In 2010-2015
Self-Assessment

EMGO+ in 2010-2015

Self-Assessment

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Institute for Health and Care Research

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Preface

The EMGO Institute for Health and Care Research (EMGO+) is a multidisciplinary research institute that, as of July 2016, brings together 725 researchers from departments of three different science communities, i.e., from the VU University Medical Center (VUmc) and the Vrije Universiteit (VU) Faculties of Behavioural and Movement Sciences, and Earth and Life Sciences. Since the inception of the **EM**GO institute within the VU Medical Center in 1987, our researchers perform high-quality research in the **E**xtra**M**ural (public) health care domain on prevention, primary care, rehabilitation and long-term care. In 2009, the EMGO institute evolved to the EMGO+ institute by including many researchers from VU departments, thus strengthening its multidisciplinary character.

As part of the six-year accountability cycle, EMGO+ was evaluated last in 2010 by an international external evaluation committee. The institute, as well as its four research programs, were rated as excellent and received the highest rating for across all domains: quality, productivity, relevance, vitality and feasibility. This external evaluation covered the 2004-2009 period. A reflection on this previous assessment is found in *Supplement A* in the form of changes in EMGO+ policies based on the recommendations of the 2010 external evaluation committee.

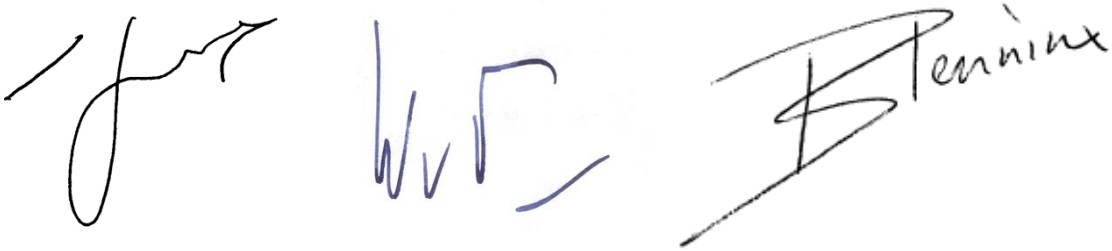
In the current self-assessment we look back on the period 2010-2015 which represented five fruitful years of the EMGO+ Institute. Our scientific output has kept increasing with noticeable impact on health care practice while our earning capacity has remained intact, despite the increased constraints on research funding. You will find the information organized following the Standard Evaluation Protocol (SEP) 2015-2021 of the Association of Universities in the Netherlands (VSNU), the Netherlands Organization for Scientific Research (NWO), and the Royal Netherlands Academy of Arts and Sciences (KNAW) as the main guideline.

Meanwhile, vibrant times have arrived. The VU Medical Center is on the verge of a merger with Amsterdam Medical Center (AMC) which will result in the largest university medical center in the country. Forerunning the full merger of care, education, specialist training, research and administration of the two medical centers, EMGO+ has entered its second evolution phase by merging its research community with >500 researchers of the AMC to build the Amsterdam Public Health Institute. At the end of this self-assessment we describe this new institute in more detail and look ahead to the successful continuation of our research in next decade.

We hope you will enjoy reading this self-assessment!

Yours sincerely,

On behalf of the EMGO+ Institute for Health and Care Research,



Eco de Geus, PhD
Director

Willem van Mechelen, MD. PhD
Vice-director

Brenda Penninx, PhD
Vice-director

Amsterdam, July 7, 2016

1. Research area

1.1 Mission and Objectives

The EMGO+ **mission** is to generate, conduct and publish excellent research of international standing to improve practice in public and occupational health, mental health care, primary care, and long-term care.

To support the mission, EMGO+ Institute's **objectives** are to:

- monitor the quality and integrity of research,
- actively support acquisition of research funds,
- build and maintain a unique research expertise and infrastructure,
- ensure a focus on societal relevance and impact on daily clinical practice.

EMGO+ outlined

1124 researchers participate or have participated in EMGO+ from 2010 to 2015

275 PhD students, PhD theses completed 93 in 2015

Research funds acquisition €25 M in 2015

Refereed articles 1263 in 2015, of which 27% in top10% impact factor journals

2014 MNCS performance index = 1.59 (59% above world average)

11 Academic Collaborative Centers with stakeholders in health care.

EMGO+ research includes qualitative and quantitative approaches, and most studies are either executed within large population-based cohorts or in public health and extramural medical practice settings, such as general practices, specialized mental health care organizations, residential homes for the elderly, nursing homes, schools, worksites and occupational health care settings. In addition, a variety of intramural studies is conducted on organization, safety, effectiveness and quality of care in the hospital.

1.2 Research Programs

All research projects carried out at EMGO+ are embedded in one of our four research programs, three of which link to the main burdens of disease in the Netherlands, as well as internationally:

1. **Lifestyle, Overweight and Diabetes** (LOD)
2. **Mental Health** (MH)
3. **Musculoskeletal Health** (MSH)

whereas projects in the fourth program

4. **Quality of Care** (QoC)

focuses on how to optimize physician-patient communication and decision making, increase patient participation, and on how to improve the safety of care in the above mentioned disease areas as well as in cancer.

Overweight and Diabetes are two of the main public health problems of our society and are strongly linked to common **Lifestyle** determinants such as physical inactivity and poor dietary habits. Physical inactivity and overweight are also main factors contributing to the development of cardiovascular disease. This research program aims to curb the obesity and diabetes epidemics by identification of the primary lifestyle and biological determinants and by evaluation of efficient ways to improve lifestyle in order to prevent disease and to improve outcomes in people with chronic diseases such as diabetes and cardiovascular disease.
Specific research themes are:

1. *Pathophysiology and epidemiology of overweight and diabetes.* This theme includes experimental and epidemiological studies of the biological, genetic and behavioral determinants of overweight and diabetes and their potential interrelations.
2. *Prevention of overweight and diabetes.* Research projects pertaining to this theme aim to modify unhealthy lifestyles with a particular emphasis on improving dietary intake and promoting or increasing physical activity and reducing sedentariness.
3. *Care for patients with overweight and diabetes.* Projects addressing the effectiveness and efficiency of health care aimed at chronic disease management of obesity and type-2 diabetes are central in this theme.

Common mental disorders have a major impact on public health and are among the conditions with the worldwide highest disease burden. By conducting observational as well as intervention studies, the **Mental Health** program contributes to a better evidence-base for the prevention and treatment of mental disorders in order to improve mental health in the population.
Specific research themes are:

1. *Epidemiology of mental health.* This theme includes observational research in the community setting, the general practice setting as well as the mental health care setting that increases our knowledge of the occurrence, pathophysiology, determinants, and consequences of mental health disorders.
2. *Prevention and treatment of mental disorders.* This theme refers to research that contributes to evidence-based information on innovative prevention and treatment interventions to improve mental health and reduce associated disability.
3. *Developmental perspective in mental health.* This theme refers to research that specifically examines developmental trajectories of psychopathology across the lifespan.

The **Musculoskeletal Health** program seeks knowledge about the development and lifelong maintenance of a healthy musculoskeletal system and about the occurrence, prognosis, prevention and treatment of musculoskeletal disorders. The research program contributes to evidence-based practice for musculoskeletal disorders and health in the setting of occupational health care, primary health care, and rehabilitation practice. Furthermore, the research program strongly contributes to the development of research methodology.
Specific research themes are:

1. *Epidemiology of musculoskeletal disorders.* This theme includes observational research on the determinants and consequences of musculoskeletal disorders in the settings of public health, occupational health, primary and secondary health care, and rehabilitation practice.
2. *Prevention of musculoskeletal disorders.* The knowledge gained from the first theme is translated into programs for setting-specific prevention of musculoskeletal disorders, and implementation and evaluation of these programs.
3. *Treatment of musculoskeletal disorders.* An important topic within this theme is research on the (cost-) effectiveness of treatments that improve societal participation of patients with musculoskeletal disorders.

A long healthy life requires not only disease-specific prevention and care, but also attention for more generic themes such as effective health communication. To ensure optimal care, issues such as taking patient perspectives into account in prevention and care, and patient safety are important. In the **Quality of Care** program, research focuses on the organization of care, for example regulations for end-of-life care, on health care professionals, for example educational programs in genetics, and on individual health care consumers, for example the quality of life of chronically ill and information needed to make health decisions.
Specific research themes are:

1. *Health, Communication and Decision Making.* Research concentrates on improving the quality of information about e.g., health risks and treatments, and improving the communication between patients and doctors in order to enable patients to have the role in the decision making process regarding their treatment.
2. *Disease, Disability and Participation.* Research focuses on personal factors and environmental factors that might hinder or help maintaining functional autonomy, participation and quality of life of people with chronic illness or a disability.
3. *Effectiveness and Safety of Care.* Describing and monitoring the quality and safety of both prevention and care is the focus of this theme. Important topics are the development and subsequent testing of specific quality indicators, as well as the effectiveness of interventions to improve collaboration between professionals or organization of care in order to optimize quality and safety of care.

2. Research environment and embedding

2.1 VU/VUmc Campus

Throughout the assessment period (2010-2015) the VU University Medical Center (VUmc) and the Vrije Universiteit (VU) were governed by a single body, the 'Foundation VU-VUmc'. In 2016, a partial

separation in governance was needed to satisfy the legal conditions (anti-trust) for a merger between the VU University Medical Center and the Academic Medical Center Amsterdam, but the Faculty of Medicine still fully resides within the VU and all full professors at VUmc are appointed also at the VU. The VU employs about 4,700 persons of which 3,000 are research staff (2300 FTE, 25% international) and caters to 23,010 students (~2,000 international). VUmc employs over 7000 persons (6000 FTE) of which 1100 are research staff. In 2015 about 23,000 patients were admitted to VUmc for inpatient care, 26,500 were admitted for day and outpatient care, and 30,000 patients were included in the emergency department in VUmc.

VU and VUmc have organized their research activities in interdisciplinary research institutes in a total of four campus-wide domains. VUmc is the largest participant in the Human Health & Life Sciences domain with five research institutes, the Cancer Center Amsterdam, Neuroscience Campus, Cardiovascular (ICar-VU), MOVE, and the EMGO$^+$ Institute. Although each of these institutes have a clear focus, various areas of collaborative overlap exist, and some departments partake in two institutes. Four of the larger EMGO$^+$ research topics that cross the border of the institutes are Quality of Life in Cancer (with CCA), basic mechanisms in musculoskeletal health and revalidation (with MOVE), the Diabetes Centre (with Cardiovascular), and basic mechanisms in psychiatry (with Neuroscience).

Close connectivity to the four other *VUmc research institutes* is realized in the VUmc Research Council, where the dean and the directors of the 5 research institutes jointly shape the general research policy and infrastructure, and identify areas of potential collaboration (or inefficient overlap). EMGO$^+$ also maintains collaborations with other *VU research institutes* by participation of the EMGO$^+$ director in the biannual discussion of general VU research policy of the VU Rector with all research institute directors and the Faculty research directors.

2.2 Organization of the EMGO$^+$ Institute

As outlined in *Supplement B* the governance of our institute is characterized by broad involvement of the key opinion leaders (e.g., department heads and program leaders chosen from full and associate professors) in major research strategy and policy decisions, and an institute-wide involvement in major quality control cycles, based on community service by institute participants in three committees. A lean (3.0 FTE) administrative structure is maintained for day-to-day management of the institute, its many external relations, and the multiple roles of the institute in the organization of VU/VUmc research.

2.3 National Collaboration

A major driver for research in the EMGO$^+$ Institute is to have an impact on daily health care practice and policy. For this we maintain a large number of Academic Collaborative Centers with health care providers, government bodies in public health at different levels (municipal, provincial, national), insurance companies, and other stakeholder organizations (see Figure 1).

An **academic collaborative center** is a formal collaboration between EMGO$^+$ and a practice setting to conduct practice-based research of strong methodological rigor. In these collaborative centers, practice, research, education and policy are brought together by direct collaboration between clinicians, teachers, researchers and managers. For a large part, funding for the research done within the academic collaborative centers comes from the societal stakeholders (e.g., companies, services, institutions) themselves.
In 2013 a midterm review of the EMGO$^+$ Institute that was conducted by the University Review Committee, the academic collaborative centers of EMGO$^+$ were hailed as a 'best practice' for the VU research institutes.

Figure 1 – Health care providers, companies and institutions that EMGO$^+$ closely collaborates with

A second major source of national collaboration are joint projects with (semi-)governmental applied research institutes (e.g. Netherlands Organization for Applied Scientific Research -TNO, National

Institute for Public Health and the Environment –RIVM, National College of Health Insurance, Netherlands Institute For Health Services Research –NIVEL, Trimbos Institute Utrecht, and the Dutch Healthcare Institute).

To link EMGO+ to these non-university based societal stakeholders in health care research or in applied research institutes we often employ professorships by special appointment. There were 34 professors by special appointment active in the EMGO+ Institute in the past six years, usually on the basis of a 0.2 FTE appointment. A full list of professors by special appointment is provided in Appendix 1.

2.4 International Collaboration

Outside of the VU/VUmc campus, EMGO+ researchers have extensive national and international collaborations, the majority of which are academic in nature and concern joint participation in program grants (e.g., Horizon 2020 or Marie Curie ITN, EU), multicenter trials, meta-analytic consortia, exchange of datasets and software tools, exchange of staff and (PhD) students, European policy development, and joint papers or educational modules.

The full list of recorded international collaborations is provided in Appendix 2 (for most consortia and other research networks, only the coordinating institute is specified in the Appendix). From 2010 to 2015, EMGO+ received 25 visiting professors/fellows (see Appendix 1) all with an honorary appointment (presence at the institute is typically condensed in a few periods of weeks/months yearly). These appointments support longstanding international collaborations or act to forge new ones.

3. Composition

The multidisciplinary nature of the EMGO+ Institute is amply illustrated by the diversity of the participating departments listed in Table 4 in *Supplement C*. Taking 2015 as the example, the VU University Medical Center is the largest contributor with ~211 research FTE, followed by the VU Faculty of Behavioural and Movement Sciences (~79 research FTE) and the VU Faculty of Earth and Life Sciences (~42 research FTE). The ratio VU/VUmc formation in FTE is 37% / 63%.

From 2010 to 2015 the number of researchers participating in EMGO+ increased from 498 to 721, and the total amount of time spent by them on actual research increased from 285 to 332 fulltime equivalent (FTE) person years. The procedure for researchers to participate in EMGO+ is described in *Supplement C* and the breakdown of the EMGO+ researcher community per job category over the last six years is provided in Table 5. Again taking 2015 as the example, a total of 27% of the researchers' salaries comes from direct University funding. An overview of the various sources used to finance EMGO+ personnel is shown in Table 6 in *Supplement C*.

