# KNOWLEDGE AGENDA
# PREVENTION

Dutch National Research route
Healthcare Research, Prevention and Treatment

# Contents

## Preface

It is my pleasure to present the Prevention Knowledge Agenda. It specifies the knowledge that is required to promote the health and daily functioning of everyone in the Netherlands and to address the increasing number of patients with chronic conditions. Promoting and maintaining health are an important priority for many people. At the same time, many are not aware of how to accomplish this, and large groups of people are not adequately reached by the current prevention policy. This Knowledge Agenda discusses the societal costs and benefits of prevention and specifies the most important themes for future research. Health promotion takes priority, along with risk reduction and the treatment and prevention of diseases. New inter- and transdisciplinary partnerships are required for prevention research that will provide applicable results, in which knowledge institutions collaborate with many other parties from society.

The Prevention Knowledge Agenda is derived from the Dutch National Research Agenda (NWA), which bundled questions submitted by the Dutch public. It is an elaboration of principles laid down in the previous NWA route 'Healthcare Research, Prevention and Treatment' and ties in with the National Plan, Research agenda into sustainable health. The Knowledge Agenda was prepared by the Prevention Taskforce, in intensive collaboration with a large number of experts and representatives from various sections of knowledge institutions, the healthcare sector, the business community and society. Without their input, it would not have been possible to organise the multitude of questions on prevention and the promotion of health.

Given the major societal and economic impact that prevention can have, a substantial investment in research into prevention should be made, with a total budget estimated at €150 million annually, sourced from public and private funds. The financing could come from national, provincial and local governments, the business community, and social organisations like health funds and healthcare insurers.

To wield sufficient authority, we argue in this Knowledge Agenda for a national platform (perhaps temporary) that supports the interests of all stakeholders. This platform can direct a targeted approach to obtaining knowledge about disease prevention and health promotion. It must also consider the logical entirety of research, development, implementation and evaluation.

Organising an effective prevention policy for the entire Dutch population is a challenge that demands considerable supplementary knowledge. The growing socio-economic health disparities show that the current approach needs adjustment. We certainly have the capacity in the Netherlands, in terms of both acquiring knowledge and implementation, to answer the many questions about knowledge in the field of prevention and to implement this knowledge effectively in practice. An investment in this field is thus also an investment in the future of our society and our economy.

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# Introduction

This Prevention Knowledge Agenda is derived from the Dutch National Research Agenda, which bundled questions submitted by the Dutch public, in particular a multitude of questions about health. The topic of health is of a matter of concern to both society and politicians. The Knowledge Agenda specifies what is required to promote the health and daily welfare of everyone in the Netherlands and to address the increasing number of patients with chronic conditions. This specifically concerns knowledge obtained from scientific research. The Knowledge Agenda presents the topics and clarifies that this knowledge acquisition must be inseparable from its application in practice. It refers not only to the knowledge itself, but to the agenda (Latin for 'things that must be done').

### *Healthcare cost and disparities in health*

In the coming decades, there will be at least two major challenges in the field of health and prevention, which happen to be closely linked: reducing the disparities in health and controlling the cost of care. Given the growth in the number of patients with one or more chronic conditions, partly due to lifestyle and the greying of the population, the cost of healthcare is continuing to rise. Prevention addresses this by reducing the incidence of diseases (including chronic ones) and care consumption as patients cope better with their disease. The disparities in health between people with a high and low socio-economic status have been increasing recently. That means personal suffering for a large group of people, a threat to social cohesion, and economic damage. It will take a great effort in the field of prevention to adequately reach groups with a low socio-economic status. Paying specific attention to certain vulnerable groups, like the elderly and the young, will also be relatively very beneficial.

### *Collaboration on technological innovations*

To adequately address the complex issues of prevention, we need more than just knowledge. We need a new way of looking at information and new ways of collaborating in research and clinical practice. It is essential to bring together knowledge from different domains (interdisciplinary) and create a better link to the knowledge gained from experience by laypeople (transdisciplinary)[1]. Much useful knowledge can be distilled from data collected for other purposes, like healthcare data and consumption data. New techniques in the field of data analysis (big data) will help access this knowledge. The synergy between concrete applications, for example in e-Health or implicit forms of influencing behaviour (nudging*),* will encourage application, as will new practice-oriented research methods and action research. Innovative prevention implies that new partnerships will be sought, for example with the media and business community, to supplement the existing contributors to prevention such as the healthcare and education sectors.

### *Individual and environment*

As we accumulate knowledge, it becomes more possible to provide each individual with customised advice about her or his health. Considerable research is still required to enable personalised prevention in practice that optimally matches the individual, their wishes and background. One promising approach targets the key moments in a person's life, such as the transition from finishing school to starting work or radical, life-changing events.

The socio-cultural environment and the living environment have a decisive influence on health and daily functioning. Inter- and transdisciplinary studies are needed to explore how this interaction works and how it can be effectively utilised for prevention. Contributors from a wide range of social spheres can support the health of large, vulnerable groups.

### *Alliances*

Although there are major challenges to face, there is sufficient reason to be optimistic about the feasibility of the ambitious agenda presented here. The interaction between technology and data analysis offers opportunities for innovation and to reach vulnerable target groups. There is a growing feeling of urgency concerning prevention and health. At all levels (national, regional and local) public-private partnerships and prevention projects are being established. The National Prevention Programme that will soon be concluded is the most obvious example of this development. More guidance and supervision of the various activities are needed, partly to secure knowledge acquisition. There is much to learn from the successes and failures in practice. Given the importance of collaboration and problem ownership, this Knowledge Agenda proposes establishing a network or platform to supervise the implementation of this agenda and collect the resulting knowledge.

### *Financing*

Given the major societal and economic impact that optimal prevention could have, a substantial investment in prevention is needed, with an estimated total budget of €150 million annually, provided by public(-private) funding at the national, provincial and local level and by the business community and societal organisations like health funds and healthcare insurers. It is highly likely that this investment will be amply recouped through the economic impact of effective prevention and the development of successful export products in the field of prevention.

### *Layout*

**Section 1** of this Knowledge Agenda summarises the successes achieved with prevention so far and the challenges anticipated in the future. There is also a brief explanation of how this agenda came about.

In **section 2** the urgency of this Knowledge Agenda and of prevention in the Netherlands is elaborated. The societal and economic benefits of prevention are clarified, the cost of prevention discussed, and the financial and organisational barriers to effective prevention are considered.

**Section 3** covers the content. Six themes are outlined which prevention research in the Netherlands will have to focus on in the coming years: Variation; Motivation, behaviour and knowledge; Totality of humans and their environment; e-Health; Big data; and Innovative research methods. The description of each theme starts with a sketch of its background, followed by innovative elements and possibilities for collaboration. They are translated into concrete research questions that can be answered by scientific research and may provide innovative insights and knowledge on which to base concrete prevention activities. Finally, an explanation may be added of which research approach and setting are required and why.

**Section 4** outlines the implementation of this Knowledge Agenda in the coming years, paying attention to prioritising, organising multi-, inter- and transdisciplinary partnerships, use of knowledge, financing and task distribution between the different parties involved.

**Section 5** presents the plea from the Taskforce for a powerful financial and organisational investment in knowledge development concerning prevention.

# 1. Prevention

After a century in which public health in the Netherlands has advanced by leaps and bounds, new problems are appearing on the horizon that will grow in the coming decades. The number of people with one or more chronic conditions is increasing, which is exerting pressure on the welfare of people and the healthcare sector. There is also an increasing disparity in the health of people with a low or high socio-economic status.

To reverse this trend, a different organisation of prevention is required, as is more and different research, with an integration of knowledge from different disciplines. The time is ripe for new forms of collaboration on prevention and prevention research. The Netherlands is good at partnerships. New alliances of scientific, governmental, private and public parties can achieve a lot in a relatively short period. Innovative technologies and research methods offer opportunities to develop more efficient and effective prevention strategies. But to realise these promises, great effort is required, which in turn demands the necessary investment. This Prevention Knowledge Agenda reveals where this effort and investment will offer the best chance of effective prevention and significant health gains for individuals and society.

## 1.1 Building on successes

The efforts devoted to the research and organisational improvement of prevention have a sound historical basis. In the past century, great strides have been made. At the turn of the 20th century, 2%[2] of children died before the age of 1, and the average life expectancy was 50 years[3]. Increasing prosperity but also the introduction of vaccinations and education quickly reduced the mortality due to infectious diseases. The well-baby clinics for infants and children, unique in the world, formed and still provide the basis for effective prevention and the early detection of diseases in children. A recent example is the reduction in the number of crib deaths as a result of advice given by the well-baby clinics: from 103 in 1986 to less than 15 in 2003 and 2004[4].

