



**Science without meritocracy. Discrimination among European specialists in infectious diseases and clinical microbiology: a questionnaire survey**

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**Science without meritocracy. Discrimination among European specialists in infectious diseases and clinical microbiology: a questionnaire survey**

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**Abstract**

**Objective** In 2009, in an European survey, around a quarter of Europeans reported witnessing discrimination or harassment at their workplace. The parity committee from the European Society of Clinical Microbiology and Infectious Diseases (ESCMID) designed a questionnaire survey to investigate forms of discrimination with respect to country, gender and ethnicity among medical professionals in hospitals and universities carrying out activities in the Clinical Microbiology (CM) and Infectious Diseases (ID) fields.

**Design** The survey consisted of 61 questions divided into five areas (socio-demographic, professional census and environment, leadership, and generical) and ran anonymously for nearly 3 months on the ESCMID website.

**Subjects** European specialists in CM / ID.

**Results** Overall, we included 1,274 professionals. The majority of respondents (68%) stated that discrimination is present in medical science. A quarter of them reported personal experience with discrimination, mainly associated with gender and geographic region. Specialists from South-Western Europe experienced events at a much higher rate (37%) than other European regions. The proportion of women among full professor was on average 36% in CM and 26% in ID. Participation in high-level decision making committees was significantly (> 10 percentage points) different by gender and geographic origin. Yearly gross salary among CM/ID professionals was significantly different among European countries and by gender, within the same country. More than one third of respondents (38%) stated that international societies in CM/ID have an imbalance as for committee member distribution and speakers at international conferences.

**Conclusions** A quarter of CM / ID specialists experienced career and research discrimination in European hospitals and universities, mainly related to gender and geographic origin. Implementing proactive policies to tackle discrimination and improve representativeness and balance in career among CM/ID professionals in Europe is urgently needed.

## Introduction

In 2000, the European Union adopted two very far-reaching laws to prohibit discrimination in the workplace based on racial or ethnic origin, religion, disability, or sexual orientation.<sup>1</sup> In 2009 a survey was conducted to track, at European level, perceptions and opinions on this field.<sup>2</sup> Overall, around a quarter of Europeans reported witnessing discrimination or harassment and 16% of them experiencing it within one year of the study. Discrimination on ethnic origin (61%) was perceived to be the most widespread grounds for discrimination, followed by discrimination based on age (58%), disability (53%), and gender (40%).<sup>2</sup>

Discrimination in the academic area is more difficult to analyze although many of the factors making scientific work settings unfriendly to women and underrepresented minority groups are as common as in any other professional environment.<sup>3,4</sup> In particular, in medical professional settings, discrimination is harder to address because medical science itself (as science in general) is considered to be objective and an area where personal success is only based on scientific merit.<sup>2</sup> The common belief of the blindness of science with respect to any personal feature of scientists is the basis of the subtle, informal and hardly visible nature of its segregating mechanisms, which often goes unrecognized even by those who are negatively affected by them.<sup>5</sup> When it comes to scientific professions, such as the medical one, it is also paramount to identify which are the real positions where leadership is expressed. In fact, these professions have undergone deep transformation in the last decades, with new roles and new professional figures emerging, modification of hierarchies and career paths and changes in the relative values attributed to different skills and capacities.<sup>6,7</sup>

Over the last years, many projects have been focused on characterizing discrimination at work level in academic settings.<sup>6,8-10</sup> Most important factors reported to contribute to the so called “chilly climate” for women and minority groups in science are the following: exclusion from informal networks and the existence of “hidden quotas” for women’s and minority groups’ presence in high-level positions,<sup>11</sup> pay gap,<sup>6</sup> access to resources for research and early-stage career development,<sup>12</sup> and evaluation of scientific merit.<sup>6</sup> Gender discrimination, in particular, has been the focus of different European researches.<sup>6,8-10,13</sup> The “She figures 2009” project, a collaboration between the Scientific Culture and Gender Issues Unit of the Directorate-General for Research of the EU Commission and the Helsinki Group, showed that although the

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feminisation of the student population is one of the most striking aspects of the evolution of research over the last 30 years, in most European countries women's academic career remains markedly characterised by strong vertical segregation. Women represented 44% among university students and 18% among full professors. Even of more interest, of all countries observed, there was none where female wages were equal to men's, despite the almost universal existence of legislation to impose gender wage equality.<sup>6</sup>

More difficult is to look for evidence of discrimination related to ethnic origin or belonging to any other underrepresented minority in medical academic area. Most observations derive from the U.S. Universities where, in 2008, African-Americans, Hispanics and Native Americans made up more than a third of the U.S. population but only 8.7 percent of physicians and 15 percent of enrolment in medical schools.<sup>14</sup>

In order to verify if, and to what extent forms of discrimination exist, the Parity Commission of the European Society of Infectious Diseases and Clinical Microbiology (ESCMID) organized a pan-European questionnaire survey. This study was designed to explore different forms of discrimination with main focus to gender, geographic origin, and belonging to a minority among clinical microbiology (CM) and infectious diseases (ID) professionals working in European hospitals and universities.

### Methods

A literature review was performed in order to define evidence and causes for discrimination in medical science and among CM/ID specialists. After assessing content validity, a pilot study including 10 participants from different European countries, evaluated its acceptance and reproducibility, and results led to minor amendments to its format. The final survey ([http://www.escmid.org/profession\\_career/parity\\_commission/parity\\_survey/](http://www.escmid.org/profession_career/parity_commission/parity_survey/)) consisted of 61 questions divided in five areas (socio-demographic, professional census and environment, leadership and generical) and ran anonymously for nearly 3 months (from March 17<sup>th</sup> to June 7<sup>th</sup> 2011) on the ESCMID website (see table 1). All ESCMID regular members, attendees of the 21st European Congress of Clinical Microbiology and Infectious Diseases (ECCMID)/27th International Congress of Chemotherapy held in Milan, Italy, and national/international ESCMID-affiliated societies' members were invited to participate.

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### **Sample size calculation**

Before administering the questionnaire a statistical description of the universe of reference (i.e. European CM/ID specialists) according to geographic region and gender was accomplished based on information provided by the ESCMID. Since the type of sampling was of a non-probabilistic nature, it was not possible to exactly determine the statistical representativeness of the sample. However, sample size to attain a confidence level of 95% and a precision of  $\pm 5\%$  was calculated as for a random sampling.<sup>16</sup> A minimum of 400 respondents was set up to fulfil confidence level and precision. Using the simple random sampling we also calculated that with a sample overcoming 1,000 units, with a confidence level of 95%, the precision of the esteem could be fixed, by analogy, at  $\pm 3\%$ . Post-stratification operations were also accomplished and respondents were weighted according to gender and geographical region of work. We consider a significant result only those showing gaps as wide as, at least, 10 percentage points (corresponding to a precision of  $\pm 5\%$ ).

### **Analysis of the main sources of discrimination**

Determinants of discrimination were grouped in three main areas: professional life (including career issues and working environmental issues), discrimination process and work-life balance. As for the sources of discrimination, results were systematically processed by gender and geographical region. The 40 European countries were classified in five geographical regions: Western Europe (WE), Northern Europe (NE), Eastern Europe (EE), South-Western Europe (SWE), and South-Eastern Europe (SEE), according to the standard ESCMID criteria (see annex 1).

To simplify presentation of the survey's results, three indexes were built (see table 2): Professional Achievement Index (PAI), Work-Life Balance Index (WLBI), and Gender Discrimination Perception Index (GDPI). To define each index a 3-step procedure was applied: selecting and weighing indicators, assembling the index for each respondent, and creating aggregates of respondents based on the index (low/medium/high).

## Results

Overall, 1,566 individuals participated in the survey. Among them, 1,274 working in European countries at the time of the study were included in the analysis. Respondents' distribution by gender, geographical region, and age is shown in table 3.

Table 4 illustrates the main professional achievement reached by 1,274 respondents. Half of interviewed individuals (51%) reported to be involved in academic career. Overall, a clear imbalance in the number of women in the highest level of academic career was detected. Women accounted on average for 36% of full professorship in CM/ID. However, the difference is significantly more evident for ID than CM professionals (26% vs. 46%) (see figures 1,2). Women are even more under-represented in boards and committees with more than 20 percentage points dividing males from females (see table 4). The most striking difference was observed for participation in editorial boards (34% of females vs. 66% of men). The presence in high-level decision making bodies is also strongly influenced by geographic regions. Highest participation in expert panels is observed in professionals from NE (45%) and lowest in those from EE (26%) (see annex 2).

Number of publications in peer-reviewed journals, considered as the most traditional measure of scientific authority, shows clear gender differences (see table 4) and less evident regional differences (data not shown). Interestingly, a similar percentage of men and women report their name not being mentioned as first author when they were the ones conceiving the scientific publication and making the greater contribution to it (41% of men vs. 37% of women). Age discrimination stands out as the most recurrent explanation given by 22% of respondents.

Yearly gross salary among ICM/ID professionals is significantly different among European countries. The highest (> 10 percentage points) salary gap is observed among women from EE and SEE. After selecting high income level only (> 95,000 EUR/year), the percentage of inclusions ranges from 5% among professional females from EE to 42% of males in WE (see figure 3).

The majority of respondents (68%) agreed that discrimination exists in scientific fields such as the medical science (see table 5). Respondents from SWE show the strongest commitment to gender issues while those from WE and NE are in an intermediate position and those from EE and SEE less agree on the presence of discrimination among ID/CM specialists (see table 6). A quarter of respondents (26%) reported witnessing or experiencing discrimination or harassment at their

workplace (37% among women and 16% among men). As for regional differences, respondents from SWE countries report discrimination events at a much higher rate (37%) than average (26%), with the largest difference for gender while discrimination on the grounds of religion is more frequently denounced from SEE countries (8%) (see table 5).

More than one third (37%) of respondents believe that CM/ID international societies have discrimination problems, mainly related to country misbalance (28%) and gender inequality (15%). More than 20% believe that the most important international CM/ID conferences (ECCMID and Interscience Conference on Antimicrobial Agents and Chemotherapy-ICCAC) are not balanced mainly for speaker's geographic region of origin (57%). The majority of respondents (72%) believe that international societies should play a major role in helping universities and hospitals in addressing career-related issues and related discriminatory events.

The number of children reported might be considered as an indirect hint of the greater difficulty of women in CM/ID fields in reconciling work and family life. More than 20 percentage points divided the number of women and men who have 2 or more children (35% of women vs. 56% of men). Analysis of geographical distribution shows that there are relevant differences among European regions having 2 or more children: NE 69%, WE 47%, SWE 40%, EE 39%, and SE 38%. Considering different age classes, people under 35 years strongly regret having to wait longer than desired for having a child. People in the age class 35-49 years, on the other hand, more often report having less children than desired, or not at all, because of work commitments (36% of women and 19% of men).

As expected, household duties are strongly influenced by gender. Women from SWE largely outnumber men as the ones who take up the greater part (75%) of household duties: 68% of women vs. 7% of men. After stratifying for age, while women under age 35 performing 100% of domestic chores are 29% and then the percentage slight decreases over the years, the trend for males is completely different. They perform all domestic duties until they presumably live alone (29% under age 35), then the figure suddenly drops of 20 percentage points and remains very low for all other age classes.

Distribution of indexes summarises major area of discrimination. The Professional Achievement Index (PAI) distribution adjusted by age is shown in figure 4. More than 20 points divide high professional achievements according to gender (46% of men vs. 26% of women) while regional



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9 differences are minimal (data not shown). The Work Life Balance index (WLBI) confirms the same  
10 distribution (see figure 5) with more than 30 percentage points of difference (81% of men vs. 52%  
11 of women). Perception of gender discrimination according to the Gender Discrimination  
12 Perception Index (GDPI) is presented in figure 6 with a significant difference between females and  
13 males (26% vs 5%).  
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### 16 17 18 **Discussion**

19 Three main conclusions can be drawn from our survey. First, gender differences in career levels  
20 for CM/ID specialists, both academic and non-academical, are significant. If gender differences in  
21 achievement are measured through substantial indicators of scientific and professional success,  
22 such as scientific publications, research funding and participation in boards and committees, large  
23 gaps are still recorded between men and women and are consistent among professionals working  
24 in all European regions. Second, more than two thirds of CM/ID professionals recognise the  
25 existence of discriminatory problems at their workplace. Perception of discrimination on the basis  
26 of the geographical region of work is more widespread among EE and SEE countries. Third, the  
27 burden of family care is disproportionately weighing on the shoulders of women. A huge gap  
28 divides men and women who are able to find a satisfactory balance between their work and  
29 family commitments. Even though there are important differences in women's situation in the  
30 different regions, the gap with men is always much wider in all regions, including NE countries.

31 The difference in proportion of CM and ID professionals in different academic grades stratified by  
32 gender is significantly more evident for ID than CM professionals (26% vs. 46%). Wide differences  
33 were also observed according to geographic regions. There are many cultural, economic and  
34 organizational reasons behind the wide differences that do emerge for academic career among  
35 CM/ID specialists. It is worth to notice that the regions where the gender gap is smaller among  
36 full professors (NE, EE and SEE) are those where women outnumber men to a larger extent  
37 among CM professionals. In this field women enjoy a relatively less discriminating environment.  
38 However, it is important to underline that in many European countries, especially where  
39 microbiology is practicing mainly as laboratory discipline and not as clinical microbiology, the  
40 career path is less "appealing" than other medical disciplines. This is not, however, the only  
41 variable having an impact, since situations are extremely varied. In daily "real" university life we  
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9 frequently hear that plausible “explanation” from women not being represented at the same  
10 level of men at highest academic career is that women are less interested in academic career  
11 since this is not feasible with family and in particular with children care. The fact that women  
12 publish less than men is usually used as a key supporting argument. However, previous studies  
13 documented that productivity is affected by a number of factors which are unrelated to scientific  
14 merit.<sup>15-19</sup> Regional differences in publishing also suggest the existence of many determinants of  
15 scientific productivity. Professionals from WE and SWE are those with the highest rate of  
16 publications among CM/ID professionals. Creamer suggested that prolific publishers are  
17 disproportionately white males because the career paths, work assignments, research interests,  
18 and access to resources conducive to frequent publishing are more characteristic of white men  
19 than of women and minorities.<sup>15</sup> However, family responsibilities probably have less effect on  
20 women’s publishing activity than work assignments and time. Finally, women’s lower publishing  
21 rates may be a consequence of a “chilly climate” in some academic departments. Women are  
22 more likely than men to be excluded and isolated from the types of professional and social  
23 networks that define the life of a department. As our survey show, women and professionals  
24 from EE are less likely than men to receive visiting appointments and participate in high-level  
25 decision making boards, activity that encourages the building of professional networks and  
26 contacts outside home institutions. In this sense, productivity appears as a function of one’s  
27 position in the communication system in a discipline rather than personal scientific merits.

