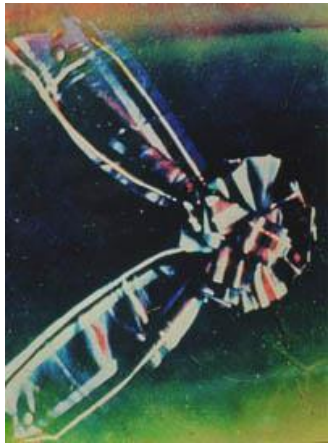
Impact of the WHO EMF Research Agendas



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Outline

1. Backgrounds and objectives of impact survey of the WHO Research Agendas
2. Impact survey and Questionnaire
3. Summary of the Questionnaires filled out
4. Limitation of this impact survey
5. Future developments to improve the accuracy of impact survey
6. Appendix: Japanese Activities

Backgrounds

- Throughout the past 15 years, the WHO International EMF Project has developed several Research Agendas for electromagnetic fields (including static, ELF and RF fields) that have been instrumental in assisting countries to develop national funding priorities in this area.
- This activity is core to the mandate of WHO in the area of "stimulating the generation, translation and dissemination of valuable knowledge".

Objectives of measuring impact of WHO EMF research agendas

- While important for internal evaluation purposes, the need for such information has also been expressed by members of the International Advisory Committee (IAC) to inform future national decisions of research funding in this area.

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The way to conduct the impact survey

- To measure the impact of the WHO EMF Research Agendas, questionnaire has distributed to the IAC members last year.
- The questionnaire was developed to capture essential information on nationally funded EMF research in different countries.
- The questionnaire is made up of four separate sheets for, (1) static, (2) ELF and (3) RF fields (2006), (4) RF fields (2010).

Objectives & Content of Impact Survey

- Grasping **the number of countries** addressing the research needs recommended in WHO Research Agendas.
- Grasping **the extent of those research activities** based on the following information:

(1) The number of researches (or research projects) supported by public funds in a country. We have intended that the number of public funds should be counted.

continued

Content of Impact Survey

(2) The status of these researches (or research projects), including completed, ongoing and planned.

(3) The main theme of research (or research project), corresponding to research needs which are recommended in WHO Research Agendas.

(4) Research periods.

(5) Funding Agencies.

(6) The budget for each research (or research project).

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Number of researches reported by each country

Respondent 21 countries	Static Fields (2006)	ELF Fields (2007)	RF Fields (2006)	RF Fields (2010)	All agendas
Australia	0	1	9	6	16
Belgium	0	2	2	2	6
Brazil	0	5	2	6	13
Canada	4	6	1	5	16
Denmark *b	0	4	2	0	6
Finland	0	2	2	21 *a	25
Germany	4	8	14	21	47
Greece	0	0	0	4	4
Italy	1	3	3	0	7
Japan	1	1	16	7	25
Korea	0	7	7	12	26
Netherlands	0	8	12	21	41
New Zealand	0	0	1	0	1
Peru	0	1	2	1	4
Philippines	0	0	0	0	0
Poland	1	1	1	2	5
Russian *c	-	-	-	-	0
Spain	0	0	1	12	13
Switzerland	0	1	7	5	13
Tunisia	(32)	0	0	0	0
United Kingdom	1	5	7	1	14
Total (excluding Tunisia)	12	55	89	126	282

*a : reported using the number of publications . *b : responded without information of budget.

*c : responed with the list of publications without specifing any category of Agenda.

Tunisia's report：Static field sheet only filled.

[Tunisia]

	WHO Research Agenda for Static Fields (2006) "High-priority " and "Other "research needs	Status and number of related research by public funds			Title of research and reference (if already published)	Research period in years	Funding source	Total budget in USD
		completed	ongoing	planned				
Epidemiological studies								
H	Nested case-control study of chronic diseases in highly exposed occupational groups							
H	Cohort study of short-term effects in highly exposed occupational groups							
H	Prospective study of pregnancy outcomes in relation to occupational exposure and MRI examinations							
H	Development of dosimeters for obtaining reliable							
Human volunteer studies								
H	Studies on vestibular function, head and eye coordination in a gradient fieldn							
O	Cognitive and behavioural effects of static magnetic fields							
O	Cardiac function in the routine clinical environment							
Animal studies								
H	Long-term (including life-time) studies concentrating on cancer-related effects using both normal and genetically-modified animals							
H	Developmental and neurobehavioural effects	2	1	1	Effects of iron overload and low frequency electromagnetic exposure on sp	5 years	University	50.000 USD
O	Effects on cardiac functions under very high field intensity (10-20 T)	1	1	1	Interaction of EMF with cardiotonic	2 years	University	20.000USD
O	Animal study to cover different endpoints	10	5	3	Interaction of EMF with metabolic and physiological parameters	6 years	University	60.000USD
Cellular studies and mechanisms								
H	Mutagenicity and transformation in primary human cells							
O	Interaction mechanisms on radical pair reactions and enz	4	2	1	Oxidative responses under Emf environment/ mineral nanoparticles/Quantu	3 years		30.000USD
O	Gene expression in primary human cells							
Dosimetry								
H	Development of a very fine resolution head-and-shoulder phantom							
H	A detailed model of induced current in the heart							
H	Dosimetric studies on the fetus under high field MRI							
O	Dosimetric studies with male/female/pregnant voxel phantoms							
Other research that your country is interested in								

Are these values based on the number of the corresponding funds or papers published?.