The full list of EMGO+ researchers in 2010-2015 is provided in Appendix 3. In total 1143 researchers participate or have participated in EMGO+, of which ~9% was employed in all six years and between 115 and 225 researchers enter newly each year. This reflects a gradual growth with a healthy turnover (mostly PhDs/postdocs) around a stable core of EMGO+ (mostly senior) researchers.

4. Scientific Quality and Relevance

4.1 Productivity

Publications or other forms of scientific output are considered EMGO+ output if and only if the institute has been mentioned in the affiliations of one (or more) of the co-authors, and the co-author was an EMGO+ researcher in the year of publication. Table 7 in *Supplement D* lists the numbers of refereed papers that were published from 2010 to 2015, as well as other scientific output. Although the bulk of the output is in the form of papers in scientific journals, EMGO+ researchers also produce many book chapters and professional publications in clinical practice oriented journals, thus contributing to the necessary knowledge transfer to professionals in several health care settings. Appendix 4 provides a full list of all 2010-2015 EMGO+ publications, ordered per program and by the main categories used in Table 7 (i.e., refereed, non-refereed, book chapters, professional, general public). Table 7 also lists the PhD theses completed in the period 2010-2015.

4.2 Benchmarks

Journal impact factors provide a first international benchmark to test the quality of the scientific output of the institute. We obtained the relative impact factors of all journals in which we publish using Thomson Reuter's journal citation reports (JCR) table. All EMGO+ publications from 2010 to 2015 were classified by the rank order of the journal as belonging to the top 10% or top 25% in their respective domain. We then counted the number of publications in top 10% and top 25% for the entire institute and each of the four programs. As shown in Table 1, **more than a quarter of our publications is in the top 10% of its field** and another 57% belongs to the top 25%.

Table 1 - Total number of refereed publications in 2010-2015 and proportion in top 10% and top 25% journals in the relevant research field, for the institute and per research program

	EMGO+	LOD	MH	QoC	MSH
Refereed articles	6184	1296	2178	1580	1130
Top 10% impact factor	1750 (28%)	341 (26%)	691 (32%)	348 (22%)	370 (33%)
Top 25% impact factor	3498 (57%)	754 (58%)	1340 (62%)	769 (49%)	635 (56%)

For this self-assessment, the Executive Board of the VUmc further asked the Center for Science and Technology Studies (CWTS; www.cwts.nl) of the University of Leiden to perform a bibliometric analysis of EMGO+ publications. In Table 8 in *Supplement D*, the results of the analysis for the entire EMGO+ Institute are presented, as well as the results for the separate research programs. According to the bibliometric analysis EMGO+ researchers co-authored a total of 4562 scientific publications in Thomson Reuters Web of science core collection between 2010 and 2014 with an **MNCS indicator of 1.56**. This reflects that the scientific impact of EMGO+'s research is 56% above world average in the scientific fields that EMGO+ contributes to. All EMGO+ research programs have a MNCS indicator above world average ranging from about 20% up to 75% above world average. In conclusion, analyses based on journal impact factors and the CWTS bibliometric approach show that the scientific impact generated by EMGO+ research across the past 6 years have remained substantial.

4.3 Academic Reputation

In the 2013 internal midterm review of the EMGO+ Institute by the University Review Committee of the VU it was concluded that "the results presented over the 2010-2012 period are impressive and the transparent and structured presentation of the institute's performance in the midterm review is exemplary. The EMGO+ Institute is a strong research institute with research programs that perform at a top level".

The excellent reputation of EMGO+ researchers is illustrated by the many invited lectures given at scientific meetings (Appendix 5), the awards and honors they obtained in the period 2010-2015 (Appendix 6) as well as their prominence in the organization of conferences and congresses (Appendix 7) and their gate keeping positions as grant reviewers, (associate) editors of international journals or executive board/committee members of academic societies (Appendix 8).

In our EMGO+ community four researchers have been awarded with the prestigious membership of the Royal Netherlands Academy of Arts and Sciences. Also one of our researchers has been honorably recognized and encouraged with the highest award in Dutch Science, the NWO Spinoza Prize. Furthermore the National Organization for Scientific Research has awarded two EMGO+ researchers with a VICI Award, which is targeted at outstanding senior researchers who have successfully demonstrated the ability to develop their own innovative lines of research, and to act as coaches for young researchers. Three EMGO+ researchers received a prestigious personal grant (2 advanced, 1 consolidator) from the European Research Council (ERC).

Researchers in the EMGO+ Institute coordinate and maintain a number of renowned cohorts and biobanks, including (ongoing) large scale cohort studies such as the Netherlands Twin Register (NTR), Netherlands Study of Depression and Anxiety (NESDA), Netherlands Study of Depression in Older Persons (NESDO), Netherlands OCD Association (NOCDA), Netherlands Longitudinal Study on Hearing (NL-SH), GENERATION2, Hoorn and West-Friesland Diabetes studies, The Amsterdam Growth and Health Longitudinal study (AGHLS), and the Longitudinal Aging Study Amsterdam (LASA). They also maintain (inter)national databases including the RAI and the LTCF Ysis database. To support cross-cohort standardization, the EMGO+ Institute initiated and funded the EMGO+ Cohort Booster

Project in 2015 to enrich these large-scale and on-going longitudinal studies within the EMGO+ Institute with a variety of existing geo-data.

5. PhD Program

From 2010 to 2015 there were 513 PhD students active in EMGO+. PhD trajectories typically last between 4 and 5 years in the Netherlands. Taking 2015 as an example, we had 277 EMGO+ PhD students working on their thesis within the institute, representing ~139 research FTE (see Table 5 in *Supplement C*). Of them 46 PhD students were external, i.e., they were not appointed by VUmc. A total of 52, 42, 61, 77, 58 and 93 PhD theses was produced in 2010-2015 respectively, the titles of which give a very good overview of the EMGO+ research output (see Appendix 9). As required by the Standard Evaluation Protocol (SEP), Table 2 summarizes the success rates of the PhD students who started their PhD program in the years 2007 to 2011. Of the 2011 cohort, 37% had already finished their PhD program in 2015.The majority of our PhD students (71%) successfully defended their dissertation within 5 years after the start of their PhD program. 11% of PhD students takes longer than 7 years or fails to complete their thesis. The majority of these latter students with a protracted PhD duration participate in 'combined PhD trajectories' in which they combine their medical residency with a PhD trajectory.

Table 2 (SEP D3d) – Duration and success rate of the PhD program

Enrolment		Success rates									
Starting Year	Total	Graduated in year <4		Graduated in year 5		Graduated in year 6		Graduated in year 7		Not yet finished	
		#	%	#	%	#	%	#	%	#	%
2007	39	3	8%	34	87%	1	3%	0	0%	0	0%
2008	91	25	27%	44	48%	9	10%	9	10%	1	1%
2009	61	15	25%	31	51%	11	18%	3	5%	1	2%
2010	117	29	25%	40	34%	11	9%	0	0%	37	32%
2011	86	18	21%	14	16%	0	0%	0	0%	54	63%
Total	**394**	**90**	**23%**	**163**	**41%**	**32**	**8%**	**12**	**3%**	**93**	**24%**

5.1 Quality of PhD training

All PhD trajectories in EMGO+ have to conform with the general rules and regulations detailed in the centralized PhD guidelines for VU/VUmc graduate programs (see VU Doctorate Regulations). These guidelines stipulate that an "education and supervision agreement (ESA)" is designed and signed by the PhD student and supervisors at the start of each PhD project, which typically lasts 4 to 4.5 years in the Netherlands. The ESA ensures the quality of the graduate program *at the beginning* of the PhD trajectory. It lists the obligatory and individually selected courses that the student must complete alongside the PhD research project for the amount of at least 30 credits in the European Credit Transfer System (1 ECT = 28 hours). The overall aim of the agreement is to ensure a course program that is tailored to the needs of the individual PhD student and project requirements.

The education (training) of a minimum of 30 ECTs can be categorized into three types of courses:

1) Compulsory courses selected by the VU/VUmc (Total: 3-5.5 ECTs)
   - Course on scientific integrity (2 ECTs)
   - Conference attendance (1 ECT without, 2 ECTs with (oral or poster) presentation)
   - BROK (if necessary, mandatory for projects that are covered by the Human Research Act (WMO)) (1.5 ECTs)
2) Compulsory courses selected by the EMGO+ institute (Total: 8 ECTs)
   - Courses focused on advanced (methodological) research skills (6 ECTs)
   - Transferrable skills (1 ECT)
   - Research meetings, expert meetings, seminars (1 ECT)
3) Elective courses (16.5-19 ECTs)
   - Courses focused on advanced (methodological) research skills
   - Transferrable skills
   - Courses that are subject-specific and related to the PhD project

Quality of the PhD thesis *at the end* of the graduate program is ensured by the Supervision Team and the Thesis Committee. The Supervision Team is composed of one or two promotors (full professors, often the PI(s) of the research proposal) and one or two co-promotors (daily supervisors of the PhD student). The Dean appoints the members of the Thesis Committee, which have no direct connection with the PhD project. They consist of 1 member affiliated with the PhD students' department, 1-2 members

affiliated with other VU or VUmc departments, and at least 2 members affiliated with a university other that the university that confers the degree (no co-authors). If sufficient quality is deemed present, the Supervision Team submits the PhD dissertation to the Thesis Committee. The Thesis Committee is responsible for the final assessment of quality and decides (majority) whether (1) the thesis can be defended by the candidate in public during a session chaired by the Dean, and based on the defense, whether (2) the doctorate can be awarded.

The EMGO+ Institute employs four instruments to support our PhDs *during* their graduate program: membership of the national CaRe graduate school, the EMGO+ PhD committee, our methodological expertise centers (presented in *Supplement E*), and the EpidM courses in epidemiology.

CaRe National Graduate School

All EMGO+ PhD students take part of the nationwide graduate school CaRe (www.researchschoolcare.nl) accredited for a second 4-year term by the Royal Dutch Academy of Arts and Sciences as a valid training program for PhDs in the areas of public Health and Primary Care Research. CaRe is a network organization of four major research institutes NIVEL, CAPHRI, RIHS and EMGO+. CaRe institutes are a source of useful PhD courses and also organizes specific PhD events during its annual meeting (e.g. in 2016 we held a PhD masterclass with the editor of BMJ, Fiona Godlee).

EMGO+ PhD committee

The EMGO+ PhD Committee advises the Executive Board on matters concerning education, supervision and assessment of PhD students. The PhD Committee is also responsible for reviewing the ESA in view of the VU PhD guidelines and EMGO+ specific demands. Their judgement is leading for the EMGO+ director who, on behalf of the Dean, gives formal accordance of the ESA to the team of (co)promotors. Beyond its advisory and review functions, the committee organizes the introduction of new PhDs into the institute and its committees and expertise, offers assistance when PhD students find themselves in a dispute with their supervisors, and directs and supports a 'PhD student intervision system' that connects a group of new PhD students to one of the PhD representatives to provide a way to discuss common or personal issues among each other. They regularly update the 'PhD manual' and the 'finish your PhD manual', which are documents that serve EMGO+ PhD students with the necessary information to start and finish their PhD projects successfully. Finally, the PhD members of the committee have a signaling function for their research program.

EpidM

The EMGO+ Institute has a long standing expertise in epidemiology, of which the EpidM master program, accredited by the Accreditation Organization of the Netherlands and Flanders (NVAO) is a prime example (www.epidm.nl). Apart from the standard arsenal of epidemiological techniques, EMGO+ researchers are made well versed in multilevel analysis, meta-analysis, genetic association analysis and mixed methods techniques. The latter are needed when addressing research questions that require a mix of quantitative and qualitative methods. For instance, quantitative methods can give insight in the frequency of a phenomenon, while qualitative methods can shed light on the way this phenomenon is experienced and impacts the life of people who encounter this phenomenon. Annual payments from the EMGO+ budget allow PhD students within the EMGO+ institute to receive a substantial reduction on the costs of EpidM courses.

5.2 Transition of PhDs to the labour market

Based on a sample of 200 alumni that were registered as PhD student in the years 2010 to 2015, exit numbers shows that 46% of our PhDs pursued a research career after graduation. 12% now works in healthcare, mainly as psychologist or psychiatrist (in training). Another 5% combines clinical work with research activities. 20% of the PhDs work for nonprofit organizations. The remaining PhDs pursue careers in consultancy, management of business development (12%), are employed by the government (3%) or are currently not employed (2%).

To encourage research within the context of public-private partnerships (PPP), EMGO+ launched an 'embedded' PhD program in 2014. These embedded PhDs work in a company setting on a research question relevant to that company, but with complete and independent scientific supervision from an EMGO+ researcher. Costs are shared by EMGO+ and the company, and the company takes care of the transferable / commercial skills training of the PhD student and offers the prospect of a job within the company (or similar ones in its sector) after the PhD project has finished. Details on the embedded PhD program are found in Appendix 10.

6. Research Integrity

The EMGO+ Institute attaches much importance to providing an environment that encourages good conduct in research and discourages misconduct. To do so it has a number of institute specific resources that strongly facilitate scientific integrity and scientific quality in all phases of research, including study design, data collection, data analysis and reporting.

6.1 Quality of the Research Process

The EMGO+ Institute employs a Quality Committee that is responsible for developing, implementing and maintaining a system for quality improvement and control for the institute. The **Quality Committee** advises the Executive Board of the EMGO+ Institute on quality issues and maintains the web-based EMGO+ quality manual (http://www.emgo.nl/kc/) that makes explicit all requirements, responsibilities and documentation for researchers during each phase of the research process (see Figure 2). The manual addresses issues regarding privacy and documentation, providing a structured overview how to properly document all important steps of a research project and how to handle and protect privacy sensitive data against unauthorized access, against theft and loss.

