

# Research, clinical and theoretical training among geriatric medicine residents in Italy: a nationwide survey

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**Objective.** Recently, the Italian Ministries of University and Health implemented a standardized accreditation system for post-graduate medical schools. Therefore, assessing the satisfaction and expectations of residents in the Geriatrics academic program may help identify the major critical issues to address. We conducted a survey to evaluate residents' satisfaction with theoretical, statistical and clinical training and to investigate their research attitude.

**Methods.** A nationwide electronic survey was developed by the Young Epidemiologists group of the Italian Society of Gerontology and Geriatrics (YES) from December 2020 to February 2021 and disseminated among the Italian residents in Geriatrics attending the II-IV specialization year. The survey asked about the ongoing training activities in the theoretical, research, and clinical areas and the residents' satisfaction with them.

**Results.** 210 eligible residents participated in the survey (47.5% from Northern, 26.9% Central, 23.6% Southern Italy). Thirty-five percent of participants attended > 10 lessons/year (more frequently in Northern Italy), and 52% took part in statistics lessons. Around one-third (32%) were satisfied with the duration and quality of the classes. Satisfaction with the educational offer was < 50% in every clinical area. Eighty percent of participants were interested in research, but only 47% participated in research activities.

**Conclusions.** From the residents' point of view, the Italian geriatric medicine residency program may have wide improvement margins. The recent update of residency programs according to National standards might improve residents' satisfaction. Promoting education on research methodology through appropriate courses and ensuring dedicated time for research activities could increase residents' satisfaction and research quality.

**Key words:** geriatrics, medical residency, training, education, research

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## INTRODUCTION

The world population is growing older; according to the World Health Organization (WHO), by 2050 people aged 65 years and older will represent more than 20% of the global population<sup>1</sup>. This process is changing the demographic structure of most high-income countries across the globe<sup>2,3</sup> and raises the economic and management burden on already beleaguered healthcare systems<sup>4</sup>. In this mutated social and conceptual framework, care pathways are shifting from a disease-oriented approach to a patient-centred and multidisciplinary system, where geriatricians may exert a pivotal role.

Despite the increasingly recognized importance of geriatric medicine in modern healthcare systems, the last two decades were characterized by a rising gap between the steadily growing number of aged patients and the shortage of geriatricians<sup>5</sup>. Moreover, the training of geriatric medicine specialists varies dramatically across different countries and even within different provinces of the same countries. With the aim to harmonize post-graduate training programs in Europe, the European Geriatric Medicine Society (EuGMS) and the European Academy of Medicine and Ageing (EAMA) have recently released an updated version of recommendations for post-graduate training programs in Geriatric Medicine. In particular, the creation of a pan-European curriculum was deemed necessary to ensure the quality of care and facilitate the transnational migration of European Union specialists<sup>6,7</sup>, in alignment with the WHO global strategy and action plan on aging and health<sup>8</sup>.

In Italy, geriatric medicine has been a distinct medical specialty since 1961, when the first course of gerontology was held in Florence<sup>9</sup>. Since then, post-graduate geriatric medical education has grown, and several residency programs in geriatric medicine have been established across the country under the supervision of the Ministry of Education, University and Research (MIUR)<sup>10</sup>. In June 2017, MIUR and the Ministry of Health implemented a new standardized accreditation system for post-graduate medical schools, recognizing full accreditation to twenty-four geriatric residency programs and partial accreditation to another eleven<sup>10</sup>. Through the Inter-ministerial Decrees 68/2015 and 402/2017, the Italian Ministry of Health has set the standards, requirements and indicators of training and assistance activities for Italian residency schools.

However, data on the current status of the educational and research activities in the geriatric residency programs along with residents' level of satisfaction are scanty. To deepen the topic and fill this gap, we conducted an electronic survey among geriatric medicine residents throughout Italy, with the following objectives:

- a) to assess the residents' level of satisfaction with the theoretical, statistical and clinical training;

- b) to examine the participation rate of residents in research, their attitudes and perceived barriers toward scientific activities.

## METHODS

This nationwide survey was ideated and carried out from December 2020 to February 2021 by the Young Epidemiologists of the Italian Society of Geriatrics and Gerontology (SIGG) (YES working group). This group comprises residents, fellows and early career researchers in Geriatrics who aim to promote cooperation among young SIGG members in research projects and training events in the fields of geriatric medicine and aging epidemiology.

The questionnaire was developed by six geriatric medicine specialists or residents, members of the YES group. The survey content included four main areas of interest: i) demographic data, including information on working setting and geographical location (region, and city; regions were further grouped into 3 macro-areas: Northern Italy, including Aosta Valley, Piedmont, Liguria, Lombardy, Emilia-Romagna, Veneto, Friuli-Venezia Giulia, and Trentino-Alto Adige; Central Italy, including Lazio, Marches, Tuscany and Umbria; Southern Italy, including Abruzzo, Apulia, Basilicata, Calabria, Campania, Molise, Sardinia, and Sicily); ii) theoretical, statistical and clinical training and participation in congresses during the residency; iii) research activity during the residency; and iv) level and modality of individual scientific updating. The English version of the questionnaire is reported in Appendix 1.

The survey was implemented using EUSurvey, an online survey management system for creating and publishing forms available to the public (<https://ec.europa.eu/eusurvey>).

