



The Global Andrology Forum (GAF): Structure, Roles, Functioning and Outcomes: An Online Model for Collaborative Research

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Purpose: There are no published examples of a global online research collaborative in andrology. We describe the development, profile and member characteristics of the first consortium of this type, the Global Andrology Forum (GAF).

Materials and Methods: An online survey sent to all GAF members collected demographic information (sex, age, experience, academic title, degrees, country, specialty, profession). It also tapped data on members' characteristics e.g., skills in research, software and statistics; preferred activities; time commitments; expected roles; and interest in participating in research, in GAF's scientific activities and collaborative online research. The findings were analyzed and tabulated. We outline members' demographic and professional characteristics and scientific achievements to date. A narrative approach outlined GAF's structure and functioning.

Results: A total of 418 out of 540 members completed the survey and were included in the analysis (77.4% response rate). The sample comprised mainly urologists (34.2%) and a third of the respondents had practiced for >15 years (33.3%). Up to 86.1% of the members expressed interest in being actively engaged in writing scientific articles. A third of the sample (37.1%) could dedicate 4 to 6 hours/week. Few respondents reported skills in statistics and artwork (2.6% and 1.9% respectively). Members were assigned to specific roles based on their expertise and experiences. Collaborative working ensured the timely completion of projects while maintaining quality. For outcomes, GAF published 29 original articles within one year of its creation, with authors from 48 countries spanning topics that included varicocele, sperm DNA damage, oxidative stress, semen analysis and male infertility, oocyte/embryo, and laboratory issues of assisted reproductive technique (ART) and male infertility evaluation.

Conclusions: GAF is a successful global online andrology research model. A healthy number of scientific articles have been published. Given such effectiveness, adopting the GAF model could be useful for other disciplines that wish to create and coordinate successful international online research groups.

Keywords: Andrology; Education; Group structure; Organizations; Research; Surveys and questionnaires

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INTRODUCTION

Andrology is a melting pot of multiple medical specialties and disciplines that share the common focus of male reproductive and sexual health from adolescence to adulthood [1]. In many regions of the world, andrology has developed substantially and come to its golden age [2,3]. Compared to other medical disciplines, the growth of the andrological specialty came later, allowing it to capitalize on modern technological advancements spanning basic, clinical, and translational sciences [1]. The introduction of local and international societies, training courses, and high-quality dedicated journals further supported the growth of andrology [2,4].

While the future of andrology is promising, continuous efforts are required in research and scientific publications, as these are key to the development and advancement of our understandings [5,6]. Although scientific publications in andrology have increased [7,8], many areas remain under-researched and represent potentially important topics for future studies [9,10].

Research within international consortia results in higher citations, more significant scientific potential, increased coverage, as well as better quality and efficiency of studies [11-13]. Notwithstanding, international research collaboratives require persistence, commitment, excellent communication, and skilled members [14,15]. Factors that contribute to the success of international research forums include existing professional relationships and research projects that offer global meaning [16]. As the COVID-19 pandemic limited face-to-face collaborations, international online communications have grown, allowing more effective and efficient working [17]. Online research groups offer benefits compared to in-person groups, including money and

time savings, and increased research accessibility [18].

Several societies bring together academia and practitioners to influence the future development of a particular field [19-21]. However, to date, there appears to be no published reports of any examples of a global online andrology research groups or consortiums. The literature lacks information on the membership features of such collaboratives, their organizational configuration, management structure and as well as the scientific potential or actual achieved outcomes. The present study bridges this knowledge gap and describes the profile of a global online research collaborative in andrology, the Global Andrology Forum (GAF). We outline the demographic and professional characteristics of its members, communicate its structure and management, and highlight its scientific achievements to date. To the best of our knowledge, this is the first study to undertake such task.

1. Setting: The Global Andrology Forum

GAF is the first non-profit, voluntary, international collaborative online research group with interest in male sexual and reproductive science. Inaugurated in December 2021, its purpose is to connect andrology scientists and professionals who are enthusiastic to create online combined research and scientific activities to reshape the future of andrology [22]. GAF's activities include research, online training and webinars, and its outcomes include publishing state-of-the-art book chapters and scientific articles. Complete descriptions of GAF's aspirations and objectives, evolution and development, as well as management team and structure are detailed elsewhere [22]. Table 1 outlines the vision and mission of GAF, and the potential benefits to its members.