In the second half of the 20th century, as prosperity in the Netherlands rose rapidly, the number of patients suffering from diseases associated with lifestyle also increased. Thanks to prevention, the number of smokers has been declining in recent decades. Within a year, the ban on smoking in public places led to a reduction in mortality, in the number of heart attacks[5] and in the number of hospital admissions of babies with severe asthma[6]. After the reduction of trans fats in foodstuffs, the number of heart attacks also declined within a couple of years. Effective traffic safety measures led to a drastic drop in the number of road fatalities, from 3000 in 1972 to 621 in 2015[7]. Since the 1960s, many steps have been taken to combat water, soil and air pollution, but the actual resulting health gain is difficult to estimate. Since 1992 the average life expectancy in the Netherlands has increased by an average of 48 months. It is estimated that about 11 months were added as a result of improved air quality[8]. The HIV/AIDS epidemic that started in the 1980s presented one of the greatest challenges for the Dutch prevention policy. But open communication with the groups at risk and the general public led to changes in behaviour and is still an international model of

successful health education and prevention. In all of the above examples, there has been a strong interaction between primary prevention, secondary prevention and curative care. Dutch healthcare is among the best in the world, and the Netherlands is among the world top in medical research, both methodological and applied. There is thus already a firm foundation in place which can and must be built on in coming years. Innovative products and services will be developed faster than before, based on validated knowledge and insights, in the interest of society and the economy.

## 1.2 Upcoming challenges

One of the major successes of the past 150 years has been the increased life expectancy. The greying of the population is now one of the greatest challenges faced by Western countries in the near future. Without a change in policy, this will lead to a sharp rise in the number of patients with dementia, diabetes, cardiovascular diseases, cancer and other chronic conditions, with more and more patients having several conditions at the same time (multimorbidity). Although the life expectancy is still growing and the number of years of living in good perceived health is also increasing, the health care consumption of the elderly is relatively high because of these chronic conditions and multimorbidity. The current healthcare and funding systems are not well equipped to deal with multimorbidity. Healthcare costs are expected to double in the period from 2015 to 2040[9]. Another important challenge is reducing the health disparity due to socio-economic differences. The life expectancy of someone with a low socio-economic status (SES) is already seven years shorter than that of someone with a high SES. The difference in number of years spent in good perceived health rises to 18 years[10]. Preventive measures and campaigns often have a relatively small impact for these especially vulnerable groups and can even be counterproductive. A thorough interdisciplinary analysis of the causes of this problem will lay the foundation for for an effective approach, which will hopefully lead to a reduction in socio-economic health disparities and the associated healthcare cost in the near future.

## 1.3 Opportunities and potential avenues of solutions

The promotion of health and the prevention of conditions (especially chronic ones) and supportive research demand a different, more integrated approach. Risk factors and risk behaviour are often linked after all, and an approach targeting one single factor has little effect. That applies also to strengthening health-promoting factors.

The ideal preventive intervention is both ‘customised’, matched to the individual, and holistic, paying attention to the many relevant contextual factors. Examples of these associated factors include the socio-cultural and physical living environment (for example, the amount of green, sport facilities, design of public spaces), air, water and soil pollution, the climate (e.g. temperature and extreme weather conditions), residential, work or school environment, social media, social network and the extent of social participation, health skills and genetic predisposition. Prevention research must develop inter- and transdisciplinary methods of collaboration in the coming years to enable such integral ‘customised’ interventions to be created and evaluated. New possibilities in this field are constantly arising through technological advances. Smartphones and sensors, for example, can measure various variables of individuals and provide immediate feedback to the individual (personalised prevention).

Collaboration between a wide range of social partners is required to organise a broad, integral approach: citizens foremost, then care providers, local and national governments, prevention institutions, societal organisations including care and knowledge institutions, education, media and the business community. Scientific research lays the foundation for this new integral approach in partnership and tests the effectiveness and efficiency of combined prevention strategies. Desirability and feasibility can also be tested.

A modern approach to prevention research and practice is almost inconceivable without utilising information and communication technology. Big data strategies and different forms of e-Health offer unparalleled opportunities for prevention research and practice. But large quantities of data and the use of interactive media do not guarantee more effective prevention. Considerable investments will have to be made in the development of methodologies to distil relevant patterns from big data and translate them into concrete knowledge and then into policy that targets the individual and vulnerable groups. Questions will also have to be answered regarding privacy and the ethical use of personal data.

The development, application and evaluation of e-Health for preventive purposes demands a sound scientific foundation. Given how fast new technology is appearing on the market, like medical apps and self-monitoring devices, a methodology is required that can produce reliable results after a short processing time. Then there is the question of whether all these new ICT applications adequately consider vulnerable groups (low SES, cultural and faith-based minorities, children and the elderly). A systematic approach also demands new methods and a multidisciplinary approach in other fields.

More scientific knowledge is needed about the way in which individuals and groups make choices regarding their lifestyle and health, in the short and the long term, which factors are influential, who benefits, which moments in life would profit the most from preventive interventions, and how effective control is possible. In other words, for future prevention, not only is more scientific research needed, it must be innovative scientific research that can supply the building blocks for a broad, integral approach to prevention.

## The goal of the Prevention Knowledge Agenda: 3% and 30% in 2030

The Prevention Knowledge Agenda must lead to applicable knowledge, which can be turned into an effective prevention policy in the coming years. The aim of the Knowledge Agenda is expressed in the societal benefits of prevention realised by 2030, as an ultimate goal of what has been achieved compared with the current situation:

1. An increase of 3% in the number of years of living in good perceived health for the average Dutch person (from the current 64[11] to 66 years);
2. 30% reduction in socio-economic health disparities[12];
3. A reduction of the estimated rise in health care expenses of 30% due to improved health.

### 1.4 Definitions of health and prevention

Health: when we write 'health' in this Knowledge Agenda, we mean health in a broad sense: not just the absence of disease but living in good perceived health (self-perceived) and the ability of people to adjust and control their lives, in light of the social, physical and emotional challenges encountered[13].

Prevention: the Knowledge Agenda targets all aspects of prevention, whether universal, selective, indicated as care-related or, to conform to a more traditional classification, primary, secondary and tertiary. Prevention covers health promotion, risk reduction, and treatment to prevent a disease, but this Knowledge Agenda implicitly favours a stronger focus on health promotion.

### 1.5 Origin and Taskforce

The Prevention Knowledge Agenda builds on the Dutch National Research Agenda (NWA), particularly the route Healthcare Research, Prevention and Treatment. In the first half of 2016, interested parties from the field of prevention were given the opportunity to contribute input to this route. This led to the recommendation to create a Prevention Taskforce to transform the accumulated deliberations, the 'route text', into a Prevention Knowledge Agenda. The assignment was as follows:

1. Develop a national Knowledge Agenda for prevention which will elaborate the game changers of the NWA-route Healthcare Research, Prevention and Treatment. The agenda covers the entire spectrum from fundamental to applied prevention research, evaluation

research and knowledge application, targets both behaviour (people) and systems (care), and is focussed on the short (4 years), middle (12 years) and long term (>30 years).

2. Estimate the short- and long-term societal and financial-economic benefits of investing in prevention.
3. Elaborate the financing agenda proposed in the NWA investment agenda.
4. Promote a sound anchoring of the programme in the scientific and prevention field and in society.

This temporary Taskforce, consisting of 16 members (see appendix 1), was established in 2017. It developed this Knowledge Agenda together with a wide-ranging group of involved parties from all sectors that interact with prevention (see appendix 2) and with the active involvement of NFU and ZonMw as route coordinators.

# 2. Urgency, costs and benefits of prevention

## 2.1 Urgency

A few decades ago, the Netherlands was in the top three of the healthiest countries in the world. Since then, we have sunk to 30th place. Apparently, we are not succeeding that well in reducing avoidable deaths, and a full explanation of this development has not yet been made. If the current trend continues, however, in 2040 some 62% of Dutch adults will be overweight[14]. Smoking costs Dutch society €33 billion 'net' per year[15] (after deducting 'benefits' like lower healthcare expenses due to premature death), and smokers die on average 13 years early[16]. Plus people with a low socio-economic status (SES) currently live 18 years less in good health, and their life expectancy is shorter by 7 years. If our prevention policy does not change, these disparities are more likely to increase than decrease because the higher SES groups will profit more from the new insights into causes of disease and benefit more from early treatment.

The research that this Knowledge Agenda argues for is focused on slowing and controlling these negative trends. Much health can be gained, which also corresponds to cost savings. There are other economic benefits, too: improved health means a longer participation in society and more social commitment, like training and labour productivity. The current prevention policy has already shown that health can be promoted in a cost-effective manner. Some measures do not even cost any money. Excise duties, for example, are the most effective instrument to stop smoking, although a powerful policy is required to transform this excise benefit into a health gain[17].