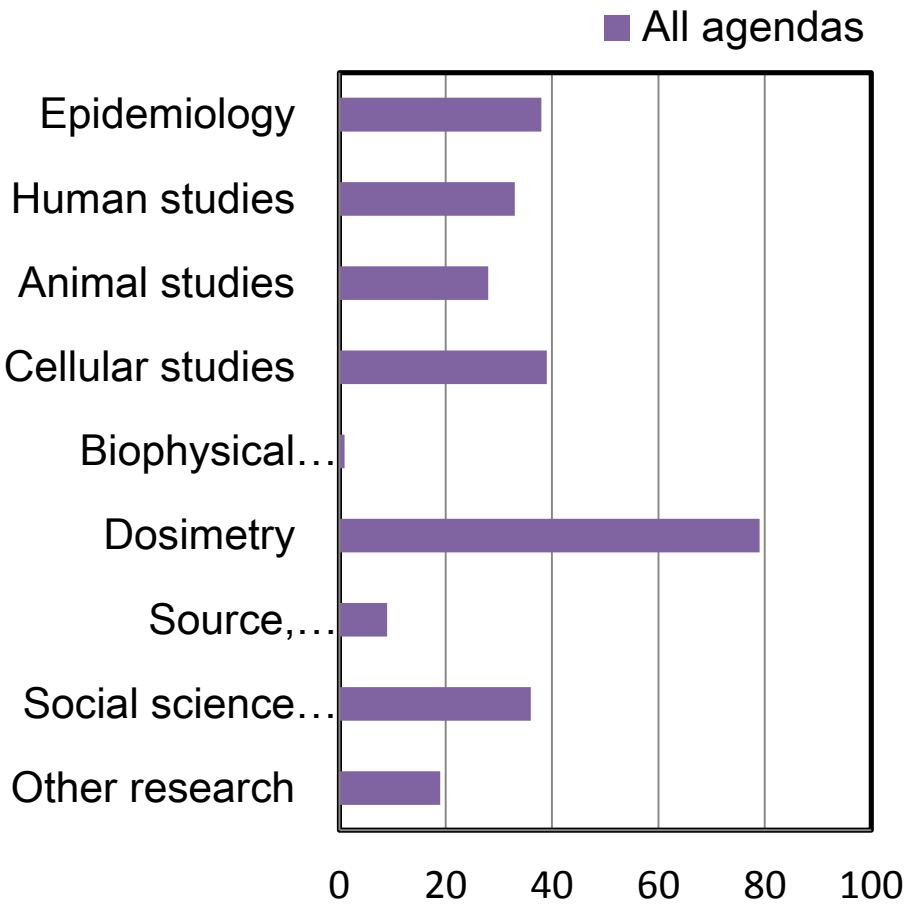
Number of researches classified into the categories

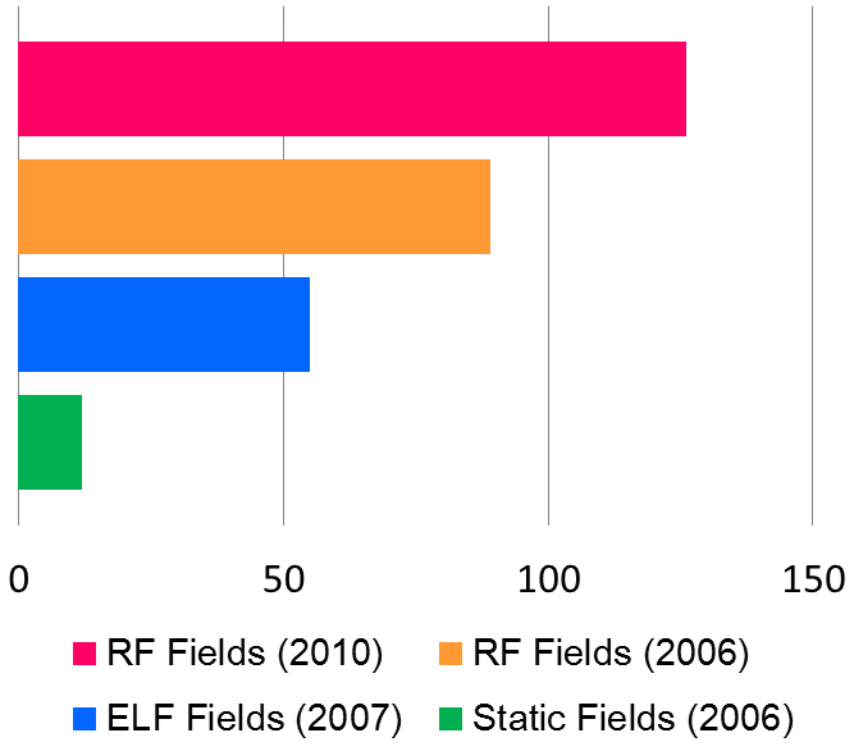
Research categories	Static Fields (2006)	ELF Fields (2007)	RF Fields (2006)	RF Fields (2010)	All agendas
Epidemiology	2	8	18	10	38
Human studies	3	1	3	26 *a	33
Animal studies	4 (29) *b	12	7	5	28 (53) *b
Cellular studies	1 (8) *b	8	17	13	39 (46) *b
Biophysical mechanisms		1			1
Dosimetry	0	7	30	42	79
Source, Measurements and Exposures		9			9
Social science research		4	8	24	36
Other research that your country is interested in	2	5	6	6	19
Total	12 (44) *b	55	89	126	282

*a : including Finland' report using the number of publications.

