

The gender gap in Italian academic medicine from 2005 to 2015: still a glass ceiling

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SUMMARY

Background: Although women make up half of the population of medical students and residents, they are still under-represented in prominent leadership positions in academia. The disparity is greatest at the highest levels and represents a loss of talent for academic health centers, showing that women must choose between career advancement and personal life. **Objectives:** The aim of this study was to analyze gender distribution in Italian medical academia in all hierarchical roles (researchers in tenure track positions, associate and full professors) in different disciplinary scientific fields (SSD) in 2015 compared to 2005. **Methods:** Medical faculties were considered at 31/12/2005 and 30/09/2015, and analyzed using Excel data sheet (Office for Windows 2007). Database was analyzed using STATA software (Texas, Inc. 2014). **Results:** Women are under-represented in all careers: in 2005 they made up 36.2% of researchers, 21.7% of associate professors and only 9.4% of full professors. The percentage of women researchers increased significantly ($p < 0.0001$) in 2015 to 41.9%, but the percentages of female associate professors (25.3%) and full professors (14.2%) were still extremely low. **Discussion:** Our study shows that women are under-represented in Italian academia, with only a slight increase in presence in 2015 compared to ten years before. More action is needed to create a supportive environment, increase awareness and monitor potential discrimination.

RIASSUNTO

«Il gender gap nella medicina accademica in Italia dal 2005 al 2015: ancora un soffitto di cristallo». **Introduzione:** Sebbene le donne rappresentino più della metà degli studenti di Medicina e Chirurgia e degli specializzandi, restano sottorappresentate nelle posizioni dirigenziali nelle Università di tutto il mondo. La disparità è maggiore nei livelli più elevati e rappresenta una perdita di talenti, visto che le donne sono i migliori studenti. **Obiettivi:** Lo scopo di questo studio è quello di valutare la distribuzione del genere nell'accademia medica italiana, considerando ricercatori, professori associati e ordinari nei vari settori scientifici disciplinari (SSD) nel 2005 e di confrontarli con quelli del 2015. **Metodi:** Il data base pubblico è stato analizzato utilizzando il programma statistico STATA (Texas, Inc. 2014). **Risultati:** Le donne sono sottorappresentate a tutti i livelli: nel 2005 erano il 36,2% dei ricercatori, il 21,7% dei professori associati e solo il 9,4% dei professori ordinari. Le percentuali di donne sono aumentate significativamente nel 2015 ($p < 0.0001$) raggiungendo il 41,9% dei ricercatori, ma restano ancora basse fra i professori associati (25,3%) e gli ordinari (14,2%). **Discussione:** Il nostro studio dimostra che ancora oggi le donne sono sottorappresentate a Medicina e che sono necessarie azioni di supporto per promuovere un ambiente favorevole alla valorizzazione dei talenti.

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INTRODUCTION

Women currently represent half of the population of medical students and residents (15, 24); nevertheless, they are still under-represented in prominent leadership positions in academia in the USA (2), the UK (17) and in other leading roles in medicine such as Councilors in Medical Societies in Japan (19). Jolliff et al. 2014 (9) reported that females comprise only 37% of full-time academic physicians in the US. In 2012, only 13% of full professors, 32% of associate professors, and 43% of assistant professors were female.

In the past, the lower percentage of female students explained this discrepancy; however, the situation has remained unchanged despite the percentage of female residents increasing from 39 to 46% over a 10-yr period (9). Averaged over a 12-yr study period in the USA (27), women represented 14.7% of professors, 9.2% of chairpersons, and 9.3% of deans. Evidently, the disparity is greatest at the highest levels in our field.

An exploration of the barriers preventing female physicians from advancement in their academic careers is fully warranted, Wietsma (24) stated that female professors reported spending a significantly greater proportion of their time teaching and in direct patient care and less time engaging in research. This difference in research activity is demonstrated in differences in the number of first and last author publications, book chapters, named lectures, grants and principal and co-principal investigator positions (24).

Another US study found that only 17.5% of editorial board members are women (1) and women are less likely to be senior authors in peer-reviewed British journals (16). In addition, women's patents have a lower technological impact than that of men (18).

Moreover, the gender bias was recently demonstrated in an evaluation of grant applications in the Netherlands (22), which showed that being a man is associated with a higher probability of winning a grant.