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37 The analysis of gap salary related to gender and geographic regions is more difficult to analyze.  
38 Major limitation we encountered is related to the impossibility to adjust our results to national  
39 gross domestic product per capita corrected by local life costs. However, the pay gap between  
40 women and men is consistent within the same country in all European nations. Therefore, a need  
41 to implement proactive policies to tackle gender pay gap at European level is crucial.

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60 Our data show that the issue of inequality in medical science is strongly perceived by the majority  
of CM/ID professionals (68%). Differences can be recorded across geographical areas, although,  
there is no region where consensus on the existence of discrimination falls below 66% of  
respondents, while if we only include those reporting substantial discrimination, we never fall  
below 50%. Even of more interest a quarter of respondents reported witnessing or experiencing  
discrimination at their workplace mainly related to gender and nationality. The analysis of the

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work-life balance also showed significant differences according to gender. However, it is note of  
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worthy, that a substantial part of respondents, regardless the gender, regret having to wait longer  
than desired for having a child or having less children than desired, or not at all, because of work  
commitments.

Finally, the use of indexes that, including different questions' results was introduced to  
summarize and simplify main conclusions, further underlines that there is a dramatic difference  
among CM/ID specialists by gender regarding professional achievement, life satisfaction, and  
perception of discrimination.

### **Strengths and weakness of study**

This is the first study performed at European level specifically addressing the issue of  
discrimination in research and career among medical specialists. Previous researchers analysed  
the issue mainly related to the scientific academic area and never specifically on the medical one.  
Since the importance of the researchers' selection and career development in medicine and the  
consequential impact on European citizens' health we do believe the definition of such high level  
of perceived and actual career discrimination should be carefully evaluated by policymakers. Our  
study has many limitations. First of all, the ESCMID survey questionnaire was designed to target  
an extremely varied set of potential respondents, including people of different gender, age,  
ethnicity, nationality, religion, sexual orientation, disciplinary specialization, professional role and  
level. It was obviously impossible, also considering it had to take the shortest time possible to be  
filled out, to adequately cover all aspects which would have deserved to be analyzed if each of  
those qualities had to be taken in full consideration. It was also impossible to proceed with a  
reliable stratification according to more variables than gender and geographic region of current  
employment.

### **Further research**

Future researches should focus on some of the neglected issues, for instance targeting ethnicity,  
religion and sexual orientation in more details. To obtain a more accurate understanding of the  
CM/ID reality as concerns equality issues other methodological approaches and sources of  
information should be added, such as direct observation, focus groups and qualitative interviews.

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It is also important to underline the tendency of professionals (both genders) to see scientific societies more involved than their own institutes in coping with parity issues. In particular, respondents seem to particularly value the role of international societies could play, beyond scientific exchange, as professional networks with a major role in dealing with professional issues, including those related to work environment, work-life balance and career. Specific studies on international medical societies and parity issues should be therefore promoted in order to better understand these dynamics and to identify which are the real demands professionals express to societies and to institutes when parity issues are at stakes.

#### **Implications for clinicians and policymakers**

We believe that the results of our survey will play a major role in stimulating CM and ID specialists, other international societies for different specialisations as well as media to press policymakers to evaluate the fairness of academic career at national level. However, we are aware that a significant improvement in the current situation at hospital and university level for medical specialists can be reached only through more direct involvement of policymakers at European level. Informal exclusion ("hidden quotas") of new and young scientists just for being women or coming from a discriminated geographic region will definitively limit research and therefore will impact on future health of the Europeans citizens. In many countries laws to define recruitment in the academic area, ensuring equal opportunities for all scientists, regardless gender and country of origin, need to be introduced. Our final common goal should be to move from science without meritocracy towards science only based upon meritocracy, in a very near future.

**Contributors:** ET had the idea of the research, contributed to the analysis and interpretation of the data, and drafted the paper. MC and GC contributed to the analysis and interpretation of the data. MP, NB, EN, and TK contributed to the conception of the study, interpretation of the data and critically revised the manuscript.

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**Competing interests:** All authors do not have financial relationships with any organisations that might have an interest in the submitted work in the previous 3 years; no other relationships or activities that could appear to have influenced the submitted work.

**Ethical approval:** Not needed.

**Data sharing:** Further summary data are available from the corresponding author at eve.tacconelli@gmail.com.

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Table 1 Questionnaire's description

<i>Area</i>	<i>No. of question</i>	<i>Description</i>
Socio-demographic Qs. 1-15	15	Qs. collecting basic information about demographic and sociographic variables.
Professional census Qs. 16-23	8	Qs. collecting information about specialty, academic and professional achievement and employment status.
Professional environment Qs. 24-35	12	Qs. collecting information on the respondent's experience/opinion about discrimination regarding three features of the professional environment: organizational cultures and behaviors; career support; and work-life balance.
Leadership Qs. 36-56	21	Qs. collecting information on the respondent's experience/opinion about discrimination regarding the attainment of leadership positions, distinguishing between discrimination affecting research practice, discrimination in the attainment of decision-making positions in research management, and discrimination in scientific communication.
General Qs. 57-61	5	Qs. collecting last impressions, comments and very general opinions.

Qs. : questions; No.: number.



Table 2 Definition of indexes according to indicators

<i>Acronym</i>	<i>Index</i>	<i>Indicators</i>
PAI	Professional Achievement Index	Peer-reviewed articles published in career
		Funding received for research as principal investigator (2008/2010)
		Membership in professional boards and committees
WLBI	Work-Life Balance Index	Responsibility for household duties
		Having the number of children desired
		Having/having not to discontinue career opportunities
		Caring for an elderly or a ill parent or relative
GDPI	Gender Discrimination Perception Index	Reporting gender discrimination events
		Perception of gender inequality in international societies
		Perception of low representativeness, as for gender, of speakers at international conferences
		Belief that gender impacts on career's opportunities

Table 3 Main epidemiological characteristics of 1,274 participants, by gender

	Females N = 784	%	Males N = 490	%	Total	%
Region*						
Western Europe	244	31.1	195	39.8	439	35.5
Northern Europe	96	12.2	61	12.4	157	12.3
Eastern Europe	127	16.2	49	10.0	176	13.8
South-Western Europe	137	17.5	79	16.2	216	17.0
South-Eastern Europe	180	23.0	106	21.6	286	22.4
Year of age						
< 35	251	32.0	102	20.8	353	27.7
35 – 49	331	42.2	217	44.3	548	43.0
50 – 64	189	24.1	155	31.6	344	27.0
> 65	13	1.7	16	3.3	29	2.3
Specialty						
Clinical Microbiology	384	48.9	216	44.1	600	47.0
Infectious Diseases	263	30.9	227	46.3	539	42.3

\*according to the ESCMID classification of European regions (see annex 1).

Table 4 Main professional achievement of respondents, by gender

	Females	%	Males	%	Total
Professional level (N = 1008)					
Head of Division	82	37,1	139	62,9†	221
Head of ward	109	48,2	117	51,8	226
Consultant	156	44,3	196	55,7	352
University career (N = 649)					
Full professors	37	36.3	65	63.7†	102
Associate professors	48	34.8	90	65.2†	138
Assistant professors	59	52.7	53	47.3	112
Lecturers	72	47.7	79	52.3	151
Memberships (N = 1274)					
Expert panels	169	35.0	314	65.0†	483
Project evaluation committees	164	38.6	261	61.4†	425
Program committees	133	37.7	220	62.3†	353
Advisory boards	122	34.1	236	65.9†	358
Recruitment committees	106	37.9	174	62.1†	280
Editorial boards	100	34.0	194	66.0†	294
Publications in peer reviewed journals (N = 1188)					
> 200	4	14.3	24	85.7†	28
101 – 200	25	33.3	50	66.7†	75
51 – 100	43	36.1	76	63.9†	119
11 – 50	160	42.9	213	57.1	373
<= 10	356	60.0†	237	40.0	593

† significant results:10 percentage points difference (corresponding to a precision of  $\pm 5\%$ ).

Table 5 Proportion of CM/ID professionals declaring to have experienced or witnessed discrimination, by gender (N = 1255)

	Females	%*	Males	%*	Total	%*
Existence of discrimination°	461	73.8	363	57.5	824	68
At least one report	230	36.8†	101	16.1	331	26.5
1 report	175	28.0	75	12.0	250	20.1
2 reports	34	5.4	14	2.2	48	3.8
> 2 reports	21	3.4	12	1.9	33	2.6
Gender	186	29.8†	39	6.2	225	18.0
Ethnicity	32	5.1	20	3.2	52	4.2
Nationality	57	9.1	43	6.9	100	8.0
Religious background	27	4.3	19	3.0	46	3.7
Sexual orientation	19	3.0	21	3.4	40	3.2

† significant results:10 percentage points difference (corresponding to a precision of  $\pm 5\%$ ); \* Percentages refer to the total number of interviewed (1251); ° the respondent was asked her/his opinion on the presence of discrimination in medical science (yes/no).

Table 6 Proportion of CM/ID professionals declaring to have experienced or witnessed discrimination, by geographic region

	WE N = 578 %	NE N = 110 %	EE N = 135 %	SWE N = 255 %	SEE N = 173 %	TOTAL N = 1251 %
At least one rep.	27,3	14,5†	17,8	37,1†	21,4	26.5
1 report	21.6	10.0	15.6	27.2	15.1	20.1
2 reports	3.5	1.8	1.5	5.5	5.2	3.8
>2 reports	2.2	2.7	0.7	4.7	1.7	2.6
Gender	17,5	12,8	12,2	29,6†	10,1	18,0
Ethnicity	4,2	2,1	1,2	6,6	4,1	4,2
Nationality	7,8	4,9	5,5	11,2	8,1	8,0
Religious background	3,9	1,1	0,5	3,0	8,1	3,7
Sexual orientation	3,1	1,1	1,0	6,2	1,9	3,2

† significant results:10 percentage points difference (corresponding to a precision of  $\pm 5\%$ ); N = number.

## Figures

**Fig 1** Proportion of 214 CM professionals in different academic grades stratified by gender  
† significant results:10 percentage points difference (corresponding to a precision of  $\pm 5\%$ ); prof.: professor.

**Fig 2** Proportion of 229 ID professionals in different academic grades stratified by gender  
† significant results:10 percentage points difference (corresponding to a precision of  $\pm 5\%$ ); prof.: professor.

**Fig 3** Proportion of 235 CM/ID professionals in top income levels (> 95.000 euro / year) stratified by gender and geographic region

**Fig 4** Professional achievement according to PAI stratified by gender

PAI: Professional Achievement Index. Each indicator was evaluated on a trichotomous ordinal scale (low/medium/high presence). Each mode was attributed a numerical value between 0 and 1. The results obtained for each individual indicator were then added. To make the results of the different indexes homogeneous, the value scale of each index has been equalized at a 0-10 range. For each index a threshold system has been set up, so to place each individual within a “low/medium/high” trichotomous scale with respect to a given profile (for instance: “medium professional achievement”). See Table 2 for indicators included in this index.

**Fig 5** Work-life balance according to WLBI stratified by gender

WLBI: Work Balance Index. Each indicator was evaluated on a trichotomous ordinal scale (low/medium/high presence). Each mode was attributed a numerical value between 0 and 1. The results obtained for each individual indicator were then added. To make the results of the different indexes homogeneous, the value scale of each index has been equalized at a 0-10 range. For each index a threshold system has been set up, so to place each individual within a “low/medium/high” trichotomous scale with respect to a given profile (for instance: “positive work-life balance”). See Table 2 for indicators included in this index.

**Fig 6** Perception of gender discrimination according to GDPI stratified by gender.

GDPI: Gender Discrimination Perception Index. Each indicator was evaluated on a trichotomous ordinal scale (low/medium/high presence). Each mode was attributed a numerical value between 0 and 1. The results obtained for each individual indicator were then added. To make the results of the different indexes homogeneous, the value scale of each index has been equalized at a 0-10 range. For each index a threshold system has been set up, so to place each individual within a “low/medium/high” trichotomous scale with respect to a given profile (for instance: “low perception of gender discrimination”). See Table 2 for indicators included in this index.

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60**Box 1. Definitions of terms used in the article**

**Meritocracy:** It is a system of government or other administration (such as business administration) wherein appointments and responsibilities are objectively assigned to individuals based upon their "merits", namely intelligence, credentials, and education, determined through evaluations or examinations

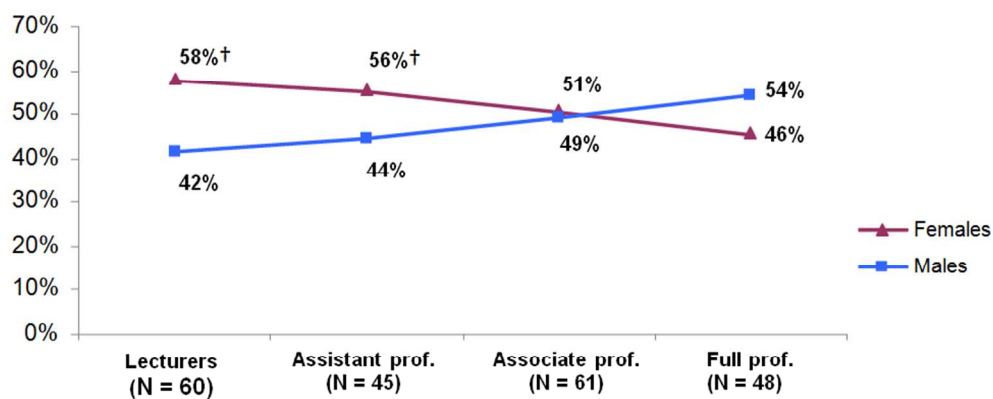
**Discrimination:** The treatment or consideration of, or making a distinction in favour of or against, a person based on the group, class, or category to which that person belongs rather than on individual merit. It involves intentional behaviours towards such groups such as, for instance, formally or informally excluding or restricting members of one group from opportunities that are available to another group.

