



HEALTH RESEARCH BOARD

Executive summary

Outputs and outcomes of HRB awards completed in 2012 and 2013

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Introduction

The HRB systematically and routinely collects output and outcomes data on all of the research that it funds. This evaluation activity is vital to ensuring that we understand how our programmes are working and helps to highlight where changes may be needed or opportunities arise. The information we collect also enables us to better communicate the value of health research to others, be they policy and practice stakeholders, the research community, patient groups, the enterprise sector or the public.

This report presents an analysis of 134 HRB grants (combined spend of €44 million) that completed in 2012 and 2013. It provides an overview of the initial outputs and some outcomes arising from these grants across a range of metrics and indicators. The purpose of the report is to: provide the HRB Management and Board with strategically useful information on the potential impacts of HRB-funded research; provide the staff of the Research Strategy and Funding Directorate with information that can inform improvement in scheme documentation and set-up, peer review processes, reporting, finalisation of metrics and so on. The report spans a very interesting time in the HRB funding portfolio when we were coming to the end of a period of peak investment in 2006/2007 and had only begun to deliver the changes set out in our current strategy through awards made in 2010/2011.

An important *proviso* in considering this report is that the analysis presented is not a complete picture of the outputs and outcomes from HRB-funded research, but rather a snapshot at the point of end-of-grant (EOG). Further outputs, outcomes and impacts would be expected to occur in the years following the completion of a grant. In addition, it should be noted that the data presented in this report relates to grants that were awarded predominantly in the 2007-2010 period, prior to and just at the beginning of the HRB's *Strategic Business Plan 2010-2014*. Hence, the data presented can provide only limited indications of the impact of the strategic shifts driven by that strategy.

Indicator framework

HRB evaluation data collection is guided by the Buxton-Hanney Payback Framework for Health Research (see Appendix 1 for the full framework). This framework groups metrics into five impact categories which span short to medium-term outputs, such as knowledge production, research capacity-building, informing policy and the public. The framework also spans longer-term outcomes, for example, policy changes, health sector innovations and economic and commercial activity. For the purposes of this report data was collected on a sub-set of quantitative metrics across all impact categories. Evaluation data to populate the framework was collected for the first time in 2013 via a bespoke online survey instrument (Outcomes Tracker.) Data for grants that completed in 2012 was a blend of End-of-Grant Management Reports collected via SurveyMonkey, combined with data on HRB outputs and outcomes collected from grants awarded between 2000 and 2009 as part of a wider portfolio analysis published in 2014.¹

¹ Curran B and Barrett R (2014) Outputs, outcomes and impacts of arising from the HRB's 2000-2009 grants portfolio. HRB Publication. <http://www.hrb.ie/publications/hrb-publication/publications//634/>

Main findings

The analysis displayed in this report demonstrates a wide variety of outputs produced by HRB-funded research in terms of scientific output, capacity-building outputs, health sector and economic benefits and outcomes. When compared to analysis of grants completed in 2010/2011 and 2008/2009, the data shows that HRB-funded research completing in 2012/2013 led to more peer reviewed publications, policy and clinical practice outputs and influences, healthcare innovations (as a proportion of total number of grants) and economic and commercial outputs and outcomes. It produced less scientific presentations and new academic collaborations, but led to a significantly more industry collaborations.

Key output statistics for grants ending in 2012/2013 compared to previous years

IMPACT CATEGORY*	2012/2013 (N=134 grants)	2010/2011 (N=196 grants)	2008/2009 (N = 204 grants)
Value of investment	€44 million	€54.5 million	€45 million
1. Knowledge production outputs			
No. peer-reviewed journal publications	584	470	526
% papers in high impact journals	N/A	28 %	31 %
No. scientific presentations reported	940	1427	1118
2. Research capacity-building outputs			
No. of research-related posts created	422	280	296
No. health professionals trained	136	82	70
No. PhDs registered	135	72	88
No. new research collaborations formed	287	415	384
No. new research materials/methods developed	112	85 (2011)	NA
3. Informing policy, practice and public			
% grants reporting policy/practice outputs	38 %	24 %	20 %
No. policy/practice outputs and activities	127	100	84
% grants that disseminated to public	50 %	35 %	21 %
4. Health sector innovations			
% grants reporting healthcare innovations	24.6 %	21 %	15 %
No. healthcare innovations in development	43	48	32
5. Economic and commercial activity			
No. research grants leveraged	149	113	117
Value of leveraged funding	€39.5 million	€34.8 million	NA
Amount leveraged per Euro of HRB investment	€0.89	€0.64	NA
No. patents filed or pending	16	11	12
No. technologies licenced	5	3	3
No. start-up companies incorporated or pending	2	2	2
No. industrial collaborations established	88	25	10