To try to understand the gender gap in academic medicine and the reason for the lack of advancement and senior roles for women, Pololi et al. (15)

investigated a stratified random sample of 4,578 full-time faculty at 26 nationally representative US medical colleges. They found that female faculty reported a lower sense of belonging and relationships within the workplace, and lower self-efficacy for career advancement. Women perceived lower gender equity, and were less likely to believe that their institutions were making changes to address diversity goals. Women perceive their institution as less family-friendly, and women reported less congruence between their own values and those of their institutions. This shows that medical schools have failed to create and sustain an environment in which women feel fully accepted and supported to succeed (15).

In 2009, Mapp (13) reported data on Italian medical academia in the academic year 2006/2007, showing that women make up only 9.8% of full professors, 22% of associate professors and 36.4% of researchers. She stressed the need *"to implement strategies to reduce gender disparity in the achievement of leadership positions in academic medicine, particularly in Italy where the gap is wide"*. Gender gap is still a real problem in Italy, which ranks 69th in the world on the Gender Gap Index, worse than many developing countries, and 129th, one of the very last, for wage equality (25). It is important to analyze the gender gap in Italian academia to know where we have to act to increase gender balance.

The aim of our study was to analyze gender distribution in Italian medical academia in all hierarchical roles (researchers in tenure track positions, associate and full professors) in different disciplinary scientific fields (SSD) in 2015 compared to 2005.

METHODS

In Italy, a national database of academic positions is available on the web at <http://cercauniversita.cineca.it>, which is a government website (Ministry of Education, University and Research) being constantly updated. Data were extracted on 31/12/2005 and 30/09/2015. Tenure track researchers, associate, and full professors in medical disciplines were considered and analyzed using Excel data sheet (Office for Windows 2007). As gender information was not available, this was deduced by considering the name:

since there are no unisex names in Italian, gender assignment based on first names is very accurate. The database was analyzed using STATA software (Texas, Inc 2014). Comparison between proportions was analyzed using the Chi-square test. Comparison between 2005 and 2015 was analyzed using McNemar's test. Estimated effects on the odds of hiring a woman from 2005 to 2015 were evaluated using McNemar's exact test.

RESULTS

In 2005, there were 10,790 medical academic figures in Italy: 5,142 tenured researchers, 2,219 associate professors and 3,429 full professors. In 2015, there was a decrease in total numbers due to older professors retiring and not being replaced as a result of cuts in public spending on Italian universities. In 2015, out of 8,724 medical academics, 1,761 were

full professors, 2,939 were associate professors and 4,024 were researchers.

Overall, women were under-represented in all careers: in 2005, they made up 36.2% of researchers, 21.7% of associated professors and only 9.4% of full professors. These percentages increased significantly ($p < 0.0001$) in 2015, to 41.9% of researchers, 25.3% of associate professors and 14.2% of full professors (figure 1). Figure 2 shows the sex distribution in the different positions in 2005 and 2015 divided into basic sciences, medical sciences and surgery, obtained by collapsing different scientific fields (SSD). Women are overall under-represented as full and associated professors with percentages below 10% in 2005 and 22% in 2015 for surgery; below 14% in 2005 and 22% in 2015 for internal medicine. Better the situation in basic sciences, where over 50% of researchers were women, but less than 30% full professors. Looking closely at the SSD, a lower pres-