All the residents attending the second, third, or fourth year of the Italian residency programs in geriatric medicine were contacted via email by the SIGG administrative office and invited to participate in the survey. An email with all the information about the project was also sent to all the directors of the abovementioned programs.

## STATISTICAL ANALYSIS

Quantitative variables were reported using mean and standard deviation (SD) or median and interquartile range (IQR) after verifying the distribution of data, while the categorical ones were reported using counts and percentages. All the analyses were performed on the total sample and stratified according to working macro-areas sub-groups (Northern, Central, and Southern Italy).

The analyses were performed using R software, version 4.1.2 (Vienna, Austria).

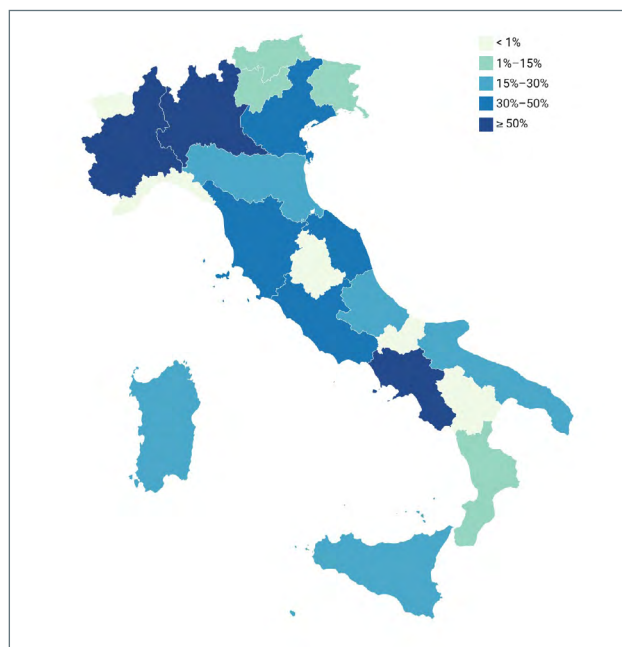
## RESULTS

Among the 648 eligible Italian residents who were attending the second, third, or fourth year of the geriatric residency programs in February 2021, 210 (32.4%) participated in the survey, 97 (47.5%) from Northern Italy, 70 (26.9%) from Central Italy, and 43 (23.6%) from Southern Italy. In total 15 in 20 Regions participated in the survey. The highest response rates were obtained from Lombardy (68%), Piemonte (62%), and Campania (51%), while the regions with the lowest rate were Friuli-Venezia Giulia and Trentino-Alto Adige (< 10%) (Fig. 1).

The mean age of survey participants was  $29.8 \pm 2.5$  years, and 142 were women (68.3%). 39.2% were attending the second, 36.8% the third and 23.9% the fourth year of residency, and most participants (76.9%) were practicing in acute care wards (Tab. I).

Thirty-five percent of residents attended more than ten lessons per year, 43% attended  $\leq 10$  lessons, and 22% reported rarely or never attending classes. The annual frequency of reported lessons was higher for residents of Northern Italy (Fig. 2). Thirty-two percent of residents reported that lectures organized by the residency program were appropriate for their specialty education, 42% felt that topics were not appropriate, and 26% that the time given to delve into the topics was inadequate. Satisfaction with the educational training was higher in Southern Italy (44%) compared to the Northern (32%) and Central (24%) regions (Tab. II).

Focusing on epidemiology and statistics training, 52% of participants attended lessons organized by their residency program and 5% to the specific course organized



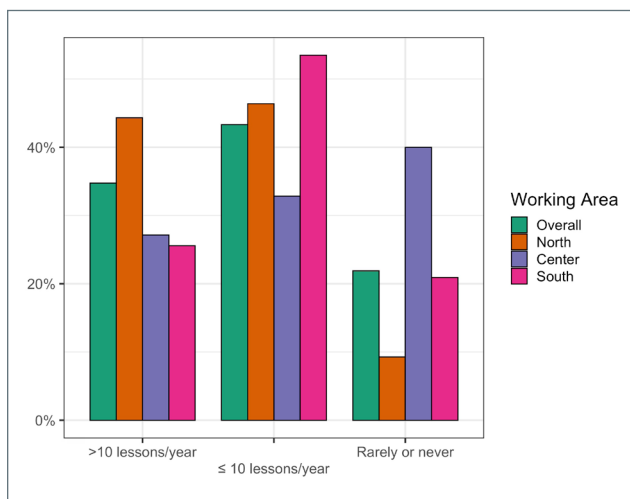
**Figure 1.** Distribution of residents participating in the survey across national regions.

by the SIGG. Southern Italy participants reported less frequently attending these classes organized by their residency program (30 vs 56% in the North and 59% in Center Italy). Seventy-eight percent of the residents declared to be able to perform descriptive statistics, 19% parametric and non-parametric statistical tests, and 2% advanced statistical tests, whereas 1% was independent in most aspects of statistical analysis (Tab. II). Education offered by residency programs throughout Italy was rated as satisfying for 45% of the responders in the management of geriatric syndromes and 61% in