* A more detailed summary of key outputs, broken down by scheme type is provided in Appendix 2.

Type of research funded

- Grants in basic and applied biomedical research that ended in 2012/2013 accounted for the largest proportion of spend, at 57 % (applied biomedical research accounted for 50.3 % of spend and basic biomedical research for 6.6 % of spend). This statistic is identical to the corresponding statistic for grants that ended in 2010/2011 and is down slightly on the statistic for grants that completed in 2008/2009, when 64 % of spend went on biomedical research.
- The percentage spend on clinical research-focused grants increased from 21 % of grants competed in 2010/2011 to almost 25 % of grants that completed in 2012/2013.
- The proportion of spend on grants in health services research was the same (15 %) for grants that competed in 2010/2011 and 2012/2013. However, the proportion of spend on grants in population health sciences decreased from 7 % to 3 % of total funding in 2010/2011 and 2012/2013, respectively.

Achievement of grant objectives

- The number of grants reporting that they had achieved all of their original objectives was 58 % (up on the corresponding 2010/2011 figure of 51 %).
- The most common reasons cited for non-fulfilment of all of the original grant objectives were 'insufficient time, or aspects of the research took longer than originally anticipated' (36 %); 'early findings led to a shift in research focus' (23 %); or one or more 'objectives changed due to developments in the field' (13 %). Grant holders also cited 'technical problems or lack of access to essential equipment or infrastructure' (12 %) as a contribution to not achieving all original objectives.
- In 2009 the HRB completed the process of moving to purely international peer review panels and increased the information required in grant applications regarding objectives, timelines, deliverables, personnel etc. This has resulted in much greater scrutiny of the feasibility of grant proposals, to the extent that proposals can be turned down on the basis of feasibility/over-ambition alone.
- There is evidence in the report that the HRB's increased emphasis on clarity in the application process, robust peer review and on-going grant monitoring is having a real impact in terms of PIs achieving their originally stated objectives.

Personnel employed

- There were a total of 422 research-related posts supported by the 134 HRB grants analysed, which represented a significant increase on previous reporting periods.
- Grants categorised as biomedical research accounted for 58 % of total posts, of which 8 % were in basic biomedicine and 50 % were in applied biomedicine. Grants focused on clinical research accounted for 22 % of posts created, while population health sciences and health services research, when combined, accounted for the remaining 20 % of posts created.
- Biomedical research grants employed 55.9 % of all post-doctoral researchers and 52 % of all PhD students. The number of post-graduate and post-doctoral researchers employed in population health sciences (5.5 %) was disproportionately low.

- Researchers with a health professional background (e.g. medicine, nursing, allied health professions) accounted for 32.2 % (N=136) of the 422 personnel employed across all grants, which was a slight increase of 3.2 % on the equivalent 2010/2011 statistic.
- The most common next destination of HRB-funded personnel was a post-doctoral research post in a higher education setting (37.7 % of all personnel). 91 personnel (21.5 % of total) were employed in the health sector, either as a medical clinician, clinical nurse or an allied health professional, which was a significant increase on the previous reporting period.