But the effect of prevention on public health could be much greater. If people with a lower SES would move towards health patterns that are currently only practised by the higher SES group, there would be an enormous health gain. The number of healthy life-years would increase ('compression' of disease), with again benefits for the cost of care. British figures have shown that the cost of healthcare for groups with a low SES is higher over the course of their life than for groups with a higher SES, although the latter live longer[18]. While a similar analysis has not yet been done for the Netherlands, there is no reason to assume that this trend would be any different.

In other words, the Netherlands could rise up the world ranking again, with a positive impact on the quality of our society, on expenditure for care and ultimately on our economy. The precondition for this is that we know how we can effectively invest in prevention and who is able and prepared to make this investment.

For every preventive intervention, it is important to consider the moment, its scope and the intentions people have. For a number of chronic conditions, it seems obvious to imagine that interventions implemented earlier in life will potentially have a larger long-term effect. If it becomes possible to introduce prevention, for example, in primary schools and communities (neighbourhoods, villages, cultural and ethnic groups) at the right moment, at crucial moments in life, its scope and possibly the returns will grow. Targeted prevention for groups at risk, at younger

or older ages, may admittedly have a smaller scope, but the intervention will quickly prove profitable.

In terms of disease prevention, we know that vaccinations and some population screenings are valuable. Preventive medication, for example treating high blood pressure, can be cost-effective, but that depends on compliance with the therapy. Insight into factors that influence compliance can provide great benefit. Improvement of working conditions and the quality of the environment can also contribute to reducing the disease burden.

It is already clear what is cost-effective in health promotion. Individual lifestyle advice and coaching of high-risk groups works well, for example, although this depends on their reach. Nudging, pricing measures, legal measures (like smoking bans) and industrial measures (like restricting trans fats, sugar, salt) offer the possibility to promote the health of large groups of people for a relatively modest investment. Considerable benefit can also be gained by searching outside the usual avenues of prevention. Organising the built environment (like building sewer systems and piping in fresh water in the past), encouraging active commuting by walking or bicycling and discouraging motorised traffic, reducing exhaust emissions (particulates), promoting social integration and work opportunities are all aspects that can have preventive and synergetic effects. Their concrete impact will have to be studied. Scientific research has already confirmed which preventive activities do not work or are counterproductive: some mass media campaigns, short, unfocused or single interventions, and total body scans.[19]

When prevention research and policy focus on the groups with the greatest health disparity (like people with a low SES) and major life events and transitions, the potential gain for each euro invested is the greatest. In the next section various approaches to effectively reach these groups are discussed, and what knowledge is required, for example, about the interaction between individuals, moments and the environment. This primarily concerns the application of existing knowledge about environmental factors and disease processes to specific vulnerable groups and individuals and at moments when the greatest impact can be expected. Consideration must also be given to the organisation and sustainable financing of these preventive activities.

More effective prevention, targeting the individual and the right moment, is not only conceivable and feasible, the time is also ripe for it. There is a massive social and political feeling of urgency, because prevention could be a way of reducing the increasing pressure on the healthcare system. There are also new technological instruments and new media available now that could be employed in prevention and care. The new technology of sensors, smart media and other innovations offers unparalleled possibilities. Currently, UMCs and other care institutions are working to bring hospital care into the daily life of people. Efforts in the field of prevention (secondary) would link nicely to that. It thus seems the perfect moment for the Netherlands to invest in innovations in the field of prevention.

But technology alone is not enough, and a one-sided focus on technology can even by counterproductive. This concerns the question of how these new means will be applied to reach the right target groups. Many of the current applications demand skills like general literacy and health literacy, which are often inadequate in vulnerable groups. If we focus exclusively on the technology, we run the risk that we shall increase the gap between the privileged and underprivileged groups. Another classic pitfall is to focus too much on parameters that are easy to measure with a new technique, while other relevant variables fade from view. The real challenge lies in reaching and actively involving the target group(s) in managing health, placing an emphasis on the groups that will benefit the most. If we can succeed there, we shall have struck gold. We will then have the knowledge and technology to promote the health of our own population. And if technology has proven added value, attractive export products are the result that have proven their usefulness in practice – not just promising blueprints on the drawing board. This brings us to the societal benefits of prevention.

## 2.2 Societal benefits

Health is an important goal on its own. It always ranks high on the list of what people find most important in their life. And the huge number of questions about health submitted by the general public to the Dutch National Research Agenda clearly confirms this idea. Health is also a means that contributes to realising other individual and social goals. It enables people to participate in economic and social life, producing not only prosperity, but supporting social cohesion in a country[20].

Improvement of individuals' state of health and of the population is an important social benefit of prevention and care. In the second half of the 19th and the first half of the 20th century, public health improved thanks to the availability of clean drinking water, the construction of sewage systems, increased knowledge about hygiene, vaccinations, perinatal care, better living and working conditions, and improved nutrition. Since the middle of the last century, new medical technologies and better care are playing a growing role, but the same preventive measures are still the cornerstone of public health. At least half of the increase in life expectancy achieved in the Netherlands in the past 50 years is due to the prevention and care of cardiovascular diseases, infectious diseases and cancer. There are reasonable indications that this is an underestimate. For example, major advances have also been made in perinatal care, which were not included. Together, prevention and care have exerted a significant influence on public health in the Netherlands.

A healthy population is an important motor of the economy, as shown by the Nobel prize-winning research of the American economist Robert W. Fogel. There are various flywheel effects: healthy people are more productive and participate more at work, which stimulates the economy; a healthier economy leads to better care and prevention, which in turn contributes to better health and health-promoting innovations, for example in terms of nutrition. Although this global association is evident from historical figures, we have not yet specified the scope of the effect of health on economic aspects like labour participation and productivity. This is an interesting

research topic and can contribute to the willingness of employers to invest in the protection and promotion of health.

The societal benefits of health, prevention and care are convincing and substantial. But they cannot be expressed as a simple (economic) profit and loss balance. The interactions are more complex, with the improvement in public health working together with the development of the modern welfare state. The great challenge for the coming decades is the changing structure of society, with an increasing percentage of elderly people. Increasing the number of years in which we live in good health means that the possibilities for the elderly to participate in society also increase. That brings economic benefits, as they can work longer or contribute unpaid labour, child care and home care, which contributes meaningfully to the functioning of our economy. Almost as important is the fact that participating in society improves the individual's quality of life and the quality of our society.

When realising the societal benefits of care and prevention, it is important to remember the differences between population groups and the underlying distribution issues. The above-mentioned health disparity of groups with a low SES often hinders an active participation in the economy and society. Vice versa, a low labour participation (for example, due to health problems) can lead to socio-economic deprivation. Social and physical environmental factors are also involved. Here, too, the causes, consequences and selection are intertwined. That is a challenge for researchers (simple monocausal explanations like ‘More green makes people healthier’ must be corrected for possible bias, for example ‘Rich neighbourhoods are often greener’).

The interlinking of causality and selection means that for a policy to be effective, it must focus on several factors concurrently. How this approach will lead to the desired reduction in health disparities depends strongly on the measure chosen. Interventions in the labour environment and local living environment benefit everyone. It is possible that their positive effect is even stronger in groups with a low SES, because of the frequent conjunction of unhealthy work, poor-quality living conditions and poorer environmental quality of their neighbourhood. The problem that low SES groups are more difficult to reach does not seem to be involved in such interventions. On the other hand, it is true that people with a lower SES have considerably fewer possibilities to exercise influence themselves over their complex conditions. The research described in this Knowledge Agenda must also produce better instruments that will increase their ability to control their lives at important moments, assisted as necessary by local and national authorities, agencies and caregivers.

The association between the economy, healthcare cost and prevention is complex. On the one hand, effective prevention, particularly in groups with the largest health disparity, can lead to a significant reduction in healthcare costs for multimorbidity and for mostly preventable conditions like lung cancer, COPD, diabetes and cardiovascular diseases. The impact of interventions can be amplified by offering them at the right moment. People who remain healthy longer also contribute longer to the economy and society. And while people who live longer because of prevention will ultimately develop chronic conditions like dementia and cancer, the cost of care spread over their

entire lifetime will be less if that life has been healthy. As stated above, that has already been shown for groups with a higher SES, for whom a longer healthy life is already prevalent.

## 2.3 Cost of prevention

It is difficult to answer the question of what is currently being spent on prevention. Several research institutes are working on making an estimate. It is clear that we spend much less on prevention than on healthcare. In 2012 the total cost of care amounted to around €83 billion; only €2.5 billion went towards disease prevention in a strict sense, like vaccinations and population screenings[21]. This does not include the many preventive interventions in healthcare that are not labelled as such in the statistics, like preventive medication and lifestyle advice given in the doctor's office. Another half billion was spent on health promotion, for example education and work conditions.