GAF comprises active members (those who take on

Table 1. The Global Andrology Forum (GAF)

Vision	To create global collaboration of clinicians and researchers to promote scientific excellence in andrology
Mission	To conduct high quality research in the field, including new systematic reviews and meta-analyses, scientometric studies, and global surveys on andrology clinical practice, and to generate cutting-edge articles on the future of male infertility and sexual medicine
Benefits to members	<ul style="list-style-type: none">- Exposure to innovative concepts and new ideas- Opportunity to participate in high-quality systematic reviews, meta-analyses, scientific articles, book chapters, online meetings- Receive training in various aspects of research, such as study design, research methodology, literature searches, scientific writing- Attend educational webinars and hybrid scientific meetings on andrology, male infertility and sexual medicine- Use tools available on GAF website- Wealth of ideas, concepts, and methodological tools, sharing of questions/ answers, and bibliographic references- Free of charge membership

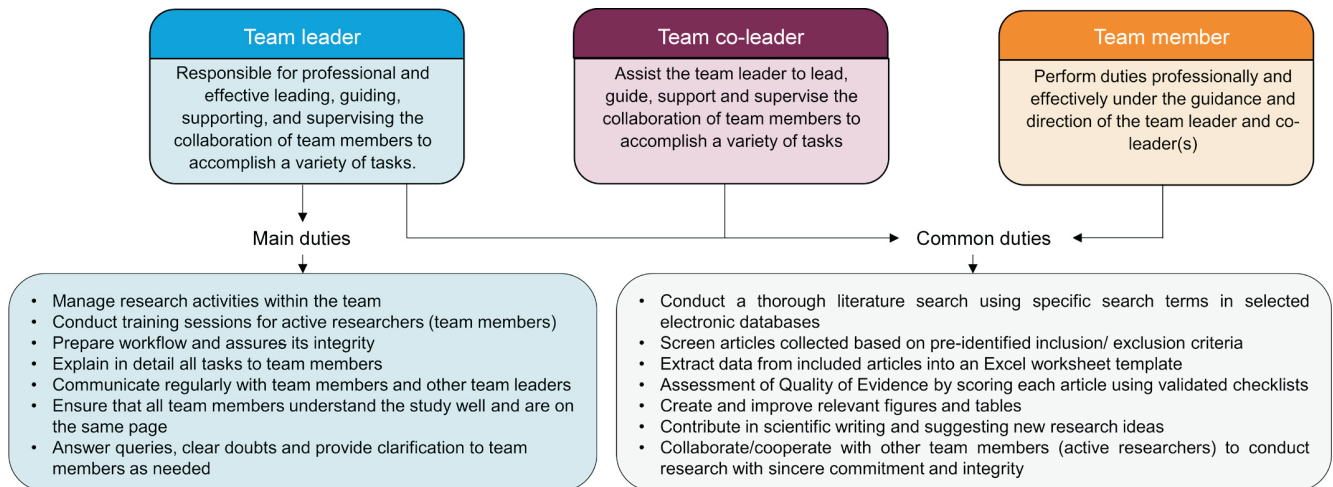


Fig. 1. The Global Andrology Forum (GAF): member roles and duties.

various research roles); and corresponding members (no active research roles but can still participate in GAF's scientific events and activities other than research). Membership status can be changed as members' aspirations shift. GAF's active members are organized into research teams spread across countries around the globe. Each team comprises active researchers working under the responsibility of a leader and two co-leaders and supervised by GAF. GAF's management team tasks are to oversee strategic planning, advise on research, statistical and scientific writing matters, operational management, review, train, communicate, coordinate, as well as liaise with other societies. GAF also involves research coordinators who work to help manage the database, generate reports, and create relevant announcements. Agreement is established for positions and roles within GAF, e.g., as guest members of the management team, team leaders, co-leaders, and active researchers so that expectations are clear. Fig. 1 outlines selected roles of members. Fig. 2 provides a snapshot of the organization, structure, functional teams and communication lines of GAF.

MATERIALS AND METHODS

1. Study design, ethics, and procedures

This survey was approved by GAF's Internal Review

Board (IR-02-23-103). Data were collected using an online survey that was available on GAF's website for new members or those interested in joining GAF. The survey used the Google Forms platform and was constructed to allow participants to review their answers before final submission; the design, distribution and analysis of the survey were in accordance with the Checklist for Reporting Results of Internet E-Surveys [23].

2. Data collection: questionnaire

Information about the survey was disseminated via email, GAF's WhatsApp group, and direct communication between members. An accompanying letter to all members explained the general aims and the specific objectives of the survey. The survey questions collected demographic information (sex, age, years of experience, academic title, degrees attained, country, specialty, and profession), as well as information on members' research interests, and interest in participating in GAF's scientific activities and collaborative online research. The list of questions was reviewed and refined by GAF's senior advisors. Sample items included questions with categorical response format e.g., specialty, 'Are you interested in being part of this collaborative online research', 'Are you interested in receiving training in research methodology?', or 'Do you wish to be actively

