



CardioScape
A survey of the European
cardiovascular research landscape



CARDIOSCAPE CONFERENCE

A PRESENTATION OF PROJECT FINDINGS

The CardioScape project has received funding from the
European Union Seventh Framework Programme
(FP7/2007- 2013) under grant agreement no: 312121





EUROPEAN
SOCIETY OF
CARDIOLOGY®



Cardiovascular disease (CVD) is the N°1 killer in Europe, claiming 1.9 million lives per year in the EU alone. The availability of adequate and effective funding is essential to tackle the CVD burden, by improving the knowledge on CVD and discovering innovative medical solutions. Yet, funding for cardiovascular research remains limited, with striking disparities between countries.



INTRODUCTION TO CARDIOSCAPE

Cardiovascular disease is a large burden to the EU in both health and economic terms, however, despite cardiovascular disease (CVD) being the most common cause of death in the EU.

Cardiovascular disease (CVD) - a group of diseases that affect the structure and/or function of the heart and blood vessels, including heart disease and stroke - is the number one killer in Europe claiming over 4 million lives in the WHO European region¹ and 1.9 million lives per year in the EU. CVD is also estimated to cost the EU economy almost €196 billion a year.²

A significant increase in CVD prevalence is expected over the next 20 years based on current trends and therefore finding new approaches to screening and prevention, early detection and management, new and innovative treatments and effective and cost effective service delivery to tackle CVD is essential.

THE CARDIOSCAPE PROJECT

To address this imbalance, the European Society of Cardiology (ESC) - representing over 80,000 cardiology professionals across Europe and the Mediterranean - together with the UK operation of the PNO Group - Europe's leading independent innovation grants consultancy - surveyed the European research landscape.

The 23 month CardioScape project funded by the European Union FP7 research programme, resulted in the creation of the CardioScape database populated with over 2,400 cardiovascular research projects funded over the period 2010-2012, as well as a compilation of funding sources across all EU-28 countries during 2010-2012. The results of the project are publicly available on the project's website **www.cardioscape.eu**

It is expected that the results of the project will enable the scientific community and the EC to comprehensively understand current cardiovascular research in order to better guide future research and development.

The results of CardioScape will also help encourage future collaboration between researchers and assist funders to make informed decisions about where to invest their funds. This will ensure that every Euro is efficiently invested to serve science and ultimately patients, and also to significantly contribute to a healthier and more productive European society.

It is expected that the results of the project will enable the scientific community and the EC to comprehensively understand current cardiovascular research in order to better guide future research and development.

Ref 1 (WHO region): http://www.who.int/choice/demography/euro_region/en/

Ref 2 (€196 billion a year): European Cardiovascular Disease Statistics 2012, European Society of Cardiology, European Heart Network

A scientist in a lab coat and safety glasses is working with test tubes in a laboratory setting. The scientist is holding a red test tube and looking at it. In the background, there are racks of test tubes with various colored caps (yellow, blue, green, red).

INFORMATION COLLECTION

157 organisations from all EU-28 member states were contacted with an ad-hoc questionnaire, 48% provided a complete response, 35% did not meet the CardioScape criteria (i.e. had not funded projects in the last three years (22%) and/or awarded grants \geq € 100 000 (13%)), 11% refused to provide any information, and 4% provided incomplete information (e.g. missing abstract, no budget indication by project). Ultimately, 2, 476 research projects were included in the CardioScape database.



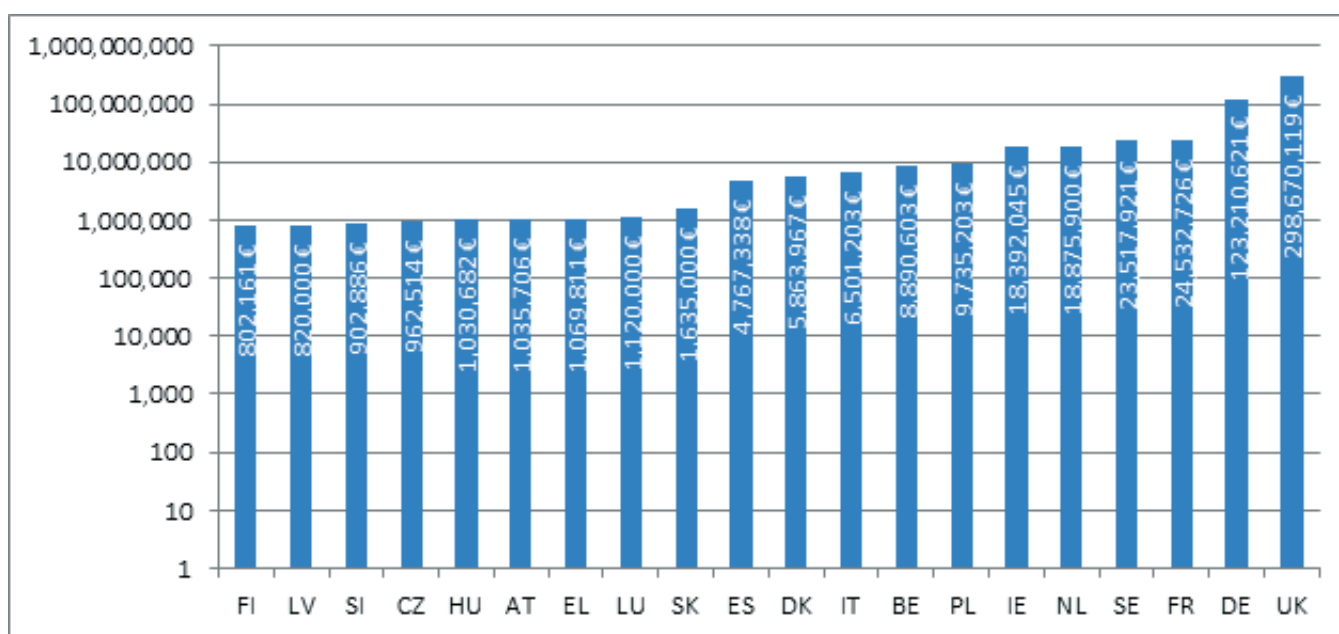
RESEARCH LANDSCAPE - SURVEY RESULTS

GENERAL ANALYSIS

The CardioScope survey shows that at least €1 billion was awarded to cardiovascular disease research in the EU-28 in 2010, 2011 and 2012. Government/public funding for cardiovascular research in Europe accounts for 53% of total spend. Charity/private agencies provide 47% of cardiovascular research funding in Europe. EU funding accounts for 37% of overall cardiovascular research spend in Europe.

CardioScope findings indicate that a large majority of projects (70%) have an average grant level of €100,000 or less per year.

GEOGRAPHICAL ANALYSIS



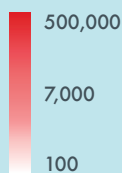
Distribution of CVD research funding in EU-28 by country (2010-2012) (logarithmic view)[3]

Based on the data submitted by the contacted funding agencies, the UK appears to be the dominant country in the European CVD research funding landscape, followed by Germany.