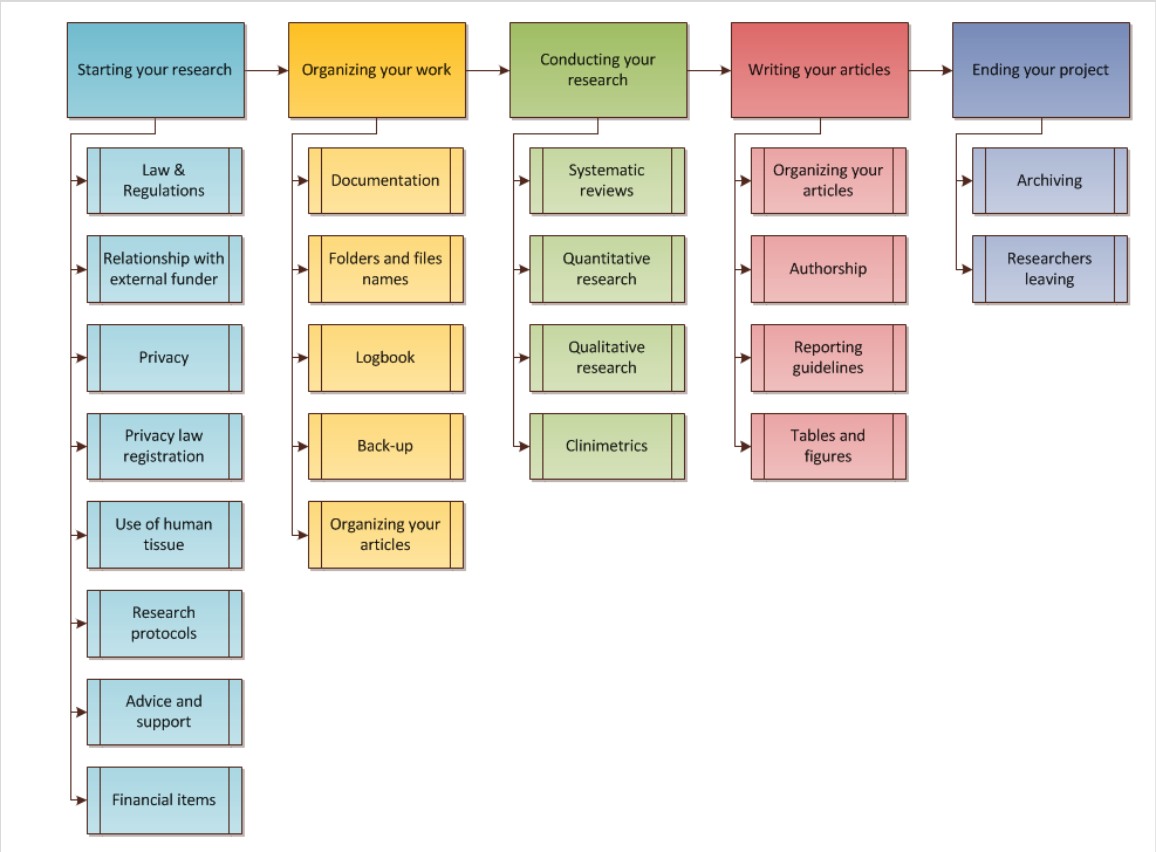


Figure 2 – Content of the online EMGO+ Quality Manual with stages of research as the main backbone

The Quality Committee consists of a representation of various professions, programs and departments of the institute and is supported by a quality officer, who also acts as the principal investigator of potential violations of research integrity brought to the attention of the Executive Board. The officer will suggest (and help implement) a course of action to correct such incidents. In 2015 for instance, four incidents of possible violations of privacy protection were reported to the quality officer, all of which have been handled through the appropriate channels. The quality officer yearly gives ~60 personal introductions in proper scientific conduct for newly appointed investigators, with a focus on privacy, medical ethical committee, experimental log books, data organization and back-up, and the guidelines in the quality manual guidelines most directly relevant to the individual researcher.

The Quality Committee also conducts in-depth audits on behalf of the institute. Yearly the Quality Committee audits ~20 research projects drawn from the total pool of ongoing studies. The aim of an on-site project audit is to provide information to the executing researcher and his/her project supervision team about what is going well and where improvements are needed, creating a dialogue

between the researcher, supervision team and two so-called auditors (one member of the Quality Committee and one junior/senior researcher from the institute). The researcher is asked to complete a self-evaluation prior to the audit. A question and answer session is held on the basis of the self-evaluation, the on-site visit and audit questions from the guidelines contained in the quality handbook. If actions have been planned following an audit, a follow-up may be undertaken to review whether the actions have been effective.

6.2 Quality and Feasibility of Research Proposals

The quality and feasibility of **all** research proposals that have been submitted to the Executive Board for formal inclusions in one the EMGO+ research programs is monitored and reviewed by the EMGO+ **Science Committee**. The committee also gives solicited and unsolicited advice to the Executive Board on all matters concerning research policy, and prioritizes awards and (travel) grant proposals funded by the institute itself. The Science Committee is a representative reflection of midcareer and senior scientists in the institute with at least two members from each of the four EMGO+ research programs.

After a check for completeness regarding all requirements (e.g., analysis plan, planning, personnel), the research proposal is sent to the appropriate program leaders to evaluate the proposal on its relevance to the EMGO+ mission and its fit within the program's scientific mission. When both criteria are met, the scientific quality of the proposal is assessed by reviewers recruited by the Science Committee. The reviewers assess the theoretical soundness of the research questions, the methodological quality and the feasibility of the proposal. In case of a negative assessment by (one of) the reviewers, the proposal will be assessed by a second (global assessment) or third reviewer (extensive assessment) who is a member of the Science Committee. The judgment of this reviewer will be final. The Science Committee sends its advice to the Executive Board that makes a final decision regarding approval of research proposals. Only after approval of the Executive Board, the research project described in the proposal will be embedded within EMGO+. The approval of the EMGO+ Science Committee is required before a proposal is submitted to the Medical Ethical Committee of the VU University Medical Center, which then conducts the second step of the Institutional Review, which is focused on the ethical aspects of the research. A full list of the 561 discussed proposals (of which 90% was approved in the year of submission) from 2010 to 2015 is presented in Appendix 11.

7. Earning capacity

As shown in Table 9 in *Supplement F*, the earning capacity of the EMGO+ Institute generally exceeds €21 million and shows an upward trend reaching ~ €25 million in 2015. This means that EMGO+ has continued to display the stable and strong earning capacity for which it was praised in the external evaluation of the 2004-2009 period. This is remarkable in the face of continued reduction in core (VUmc/VU) research funding and in the budgets of the national science funding agencies, and an increase in the volume of the competition in the European arena, leading to decreased *a priori* hit rates for collaborative grants.

Appendix 12 lists all grants and funding acquired by EMGO+ researchers in the period 2010-2015. Because our research is focused on societally relevant questions, we are confident that sufficient funding opportunities for EMGO+ researchers will keep presenting themselves nationally and internationally. Nonetheless, such confidence should not detract us from the harsh fact that the economic tide has not fully turned. The planned merger of the AMC and VUmc provides a unique opportunity to strengthen our visibility, by uniting an even larger number of Public Health researchers in a joint pan-Amsterdam research institute.

8. Societal Relevance

EMGO+ aims to produce excellent scientific research, but this research only fulfills its potential when it benefits society at large. Although analyses based on journal impact factors and the CWTS bibliometric approach may show that the scientific impact that EMGO+ research generates is high compared to the world average, we must acknowledge the limitations of these analyses. We specifically note that for the major aim of the institute, i.e. to generate scientific innovation that has a measurable **societal and clinical impact**, the analysis of journal or author impact factors is at best an incomplete instrument. Striving for societal impact not only justifies our use of public funds, but also provides focus for our research projects and direction for the institute's policy. We therefore use

the indicators proposed by the Dutch Health Council to also evaluate and monitor the societal impact of our research.

From 2010 to 2015 EMGO+ researchers contributed to at least 200 clinical guidelines / health policy reports on various topics, reflected in the form of co-authorships. These guidelines and policy reports contribute to evidence-based practice and thus represent an important aspect of the societal impact of our research. Examples of national guidelines that involved EMGO+ researchers are the national guidelines on a healthy diet published in 2015 and the national guidelines on physical activity and sedentary behavior (to be published in 2017 by the national guideline committee chaired by the EMGO+ director). A detailed list of these EMGO+ contributions to a directive, protocol or policy note can be found in Appendix 13. In addition to the clinical guidelines and health policy reports, there are articles in national professional journals, articles written for the general public and (chapters in) handbooks that we consider contributing to the societal impact of our research. These products are included in Appendix 4, in particular under the headings *professional* and *popular* publications. Appendix 8 lists the EMGO+ memberships of civil society advisory bodies in the public or commercial field through which we can translate our scientific insights directly into policy, medical practice and medical products.

The results of EMGO+ research projects attract substantial attention from the media (see Appendix 14). Our researchers were interviewed on television at least 115 times, and at least as many interviews on national public radio were broadcasted. Interviews and articles about research projects and their results were published locally or nationally in at least 385 newspapers (online and print) and 410 magazine articles (online and print) and in more than 80 different other online sources (e.g., weblogs, newsfeeds and online newsletters).The internet is arguably the most important source of health information. Therefore, websites can be highly relevant for measuring the societal impact of EMGO+'s research. The EMGO+ Institute maintains a number of own websites, in part conveying general information, in part explaining the rationale and/or the results of our ongoing research and research collaborations. The list of our most important websites is given in Appendix 15. A further indicator of societal impact is the many invitations EMGO+ researchers receive to deliver lectures to health care professionals, policy makers and non-professionals. Topics covered in these presentations can be gleaned from Appendix 16, which provides an overview of the 2010-2015 lectures for various non-scientific audiences. Our researchers are frequently involved in teaching programs based on the results of EMGO+ research projects. We have a major contribution to the regular curriculum of the bachelor and master programs of medicine (VUmc), psychology & educational science (VU FGB) and health sciences (VU FALW), as well as to the Master of Epidemiology. We also provide a substantial contribution to the 'life long learning' of healthcare professionals. Examples of EMGO+ involvement in this post initial education are listed in Appendix 17.

In order to have a true impact on the daily practice of extramural and clinical health care EMGO+ has established over the years a number of Research & Expertise Centers and its Academic Collaborative Centers. The Research & Expertise Centers active in 2015 are listed in Appendix 18. These centers cover specific topics of applied research and develop and provide expertise relevant to health care practice. Last but not least, Appendix 19 lists the EMGO+ Academic Collaborative Centers active in 2015, which are a major source of the application of our research in daily practice.

9. Future developments and strategy

9.1 Transformations in Health Care

Modern societies are facing impressive sociodemographic transitions. On the one hand fertility rates have fallen, on the other hand life expectancy has increased. As a combined effect of these two trends, we have an aging population that suffers more and longer from chronic diseases such as obesity, diabetes, cardiovascular diseases, and cancer. In addition, linked to urbanization and globalization, mental health problems such as depressive disorders, anxiety, and alcohol use disorders are increasing and they too rank among the conditions with the largest disease burden worldwide.
On top of demographic and epidemiological changes, shifting expectations about health and healthcare, technological advances and limited resources put additional pressure on the health care system. Meaningful participation in society and wellbeing and quality of life are now widely being recognized as a more important goal than the absence of disease. In parallel, medicine is shifting

from being doctor-driven to becoming patient-driven. Patient-important outcomes, client preferences, equity in the use of scarce resources have become central issues in health care.
The combination of ongoing (bio-)technological developments and the perceived need for shared decision making has pushed medicine into an era where more customization is both needed and possible. Personal genomes paired to information of the person's environmental exposome and, as importantly, the person's individual preferences will guide stratification and personalization in health care. Personalized medicine is no longer a buzzword but rapidly becoming a reality.
Personalization is furthermore not limited to care. Tailored prevention on lifestyle factors like smoking, physical inactivity, excessive sedentary behavior, and unhealthy dietary behavior through (tailored) behavioral intervention is increasingly recognized as an essential tool to curb the rising societal and economic burden caused by chronic disabilities and disorders, related sickness absence, work disability and (temporary) unemployment.
To respond to the dilemmas posed by a shrinking workforce in the care sector, we also need closer collaboration between science, (information) technology and industry. We have to design, test and implement innovative care solutions in the fields of e-health, assistive technology and robotics. With existing big data resources, such as electronic patient records, determinants of quality and safety of care can be analyzed and valid and useable indicators can be developed with relevant stakeholders, such as healthcare professionals, patients, informal caregivers, and policymakers.
The world also witnesses a strong globalization with unprecedented migration and urbanization. For the first time in human history more than 50% of the world's population lives in urban centers. This number is projected to increase to 70% by 2050. This requires a global health perspective.
Historically infectious diseases like HIV, tuberculosis and malaria were a major focus in low and middle-income countries. Increasingly, non-communicable diseases (NCDs), maternal health, and environmental determinants, such as climate change and conflicts and migration, are now major causes of concern impacting on health in low, middle, as well as in high-income countries. In addition, health care problems related to migration and urbanization, often linked to unfavorable lifestyle changes, are shared across the globe.
Two major local developments in Dutch health care (policy) add to these transformations in health care: (1) a shift from the primary funding/responsibility of health care provision from the national to the municipal level and (2) the displacement of monitoring and treatment of patients from in-hospital to extramural care settings, with a strong drive towards informal care within families and other social groups, and also more self-management of people with chronic health problems.

The above transformations and developments, paired to the rising health care costs, necessitate the generation, dissemination, and translation of knowledge based on sound research on public health. This knowledge will help decision-makers at all levels to assess health needs, create a healthy environment, strengthen the healthcare system and safeguard its sustainability, assist healthcare professionals in maintaining and improving their performance, and empower patients and citizens in managing their health.

Merger of the AMC and VUmc medical centers

The Amsterdam Metropolitan Area contains two of the eight national university medical centers, the VU University Medical Center (VUmc, affiliated with the VU Amsterdam) and the Academic Medical Center (AMC, affiliated with the University of Amsterdam). From 2014 to 2020 there will be a gradual merger of these two medical centers into a single academic medical center for Amsterdam affiliated with both Universities (which at a slower time pace are also preparing a future merger into a single University).

The director of EMGO$^+$ and the chair of the AMC division for Public Health and Clinical Evaluation research were commissioned in 2015 by the Boards of both medical centers to create an Amsterdam-wide research network organization, entitled **Amsterdam Public Health,** (abbreviated **APH**). The proposed organization must gradually grow out of the existing situation. At the VUmc and VU all Public Health research was almost entirely embedded in the EMGO$^+$ Institute. Public Health research at the AMC was more widely distributed across the organization. After we joined the total number of APH researchers now amounts to 1140, including over 200 senior investigators (i.e. associate and full professors). About two-fifths of the APH comes from the AMC, two-fifths from VUmc, and one-fifth form the Universities.

9.2 Research Programs Amsterdam Public Health

On the basis of consensus meetings with the heads of departments and their key opinion leaders in research, eight research programs were defined, targeting specific aims within selected research themes. Specific research themes within the programs were chosen, based on their societal

relevance taking the large transformations in health care reviewed above as our starting point. Additional perspectives were funding viability and the existing scientific expertise/resources within the new EMGO+/AMC researcher community. Because they are at the heart of our future strategy, we list the APH programs and their themes below in some detail:

Health Behaviors & Chronic Diseases
In this program we will measure, survey and study determinants of health behaviors. We will examine patterns of health behaviors, genomic and environmental determinants of these behaviors as well as their impact on chronic diseases and functioning. We will develop and evaluate (e- & m-Health) interventions to promote healthy behavior with the aim of reducing chronic disease morbidity and mortality and improve quality of life.