Along with these investments in prevention, a considerable sum is devoted annually to health protection: around €10 billion. This covers traffic safety, waste processing and the sewage system. They are without a doubt important investments in public health and the quality of society, but are not exclusively investments in 'prevention'. Even if waste processing and the sewage system did not contribute to our health, we would continue to invest in these basic facilities. Other measures, for example combatting poverty and preventing malnutrition (e.g. food banks), are not included in this overview although they definitely contribute to public health.

In general, we can conclude that the Dutch citizen is prepared to invest in health protection and the prevention of disease and its consequences for daily functioning. Health promotion is the smallest cost item but with a relatively large contribution to business from measures affecting work conditions. The amount devoted to lifestyle improvement by combatting smoking, overweight and alcohol abuse is strikingly low, certainly in comparison with the advertising budgets of the respective industries. An item that is not explicitly specified in this table is the investment in direct person-oriented prevention and the development of new and effective interventions. Research from abroad suggests that this involves a relatively limited amount.

The Netherlands devotes just a fraction of the total prevention budget to the prevention of mental disorders (€75 mln), although mental disorders take first place in the top ten of conditions with the greatest disease burden. The prevention of some mental disorders has been shown to greatly reduce the societal cost[23], so researching how to expand this scope would bring benefits.

Some of the figures presented here are already outdated. A new analysis will soon be published as a result of the COST2HALE project from RIVM. Both environmental and health policies target an extension of the healthy life expectancy and the prevention of early mortality due to accidents, environmental pollution or food poisoning, unhealthy lifestyle or outbreaks of infectious diseases. COST2HALE will supply knowledge and thus advice about the possibilities to achieve these goals in a cost-effective manner, taking into account political and societal restrictions. COST2HALE is

developing a shortlist of interventions that need to take priority, while respecting moral values and social aspects (inequality). The report is expected to appear in the first half of 2018. Other Dutch research institutes and groups are also working on analyses of the economic costs and benefits of prevention.

## 2.4 Structural and financial hindrances to prevention

The partitions between the different financial flows for prevention form a great barrier to an effective prevention policy that would benefit all Dutch people (especially the most vulnerable ones). Most of the preventive interventions for health promotion and health protection fall outside the Healthcare Insurance Act or the Long-Term Care Act. Prevention is thus not a guaranteed right and depends entirely on subsidies and the budget of local and national authorities. Especially in the field of health promotion there is inadequate control, and fundamental funding repeatedly appears to be an important bottleneck. Currently, there are too few stimuli either in the care sector or outside it to develop and implement prevention further; the current financial stimuli may even be counterproductive and hinder effective prevention.

At the local authority level, where a significant proportion of the prevention activities takes place, if all goes well, great disparities may arise due to the extensive freedom to design policies granted to the local authorities along with unclear responsibilities. In many municipalities there is evident fragmentation, not enough feeling of urgency, not enough participation by citizens, and a lack of structural financing and funding. We also find that prevention is defined differently in different legal frameworks, leading to a lack of clarity concerning responsibilities, and citizens not knowing what they are entitled to and what possibilities are available for them to draw on.

## 2.5 Research into solutions

Prevention is a cost-effective way to promote public health, with the potential to have a positive impact on the quality of life, the quality of society, healthcare costs and the economy as a whole. Yet prevention needs help to get started. The field is fragmented, there is a lack of clarity between personal and collective responsibilities, and stimuli are missing from the healthcare market. There is no complete and simple solution to overcome these problems. This has been confirmed by experiences in other countries, which are subject to the same issues.

Practice-oriented research can contribute to overcoming several of these bottlenecks. This covers research into more effective interventions, but the economic and societal value of prevention is also an important topic. In terms of policy, a highly relevant question is how much can prevention contribute to a reduction in the costs of curative care and long-term care and how long will this take? Insight into the return on investment (ROI) within and outside the domain of public health would make clear decision-making easier.

At least as important is the question of who exactly benefits from each investment. When insurer A takes a risk but a significant portion of the ROI accrues to competitor B, the local authority or a major employer in the region, then insurer A is not likely to continue investing. When a trial project reveals who pays and who profits, all relevant parties can be involved in a larger roll-out so this problem of the wrong pockets can be addressed and the investment made by the parties that will benefit. Research could show whether the risk equalization formula currently used by healthcare insurers could be translated to other domains in the context of prevention.

When researching prevention, programme cohesion is important. Evaluations of the social and economic benefits should be based on the assumption of innovative and effective interventions that reach enough people, rather than the moderate results from small and barely innovative projects from the past. It is also important to examine which financing models are conceivable in the current system, or what alternatives there are. Finally, issues concerning implementation and the efficient organisation of prevention associated with the above must be explored.

# 3. Themes in prevention research

## Introduction

In this section we focus on the content of the Prevention Knowledge Agenda. The research questions that need answering in the near future to adequately support the Dutch efforts in the field of prevention are grouped into six themes:

- Variation
- Motivation, behaviour and knowledge
- Totality of humans and their environment
- E-Health
- Big data
- Innovative research methodologies

We present the most relevant research questions for each of these themes. The themes are closely linked, and thus the research questions for each theme can overlap.

## 3.1 Variation

In the field of prevention, the choices made have often focussed on breadth, on approaches that address large groups of people. They have clearly delivered benefits on the population level. But many vulnerable groups were helped much less, like the elderly, youth, patients with co-morbidity, people with a low socio-economic status and immigrants. Current insights suggest that a more differentiated approach to prevention could be more effective in maintaining or improving the health of people from vulnerable groups. In other words, attention must be paid to the differences between people, to variation. Also we know that the entire context in which people live contributes to the level of success of prevention for different groups of people and situations (see also section 3.3).

What approach to prevention is optimal depends partly on the stage of life of the group of people targeted by the prevention approach. Youth, for example, is a stage in which preventive measures for particular conditions can have major long-term effects, as the success of the National Vaccination Programme shows for decades. Given their sensitivity to environmental influences and habit formation, children and youths are important target groups for prevention, and knowledge about interactions with their environment is essential. By considering prevention as early as possible in life, preferably during or even before pregnancy, potentially significant benefits can be realised. For the elderly, prevention can intervene in a phase which will yield favourable effects in a relatively short timeframe as the immediate risks are high. For example, treating high blood pressure will prevent strokes. Other factors are also involved with the elderly, such as a weakening of their social network and the interaction between health, mobility and social participation, which offer leads for early detection and preventive interventions.

A research approach that is designed for a particular target group and moment must be developed for different phases of life (preconception, infants, children, young adults, young parents, middle-aged people, elderly), target groups (for example, people with a low SES, immigrants, chronic diseases with multimorbidity) and target moments (birth, transition from education, loss of partner, hospital admission, fall and trauma). To support a target-oriented approach, much research is needed into the biological, social, behavioural and educational aspects of health and into the most effective and durable preventive strategies and conditions, using social media, e-Health and other technological applications. Other research will have to explore the most suitable and profitable approach, the correct and sustainable implementation and organisation (including the long-term funding) and shaping of the legal and financial framework.

### *Research questions*

*Content*

1. Over the course of life, what is the extent of variation in determinants of health within and between groups of citizens? What are the determinants of the effects of preventive interventions? Which determinants are decisive in the short, medium and long term?
2. What are the contextual (biological, social, mental, environmental, behavioural, health skills and technological) determinants of healthy behaviour and health and its maintenance, and what are the interactions between them in vulnerable people at the individual and group level? Which determinants are decisive in the short, medium and long term?
3. Which preventive strategies can be designed and implemented that will specifically help to promote health in vulnerable groups in the short, medium and long term?
4. How can the implementation of existing effective prevention strategies be improved so larger groups and specific (vulnerable) target groups can be reached, especially before and during target moments?

*Methodology*

5. Which research methods and techniques are needed to implement and evaluate more personalised or differentiated prevention strategies at different levels of prevention?

*Organisation*

6. How can legislation promote health in the short, medium and long term in the total population and in vulnerable people? Which laws and regulations will have an adverse effect on the health of specific (vulnerable) groups?
7. How can citizens be effectively involved in the design of strategies?
8. How can other actors and parties besides caregivers make an effective contribution to prevention? Which factors determine the effective collaboration of different stakeholders and how can this integration be promoted?

9. Which social, behavioural, organisational, technological, political and financial conditions are necessary to establish prevention firmly as a cornerstone of public health in our society?