Peer-reviewed publications

- The 134 grants that ended in 2012/2013 produced 584 peer-reviewed publications, giving an average of 4.4 papers per grant. This is an increase on both the 2010/11 and 2008/2009 statistic of 470 and 526 publications, respectively, or an average of 2.4 and 2.6 papers per grant, respectively. This may be accounted for by two PhD Scholars programmes (both categorised as applied biomedical research) that completed in 2012/2013, where peer-reviewed publications were a primary output.
- Five-year programmatic grants, on average, produced slightly fewer papers per €1 million spend than other scheme types while the MRCG Co-fund scheme produced more papers per €1 million spend (20.8) than any other scheme type.
- ePublications accounted for 17.1 % of total publications in 2012/2013 (in 2010/2011 the equivalent statistic was 16.3 %.) In most cases this indicated that the electronic version of the paper was available ahead of printing, although not necessarily in an open access format. However, the number of papers published in the open access on-line journal PLoS increased from 5 in 2010/2011 to 15 in 2012/2013, indicating that this approach to publication is improving.

Dissemination and collaborations

- Grant-holders reported 940 scientific dissemination events (oral and poster presentations at scientific conferences), or 7.0 per grant. This is less than the 2010/2011 statistic of 1427 (7.2 per grant) but in terms of presentations per grant, is a slight increase on the 2008/2009 statistic of 5.5 presentations per grant (N = 1,118 presentations)
- 51 % of grant holders disseminated their research findings to patient groups or the public – this is a significant increase on the corresponding statistics of 35 % and 21 % for grants that ended in 2010/2011 and 2008/2009, respectively.
- Relative to other scheme types the number of keynote addresses per €1 million spend at both national and international scientific conferences was almost two times higher for MRCG Co-fund Awards.
- Grant holders reported the establishment of 278 new research collaborations or partnerships during the lifetime of the HRB grant. This represents an average of 2.1 per grant which is identical to the statistic for 2010/2011, and an increase on the 2008/2009 statistic of 1.9 new collaborations per grant.
- The proportion of collaborations established with health bodies increased from 10 % of total new collaborations in 2010/2011 to 14 % in 2012/2013.

- The number of industry collaborations, as a proportion of all collaborations established, increased dramatically from the 2010/2011 reporting period, from 8 % of new collaborations in 2010/2011 to 31 % in 2012/2013.
- For the first time in 2013, one PI reported the use of social media to disseminate the results of their research to a wider audience.

Policy and practice-oriented outputs

- 52 grant-holders (38 % of total) reported a total of 127 policy or clinical practice outputs and influences. This is an increase on the corresponding statistics for 2010/2011 and 2008/2009 when 48 and 41 grant-holders, respectively, reported 100 and 84 policy and practice outputs and influences, respectively.
- Per €1 million spend, grants in health services research produced more health sector outputs and influences than either population health sciences, clinical research or applied biomedical research. Surprisingly, basic research grants reported almost as many policy and practice outputs as health service research awards per €1 million spend but these tended to be presentations to stakeholder groups and publication or citation in systematic reviews or specialist publications.
- Project Grants accounted for almost 60 % of reported policy and practice outputs, and 4.4 outputs per €1 million spend, as compared to Programme Grants and Fellowship Awards which produced 2.6 and 2.2 outputs per €1 million spend, respectively.
- MRCG Co-fund awards had the highest productivity of all scheme types for this metric, with 6.9 policy and practice outputs reported per €1 million spend.

Health sector innovations

- A total of 33 grant-holders (24.6 % of total) reported 43 healthcare innovations. This is similar to the corresponding statistic for 2010/2011 (48 innovations) but higher than 2008/2009 (32 innovations).
- The most common type of healthcare innovation reported was development of a new, or refinement of an existing, care model of service.
- Per €1 million spend, grants in population health and health services research produced more health sector innovations than other scheme types (2.2 and 2.0, respectively.) Surprisingly, basic research grants (primarily the MRCG Co-fund scheme) reported almost as many healthcare innovations (1.0 per €1 million spend) as clinical research (1.1 outputs per €1 million spend), and more than applied biomedical grants (0.5 per €1 million spend.)
- The vast majority of the 43 innovations were in the early stages of development or were still being tested and refined, with only 2 % reported as having achieved large scale adoption in the health sector, although a further 14 % had been adopted on a small scale within the health sector.

