journal of Radiological Protection	1.169
Journal of Risk Research	1.040
Milieu	
Naturwissenschaften	2.126
New Phytologist	5.178
Occupational and Environmental Medicine	3.302
Optical Engineering	0.722
Particle and Fibre Toxicology	
Pedobiologia	1.451
Pesticide Management Science	2.040
Photochemistry and Photobiology	2.287
Photochemistry and Photobiology Science	2.144
Plant and Soil	1.998
Public Understanding of Science	1.286
QSAR and Combinatorial Science	2.594
Radiation and Environmental Biophysics	1.787
Radiation Protection Dosimetry	0.951
Radiation Research	3.043
Risk Analysis	1.831
Risk and Decision	
Science of the Total Environment	2.579
Science Communication	0.886
Soil Biology and Biochemistry	2.926
Statistics in Medicine	2.111
Theoretical and Applied Climatology	1.621
Tijdschrift voor Communicatiewetenschappen	
Toxicological Sciences	4.443
Toxicology in Vitro	2.473
Toxicology Letters	3.249
Water Science and Technology	1.005
Water Air and Soil Pollution	1.398
	Average impact: 2.390
	Threshold: 0.538

## Theme: ERF

Journal name	Journal Impact Factor (in 2009)	
Analytical Chemistry	5.712	
Applied and Environmental Microbiology	3.801	
Archives of Toxicology	2.626	
BMC Health Services Research	1.680	
BMC Medical Research Methodology		
BMC Microbiology	2.877	
British Journal of Psychiatry	5.077	
Clinica Chimica Acta	2.960	
Clinical Microbiology and Infection	3.554	
Clinical Toxicology	1.505	
Computers and Geosciences	1.188	
Diagnostic Microbiology and Infectious Disease	2.139	
Emerging Infectious Diseases	6.449	
Environmental Health Perspectives	6.123	
Environmental Monitoring and Assessment	1.035	
Environmental Science and Technology	4.458	
European Journal of Epidemiology	2.572	
European Journal of Public Health	2.176	
Externe Veiligheid		
FEMS Immunology Medical Microbiology	1.972	
FEMS Microbiology Letters	2.021	
Human and Experimental Toxicology	1.456	
International Journal of Emergency Management		
International Journal of Epidemiology	5.838	
International Journal of Geographical Information Science	1.596	
International Journal of Risk Assessment and Management		
Journal of Toxicology Environmental Health	1.676	
Journal of Applied Microbiology	2.028	
Journal of Chromatography A	3.756	
Journal of Chromatography B	2.500	
Journal of Clinical Microbiology	3.945	
Journal of Disaster Management		
Journal of Exposure Science and Environmental Epidemiology	2.196	
Journal of Molecular Diagnostics	3.643	
Medical Microbiology and Immunology	2.222	
Molecular and Cellular Probes	2.196	
Psychological Medicine	4.718	
Public Health	1.204	
Radiation Protection Dosimetry	0.951	THR
Risk Analysis	1.831	
Toxicology Letters	3.249	
Average impact:		2.915
Threshold:		0.951

**Theme: INF**

<b>Journal name</b>	<b>Journal Impact Factor (in 2009)</b>	
Clinical and Experimental Allergy	3.556	
Clinical and Experimental Immunology	2.853	
European Journal of Immunology	4.865	
Infection and Immunity	3.987	
Journal of Clinical Microbiology	3.945	
Journal of Immunological Methods	2.120	THR
Journal of Infectious Diseases	5.682	
Journal of Virology	5.308	
Vaccine	3.298	
Average impact:		3.957
Threshold:		2.120



## Theme: MFF

Journal name	Journal Impact Factor (in 2009)	
Biologicals	1.108	
Biopharmaceutics and Drug Disposition	1.542	
British Journal of Clinical Pharmacology	3.128	
British Journal of Nutrition	2.764	
British Medical Journal	12.827	
Clinical Immunology	3.606	
European Journal of Nutrition	1.899	
European Journal of Pharmaceutical Sciences	3.650	
European Journal of Pharmaceutics and Biopharmaceutics	3.344	
Food and Chemical Toxicology	2.321	
International Journal of Pharmaceutics	3.061	
Journal of Pharmaceutical and Biomedical Analysis	2.629	
Journal of Immunology	6.000	
Journal of Pharmaceutical Sciences	2.996	
Molecular Immunology	3.555	
Pediatrics	4.789	
Pharmaceutical Research	4.024	
Pharmacoepidemiology and Drug Safety	2.516	
Pharmacy World Science	1.016	THR
Pharmeuropa Scientific Notes		
Toxicology	2.836	
Toxicology and Applied Pharmacology	3.364	
Trends in Food Science and Technology	3.850	
Average impact:		3.492
Threshold:		1.016