Mental Health
To understand the entire spectrum of mental health, this program will examine the development of (chronic) mental disorders, but will also encompass research on the determinants of mental well-being and quality of life. We will provide insight into risk and resilience factors in mental health, and develop evidence-based preventive strategies and interventions to reduce the burden of mental health problems. We will further facilitate research on the interface between mental health and somatic disease. This will include effects of stress and mental disorders on somatic disease processes, as well as common mental reactions to somatic diseases, such as anxiety, hope, and growth.

Societal Participation & Health
We will research new ways to prevent unemployment and to improve societal participation in patients with a chronic disease, with chronic health complaints or with complex work-related health issues. We will further examine how the increase of participation in competitive work (delayed retirements) interacts with other forms of societal participation like informal care or other forms of voluntary work. Our research will provide insights in the promotion of health behaviors in the working population, improve preventive and medical assessments in the occupational context, improve employee health guidance and study the etiology and prevention of work-related disorders and occupational diseases.

Aging & Later Life
This program aims to understand health changes in later life with interacting factors like medical conditions, physical functioning, and well-being. We will design and implement preventive, treatment and care strategies to improve quality of life, functioning and participation of older persons throughout the aging trajectory, with appropriate attention to ethical issue, e.g. the balance between prolonging life and maintaining wellbeing. Research will address issues of multi-morbidity, functional impairment, polypharmacy, atypical presentation, and personal preferences. A core concept will be resilience in relation to different adversities that older persons can be confronted with during the aging trajectory.

Quality of Care
To improve patient safety we will study the role of various technical, professional, organizational, regulatory and patient-related factors in causing errors and adverse events, and we will design and implement solutions to create a safer healthcare environment. We will promote equity by developing, improving, implementing and evaluating measures to reduce or eliminate undesirable variability across patient groups and population subgroups, in access to healthcare, healthcare processes and outcomes. We will develop and focus on person-specific outcome measures, and will evaluate the (cost)effectiveness of shared decision making and healthcare interventions that take into account ethics, person characteristics and preferences.

Personalized Medicine
In this program, the healthcare responsiveness to the cultural, ethnic, socio-economic, and psychological, metabolic and genomic diversity in the population will be studied to optimize prevention and treatment, including reduction of side-effects, by 'tailoring' to this diversity. For tailoring we will rely on existing approaches (e.g. prediction modelling), but will also develop new techniques for risk profiling, classifying and stratifying patients and other clients, to predict benefit or harm from diagnostics and interventions. We will in parallel study how future healthcare professionals can be better trained to be receptive and effective to differences in patient diversity, presentation, needs, and goals.

Global Health
Research in the global contributes to health for all in a global context through inter- and transdisciplinary collaboration that fosters interaction between theory, policy and practice. Our research will provide insights in key issues in the role of urbanization on health in low-resource settings, and the vulnerable migrant population globally, including in high-income countries. We also study factors affecting maternal health and the health of the early life, including poverty, malnutrition, low education and poor access to healthcare services. We study surveillance, disease program evaluations, transmission models, antimicrobial resistance, and preventive strategies of several communicable diseases. Research will also be used to support health systems strengthening particularly in low-resource settings.

Methodology
There is a constant need for the development, application, validation and implementation of the methods and instruments in every step of the scientific process, from the definition of a new idea until the delivery or implementation of a health (care) product. Therefore, APH spawned a dedicated research program to develop, apply, evaluate, and broadly implement new instruments and methods. These will include elements of epidemiology, biostatistics, informatics, clinimetrics/ psychometrics and may be organized in a flowchart model of four *phases* that naturally correspond to the lifecycle of (empirical) research: *Define*: we will develop core outcome sets, risk factors, and predictors in multiple areas in healthcare, construct patient-reported outcomes, and evaluate improved study designs. *Collect*: we will research the development, adaptation and evaluation of record linkage, interoperability and automation methods for big data analytics. *Model and interpret*: we will be engaged in quantitative genomics, disease and system (etiological) modeling, predictive (diagnostic and prognostic) modeling, meta-analysis and causal inference. *Knowledge delivery*: we will study audit & feedback mechanisms, computerized decision support systems (CDSSs), the understanding of communication with the patient, and how shared decision-making can be facilitated.

Cross-program and cross-institute collaborations

The eight programs form the main **communities of research** in the APH Institute, but they are not strictly separated silos. Each program has a core of about 150 researchers, with junior researchers confined to a single theme, but the more senior researchers will often participate in more than one theme in the program, or in themes across *different* programs. Together with the sharing of the longitudinal cohorts and biobank resources, they provide the linking pins across programs.

In keeping with the pan-Amsterdam and multidisciplinary character of the research, the APH Institute cuts across universities, medical center divisions and departments. Part of the departments that participate in the APH institute will also have researchers who participate in one of the **seven other research institutes of the merged medical centers** and various senior researchers will have a dual membership. Specific examples of cross-institute collaboration are on topics like *quality of life in cancer* (APH with the Amsterdam Cancer Center), *exercise is medicine* (APH with Amsterdam Movement Sciences), *genetics and/or biomarkers of anxiety and depression* (APH with Amsterdam Neuroscience), *diabetes care* (APH with Amsterdam Cardiovascular Sciences), *twinning and fertility* (with Amsterdam Reproduction and Development) and *HIV epidemiology* (APH with Amsterdam Infection and Immunity).

Amsterdam Public Health Partner Organizations

Collaborations with strategic partners are essential elements in the research institute for reaching its goals. The APH institute will be the major interface between in-hospital health care of the merged University Medical Center and the vast extramural health care field in and around Amsterdam. The institute will therefore strengthen its collaborations with **other knowledge institutes in the fields of primary care and public health**.

APH will further consolidate the longstanding and only partially overlapping ties of both AMC and VUmc to (scientific) professional organizations, government bodies in public health at different levels (municipal, provincial, national) and stakeholder organizations. The successful strategy for bringing regional partners together, **academic collaborative centers**, will be continued in full, again extending those linked to VUmc with those linked to AMC.

9.3 From EMGO+ to Amsterdam Public Health

Amsterdam Public Health is led by two directors, an AMC director (prof Judith Sluiter) and the current director of the EMGO+ institute (prof Eco de Geus). The eight new programs formally started in 2016, headed by two program leaders and four senior program council members. One of the 'old' program leaders of each EMGO+ program has taken a role as program leader in the new APH programs and often the other is a member of the program council. This ensures that they can help researchers' transition smoothly from EMGO+ to APH. The bulk of the flows in the transition from old EMGO+ to new APH programs follows the arrows depicted below (but note that many arrows for small groups of researchers following different paths could have been drawn as well):

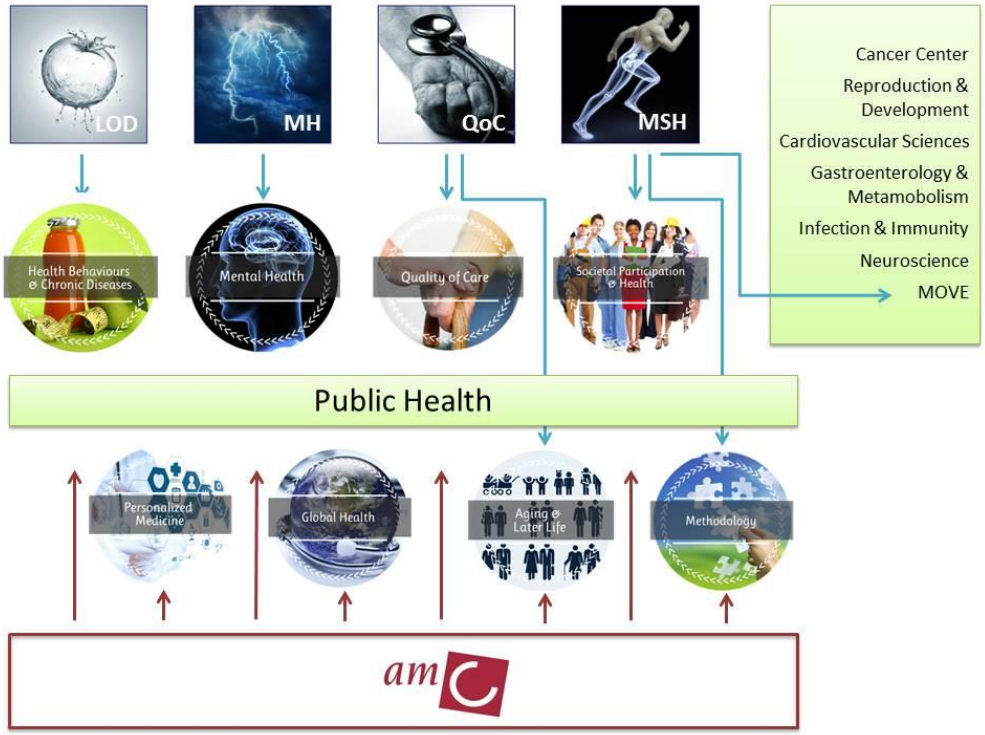


Figure 3 – Migration scheme EMGO+ researchers to Amsterdam Public Health

Briefly, the EMGO+ LOD, MH and QoC programs transition to their parallel programs in the APH. A major change for the Quality of Care program is the creation of the (long due) separate Aging & Later Life program. The merger has the largest impact on the EMGO+ Musculoskeletal Health program. Large parts fit perfectly in the Societal Participation and Methodology programs, but other parts may fare better in the new Movement Sciences Institute, that will have a strong focus on basic science and clinical mechanisms in musculoskeletal disorders, sports medicine and sports injury prevention. All programs, but in particular the Global Health, Personalized Medicine programs will receive strong input from the AMC.

What does this major development mean for our viability?

Amsterdam Public Health will be a center of excellence for multidisciplinary research on risk and protective factors, on effective prevention and intervention, and on health policies and practices. We build on the 23 years of the EMGO+ tradition and pair it with excellent reputation of the AMC in the Public Health domain. Although there is no simple recipe for continued success, major characteristics for building a strong institute - irrespective of joint housing - can be delineated. These include a consensus on shared leadership in the various research programs, a strong strategic and complementary research agenda, a shared, excellent graduate training program, shared infrastructure for methodology, quality control, cohort-studies and their biobanks, and last but not least a strong network of local and societal stakeholders. We firmly believe APH has lined up all ingredients to create a world-class pan-Amsterdam research institute in the next five to ten years. In short, the clear synergy derived from merging two healthy communities of researchers with complementary skills, the full integration in the two Amsterdam universities, the strong ties with regional partners in research and practice, and the merger of our national and international research networks should enable us to **rank among the major institutes of Public Health worldwide**. This is, unambiguously, our aim for the future.

10. SWOT Analysis – EMGO+ Institute

Strengths

- High volume and high quality scientific output on major multidisciplinary research themes.
- Widely respected for its methodological rigor and promotion of the quality of the scientific process and scientific conduct.
- Internationally renowned longitudinal cohort studies (e.g. LASA, NESDA, NTR, Hoorn, Generations2, AGHLS).
- Longstanding focus on translational research and impact (e.g. through academic collaborative centers with regional stakeholders, and collaboration with many clinical departments and national public health and primary care institutions).
- Large societal relevance, as indicated by memberships of national and international policy advisory groups and frequent media coverage.
- Good performance in the acquisition of external research funding (76% of total funding), even in the face of dwindling national research funding.

Weaknesses

- The large scope of the research in EMGO+ is one of its strengths but at the same time impedes the exceptional research that becomes possible with a very focused channeling of resources.
- Underdeveloped networks with SME (Small and medium-sized enterprises) and industry for public private partnerships and low attractiveness of public health research themes to philanthropists.
- Small number of (tenured) staff members (relative to the large number of PhD students).
- Modest number of international staff and PhD students.

Opportunities

- AMC/VUmc collaboration within the new Amsterdam Public Health (APH) Institute greatly expands and strengthens the existing research themes in the LOD, MH and QoC programs and brings new programs that, amongst others, allow us to:
  - Attract international talent to the combination of two strong brands, "Amsterdam" and "Public Health".
  - Become the major player in the public health research and policy development arena in the Amsterdam Metropolitan Area.
  - Create coherence in our research on Aging and Later Life, doing justice to the societal urgency and the substantial amount of EMGO+ researchers working on this theme.
  - Expand our Health care (services) research to Global Health care (services) research.
  - Create a program completely dedicated to innovation in Methodology.
- EMGO+/APH research themes figure prominently on European research agenda (Horizon 2020) and the National Science Agenda.
- New sources of research funding from industry related to E-health and M-health applications in prevention and care settings.
- Growing focus on patient perspectives in health care, including patient participation, personalized medicine, shared decision making, and patient rights.

Threats

- The complex merger of VUmc and AMC also brings risks:
  - The naturally strong bond between the two merging university medical centers may drive a wedge between the tight on-campus collaboration between the VUmc and the VU University that needs to be willing to accommodate this large and powerful "third" party.
  - Cultural difference with the AMC: AMC does not have a research institute tradition, but instead organizes its research strongly around principal Investigators.
  - The attention to primary care and public health research may dwindle in the new merged medical center if it chooses to focus more strongly on specialized (tertiary) care and in-hospital patient groups.
  - The substantial growth of the institute may lead to loss of the sense of belonging and poor identification of the researchers with the new APH "brand".
- General thinning of mid-career levels, aggravated by new national laws on temporary contracts (maximum of 2, total 4 years) and impoverished career perspectives for PhDs and postdocs.
- Increasing dependency on external funding (to counter the above) comes with a threat to high risk projects and true innovation.

In 2010-2015 Self-Assessment *supplements*

Supplement A – Changes in EMGO+ policy based on the 2010 EEC recommendations

Looking back on the period of 2004-2009, the 2010 External Evaluation Committee (EEC; Prof. Harry Rooijmans, Prof. Jozien Bensing, Prof. Cyrus Cooper, Prof. Peter Croft and Prof. Simon Griffin) was hugely impressed by the high quality of research and the way in which the EMGO+ Institute is organized. To ensure continued success, a number of recommendations were made by the EEC in their management letter. These have been the base of important changes in our policy across the 2010-2015 period. Below, we list the main points made by the EEC for the institute and its programs and indicate how we have aimed to respond to these valid recommendations.