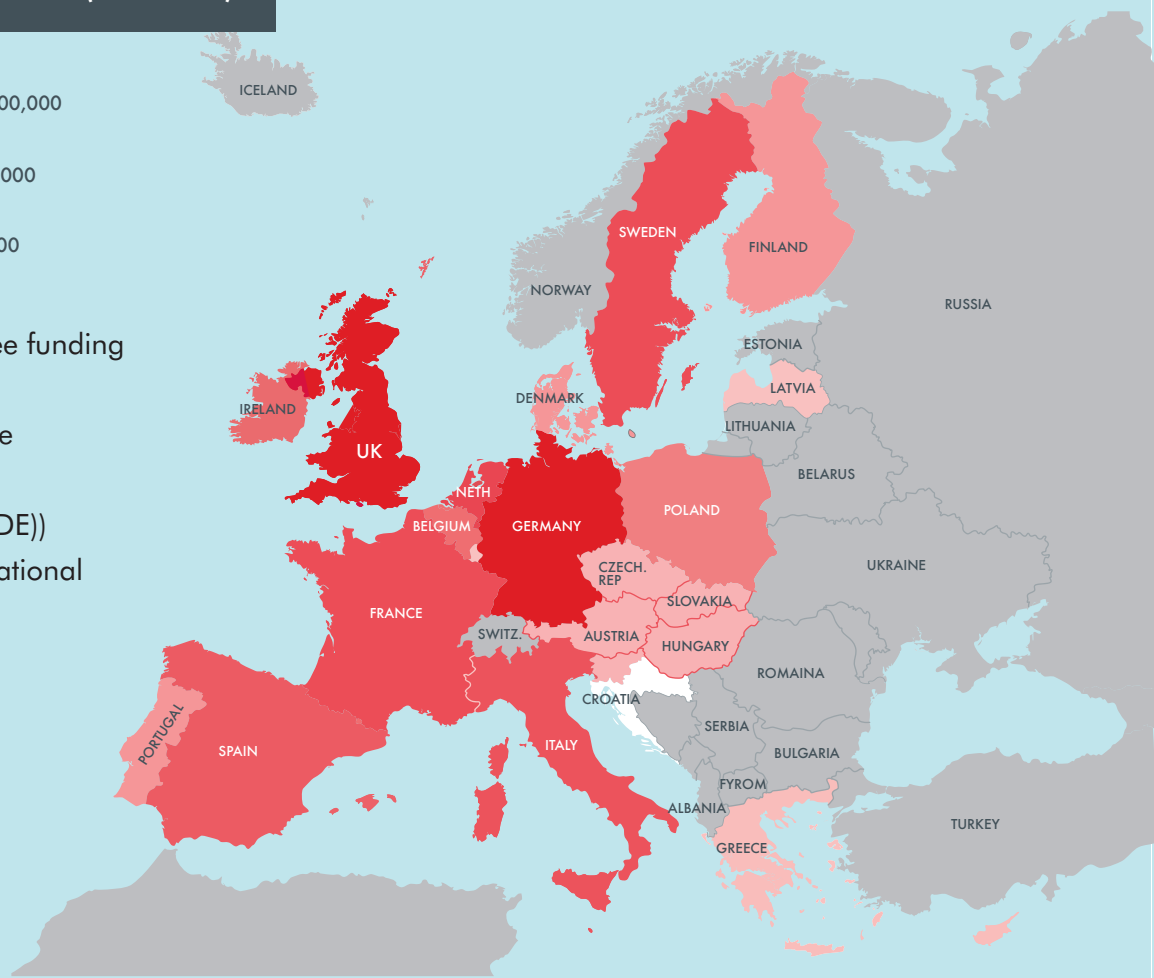
3 In Romania and Malta, no funding organisations were identified by the experts nominated by the National Cardiac Societies. In Bulgaria, Cyprus, Croatia, Estonia, Lithuania and Portugal no funding > €100 00 was available for CV research in the period 2010-2012.

FIGURE 2:
CVD research funding in EU-28 (2010-2012)

CVD RESEARCH BY
COUNTRY IN K€



The project found that three funding agencies (the British Heart Foundation (UK), Wellcome Trust (UK), Deutsche Forschungsgemeinschaft (DE)) account for over 50% of national CVD funding.