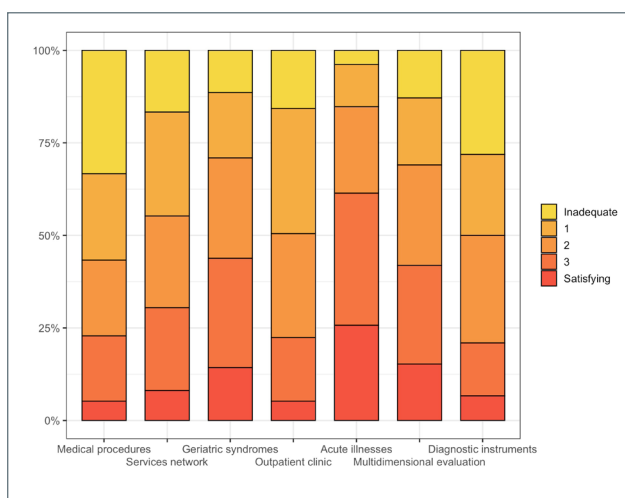
**Table I.** General characteristics of the survey participants.

|                             | All<br>(N = 210) | Northern Italy<br>(N = 97) | Central Italy<br>(N = 70) | Southern Italy<br>(N = 43) |
|-----------------------------|------------------|----------------------------|---------------------------|----------------------------|
| Age (year)                  | 29.8 (2.5)       | 29.7 (2.7)                 | 29.9 (2.6)                | 29.6 (2.1)                 |
| Female sex                  | 142 (68.3)       | 68 (70.1)                  | 50 (71.4)                 | 24 (58.5)                  |
| <i>Year of residency</i>    |                  |                            |                           |                            |
| II                          | 82 (39.2)        | 40 (41.7)                  | 24 (34.3)                 | 18 (41.9)                  |
| III                         | 77 (36.8)        | 32 (33.3)                  | 26 (37.1)                 | 19 (44.2)                  |
| IV                          | 50 (23.9)        | 24 (25)                    | 20 (28.6)                 | 6 (13.9)                   |
| <i>Current work setting</i> |                  |                            |                           |                            |
| Acute care ward             | 160 (76.9)       | 78 (81.3)                  | 53 (76.8)                 | 29 (67.4)                  |
| Outpatient clinic           | 17 (8.2)         | 4 (4.2)                    | 7 (10.1)                  | 6 (14)                     |
| Rehabilitation              | 10 (4.8)         | 7 (7.3)                    | 3 (4.3)                   | 0 (0)                      |
| Day hospital                | 6 (2.9)          | 1 (1)                      | 2 (1.4)                   | 3 (7)                      |
| Other                       | 17 (7.2)         | 7 (6.3)                    | 5 (7.4)                   | 5 (11.6)                   |

Notes: numbers are mean (SD) for age, and count (%) for the other variables.



**Figure 2.** Annual frequency of lessons of residents participating in the survey across national macro-areas.



**Figure 3.** Residents' level of satisfaction for the training on professionalizing activities (e.g. practice of cardiopulmonary resuscitation maneuvers, thoracentesis and paracentesis, nasogastric tube insertion) and the use of diagnostic instruments.

the management of acute conditions, while 23% were satisfied with the training on professionalizing activities (e.g. practice of cardiopulmonary resuscitation manoeuvres, thoracentesis and paracentesis, nasogastric tube insertion) and 21% with the use of diagnostic instruments (Fig. 3). Supplementary figures 1, 2 and 3 show residents' satisfaction levels according to the working macro-area.

Concerning the participation in national and international scientific conferences, residents reported participating in no more than one congress per year in 56% of cases, 37% attended two to three congresses, and only 7%

experienced more than three academic events per year. Participation was higher in Central and Southern Italy responders. Only 11% of participants attended international congresses, similarly by geographic area (Tab. II). Despite most of the respondents (80%) have declared to be interested in research in the Geriatrics field, with no differences across working macro-areas, active participation in research was less frequently reported. Indeed, only 47% of survey participants actively took part in research activities, 56% in the North and 44% in the South (Tab. III), for a median of 4 hours/week (IQR 2-6), 3 in the North (IQR 2-6), 4 in the Center (IQR 2-7), and 5 (IQR 3-7.5) in South Italy. Among those involved in research activities, more than 40% contributed to data collection and database compilation and about 30% to patients' enrolment. In contrast, less than 15% were involved in the study protocol drafting, statistical analysis, or manuscript writing, with no geographic differences (Fig. 4, panel A). Looking at the residents' interest in the activities mentioned above, one-fifth of the participants expressed willingness to contribute further to study design, protocol drafting, grant application, and manuscript preparation and submission. (Fig. 4, Panel B).

Thanks to their involvement in research activities, 26% of survey participants reported having developed new professional collaborations, mainly with residents from other medical specialties of the same university (57%) but also from other universities (36%), and 7% built international collaborations (Tab. III). One in three residents (34%) was satisfied with the research opportunities provided by their residency program (30% in North, 32% in Center, and 49% in South Italy). Complaints were mainly related to not receiving enough specific formation (64% of the total sample; 69% in the North, 48% in the Center, and 86% in the South) or not having enough time to participate in research activities (25% of all participants; 14% in the North, 50% in the Center, and 9% in the South) (Tab. III).