Institute
"The EEC is evaluating an interfaculty institute and not the university as a whole. Therefore, we cannot make any statements about distribution of resources within the university, but EMGO+ would be likely to benefit from a system of allocation directly to the institute based on performance indicators such as the acquisition of external funds. This could prevent the development of a situation in which EMGO+ becomes the victim of its own success."

In spite of these recommendations to the Executive Boards of the VUmc/VU, EMGO+ (and all other Vu/VUmc research institutes) continue to operate as a matrix organization, which means that allocation of research funds based on performance indicators such as the acquisition of external funds is directly from the Boards to the departments. However, the Boards do pre-allocate structural funding of around 1 million € annually to EMGO+ (which VUmc subtracts from its structural funding to the departments).

"The EEC recommends introducing a system that enables the institute to provide exact numbers on the duration of PhD-trajectories, completion rates and their subsequent career destinations."

In response we have set up a PhD monitoring system to provide the exact numbers of PhD students, the phase of their research, and the total time spent in the PhD trajectory in each annual report since 2010. An Alumnus network (through LinkedIn since 2014) now provides us with information on how they fare after they obtain their doctorate.

"The EEC suggests that a critical review of the impact of the current PhD:senior research staff ratio on strategic focus, collaborations and leadership, might be helpful."

The ratio of PhD students to other scientific staff is ~1.5 in EMGO+ (see Table 5 in *Supplement C*). This may misleadingly suggest that they only have 1 to 2 supervisors. In practice, however, senior staff (i.e. assistant professor and up) supervise an average of 5 to 10 PhD students, and most PhD students have 2 to 3 supervisors. This is not an unusual ratio in the Netherlands. Notwithstanding, we do share the committee's concern about the small number of senior staff members relative to the large number of PhD students in the current (Dutch) academic climate. Other than in the PhD committee, the PhDs have not been tasked to contribute to strategy and research policy. They do play a key role as linking pins in international collaborations but are not expected to take the initiative for such collaboration.

"The EEC would welcome explicit strategy discussion within the institute and between the institute and the board on the relative importance attached to Crown-indicator and indicators of societal relevance, and consideration of development of markers of the latter."

In response to this important concern we have expanded our annual reports from 2010 onwards to contain a set of markers of the societal impact of our research. Please note that we explicitly added "to improve practice" and "a focus on societal relevance and impact on daily clinical practice" to our mission and objectives. Our continued efforts to expand our academic collaborative centres hopefully show that we take our mission seriously. We have aimed at stating our dual appreciation of high quality scientific output and measurable societal impact more clearly in the current self-evaluation and we confidently look forward to the Committee's evaluation of this aspect of our institute.

"The EEC is happy to see initiatives around fellowships within EMGO+ aimed at strengthening the postdoc early- and mid-career opportunities for talented researchers within the institute. However,

in view of the number of people who are working within the institute, the number of fellowships is relatively small and the EEC considers there is a deserving case to increase the number of fellowships."

The EEC sharply recognized the danger of a reduced flow through the mid-career level. Attracting promising post-docs and enabling tenure tracks for successful postdocs is key to research talent policy. We proudly point out that we have spent a large amount of our structural funds to post-doc fellowships and to securing longer term research funds for young assistant professors. From 2009-2013, we appointed (for 2 years) four "glue" postdocs to support cross-program research, and one "glue" post-doc to support cross program research methods development. The glue aspect refers to the fact that these postdoctoral leaders engaged in innovative research that crossed program boundaries. In addition, in 2013-2017 we funded four experienced post doc researchers for two years with the explicit task to participate in the grand challenges collaborative projects of Horizon 2020. These postdocs continued their research while also freeing up considerable time for grant writing and consortium formation/participation. We also funded a post-doc to coordinate our cohort booster, the enrichment of our cohorts with geo-data. Lastly, in 2015 we funded 4 post-doc/assistant professors who had made it to the 'finals' of the NWO personal grant competition but who were not awarded because of the fierce reduction in funding for these programs in the past years. As can be derived from Appendix 3, the number of mid-careers levels (e.g. assistant and associate professors) remained relatively stable over the past five years, i.e. between 135 individuals in 2010 and 138 in 2015.

1. Lifestyle, Overweight and Diabetes
"The EEC recommends a strengthening of the collaboration between the different parts of the programme, as well as with other programmes and utilization of other well-characterized study populations, in parallel with some consideration of strategic direction."

The program has its origin in a Diabetes Mellitus program that was changed to Lifestyle, Overweight and Diabetes in 2004. From 2004-2009 the emphasis was on developing the 'lifestyle and overweight' aspect while maintaining our contribution to the evidence-base diabetes care and innovation of such care (we developed a risk assessment tool for the identification of type 2 diabetes in potentially high-risk adults not previously diagnosed with hypertension, hypercholesterolemia which was implemented within the Dutch Primary Care guideline 'Prevention Consult'). We can understand that this created the impression of two distinct parts in 2009. To accommodate the valuable suggestions of the external evaluation committee we have appointed two post-doc researchers with the explicit aim to increase the cohesion between diabetes and lifestyle research (Hanne van Ballegooijen and Femke Rutters, please see Appendix 4 for their productivity). Furthermore, in developing lifestyle and overweight research we focused strongly on physical (in)activity and dietary intake behaviors. These are the major behavioral risk factors for diabetes, and targets for primary as well as secondary and tertiary prevention in diabetes. Many of our projects took place in these prevention domains. Our strategy to increasingly focus on the these behaviors is reflected in the appointment of the two current program leaders, energetic female full professors with an impressive track record (Mai Chin A Paw & Ingeborg Brouwer) even uncorrected for their young age. We further recruited Dr Joline Beulens as an associate professor within our ranks. Joline brings extensive experience in research on cardiovascular risk factors in diabetes patients, epidemiology of dietary habits, and the management of large cohorts like Hoorn/West Friesland. In recent years, research on measurement, interventions and health effects of sedentary behavior has become an important theme, with a particular focus on cardiometabolic effects. We are currently developing interventions for healthy as well as patient groups. In conjunction with the mental health program, the LOD program has developed interventions to increase the mental health of diabetes patients. Improved utilization of our cohorts was seen in basic research on the etiology of overweight and diabetes: the NESDA, Hoorn, and NTR cohorts have all partaken in the 'gene finding' revolution and are loyal contributors to GIANT, MAGIC, EGG and ENGAGE genomics consortia.

2. Mental Health
"The EEC thinks that it is of importance to strengthen the content and aims of the basic science links and studies, as well as the program's focus on primary prevention."

Under supervision of the program leaders three major changes have taken place over the past 6 years that address these recommendations:

- The NESDA cohort, together with the Netherlands Twin Registry have become part of the major genome-wide association consortia worldwide, including the Psychiatric Genetics

Consortium. This has led to a flurry of 'omics' activities with NESDA/NTR publishing the largest eQTL study to date and the largest metabolomics GWA meta-analysis. Recent successes include the GWA meta-analysis for wellbeing and depression. These studies have provided vast links to bioinformatics and functional annotation groups, helping to create the basic science links alluded to.

- The Psychiatry and Biological Psychology departments also participate in the Neuroscience Campus institute (and the ENIGMA consortium) and studies using MRI are interbred with the longitudinal data on anxiety and depressive symptoms/disorders, again creating a link between the epidemiological and basic science perspectives.
- Researchers from Clinical Psychology and Psychiatry have been hugely successful in developing and implementing internet-based therapies for anxiety and depressive disorders and using e-health tools for behavioral activation, which is now increasingly shifted into the domain of prevention. In addition, other large-scale prevention projects, e.g. intervening on nutrition, vitamin D deficiency and sleep, are currently taken place for which (inter)national funding has been obtained over the last years.

3. Quality of Care
"In order to avoid the Quality of Care programme simply becoming the place where research is done which cannot be allocated to any of the other three programmes, it is very important that a fundamental discussion is initiated by the directorate of the institute and the program leaders on the nature and direction of the research within this programme."

In response to this concern, the program has been completely redefined. It still has a broad scope, because it is linked to quality of in-hospital as well as extramural (long term) care. However, the program is now confined to three research themes:

- *Health, Communication and Decision Making.* Research concentrates on improving the quality of information about e.g., health risks and treatments, and on improving the communication between patients and doctors in order to enable patients to take their role in the decision making process regarding their treatment (e.g. end-of-life research)
- *Disease, Disability and Participation.* Research focuses on personal factors and environmental factors that might hinder or help maintaining functional autonomy, participation and quality of life of people with chronic illness or a disability.
- *Effectiveness and Safety of Care.* Describing and monitoring the quality and safety of both prevention and care is the focus of this theme. Important topics are the development and subsequent testing of specific quality indicators, as well as the effectiveness of interventions to improve collaboration between professionals or organization of care in order to optimize quality and safety of care.

The program leaders still give room to the early development of new emerging research topics (incubator function) but they now need to fit these themes. This has provided a much clearer focus.

4. Musculoskeletal Health
"The EEC recommends more discussion on the future vision and research strategy regarding this programme, including linkage with other disciplines within the University, with clinical services (Rheumatology and Orthopaedics), and with more fundamental sciences (such as imaging and biomechanics)."

The program leaders of the Musculoskeletal Health program have taken this to heart. They have actively pursued links between the program both with clinical units and more fundamental disciplines. Specifically, this has led to (1) the founding of the Amsterdam Spine Center, which is a collaboration with, among others, researchers from Musculoskeletal Health program and those from Orthopaedics, Neurology, Traumatology, Rehabilitation, and fundamental Human Movement Sciences (this Amsterdam Spine Center recently had its 9th research meeting), (2) the initiation and conduction of several joint (PhD and postdoc) projects with these clinical departments, (3) the facilitation of writing and submitting joint grant proposals with these clinical departments, e.g. for funding agencies such as Horizon 2020, ZonMw, and NWO, (4) the active promotion of closer collaboration between Musculoskeletal Health program and more fundamental science programs in the MOVE research institute.

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Supplement B – Organization

Figure 4 outlines the organization of the EMGO+ Institute from 2010 to 2015. Strategic management lies with the **Executive Board** consisting of the Director and two members selected from the senior staff of the departments participating in the EMGO+ Institute.

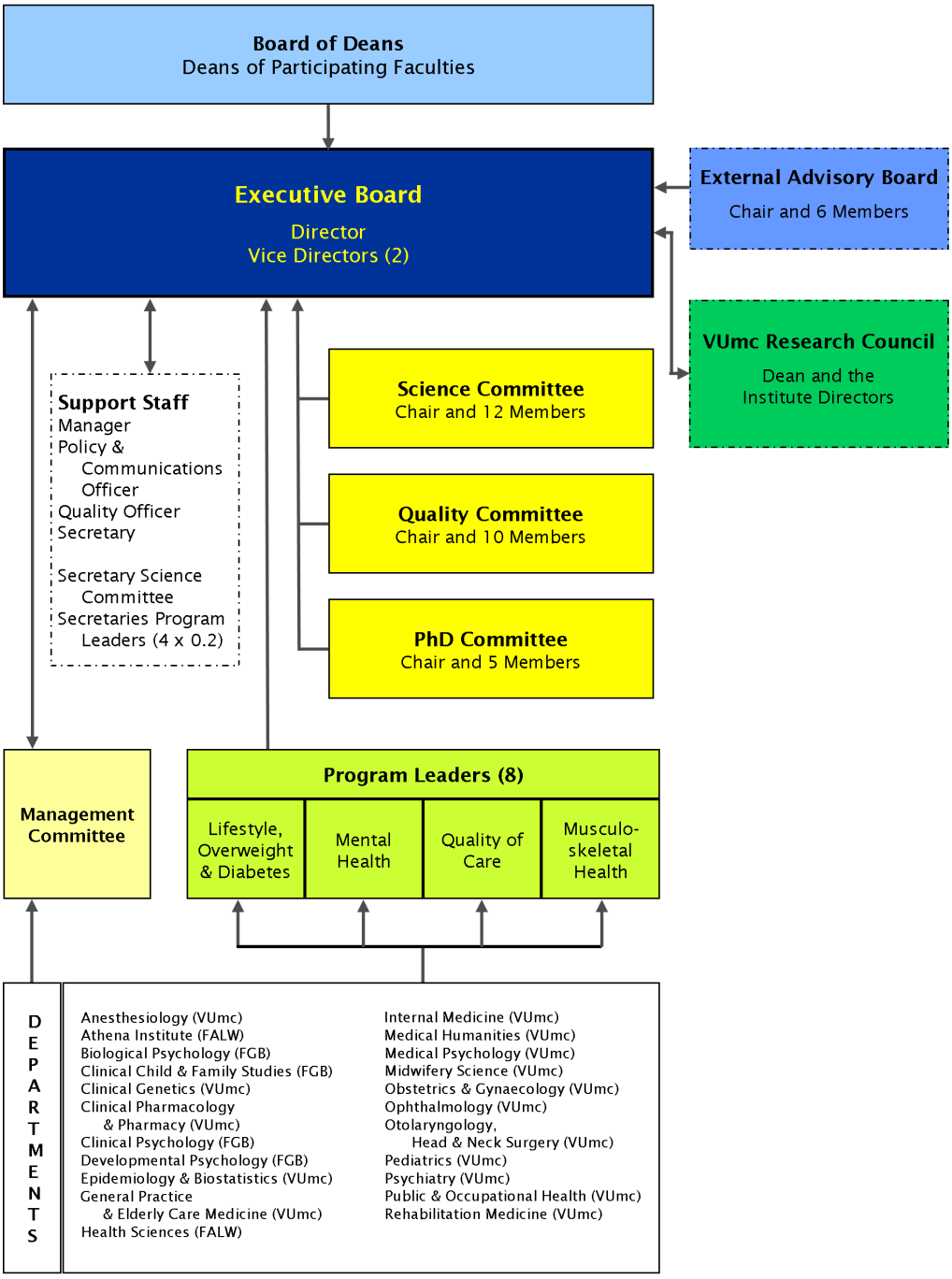

Figure 4 – Organization of the EMGO+ Institute

The Executive Board answers to the **Board of Deans** representing the VU University Medical Center, VU University Faculty Earth and Life Sciences, and VU University Faculty Behavioural and Movement Sciences. Strategic advice on positioning of the institute in the national and international context is obtained from the **External Advisory Board**, the composition of which is shown in Table 3.

Intercollegiate connectivity with the directors of the four other *VUmc research institutes* is realized by VUmc Research Council membership of the EMGO+ director. The Research Council, headed by the VUmc dean, advices the **VUmc Executive Board** on the general research policy and the research

infrastructure of VUmc. Intercollegiate connectivity with the directors of the other *VU research institutes* is realized by participation of the EMGO+ director in the biannual discussion of general VU research policy of the Rector with all research institute directors and the Faculty research directors.