Follow-on funding leveraged

- 149 follow-on grants were leveraged by PIs whose grants completed in 2012/2013. This is an increase on the 2010/2011 and 2008/2009 statistics of 113 and 117 follow-on grants, respectively.
- Of the approximately €39.5 million that these 149 grants were collectively worth, 54.7 % came from non-exchequer sources such as industry, charities, and international bodies. This was the first time since this data began to be collected on this metric that leveraged non-exchequer funding exceeded exchequer funding.
- The return on HRB investment of leveraged funding, euro for euro, was almost parity (€0.89), in comparison to the 2010/11 reporting period, when it was €0.65 of leveraged funding for every €1.00 of HRB funding invested.
- Nine grant-holders had secured follow-on technology development or commercialisation grants from Enterprise Ireland, which is a significant increase on the corresponding 2010/2011 statistic of two awards.

Intellectual property and commercial activities

- Grants that ended in 2012/2013 produced 16 patents, five licensed technologies, contributed to the establishment of two start-up companies, and led to 88 academic-industry collaborations.
- In total, HRB grant-holders reported 48 commercial outputs - this is similar to the 2010/2011 statistic of 54 outputs, and a slight increase on the 2008/2009 statistic of 42 commercial outputs.
- Unsurprisingly, grants in the biomedical sciences produced more commercial opportunities than clinical research, health services research and population health sciences grants.
- Project Grants produced 1.2 commercial/enterprise outputs per €1 million spend. Other scheme types produced between 0.2 and 0.7 outputs per €1 million spend.

Conclusions

A number of observations can be made from the data presented in this report:

- Grants in the biomedical and clinical sciences produced the most scientific publications and commercial opportunities such as patents and industrial collaborations;
- Grants in health services research, population health sciences and clinical research produced the most health policy and practice outputs and provided the most research training opportunities for health professionals;
- The MRCG Co-fund scheme was very productive in terms of number of outputs per €1 million spend across a wide range of metrics.

The implication of a shift away from basic biomedical and applied biomedical research that is not specifically patient-oriented, towards greater investment in patient oriented research, population health sciences and health services research, is that over the coming years we may see a slight decrease in scientific 'productivity' (e.g. number of peer-reviewed publications per €1 million spend) and commercial impact (e.g. patents, industry collaborations), since these outputs tend to arise predominantly from the former types of research activity. However, there is no reason to believe that a decrease will occur in indicators of scientific quality (e.g. field-normalised citation impact).

The new HRB funding initiatives in Clinical Research, Population Health Sciences and Health services research, based on the multi-disciplinary collaborative funding model, along with the emphasis placed by international peer review panels on methodological rigour, ensures that only high-quality research is funded with the potential for both scientific and health impact. Therefore, possible decreases in productivity metrics will be more than offset by a concomitant increase in health sector outcomes such as development of healthcare innovations (e.g. interventions, therapies) and influences on policy and practice (e.g. clinical guidelines, policy briefs, advisory roles) which tend to be associated with these broad research areas.

Appendix 1: Impact Assessment Framework

Based on the Payback Framework of Buxton and Hanney

Impact Category	Indicators
Knowledge Production	<ul style="list-style-type: none"> ○ Peer reviewed publications and citations ○ Other publications such as books, book chapters, editorials or bulletins ○ Presentations to national and international conferences ○ Research reports and 'grey literature' produced ○ Cochrane systematic reviews produced or findings included in a review
Research capacity-building and targeting	<ul style="list-style-type: none"> ○ Education and training of personnel such as clinicians, health professionals and scientists ○ Higher degrees, such as PhD, obtained by research personnel ○ Retention rates of research personnel in national research system ○ Research personnel attracted from overseas ○ Spin-off projects developed and further research funding leveraged ○ Development and use of novel research techniques ○ Establishment of new datasets, databases or research data lodged in national database ○ New national/international collaborations or strategic partnerships formed with other research teams, industrial partners or health agencies ○ Level of all-Ireland collaboration and benefits accruing from this ○ Internationalisation of research: Involvement of HRB-funded researchers with EU and global health research initiatives
Informing policy, practice and product development	<ul style="list-style-type: none"> ○ Influencing national and international research policies and strategies ○ Dissemination and knowledge-transfer events or networks established with research 'users', such as policy-makers and health professionals ○ Advisory roles of HRB-funded researchers to government or policy-makers ○ Commissioned reports or projects from government departments or agencies ○ Policy briefing papers, practical handbooks and other grey material produced and disseminated to research users such as policy-makers and health professionals ○ Contribution of research to clinical treatment or best practice guidelines ○ Evidence of public outreach and dissemination through media and other fora ○ Patents and other IP applications and award of commercialisation support grants to develop marketable products or devices ○ Licence agreements and revenues generated as a result ○ Spin-out companies or formal collaborative partnerships between researchers and industry
Health sector benefits and innovations	<ul style="list-style-type: none"> ○ Contribution of HRB-funded research to health promotion initiatives ○ Randomised control trials completed and new interventions established as a result ○ Numbers of patients enrolled on clinical trials or engaged with studies undertaken in clinical research facilities supported by the HRB ○ Contribution of HRB-funded research to actual health benefits within Irish population ○ Savings to the health system through gains in health service efficiency, improved primary care or introduction of preventative health measures, where research and evidence generated by HRB-funded researchers contributed to