As regards the individual scientific updating, half of the survey respondents reported using Pubmed or other specific research databases for their professional and scientific updating, 24% using Google and 21% using scientific societies' websites. Furthermore, about three-fourths of participants read more than six scientific papers per year, preferring narrative or systematic reviews or meta-analyses (34%) or clinical practice guidelines (39%) (Tab. IV).

## DISCUSSION

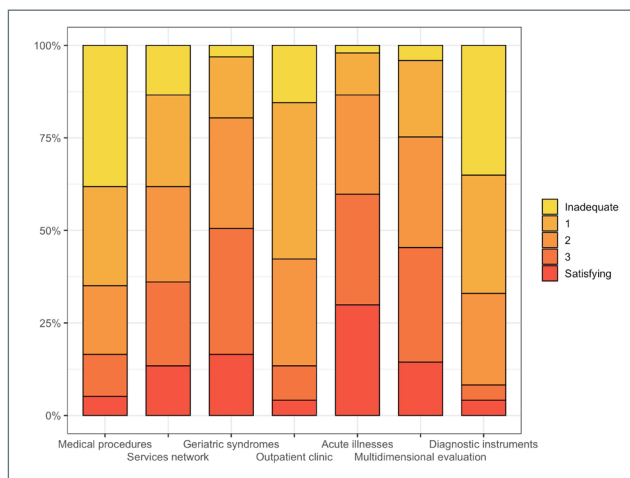
The present manuscript reports the results from a survey aiming at describing for the first time the perceptions of Italian geriatric medicine residents about the

**Table II.** Assessment of theoretical and statistical training of residents of the whole sample and across macro-areas.

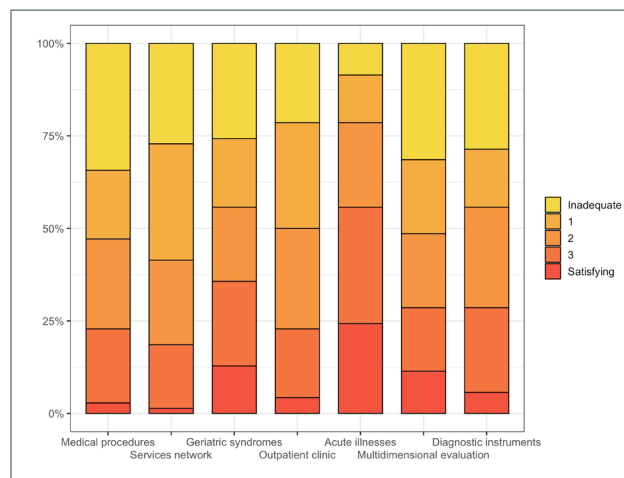
|  | All       | Northern Italy | Central Italy | Southern Italy |
|--|-----------|----------------|---------------|----------------|
|  | (N = 210) | (N = 97)       | (N = 70)      | (N = 43)       |
| How often does your residency program organize lectures?   |           |                |               |                |
| > 10 lectures per year (%)   | 35        | 44             | 27            | 26             |
| ≤ 10 lectures per year (%)   | 43        | 46             | 33            | 53             |
| Only occasionally or never (%)   | 22        | 9              | 40            | 21             |
| Do you think that lectures organized by your residency program are appropriate for your specialty education? |           |                |               |                |
| Overall yes (%)  | 32        | 32             | 25            | 44             |
| No, I think that the topics are inappropriate (%)  | 42        | 31             | 61            | 35             |
| No, I think that the time given to delve into the topics is inappropriate (%)                                | 26        | 36             | 14            | 21             |
| Have you ever attended Epidemiology and/or Statistics lessons during residency?                              |           |                |               |                |
| Yes, I have attended lessons organized by my residency program (%)   | 52        | 56             | 59            | 30             |
| Yes, I have attended the Statistics and Epidemiology course organized by SIGG (%)                            | 5         | 4              | 9             | 0              |
| Yes, both (%)  | 4         | 3              | 4             | 5              |
| No (%)   | 40        | 36             | 3             | 65             |
| In your opinion, what is your knowledge of medical statistics?   |           |                |               |                |
| Basics of descriptive statistics: mean, median, mode, standard deviation (%)                                 | 78        | 79             | 81            | 70             |
| Basics of parametric and non-parametric statistical tests: t-test, Kruskal-Wallis, chi-squared, ANOVA (%)    | 19        | 18             | 15            | 26             |
| Advanced statistic tests: correlation, linear and logistic regressions, survival analysis (%)                | 2         | 3              | 1             | 2              |
| Independent statistical analysis of databases with specific software (%)                                     | 1         | 0              | 1             | 2              |
| How many congresses do you attend by year on average since the beginning of your residency program?          |           |                |               |                |
| Once a year at most (%)  | 56        | 65             | 49            | 50             |
| Two or three times a year (%)  | 37        | 31             | 43            | 40             |
| More than three times a year (%)   | 7         | 4              | 9             | 9              |
| Have you ever attended international congresses as part of your residency?                                   |           |                |               |                |
| Yes (%)  | 11        | 11             | 12            | 9              |

theoretical, educational and research training offered in their residency programs. About one-third of geriatric medical residents are satisfied with their current theoretical and research training. The difference in satisfaction rates was stark across Italian macro-areas, with an increasing gradient from North to South. In contrast, rates of attendance to lessons and research activities within residency programs were higher among Northern Italy residents, followed by Central and Southern Italy respondents. Interest in clinical research among geriatric medicine residents is high in all Italian geographic areas, despite satisfaction from research opportunities provided by residency programs could be improved.