**Inequality:** The observable and measurable effects of discriminatory practices and habits, resulting in differential conditions of professionals within scientific and managerial careers.

**Minorities:** Minorities among healthcare workers were defined as those discriminated in their professional career and/or underrepresented in scientific societies because of gender, age, sexual orientation, racial, regional, religious and/or political reasons without consideration of their personal achievements.

**Box 2****WHY IS DISCRIMINATION SO HARD TO ACKNOWLEDGE?**

- Difficult to recognize, since it is subtle, informal and generally embodied in well-established cultural, organizational and behavioural patterns;
- Annoying to admit, since it jeopardizes one's opinion about the fairness and quality of the environment s/he works in, which may be experienced by some as an aggression to their professional identity;
- Somewhat depressing to admit, since it affects the self-esteem, self confidence and hopes of the potential victims of;
- Often counterproductive to admit, since it puts the hard-won credibility of women and under-represented groups at risk in the working environment.

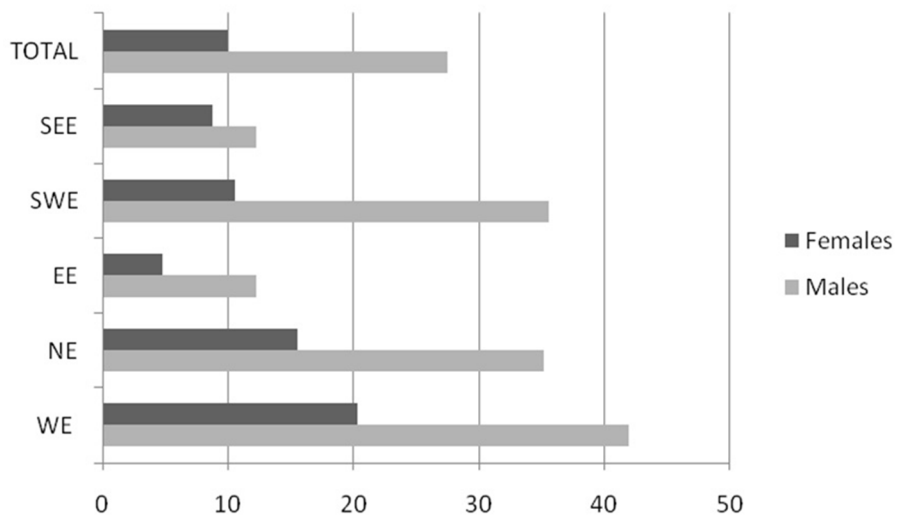


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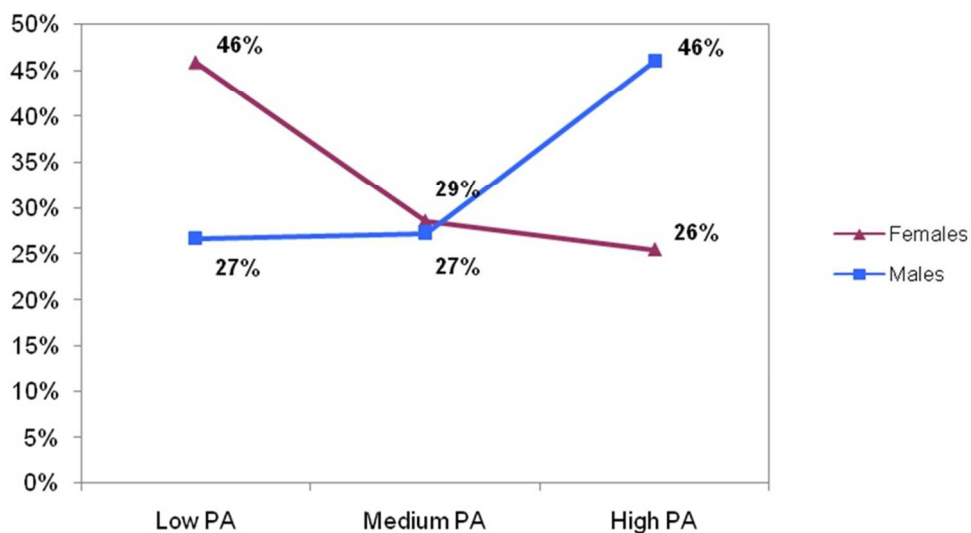
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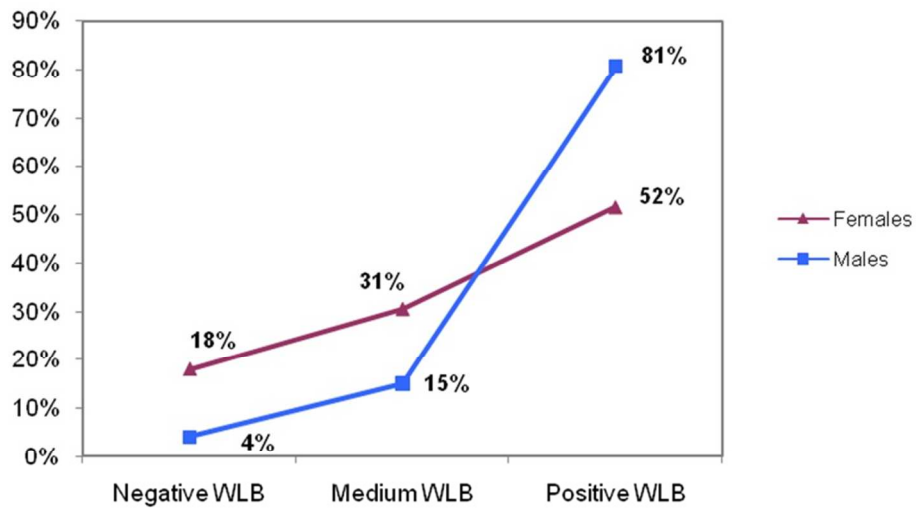


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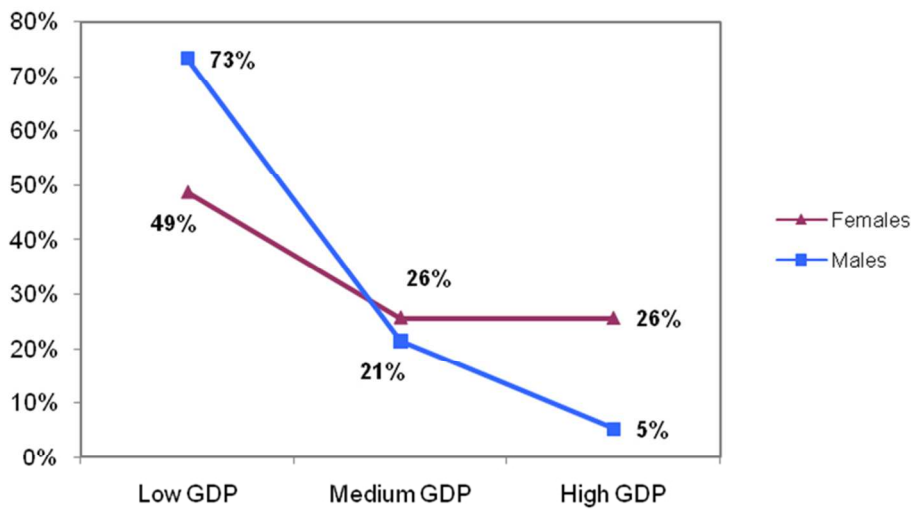
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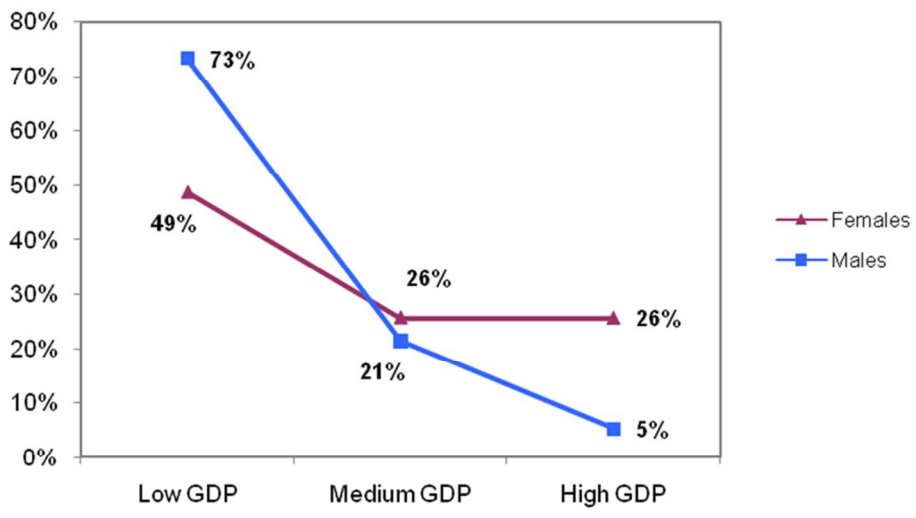


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## Annex 1

### ESCMID Definition of European Regions

#### Western Europe

- Austria (AT)
- Belgium (BE)
- France (FR)
- Germany (DE)
- Republic of Ireland (IE)
- Liechtenstein (LI)
- Luxembourg (LU)
- The Netherlands (NL)
- Switzerland (CH)
- United Kingdom (UK)

#### Northern Europe

- Denmark (DK)
- Finland (FI)
- Iceland (IS)
- Norway (NO)
- Sweden (SE)

#### Eastern Europe

- Armenia (AM)
- Azerbaijan (AZ)
- Belarus (BY)
- Czech Republic (CZ)
- Estonia (EE)
- Georgia (GE)
- Hungary (HU)
- Latvia (LV)
- Lithuania (LT)
- Moldova (MD)
- Poland (PL)
- Romania (RO)
- Russia (RU)
- Slovakia (SK)
- Ukraine (UA)

#### South-Western Europe

- Andorra (AD)
- Italy (IT)
- Malta (MT)
- Monaco (MC)
- Portugal (PT)
- San Marino (SM)
- Spain (ES)

#### South-Eastern Europe

- Albania (AL)
- Bosnia and Herzegovina (BA)
- Bulgaria (BG)
- Croatia (HR)
- Cyprus (CY)
- Greece (GR)
- Israel (IL)
- Kosovo (KVM)
- Republic of Macedonia (MK)
- Montenegro (ME)
- Serbia (RS)
- Slovenia (SI)
- Turkey (TR)

## ANNEX 2

## Past and current memberships among 1,274 ID/CM professionals stratified by geographic regions.

	WE	NE	EE	SWE	SEE	TOTAL
	n = 593	n = 111	n = 135	n = 262	n = 174	n = 1274
	%	%	%	%	%	%
Expert panels	42.8	45.5	26.7†	35.9	28.3	37.9
Project evaluation committees	36.6	31.2	25.2	34.7	27.7	33.4
Advisory boards	33.2	32.1	21.5	20.6	24.3	28.2
Program committees	26.1	28.6	28.9	24.0	36.7	27.7
Editorial boards	22.1	16.1	27.4	24.0	26.0	23.1
Recruitment committees	32.0†	25.0	5.9†	13.4	10.1†	22.0
Other	4.5	5.4	8.9	3.8	6.9	5.7

† Significant results: 10 percentage points difference (corresponding to a precision of ±5%).



**Science without meritocracy. Discrimination among European specialists in infectious diseases and clinical microbiology: a questionnaire survey**

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Secondary Subject Heading:	Infectious diseases
Keywords:	Discrimination, Career, European research, INFECTIOUS DISEASES, Clinical Microbiology

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**Science without meritocracy. Discrimination among European specialists in infectious diseases and clinical microbiology: a questionnaire survey**

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**Abstract**

**Objective** In 2009, in an European survey, around a quarter of Europeans reported witnessing discrimination or harassment at their workplace. The parity committee from the European Society of Clinical Microbiology and Infectious Diseases (ESCMID) designed a questionnaire survey to investigate forms of discrimination with respect to country, gender and ethnicity among medical professionals in hospitals and universities carrying out activities in the Clinical Microbiology (CM) and Infectious Diseases (ID) fields.

**Design** The survey consisted of 61 questions divided into five areas (socio-demographic, professional census and environment, leadership, and generical) and ran anonymously for nearly 3 months on the ESCMID website.

**Subjects** European specialists in CM / ID.

**Results** Overall, we included 1,274 professionals. The majority of respondents (68%) stated that discrimination is present in medical science. A quarter of them reported personal experience with discrimination, mainly associated with gender and geographic region. Specialists from South-Western Europe experienced events at a much higher rate (37%) than other European regions. The proportion of women among full professor was on average 36% in CM and 26% in ID. Participation in high-level decision making committees was significantly (> 10 percentage points) different by gender and geographic origin. Yearly gross salary among CM/ID professionals was significantly different among European countries and by gender, within the same country. More than one third of respondents (38%) stated that international societies in CM/ID have an imbalance as for committee member distribution and speakers at international conferences.

**Conclusions** A quarter of CM / ID specialists experienced career and research discrimination in European hospitals and universities, mainly related to gender and geographic origin. Implementing proactive policies to tackle discrimination and improve representativeness and balance in career among CM/ID professionals in Europe is urgently needed.