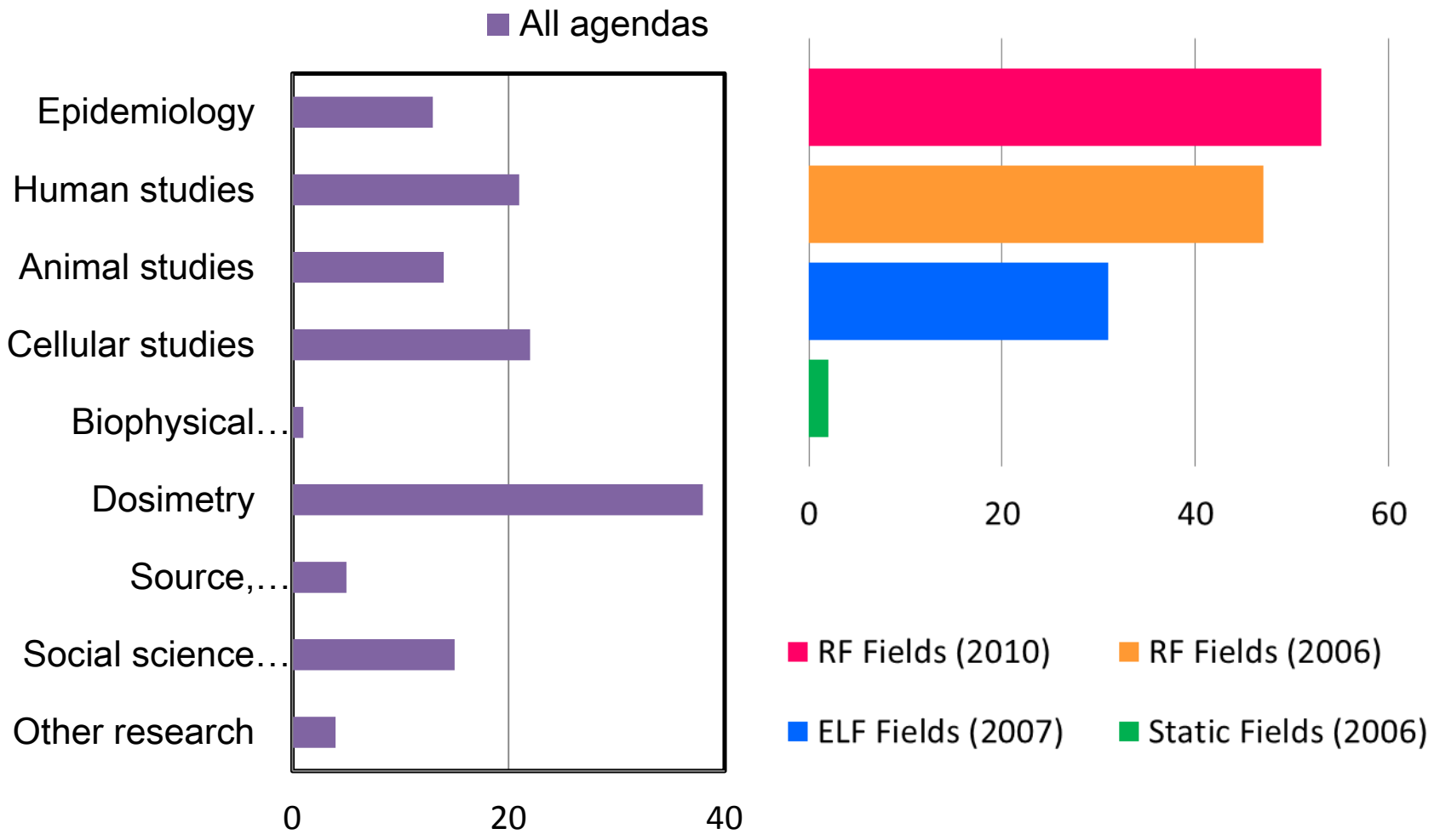
*b : including Tunisia' report.

Number of researches in various status, including completed, ongoing and planned.