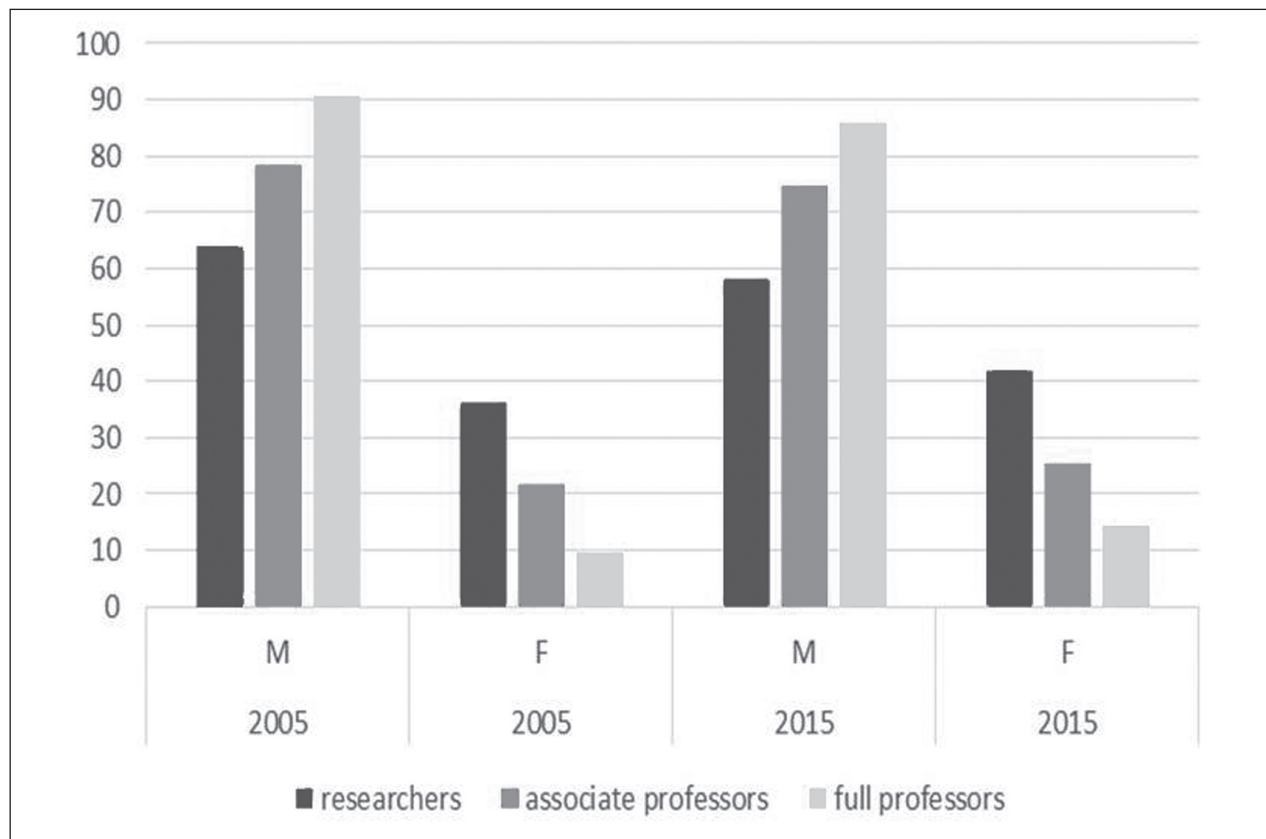


Figure 1 - Gender percentages in different medical academic roles in Italy in 2005 and 2015 ($p < 0.001$ between men and females) Man-Whitney U-test between 2005 and 2015 significant for all roles ($p < 0.05$)