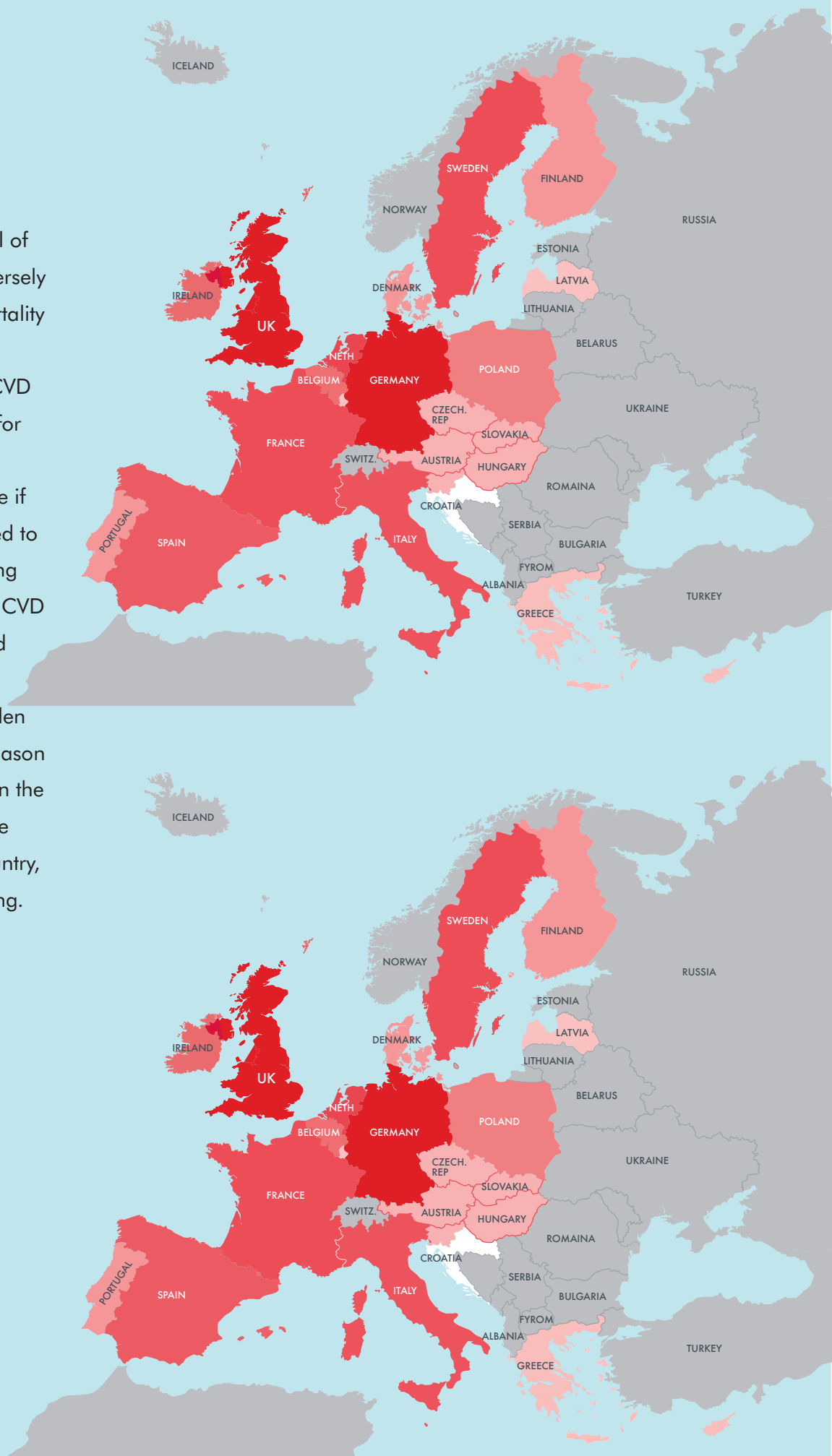


DEMOGRAPHIC ANALYSIS

CVD RESEARCH FUNDING VS POPULATION

The CardioScape analysis shows that there is no or little relationship between the total national spend on CVD research funding and a country's population size. Countries with powerful charity/private organisations and/or fund raising cultures and activities (UK, Ireland, Netherlands, Sweden) appear to have a far greater ratio of CVD research spending per capita.

Research shows that the level of CVD research funding is inversely proportional to the CVD mortality rates. Eastern and Central European countries, where CVD causes up to 50% of deaths for both men and women (e.g. Bulgaria, Romania) have little if any health research dedicated to CVD. On the contrary, funding dedicated to cardiology and CVD research is high in North and Western Europe, where CVD mortality has significantly fallen over the last decades. The reason behind this observation lies in the economic development of the countries: the poorer the country, the less available R&D funding.



DISTRIBUTION OF FUNDING BY RESEARCH AREA

CardioScope shows that research spend is highest for human and clinical research and lowest for epidemiology/population/public health research.

The number of research projects funded is similar for human/clinical and basic/pre-clinical and smallest for prevention/population/public health.

By adding data on European Union Framework Programme 7 (FP7) projects, CardioScope shows that EU funding is almost 5 times greater for human/clinical research than for basic/preclinical research. This is explained by the clear focus of FP7 on clinical research. EU FP7 funding for epidemiology/population/public health is negligible. It is to be noted however that data from the EU Public Health Programme do not appear in this survey. During the 2010-2012 period, the European Union co-funded the EuroHeart II project worth €2.7 million, including a European Commission contribution of €1.023 million.

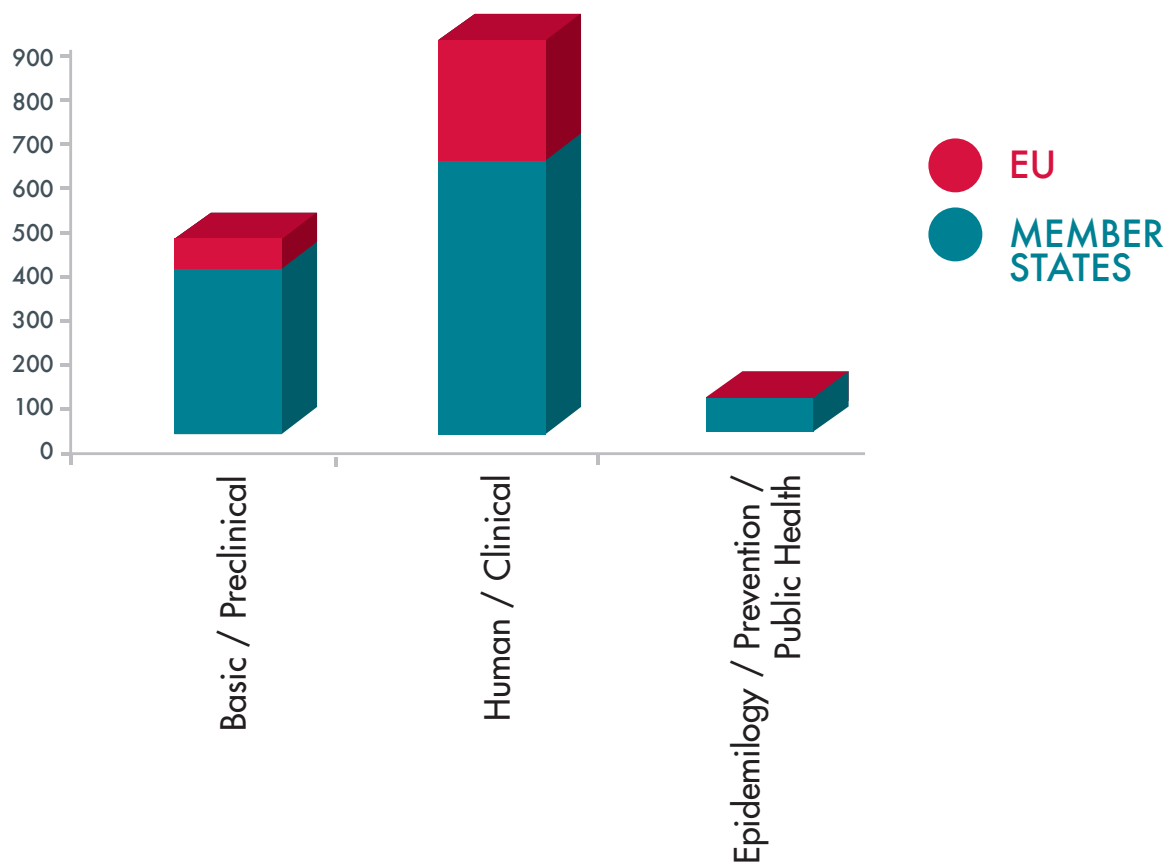


FIGURE 5:
Distribution of CVD research spend by research area in M€ in EU-28 (2010 - 2012)