The Director and the Manager assisted by administrative support staff and three Committees recruited from volunteers carry out the day-to-day management of the institute. The Science Committee discusses and, with the help of reviewers, judges all project proposals and consists of a mix of midcareer and senior scientists representing EMGO+ scientific and methodological expertise. The Quality Committee is supported by a quality officer. Their role is to introduce all EMGO+ researchers to the quality guidelines laid down in the EMGO+ quality handbook (www.emgo.nl/kc/), to advise on policies regarding scientific quality and integrity, and to perform yearly audits of research projects. The PhD Committee organizes the introductory day for PhD students, maintains an intervision system for PhDs, and reviews the PhD training- and education plans. It also produces PhD handbooks with tips and tricks, including the 'Finish your PhD' manual to guide students through the final six months of their PhD project.

The eight program leaders provide the scientific leadership of the institute. Per program they ensure sufficient interfaculty cross talk and scientific focus within the program. Together with the Executive Board they facilitate productivity in scientific and societal output as well as in external fund raising. Broad support for scientific and strategic policy is ensured through quarterly meetings of the Executive Board and program leaders with the Management Committee that consists of the heads of the departments with a large participation in EMGO+.

At the VU University the largest participation comes from the Health Sciences and Clinical Psychology departments, whereas at the VU University Medical Center the departments of Public and Occupational Health, Psychiatry, General Practice & Elderly Care Medicine, and Epidemiology and Biostatistics are the largest participators in keeping with the extramural roots of the institute. However, there is also a strong participation from a diversity of clinical departments (e.g., Clinical Genetics, Otolaryngology, Head & Neck Surgery, Medical Psychology, Internal Medicine, Pediatrics) reflecting the importance of clinical evaluation research and evidence-based practice in trans- and intramural research.

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Table 3 – Advisory Board of the EMGO+ Institute in 2010-2015

Name	Affiliation and Function during membership Board	2010	2011	2012	2013	2014	2015
Prof. S.E. (Simone) Buitendijk	Vice Rector Magnificus, Member of the Executive Board of the University of Leiden, and Professor of Women's and Family Health at the University of Leiden	x	x	x	x	x	x
Prof. W. (Willem) van Tilburg	Head of the Department of Psychiatry and Professor (Emeritus) of Clinical Psychiatry at the VU University Medical Center	x					
Prof. R. (Richard) van Dyck (chair)	Head of the Department of Psychiatry and Professor (Emeritus) of Psychiatry at the VU University Medical Center		x	x	x	x	x
Prof. P.C. (Peter) Huijgens	Director of the Institute for Cardiovascular Research (ICaR-VU); Professor (Emeritus) of Hematology at the VU University Medical Center	x					
Prof. W.R. (Winald) Gerritsen	Director of the Cancer Center Amsterdam (CCA); Professor of Medical Oncology at the VU University Medical Center		x				
Prof. V.W.M. (Victor) van Hinsbergh	Director of the Institute for Cardiovascular Research (ICaR-VU); Professor (Emeritus) of Cellular Pathophysiology at the VU University Medical Center			x	x	x	x
Prof. J.A. (André) Knottnerus	Chair of the Scientific Council for Government Policy (WRR); Professor of General Practice at Maastricht University	x	x	x	x	x	x
Prof. F.D. (Frank) Pot	Professor of Social Innovation at the Radboud University Nijmegen	x	x				
Dr. H. (Herman) Kroneman	Chief Medical Officer at the Employee Insurance Agency (UWV)			x	x	x	x
Dr. Ir. M.N. (Moniek) Pieters	Director Public Health and Health Services at the National Institute for Public Health and the Environment (RIVM)	x	x	x	x		
Drs. A.M.P. (Annemiek) van Bolhuis	Director Public Health and Health Services at the National Institute for Public Health and the Environment (RIVM)					x	x
Prof. K. (Karien) Stronks	Head of the Department of Social Medicine and Professor of Social Medicine at the Academic Medical Center Amsterdam, University of Amsterdam	x	x	x	x	x	
Prof. J.P. (Johan) Mackenbach	Chair of the Department of Public Health and Professor of Public Health at the Erasmus MC, University Medical Center Rotterdam						x

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Supplement C – Composition

Table 4 lists the many participating departments from the VU University (Faculty of Behavioural and Movement Sciences & Faculty of Earth and Life Sciences and the VU Medical Center.

Table 4 - Departments and research staff participating in the EMGO+ Institute in 2010-2015

Departments	Head of Department (most recent)	2010		2011		2012		2013		2014		2015	
		#	FTE	#	FTE	#	FTE	#	FTE	#	FTE	#	FTE
FALW Health Sciences (incl. Nutrition and Health)	Maurits van Tulder	54	33,9	60	29,9	60	28,7	60	27,7	63	31,6	70	34,3
FALW Athena Institute	Jacqueline Broerse	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	19	8,2
FGB Biological Psychology	Dorret Boomsma	18	15,0	19	11,3	23	13,6	26	12,4	25	14,7	27	16,0
FGB Clinical Psychology	Pim Cuijpers	37	25,0	39	26,1	50	26,6	52	25,7	60	31,3	68	37,8
FGB Developmental Psychology	Hans Koot	18	10,5	21	10,8	22	9,6	26	13,7	21	13,2	23	12,8
FGB Clinical Child & Family Studies	Carlo Schuengel	27	11,8	27	12,8	30	11,2	31	10,7	28	11,3	27	12,1
	total VU	***154***	***96,1***	***166***	***90,8***	***185***	***89,7***	***195***	***90,2***	***197***	***102,1***	***234***	***121,2***
Anesthesiology	Stephan Loer	4	3,0	3	2,3	3	1,3	3	1,9	5	2	2	0,9
Clinical Genetics (incl. Community Genetics)	Hanne Meijers-Heijboer	5	1,6	16	7,8	17	9,2	20	10,1	17	6,8	13	8,0
Clinical Pharmacology & Pharmacy	Noortje Swart	2	1,2	2	1,2	2	0,5	1	0,3	3	1,1	3	1,1
Epidemiology & Biostatistics	Hans Berkhof (a.i.)	57	33,8	51,5	34,5	56	33,1	57	31,3	59	27,2	63	25,5
General Practice & Elderly Care Medicine	Henriëtte van der Horst	61	33,1	73	36,3	68	35,3	61	34,3	64	30,7	62	25,2
Internal Medicine (incl. Endocrinology; Nutrition and Dietetics)	Mark Kramer	11	2,3	9	3,3	6	4,0	11	5,4	12	4,5	16	7,0
Medical Humanities	Guy Widdershoven	3	2,4	3	1,8	30	15,4	38	17	34	17,7	40	13,6
Medical Psychology	Frank Snoek	6	4,8	5	4,0	9	3,6	10	6,7	10	5,3	10	6,3
Midwifery Science	Gea Vermeulen	4	2,7	7	4,6	10	6,0	11	7,3	17	6,8	24	7,1
Obstetrics & Gynaecology	Christianne de Groot	1	0,5	1	0,0	n/a	n/a	2	0,9	4	1,6	4	1,6
Ophthalmology	Stevie Tan	10	5,0	10	4,3	9	4,2	8	4	8	3,4	10	4,3
Otolaryngology, Head & Neck Surgery	René Leemans	20	7,9	21,5	9,6	21	8,1	17	6,7	19	7,6	25	9,6
Pediatrics (incl. Child & Adolescent Psychiatry)	Hans van Goudoever	17	10,5	23	12,8	24	12,6	24	11	28	12,3	31	11,0
Psychiatry - GGZ inGeest	Aartjan Beekman	40	16,5	37	14,1	47	20,4	59	21,7	69	30,9	84	39,2
Public & Occupational Health	Willem van Mechelen	95	58,2	101	57,8	110	48,7	126	61,4	112	47,9	104	46,9
Rehabilitation Medicine	Vincent de Groot	12	5,6	13	6,4	16	6,8	15	4,6	9	3,1	10	3,6
	total VUmc	***348***	***188,9***	***376***	***200,7***	***428***	***209,2***	***463***	***224,6***	***470***	***209,2***	***501***	***210,7***
	total VU + VUmc	502		542		613		658		667		**735**	
	total (corrected for dual appointment)	**498**	**285,0**	**532**	**291,5**	**594**	**298,9**	**639**	**314,8**	**650**	**311,3**	**721**	**331,9**

Who participates as an EMGO+ researcher?

To unambiguously define EMGO+ researchers the following definitions, in accordance with the VU University guidelines, were used throughout:

- An *EMGO+ researcher* is any tenured or untenured research personnel that
  - has been listed as part of EMGO+ by one of the department heads in Table 2, or
  - takes part in an EMGO+ project, where
- An *EMGO+ project* is any project that has been reviewed by the Science Committee and positively judged to fit the EMGO+ research programs *and* to be of sufficient scientific and methodological quality.

For each EMGO+ researcher the department head is asked to indicate the percentage of the employed time that the researcher spends on research in EMGO+ projects; this is the basis of the research full time equivalent (**FTE**) in Tables 3 and 4. To validate our approach, we compare the indicated research time by the department heads for each researcher to the mean research time for the rank of the researcher (e.g., postdoc 100%, assistant professor 60%, associate professor 40% and full professor 30%) as well as (when applicable) to the research time of the same researcher in previous years. In case of a large deviation from the expectation based on these sources, we engage the heads of department to actively confirm the indicated research time for that researcher.

Recruitment of EMGO+ researchers

The above-mentioned definitions also determine how researchers are selected to be part of the EMGO+ Institute. Selection is based on the department (or section, in case of larger departments) to which the individual belongs, where the individual must also be participating in one or more projects approved by the Science Committee in the past three years. Departments or their sections apply for EMGO+ membership if the bulk of their research falls in one or more of the research themes of the four programs and if they have a good track record in publication and fund raising. A good track record is defined relative to the average EMGO+ performance, using a minimum of 75% of the average over the past two years as a guideline.

The admittance of new EMGO+ departments/sections is done by the Executive Board, after a two-period of affiliated membership. The Executive Board decides whether the research of the department fits the EMGO+ themes after seeking the advice of the program leaders and Management Committee. Once, admitted, EMGO+ departments are carried forward from the previous year provided they keep meeting the criteria used to admit new departments.

From 2010 to 2015, Midwifery Science, Medical Humanities, and the Athena Institute entered EMGO+. Currently, the Center of Expertise on Gender Dysphoria is an affiliated member. During a period of affiliated membership, input and output of the affiliated departments is not yet incorporated in the tables of our annual reports.

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Research FTE

An overview of the research FTE of the EMGO+ Institute from 2010 to 2015 is listed in Table 5. Scientific core staff includes professors, associate professors, assistant professors. Other scientific staff includes senior researchers, postdocs and junior researchers. PhD students consist of standard PhDs (employed) and contract PhDs (externally or internally funded, but not employed).

Table 5 (SEP D3a) - Total research FTE for the institute and per program

EMGO+	2010	2011	2012	2013	2014	2015
Scientific core staff *	74,0	74,9	63,8	74,5	60,9	61,7
PhD students	109,4	117,3	133,8	138,4	136,4	139,2
Other scientific staff	101,7	99,4	101,1	101,9	113,9	131,1
Total research staff	**285,0**	**291,5**	**298,7**	**314,8**	**311,3**	**331,9**

Lifestyle, Overweight and Diabetes	2010	2011	2012	2013	2014	2015
Scientific core staff	16,3	15,5	16,1	20,0	11,4	8,8
PhD students	26,3	23,8	21,1	22,2	26,7	26,4
Other scientific staff	29,6	31,3	23,2	23,6	28,4	31,4
Total research staff	**72,2**	**70,6**	**60,4**	**65,8**	**66,5**	**66,6**

Mental Health	2010	2011	2012	2013	2014	2015
Scientific core staff	22,7	22,6	22,5	24,7	25,0	25,7
PhD students	45,8	53,1	46,2	49,1	57,4	65,0
Other scientific staff	28,7	19,8	33,3	29,2	38,7	44,3
Total research staff	**97,2**	**95,5**	**102,0**	**102,9**	**121,2**	**134,9**

Quality of Care	2010	2011	2012	2013	2014	2015
Scientific core staff	19,3	22,5	14,3	19,4	16,9	18,6
PhD students	20,0	20,7	42,7	41,0	36,2	38,3
Other scientific staff	27,5	36,1	36,1	41,4	36,7	42,8
Total research staff	**66,8**	**79,3**	**93,1**	**101,9**	**89,8**	**99,7**

Musculoskeletal Health	2010	2011	2012	2013	2014	2015
Scientific core staff	15,7	14,2	10,9	10,4	7,6	8,5
PhD students	17,3	19,7	23,8	26,1	16,1	9,6
Other scientific staff	15,8	12,3	8,6	7,7	10,1	12,6
Total research staff	**48,9**	**46,2**	**43,2**	**44,2**	**33,8**	**30,7**

* In the previous Standard Evaluation Protocol (2009-2015) that was used in the annual reports 2009-2013, a distinction in the job categories was made between: i) tenured staff (professors, associate professors, assistant professors and senior researchers); and ii) non-tenured staff (junior researchers and postdocs). The numbers in this Table from the years 2009-2013 still correspond with this approach (tenured staff – scientific core staff / non-tenured staff – other scientific staff). In the 2015-2021 SEP (the protocol used in the 2014 and 2015 annual report) senior researchers are listed in the job category 'other scientific staff', explaining the increase in this category and the parallel decrease in FTE in scientific core staff.

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Financial input

Table 6 provides an overview of the various sources used to finance EMGO+ research personnel. Taking 2015 as the example, a total of 27% of the researchers' salaries comes from direct University funding. A total of 23.5 million €, or 71% of the researchers' salaries is actively acquired and comes from research grant agencies responsible for distribution of governmental budgets for scientific research like the Netherlands Organization for Health Research and Development ('ZonMW'), the Netherlands Organization for Scientific Research ('NWO'), the European Union, the Ministry of Health and Welfare, or from charitable societies and charity funds like the Dutch Heart Foundation, the Diabetes Fund, and World Cancer Research Fund. Currently only a small part of the total amount of research personnel is funded by industry (~2%).