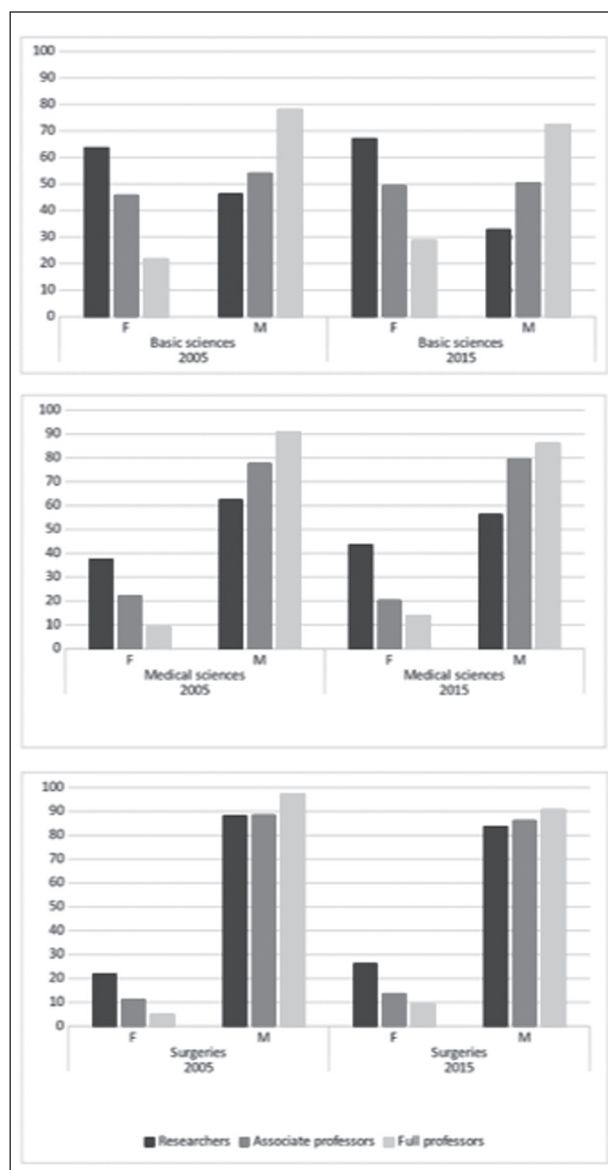


Figure 2 - Gender percentages in different medical academic roles in Italy in 2005 and 2015 divided into basic, medical and surgical sciences ($p < 0.001$ between men and females). Mc Nemar test between 2005 and 2015 significant for all roles ($p < 0.05$)

ence of women in higher positions was evident in all scientific fields, with zero or very low numbers of female full professors. Eleven SSD had no women as full professors and 13 SSD had a female presence below 10% (table 1).

In occupational medicine, over 40% of researchers were women in the years considered, while there were 7 associate professors (14.6%) in 2005 and 11

(23.9%) in 2015, but there was only one female full professor in 2005 and none in 2015.

Table 2 shows the estimated effects on the odds of hiring a woman from 2005 to 2015 in different academic fields. In the basic sciences, women were over-represented as researchers (OR=1.97; LC 95% 1.66-2.33), and for associate professors there were no gender differences. The chances of women being hired as full professors was significantly lower in the basic sciences (OR=0.37; CI 95% 0.29-0.48) and in all positions in the medical sciences and surgery.

DISCUSSION

Our study shows some small improvements in the situation of women in several SSD in Italian medical academia between 2005 and 2015, although further progress is ongoing.

However, women are still under-represented in almost all sectors in top positions, and are only 14.2% of full professors. This gender gap is common in many countries despite the fact that over 50% of medical students are women. In Italy, things have improved in recent years, but the situation is still critical in many surgical sectors, with no female full professors, while the imbalance is lower in medical sectors and in the lower career levels.

The situation in Italy is worse than in other countries. In a 12-year survey in the US (1997-2008), Yu et al. (27) reported that only 14.7% of women were full professors, but more recent statistics show that in 2014, 21% of full professors in academic medicine in the USA were women (12). A recent study carried out in Europe reported that the percentage of female full professors is 19% at Charité, Berlin (Germany) and at Vienna University (Austria), and 22% at Oxford University (UK). The best situation can be found in Sweden, with 28% of full professors at Karolinska (Stockholm) being women (11).

Much lower percentages are found in Japan, where the gender gap is wider than in Italy, and women surgeons are barely 10% of the total (like in Italy). Japanese women leave the profession because of child-care duties, when there is no 24-hour childcare facility or sick child facility available at the workplace, and no cooperation from the husband (14, 20, 23).

Table 1 - Number and percentages of women in Medical departments in 2005 and 2015 in different scientific sectors and career degrees