## 3.2 Motivation, behaviour and knowledge

Insight into human behaviour is needed to change behaviour with consequences for health. Behaviour and motivation are central aspects in the new definition of health, in which adaptability and personal control are important aspects. There is already a lot of insight into the role of behavioural factors and motivation in prevention. Many interventions targeting behavioural change are only successful in the short term, and with average groups. To realise long-term behavioural change in all target groups and to strengthen the adaptability of individuals and groups, there is a need for knowledge that can be implemented on the individual level and takes into account the context in which the behaviour occurs[25]. The social and physical environments not only have a direct influence on health, they also influence behaviour. It is therefore important to know in detail when and where certain healthy/unhealthy behaviour occurs and what psychological/social and environmental factors are involved. Work and the work environment are also important factors in this connection.

To design and set up successful preventive strategies, much more knowledge is needed about individual behaviour and group behaviour, the social and physical environment people are exposed to (the 'exposome')[26], and the interactions between them – and indeed the effect on health of different forms of behaviour. This presents a large methodological challenge. The question is how we can generate this kind of knowledge and ensure its application in concrete prevention projects that actually lead to healthy behaviour that will be sustained in the long term. This demands multidisciplinary and interdisciplinary research in which health sciences, medical sciences, social sciences (and more explicitly the domain of behaviour and psychology), communication sciences and disciplines addressing environmental exposure, the built environment, climate and the environment work together and integrate their competencies. Given the increasing importance of the digital environment, technical disciplines and data sciences will have to be included as well.

A more personalised approach to prevention concerns people's private lives. The associated ethical and legal research questions must be documented and answered.

### *Research questions*

*Content*

1. How do we develop and integrate knowledge about the effects of behaviour, psychological factors, the social, economic, cultural and physical environments on health and the daily functioning of individuals and populations?
2. How can we understand the behaviour of individuals on different levels (family, neighbourhood, city, etc.) and environmental aspects (e.g. physical, social, economic,

political, cultural)? Which determinants are decisive in the short, medium and long term? What is their mutual interaction?

3. On the basis of this knowledge, how do we develop and implement targeted, sustainable intervention strategies to promote health (behaviour) in the short, medium and long term on the population and individual level? What are effective ways to involve citizens from significant target groups in the initiatives?

*Methodology*

4. Which research methods and techniques can give us more and new insight into psychological factors and the environmental factors (including socio-economic factors) that form the complete context for healthy/unhealthy behaviour? Which research methods are promising for innovation?

5. How do we evaluate the effectiveness and cost-effectiveness (from a societal perspective) of preventive interventions targeting psychological, social, economic and physical environmental aspects that influence behaviour, and which methods and techniques are required for that?

*Organisation*

6. Which social, organisational, technological, political and financial conditions are essential to promote the motivation and behaviour towards prevention in different target groups?

## 3.3 Totality of humans and their environment

To create an effective prevention policy for the future, a systematic approach is required that stresses the interaction between the individual and the social and physical context. This approach will generate knowledge that can be used for integrated, collective and yet targeted prevention.

Much evidence-based work has been founded on the context, making use of three sources of knowledge: scientific knowledge, professional knowledge, and experiential knowledge and the patient's preferences in his/her specific situation[27]. Prevention research does collect the essential evidence required, but should also focus more on the context than it does now, such as the social and physical environment, the healthcare sector, the business community and social media. The Council for Health and Society (RVS) even advises making the context the starting point for obtaining knowledge and promoting implementation[28]. This advice stresses the importance of an interdisciplinary and transdisciplinary approach. To follow this advice, it is necessary to keep defining the context clearly – and as already stated, the 'hard' evidence must not be ignored. When implementing prevention, paying attention to the context requires re-defining the roles for the various parties involved and establishing collaboration with new parties that have so far not been involved in the prevention policy. Finally, it is essential to make room for the individual's own responsibility and freedom of choice.

The above-mentioned insight that the physical, social and cultural environments are extremely important for health and prevention is not innovative in itself. It is already being cited in several research and knowledge agendas as a point of concern. But much more knowledge is needed to ensure a successful, integrated and sustainable approach. There are already many local integrated initiatives in the field of health promotion. It is important to explore to what extent these initiatives produce sustainable results. Then we could develop a set of workable measures as modules, which can be deployed according to the context; it must be clear which modules are applicable in which contexts. Such knowledge must also be made available to potential users, for example analogously to https://www.loketgezondleven.nl/over-ons/english.

The organisation of a preventive approach oriented to the environment deserves more research. What changes, collaborations and other matters are necessary for a broad, integral approach to prevention? How should parties collaborate, and when is a particular approach preferable? For example, what is the role of co-creation, and when is centralised control desirable? And how do we study these questions? Which end points do we want to use when we also focus on the personal perception of health?

### *Research questions*

*Content*

1. How can a prevention strategy be designed that matches with people's living environment and culture, their phase of life and particular moments? How do we develop an effective strategy for achieving health benefits for vulnerable groups?
2. How important do people (individuals, populations, vulnerable groups) consider a healthy life in relation to environmental, social, and financial aspects of life? What is the relation of this concept to their actual behaviour?

*Methodology*

3. Which new measurements of health, limitations and disease are valid and suitable to make a more integral measurement of health that takes into account the fact that an individual's health is determined by more than just the presence or absence of disease?
4. What are the most suitable research methodologies to evaluate the short-, medium- and long-term effectiveness and cost-effectiveness of integral (small-scale) prevention strategies and to model the future in terms of the long-term benefits and costs?

*Organisation*

5. What scientific approach will have to be chosen to realise the most optimal partnerships between different disciplines and stakeholders, in research, design and implementation?
6. Which technical, political, legal and financial conditions are necessary to make health promotion a cornerstone of public health and anchor it in our healthcare system and our society, and how can we evaluate this?

7. How do we optimally involve the private sector in the scientific approaches and implementation?

### 3.4 e-Health

The emergence of smart media (like smartphones, wearables and sensors) and pervasive technologies (for example, sensors in textiles, internet of things) in combination with innovative data-analytical techniques has given a powerful impulse to the development of e-Health, certainly in the field of early diagnosis and prevention. This is a development involving many parties. It is an excellent area with opportunities for public-private partnerships, with the developers of e-Health and with classic and new media, to reach a range of groups in society. A start has been made with the collaboration in the top sectors Life science and Health LSH and Creative Industry, with important opportunities available for care-related prevention.

There are high expectations for e-Health. One important question is whether the successive e-Health applications are really efficient and effective. There is not yet sufficient support for the effects of e-Health in prevention, like the promotion of healthy behaviour. More knowledge is also required about potential adverse effects of preventive e-Health interventions. In other words, there is an urgent need for more insight into the effects of e-Health in prevention, in the short and the long term. e-Health offers unique possibilities for a differentiated, target group-oriented approach that also demands some sound support. We need to find out which applications of e-Health are most suitable for different target groups. To answer all these research questions, new design strategies and new evaluation methods must be developed that provide insight into the implementation of *e-Health* in practice and into its effects on behaviour and health. It is not possible to determine variations in response, risks and behaviour between individuals and groups only through randomised studies.

Optimal application of e-Health demands another approach to the interaction between people, the environment and technology, thus between context, content and system. Considering this interaction in an integral approach of technology is important for a successful implementation. Implementation is not a post-design step but an incremental part of an e-Health design. For an evidence-based design of e-Health, collaboration with the end users and stakeholders is essential to determine the added value of e-Health (value-based health care), specify the implementation conditions (business model), and promote acceptance and adoption.

There is also another reason to analyse e-Health with new methods; the use of e-Health technologies by citizens, for example, generates huge quantities of data. Those data offer opportunities for measuring and analysing variations in response, risks and behaviour between individuals and groups that would be much more difficult to examine in less data-intensive (randomised) studies. The data can be used for customised, targeted prevention. The emergence of e-Health raises various other research questions, for example into the ethical and legal aspects of e-Health applications, the organisation of the data infrastructure (like Health-RI[29]) and the role of different parties (healthcare providers, preventive organisations, commercial parties). The advantages and bottlenecks in these fields should be documented and resolved. At the same time,

the interests of the individual and of society should be safeguarded (see also the theme of big data).

### *Research questions*

*Content*

1. What are the sources of variation in response to e-Health interventions, and which interventions are more or less effective in the short, medium or long term and for which population groups, on the basis of age, behaviour, health literacy or other characteristics?
2. Which new forms of e-Health applications (like virtual reality and social robots) are most suitable for which target groups? In what prevention context?
3. What are the effectiveness, efficiency, cost-effectiveness and disadvantages of e-Health interventions in the field of prevention in the short, medium and long term?