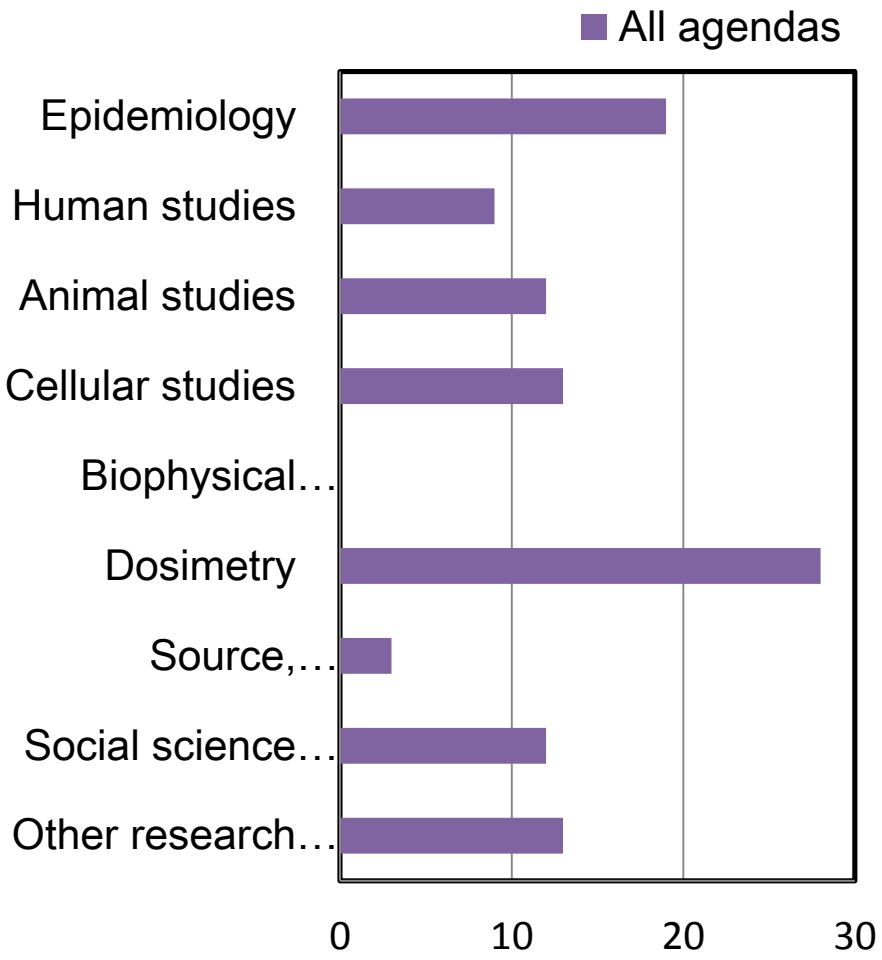


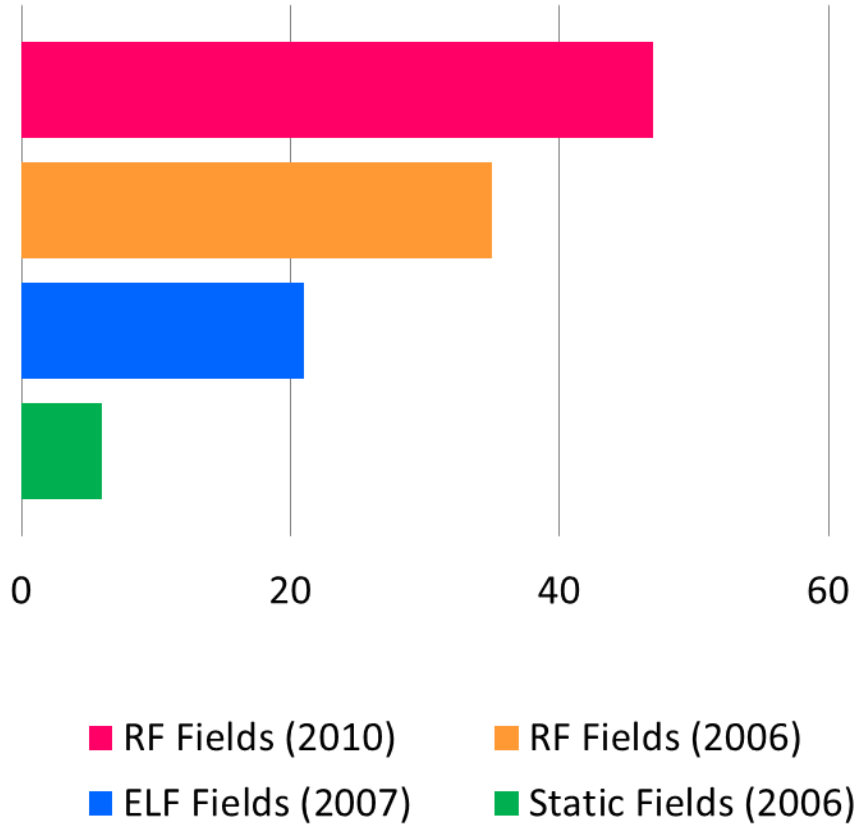


Number of researches *completed*

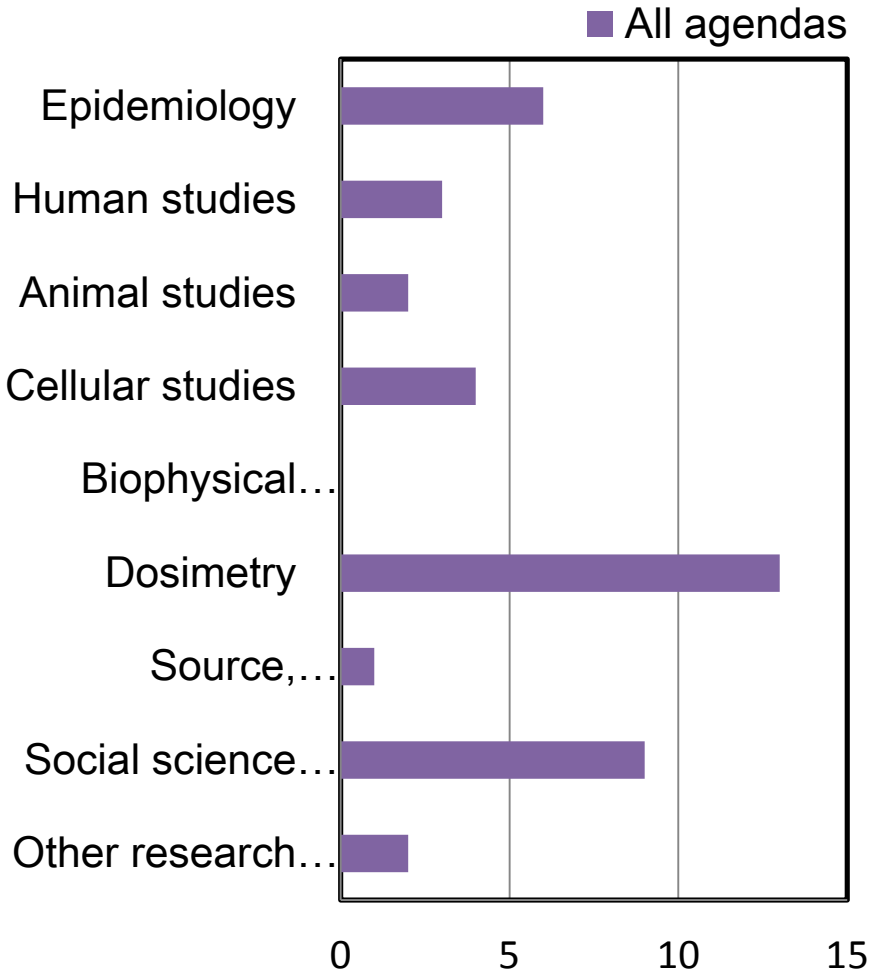


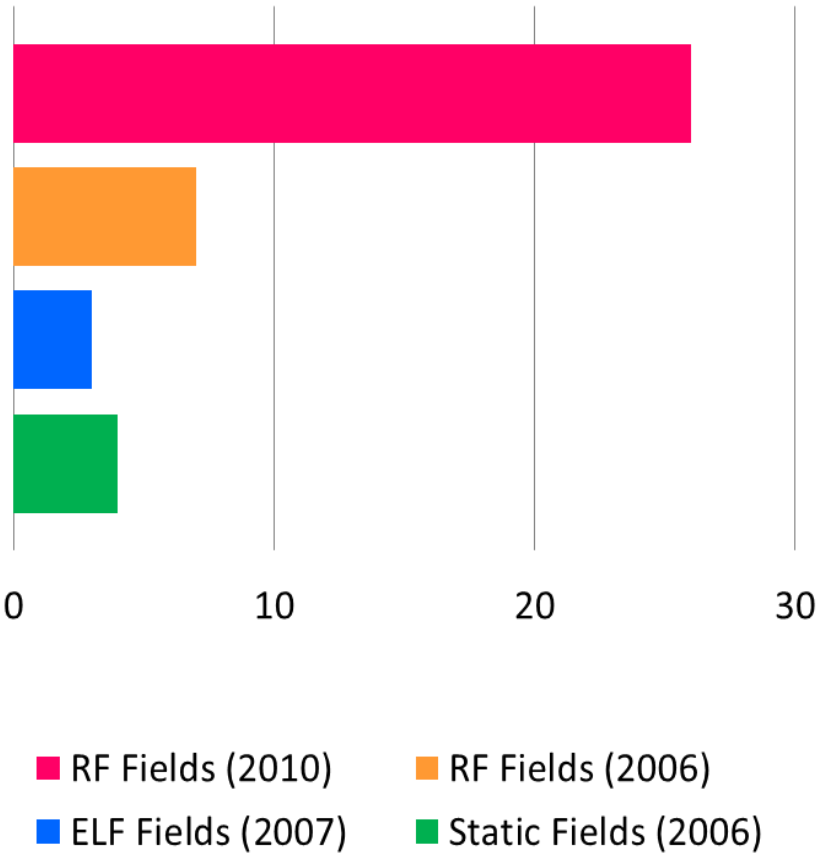