Scientific Sector (SSD)	Researchers		Associate professors		Full professors	
	2005	2015	2005	2015	2005	2015
	F n° (%)	F n° (%)	F n° (%)	F n° (%)	F n° (%)	F n° (%)
MED/01 Medical Statistics	24 (70.6)	21 (65.6)	10 (29.4)	18 (43.9)*	4 (23.5)	7 (33.3)
MED/02 History of Medicine	6 (60.0)	8 (44.4)	9 (75.0)	6 (85.7)	2 (28.6)	1 (20.0)
MED/03 Medical Genetic	27 (62.8)	35 (67.3)	29 (60.4)	31 (62.0)	7 (24.1)	6 (17.6)
MED/04 General Pathology	147 (69.3)	153 (72.5)	84 (50.0)	81 (51.3)	36 (22.4)	37 (34.6)
MED/05 Clinical Pathology	27 (62.8)	37 (71.1)	19 (55.9)	18 (66.7)	6 (24.0)	8 (29.6)
MED/06 Medical Oncology	22 (38.6)	28 (50.9)*	5 (15.1)	5 (15.1)	0 (0.0)	1 (3.8)
MED/07 Clinical Microbiology	116 (75.3)	108 (75.0)	52 (55.9)	57 (61.3)	28 (29.8)	27 (43.5)
MED/08 Anatomic Pathology	56 (51.8)	51 (54.8)	32 (31.7)	35 (35.7)	11 (11.3)	14 (20.6)
MED/09 Internal Medicine	98 (35.3)	140 (40.1)	55 (15.3)	48 (17.8)	13 (6.3)	13 (9.3)
MED/10 Respiratory Diseases	16 (34.0)	16 (40.0)	10 (18.9)	7 (16.7)	1 (4.8)	4 (17.4)
MED/11 Cardiovascular Diseases	38 (28.8)	38 (33.6)	14 (16.9)	10 (13.3)	2 (5.9)	3 (7.9)
MED/12 Gastroenterology	24 (35.3)	14 (29.2)	9 (14.7)	13 (24.1)	2 (6.1)	3 (8.3)
MED/13 Endocrinology	38 (33.0)	36 (41.9)	15 (18.1)	22 (30.6)	1 (2.1)	5 (11.4)
MED/14 Nephrology	15 (31.9)	13 (26.0)	3 (7.1)	5 (17.2)	2 (10.5)	0 (0.0)
MED/15 Hematology	35 (43.2)	40 (51.3)	13 (26.5)	13 (22.0)	0 (0.0)	2 (7.4)
MED/16 Rheumatology	19 (45.2)	25 (56.8)	5 (25.0)	4 (15.4)	0 (0.0)	2 (9.1)
MED/17 Infectious Diseases	33 (40.7)	31(53.4)	13 (23.6)	14 (29.8)	3 (8.3)	3 (11.5)
MED/18 Surgery	76 (14.2)	59 (16.4)	23 (6.2)	19 (7.2)	5 (2.4)	5 (3.8)
MED/19 Plastic Surgery	7 (18.4)	6 (19.3)	3 (10.7)	3 (15.0)	1 (5.8)	2 (10.0)
MED/20 Pediatric Sugery	3 (14.3)	3 (17.6)	1 (3.1)	0 (0.0)	0 (0.0)	0 (0.0)
MED/21 Thoracic Surgery	1 (3.8)	1 (4.8)	1 (6.2)	0 (0.0)	0 (0.0)	1 (5.3)
MED/22 Vascular Surgery	3 (6.7)	8 (19.0)	2 (5.7)	3 (10.0)	0 (0.0)	0 (0.0)
MED/23 Cardiac Surgery	1 (2.1)	0 (0.0)	0 (0.0)	1 (3.2)	1 (4.3)	0 (0.0)
MED/24 Urology	6 (7.6)	3 (4.7)	1 (1.9)	2 (4.1)	0 (0.0)	0 (0.0)
MED/25 Psychiatry	44 (36.4)	36 (45.0)	16 (24.2)	15(34.9)	3 (6.0)	7 (17.9)
MED/26 Neurology	74 (37.9)	63 (40.9)	27 (20.6)	34 (28.6)	3 (3.7)	6 (8.8)
MED/27 Neurosurgery	5 (7.6)	5 (11.9)	2 (4.0)	1 (2.4)	0 (0.0)	0 (0.0)
MED/28 Dentistry	41 (24.0)	48 (30.2)	25 (21.9)	23 (16.4)	10 (9.4)	15 (17.0)
MED/29 Ophthalmology	1 (3.8)	4 (16.0)	2 (6.9)	1 (5.9)	3 (11.5)	0 (0.0)
MED/30 Respiratory Diseases	45 (26.8)	38 (29.5)	8 (12.3)	4 (7.8)	0 (0.0)	1 (4.3)
MED/31 Otolaryngology	13 (16.2)	9 (16.1)	2 (4.2)	3 (6.8)	0 (0.0)	0 (0.0)
MED/32 Audiology	13 (46.4)	13 (54.2)	6 (30.0)	4 (19.0)	0 (0.0)	0 (0.0)
MED/33 Orthopedics	4 (4.0)	4 (6.1)	1 (1.4)	0 (0.0)	0 (0.0)	1 (2.9)
MED/34 Physical Medicine and Rehabilitation	6 (42.9)	9 (47.4)	4 (25.0)	5 (23.8)	0 (0.0)	4 (20.0)
MED/35 Dermatology	35 (38.5)	33 (49.2)	14 (29.8)	12 (27.3)	6 (15.8)	7 (30.4)
MED/36 Radiology and Radiotherapy	50 (27.6)	50 (34.5)	14 (11.1)	17 (17.5)	1 (1.6)	4 (6.8)
MED/37 Neuroradiology	5 (29.4)	5 (29.4)	0 (0.0)	2 (20.0)	0 (0.0)	0 (0.0)
MED/38 Pediatrics	8 (58.5)	99 (57.2)	58 (34.1)	38 (36.5)	10 (12.2)	8 (14.5)
MED/39 Neuropsychiatry	39 (69.6)	27 (65.8)	14 (45.2)	7 (31.8)	3 (13.0)	3 (17.6)
MED/40 Gynecology and Obstetrics	102 (33.1)	75 (42.4)	23 (14.8)	19 (18.3)	1 (1.6)	5 (11.1)
MED/41 Anesthesiology	66 (37.3)	48 (39.3)	15 (22.4)	8 (13.8)	4 (7.8)	3 (7.7)
MED/42 Public Hygiene	82 (56.9)	80 (60.1)	57 (47.9)	52 (53.1)	26 (26.8)	25 (33.3)
MED/43 Forensic Pathology	35 (31.5)	40 (39.6)	22 (27.8)	23 (35.4)	3 (5.2)	6 (14.6)
MED/44 Occupational Medicine	36 (42.9)	26 (48.1)	7 (14.6)	11 (23.9)	1 (2.4)	0 (0.0)