*Methodology*

4. How is new knowledge about health and the behaviour of groups and individuals to be acquired by making use of data obtained via e-Health interventions (whether combined or not with other relevant data)?
5. Which research methods are suitable to answer questions about the efficiency and effectiveness of e-Health interventions in a valid and sufficiently fast way? This also requires an evaluation of the best outcome measures to estimate health gain.
6. In what ways can successful e-Health applications be implemented (on a large scale)?
7. How can e-Health technologies be designed in collaboration with the target groups to make them useful and applicable in practice?

*Organisation*

8. How can we optimally involve the private parties in the scientific approaches and implementation?

*Legal/Ethical*

10. How should the management, access, ownership and governance of data obtained via *e-Health* applications be arranged to protect the interests of the individual and of society?
11. What are the legal and ethical considerations in using e-Health? What are the benefits and disadvantages of big data and e-Health research to promote health?

## 3.5 Big data

The availability and accessibility of huge, distributed databases and big data analytics have the potential to give scientific research a powerful stimulus. In the context of prevention, 'big data' can lead to new knowledge about individual variation and provide new insights into the complexity of

human health. For the first time in history, it is possible to analyse the complete picture of bodily, mental, social and physical factors based on the multitude of data flows available for individuals, and thus even predict the behaviour of groups and perhaps of individuals. That is concurrently an enormous challenge. Integrating data flows from existing and new sources, like cohort data, 'omics', analyses, wearables, sensors, geo-information systems, social media, health registers, tax registers, biomedical and environmental data, exposomics, etc., sets high requirements for data collection, quality control, data management, data reduction and data analysis. The value of data obtained from new sources like social media will have to be demonstrated. The same applies for enriching these data with biological data, like 'omics', and data from all types of medical imaging.

The Health Research Infrastructure is being developed as a national and binding research infrastructure for big data in healthcare (www.health-ri.nl). Health-RI is a joint initiative of DTL, ELIXIR-NL, BBMRI-NL, EATRIS-NL, NFU, and Health~Holland, supported by a large group of stakeholders in the health domain. The collaboration aims to address the existing fragmentation and to ensure that the Netherlands is connected to international initiatives. Health-RI will also support the implementation of the Prevention Knowledge Agenda.

To handle and analyse gigantic quantities of data, it is necessary to supplement the conventional methods for observational research with new forms of data analysis, often derived from other fields of science. Examples of the latter include automated forms of pattern recognition (neural networks, machine learning, artificial intelligence), which can be used to distil useful information from huge data collections. When developing and testing hypotheses with such datasets, computer models will also become more important. Such a model can calculate which interventions provide the best opportunities for real health promotion. To realise an actual contribution to more effective prevention, the validation and calibration of such models on the basis of intervention data (preferably prospective) are essential.

Although the promise of big data is unprecedented, its application in the field of prevention is just beginning. To develop this potential in the coming years, the availability of the right competences and capacity is essential. In other words, we need an answer soon to the question of how we shall ensure enough well-trained data scientists in the near future, who are also well informed about prevention research. It is also important to think critically about the legal and ethical boundaries of combining and interpreting personal data. These aspects will also play a role in other NWA routes that involve big data, especially the Big Data route.

### *Research questions*

*Methodology*

1. In what way can data, both structured and unstructured, from a range of sources be combined and analysed to benefit detailed research into the effects of biological, social, economic and physical factors on health and into the effects of preventive interventions?

2. What is the added value of new analysis techniques like machine learning, neural networks, artificial intelligence and computational modelling, with regard to conventional approaches in generating prevention-relevant knowledge from huge databases?

*Organisation*

3. How can we join up with wider movements like Health-RI?

*Legal/ethical*

4. How should we regulate the management, access, ownership and governance of data providing input for big data and data obtained from big data to safeguard the interests of the individual and of society?
5. What are the legal and ethical restrictions in the use of big data, how can these developments negatively affect personal privacy, and what is the balance in the benefits and disadvantages of big data research needed to promote health?
6. How can we increase the capacity in the field of data science that is available for scientific research in the field of prevention?

### 3.6 Innovative research methodologies

A common theme in the preceding topics is the radical change in the view of prevention and the way in which research must be designed and conducted. There is a frequent repetition of the need for new methodologies. And the wish list is not short. The new methodologies must be able to bridge different disciplines, integrate knowledge from different domains, make the interaction between context and the individual measureable, evaluate e-Health applications before they are outdated, and all while using big data. This concerns far more than new instruments or methods of analysis. Multi-, inter- and transdisciplinary partnerships demand a linking of research cultures and methods that exceeds the individual disciplines and even extends outside the domains. More value is being attached, and rightly so, to the input of citizens even in the design and conduct of research (transdisciplinary approach). The inclusion of their experiential knowledge fits well with the new definition of health, but adds an extra layer of complexity to the above list of challenges.

Along with new forms of collaboration, new methods are also required. The traditional evaluation methods, like randomised studies, qualitative studies, and action research, cannot be expected to solve all of the complex issues present by themselves. New methods of intervention research that take the complexity of the issues into account, like complex systems approaches, and methods that combine existing methods to arrive at the outcome (mixed methods*)* will be needed to answer the questions raised in this agenda.

In the meantime, the ‘old’ methodologal challenges in the field of prevention persist. With some interventions, it can take years before the final effects on the quality of life and life expectancy

become evident. To be able to measure the effect of an intervention sooner, reliable intermediary measures are needed. With other preventive interventions, particularly in secondary and tertiary prevention, the short-term effect is already demonstrable in terms of decreasing morbidity and mortality. In those cases, a classic randomised study can still be the best option. In other words, there is a need for renewal, with the understanding that what is new is not obviously better than what already exists.

### *Research questions*

*Methodology*

1. Which of the self-reported outcomes of individuals (like the Patient Reported Outcome Measures, PROMS, and Patient Reported Experience Measures, PREMS, in healthcare) are suitable to evaluate the effects of preventive interventions and strategies and prioritise them in the short, medium and long term? How can individuals be optimally involved in this determination?
2. What are useful and reliable proxy or intermediate measures from, for example, administrative data for measuring and comparing the effects of preventive interventions and strategies in the short, medium and long term?
3. Which research methods are suitable for determining the short-, medium- and long-term effects of complex preventive interventions and strategies, including data-driven interventions like big data and behaviour coaching, or the implementation of quality systematics for prevention in healthcare?
4. How can findings from different studies be combined to come to valid conclusions about the short-, medium- and long-term effects of complex interventions and strategies?

*Organisation*

5. How can different research methods and cultures be linked and combined across different disciplines to form multi-, inter- and transdisciplinary integrated prevention research?
6. Which adjustments will be required in the organisation, financing and inter-institutional collaboration of knowledge institutions to achieve progress in scientifically high-quality and relevant prevention research along the lines sketched in this Knowledge Agenda?

# 4. Implementation aspects

## 4.1 Agenda implementation

The Prevention Knowledge Agenda demands a new approach to research and development in the field of prevention. Renewal, support and societal benefit are key aspects. This means that links must be laid between science, policy, practice, education, the business community and media, which demands in turn an innovative approach in the manner of arranging, implementing and financing the programme. Citizens and the end users of the new knowledge and insights in practice must be involved in formulating the research questions and prioritising and implementing the research projects.

It is important that the implementation of this Knowledge Agenda follows on from existing agendas like the Sport and Exercise Knowledge Agenda[30], Tobacco Control Research Agenda[31], National Nutrition Research Agenda[32] and the action agendas of NPHF/Federation for Health[33], which also argue for science innovation. It would also be good to link it closely to the agendas of the various health funds and the multi-year programme of the Collaborating Health Funds with the working title, Healthy Generation, a proposed programme with the aim to have Dutch youth become the healthiest youth in the world. There are other NWA routes, like Sport and Exercise and Sustainable production of healthy and safe food, which it supports. Given the societal anchoring and the sustainable financing, it is important to connect with current initiatives (societal), like Everything is health[34], the five top sectors that have chosen prevention as their core principle, NL2025[35] and the prevention agreement that is currently being prepared. More and more scientific research is being done in an international context, so we shall have to look towards aligning and collaborating with international programmes, for example in the framework of the Joint Programming Initiatives of the EU[36].

The implementation will first have to focus on knowledge synthesis: documenting and integrating existing scientific knowledge, practice-based knowledge and experiential knowledge. Knowledge from outside the Netherlands will have to be included. This will not only provide a basis for knowledge application, it will also reveal the gaps in our knowledge.

When implementing this Knowledge Agenda, it is important to maintain the balance in the desired programmatic cohesion to avoid a straitjacket that hinders renewal. Following on from the national programming via this Prevention Knowledge Agenda, regional and local programming is necessary, with short-term projects to provide quick answers to fill the local need for knowledge and longer-term projects with collaborative consortia. Good communication will ensure that fragmentation and duplication are avoided.