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## Introduction

In 2000, the European Union adopted two very far-reaching laws to prohibit discrimination in the workplace based on racial or ethnic origin, religion, disability, or sexual orientation.<sup>1</sup> In 2009 a survey was conducted to track, at European level, perceptions and opinions on this field.<sup>2</sup> Overall, around a quarter of Europeans reported witnessing discrimination or harassment and 16% of them experiencing it within one year of the study. Discrimination on ethnic origin (61%) was perceived to be the most widespread grounds for discrimination, followed by discrimination based on age (58%), disability (53%), and gender (40%).<sup>2</sup>

Discrimination in the academic area is more difficult to analyze although many of the factors making scientific work settings unfriendly to women and underrepresented minority groups are as common as in any other professional environment.<sup>3,4</sup> In particular, in medical professional settings, discrimination is harder to address because medical science itself (as science in general) is considered to be objective and an area where personal success is only based on scientific merit.<sup>2</sup> The common belief of the blindness of science with respect to any personal feature of scientists is the basis of the subtle, informal and hardly visible nature of its segregating mechanisms, which often goes unrecognized even by those who are negatively affected by them.<sup>5</sup> When it comes to scientific professions, such as the medical one, it is also paramount to identify which are the real positions where leadership is expressed. In fact, these professions have undergone deep transformation in the last decades, with new roles and new professional figures emerging, modification of hierarchies and career paths and changes in the relative values attributed to different skills and capacities.<sup>6,7</sup>

Over the last years, many projects have been focused on characterizing discrimination at work level in academic settings.<sup>6,8-11</sup> Most important factors reported to contribute to the so called “chilly climate” for women and minority groups in science are the following: exclusion from informal networks and the existence of “hidden quotas” for women’s and minority groups’ presence in high-level positions,<sup>12</sup> pay gap,<sup>6</sup> access to resources for research and early-stage career development,<sup>13</sup> and evaluation of scientific merit.<sup>6</sup> Gender discrimination, in particular, has been the focus of different European researches.<sup>6,8-10,14</sup> The “She figures 2009” project, a collaboration between the Scientific Culture and Gender Issues Unit of the Directorate-General for Research of the EU Commission and the Helsinki Group, showed that although the

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feminisation of the student population is one of the most striking aspects of the evolution of research over the last 30 years,<sup>15</sup> in most European countries women's academic career remains markedly characterised by strong vertical segregation. Women represented 44% among university students and 18% among full professors. Even of more interest, of all countries observed, there was none where female wages were equal to men's, despite the almost universal existence of legislation to impose gender wage equality.<sup>6</sup>

More difficult is to look for evidence of discrimination related to ethnic origin or belonging to any other underrepresented minority in medical academic area. Most observations derive from the U.S. Universities where, in 2008, African-Americans, Hispanics and Native Americans made up more than a third of the U.S. population but only 8.7 percent of physicians and 15 percent of enrolment in medical schools.<sup>16</sup>

In order to verify if, and to what extent forms of discrimination exist, the Parity Commission of the European Society of Infectious Diseases and Clinical Microbiology (ESCMID) organized a pan-European questionnaire survey. This study was designed to explore different forms of discrimination with main focus to gender, geographic origin, and belonging to a minority among clinical microbiology (CM) and infectious diseases (ID) professionals working in European hospitals and universities.

### Methods

A literature review was performed in order to define evidence and causes for discrimination in medical science and among CM/ID specialists. After assessing content validity, a pilot study including 10 participants from different European countries, evaluated its acceptance and reproducibility, and results led to minor amendments to its format. The final survey ([http://www.escmid.org/profession\\_career/parity\\_commission/parity\\_survey/](http://www.escmid.org/profession_career/parity_commission/parity_survey/)) consisted of 61 questions divided in five areas (socio-demographic, professional census and environment, leadership and generical) and ran anonymously for nearly 3 months (from March 17<sup>th</sup> to June 7<sup>th</sup> 2011) on the ESCMID website (see table 1). All ESCMID regular members, attendees of the 21st European Congress of Clinical Microbiology and Infectious Diseases (ECCMID)/27th International Congress of Chemotherapy held in Milan, Italy, and national/international ESCMID-affiliated societies' members were invited to participate.

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### Sample size calculation

Before administering the questionnaire a statistical description of the universe of reference (i.e. European CM/ID specialists) according to geographic region and gender was accomplished based on information provided by the ESCMID. Since the type of sampling was of a non-probabilistic nature, it was not possible to exactly determine the statistical representativeness of the sample. However, sample size to attain a confidence level of 95% and a precision of  $\pm 5\%$  was calculated as for a random sampling.<sup>17</sup> A minimum of 400 respondents was set up to fulfil confidence level and precision. Using the simple random sampling we also calculated that with a sample overcoming 1,000 units, with a confidence level of 95%, the precision of the esteem could be fixed, by analogy, at  $\pm 3\%$ . Post-stratification operations were also accomplished and respondents were weighted according to gender and geographical region of work. We consider a significant result only those showing gaps as wide as, at least, 10 percentage points (corresponding to a precision of  $\pm 5\%$ ).

### Analysis of the main sources of discrimination

Determinants of discrimination were grouped in three main areas: professional life (including career issues and working environmental issues), discrimination process and work-life balance. As for the sources of discrimination, results were systematically processed by gender and geographical region. The 40 European countries were classified in five geographical regions: Western Europe (WE), Northern Europe (NE), Eastern Europe (EE), South-Western Europe (SWE), and South-Eastern Europe (SEE), according to the standard ESCMID criteria (see annex 1). [To assess salary differences, each respondent was asked to declare his/her gross-income level in Euros compared to 6 predefined income-classes in the questionnaire: < 25,000 Eur; 25,000-44,999 EUR; 45,000 – 64,999 EUR; 65,000 – 94,999 EUR; > 125,000 EUR.](#)

To simplify presentation of the survey's results, three indexes were built (see table 2): Professional Achievement Index (PAI), Work-Life Balance Index (WLBI), and Gender Discrimination Perception Index (GDPI). To define each index a 3-step procedure was applied: selecting and weighing indicators, assembling the index for each respondent, and creating aggregates of respondents based on the index (low/medium/high).

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## Results

Overall, 1,566 individuals participated in the survey. Among them, 1,274 working in European countries at the time of the study were included in the analysis. Respondents' distribution by gender, geographical region, and age is shown in table 3.

Table 4 illustrates the main professional achievement reached by 1,274 respondents. Half of interviewed individuals (51%) reported to be involved in academic career. Overall, a clear imbalance in the number of women in the highest level of academic career was detected. Women accounted on average for 36% of full professorship in CM/ID. However, the difference is significantly more evident for ID than CM professionals (26% vs. 46%) (see figures 1,2). Women are even more under-represented in boards and committees with more than 20 percentage points dividing males from females (see table 4). The most striking difference was observed for participation in editorial boards (34% of females vs. 66% of men). The presence in high-level decision making bodies is also strongly influenced by geographic regions. Highest participation in expert panels is observed in professionals from NE (45%) and lowest in those from EE (26%) (see annex 2).

Number of publications in peer-reviewed journals, considered as the most traditional measure of scientific authority, shows clear gender differences (see table 4) and less evident regional differences (data not shown). Interestingly, a similar percentage of men and women report their name not being mentioned as first author when they were the ones conceiving the scientific publication and making the greater contribution to it (41% of men vs. 37% of women). Age discrimination stands out as the most recurrent explanation given by 22% of respondents.

Yearly gross salary among ICM/ID professionals is significantly different among European countries. The highest (> 10 percentage points) salary gap is observed among women from EE and SEE. After selecting high income level only (> 95,000 EUR/year), the percentage of inclusions ranges from 5% among professional females from EE to 42% of males in WE (see figure 3).

The majority of respondents (68%) agreed that discrimination exists in scientific fields such as the medical science (see table 5). Respondents from SWE show the strongest commitment to gender

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9 issues while those from WE and NE are in an intermediate position and those from EE and SEE  
10 less agree on the presence of discrimination among ID/CM specialists (see table 6). A quarter of  
11 respondents (26%) reported witnessing or experiencing discrimination or harassment at their  
12 workplace (37% among women and 16% among men). As for regional differences, respondents  
13 from SWE countries report discrimination events at a much higher rate (37%) than average (26%),  
14 with the largest difference for gender while discrimination on the grounds of religion is more  
15 frequently denounced from SEE countries (8%) (see table 5).

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19 More than one third (37%) of respondents believe that CM/ID international societies have  
20 discrimination problems, mainly related to country misbalance (28%) and gender inequality  
21 (15%). More than 20% believe that the most important international CM/ID conferences (ECCMID  
22 and Interscience Conference on Antimicrobial Agents and Chemotherapy-ICCAC) are not balanced  
23 mainly for speaker's geographic region of origin (57%). The majority of respondents (72%) believe  
24 that international societies should play a major role in helping universities and hospitals in  
25 addressing career-related issues and related discriminatory events.  
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30 The number of children reported might be considered as an indirect hint of the greater difficulty  
31 of women in CM/ID fields in reconciling work and family life. More than 20 percentage points  
32 divided the number of women and men who have 2 or more children (35% of women vs. 56% of  
33 men). Analysis of geographical distribution shows that there are relevant differences among  
34 European regions having 2 or more children: NE 69%, WE 47%, SWE 40%, EE 39%, and SE 38%.  
35 Considering different age classes, people under 35 years strongly regret having to wait longer  
36 than desired for having a child. People in the age class 35-49 years, on the other hand, more often  
37 report having less children than desired, or not at all, because of work commitments (36% of  
38 women and 19% of men).  
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43 As expected, household duties are strongly influenced by gender. Women from SWE largely  
44 outnumber men as the ones who take up the greater part (75%) of household duties: 68% of  
45 women vs. 7% of men. After stratifying for age, while women under age 35 performing 100% of  
46 domestic chores are 29% and then the percentage slight decreases over the years, the trend for  
47 males is completely different. They perform all domestic duties until they presumably live alone  
48 (29% under age 35), then the figure suddenly drops of 20 percentage points and remains very  
49 low for all other age classes.  
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Distribution of indexes summarises major area of discrimination. The Professional Achievement Index (PAI) distribution adjusted by age is shown in figure 4. More than 20 points divide high professional achievements according to gender (46% of men vs. 26% of women) while regional differences are minimal (data not shown). The Work Life Balance index (WLBI) confirms the same distribution (see figure 5) with more than 30 percentage points of difference (81% of men vs. 52% of women). Perception of gender discrimination according to the Gender Discrimination Perception Index (GDPI) is presented in figure 6 with a significant difference between females and males (26% vs 5%).

### Discussion

Three main conclusions can be drawn from our survey. First, gender differences in career levels for CM/ID specialists, both academic and non-academical, are significant. If gender differences in achievement are measured through substantial indicators of scientific and professional success, such as scientific publications, research funding and participation in boards and committees, large gaps are still recorded between men and women and are consistent among professionals working in all European regions. Second, more than two thirds of CM/ID professionals recognise the existence of discriminatory problems at their workplace. Perception of discrimination on the basis of the geographical region of work is more widespread among EE and SEE countries. Third, the burden of family care is disproportionately weighing on the shoulders of women. A huge gap divides men and women who are able to find a satisfactory balance between their work and family commitments. Even though there are important differences in women's situation in the different regions, the gap with men is always much wider in all regions, including NE countries. Our data clearly show the gap in professorship's distribution between men and women. The data resembles the "scissor phenomenon", a graphical representation of the divergence of men and women as they adopt senior positions in academic research, associate professorships, and full professorships over time. Previous studies showed that, although the number of women entering the first grade of medical school outnumbered that one of men, they then suddenly, after Ph.D, are no longer found in positions of relevance in any universities across Europe.<sup>6,10</sup> Among CM and ID professionals the difference in different academic grades stratified by gender is significantly more evident for ID than CM professionals (26% vs. 46%). Wide differences were also observed

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9 according to geographic regions. There are many cultural, economic and organizational reasons  
10 behind the wide differences that do emerge for academic career among CM/ID specialists. It is  
11 worth to notice that the regions where the gender gap is smaller among full professors (NE, EE  
12 and SEE) are those where women outnumber men to a larger extent among CM professionals. In  
13 this field women enjoy a relatively less discriminating environment. However, it is important to  
14 underline that in many European countries, especially where microbiology is practicing mainly as  
15 laboratory discipline and not as clinical microbiology, the career path is less “appealing” than  
16 other medical disciplines. This is not, however, the only variable having an impact, since situations  
17 are extremely varied. In daily “real” university life we frequently hear that plausible “explanation”  
18 from women not being represented at the same level of men at highest academic career is that  
19 women are less interested in academic career since this is not feasible with family and in  
20 particular with children care. The fact that women publish less than men is usually used as a key  
21 supporting argument. However, previous studies documented that productivity is affected by a  
22 number of factors which are unrelated to scientific merit.<sup>15-21</sup> Regional differences in publishing  
23 also suggest the existence of many determinants of scientific productivity. Professionals from WE  
24 and SWE are those with the highest rate of publications among CM/ID professionals. Creamer  
25 suggested that prolific publishers are disproportionately white males because the career paths,  
26 work assignments, research interests, and access to resources conducive to frequent publishing  
27 are more characteristic of white men than of women and minorities.<sup>17</sup> However, family  
28 responsibilities probably have less effect on women’s publishing activity than work assignments  
29 and time. Finally, women’s lower publishing rates may be a consequence of a “chilly climate” in  
30 some academic departments. Women are more likely than men to be excluded and isolated from  
31 the types of professional and social networks that define the life of a department. As our survey  
32 show, women and professionals from EE are less likely than men to receive visiting appointments  
33 and participate in high-level decision making boards, activity that encourages the building of  
34 professional networks and contacts outside home institutions. In this sense, productivity appears  
35 as a function of one’s position in the communication system in a discipline rather than personal  
36 scientific merits.