(continued)

Table 1 (continued) - Number and percentages of women in Medical departments in 2005 and 2015 in different scientific sectors and career degrees

Scientific Sector (SSD)	Researchers		Associate professors		Full professors	
	2005	2015	2005	2015	2005	2015
	F n° (%)	F n° (%)	F n° (%)	F n° (%)	F n° (%)	F n° (%)
MED/45 Nurses Sciences	4 (50.0)	10 (83.3)	10 (62.5)	12 (60.0)	--	2 (100.0)
MED/46 Sciences of Laboratory Medicine	40 (74.1)	43 (76.8)	2 (20.0)	16 (51.6)	5 (71.4)	3 (30.0)
MED/47 Obstetric Nurse Sciences	1 (100.0)	4 (100.0)	1 (50.0)	2 (100.0)	--	--
MED/48 Neuro-Psychiatric Rehabilitation Sciences	1 (33.3)	6 (54.5)	1 (33.3)	2 (28.6)	--	1 (100.0)
MED/49 Dietetic Sciences	5 (62.5)	18 (72.0)	4 (33.3)	12 (42.9)	4 (57.1)	3 (33.3)
MED/50 Medical Applied Sciences	7 (36.8)	17 (47.2)	2 (12.5)	4 (18.2)	0 (0.0)	3 (13.6)
Total	1860 (36.2)	1684 (41.9)**	745 (21.7)	742 (25.3)**	208 (9.4)	251 (14.2)**

* Significant increase in percentage between 2005 and 2015 * p<0.05; ** p<0.0001

Table 2 - Estimated effects on odds of hiring a women from 2005 to 2015 evaluated using McNemar's exact test

Academic fields	Position	OR	95%CI	p
Basic sciences	Researcher	1.97	1.66-2.33	0.000
	Associate professor	0.93	0.76-1.12	0.500
	Full professor	0.37	0.29-0.48	0.000
Medical sciences	Researcher	0.58	0.52-0.64	0.000
	Associate professor	0.28	0.25-0.32	0.000
	Full professor	0.13	0.10-0.16	0.000
Surgeries	Researcher	0.43	0.38-0.48	0.000
	Associate professor	0.14	0.04-0.21	0.000
	Full professor	0.07	0.05-0.10	0.000
Total	Researcher	0.46	0.43-0.49	0.000
	Associate professor	0.25	0.23-0.27	0.000
	Full professor	0.11	0.10-0.86	0.000