Consortia will make an important contribution to conducting research and development. They will ensure the necessary continuity over the years and a broad interdisciplinary or even transdisciplinary approach. It is preferable for citizens, the education sector and local players to have a place in these consortia alongside academia, expertise centres, policy, practice and

commercial parties. Local consortia and academic workplaces, with neighbourhood-linked research and an explicit tie to the local politics and decision-making, could suggest a format. In the Netherlands the university medical centres have an important task and responsibility in the field of innovation, including the aspect of prevention. This demands more attention for practice-oriented research and education and for constructing a practice-oriented research infrastructure (for example with professors, doctoral students, practice professionals). It is essential that they actively focus on research and development in this field and thereby remove hindrances to interdisciplinarity where necessary. To realise renewal, regular interaction between consortia is also required. Furthermore, free space is required for experimentation and unusual forms of collaboration to develop new methods and other approaches (media).

When developing new prevention strategies, more emphasis will be placed on concurrent evaluation, implementation and embedding than in the past. This requires structural financing guaranteed over years, instead of a succession of projects.

## 4.2 Prioritising

This Knowledge Agenda must focus on the question of what leads to societal benefit. Recent recommendations[37, 38] point out the importance of making links to the pluralist practice and bypassing the demand for the effectiveness of individual interventions. When implementing this Knowledge Agenda, the potential for using knowledge is an important criterion, along with the essential investments in infrastructure, data science, etc. In addition, the pressure on the economic returns for society as a whole will increase. 'Health' gains are more likely by marketing health with the input of the private sector, rather than just treating disease. When looking for optimal returns, the question will also arise of how the investors will profit, and within what timeframe. Once this is all clarified, there will be a sound basis for local or large-scale alliances.

The societal benefit of prevention is greatest when socio-economic health disparities can be reduced. This should become an important priority. It does demand an innovative approach, from the viewpoint of research and knowledge development as well, as related efforts made in the past few decades failed or barely succeeded. Despite various measures being implemented, the socio-economic health disparities continue to increase. Although it is always difficult to demonstrate causality, we can at least state that a more effective policy is required.

## 4.3 Multi-, inter- and transdisciplinary approaches

The development of effective prevention strategies that adequately reach vulnerable individuals is only possible by integrating knowledge from different domains. Depending on the extent to which experiential knowledge is incorporated along with scientific knowledge, we can talk about an inter- or transdisciplinary approach. Such an approach in research, development and implementation demands radical changes in the current scientific methods, structure and culture. The way of publishing and measuring scientific output, for example, will have to be supplemented by new

approaches that optimise the societal impact, like the possibility for doctoral students to include a societal portfolio in their thesis.

The current financing and realisation of research programmes of subsidy providers and the evaluation of proposals by reviewers (often trained in a single discipline) will also have to be modified to match the new approach in prevention research.

New players are appearing in the field, like the industry (which innovates and provides care, for example through e-Health), fitness centres and media companies that have more room for innovative partnerships thanks to the new Media Act. There are many other suppliers of products and services (convenience) involving healthy nutrition, and health insurers that are experimenting with their own prevention programmes. The entire field of influence is changing, giving rise to new opportunities and new risks. The interests of the different players do not necessarily run parallel of course. Socially responsible innovation means that the various parties must work together with an open mind, being critical and constructive at the same time.

Public-private partnerships impose other conditions on the conduct of research. Different forms of data collection and influencing behaviour become possible. Innovation brings with it a need for research into the desired and undesirable effects of disruption in care and prevention, plus a greater demand for more funding of implementation research (innovative).

Practice-oriented research accompanied by action will grow in importance. That demands suitable research methods and forms of financing and a research infrastructure that copes well with local problems and their changes and associated knowledge questions. The expectations on both sides must be clarified in advance and adjusted as necessary during the conduct of a project. The duration, the way of presenting results to the outside world, and the engagement of citizens, companies, local authorities and other parties must be designed transparently. In the past few years some experience has been gained with strengthening the interaction between research and practice. We need to build on these experiences, to ensure sufficient alignment between researchers, workers from the practice and the target group in all phases of the knowledge cycle. New interactive instruments and approaches will have to be developed or improved. Practice-oriented research also makes demands on the researchers' attitude and methodology. To establish research lines, it is preferable to consolidate knowledge and experience in a programme-based structure of knowledge development than to have individual contracts and projects. Plus fundamental and practice-oriented research are mutually dependent and must supplement each other.

In tertiary education and in medical care practice, practice-oriented research and education are undergoing radical change. For example, NWO grants for higher professional education teachers finance paths to promotion, and the colleges are also making funds available to finance paths to promotion with a focus on practice-oriented research in the policy-research-practice triangle, with input from science practitioners, testing grounds and living labs[39].[38]

Benefit can also be gained in training and the continued education of different professionals who are directly or indirectly involved with prevention. For example, nutrition is practically absent in the medical curriculum, while in the secondary vocational training of chefs, hardly any attention is paid to health. In post-graduate education, there is a great need to train data scientists who also know about disease and health. Multidisciplinary attention for prevention is required in primary and secondary schools, with the aim to teach healthy behaviour and promote health literacy.

Education, research and evaluation are mostly monodisciplinary at the moment. There are fewer application procedures for interdisciplinary proposals, and they are generally not as highly appreciated. This Knowledge Agenda calls for the development of innovative financing possibilities for innovative research and for more room for interdisciplinarity in education, both in the curriculum and in the training of doctoral students. Appropriate incentives are required.

*Questions to be considered:*

1. What changes in the current scientific approach, structure and culture are required to promote multi- and interdisciplinary research in the field of prevention?

2. How can practice-oriented research (e.g. in colleges or medical practice) be promoted among researchers who are academically state of the art while also having a connection to practice?

3. How can practice-oriented research be optimally linked to innovative, fundamental prevention research in a so-called innovation loop?

4. What role can academic workplaces and industry play?

5. What effect will this have on the design of academic PhD programmes?

6. How can we promote adding to the top academic staff - special chairs, associate professors - to focus on the relation with the practice of prevention? Which subjects have gaps?

7. What is required to create study programmes on the interface between data science and life sciences to train the competences and knowledge in prevention-relevant big data analytics*?*

8. Which investments in research infrastructure are needed for effective practice-oriented prevention research as described here?

## 4.4 Knowledge valorisation

To ensure that knowledge about disease prevention and health promotion does lead to concrete improvements, a contextual approach is needed[40]. There are many possibilities for contextual knowledge valorisation, for example as part of course lessons, legislation, building regulations and

CLOs. But it will need a helping hand. Knowledge valorisation sometimes requires legislation and the power to persevere. Criteria will have to be set for knowledge valorisation in different contexts, as is currently standard when developing multidisciplinary guidelines in healthcare. Equally important is paying attention to the de-implementation of what doesn't work or has even been shown to be harmful. Knowledge sharing must be done cleverly. There is a need for a sound and open (ICT) platform that makes knowledge, expertise and data available from and for the wider professional field, links them together and keeps them up to date (see the section on big data). Knowledge valorisation must be given high priority in the Prevention Knowledge Agenda, involving the engagement and input of all interested parties (policy, research, practice, education, business). Fragmented knowledge and activities regarding healthy behaviour must be assembled and made easily accessible to professionals and interested citizens. To finance new initiatives, consideration should be given to restoring and reassessing the budget for lifestyle-related prevention that has been reduced in the past decade.

The way in which knowledge is used depends on the context. Professionals in healthcare or prevention work with knowledge in a different way than, for example, professionals in education, civil servants preparing municipal by-laws or volunteers of a sport association. Similarly, the manner and deadline for answering a knowledge question vary by context. In practice, there is often a need for short-cycle knowledge accumulation and application, while in academia longer-term approaches are taken. New methods (interdisciplinary) are needed to allow research and application to be done concurrently. This would enable adjustments to be made during implementation to promote the desired outcomes and to modify the approach to suit the local situation. But the need will remain for classic knowledge collection and exchange in the scientific domain and in the dialogue between disciplines.

Implementation of this Knowledge Agenda will address the major challenges in the application of the available knowledge, followed by collecting and analysing all the local applications, to measure the effect of interventions and generate new knowledge.

*Questions to be considered:*

1. How can research data be used further for knowledge sharing and generating new questions? What facilities will be required?

2. How can short-term, practice-oriented projects be optimally integrated in the longer-term academic programme for knowledge development and linked to more fundamental, innovative prevention research?

### 4.5 Financial aspects

To implement this ambitious Knowledge Agenda, a substantial investment will indeed be needed. Along with a government budget, alternative ways will have to be found to finance knowledge development and valorisation. This could include private financing from companies and institutions

and contributions in kind from inter-institutional collaboration. In the current situation, considerable sums disappear because there are not enough clear choices to make – a drawback of our Dutch polder mentality. Clearly described agenda topics that are commonly agreed on make it easier to create sufficient societal support among stakeholders to ensure the necessary funding.