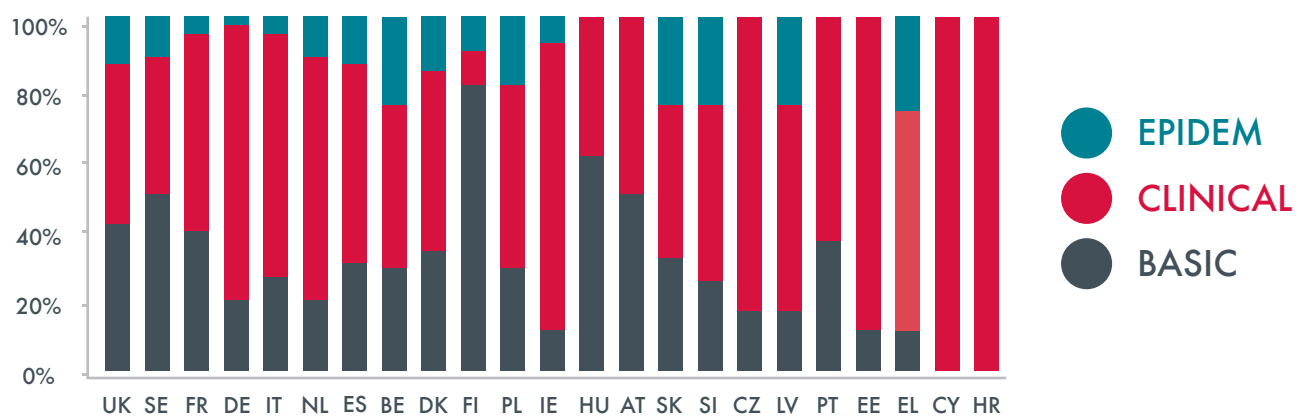


FIGURE 6:
Distribution Of CVD Research Spend By Research Area In EU-28 by % (2010-2012)

The distribution of CVD research projects by research area in each EU country varies widely and is highly dependent on the number of projects collected for each country. However, the European landscape country by country is dominated by human/clinical research.

DISTRIBUTION OF FUNDING BY RESEARCH TOPIC

Top 10 most funded topics by area of research

The following figures show the top 10 topics funded across Europe, for each area of research.

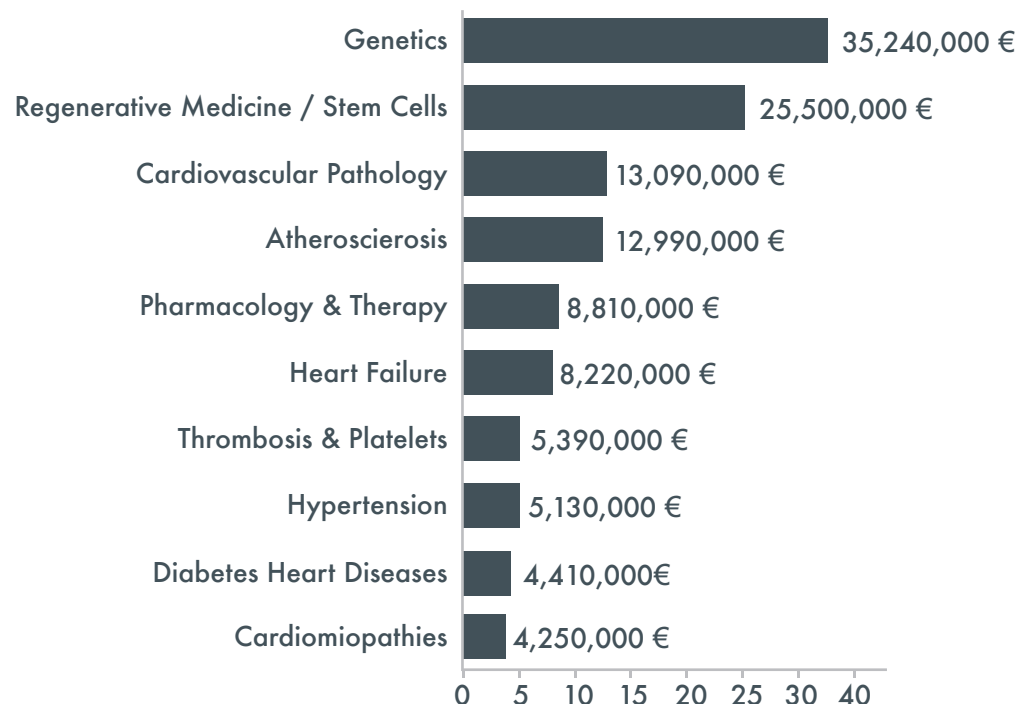


FIGURE 7:

Top 10 Topics Funded in CVC Basic / Preclinical Research (2010 - 2012)

COMPARISON WITH RESEARCH SPEND FOR OTHER NON-COMMUNICABLE DISEASES

Although CVD is the most common cause of death in EU, research spend is largest for cancers with €2.25 billion over 3 years (data 2002-2003)⁹. Of course, to make comparisons with research spend for other non-communicable diseases requires contemporary data of the same quality and this information is not readily available. Expanding the CardioScape approach (data gathering, data analysis, database access) to other fields would be a good option to obtain such data.

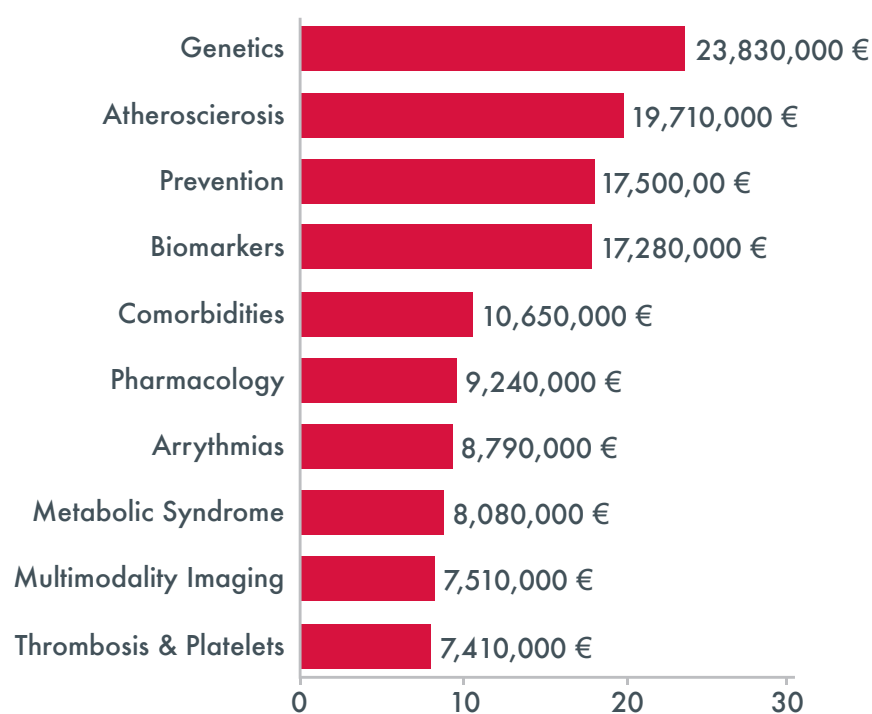


FIGURE 8:
Top 10 Topics Funded in CVC Human / Clinical Research (2010 - 2012)