Table 6 (SEP D3c) – Sources of funding of the research staff for the institute and per program (in FTE's)

EMGO+ institute	2010	2011	2012	2013	2014	2015	2015 (%)
Direct funding	**86,8**	**80,9**	**74,6**	**79,3**	**81,5**	**90,4**	**27%**
Research staff: Research grants (RG)	89,8	93,3	81,6	83,1	92,0	87,3	26%
Research staff: Contract research (CR)	99,8	112,5	137,3	148,1	131,3	149,6	45%
Research staff: Other funding (OF)	8,6	4,8	5,3	4,3	6,4	4,7	2%
External funding (total RG + CR + OF)	**198,3**	**210,6**	**224,1**	**235,5**	**229,8**	**241,6**	**73%**
Total internal+external	285,0	291,5	298,7	314,8	311,3	331,9	100%

Lifestyle, Overweight and Diabetes	2010	2011	2012	2013	2014	2015	2015 (%)
Direct funding	**23,9**	**20,2**	**22,5**	**20,7**	**14,5**	**16,6**	**25%**
Research staff: Research grants (RG)	17,2	20,6	13,8	14,3	16,1	13,9	21%
Research staff: Contract research (CR)	24,7	27,6	22,5	29,9	32,8	34,4	51%
Research staff: Other funding (OF)	6,4	2,2	1,6	0,9	3,1	1,7	3%
External funding (total RG + CR + OF)	**48,3**	**50,4**	**37,9**	**45,2**	**52,0**	**50,1**	**75%**
Total internal+external	72,2	70,6	60,4	65,8	66,5	66,6	100%

Mental Health	2010	2011	2012	2013	2014	2015	2015 (%)
Direct funding	**29,7**	**29,3**	**23,7**	**29,4**	**34,8**	**39,5**	**29%**
Research staff: Research grants (RG)	39,5	40,7	38,8	39,0	51,6	52,0	38%
Research staff: Contract research (CR)	27,5	25,3	38,7	34,5	34,3	42,6	32%
Research staff: Other funding (OF)	0,6	0,2	0,8	0,0	0,5	0,9	1%
External funding (total RG + CR + OF)	**67,5**	**66,2**	**78,3**	**73,5**	**86,4**	**95,4**	**71%**
Total internal+external	97,2	95,5	102,0	102,9	121,2	134,9	100%

Quality of Care	2010	2011	2012	2013	2014	2015	2015 (%)
Direct funding	**12,7**	**11,9**	**14,6**	**13,5**	**16,6**	**21,3**	**22%**
Research staff: Research grants (RG)	21,8	21,6	18,0	21,0	18,6	18,1	18%
Research staff: Contract research (CR)	30,6	43,3	57,7	64,0	51,8	58,2	58%
Research staff: Other funding (OF)	1,6	2,4	2,8	3,4	2,8	2,1	2%
External funding (total RG + CR + OF)	**54,1**	**67,3**	**78,5**	**88,3**	**73,3**	**78,4**	**78%**
Total internal+external	66,8	79,3	93,1	101,9	89,8	99,7	100%

Musculoskeletal Health	2010	2011	2012	2013	2014	2015	2015 (%)
Direct funding	**20,5**	**19,5**	**13,8**	**15,7**	**15,7**	**13,0**	**42%**
Research staff: Research grants (RG)	11,3	10,4	11,0	8,8	5,7	3,3	11%
Research staff: Contract research (CR)	17,0	16,3	18,4	19,7	12,4	14,4	47%
Research staff: Other funding (OF)	0,0	0,0	0,0	0,0	0,0	0,0	0%
External funding (total RG + CR + OF)	**28,4**	**26,7**	**29,4**	**28,5**	**18,1**	**17,7**	**58%**
Total internal+external	48,9	46,2	43,2	44,2	33,8	30,7	100%

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Supplement D – Scientific Output

Productivity

Table 7 lists the number of refereed papers that were published from 2010 to 2015 and the PhD theses completed in the period 2010-2015, as well as other scientific output. The scientific productivity is first given across the entire institute, followed by the productivity per program.

Table 7 (SEP D3b) – EMGO+ Scientific output for the institute and per program

EMGO+ Institute	2010	2011	2012	2013	2014	2015
Refereed articles	786	851	954	1124	1209	1263
Non-refereed articles	157	17	18	11	5	13
Books and book chapters	131	82	110	102	65	77
PhD-theses	52	42	61	77	58	93
Professional publications	75	110	164	218	200	189
Publications aimed at the general public	4	5	18	23	23	19
Total publications	**1205**	**1107**	**1325**	**1555**	**1560**	**1654**

Lifestyle, Overweight and Diabetes	2010	2011	2012	2013	2014	2015
Refereed articles	139	218	205	259	236	239
Non-refereed articles	15	3	2	0	1	2
Books and book chapters	15	4	17	10	4	5
PhD-theses	3	9	10	20	11	15
Professional publications	9	5	15	21	21	14
Publications aimed at the general public	1	2	2	0	2	1
Total publications	**182**	**241**	**251**	**310**	**275**	**276**

Mental Health	2010	2011	2012	2013	2014	2015
Refereed articles	270	288	321	376	419	506
Non-refereed articles	42	7	7	3	0	5
Books and book chapters	62	38	57	31	10	38
PhD-theses	29	18	30	28	10	34
Professional publications	12	44	49	47	54	63
Publications aimed at the general public	0	0	3	11	9	8
Total publications	**415**	**395**	**467**	**496**	**502**	**654**

Quality of Care	2010	2011	2012	2013	2014	2015
Refereed articles	199	210	229	298	334	311
Non-refereed articles	76	6	8	7	4	6
Books and book chapters	47	36	32	50	35	33
PhD-theses	10	9	16	18	20	29
Professional publications	39	51	81	142	109	106
Publications aimed at the general public	3	3	11	11	12	8
Total publications	**374**	**315**	**377**	**526**	**514**	**493**

Musculoskeletal Health	2010	2011	2012	2013	2014	2015
Refereed articles	178	135	199	191	220	207
Non-refereed articles	24	1	1	1	0	0
Books and book chapters	7	4	4	11	16	1
PhD-theses	10	6	5	11	17	15
Professional publications	15	10	19	8	16	6
Publications aimed at the general public	0	0	2	1	0	2
Total publications	**234**	**156**	**230**	**223**	**269**	**231**

EMGO+ publications are frequently cited by peers across a broad spectrum of scientific subject areas, emphasizing the transdisciplinary nature of the institute. In addition, its scientific world translates to substantial clinical and societal impact. To illustrate this, we below list per program examples of key scientific publications (with Citations and Journal Impact Factor as of July 1 2016) and/or important societal outputs from 2010 to 2015.

Examples of output 2010-2015

Lifestyle, Obesity, Diabetes

- Ruyter, J.C. de, Olthof, M.R., Seidell, J.C. & Katan, M.B. (2012). A Trial of Sugar-free or Sugar-Sweetened Beverages and Body Weight in Children. *New England Journal of Medicine, 367* (15), 1397-1406. (Citations: 206 IF: 51.6)
- Singh, A.S., Uijtdewilligen, L., Twisk, J.W., Mechelen, W. van & Chin A Paw, M.J.M. (2012). Physical activity and performance at school A systematic review of the literature including a methodological quality assessment. *Archives of Pediatrics and Adolescent Medicine, 166* (1), 49-55. (Citations: 105 IF: 4.3)
- Giskes, K., Lenthe, F. van & Brug, J. (2011). A systematic review of environmental factors and obesogenic dietary intakes among adults: are we getting closer to understanding obesogenic environments? *Obesity reviews, 12* (501), e95-e106. (Citations: 99, IF: 7.0)
- In 2012 an EMGO+ developed risk assessment tool for the identification of cardiovascular diseases (CVD), type 2 diabetes, and chronic kidney disease in potentially high-risk adults not previously diagnosed with hypertension, hypercholesterolemia was implemented within the Dutch Primary Care guideline 'Prevention Consult' for referring the highest risk individuals to health care for further (multivariable) risk assessment.
- In 2014, prof Giel Nijpels was appointed Knight of the Order of Orange-Nassau. He received this royal award for his services to healthcare in general and in particular to the improvement of the health and quality of life of diabetes patients.
- Huppertz, C., Bartels, M., Jansen, I.E., Boomsma, D.I., Willemsen, G., Moor, M.H.M. de & Geus, J.C.N. de (2014). A Twin-Sibling Study on the Relationship Between Exercise Attitudes and Exercise Behavior. Behavior Genetics, 44(1), 45-55. 10.1007/s10519-013-9617-7 (Citations: 8, IF: 3.268)

Mental Health

- In 2010, Anton van Balkom, psychiatrist and professor in Evidence-based Practice in EMGO+ chaired the national multidisciplinary committee crafting the guidelines on treatment of depressive and anxiety disorders.
- Cuijpers, P., Donker, T., Straten, A. van, Li, J. & Andersson, G. (2010). Is guided self-help as effective as face-to-face psychotherapy for depression and anxiety disorders? A systematic review and meta-analysis of comparative outcome studies. *Psychological Medicine, 40* (12), 1943-1957. (Citations: 193; IF: 5.2)
- Dongen, J. van, Slagboom, P.E., Draisma, H.H.M., Martin, N.G. & Boomsma, D.I. (2012). The continuing value of twin studies in the omics era. *Nature Reviews Genetics, 13* (9), 640-653. (Citations: 95; IF: 41.1)
- Lamers, F., Vogelzangs, N., Merikangas, K.R., Jonge, P. de, Beekman, A.T.F. & Penninx, B.W.J.H. (2013). Evidence for a differential role of HPA-axis function, inflammation and metabolic syndrome in melancholic versus atypical depression. *Molecular Psychiatry, 18* (6), 692-699. (Citations: 94; IF: 15.1)
- Wright, F.A., Sullivan, P.F., Brooks, A.I., Zou, F., Sun, W., Xia, K., Madar, V., Jansen, R., Chung, W., Zhou, Y.H., Abdellaoui, A., Batista, S., Butler, C., Chen, G., Chen, T.H., D'Ambrosio, D., Gallins,

P., Ha, M.J., Hottenga, J.J., Huang, S., Kattenberg, V.M., Kochar, J., Middeldorp, C.M., Qu, A., Shabalin, A., Tischfield, J., Todd, L., Tzeng, J.Y., Grootheest, G., Vink, J.M., Wang, Q., Wang, W., Wang, W., Willemsen, G., Smit, J.H., Geus, E.J.C. de, Yin, Z., Penninx, B.W.J.H. & Boomsma, D.I. (2014). Heritability and genomics of gene expression in peripheral blood. *Nature Genetics, 46*(5), 430-437. (Citations: 39; IF: 29.352)

- Voort, T.Y. van der, Meijel, B. van, Goossens, P.J., Hoogendoorn, A.W., Draisma, S., Beekman, A. & Kupka, R.W. (2015). Collaborative care for patients with bipolar disorder: randomised controlled trial. *British Journal of Psychiatry*, 206 (5), 393-400. (Citations: 4; IF: 7,06)

Musculoskeletal Health

- As the direct result of research in collaboration with the MSH research program on neuromuscular factors and disability in osteoarthritis, the Reade center for Rehabilitation and Rheumatology in 2010 established the outpatient clinic for osteoarthritis. All patients referred to the outpatient clinic are included in the EMGO+ led Amsterdam Osteoarthritis cohort, which consists of a biobank and data on neuromuscular factors, pain, disability and quality of life.
- Mokkink, L.B., Terwee, C.B., Patrick, D.L., Alonso, J., Stratford, P.W., Knol, D.L., Bouter, L.M. & Vet, H.C.W. de (2010). The COSMIN study reached international consensus on taxonomy, terminology, and definitions of measurement properties for health-related patient-reported outcomes. *Journal of Clinical Epidemiology, 63* (7), 737-745. (Citations: 392; Impact factor: 3.8)
- Middelkoop, M. van, Rubinstein, S.M., Kuijpers, T., Verhagen, A.P., Ostelo, R.W.J.G., Koes, B.W. & Tulder, M.W. van (2011). A systematic review on the effectiveness of physical and rehabilitation interventions for chronic non-specific low back pain. *European Spine Journal, 20* (1), 19-39. (Citations: 147; IF: 2.0)
- Schoor, N.M. van & Lips, P.T.A.M. (2011). Worldwide vitamin D status. *Baillière's Best Practice and Research. Clinical Endocrinology and Metabolism, 25* (4), 671-680. (Citations: 128; IF: 4.1)
- In 2014, the Amsterdam Collaboration on Health & Safety in Sports (a joint initiative of VUmc and AMC) was recognized by the International Olympic Committee (IOC) as *IOC Research Center for Prevention of Injury and Protection of Athlete Health*.
- Kamper, S.J., Apeldoorn, A.T., Chiarotto, A., Smeets, R.J.E.M., Ostelo, R.W.J.G., Guzman, J. & Tulder, M.W. van (2015). Multidisciplinary biopsychosocial rehabilitation for chronic low back pain: Cochrane systematic review and meta-analysis. *BMJ (Online),* 350:h444. (Citations: 17;IF: 19, 697)

Quality of Care

- In 2010, the Meeting Centers Support Program (MCSP), a combined intensive support program for community dwelling people with dementia and their caregivers, developed by prof Rose-Marie Dröes, was selected by Alzheimer's Disease International and Fondation Médéric Alzheimer as the second best evidence-based psychosocial intervention worldwide.
- Huisman, M., Poppelaars, J.L., Horst, M.H.L. van der, Beekman, A.T.F., Brug, J., Tilburg, T.G. van & Deeg, D.J.H. (2011). Cohort profile: The Longitudinal Aging Study Amsterdam. *International Journal of Epidemiology, 40* (4), 868-876. (Citations: 117; Impact factor: 6.4)
- Cohen, J., Houttekier, D., Onwuteaka-Philipsen, B.D., Miccinesi, G., Ddington-Hall, J., Kaasa, S., Bilsen, J. & Deliens, L. (2010). Which patients with cancer die at home? a study of six european countries using death certificate data. *Journal of Clinical Oncology, 28* (13), 2267-2273. (Citations: 83; IF: 19.0)
- Berkhof, M., Rijssen, H.J. van, Schellart, A.J.M., Anema, J.R. & Beek, A.J. van der (2011). Effective training strategies for teaching communication skills to physicians: an overview of systematic reviews. *Patient Education and Counseling, 84* (2), 152-162. (Citations: 64; IF: 2.3)
- El, C.G. van, Cornel, M.C., Borry, P., Hastings, R.J., Fellmann, F., Hodgson, SV, Howard, H.C., Cambon-Thomsen, A., Knoppers, B.M., Meijers-Heijboer, H., Scheffer, H., Tranebjaerg, L., Dondorp, W. & Wert, G.M.W.R. De (2013). Whole-genome sequencing in health care Recommendations of the European Society of Human Genetics. *European Journal of Human Genetics, 21* (6), 580-584.(Citations: 55; IF: 4.2)
- In 2014, Dutch university medical centers were allowed to offer the Non Invasive Prenatal Test (NIPT) developed at VUmc in the context of the national TRIDENT study (Trial by Dutch laboratories for Evaluation of Non-invasive Prenatal Testing) in which our Quality of Care researchers play a key role. In 2016, the test became available to all pregnant women in the Netherlands.