### 4.6 Ownership and roles

One of the current major problems regarding prevention is that it is 'everyone's and no one's responsibility'. But ownership is an important precondition to ensure that a problem is tackled. Healthcare insurers, for example, do not receive enough stimuli to invest in prevention. Policy holders are not used to judging a healthcare insurance policy on its prevention-promoting aspects. And expecting healthcare insurers to invest more in prevention of their own accord is unrealistic[41]. It is therefore important to critically evaluate financing structures and to develop alternatives, for example models for shared savings. The extent to which other agents like local authorities act as an owner of prevention often depends on random preferences and local political choices.

In other countries, like Iceland, Great Britain and Finland, there are great examples of the successful implementation of prevention, because national agencies like the National Health Service or local and regional authorities take on a clear role. In those countries prevention is incorporated more in healthcare, making prevention research and the financing of prevention easier. Concerning secondary and tertiary prevention, such an approach is also promising for the Dutch situation. This concerns reaching vulnerable groups better, and recognising the quality of the Dutch healthcare system as a test environment, a potential asset for business.

In our country, the lack of committed ownership means that coalitions have to be formed to promote prevention, as is happening with the healthy cities approach, with links being established at the local authority level between different fields of policy and activities organised based on several criteria. Support and ownership (shared) can be created by linking to and between different current developments, such as the Agenda for healthcare, citizens' initiatives in healthcare (cooperatives), the prevention agreement currently being prepared, the proposed prevention coalition as part of the LSH top sector and the four other top sectors that have chosen to emphasise prevention in their new plans.

Several stakeholders can envisage carrying out implementation. Some parties can spread knowledge and communicate with their supporters; others can facilitate inter- and transdisciplinarity, to form links to practice-oriented research, contribute to the implementation of knowledge in education or co-finance or implement projects as part of the Knowledge Agenda. The business community envisages a role for itself in prevention more and more. For example, profitable prevention-oriented products can be developed in the fields of e-Health and data analysis; employers have an interest in investing in the health of their employees; and socially responsible contributions can be made to a healthy living environment. To engage the different stakeholders in the implementation of the Prevention Knowledge Agenda, it is important to have a

longer-term vision that clearly specifies the financial boundary conditions and the forecast budget that will be required in the long term.

# 5. Plea

The time is ripe for a joint approach to prevention in the Netherlands, aimed at promoting health and the daily functioning of everyone and reducing the disparities in health between different groups. Enabling this will require a combination of innovative research methods and more practice-oriented knowledge: an integration of existing knowledge in various domains, supplemented by knowledge from new research, preferably involving sustainable public-private partnerships. This Knowledge Agenda specifies which efforts must be made to realise all this.

It is clear that for a successful implementation of prevention in the Netherlands, an intensive and multi-year collaboration is required between governments (national, provincial and local authorities), the business community, the healthcare sector, knowledge institutions and societal organisations. To develop enough real support, we need a national platform (perhaps temporary) to focus on the interests of all stakeholders and supervise the different targeted approaches of knowledge collection on disease prevention and health promotion. It is also important to pay attention to the logical entirety of research, development, implementation and evaluation.

Advances can then be scientifically monitored and evaluated, and any knowledge gaps revealed can be submitted to scientific research. This could lead to a national, multi-year and 'educative' approach to prevention, with a focus on realising the widely shared objectives for health and healthy living.

For that purpose, broadly supported end goals (politically and socially) will have to be formulated on the basis of the Prevention Knowledge Agenda and a subsequent prevention agreement (for the short, medium and long term - 2020, 2030 and 2050) and translated into roadmap phases. Purpose, support, a short-cycle approach and suitable budgets are success factors here. There will have to be room for experimentation and reforming the practice. Thanks to the input from society and from new partners, for example the media and different sectors of the business community, new forms will develop outside the customary conceptual and implementation paradigms.

The coalition agreement of the third Rutte cabinet offers content and financial opportunities for implementing this Knowledge Agenda (creating a prevention agreement or additional funding for research, respectively). The aims are ambitious. To realise them and to make the Knowledge Agenda a sound basis for the implementation of the prevention agreement, a public(-private) investment of €150 million annually is required. This sum is made up of the following aspects:

- €30 million for creating and maintaining regional, practice-oriented testing grounds;
- €50 million for the five themes of the Knowledge Agenda and €20 million specifically for research into disease-oriented prevention.

According to the NWA vision, this sum will have to be matched by €50 million annually as an investment in binding, long-term, inter- and transdisciplinary scientific lines and the required infrastructure.

The Netherlands has sufficient capacity to take a leading global role again in the field of prevention. That is not only in the interests of our population, it can also serve as a source of inspiration for innovations elsewhere and for the export of innovative Dutch system concepts, products and services.

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## Appendix 1: Composition of Prevention Taskforce

The Prevention taskforce consisted of the following members:

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Prof. E.F.C. van Rossum (Erasmus MC)

Prof. W.J.J. Assendelft (Radboud University)

Prof. G.J. Navis (UMC Groningen)

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Dr. R.J. Renes (HU University of Applied Sciences Utrecht)

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Route coordinators (NFU and ZonMw)*

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Dr. G.J. Hasselaar (NFU)

J. Zandvliet (ZonMw)

M. Raijmakers (ZonMw)

(*) NFU and ZonMw are coordinators of the NWA route Healthcare research, prevention and treatment. One assignment from this route was setting up a taskforce to write a Prevention Knowledge Agenda. ZonMw and NFU took the initiative for this together with Health~Holland. ZonMw and NFU then supported its organisation and financed the taskforce.

# Appendix 2

*Circle of stakeholders*

Ahold

AJN Jeugdartsen Netherlands

Alles is gezondheid

Arbeidsdeskundig kenniscentrum

Centrum Media & Gezondheid

College Perinatale zorg

Fit!Vak

GGD/GHOR Nederland

ID-studiolab TU Delft

Ieder(in)

Institute Positive Health

Kenniscentrum Sport

Kennisplatform Veehouderij & humane gezondheid

Koepel Artsen Maatschappij en Gezondheid

Kondorwessels

Koninklijk Nederlands Genootschap Fysiotherapie

Koninklijke Nederlandse Maatschappij tot bevordering der Geneeskunst

MBO-raad

Medical Delta

Ministerie van Volksgezondheid, Welzijn en Sport

Ministerie van Onderwijs, Cultuur en Wetenschap

Ministerie van Economische Zaken

Ministerie van Sociale Zaken en Werkgelegenheid

Ministerie van Infrastructuur en Milieu

Movisie

Nationaal Regieorgaan Onderwijs-onderzoek

Nedap Healthcare

Nederlands Centrum Jeugdgezondheid

Nederlands Huisartsen Genootschap

Nederlandse Vereniging voor Arbeids- en Bedrijfsgeneeskunde

Nederlandse Zuivel Organisatie

Netherlands School of Public and Occupational Health

NPHF Federatie voor Gezondheid

Patiënten Federatie NL

Pharos

Philips

Planbureau voor de Leefomgeving

PO-Raad Programma Gezonde School

RABO-bank

RIVM

Rutgers

Samenwerkende Gezondheids Fondsen

SOA AIDS Ned

Thales

TNO Gezond Leven

Topsector Agrifood

Trimbos instituut

Vereniging Nederlandse Gemeenten

VeiligheidNL

Vereniging Hogescholen

Vereniging voor Gezondheidsrecht

VNO-NCW / MKB

Voedingscentrum

V&VN

Zorgverzekeraars Nederland

# Colophon

The Prevention Knowledge Agenda is an elaboration of questions and game changers from the 'Healthcare research, prevention and treatment' route of the Dutch National Research Agenda (NWA).
This Knowledge Agenda has been prepared on the basis of a close interweaving of research, education and prevention. The Netherlands Federation of University Medical Centres (NFU) and ZonMw initiated and facilitated this process.

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Mark Raijmakers

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Prof. Johan Polder

Prof. Karel Moons

Dr. Pieter van Baal

Dr. Ardine de Wit

Dr. Jochen Mierau

More information

www.zonmw.nl/nl/over-zonmw/nationale-wetenschapsagenda/route-preventie

www.nfu.nl/wetenschap/nationale-wetenschapsagenda

https://wetenschapsagenda.nl/?lang=en

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| 081 | 082 | 083 | 084 | 085 | 086 | 087 | 088 | 089 | 090 |
| 091 | 092 | 093 | 094 | 095 | 096 | 097 | 098 | 099 | 100 |
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