The low number of females in positions of leadership suggests to women that they must choose between career advancement and their personal life. Consequently, women reported a lower sense of belonging and relationships within the workplace (15), which certainly does not facilitate their integration and advancement (21). One of the obstacles to female advancement in academic medicine is academic productivity. Female physicians, who do not have the time to engage in research either because of family, educational, or clinical responsibilities, are less likely to be promoted. Kaplan et al (10) showed that gender imbalance in promotion disappears after adjusting for differences of authorships, grants,

investigator positions, allocation of time between research and clinical work, and institutional support for research.

An additional barrier, which is less quantifiable, is the lack of quality mentorship for female physicians. The existence of 'powerful women' in very visible positions is 'attracting females of similar caliber and also paving the way for younger female trainees' (26). Cheng et al. (5) demonstrated this in a study of female leadership in emergency medicine residency programs. Out of 133 university emergency medicine departments, 7.5% have a female chairperson. Compared with the majority of programs led by male chairs, these programs have a higher percent-

age of female faculty, (22% vs. 31%). The presence of female department chairs also correlates with a significantly higher percentage of female residency program directors, (50% vs. 12%) (10). Thus, female physicians are both more likely to be employed and promoted in academic centers that are led by a female chairperson (24).

To improve the actual situation, it is necessary to combat the current culture in academic medicine that prevents women's career advancement. In fact, Westring et al. (23), have shown how, at equivalent levels of work demands, women in more supportive cultures experienced lower levels of work-to-family conflict.

This change in cultural norms requires interventions both at the individual level and at the institutional one, in order to increase women's leadership self-efficacy. First, it is necessary to plan steps to make the behavioral change and later it is essential to find a way of reinforcing the new behavior so as to prevent relapse (8).

To overcome stereotype and prejudices, it is vital to promote self-esteem and monitor potential instances of discrimination. Then, by increasing leadership efficacy among females, exposure to successful female leaders can be increased (3, 4, 7).

Programs to support women academic career are also important: one example is the *Women and Health Science* program that used a whole series of actions to enhance women's presence in the California Davis School of Medicine from 2001 to 2011. Another experience is taking place at Stanford University, where a specific program is trying to improve women's career paths. This plan, entitled Academic Biomedical Career Customization (ABCC), provides solutions to both work-life and work-work conflicts. The ABCC framework involves creating individualized career plans that span a faculty member's entire career, with built-in options to flex up or down in research, patient care, administration, and teaching. Their aim is to succeed in this important mission and eliminate the gender leadership gap to achieve 50/50 in 2020.

There are also applied solutions to redress the imbalance between men and women's careers, but these do not solve the problem in the long term: part-time employment and the extension of one's

probationary period certainly provide flexibility, but these options can hinder a female physician's productivity, preventing academic advancement.

Italian academia needs to act to reduce the gender gap and to improve scientific career and advancement for women, as already stated by Mapp in 2009 (13). Our data show that in 10 years, there has been significant improvement only in the medical sciences and mainly in the number of researcher positions held, while the percentage of women who are associate and full professors is still extremely low. Trieste University financed the program TALENTA with the aim of improving women's leadership in research: this program aims to improve self-esteem and self-efficacy through class lessons and training. However, the causes of under-representation of women in senior positions in Italian academia still need to be better explored, and this should be the first step towards promoting appropriate career support strategies.

The future goal is to increase women's representativeness in Italian academia, to reduce disparities and to permit a balanced advancement in careers for both genders. A more inclusive system with clear rules for career advancements, together with an increase in self-efficacy and leadership is the proper way to boost the presence of women in Italian medical faculties (6). These actions, together with the application in Italy of the so-called Gelmini law, named after a former Italian education minister (L 240/2010), which finally laid down clear rules and made it compulsory to use international indexes to evaluate scientific productivity (such as impact factor and the number of papers published in peer-reviewed journals) will undoubtedly do much to bring about an improvement in career opportunities for Italian women scientists.

NO POTENTIAL CONFLICT OF INTEREST RELEVANT TO THIS ARTICLE WAS REPORTED BY THE AUTHORS

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