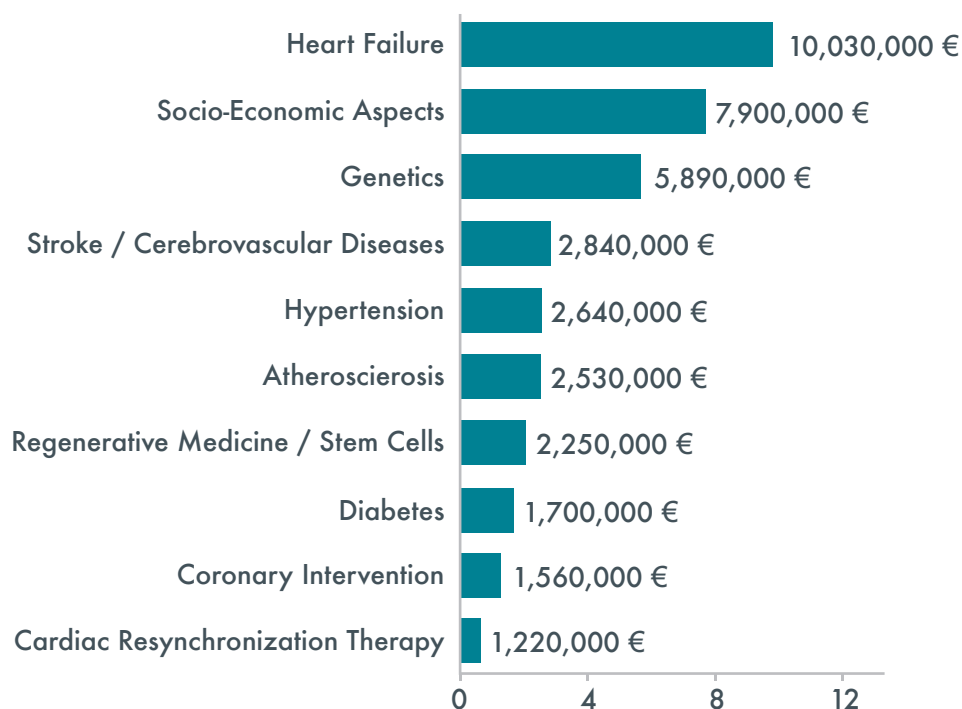


FIGURE 9:
Top 10 Topics Funded in CVC Epidemiology / Prevention Public Health Research (2010 - 2012)

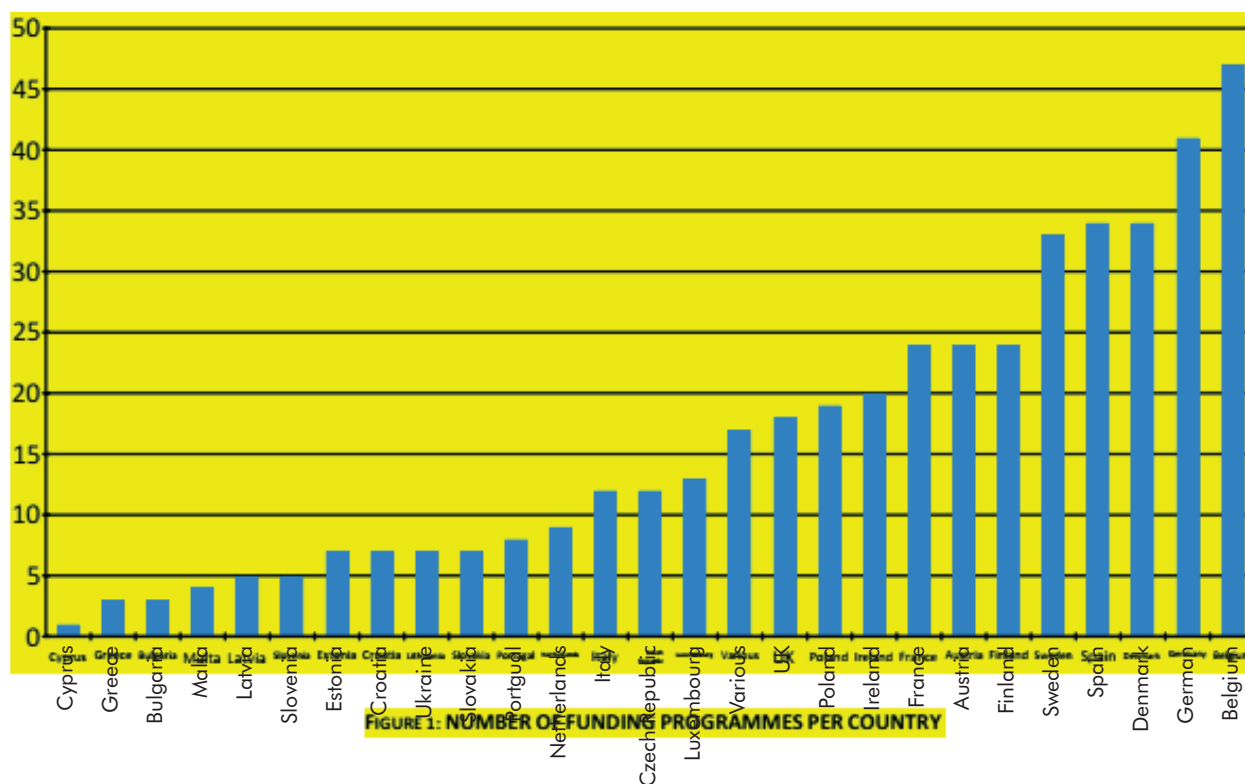
FUNDING LANDSCAPE

SUMMARY OF RESULTS

- 28 COUNTRIES INVESTIGATED
- 187 FUNDING BODIES IDENTIFIED
- 438 FUNDING SCHEMES PROGRAMMES OF RELEVANCE

The exhaustive research performed by PNO on the funding landscape across Europe highlighted that there are a wealth of opportunities to fund work related to CVD prevention, diagnosis and treatment. Funding bodies range from private companies, foundations and charities, European, national and local government departments, associations, banks and private equity.

The type of funding mechanisms included loan instruments, equity investment, bank guarantees, tax incentives, grant funding and prizes/awards.



It is apparent that the central and eastern Europe, and the countries subject to EC bail outs have the lowest number of available funding programmes, with the exception of Ireland. In general the countries with the highest amount of open funding schemes are member states in the north and west of Europe.

These opportunities are offered by a range of organisation types, the majority being from governmental bodies, however foundations and private equity also provide a rich vein of funding.