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International Benchmarking

Table 8 presents the results of a formal bibliometric analysis of the EMGO+ institute by the CWTS. The analysis used publications between 2010 and 2014, including citations until the end of 2015 (based on the methodological assumption that papers should have at least one year to get cited). The CWTS analysis is based on weighted scientific impact. For each publication the number of citations is compared to the average number of citations per publication in the subject area in which it was published in the year of publication (Thomson Reuters 'Journal citation reports'). Weighting of the mean number of citations (MCS) for all publications together lead to the so called 'Mean Normalized Citation Score' (MNCS) where a score of 1 represents the world average.

Table 8 – Results of bibliometric analysis performed by the CWTS

unit	period	publications	mcs	mncs
EMGO+ Institute	2010-2014	4563	11,27	**1,56**
Lifestyle, Overweight and Diabetes	2010-2014	1018	13,61	**1,73**
Mental Health	2010-2014	1582	13,31	**1,75**
Quality of Care	2010-2014	1126	7,01	**1,19**
Musculoskeletal Health	2010-2014	850	10,30	**1,46**

To allow a more field-specific comparison of EMGO+ researchers to the world average, figure 5 presents the total number of publications (p) between 2010 and 2014, and MNCS (based on the number of citations between 2010 and 2015), for the subject areas according to web of science in which we publish at least 70 papers.

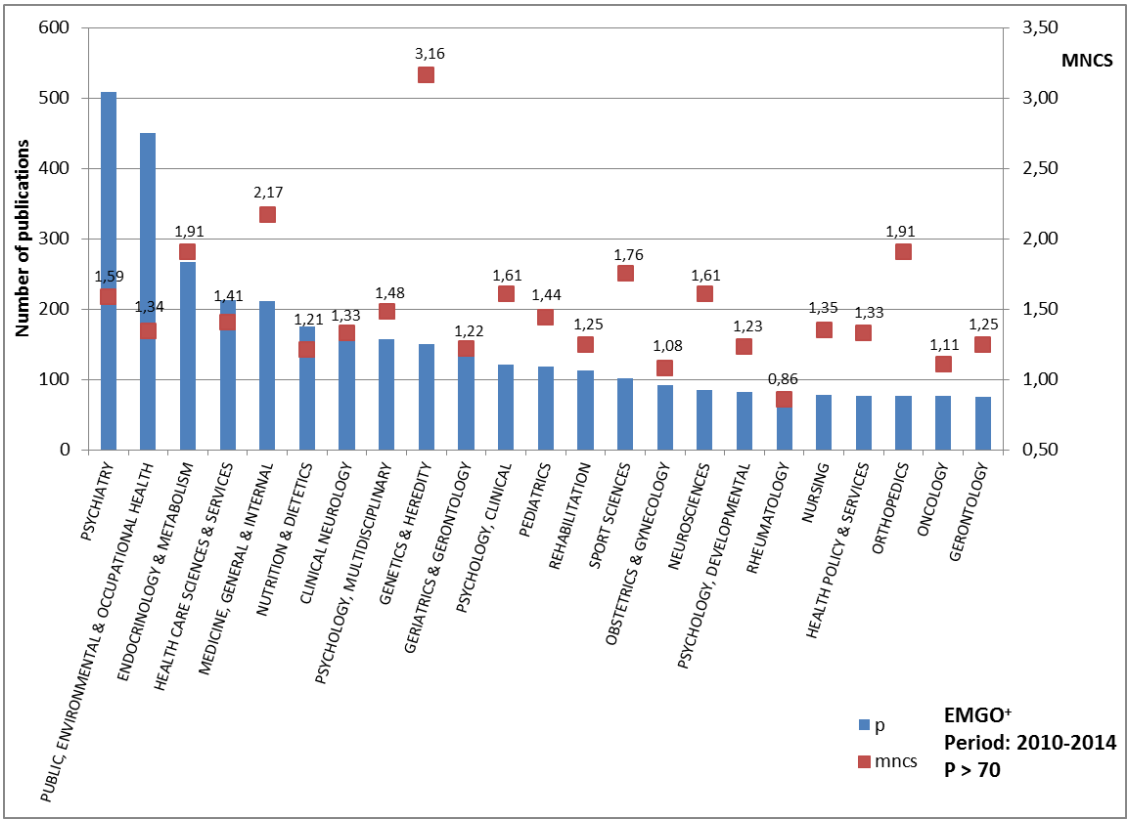

Figure 5 – CWTS analysis of the EMGO+ Institute's publication profile

Two striking features are evident in the figure. First, EMGO+ remains very true to its transdisciplinary nature by publishing in a large number of fields. Second, the weighted citation score of EMGO+ researchers is above the world average almost all across the board, and more than 50% higher than the world average for 8 out of the 23 categories listed.

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Supplement E – Methodological Expertise Centers

Researchers of the institute, not limited to but in particular PhDs and postdocs, can obtain support for a number of crucial steps in the research process through our methodological expertise centers.

Knowledge center on Measurement Instruments
The mission of the *knowledge center on Measurement Instruments* is to optimize the quality of measurement in health science and medical research by consultations, education, and research. For this purpose, the center gives advice and cooperates with researchers from different fields of health science and medical research in searching for available measurement instruments, examining the quality of the available measurement instruments, choosing the most appropriate measurement instrument for a certain purpose, and designing and performing studies on measurement properties of measurement instruments. Important international research projects are the work of the COSMIN initiative (www.cosmin.nl) which aims to improve the selection of health measurement instruments, and the Dutch-Flemish PROMIS group (www.dutchflemishpromis.nl), which aims to translate, validate, and implement high quality IRT-based PROMIS instruments and Computer Adaptive Tests in the Netherlands and Flanders.

Epidemiology & Biostatistics support (E&B Xpert)
E&B Xpert is part of the VUmc department of Epidemiology and Biostatistics. It supports researchers at the beginning of their research in choosing appropriate study outcomes and measurement instruments, sample size calculations, and in preparing a plan for the statistical analysis of their data. E&B Xpert also assists researchers in analyzing data resulting from their studies, in presenting the results in reports and papers and in answering reviewers' questions on statistical issues. E&B Xpert supports ranges from short consultations via e-mail, telephone or in person to long-term participation in medical and biomedical research projects. Statisticians, research methodologists, and health economists provide the expertise and support.

Health Technology Assessment
Within the EMGO+ Institute many trials are conducted by PhD students that also include an economic evaluation, e.g. showing cost-effectiveness of their proposed intervention in comparison with usual care. Health Technology Assessment (HTA) is a multi-disciplinary field of policy-analysis that examines the medical, economic, social and ethical implications of the incremental value, diffusion and use of a medical technology in health care (www.inahta.org). Expert supervision for the design, conduct, analysis and interpretation of these economic evaluations is available in a group of experienced researchers embedded in the department of Health Sciences.

Cohort Booster
To support cross-cohort standardization and to facilitate exchange between PhDs working on different cohorts, the EMGO+ Institute initiated and funded the EMGO+ Cohort Booster Project to enrich six of its large-scale and on-going longitudinal studies with a variety of existing environmental 'exposome' data. These exposome data came from a variety of existing geo-data on address-zip code-, as well as neighborhood level from different sources. Data are available for several years, depending on the database used.

Examples of geo-data that have been made available for record linkage with data from the cohort studies are: road-, rail-, and air traffic noise on address-level, and number of different types of facilities (e.g., health care facilities, sport facilities, educational facilities, and socio-cultural facilities) on 4-digits zip code level. For the data-linking between the collected geo-data and respondents of each specific cohort study, 4-digits zip codes and 6-digits zip codes are used as identifier. All collected geo-data have been documented for broad use by PhD students (provided they are supervised by qualified EMGO+ researchers in view of privacy regulations).

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Supplement F – Earning Capacity

As shown in Table 9, the earning capacity of the EMGO+ Institute generally exceeds €21 million and shows an upward trend reaching ~ €25 million in 2015. The bulk of our research (73%) remains externally funded, with public science funding agencies or charitable societies as the main source. From 2010-205 about 40% (~€57 million) of our acquired research funds came from funding agencies that distribute public money for science from Dutch government ministries by means of competition to the universities and national research institutes (e.g. the National Organization for Scientific Research and the Netherlands Organization for Health Research and Development). Also the European Union (~15%) was an important contributor to the external researcher funds acquired by EMGO+ researchers in the past six years.

Table 9 – Past and current acquisition of research funds for the institute and per program

EMGO+	2010	2011	2012	2013	2014	2015
Research Grants	€ 18.815.942	€ 9.891.265	€ 14.726.635	€ 10.572.350	€ 6.307.295	€ 11.878.842
Contract Research	€ 9.713.825	€ 7.423.260	€ 6.383.789	€ 15.483.945	€ 12.713.226	€ 11.569.503
Other funding	€ 437.078	€ 190.600	€ 350.000	€ 930.535	€ 2.389.170	€ 1.708.450
Total	**€ 28.966.845**	**€ 17.505.125**	**€ 21.460.424**	**€ 26.986.830**	**€ 21.409.691**	**€ 25.156.795**
Of which European funding			*€ 3.823.929*	*€ 7.672.424*	*€ 3.342.014*	*€ 5.595.581*
%			*17,8%*	*28,4%*	*15,6%*	*22,2%*

Lifestyle, Overweight, and Diabetes	2010	2011	2012	2013	2014	2015
Research Grants	€ 3.716.977	€ 1.150.369	€ 2.277.395	€ 2.153.790	€ 689.833	€ 929.864
Contract Research	€ 2.200.517	€ 1.541.115	€ 1.001.199	€ 5.789.680	€ 287.261	€ 1.520.736
Other funding	€ 169.953	€ 32.500	€ 1.500	€ 117.780	€ 194.000	€ 860.000
Total	**€ 6.087.447**	**€ 2.723.984**	**€ 3.280.094**	**€ 8.061.250**	**€ 1.171.094**	**€ 3.310.600**

Mental Health	2010	2011	2012	2013	2014	2015
Research Grants	€ 7.892.491	€ 5.147.627	€ 2.994.078	€ 2.371.326	€ 2.457.118	€ 5.139.763
Contract Research	€ 3.399.377	€ 2.060.524	€ 3.170.810	€ 4.698.185	€ 6.272.407	€ 2.677.348
Other funding	€ 1	€ 158.100	€ 125.000	€ 108.300	€ 1.338.970	€ 528.000
Total	**€ 11.291.869**	**€ 7.366.251**	**€ 6.289.888**	**€ 7.177.811**	**€ 10.068.495**	**€ 8.345.111**

Quality of Care	2010	2011	2012	2013	2014	2015
Research Grants	€ 4.489.200	€ 2.271.571	€ 7.806.707	€ 4.219.864	€ 2.807.652	€ 5.383.512
Contract Research	€ 1.796.925	€ 2.765.767	€ 1.846.428	€ 4.287.823	€ 2.202.184	€ 5.866.340
Other funding	€ 267.121	€ -	€ 220.860	€ 360.380	€ 759.200	€ 320.450
Total	**€ 6.553.246**	**€ 5.037.338**	**€ 9.873.995**	**€ 8.868.067**	**€ 5.769.036**	**€ 11.570.302**

Musculoskeletal Health	2010	2011	2012	2013	2014	2015
Research Grants	€ 2.717.274	€ 1.321.698	€ 1.648.455	€ 1.827.370	€ 352.692	€ 425.703
Contract Research	€ 2.317.006	€ 1.055.854	€ 365.352	€ 708.257	€ 3.951.374	€ 1.505.079
Other funding	€ 3	€ -	€ 2.640	€ 344.075	€ 97.000	€ -
Total	**€ 5.034.283**	**€ 2.377.552**	**€ 2.016.447**	**€ 2.879.702**	**€ 4.401.066**	**€ 1.930.782**

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Supplement G – Summary and explanation of the chosen output indicators

The Association of Universities in the Netherlands (VSNU), the Netherlands Organisation for Scientific Research (NWO), and the Royal Netherlands Academy of Arts and Sciences (KNAW) have jointly developed a new Standard Evaluation Protocol (SEP) for the period 2015-2021. The VUmc Research Institutes use this protocol as their main guideline in their annual reports and external visitations. The new protocol allows a certain amount of freedom in choosing research output indicators to use in the reports. VUmc has chosen a number of indicators, approved by the VUmc Research Council, that it believes to demonstrate the excellent and translational character of research in the best way.

The indicators chosen for the EMGO+ Self-Evaluation 2010-2015 can be found in Table 10 with URL's to the relevant appendices and references to the relevant chapters.

Table 10 (SEP D1) - Output Indicators

		QUALITY DOMAINS	
		Research quality	**Relevance to society**
ASSESSMENT DIMENSIONS	**Demonstrable products**	**1. Research products for peers** Indicators: • Research articles (refereed vs. non-refereed) (see Chapter 4.1) • Scientific books and book chapters (see Chapter 4.1) • Other research outputs (instruments, infrastructure, datasets, software tools or designs that the unit has developed) (see Chapter 8) • Dissertations (see Chapter 5)	**4. Research products for societal target groups** Indicators: • Reports (for example for policymaking) (see Chapter 8) • Articles in professional journals and books/book chapters for a professional audience (see Chapter 4.1 and 8) • Other outputs (instruments, infrastructure, datasets, software tools or designs that the unit has developed for societal target groups) (see Chapter 8) • Outreach activities, for example lectures for general audiences, contributions to post initial education, and organizational activities (see Chapter 8)
	Demonstrable use of products	**2. Use of research products by peers** Indicators: • Citations (see Chapter 4.1) • Use of datasets, software tools, etc. by peers (see Chapter 2) • Use of research facilities by peers (see Chapter 2)	**5. Use of research products by societal groups** Indicators: • Use of research facilities by societal groups (see Chapter 2) • Contract research (see Chapter 7)

	Demonstrable marks of recognition	**3. Marks of recognition from peers** Indicators: • Science awards/scholarly prizes (see Chapter 4.3) • Research grants awarded to individuals (see Chapter 7) • Invited lectures (see Chapter 4.3) • Membership of scientific committees, editorial boards, etc. (see Chapter 4.3)	**6. Marks of recognition by societal groups** Indicators: • Public prizes (see Chapter 4.3) • Valorization funding (see Chapter 5.2) • Media attention (see Chapter 8) • Number of professor positions paid for by societal groups (see Chapter 2.3 and 2.4) • Membership of civil society advisory bodies (see Chapter 4.3)