Number of researches *ongoing*



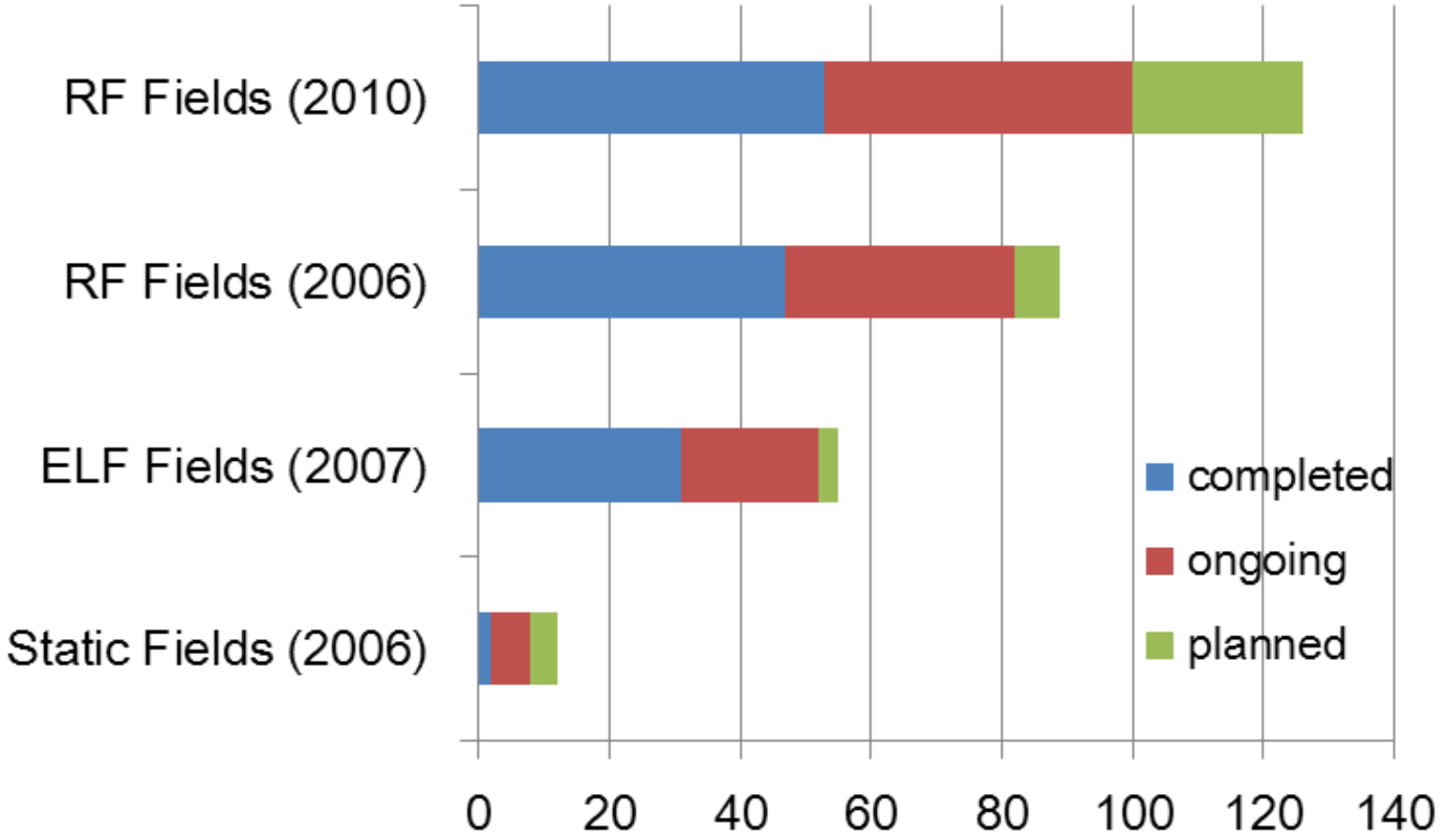


Number of researches *planned*





Number of researches in 3 status, regarding to each agenda.