## Theme: RPC

Journal name	Journal Impact Factor (in 2009)	
Biological Reproduction	3.469	
Biomaterials	6.646	
British Journal of Nutrition	2.764	
British Medical Journal	12.827	
Cancer Prevention Research		
Carcinogenesis	4.930	
Environmental Health Perspectives	6.123	
European Journal of Clinical Nutrition	2.686	
European Journal of Public Health	2.176	
Food and Chemical Toxicology	2.321	
Health Services Research	2.713	
International Journal of Medical Informatics	2.754	
International Journal of Nanomedicine	1.642	
International Journal of Quality Health Care	1.561	THR
Journal of Applied Toxicology	2.127	
Journal of Clinical Epidemiology	2.896	
Journal of Critical Care	1.747	
Journal of Immunological Methods	2.120	
Journal of Infectious Diseases	5.682	
Journal of Medical Internet Research	3.590	
Journal of Proteome Research	5.684	
Journal of Virology	5.308	
Medical Care	3.194	
Nano Letters	10.371	
Nanomedicine	6.093	
Nanotoxicology	3.720	
Pharmacogenomics	3.551	
Proteomics	4.586	
Public Health Nutrition	2.123	
Regulatory Toxicology and Pharmacology	2.353	
Risk Analysis	1.831	
Toxicological Sciences	4.443	
Toxicology	2.836	
Toxicology and Applied Pharmacology	3.364	
	Average impact:	3.946
	Threshold:	1.561



## Annex 5 New assignments contracts and clients

Number of new assignment contracts awarded as a result of SOR-related research projects.  
Clients are listed in the last column.

Theme	Number of contracts	Clients
RPC	4	VWS, VWA, EFSA
ERF	2	NCTB, VWS, VWA, LNV, ZonMw
INF	1	ZonMw
CIL	10	IGZ, VWS, VU, UMCU, FP7- EU
MFF	5	VWA, LNV, VWS(IGB), Erasmus University, EU
EQH	6	VROM, LNV, V&WEU/IRC, EU/EC
Total	28	



## Annex 6 Indicators for the impact of health research on society

Indicators from RGO report		Indicators selected for RIVM Strategic Research	
<i>Indicators for societal impact</i>		<i>Indicators for societal impact</i>	
Process-based	Memberships of health-related advisory committees Collaborations with stakeholders (e.g. patient organizations) Research publications (including [Dutch] journals, text books and so on) Contributions to professional education Informing the public through authorized web sites References to research in public media.	Process-based	Participation in international advisory bodies Request for advice from third parties Follow-up assignments
Product-based	References in (treatment) guidelines and protocols  References in significant policy documents Contributions to health-related technologies and services New diagnostics New treatments or medicines	Product-based	Application of research outcomes in guidelines, regulation, policies and so on
<i>Indicators for economic impact</i>		<i>Indicators for economic impact</i>	
Process-based	Memberships of advisory committees in the private domain	Process-based	N/A
Product-based	Commercial products Private spin-out companies  Patents	Product-based	N/A

Note: Not all indicators on the RGO list were selected. Some of them could be meaningful when applied to RIVM as a whole, but were deemed too far removed from the goals of RIVM's Strategic Research Programme.



## Annex 7 Projects launched in 2010

Research Theme	Division	Project nr.	Project leader	Title
EQH	MEV	S/601150	Drs. E. Rorije	Developmental toxicity analysis
EQH	MEV	S/601151	Dr. J.W.A. Scheepmaker	Fungal
EQH	MEV	S/607150	Dr. L. Posthuma	ICQSAF
EQH	MEV	S/610150	Dr. J.F.B. Bolte	KINESE
EQH	MEV	S/660150	Ph. D. C.C. Hunault	PK/PD modelling in human toxicology
EQH	MEV	S/680150	Ir. J. Jabben	Noise and Health in the Rijnmond
EQH	MEV	S/680151	Drs. D.E. Lolkema	Brightness of the night sky (BNS)
ERF	Cib	S/609150	Dr. Ir. L. Grievink	Health 10 yrs post-disaster in Enschede
INF	Cib	S/210086	Dr. H.E. de Melker	Set-up a monitoring acceptance NIP
INF	Cib	S/340002	Mw. Dr. C.M. Janssen	Effects of paracetamol on vaccination
MFF	VGC	S/360003	Dr. J.W. van der Laan	Carcinogenicity of growth factors
MFF	VGC	S/370001	Dr. F. Vroom	NOCEBO
RPC	VGC	S/320002	Prof. dr. F.X.R. van Leeuwen	Improvement of risk assessment
RPC	VGC	S/340001	Dr. A. de Vries	Adverse effects of circadian disruption



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