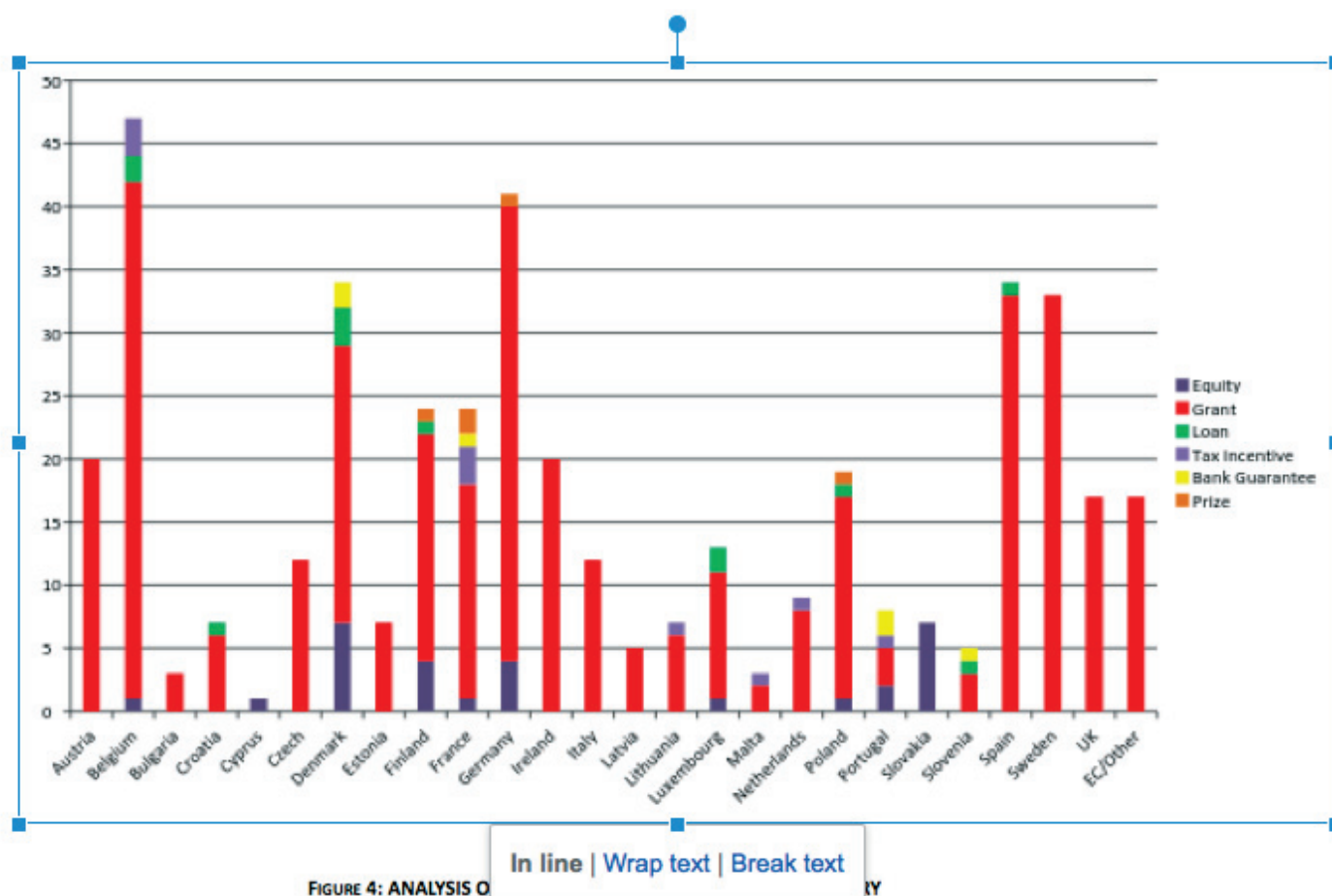


FIGURE 4: ANALYSIS OF

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Perhaps one of the most interesting outcomes of this investigation into funding opportunities is the type of activity that on which funding is focussed. Most researchers involved in R&D in CVD are aware of the grant funding that is available in their country for pure research. However this project has highlighted other activities that can attract funding, such as protecting intellectual property, medical trials, funding spin-offs from university research, funding the development of research of infrastructure, or technology transfer activity. Of particular note is funding available for Research, Development and Innovation (RD&I), which enables the applicant organisation to take their R&D activity through to market.

“

The results of the project will enable to comprehensively understand current cardiovascular research landscape in Europe. It will help encourage future collaboration between researchers, avoid duplication and assist funders to make informed decisions about where to invest their funds. Funding bodies and researchers are now encouraged to continue adding to the CardioScape database (www.cardioscape.eu) to inform others of their cardiovascular

research and to look for partners. Ultimately, this will ensure that every Euro is efficiently invested to serve science and patients, and also to significantly contribute to a healthier and more productive European society.”

PROFESSOR DAVID WOOD, CARDIOSCAPE
SCIENTIFIC COORDINATOR AND PROFESSOR
FRANS VAN DE WERF, CHAIR OF THE
CARDIOSCAPE SCIENTIFIC COMMITTEE

When considering the type of applicant that funding is directed towards, there is a clear focus on academic researchers, with 112 schemes available across the EU-28 aimed at university-based researchers. 33 funding streams are available that can fund individual scientists activities, where these scientists can be based within a university, but also in many cases within a company. 57 schemes were open to any type of applicant.

Notably there is also a clear focus on funding available for SMEs (83) and any sized companies (53). Collaborative approaches are required to be eligible for 36 of the available funding mechanisms.

During the investigation it was discovered that there are some funding grant funding programmes specifically aimed a surgeons, medical centres, health research clusters and incubators/innovation hubs.

Additional breakdown of the levels of funding available to each of the applicant organisation types are shown in Figure 9.