Total Budget reported by each country（in million USD）

Respondent 21 countries	Static Fields (2006)	ELF Fields (2007)	RF Fields (2006)	RF Fields (2010)	ALL Agendas
Australia	0.00	0.00	2.31	0.95	3.26
Belgium	0.00	0.28	0.00	0.01	0.29
Brazil	0.00	2.50	0.80	6.30	9.60
Canada	1.40	0.45	0.30	0.36	2.51
Denmark *a	-	-	-	-	-
Finland	0.00	0.50	0.13	1.10	1.73
Germany	2.56	3.51	6.18	9.47	21.72
Greece	0.00	0.00	0.00	15.00	15.00
Italy	0.28	0.00	0.00	0.00	0.28
Japan	0.00	0.60	20.05	12.25	32.90
Korea	0.00	2.86	1.01	1.19	5.06
Netherlands	0.00	3.36	14.30	4.68	22.34
NZ	0.00	0.00	0.10	0.00	0.10
Peru	0.00	0.05	0.01	0.15	0.21
Philippines	0.00	0.00	0.00	0.00	0.00
Poland	0.00	0.00	0.00	0.00	0.00
Russian *a	-	-	-	-	-
Spain	0.00	0.00	0.00	0.84	0.84
Switzerland	0.00	0.70	2.77	3.26	6.73
Tunisia	0.16	0.00	0.00	0.00	0.16
UK	0.07	0.60	5.47	1.00	7.14
Total	4.47	15.41	53.43	56.56	129.87

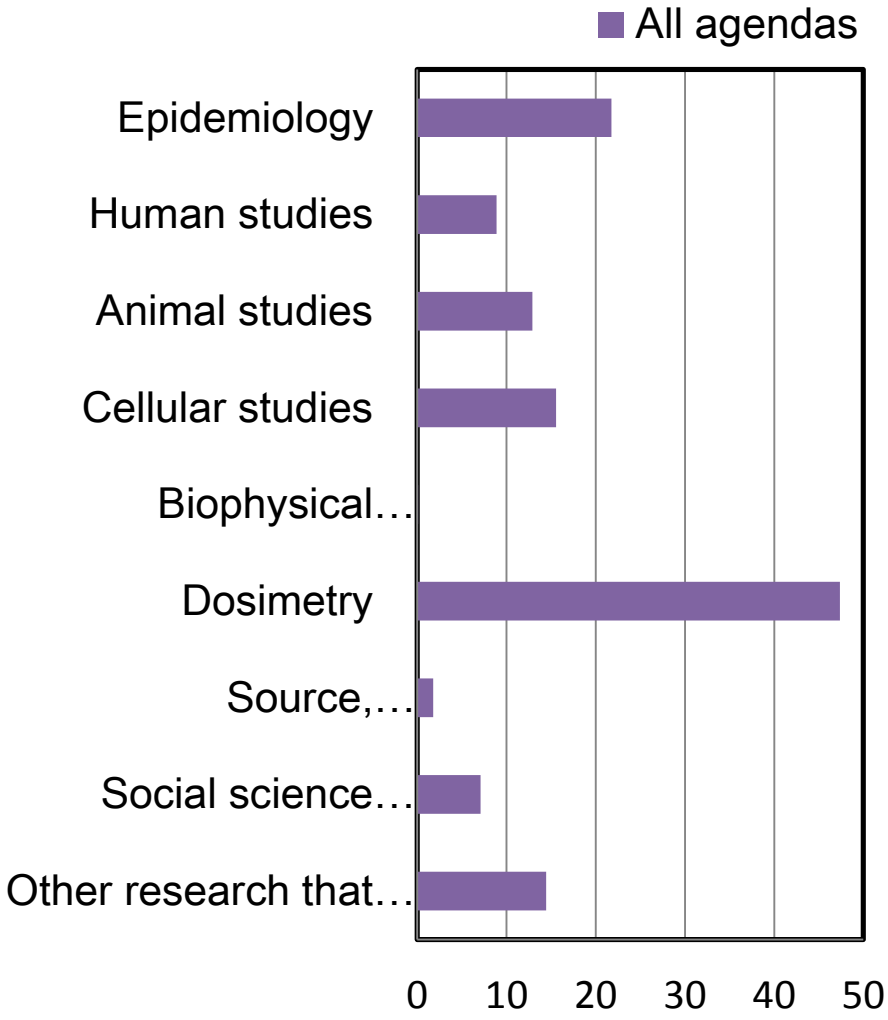
*a : responed without information of budget.