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50 The analysis of gap salary related to gender and geographic regions is more difficult to analyze.  
51 Major limitation we encountered is related to the impossibility to adjust our results to national  
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9 gross domestic product per capita corrected by local life costs. However, the pay gap between  
10 women and men is consistent within the same country in all European nations. Therefore, a need  
11 to implement proactive policies to tackle gender pay gap at European level is crucial.

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13 Our data show that the issue of inequality in medical science is strongly perceived by the majority  
14 of CM/ID professionals (68%). Differences can be recorded across geographical areas, although,  
15 there is no region where consensus on the existence of discrimination falls below 66% of  
16 respondents, while if we only include those reporting substantial discrimination, we never fall  
17 below 50%. Even of more interest a quarter of respondents reported witnessing or experiencing  
18 discrimination at their workplace mainly related to gender and nationality. The analysis of the  
19 work-life balance also showed significant differences according to gender. However, it is note of  
20 worthy, that a substantial part of respondents, regardless the gender, regret having to wait longer  
21 than desired for having a child or having less children than desired, or not at all, because of work  
22 commitments.

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24 Finally, the use of indexes that, including different questions' results was introduced to  
25 summarize and simplify main conclusions, further underlines that there is a dramatic difference  
26 among CM/ID specialists by gender regarding professional achievement, life satisfaction, and  
27 perception of discrimination.

### 28 29 30 31 32 33 34 35 36 **Strengths and weakness of study**

37 This is the first study performed at European level specifically addressing the issue of  
38 discrimination in research and career among medical specialists. Previous researchers analysed  
39 the issue mainly related to the scientific academic area and never specifically on the medical one.  
40 Since the importance of the researchers' selection and career development in medicine and the  
41 consequential impact on European citizens' health we do believe the definition of such high level  
42 of perceived and actual career discrimination should be carefully evaluated by policymakers. Our  
43 study has many limitations. First of all, the ESCMID survey questionnaire was designed to target  
44 an extremely varied set of potential respondents, including people of different gender, age,  
45 ethnicity, nationality, religion, sexual orientation, disciplinary specialization, professional role and  
46 level. It was obviously impossible, also considering it had to take the shortest time possible to be  
47 filled out, to adequately cover all aspects which would have deserved to be analyzed if each of  
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9 those qualities had to be taken in full consideration. It was also impossible to proceed with a  
10 reliable stratification according to more variables than gender and geographic region of current  
11 employment.  
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### 13 14 15 **Further research**

16 Future researches should focus on some of the neglected issues, for instance targeting ethnicity,  
17 religion and sexual orientation in more details. To obtain a more accurate understanding of the  
18 CM/ID reality as concerns equality issues other methodological approaches and sources of  
19 information should be added, such as direct observation, focus groups and qualitative interviews.  
20 It is also important to underline the tendency of professionals (both genders) to see scientific  
21 societies more involved than their own institutes in coping with parity issues. In particular,  
22 respondents seem to particularly value the role of international societies could play, beyond  
23 scientific exchange, as professional networks with a major role in dealing with professional issues,  
24 including those related to work environment, work-life balance and career. Specific studies on  
25 international medical societies and parity issues should be therefore promoted in order to better  
26 understand these dynamics and to identify which are the real demands professionals express to  
27 societies and to institutes when parity issues are at stakes.  
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### 34 35 36 **Implications for clinicians and policymakers**

37 We believe that the results of our survey will play a major role in stimulating CM and ID  
38 specialists, other international societies for different specialisations as well as media to press  
39 policymakers to evaluate the fairness of academic career at national level. However, we are  
40 aware that a significant improvement in the current situation at hospital and university level for  
41 medical specialists can be reached only through more direct involvement of policymakers at  
42 European level. Informal exclusion ("hidden quotas") of new and young scientists just for being  
43 women or coming from a discriminated geographic region will definitively limit research and  
44 therefore will impact on future health of the Europeans citizens. In many countries laws to define  
45 recruitment in the academic area, ensuring equal opportunities for all scientists, regardless  
46 gender and country of origin, need to be introduced. Our final common goal should be to move  
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9 from science without meritocracy towards science only based upon meritocracy, in a very near  
10 future.  
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15 **Contributors:** ET had the idea of the research, contributed to the analysis and interpretation of  
16 the data, and drafted the paper. MC and GC contributed to the analysis and interpretation of the  
17 data. MP, NB, EN, and TK contributed to the conception of the study, interpretation of the data  
18 and critically revised the manuscript.  
19

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21

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25

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27

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30

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Table 1 Questionnaire's description

<i>Area</i>	<i>No. of question</i>	<i>Description</i>
Socio-demographic Qs. 1-15	15	Qs. collecting basic information about demographic and sociographic variables.
Professional census Qs. 16-23	8	Qs. collecting information about specialty, academic and professional achievement and employment status.
Professional environment Qs. 24-35	12	Qs. collecting information on the respondent's experience/opinion about discrimination regarding three features of the professional environment: organizational cultures and behaviors; career support; and work-life balance.
Leadership Qs. 36-56	21	Qs. collecting information on the respondent's experience/opinion about discrimination regarding the attainment of leadership positions, distinguishing between discrimination affecting research practice, discrimination in the attainment of decision-making positions in research management, and discrimination in scientific communication.
General Qs. 57-61	5	Qs. collecting last impressions, comments and very general opinions.

Qs. : questions; No.: number.

Table 2 Definition of indexes according to indicators

<i>Acronym</i>	<i>Index</i>	<i>Indicators</i>
PAI	Professional Achievement Index	Peer-reviewed articles published in career
		Funding received for research as principal investigator (2008/2010)
		Membership in professional boards and committees
WLBI	Work-Life Balance Index	Responsibility for household duties
		Having the number of children desired
		Having/having not to discontinue career opportunities
		Caring for an elderly or a ill parent or relative
GDPI	Gender Discrimination Perception Index	Reporting gender discrimination events
		Perception of gender inequality in international societies
		Perception of low representativeness, as for gender, of speakers at international conferences
		Belief that gender impacts on career's opportunities

Table 3 Main epidemiological characteristics of 1,274 participants, by gender

	Females N = 784	%	Males N = 490	%	Total	%
Region*						
Western Europe	244	31.1	195	39.8	439	35.5
Northern Europe	96	12.2	61	12.4	157	12.3
Eastern Europe	127	16.2	49	10.0	176	13.8
South-Western Europe	137	17.5	79	16.2	216	17.0
South-Eastern Europe	180	23.0	106	21.6	286	22.4
Year of age						
< 35	251	32.0	102	20.8	353	27.7
35 – 49	331	42.2	217	44.3	548	43.0
50 – 64	189	24.1	155	31.6	344	27.0
> 65	13	1.7	16	3.3	29	2.3
Specialty						
Clinical Microbiology	384	48.9	216	44.1	600	47.0
Infectious Diseases	263	30.9	227	46.3	539	42.3

\*according to the ESCMID classification of European regions (see annex 1).



Table 4 Main professional achievement of respondents, by gender

	Females	%	Males	%	Total
Professional level (N = 1008)					
Head of Division	82	37,1	139	62,9†	221
Head of ward	109	48,2	117	51,8	226
Consultant	156	44,3	196	55,7	352
University career (N = 649)					
Full professors	37	36.3	65	63.7†	102
Associate professors	48	34.8	90	65.2†	138
Assistant professors	59	52.7	53	47.3	112
Lecturers	72	47.7	79	52.3	151
Memberships (N = 1274)					
Expert panels	169	35.0	314	65.0†	483
Project evaluation committees	164	38.6	261	61.4†	425
Program committees	133	37.7	220	62.3†	353
Advisory boards	122	34.1	236	65.9†	358
Recruitment committees	106	37.9	174	62.1†	280
Editorial boards	100	34.0	194	66.0†	294
Publications in peer reviewed journals (N = 1188)					
> 200	4	14.3	24	85.7†	28
101 – 200	25	33.3	50	66.7†	75
51 – 100	43	36.1	76	63.9†	119
11 – 50	160	42.9	213	57.1	373
<= 10	356	60.0†	237	40.0	593

† significant results:10 percentage points difference (corresponding to a precision of  $\pm 5\%$ ).

Table 5 Proportion of CM/ID professionals declaring to have experienced or witnessed discrimination, by gender (N = 1255)

	Females	%*	Males	%*	Total	%*
Existence of discrimination°	461	73.8	363	57.5	824	68
At least one report	230	36.8†	101	16.1	331	26.5
1 report	175	28.0	75	12.0	250	20.1
2 reports	34	5.4	14	2.2	48	3.8
> 2 reports	21	3.4	12	1.9	33	2.6
Gender	186	29,8†	39	6,2	225	18,0
Ethnicity	32	5,1	20	3,2	52	4,2
Nationality	57	9,1	43	6,9	100	8,0
Religious background	27	4,3	19	3,0	46	3,7
Sexual orientation	19	3,0	21	3,4	40	3,2

† significant results:10 percentage points difference (corresponding to a precision of  $\pm 5\%$ ); \* Percentages refer to the total number of interviewed (1251); ° the respondent was asked her/his opinion on the presence of discrimination in medical science (yes/no).

Table 6 Proportion of CM/ID professionals declaring to have experienced or witnessed discrimination, by geographic region

	WE N = 578 %	NE N = 110 %	EE N = 135 %	SWE N = 255 %	SEE N = 173 %	TOTAL N = 1251 %
At least one rep.	27,3	14,5†	17,8	37,1†	21,4	26.5
1 report	21.6	10.0	15.6	27.2	15.1	20.1
2 reports	3.5	1.8	1.5	5.5	5.2	3.8
>2 reports	2.2	2.7	0.7	4.7	1.7	2.6
Gender	17,5	12,8	12,2	29,6†	10,1	18,0
Ethnicity	4,2	2,1	1,2	6,6	4,1	4,2
Nationality	7,8	4,9	5,5	11,2	8,1	8,0
Religious background	3,9	1,1	0,5	3,0	8,1	3,7
Sexual orientation	3,1	1,1	1,0	6,2	1,9	3,2

† significant results:10 percentage points difference (corresponding to a precision of  $\pm 5\%$ ); N = number.

## Figures

**Fig 1** Proportion of 214 CM professionals in different academic grades stratified by gender  
† significant results:10 percentage points difference (corresponding to a precision of  $\pm 5\%$ ); prof.: professor.

**Fig 2** Proportion of 229 ID professionals in different academic grades stratified by gender  
† significant results:10 percentage points difference (corresponding to a precision of  $\pm 5\%$ ); prof.: professor.

**Fig 3** Proportion of 235 CM/ID professionals in top income levels (> 95.000 euro / year) stratified by gender and geographic region

**Fig 4** Professional achievement according to PAI stratified by gender

PAI: Professional Achievement Index. Each indicator was evaluated on a trichotomous ordinal scale (low/medium/high presence). Each mode was attributed a numerical value between 0 and 1. The results obtained for each individual indicator were then added. To make the results of the different indexes homogeneous, the value scale of each index has been equalized at a 0-10 range. For each index a threshold system has been set up, so to place each individual within a “low/medium/high” trichotomous scale with respect to a given profile (for instance: “medium professional achievement”). See Table 2 for indicators included in this index.

**Fig 5** Work-life balance according to WLBI stratified by gender

WLBI: Work Balance Index. Each indicator was evaluated on a trichotomous ordinal scale (low/medium/high presence). Each mode was attributed a numerical value between 0 and 1. The results obtained for each individual indicator were then added. To make the results of the different indexes homogeneous, the value scale of each index has been equalized at a 0-10 range. For each index a threshold system has been set up, so to place each individual within a “low/medium/high” trichotomous scale with respect to a given profile (for instance: “positive work-life balance”). See Table 2 for indicators included in this index.

**Fig 6** Perception of gender discrimination according to GDPI stratified by gender.

GDPI: Gender Discrimination Perception Index. Each indicator was evaluated on a trichotomous ordinal scale (low/medium/high presence). Each mode was attributed a numerical value between 0 and 1. The results obtained for each individual indicator were then added. To make the results of the different indexes homogeneous, the value scale of each index has been equalized at a 0-10 range. For each index a threshold system has been set up, so to place each individual within a “low/medium/high” trichotomous scale with respect to a given profile (for instance: “low perception of gender discrimination”). See Table 2 for indicators included in this index.

**Box 1. Definitions of terms used in the article**

**Meritocracy:** It is a system of government or other administration (such as business administration) wherein appointments and responsibilities are objectively assigned to individuals based upon their "merits", namely intelligence, credentials, and education, determined through evaluations or examinations.

**Discrimination:** The treatment or consideration of, or making a distinction in favour of or against, a person based on the group, class, or category to which that person belongs rather than on individual merit. It involves intentional behaviours towards such groups such as, for instance, formally or informally excluding or restricting members of one group from opportunities that are available to another group.

**Inequality:** The observable and measurable effects of discriminatory practices and habits, resulting in differential conditions of professionals within scientific and managerial careers.

**Minorities:** Minorities among healthcare workers were defined as those discriminated in their professional career and/or underrepresented in scientific societies because of gender, age, sexual orientation, racial, regional, religious and/or political reasons without consideration of their personal achievements.

**Box 2****WHY IS DISCRIMINATION SO HARD TO ACKNOWLEDGE?**

- Difficult to recognize, since it is subtle, informal and generally embodied in well-established cultural, organizational and behavioural patterns;
- Annoying to admit, since it jeopardizes one's opinion about the fairness and quality of the environment s/he works in, which may be experienced by some as an aggression to their professional identity;
- Somewhat depressing to admit, since it affects the self-esteem, self confidence and hopes of the potential victims of;
- Often counterproductive to admit, since it puts the hard-won credibility of women and under-represented groups at risk in the working environment.