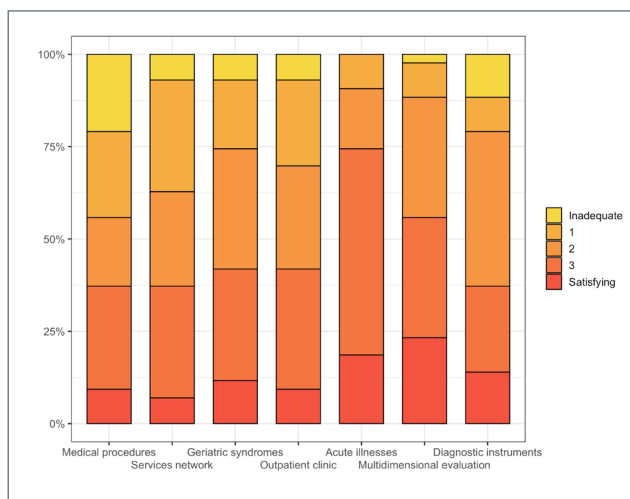
Research activity is a pivotal part of residency training, and the residency programs directors are annually asked to list the scholarly activities and products of their results. Interestingly, only one-third of the participants declared to be satisfied by the organization of the theoretical lessons in gerontology and geriatrics. Most residents consider that classes should be better organized or more time should be given to delve into their topics. Interestingly, the lowest satisfaction level, and also the highest attendance rate, were reached by Northern Italy residents. About half of the study sample attended epidemiology and biostatistics lessons organized within their residency program, and most responders reported



**Supplementary Figure 1.** Satisfaction level of residents working in Northern Italy.



**Supplementary Figure 2.** Satisfaction level of residents working in Central Italy.



**Supplementary Figure 3.** Satisfaction level of residents working in Southern Italy.

to have basic statistical skills. In order to ensure consistency of research training across institutions, consideration should be given to develop research tutors within regional training programs. Furthermore, the creation of national registries engaging interested residents at different institutions could help creating collaborations among students and decrease geographical differences. However, other studies have highlighted a high variability in geriatric medicine training across European countries, reflecting at least in part different national needs and social and cultural background<sup>6,11-14</sup>. Indeed, despite the increasing burden of older patients on healthcare systems, geriatric medicine is not recognized as a specialty all over Europe and the structure and length of postgraduate training differ substantially

between European countries. For instance, in the UK, the 9-year post-graduate training program includes 4 years specifically dedicated to Geriatric Medicine and Internal Medicine, with a very comprehensive curriculum covering all areas of Geriatric care; in other countries, like Romania and Netherlands, post-graduate training lasts 5 years, with 2-3 years specifically dedicated to geriatric medicine and a variable amount of time reserved for rotations in internal medicine; in other countries like Italy, geriatric training lasts 4 years, with some rotations among different specialties and time blocks dedicated to nursing home practice<sup>6,12</sup>. In all countries, time dedicated to research training is highly variable and not standardized<sup>7</sup>. Therefore, the survey results are not surprising because, despite the efforts made at national and European levels<sup>7</sup>, the implementation of consistent geriatric medicine training programs is still an ongoing process.

Besides basic knowledge and clinical skills, academic education also plays an essential role in training clinician-educators and researchers through “train the trainers” programs<sup>15</sup>. In Italy, SIGG has underlined the need to establish a standardized syllabus on geriatric medicine since 2014-2017<sup>16</sup>, and in present times is actively offering opportunities to improve clinical and epidemiological training from the very first years of residency.

Developing a clinical and research curricular pathway is another crucial point of post-graduate education in geriatric medicine. Despite the high interest in clinical research, less than half of the residents reported being actively involved in research activities during their training. Of these, most of them expressed the will to contribute to data entry and patient enrolment, and also to take part in other research activities, such as study protocol or manuscript drafting. Inadequate formation