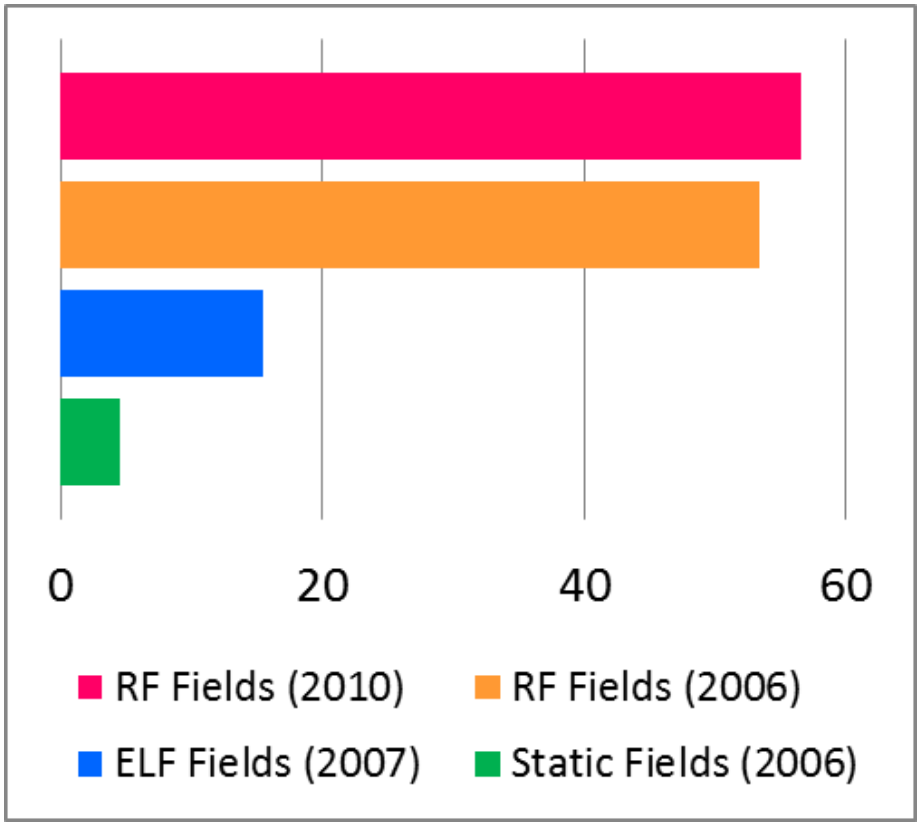
Total Budget reported (in million USD)

Research categories	Static Fields (2006)	ELF Fields (2007)	RF Fields (2006)	RF Fields (2010)	All agendas
Epidemiology	0.07	0.72	13.36	7.62	21.77
Human studies	1.08	0.00	1.11	6.69	8.88
Animal studies	1.81	3.17	5.17	2.76	12.91
Cellular studies	0.23	3.82	7.18	4.32	15.55
Biophysical mechanisms		0.10			0.10
Dosimetry	0.00	1.45	15.94	29.98	47.37
Source, Measurements and Exposures		1.77			1.77
Social science research		2.51	1.25	3.32	7.08
Other research that your country is interested in	1.28	1.87	9.42	1.86	14.43
Total (in million USD)	4.47	15.41	53.43	56.55	129.86

NOTE: Including Tunisia's report.

Total Budget reported (in million USD)





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Comparison with IEEE Database

	This survey		Number of projects in IEEE Database (updated Apr. 6, 2012)					
Frequency Range	All	RF	All	RF	ELF	Static	IF	TF
Australia	16	15	57	55	2	0	0	0
Belgium	6	4	11	11	0	0	0	0
Brazil	13	8	12	9	3	0	0	0
Canada	16	6	39	30	9	0	0	0
Denmark	6	2	18	15	3	0	0	0
Finland	25	23	44	43	0	0	1	0
Germany	47	35	171	147	21	0	2	1
Greece	4	4	12	12	0	0	0	0
Italy	7	3	103	79	24	0	0	0
Japan	25	23	64	52	11	0	1	0
Korea	26	19	49	35	10	0	4	0
Netherlands	41	33	12	9	3	0	0	0
New Zealand	1	1	6	5	0	0	1	0
Peru	4	3	0	0	0	0	0	0
Philippines	0	0	0	0	0	0	0	0
Poland	5	3	29	22	7	0	0	0
Russian	0	0	50	43	5	0	0	2
Spain	13	13	19	15	4	0	0	0
Switzerland	13	12	39	36	3	0	0	0
Tunisia	0	0	0	0	0	0	0	0
United Kingdom	14	8	93	82	10	1	0	0
21 countries Total	282	215	828 (45.1%)	700 (45.2%)	115 (43.7%)	1	9	3
USA	–	–	546 (29.7%)	484 (31.2%)	56 (21.3%)	2	2	2
France	–	–	90 (4.9%)	84 (5.4%)	6 (2.3%)	0	0	0
IEEE Databese Total			1836 (100%)	1550 (100%)	263 (100%)	4	14	5

Note: Database Search Criteria: Project Status=All ; Funding Agencies=All.

Misleading terms

Status and number of related research by public funds			Title of research and reference (if already published)	Research period in years	Funding source	Total budget in USD
completed	ongoing	planned				

Some respondent countries answered to this question with a list of papers published.

RF(2010)
RF(2006)
ELF(2007)
Static(2006)

WHO Research Agenda for Static Fields (2006) "High-priority research needs" and "Other research needs"		Status and number of			arch and reference (if already	Research period in years	Funding source	Total budget in USD
		completed	ongoing	planned				
Epidemiological studies								
H	Chronic diseases, Highly exposed occupational							
H	short-term effects, Highly exposed occupational							
H	Prospective, pregnancy outcomes, MRI							
H	Development of dosimeters							
Human volunteer studies								
H	Vestibular function, Head and eye coordination, Gradient fields							
O	Cognitive and behavioural effects, Static fields							
O	Cardiac function, Clinical environment							
Animal studies								
H	Long-term, Cancer-related effects, normal and genetically-modified animals							
H	Developmental and neurobehavioural effects							
O	Cardiac functions, Very high field intensity (10-20 T)							
O	Animal study to cover different endpoints							
Cellular studies and mechanisms								
H	Mutagenicity and transformation in primary human cells							
O	Interaction mechanisms on radical pair reactions and enzymatic activity							
O	Gene expression in primary human cells							
Dosimetry								
H	Development of a very fine resolution head-and-shoulder phantom							
H	A detailed model of induced current in the heart							
H	Dosimetric studies on the fetus under high field MRI							
O	Dosimetric studies with male/female/pregnant voxel phantoms							
Other research that your country is interested in								

Limitation of this impact survey

- Low response rate (below 50%).
- Lack of the information on research activities in USA and France whose contribution may be about 35% (rough estimate).
- Previous agendas not included(1997, 2003).
- Inaccurate answers in some response sheets, partially because of inadequate instructions for filling the questionnaire as well as its question items using some misleading terms.