## Annex 1

### ESCMID Definition of European Regions

#### Western Europe

- Austria (AT)
- Belgium (BE)
- France (FR)
- Germany (DE)
- Republic of Ireland (IE)
- Liechtenstein (LI)
- Luxembourg (LU)
- The Netherlands (NL)
- Switzerland (CH)
- United Kingdom (UK)

#### Northern Europe

- Denmark (DK)
- Finland (FI)
- Iceland (IS)
- Norway (NO)
- Sweden (SE)

#### Eastern Europe

- Armenia (AM)
- Azerbaijan (AZ)
- Belarus (BY)
- Czech Republic (CZ)
- Estonia (EE)
- Georgia (GE)
- Hungary (HU)
- Latvia (LV)
- Lithuania (LT)
- Moldova (MD)
- Poland (PL)
- Romania (RO)
- Russia (RU)
- Slovakia (SK)
- Ukraine (UA)

#### South-Western Europe

- Andorra (AD)
- Italy (IT)
- Malta (MT)
- Monaco (MC)
- Portugal (PT)
- San Marino (SM)
- Spain (ES)

#### South-Eastern Europe

- Albania (AL)
- Bosnia and Herzegovina (BA)
- Bulgaria (BG)
- Croatia (HR)
- Cyprus (CY)
- Greece (GR)
- Israel (IL)
- Kosovo (KVM)
- Republic of Macedonia (MK)
- Montenegro (ME)
- Serbia (RS)
- Slovenia (SI)
- Turkey (TR)

## ANNEX 2

Past and current memberships among 1,274 ID/CM professionals stratified by geographic regions.

	WE	NE	EE	SWE	SEE	TOTAL
	n = 593	n = 111	n = 135	n = 262	n = 174	n = 1274
	%	%	%	%	%	%
Expert panels	42.8	45.5	26.7†	35.9	28.3	37.9
Project evaluation committees	36.6	31.2	25.2	34.7	27.7	33.4
Advisory boards	33.2	32.1	21.5	20.6	24.3	28.2
Program committees	26.1	28.6	28.9	24.0	36.7	27.7
Editorial boards	22.1	16.1	27.4	24.0	26.0	23.1
Recruitment committees	32.0†	25.0	5.9†	13.4	10.1†	22.0
Other	4.5	5.4	8.9	3.8	6.9	5.7

† Significant results:10 percentage points difference (corresponding to a precision of ±5%).

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12 **Science without meritocracy. Discrimination among European specialists in infectious diseases**  
13 **and clinical microbiology: a questionnaire survey**  
14

15 *Evelina Tacconelli, Mario Poljak, Marina Cacace, Giovanni Caiati, Nur Benzonana, Elisabeth Nagy,*  
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25 ESCMID Advocate for Geographic Balance; Marina Cacace and Giovanni Caiati, ASDO, Women  
26 Assembly for Combating against Social Exclusion, Rome, Italy; Nur Benzonana, Department of  
27 Infectious Diseases and Clinical Microbiology, Dr. Lutfi Kirdar Kartal Education and Research  
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30 Elisabeth Nagy, ESCMID Professional Affair Officer for Clinical Microbiology; Titia Kortbeek,  
31 Centre for Infectious Disease Control Netherlands, Laboratory for Infectious Diseases and  
32 Perinatal Screening, National Institute of Public Health and the Environment, Bilthoven, The  
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**Abstract**

**Objective** In 2009, in an European survey, around a quarter of Europeans reported witnessing discrimination or harassment at their workplace. The parity committee from the European Society of Clinical Microbiology and Infectious Diseases (ESCMID) designed a questionnaire survey to investigate forms of discrimination with respect to country, gender and ethnicity among medical professionals in hospitals and universities carrying out activities in the Clinical Microbiology (CM) and Infectious Diseases (ID) fields.

**Design** The survey consisted of 61 questions divided into five areas (socio-demographic, professional census and environment, leadership, and general) and ran anonymously for nearly 3 months on the ESCMID website.

**Subjects** European specialists in CM / ID.

**Results** Overall, we included 1,274 professionals. The majority of respondents (68%) stated that discrimination is present in medical science. A quarter of them reported personal experience with discrimination, mainly associated with gender and geographic region. Specialists from South-Western Europe experienced events at a much higher rate (37%) than other European regions. The proportion of women among full professor was on average 36% in CM and 26% in ID. Participation in high-level decision making committees was significantly (> 10 percentage points) different by gender and geographic origin. Yearly gross salary among CM/ID professionals was significantly different among European countries and by gender, within the same country. More than one third of respondents (38%) stated that international societies in CM/ID have an imbalance as for committee member distribution and speakers at international conferences.

**Conclusions** A quarter of CM / ID specialists experienced career and research discrimination in European hospitals and universities, mainly related to gender and geographic origin. Implementing proactive policies to tackle discrimination and improve representativeness and balance in career among CM/ID professionals in Europe is urgently needed.



## Introduction

In 2000, the European Union adopted two very far-reaching laws to prohibit discrimination in the workplace based on racial or ethnic origin, religion, disability, or sexual orientation.<sup>1</sup> In 2009 a survey was conducted to track, at European level, perceptions and opinions on this field.<sup>2</sup> Overall, around a quarter of Europeans reported witnessing discrimination or harassment and 16% of them experiencing it within one year of the study. Discrimination on ethnic origin (61%) was perceived to be the most widespread grounds for discrimination, followed by discrimination based on age (58%), disability (53%), and gender (40%).<sup>2</sup>

Discrimination in the academic area is more difficult to analyze although many of the factors making scientific work settings unfriendly to women and underrepresented minority groups are as common as in any other professional environment.<sup>3,4</sup> In particular, in medical professional settings, discrimination is harder to address because medical science itself (as science in general) is considered to be objective and an area where personal success is only based on scientific merit.

<sup>2</sup> The common belief of the blindness of science with respect to any personal feature of scientists is the basis of the subtle, informal and hardly visible nature of its segregating mechanisms, which often goes unrecognized even by those who are negatively affected by them.<sup>5</sup> When it comes to scientific professions, such as the medical one, it is also paramount to identify which are the real positions where leadership is expressed. In fact, these professions have undergone deep transformation in the last decades, with new roles and new professional figures emerging, modification of hierarchies and career paths and changes in the relative values attributed to different skills and capacities.<sup>6,7</sup>

Over the last years, many projects have been focused on characterizing discrimination at work level in academic settings.<sup>6,8-10</sup> Most important factors reported to contribute to the so called “chilly climate” for women and minority groups in science are the following: exclusion from informal networks and the existence of “hidden quotas” for women’s and minority groups’ presence in high-level positions,<sup>12,13</sup> pay gap,<sup>6</sup> access to resources for research and early-stage career development,<sup>13,2</sup> and evaluation of scientific merit.<sup>6</sup> Gender discrimination, in particular, has been the focus of different European researches.<sup>6,8-10,14,3</sup> The “She figures 2009” project, a collaboration between the Scientific Culture and Gender Issues Unit of the Directorate-General for Research of the EU Commission and the Helsinki Group, showed that although the

feminisation of the student population is one of the most striking aspects of the evolution of research over the last 30 years.<sup>15</sup> in most European countries women's academic career remains markedly characterised by strong vertical segregation. Women represented 44% among university students and 18% among full professors. Even of more interest, of all countries observed, there was none where female wages were equal to men's, despite the almost universal existence of legislation to impose gender wage equality.<sup>6</sup>

More difficult is to look for evidence of discrimination related to ethnic origin or belonging to any other underrepresented minority in medical academic area. Most observations derive from the U.S. Universities where, in 2008, African-Americans, Hispanics and Native Americans made up more than a third of the U.S. population but only 8.7 percent of physicians and 15 percent of enrolment in medical schools.<sup>164</sup>

In order to verify if, and to what extent forms of discrimination exist, the Parity Commission of the European Society of Infectious Diseases and Clinical Microbiology (ESCMID) organized a pan-European questionnaire survey. This study was designed to explore different forms of discrimination with main focus to gender, geographic origin, and belonging to a minority among clinical microbiology (CM) and infectious diseases (ID) professionals working in European hospitals and universities.

### Methods

A literature review was performed in order to define evidence and causes for discrimination in medical science and among CM/ID specialists. After assessing content validity, a pilot study including 10 participants from different European countries, evaluated its acceptance and reproducibility, and results led to minor amendments to its format. The final survey ([http://www.escmid.org/profession\\_career/parity\\_commission/parity\\_survey/](http://www.escmid.org/profession_career/parity_commission/parity_survey/)) consisted of 61 questions divided in five areas (socio-demographic, professional census and environment, leadership and generical) and ran anonymously for nearly 3 months (from March 17<sup>th</sup> to June 7<sup>th</sup> 2011) on the ESCMID website (see table 1). All ESCMID regular members, attendees of the 21st European Congress of Clinical Microbiology and Infectious Diseases (ECCMID)/27th International Congress of Chemotherapy held in Milan, Italy, and national/international ESCMID-affiliated societies' members were invited to participate.

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### Sample size calculation

Before administering the questionnaire a statistical description of the universe of reference (i.e. European CM/ID specialists) according to geographic region and gender was accomplished based on information provided by the ESCMID. Since the type of sampling was of a non-probabilistic nature, it was not possible to exactly determine the statistical representativeness of the sample. However, sample size to attain a confidence level of 95% and a precision of  $\pm 5\%$  was calculated as for a random sampling.<sup>176</sup> A minimum of 400 respondents was set up to fulfil confidence level and precision. Using the simple random sampling we also calculated that with a sample overcoming 1,000 units, with a confidence level of 95%, the precision of the esteem could be fixed, by analogy, at  $\pm 3\%$ . Post-stratification operations were also accomplished and respondents were weighted according to gender and geographical region of work. We consider a significant result only those showing gaps as wide as, at least, 10 percentage points (corresponding to a precision of  $\pm 5\%$ ).

### Analysis of the main sources of discrimination

Determinants of discrimination were grouped in three main areas: professional life (including career issues and working environmental issues), discrimination process and work-life balance. As for the sources of discrimination, results were systematically processed by gender and geographical region. The 40 European countries were classified in five geographical regions: Western Europe (WE), Northern Europe (NE), Eastern Europe (EE), South-Western Europe (SWE), and South-Eastern Europe (SEE), according to the standard ESCMID criteria (see annex 1). To assess salary differences, each respondent was asked to declare his/her gross-income level in Euros compared to 6 predefined income-classes in the questionnaire: < 25,000 Eur; 25,000-44,999 EUR; 45,000 – 64,999 EUR; 65,000 – 94,999 EUR; > 125,000 EUR.

To simplify presentation of the survey's results, three indexes were built (see table 2): Professional Achievement Index (PAI), Work-Life Balance Index (WLBI), and Gender Discrimination Perception Index (GDPI). To define each index a 3-step procedure was applied: selecting and weighing indicators, assembling the index for each respondent, and creating aggregates of respondents based on the index (low/medium/high).

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## Results

Overall, 1,566 individuals participated in the survey. Among them, 1,274 working in European countries at the time of the study were included in the analysis. Respondents' distribution by gender, geographical region, and age is shown in table 3.

Table 4 illustrates the main professional achievement reached by 1,274 respondents. Half of interviewed individuals (51%) reported to be involved in academic career. Overall, a clear imbalance in the number of women in the highest level of academic career was detected. Women accounted on average for 36% of full professorship in CM/ID. However, the difference is significantly more evident for ID than CM professionals (26% vs. 46%) (see figures 1,2). Women are even more under-represented in boards and committees with more than 20 percentage points dividing males from females (see table 4). The most striking difference was observed for participation in editorial boards (34% of females vs. 66% of men). The presence in high-level decision making bodies is also strongly influenced by geographic regions. Highest participation in expert panels is observed in professionals from NE (45%) and lowest in those from EE (26%) (see annex 2).

Number of publications in peer-reviewed journals, considered as the most traditional measure of scientific authority, shows clear gender differences (see table 4) and less evident regional differences (data not shown). Interestingly, a similar percentage of men and women report their name not being mentioned as first author when they were the ones conceiving the scientific publication and making the greater contribution to it (41% of men vs. 37% of women). Age discrimination stands out as the most recurrent explanation given by 22% of respondents.

Yearly gross salary among ICM/ID professionals is significantly different among European countries. The highest (> 10 percentage points) salary gap is observed among women from EE and SEE. After selecting high income level only (> 95,000 EUR/year), the percentage of inclusions ranges from 5% among professional females from EE to 42% of males in WE (see figure 3).

The majority of respondents (68%) agreed that discrimination exists in scientific fields such as the medical science (see table 5). Respondents from SWE show the strongest commitment to gender

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11 issues while those from WE and NE are in an intermediate position and those from EE and SEE  
12 less agree on the presence of discrimination among ID/CM specialists (see table 6). A quarter of  
13 respondents (26%) reported witnessing or experiencing discrimination or harassment at their  
14 workplace (37% among women and 16% among men). As for regional differences, respondents  
15 from SWE countries report discrimination events at a much higher rate (37%) than average (26%),  
16 with the largest difference for gender while discrimination on the grounds of religion is more  
17 frequently denounced from SEE countries (8%) (see table 5).

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19  
20 More than one third (37%) of respondents believe that CM/ID international societies have  
21 discrimination problems, mainly related to country misbalance (28%) and gender inequality  
22 (15%). More than 20% believe that the most important international CM/ID conferences (ECCMID  
23 and Interscience Conference on Antimicrobial Agents and Chemotherapy-ICCAC) are not balanced  
24 mainly for speaker's geographic region of origin (57%). The majority of respondents (72%) believe  
25 that international societies should play a major role in helping universities and hospitals in  
26 addressing career-related issues and related discriminatory events.

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29 The number of children reported might be considered as an indirect hint of the greater difficulty  
30 of women in CM/ID fields in reconciling work and family life. More than 20 percentage points  
31 divided the number of women and men who have 2 or more children (35% of women vs. 56% of  
32 men). Analysis of geographical distribution shows that there are relevant differences among  
33 European regions having 2 or more children: NE 69%, WE 47%, SWE 40%, EE 39%, and SE 38%.  
34 Considering different age classes, people under 35 years strongly regret having to wait longer  
35 than desired for having a child. People in the age class 35-49 years, on the other hand, more often  
36 report having less children than desired, or not at all, because of work commitments (36% of  
37 women and 19% of men).