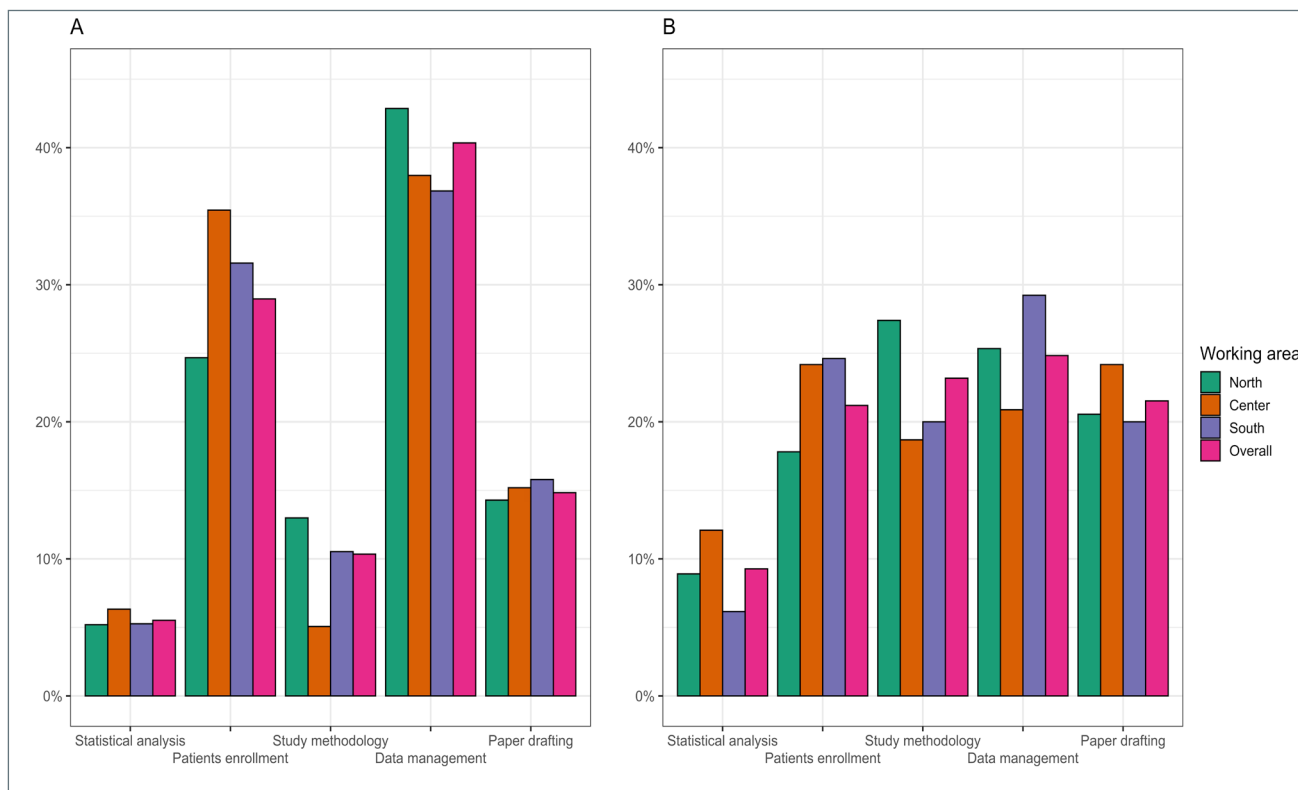


Figure 4. Residents' involvement (Panel A) and interest (Panel B) in research activities.

Table III. Assessment of research activity of residents of the whole sample and across macro-areas.

|   | All<br>(N = 210) | Northern Italy<br>(N = 97) | Central Italy<br>(N = 70) | Southern Italy<br>(N = 43) |
|---|------------------|----------------------------|---------------------------|----------------------------|
| Are you satisfied from the research opportunities provided by your residency program? |                  |                            |                           |                            |
| Yes (%)   | 80               | 70                         | 87                        | 91                         |
| Do you do research?   |                  |                            |                           |                            |
| Yes (%)   | 47               | 56                         | 36                        | 44                         |
| Did you develop new collaborations thanks to research activity?                       |                  |                            |                           |                            |
| Yes (%)   | 26               | 31                         | 19                        | 22                         |
| If yes, with whom?  |                  |                            |                           |                            |
| Residents from other specializations of your university                               | 56               | 52                         | 38                        | 89                         |
| Residents from your specialization belonging to other universities                    | 16               | 24                         | 13                        | 0                          |
| Residents from other specializations belonging to other universities                  | 19               | 20                         | 38                        | 0                          |
| International collaborations  | 9                | 4                          | 13                        | 11                         |
| Are you satisfied from the research opportunities provided by your residency program? |                  |                            |                           |                            |
| Yes   | 34               | 30                         | 32                        | 49                         |
| If not, why:  |                  |                            |                           |                            |
| Not enough time   | 25               | 14                         | 50                        | 9                          |
| Too much time   | 1                | 3                          | 0                         | 0                          |
| Not enough specific education   | 64               | 69                         | 48                        | 86                         |
| Other   | 9                | 14                         | 2                         | 5                          |

**Table IV.** Assessment of individual scientific updating of residents of the whole sample and across macro-areas.

|   | All       | Northern Italy | Central Italy | Southern Italy |
|---|-----------|----------------|---------------|----------------|
|   | (N = 210) | (N = 97)       | (N = 70)      | (N = 43)       |
| Which browsers do you use to search for papers or scientific news in general? (%) |           |                |               |                |
| Google  | 24        | 22             | 27            | 22             |
| Pubmed, Web of Science, TRIP, medRxiv and other specific browsers                 | 49        | 51             | 48            | 46             |
| Websites of scientific societies  | 21        | 19             | 21            | 25             |
| Everything allows to download Italian-translated articles                         | 6         | 8              | 4             | 7              |
| How many papers did you read in the last year? (%)                                |           |                |               |                |
| < 2   | 6         | 6              | 2             | 5              |
| Between 2 and 6   | 20        | 17             | 17            | 18             |
| > 6   | 73        | 77             | 81            | 76             |
| What kind of article do you prefer reading? (%)                                   |           |                |               |                |
| Guidelines  | 39        | 40             | 38            | 40             |
| Review/meta-analyses  | 34        | 36             | 31            | 35             |
| Case report   | 10        | 8              | 12            | 12             |
| RCTs  | 8         | 7              | 12            | 5              |
| Observational studies   | 8         | 9              | 8             | 8              |

and lack of time to dedicate to research activities were the two most common causes of low participation to research. In keeping with these data, previous studies have reported that research methodology training shortcomings are one of the greatest barriers to scholarly activity<sup>17</sup>.