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Some points to improve the accuracy of survey (1/4)

1. Explaining more clearly to persons filling Questionnaire that the targets of our survey are the studies supported by national or public funds, and their answers should be limited to such researches.
2. The respondent countries have hardly answered to questions in the agenda on static field. Thus, we should again request them to answer to our questions on how they have addressed the issues recommended in Research Agenda for static fields (2006).

Some points to improve the accuracy of survey (2/4)

3. Most confusing matter is how to count the number of related studies sponsored by public funds. Major part of respondent countries answered to this question the number of related funds, while some answered with a list of papers published. However, such answer is not in line with the original purpose of the questionnaire.

   ... Whether the misleading terms "reference (if already published) " are essential to be written or not.

Some points to improve the accuracy of survey (3/4)

4. We need the information on the titles of studies only to know to which research needs of the agenda are being addressed.
5. On the assumption that activities of research funds should be a suitable measure to evaluate the impact of Research Agendas. The respondent countries should never fail to answer to the items of funding agency and total budget in USD.

Some points to improve the accuracy of survey (4/4)

6. It would be useful for the respondent countries to include the URL where their research activities and achievements are posted.
7. Adding other Agendas (1997, 2003), if appropriate.
8. Questionnaire should be revised and sent again, together with a report of our first analysis, to obtain more accurate information to evaluate the impact of WHO Research Agendas.

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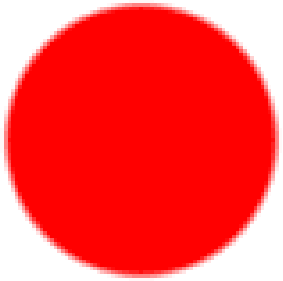
Outlines of Japanese Activities on RF-EMF



PARF

Background and Purpose of Establishment

In response to growing concern as to the adverse health effects of RF-EMF among the general public, the Ministry of Internal Affairs and Communications (MIC) established a **Committee on the Possible Adverse Health Effects of Radio Frequency Electromagnetic Fields (PARF)** for the purposes of **promoting researches** by evaluating and analyzing the research results on the possible adverse health effects of RF-EMF on humans and **determining the research topics** to be addressed, and of constructing a society in which people can use RF-EMF safely and securely, by **evaluating and validating the Radio Radiation Protection Guidelines (RRPG: MIC guidelines)**.

(1) Evaluating and analyzing the research results worldwide

The results of new researches worldwide are evaluated and analyzed.

(2) Determining the research issues to be addressed

In response to the “Many objectives remain to be investigated” remarked by the Committee to Promote Research on the Possible Biological Effect of Electromagnetic Fields, the PARF emphasized the importance of promoting researches on the safety of radio waves while improving the reliability of scientific data. (**Research topics are coordinated along with WHO RF Research Agendas 2003, 2006 & 2010**.)

Determining the Research Topics to be Addressed

(3) Evaluating and Validating the MIC Guidelines

Based on the evaluation and analysis of the results of the latest researches, the current MIC Guidelines are evaluated and validated.

(4) Other related issues

International contributions, such as GLORE meeting, are reviewed if necessary.

Members of the PARF

Name	Name
IMAIDA Katsumi	TSUNEMATSU Yukiko
UGAWA Yoshikazu	NAGAWA Hirokazu
USHIYAMA Akira	NISHIZAWA Mariko
OHKUBO Chiyoji (Chairperson)	NOJIMA Toshio
OKUNO Tsutomu	HIDA Eriko
KAMADA Tamaki	FUJIWARA Osamu
KUMADA Akiko	MIYAKOSHI Junji
SASAKI Hiroshi	YAMAGUCHI Naohito
JIMBO Yasuhiko	YAMANE Kaori
TAKI Masao (Vice Chairperson)	**WATANABE Soichi**

List of the Current Research Projects

- **Epidemiology**
  1. Mobi-Kids study and Prospective Follow-up Study of Children and Adolescents
- **Human Voluntary Studies**
  2. Effects of Electromagnetic Field Emitted from Mobile Phones on Human Sleep.
- **Animal Studies**
  3. Effects on Immune Function from the 2GHz RF-EMF Exposure to Pre-natal and Juvenile Rats.
  4. Effects on Hematopoietic Activity in Rats after Prenatal Exposure to 2 GHz Electromagnetic Field.
  5 Effects of Composite Exposure Using Multi-frequency Electromagnetic Field in Rats.
  6 Verification of Safety Guidelines at 60 GHz Millimeter Wave Ocular Exposure.
- **Cellular Studies**
  7. Effects of RF Exposure on Neurite Outgrowth in PC12VG Cells.
- **Dosimetry**
  8. In vitro Study on MMW Exposure.
  9. Development of Multiple-Frequency Exposure System 800 MHz - 5.5 GHz relating No.5 Research Project.
  10. Development of Exp. Setup for Immune System Study relating No.3 Research Project.
  11. Computational Dosimetry of In-direct Coupling between EM Field and Human at Intermediate Frequencies.

Thank you for your attention!