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40 As expected, household duties are strongly influenced by gender. Women from SWE largely  
41 outnumber men as the ones who take up the greater part (75%) of household duties: 68% of  
42 women vs. 7% of men. After stratifying for age, while women under age 35 performing 100% of  
43 domestic chores are 29% and then the percentage slight decreases over the years, the trend for  
44 males is completely different. They perform all domestic duties until they presumably live alone  
45 (29% under age 35), then the figure suddenly drops of 20 percentage points and remains very  
46 low for all other age classes.

Distribution of indexes summarises major area of discrimination. The Professional Achievement Index (PAI) distribution adjusted by age is shown in figure 4. More than 20 points divide high professional achievements according to gender (46% of men vs. 26% of women) while regional differences are minimal (data not shown). The Work Life Balance index (WLBI) confirms the same distribution (see figure 5) with more than 30 percentage points of difference (81% of men vs. 52% of women). Perception of gender discrimination according to the Gender Discrimination Perception Index (GDPI) is presented in figure 6 with a significant difference between females and males (26% vs 5%).

### Discussion

Three main conclusions can be drawn from our survey. First, gender differences in career levels for CM/ID specialists, both academic and non-academical, are significant. If gender differences in achievement are measured through substantial indicators of scientific and professional success, such as scientific publications, research funding and participation in boards and committees, large gaps are still recorded between men and women and are consistent among professionals working in all European regions. Second, more than two thirds of CM/ID professionals recognise the existence of discriminatory problems at their workplace. Perception of discrimination on the basis of the geographical region of work is more widespread among EE and SEE countries. Third, the burden of family care is disproportionately weighing on the shoulders of women. A huge gap divides men and women who are able to find a satisfactory balance between their work and family commitments. Even though there are important differences in women's situation in the different regions, the gap with men is always much wider in all regions, including NE countries.

Our data clearly show the gap in professorship's distribution between men and women, difference in proportion of CM and ID professionals in different academic grades stratified by gender is significantly more evident for ID than CM professionals (26% vs. 46%). The data resembles the "scissor phenomenon", a graphical representation of the divergence of men and women as they adopt senior positions in academic research, associate professorships, and full professorships over time. Previous studies showed that, although the number of women entering the first grade of medical school outnumbered that one of men, they then suddenly, after Ph.D, are no longer found in positions of relevance in any universities across Europe.<sup>5,10</sup> Among CM and

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11 ID professionals the difference in different academic grades stratified by gender is significantly  
12 more evident for ID than CM professionals (26% vs. 46%).

13 Wide differences were also observed  
14 according to geographic regions. There are many cultural, economic and organizational reasons  
15 behind the wide differences that do emerge for academic career among CM/ID specialists. It is  
16 worth to notice that the regions where the gender gap is smaller among full professors (NE, EE  
17 and SEE) are those where women outnumber men to a larger extent among CM professionals. In  
18 this field women enjoy a relatively less discriminating environment. However, it is important to  
19 underline that in many European countries, especially where microbiology is practicing mainly as  
20 laboratory discipline and not as clinical microbiology, the career path is less “appealing” than  
21 other medical disciplines. This is not, however, the only variable having an impact, since situations  
22 are extremely varied. In daily “real” university life we frequently hear that plausible “explanation”  
23 from women not being represented at the same level of men at highest academic career is that  
24 women are less interested in academic career since this is not feasible with family and in  
25 particular with children care. The fact that women publish less than men is usually used as a key  
26 supporting argument. However, previous studies documented that productivity is affected by a  
27 number of factors which are unrelated to scientific merit.<sup>15-219</sup> Regional differences in publishing  
28 also suggest the existence of many determinants of scientific productivity. Professionals from WE  
29 and SWE are those with the highest rate of publications among CM/ID professionals. Creamer  
30 suggested that prolific publishers are disproportionately white males because the career paths,  
31 work assignments, research interests, and access to resources conducive to frequent publishing  
32 are more characteristic of white men than of women and minorities.<sup>175</sup> However, family  
33 responsibilities probably have less effect on women’s publishing activity than work assignments  
34 and time. Finally, women’s lower publishing rates may be a consequence of a “chilly climate” in  
35 some academic departments. Women are more likely than men to be excluded and isolated from  
36 the types of professional and social networks that define the life of a department. As our survey  
37 show, women and professionals from EE are less likely than men to receive visiting appointments  
38 and participate in high-level decision making boards, activity that encourages the building of  
39 professional networks and contacts outside home institutions. In this sense, productivity appears  
40 as a function of one’s position in the communication system in a discipline rather than personal  
41 scientific merits.  
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11 The analysis of gap salary related to gender and geographic regions is more difficult to analyze.  
12 Major limitation we encountered is related to the impossibility to adjust our results to national  
13 gross domestic product per capita corrected by local life costs. However, the pay gap between  
14 women and men is consistent within the same country in all European nations. Therefore, a need  
15 to implement proactive policies to tackle gender pay gap at European level is crucial.  
16

17 Our data show that the issue of inequality in medical science is strongly perceived by the majority  
18 of CM/ID professionals (68%). Differences can be recorded across geographical areas, although,  
19 there is no region where consensus on the existence of discrimination falls below 66% of  
20 respondents, while if we only include those reporting substantial discrimination, we never fall  
21 below 50%. Even of more interest a quarter of respondents reported witnessing or experiencing  
22 discrimination at their workplace mainly related to gender and nationality. The analysis of the  
23 work-life balance also showed significant differences according to gender. However, it is note of  
24 worthy, that a substantial part of respondents, regardless the gender, regret having to wait longer  
25 than desired for having a child or having less children than desired, or not at all, because of work  
26 commitments.  
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28 Finally, the use of indexes that, including different questions' results was introduced to  
29 summarize and simplify main conclusions, further underlines that there is a dramatic difference  
30 among CM/ID specialists by gender regarding professional achievement, life satisfaction, and  
31 perception of discrimination.  
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### 38 **Strengths and weakness of study**

39 This is the first study performed at European level specifically addressing the issue of  
40 discrimination in research and career among medical specialists. Previous researchers analysed  
41 the issue mainly related to the scientific academic area and never specifically on the medical one.  
42 Since the importance of the researchers' selection and career development in medicine and the  
43 consequential impact on European citizens' health we do believe the definition of such high level  
44 of perceived and actual career discrimination should be carefully evaluated by policymakers. Our  
45 study has many limitations. First of all, the ESCMID survey questionnaire was designed to target  
46 an extremely varied set of potential respondents, including people of different gender, age,  
47 ethnicity, nationality, religion, sexual orientation, disciplinary specialization, professional role and  
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11 level. It was obviously impossible, also considering it had to take the shortest time possible to be  
12 filled out, to adequately cover all aspects which would have deserved to be analyzed if each of  
13 those qualities had to be taken in full consideration. It was also impossible to proceed with a  
14 reliable stratification according to more variables than gender and geographic region of current  
15 employment.  
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#### 18 19 **Further research**

20 Future researches should focus on some of the neglected issues, for instance targeting ethnicity,  
21 religion and sexual orientation in more details. To obtain a more accurate understanding of the  
22 CM/ID reality as concerns equality issues other methodological approaches and sources of  
23 information should be added, such as direct observation, focus groups and qualitative interviews.  
24 It is also important to underline the tendency of professionals (both genders) to see scientific  
25 societies more involved than their own institutes in coping with parity issues. In particular,  
26 respondents seem to particularly value the role of international societies could play, beyond  
27 scientific exchange, as professional networks with a major role in dealing with professional issues,  
28 including those related to work environment, work-life balance and career. Specific studies on  
29 international medical societies and parity issues should be therefore promoted in order to better  
30 understand these dynamics and to identify which are the real demands professionals express to  
31 societies and to institutes when parity issues are at stakes.  
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#### 38 **Implications for clinicians and policymakers**

39 We believe that the results of our survey will play a major role in stimulating CM and ID  
40 specialists, other international societies for different specialisations as well as media to press  
41 policymakers to evaluate the fairness of academic career at national level. However, we are  
42 aware that a significant improvement in the current situation at hospital and university level for  
43 medical specialists can be reached only through more direct involvement of policymakers at  
44 European level. Informal exclusion ("hidden quotas") of new and young scientists just for being  
45 women or coming from a discriminated geographic region will definitively limit research and  
46 therefore will impact on future health of the Europeans citizens. In many countries laws to define  
47 recruitment in the academic area, ensuring equal opportunities for all scientists, regardless  
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11 gender and country of origin, need to be introduced. Our final common goal should be to move  
12 from science without meritocracy towards science only based upon meritocracy, in a very near  
13 future.  
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18 **Contributors:** ET had the idea of the research, contributed to the analysis and interpretation of  
19 the data, and drafted the paper. MC and GC contributed to the analysis and interpretation of the  
20 data. MP, NB, EN, and TK contributed to the conception of the study, interpretation of the data  
21 and critically revised the manuscript.  
22

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24 **Competing interests:** All authors do not have financial relationships with any organisations that  
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26 activities that could appear to have influenced the submitted work.  
27

28 **Ethical approval:** Not needed.  
29

30 **Data sharing:** Further summary data are available from the corresponding author at  
31 [Evelinaeve.Tacconelli@med.uni-tuebingen.de](mailto:Evelinaeve.Tacconelli@med.uni-tuebingen.de).

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34 work.  
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Table 1 Questionnaire's description

<i>Area</i>	<i>No. of question</i>	<i>Description</i>
Socio-demographic Qs. 1-15	15	Qs. collecting basic information about demographic and sociographic variables.
Professional census Qs. 16-23	8	Qs. collecting information about specialty, academic and professional achievement and employment status.
Professional environment Qs. 24-35	12	Qs. collecting information on the respondent's experience/opinion about discrimination regarding three features of the professional environment: organizational cultures and behaviors; career support; and work-life balance.
Leadership Qs. 36-56	21	Qs. collecting information on the respondent's experience/opinion about discrimination regarding the attainment of leadership positions, distinguishing between discrimination affecting research practice, discrimination in the attainment of decision-making positions in research management, and discrimination in scientific communication.
General Qs. 57-61	5	Qs. collecting last impressions, comments and very general opinions.

Qs. : questions; No.: number.

Table 2 Definition of indexes according to indicators

<i>Acronym</i>	<i>Index</i>	<i>Indicators</i>
PAI	Professional Achievement Index	Peer-reviewed articles published in career
		Funding received for research as principal investigator (2008/2010)
		Membership in professional boards and committees
WLBI	Work-Life Balance Index	Responsibility for household duties
		Having the number of children desired
		Having/having not to discontinue career opportunities
		Caring for an elderly or a ill parent or relative
GDPI	Gender Discrimination Perception Index	Reporting gender discrimination events
		Perception of gender inequality in international societies
		Perception of low representativeness, as for gender, of speakers at international conferences
		Belief that gender impacts on career's opportunities

Table 3 Main epidemiological characteristics of 1,274 participants, by gender

	Females N = 784	%	Males N = 490	%	Total	%
Region*						
Western Europe	244	31.1	195	39.8	439	35.5
Northern Europe	96	12.2	61	12.4	157	12.3
Eastern Europe	127	16.2	49	10.0	176	13.8
South-Western Europe	137	17.5	79	16.2	216	17.0
South-Eastern Europe	180	23.0	106	21.6	286	22.4
Year of age						
< 35	251	32.0	102	20.8	353	27.7
35 – 49	331	42.2	217	44.3	548	43.0
50 – 64	189	24.1	155	31.6	344	27.0
> 65	13	1.7	16	3.3	29	2.3
Specialty						
Clinical Microbiology	384	48.9	216	44.1	600	47.0
Infectious Diseases	263	30.9	227	46.3	539	42.3

\*according to the ESCMID classification of European regions (see annex 1).

Table 4 Main professional achievement of respondents, by gender

	Females	%	Males	%	Total
Professional level (N = 1008)					
Head of Division	82	37,1	139	62,9†	221
Head of ward	109	48,2	117	51,8	226
Consultant	156	44,3	196	55,7	352
University career (N = 649)					
Full professors	37	36.3	65	63.7†	102
Associate professors	48	34.8	90	65.2†	138
Assistant professors	59	52.7	53	47.3	112
Lecturers	72	47.7	79	52.3	151
Memberships (N = 1274)					
Expert panels	169	35.0	314	65.0†	483
Project evaluation committees	164	38.6	261	61.4†	425
Program committees	133	37.7	220	62.3†	353
Advisory boards	122	34.1	236	65.9†	358
Recruitment committees	106	37.9	174	62.1†	280
Editorial boards	100	34.0	194	66.0†	294
Publications in peer reviewed journals (N = 1188)					
> 200	4	14.3	24	85.7†	28
101 – 200	25	33.3	50	66.7†	75
51 – 100	43	36.1	76	63.9†	119
11 – 50	160	42.9	213	57.1	373
<= 10	356	60.0†	237	40.0	593

† significant results:10 percentage points difference (corresponding to a precision of ±5%).



Table 5 Proportion of CM/ID professionals declaring to have experienced or witnessed discrimination, by gender (N = 1255)

	Females	%*	Males	%*	Total	%*
Existence of discrimination <sup>°</sup>	461	73.8	363	57.5	824	68
At least one report	230	36.8 <sup>†</sup>	101	16.1	331	26.5
1 report	175	28.0	75	12.0	250	20.1
2 reports	34	5.4	14	2.2	48	3.8
> 2 reports	21	3.4	12	1.9	33	2.6
Gender	186	29.8 <sup>†</sup>	39	6.2	225	18.0
Ethnicity	32	5.1	20	3.2	52	4.2
Nationality	57	9.1	43	6.9	100	8.0
Religious background	27	4.3	19	3.0	46	3.7
Sexual orientation	19	3.0	21	3.4	40	3.2

<sup>†</sup> significant results:10 percentage points difference (corresponding to a precision of  $\pm 5\%$ ); \* Percentages refer to the total number of interviewed (1251); <sup>°</sup> the respondent was asked her/his opinion on the presence of discrimination in medical science (yes/no).