Given the widespread interest of Italian geriatric medicine trainers in the field of research and the importance of developing specific skills during residency years, the implementation of a research plan, including theoretical training and time explicitly allocated to research activities during the residency programs, may increase residents' research involvement and satisfaction. Furthermore, the definition of a structured training in statistics and epidemiology can foster a constant individual scientific updating, by improving the understanding of research articles and formulation of updated answers to everyday clinical questions. Resident seminars, one-on-one tutorials with academic editors, as well as simulations on research cases could be useful to stimulate resident participation to research, thereby increasing residents' satisfaction and interest in more advanced research activities; seminars are an opportunity to introduce residents to new concepts, broaden their own horizons, and get feedbacks from their supervisors; similarly, conference presentations may represent an opportunity to disseminate results of research and develop fruitful collaborations. Geriatric medicine is a relatively young discipline compared to other medical specialties, accordingly, training on its theoretical bases is complex and requires a collective effort. The ultimate goal of academic and non-academic realities dealing with the

study and care of older adults should be to improve the quality of geriatric education promoting innovation, policy-guided clinical care leadership and communication abilities. With these aims, the organization of supervised training pathways could be an excellent option to increase the quality of education in gerontology and geriatrics. Despite the pursuit of research interests is highly variable among residency trainees, the critical appraisal of the literature and development of a scientific method are certainly important for all residents. However, although most students are generally aware of the availability of multiple bibliographic databases, often they may be inadequately trained in selecting essential information and distinguishing indexed journals. Furthermore, they may have misconceptions about the difficulty and complexity of bibliographic search. Several training programs can be implemented to help trainees to overcome these barriers; creation of working groups with structured interactions among students can improve development of bibliographic skills; similarly, journal clubs and forums can be used to engage groups of students in discussions of research questions, search strategies, and translation of research evidence in clinical practice.

The main strength of this work is its nationwide extension and its relatively high representativeness of Italian residents in Geriatrics. Furthermore, our survey investigated multiple aspects of participants' training, from theory to clinical practice, with a specific focus on research interests and activities. Some potential biases inherent to this survey must be acknowledged. First, a selection bias due to the relatively low response rate



(38%) is not negligible: those most interested in research and clinical and theoretical education among geriatric medicine residents might have responded more. Otherwise, unsatisfied residents might have more frequently answered to voice their discomfort. Second, residents' perceptions may underestimate or overestimate the actual quality of the residency programs: independent verification of subjective answers (e.g. those regarding publications, presentations and time dedicated to research pursuits) was not possible. Eventually, as for any self-report data, there might be additional influencing factors that could not be considered in this survey, such as institutional and training program differences, specific personal interest, and faculty support.

To improve response rates and quality of captured information, future surveys should contemplate use of additional incentives for trainee participation, such as lottery prizes and charitable donations; furthermore, a mixed web- and paper-based approach could also be useful; although the administration of Web survey is very quick and inexpensive, paper surveys directly distributed through the program's director office could increase the sense of reciprocity and underline the importance for individual participation; furthermore, survey support by an authority figure such as the program director or a fellow resident can increase motivation and sense of responsibility among residents; use of multiple communication channels including lecture visits, social media, and face-to-face promotion may also be considered to reach a larger and representative sample.

Despite the abovementioned limitations, this survey underlines the importance of residency training in developing a strong research background of future geriatricians. To address research-related barriers and improve resident satisfaction and productivity, a multifaceted and structured approach should be based on the following recommendations: a) dedicating protected research blocks of time (i.e. weeks or days) during the course of residency can be useful to accommodate the longitudinal nature of research and foster a more engaged research environment; b) reinforcing support from institutional leadership, by defining a residency advisory research board to formalize the research training process, can help students in conducting research activities and give them a rewarding experience with research; c) stimulating residents' interest and participation to research activities, by organizing resident lectures, symposia, and workshops with hands-on training, can equip the trainees with basic and advanced research skills and help them develop fruitful collaborations; d) incorporating a formal and structured research training program with practical sessions on basic methodology and biostatistics in resident curriculum can improve resident research knowledge and

experience. We think that these steps can finally result in greater overall satisfaction and productivity for residents, programs directors, and institutions.

## CONCLUSIONS

Overall, from the residents' point of view, the theoretical, clinical, and research training of geriatrics residency programs in Italy may have wide margins for improvement. Recent alignment of all residency programs to National standards might increase residents' satisfaction in the next years. However, improving research methodology through specific training courses and dedicating structured research time may improve residents' satisfaction and research quality.

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### Conflict of interest statement

The authors declare no conflict of interest.

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### Author contributions

DL, CO, CT, PF, IP, LB, MC: contributed to the study conception and design and to acquisition of data; DL: performed data analysis, and interpreted by all the authors. LS, SC, DL: written the first draft of the manuscript, and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

### Ethical consideration

This research complies with the ethical rules for human experimentation stated in the Declaration of Helsinki.