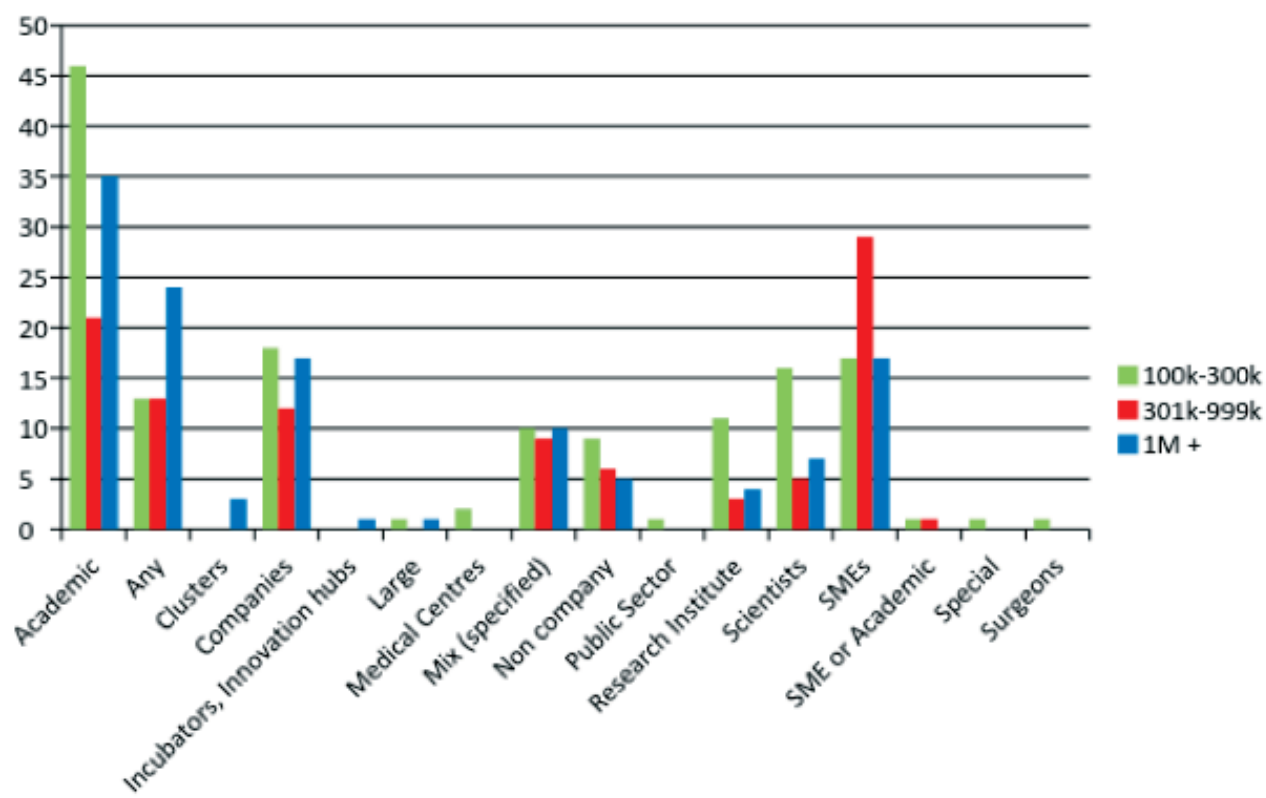


FIGURE 9: ANALYSIS OF FUNDING AMOUNTS AVAILABLE BY RECIPIENT CLASS



KEY FINDINGS & CONCLUSIONS

- At least €1 billion was awarded for CVD research in the EU over a three years period (2010 – 2012).
- 2/3 of CVD research spend comes from national sources (government/public and charity/private), while the remaining 1/3 comes from the EU.
- 130 funding organisations, government/public and charity/private, fund CVD research across the EU-28.
- Government/public funding for cardiovascular research in Europe accounts for 53% of total spend. Charity/private agencies provide 47% of cardiovascular research funding in Europe.
- One funding agency alone, the British Heart Foundation, accounts for 14% of total spend in CVD research, including EU funding, and 22% of CVD research spend across EU-28 excluding EU funding.
- 3 funding agencies account for over 50% of nationally provided funding dedicated to CVD research.
- Only 3 charity/private agencies have budgets higher than €10 million for CVD research over the years 2010-2012.
- 7 government/public agencies have budgets above €10 million for CVD research over the years 2010-2012.
- Although CVD is the most common cause of death in EU, research spend is largest for cancer: €2.25 billion over three years (latest available data from 2002-2003).
- Research spend is highest for the area of human/clinical research and lowest for research in prevention/population/public health.
- EU FP7 funding for epidemiology/population/public health is negligible.
- As of 2013/early 2014 there are numerous grants, bank loans, tax credits, equity investment that can be accessed by organisations to fund academic research into diagnosis, prevention and treatment of cardiovascular disease.
- There are numerous schemes that companies can access for research in these fields, including research, development and commercialisation of diagnostic tools, pharmaceuticals and medical devices. The member states with the largest populations and strongest economies have the richest funding landscape, and have the strongest research communities.
- The global economic crisis has clearly impacted some member states more than others. Many funding bodies were identified in southern and eastern European countries that had previously funded research, development and innovation activities, but had no currently open funding calls. This was much less noticeable in the Northern and Western member states, which still possess a very rich funding landscape.
- It is likely that as the economy in the southern and eastern member states normalises that the funding landscape for CVD related research will also improve.

CONCLUSIONS

The CardioScape database provides a unique snapshot of funding for cardiovascular research for the period 2010 – 2012.

The baseline data summarised in this report illustrate the extent and diversity of funding sources across the EU-28 devoted to cardiovascular research and show the wide disparity in the level of funding between different nations.

There is a difference in the scale of funding between government/public organisations and charity/private funders. On average government/public organisations spend more money, and more per project, than charity/private funders.

Though EU research funding represents a mere 5% of total investment by EU Member States in European R&D in all disciplines, EU funding dominates the cardiovascular research funding landscape in Europe, accounting for 37% of total spend. This indicates that EU funding is essential for cardiovascular research.

CardioScape could be an incentive for researchers and funding bodies to include data in the database, in order to be part of a global picture. Overall, this would improve the extent and quality of knowledge on cardiovascular research funded and performed in the EU.





RECOMMENDATIONS

GENERAL RECOMMENDATIONS

CardioScape's findings emphasize the need for future multinational funding efforts to address the pan-European burden of cardiovascular disease. The data thus provide strong incentives for more cross-national collaboration between funders.

Further analysis is needed to understand whether the wide disparity in the level of funding between different nations reflects differences in the stages in the translational research pipeline supported by each type of funder.

Although industry funding for cardiovascular research represents an important share of the overall funding provided at a European and national level it was not possible to include such data in the CardioScape project. It is recommended that this shortcoming is addressed in future by further dialogue with industry, so that non-confidential summary information (of the kind presented in this report) can be used to aid funders and researchers.

CardioScape's findings should be interpreted cautiously, because there is not necessarily a strong correlation between the level of funding for a specific topic and the impact this has on human health and the wealth of the economy.

Evaluation of the impact of research on health and wealth is complex, partly because of the time lag between scientific discovery and clinical benefit and needs different tools for analysis. Methods for the evaluation of impact of research on health and wealth of EU population should be developed.

A valuable output of the CardioScape investigation is the database that is accessible through the CardioScape website. The CardioScape database will increase in value substantially if it is regularly updated, maintained and developed further to become an essential and unavoidable EU cardiovascular research inventory, enabling improved decisions about research priorities and research funding both at the EU and national level. It is suggested that funders should co-operate to continue to populate this unique database.

It is also recommended that the findings of this project are disseminated as widely as possible to all individuals and organisations that are actively involved in any research



activity relating to CVD. For example academics researchers may be fully cognisant of grant funding to fund their research activity, but are often not aware of the funding opportunities to take their work from the laboratory to implementation, such as for the development of prototypes, protection of IP, commercialisation of research results.

A clear benefit can be derived from those funding organisations with successful track records of investing in CVD research that has had a positive impact, sharing with other funding bodies across Europe their funding decision and project monitoring processes. Sharing of best practise in these areas would be of benefit in respect to the return on investments and also to increase the likelihood of high impact research results.

In respect of those countries previously highlighted with the least robust funding landscape, it is recommended that the relevant heart associations and national contact points make a concerted effort to involve academic researchers and companies in the field of CVD to engage in EC funded collaborative projects, or those national funding schemes of other member states that allow the participation of cross border partners. Also the governmental funding bodies in these countries should be lobbied to prioritise funding to CVD research related activities, given the pan-European issue that cardiovascular disease represents.