Impact Category	Indicators
	<p>this</p> <ul style="list-style-type: none"> ○ Increased availability of local pool of evidence and evidence “generators” to Irish health policy-makers and health practitioner
<p>Economic, commercial and enterprise benefits</p>	<ul style="list-style-type: none"> ○ Improved international reputation of Ireland for health and medical research (e.g. by attracting pharma industry R&D and collaborative partnerships with HRB-funded researchers; invited keynote addresses to international conferences; involvement of HRB-funded researchers in international research programmes) ○ Success of HRB-funded personnel in attaining additional research funding, for example through the EU’s Framework Programmes ○ Success of HRB-funded researchers in commercialising the outcomes of their research (through invention disclosures, patents, licences, formation of start-up and spin-out companies) ○ Success of HRB-funded researcher in obtaining EI funding for further development of potentially viable enterprise outputs of the research.

Appendix 2: Summary of key outputs from 2012/2013 EOG reports by scheme

Impact Category / Key Indicator (No.)	Project Grants (70 grants)	Fellowship Awards (47 grants)	Programme Grants/CSA (6 grants)	MRCG Co-funded (9 grants)	PhD Scholars Programme (2 grants)
Scientific outputs					
No. peer-reviewed publications (N=584)	209	134	71	36	134
Mean no. peer-reviewed publications per grant	3	2.9	11.8	4	67
No. publications per €1 million spend	12.5	13.4	10.2	20.8	15.5
Average cost per paper	€80,031	€79,595	€97,584	€48,018	€64,463
Research capacity outputs					
Mean no. personnel per grant (total=422)	2.9	1	15.3	3.1	27
No. PhD degrees (total=131)	31	21	22	7	50
No. health professionals trained (total=136)	86	30	19	1	-
No. research collaborations established (N=278)	128	67	24	19	40
No. collaborations established per €1 million spend	7.7	6.7	3.5	11.0	8.9
Policy and practice outputs					
No. policy/practice outputs (total=127)	74	26	15	12	-
No. policy and practice outputs per €1m spend	4.4	2.6	2.2	6.9	-
No. of patient/public engagement outputs (total=188)	87	66	12	15	8
No. patient/public engagement outputs per €1 million spend	5.4	6.6	1.9	8.7	1.8
Healthcare innovation outputs					
No. health innovations developed (total=43)	29	5	5	3	1
No. healthcare innovations per €1 million spend	1.7	0.5	0.7	1.7	0.1
Leveraging and commercialisation outputs					
No. leveraged additional grants (total=149 grants worth €39.5 million)	91	18	14	16	10
Amount of exchequer/non-exchequer funding leveraged	€13.6/€9.6 million	€0.9/€0.3 million	€2.5/€8.5 million	€0/€2.5 million	€0.9/€0.8 million
No. patents filed or pending (N=16)	8	1	5	-	2
No. licenced technologies developed (N=5)	4	1	-	-	-
No. start-ups companies established or in train (N=2)	1	-	-	1	-
No. industrial collaborations established (N=88)	38	22	15	12	1
No. commercialisation outputs per €1 million spend	1.2	0.2	0.7	0.6	0.2