Table 6 Proportion of CM/ID professionals declaring to have experienced or witnessed discrimination, by geographic region

	WE N = 578 %	NE N = 110 %	EE N = 135 %	SWE N = 255 %	SEE N = 173 %	TOTAL N = 1251 %
At least one rep.	27,3	14,5 <sup>†</sup>	17,8	37,1 <sup>†</sup>	21,4	26.5
1 report	21.6	10.0	15.6	27.2	15.1	20.1
2 reports	3.5	1.8	1.5	5.5	5.2	3.8
>2 reports	2.2	2.7	0.7	4.7	1.7	2.6
Gender	17,5	12,8	12,2	29,6 <sup>†</sup>	10,1	18,0
Ethnicity	4,2	2,1	1,2	6,6	4,1	4,2
Nationality	7,8	4,9	5,5	11,2	8,1	8,0
Religious background	3,9	1,1	0,5	3,0	8,1	3,7
Sexual orientation	3,1	1,1	1,0	6,2	1,9	3,2

<sup>†</sup> significant results:10 percentage points difference (corresponding to a precision of  $\pm 5\%$ ); N = number.

## Figures

**Fig 1** Proportion of 214 CM professionals in different academic grades stratified by gender

† significant results:10 percentage points difference (corresponding to a precision of  $\pm 5\%$ ); prof.: professor.

**Fig 2** Proportion of 229 ID professionals in different academic grades stratified by gender

† significant results:10 percentage points difference (corresponding to a precision of  $\pm 5\%$ ); prof.: professor.

**Fig 3** Proportion of 235 CM/ID professionals in top income levels (> 95.000 euro / year) stratified by gender and geographic region

**Fig 4** Professional achievement according to PAI stratified by gender

PAI: Professional Achievement Index. Each indicator was evaluated on a trichotomous ordinal scale (low/medium/high presence). Each mode was attributed a numerical value between 0 and 1. The results obtained for each individual indicator were then added. To make the results of the different indexes homogeneous, the value scale of each index has been equalized at a 0-10 range. For each index a threshold system has been set up, so to place each individual within a "low/medium/high" trichotomous scale with respect to a given profile (for instance: "medium professional achievement"). See Table 2 for indicators included in this index.

**Fig 5** Work-life balance according to WLBI stratified by gender

WLBI: Work Balance Index. Each indicator was evaluated on a trichotomous ordinal scale (low/medium/high presence). Each mode was attributed a numerical value between 0 and 1. The results obtained for each individual indicator were then added. To make the results of the different indexes homogeneous, the value scale of each index has been equalized at a 0-10 range. For each index a threshold system has been set up, so to place each individual within a "low/medium/high" trichotomous scale with respect to a given profile (for instance: "positive work-life balance"). See Table 2 for indicators included in this index.

**Fig 6** Perception of gender discrimination according to GDPI stratified by gender.

GDPI: Gender Discrimination Perception Index. Each indicator was evaluated on a trichotomous ordinal scale (low/medium/high presence). Each mode was attributed a numerical value between 0 and 1. The results obtained for each individual indicator were then added. To make the results of the different indexes homogeneous, the value scale of each index has been equalized at a 0-10 range. For each index a threshold system has been set up, so to place each individual within a "low/medium/high" trichotomous scale with respect to a given profile (for instance: "low perception of gender discrimination"). See Table 2 for indicators included in this index.

**Box 1. Definitions of terms used in the article**

**Meritocracy:** It is a system of government or other administration (such as business administration) wherein appointments and responsibilities are objectively assigned to individuals based upon their "merits", namely intelligence, credentials, and education, determined through evaluations or examinations.

**Discrimination:** The treatment or consideration of, or making a distinction in favour of or against, a person based on the group, class, or category to which that person belongs rather than on individual merit. It involves intentional behaviours towards such groups such as, for instance, formally or informally excluding or restricting members of one group from opportunities that are available to another group.

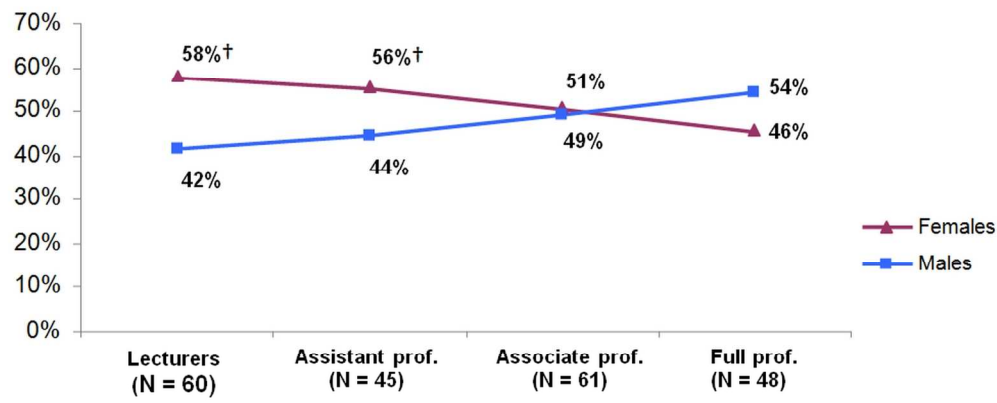
**Inequality:** The observable and measurable effects of discriminatory practices and habits, resulting in differential conditions of professionals within scientific and managerial careers.

**Minorities:** Minorities among healthcare workers were defined as those discriminated in their professional career and/or underrepresented in scientific societies because of gender, age, sexual orientation, racial, regional, religious and/or political reasons without consideration of their personal achievements.

**Box 2****WHY IS DISCRIMINATION SO HARD TO ACKNOWLEDGE?**

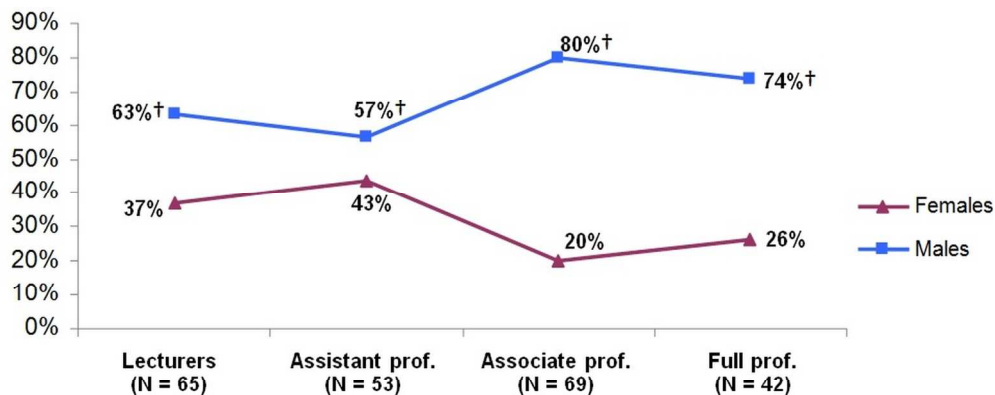
- Difficult to recognize, since it is subtle, informal and generally embodied in well-established cultural, organizational and behavioural patterns;
- Annoying to admit, since it jeopardizes one's opinion about the fairness and quality of the environment s/he works in, which may be experienced by some as an aggression to their professional identity;
- Somewhat depressing to admit, since it affects the self-esteem, self confidence and hopes of the potential victims of;
- Often counterproductive to admit, since it puts the hard-won credibility of women and under-represented groups at risk in the working environment.

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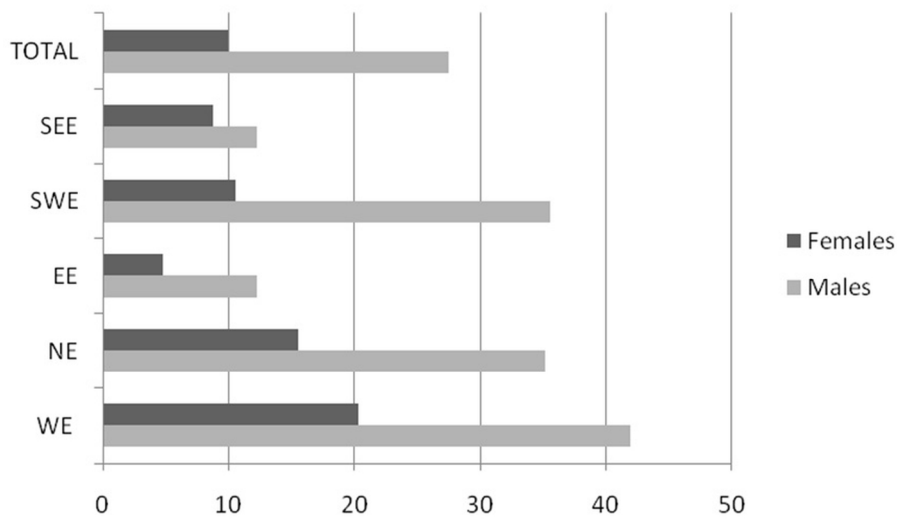


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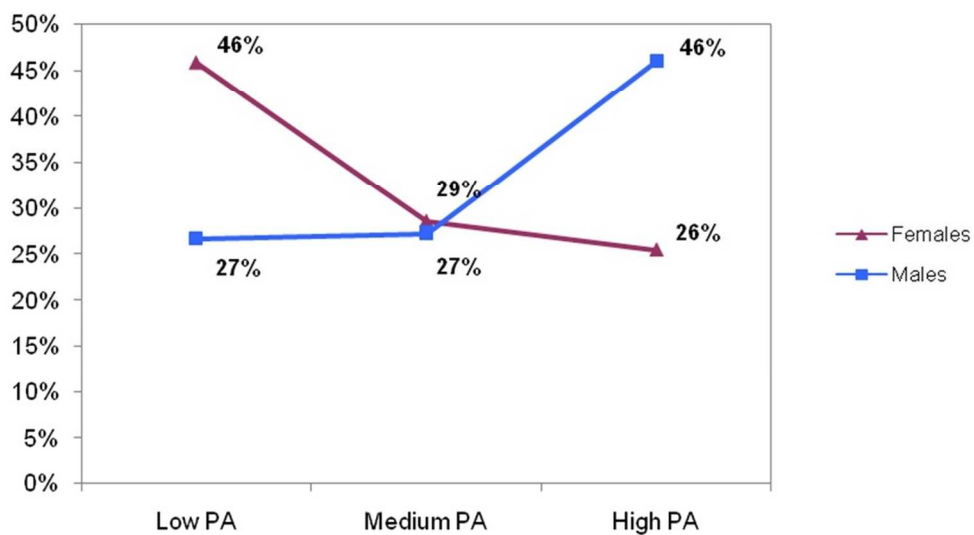
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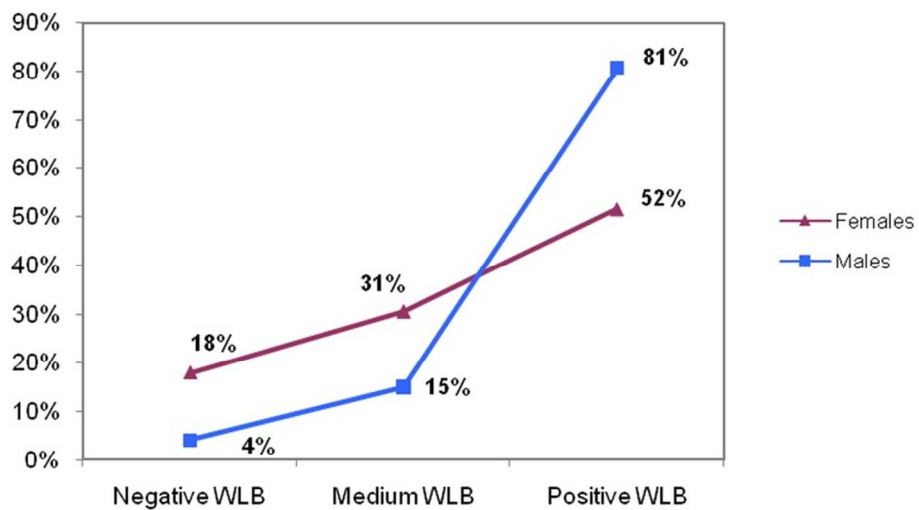


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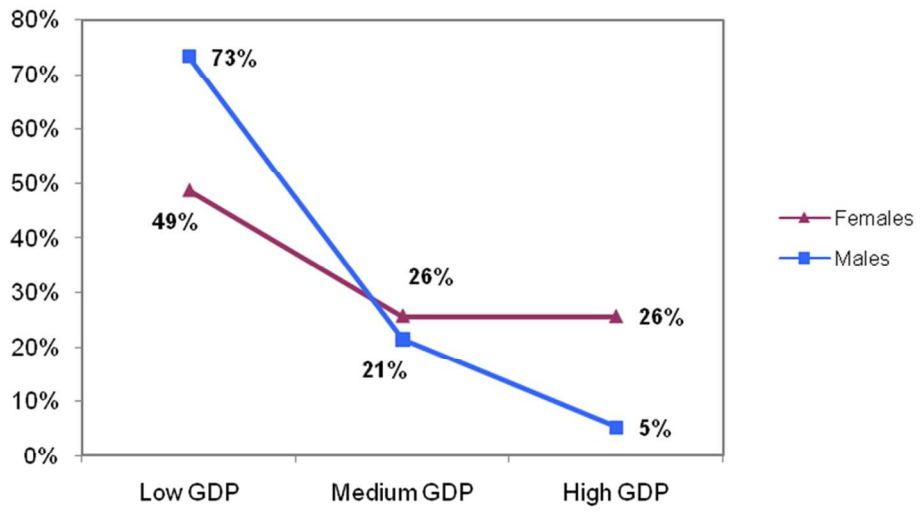
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