RESEARCH-SPECIFIC RECOMMENDATIONS

- **AGEING** - Based on the information contained in the CardioScape database, despite the current aging of the population and the large changes that occur in the cardiovascular system with aging, the amount of research efforts funded in Europe evaluating the prevention, causes, occurrence and treatment of cardiovascular disease in the elderly and their association with the aging process is very limited (20 projects) and thus deserves further evaluation and consideration for funding.
- **CARDIOVASCULAR NURSING** - Funding of research in the area of cardiovascular nursing was found to be scarce. In particular, no projects address nursing education neither in human/clinic nor in epidemiology/prevention research areas. The available funds are located on a national level and support relatively small projects. To deliver optimal patient care and to support healthcare staff of all disciplines in the decision-making process, evidence-based nursing practice is a prerequisite and support for research in cardiovascular nursing is needed.
- **COMPUTER MODELLING & COMPUTERS IN CARDIOLOGY** - In the two related areas 'Computer modelling' and 'Computers in cardiology' the CardioScape database reports a sizeable number of funded projects (22 and 128), evidencing broad and competitive scientific activity in the field. A main component of the computer / modelling approach to cardiovascular medicine or medicine as a whole is the development of a patient specific understanding of pathophysiological mechanisms and tailored treatment options. This approach was initiated by the EU in the STEP process in 2005 and is funded via the 'VPS' (virtual physiological human) programme. Despite the significant number of funded projects in the area, however, this approach has not entered the 'mainstream' of cardiovascular science or even practice. Thus, its potential is grossly underused. This is evident, e.g. by the low representation of related events at the ESC conferences. Here, a lack of structural and strategic funding is evident, which would be aimed at bringing the individual approaches together, increasing the scientific discussion and translating the results into clinically testable concepts. Such funding would have to be supranational and should not so much target individual research projects, but corroborate the strength, interaction and visibility of the field by supporting conferences, career options and translational efforts.
- **HEART FAILURE** - In the field of heart failure (HF), there are 2 major unsolved issues: the classification and treatment of patients hospitalized for acute HF, and the classification and treatment of patients with chronic HF and preserved ejection fraction. Analyzing the CardioScape database, it seems that HF is a clinical area with lot of studies (212), but just a minority of them are focused on the most relevant unmet needs: one study specifically focused on chronic HF with preserved EF and five studies on acute HF.
- **METABOLOMICS** - The application of systems biology could permit a better identification of the etiopathological pathways leading to CVD. On this regard metabolomics could play a role in improving our diagnostic and predictive capacity to detect CVD as well as provide information regarding potential etiological pathways that could be targeted for treatment.

Overall, although there are not many funded projects on metabolomics (23 results), many of these received large amounts of funding, suggesting the presence of a few large collaborative projects in Europe focused on metabolomics. Further efforts are needed in maintaining the current projects focused on using OMICs technologies for CVD and on translating these findings to facilitate their incorporation in clinical practice.

- **PLATELET FUNCTION & ANTI-PLATELET TREATMENT** - In the area of research on platelets there is a need for a geographical widening of research activity as there currently only seem to be activities ongoing in seven EU countries. There is also very limited publicly funded clinically based research on healthy volunteers or patients exploring newer modes of platelet function testing or the use of new antiplatelet treatment strategies.
- **PREVENTION** - The amount of grants funded and resources allocated to primary prevention in Europe is scarce (only 16 projects, the largest grant being € 1.7 M – no EU FP7 research funding). This finding is quite worrying considering that industry funding is generally not directed to epidemiology/ prevention/public health research. Population based registers of major cardiovascular events are rare; after the experience in the MONICA register (MONItoring of trends and determinants of CARdiovascular disease) coordinated by WHO in the eighties and nineties, there have been no further attempts to describe the burden caused by acute myocardial infarction in terms of morbidity, mortality and case fatality, at the level of the European population. Hospital-based registers illustrate only the top of the iceberg.

There is an urgent need for new population-based observational cohort studies in order to develop more accurate and up to date models to estimate the total CV risk in the apparently healthy population; community-based intervention trials regarding the efficacy and safety of lifestyle- and environment-related exposures are needed to develop evidence-based health policies in the field of preventive cardiology. There remain a lot of unresolved problems as to the most efficient strategy to prevent CVD at the level of the community. Research should be carried out on the implications of the changing CV mortality pattern and of changing the time course of CVD in order to plan health services. Such studies need collaborative research by networks of epidemiologists and public health workers with special interest in CVD. Further efforts are necessary to improve the amount of funding directed towards prevention of CVD.

- **REGENERATIVE MEDICINE/STEM CELLS** - In general, this field was well funded with more than 200 projects and € 25 M of funding over three years. However, some aspects in this field have not been adequately addressed and should receive more funding in the future. This includes: 1) Stem cells (iPS) as models for cardiac development, because these cells undergo all steps from pluripotency to cardiac myocytes. 2) Tissue engineering for myocardial regeneration is a promising field because the effects of cells can be controlled ex vivo. 3) Finally, since no clinically applicable strategy of stem cell transplantation for cardiac regeneration has been established yet, more focus should be directed towards endogenous regeneration through cell cycle activation strategies of myocytes or transdifferentiation strategies of nonmyocytes.

YOUR CARDIOSCAPE DATABASE

www.cardioscape.eu

The CardioScape database gives free access to the whole scientific community, including academic experts, funding bodies and industry leaders, to a greater understanding about the CVD research and funding landscape across Europe.

This will provide a better understanding as to what research is being undertaken, where it is taking place and who is funding the work.

It will help to establish the extent of duplication across national research programmes, identify gaps that reduce opportunities for innovation, highlight areas where coordination can be improved and define future funding priorities and strategies for CVD research in Europe.



A CALL TO ALL CVD RESEARCHERS AND FUNDING BODIES...

Funding bodies at European and national levels and scientists from all areas of CVD research are invited to update the database with their projects - contact the CardioScape team at:

www.cardioscape.eu/Contact-us

CARDIOSCAPE CONFERENCE 17 SEPTEMBER 2014

The CardioScape conference, held in Brussels at the International Press Center 'Résidence Palace' on 17 September 2014, presented project findings along with recommendations for furthering the European research activity in this field. Delegates included medical professionals, academics and other stakeholders including medical research organisations with an interest in cardiology such as EU policy makers.

THANK YOU TO ALL CARDIOSCAPE CONTRIBUTORS...

The CardioScape project, led by the European Society of Cardiology, involved many dedicated, passionate cardiologists who gave their time freely. Their contribution allowed the assembly of the CardioScape database that covers 28 EU countries, to provide a snapshot of cardiovascular research at a European and national level, in order to guide future research priorities. We wish to warmly thank them all for their commitment in this ambitious project.



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