### YES GROUP

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Gender: M  F  Birth year: \_\_\_\_\_ Graduation year: \_\_\_\_\_

Resident in Geriatrics at \_\_\_\_\_ year of the residency program

*Current work setting:*

Acute care department  Post-acute Long-term care   
 Rehabilitation department  Nursing Home   
 Day Hospital  Outpatient clinic  Home care  Other   
 (specify) \_\_\_\_\_

Work area: Northern Italy  Central Italy  Southern Italy  Abroad

Working region: \_\_\_\_\_ Working city: \_\_\_\_\_

1. Have you ever attended epidemiology and/or statistics lessons during residency?

1. yes, I have attended lessons organized by my residency program
2. yes, I have attended the statistics and epidemiology course organized by the SIGG
3. a) and b)
4. no

2. In your opinion, what is your knowledge of medical statistics?

1. basic descriptive statistics: mean, median, mode, standard deviation
2. basic parametric and non-parametric statistical tests: t-test, Kruskal-Wallis, chi-squared, ANOVA
3. advanced statistical tests: correlation, linear and logistic regressions, survival analysis
4. independent statistical analysis of databases with specific softwares

3. Which browsers do you use for professional and scientific updating?

1. Google
2. Pubmed, Web of Science, TRIP, medRxiv and other specific browsers
3. websites of scientific societies
4. everything allows to download Italian-translated articles

4. How often does your residency program organize lectures?

1.  $\leq 10$  lectures per year
2.  $> 10$  lectures per year
3. only occasionally or never

5. Do you think that lectures organized by your residency program are appropriate for your residency training?

1. Yes
2. No, I think that the topics are inappropriate
3. No, I think that the time given to delve into the topics is inappropriate

6. Rate the education offer proposed by your residency program for the following macro-areas (from 0 = inadequate to 4 = satisfying)

|   |   |   |   |   |   |
|---|---|---|---|---|---|
| Knowledge and management of geriatric syndromes (cognitive decline, urinary incontinence, falls, malnutrition, pressure ulcers)                                 | 0 | 1 | 2 | 3 | 4 |
| Proficiency in Multidimensional Geriatric Assessment techniques (domains and tools) in different settings (nursing home, post-acute long-term care, acute care) | 0 | 1 | 2 | 3 | 4 |
| Management of older adults with acute illnesses: hospitalization goals and risks, early supported discharge   | 0 | 1 | 2 | 3 | 4 |
| Knowledge of territorial services network and of geriatric evaluation unit  | 0 | 1 | 2 | 3 | 4 |
| Independence in practical tasks (nasogastric tube placement, thoracentesis and paracentesis, CPR maneuvers)   | 0 | 1 | 2 | 3 | 4 |
| Use of diagnostic tools (electrocardiograph, ultrasound machine, spirometer)  | 0 | 1 | 2 | 3 | 4 |
| Experience in outpatient specialist clinics (pain management and palliative care, movement disorders, diabetology, osteoporosis, functional rehabilitation)     | 0 | 1 | 2 | 3 | 4 |

7. How often does your residency program organize seminars (internal or external)?

1. Weekly
2. Monthly
3. Yearly
4. Occasionally or never

8. How many congresses do you attend by year on average, since the beginning of your residency program?

1. Once a year at most
2. Twice or three times a year
3. More than three times a year

9. Have you ever attended international congresses during residency?

1. yes
2. no

10. Are you interested in geriatric research?

1. yes
2. no

11. How worthwhile is geriatric research, in your opinion?

1. very worthwhile
2. somewhat worthwhile
3. quite worthwhile
4. not much worthwhile
5. not worthwhile at all

12. Do you practice research?

1. yes
2. no

If yes, how many hours a week on average? \_\_\_\_\_

13. What do you are involved in during your research activity? (more than one choice)

1. study design/ protocol drafting/grant application
2. patient enrollment
3. data collection/database compilation
4. statistical analysis
5. manuscript drafting

14. What are you interested in? (more than one choice)

1. study design/protocol drafting/grant application
2. patient enrollment
3. data collection/database compilation
4. statistical analysis
5. manuscript drafting

15. Have you developed new professional collaborations thanks to involvement in research activity?

1. yes
2. no

If yes, with whom?

1. residents from other medical specialties of the same university
2. residents from your medical specialties of other universities
3. residents from other medical specialties of other universities
4. collaborations abroad

16. How many papers have you read in the last year?

1. < 2
2. between 2 and 6
3. ≥ 6

17. What kind of article do you prefer reading?

1. guidelines
2. review/meta-analysis
3. case reports
4. RCTs
5. observational studies

18. Do you know which is the highest scientific evidence in literature?

1. expert consensus document
2. meta-analysis
3. systematic reviews of literature
4. randomized control trials

19. Are you satisfied with the research opportunities provided by your residency program?

1. yes
2. no

If not, why:

1. not enough time
2. too much time
3. not enough specific education
4. other (specify) \_\_\_\_\_

20. Are there any initiatives that would you like to propose to improve the current research offer?

1. theoretical and/or practical statistics
2. how to write a study protocol
3. critical interpretation of scientific articles
4. other (specify) \_\_\_\_\_