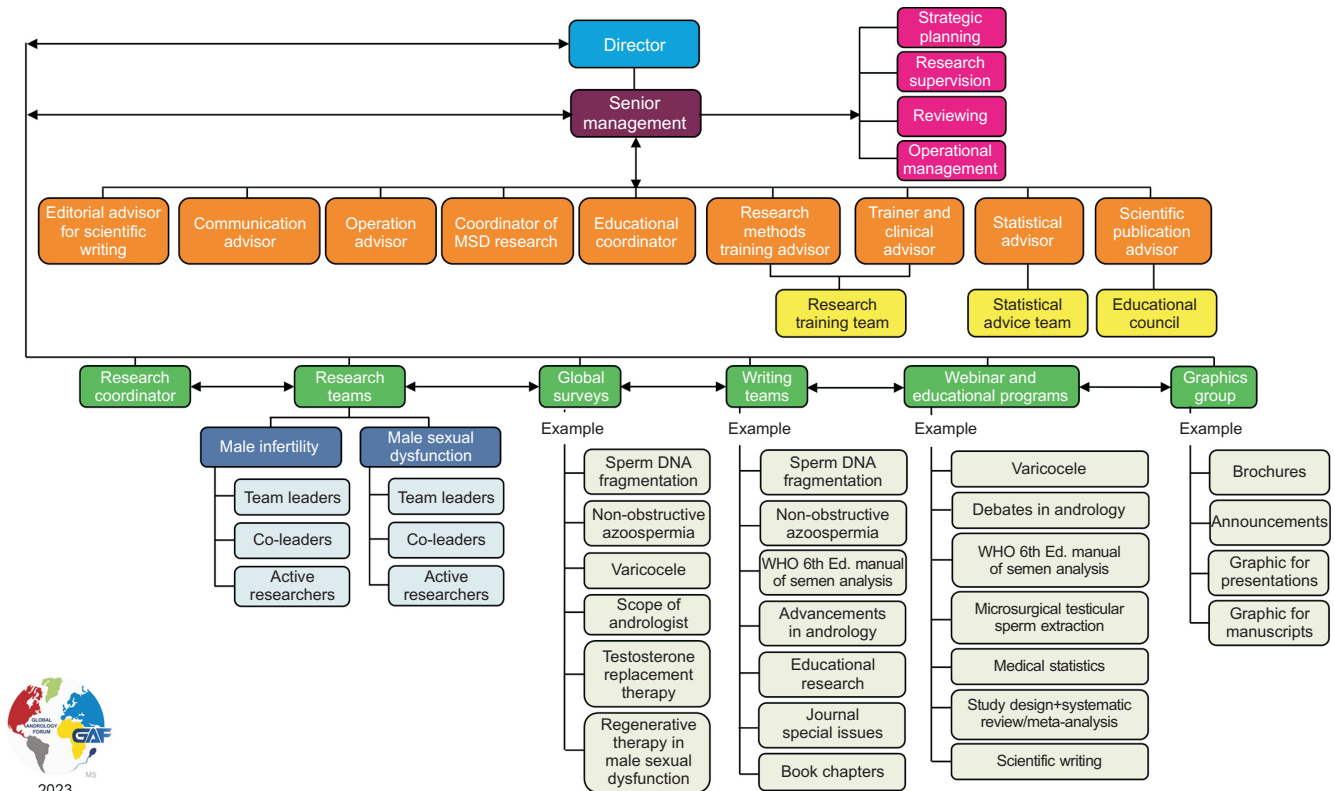


Fig. 2. A snapshot of the Global Andrology Forum (GAF): Organization, structure, functional teams and communication lines.

engaged in writing scientific research articles?'. Other questions had Likert scale response format e.g., How would you rate: 'your interest in participating in GAF administrative activities', 'your interest in participating in GAF research projects' (0=no interest at all, 10=extreme interest); 'your knowledge of medical statistics', 'your knowledge in preparing graphics for scientific publications?' (0=no knowledge at all, 10=extremely experienced). The questionnaire was available online from August 24, 2022 to January 2, 2023, with multiple reminders. By completing the questionnaire, members were informed that they consent to partake in the study. Participation was anonymous, voluntary and confidential. Data protection was always observed.

3. Statistical analysis

Data from Google Forms platform was imported as an Excel file and only complete data forms were included in the analysis. The descriptive analysis outlined the binary and categorical response options. For questions where multiple responses were selected, analysis was based on the total number of responses for the given question. Categorical data are presented as frequency and percentages; and continuous data of

the interest and knowledge questions were presented as mean±standard deviation. Microsoft Excel was used for statistical analysis.

RESULTS

1. Demographic characteristics of the sample

The total number of valid responses received was 418 out of 540 members from 66 countries (response rate=77.4%) (Supplement File 1). Fig. 3 shows that participants extended worldwide, with the highest proportion from India (14.1%) followed by Turkey, Indonesia, and Italy. Members represented all continents; but there were modest representations from some countries characterized by large populations such as China, Brazil, and UK.

The specialities involved in GAF revealed that urologists comprised the largest group (34.2%) followed by andrologists, researchers, *in vitro* fertilization (IVF) specialists, embryologists, and endocrinologists (Fig. 4). Other professional groups included specializations in immunology, biomedical engineering, product innovation, pediatrics, primary health care, public health, health care management, and genetics. About a third

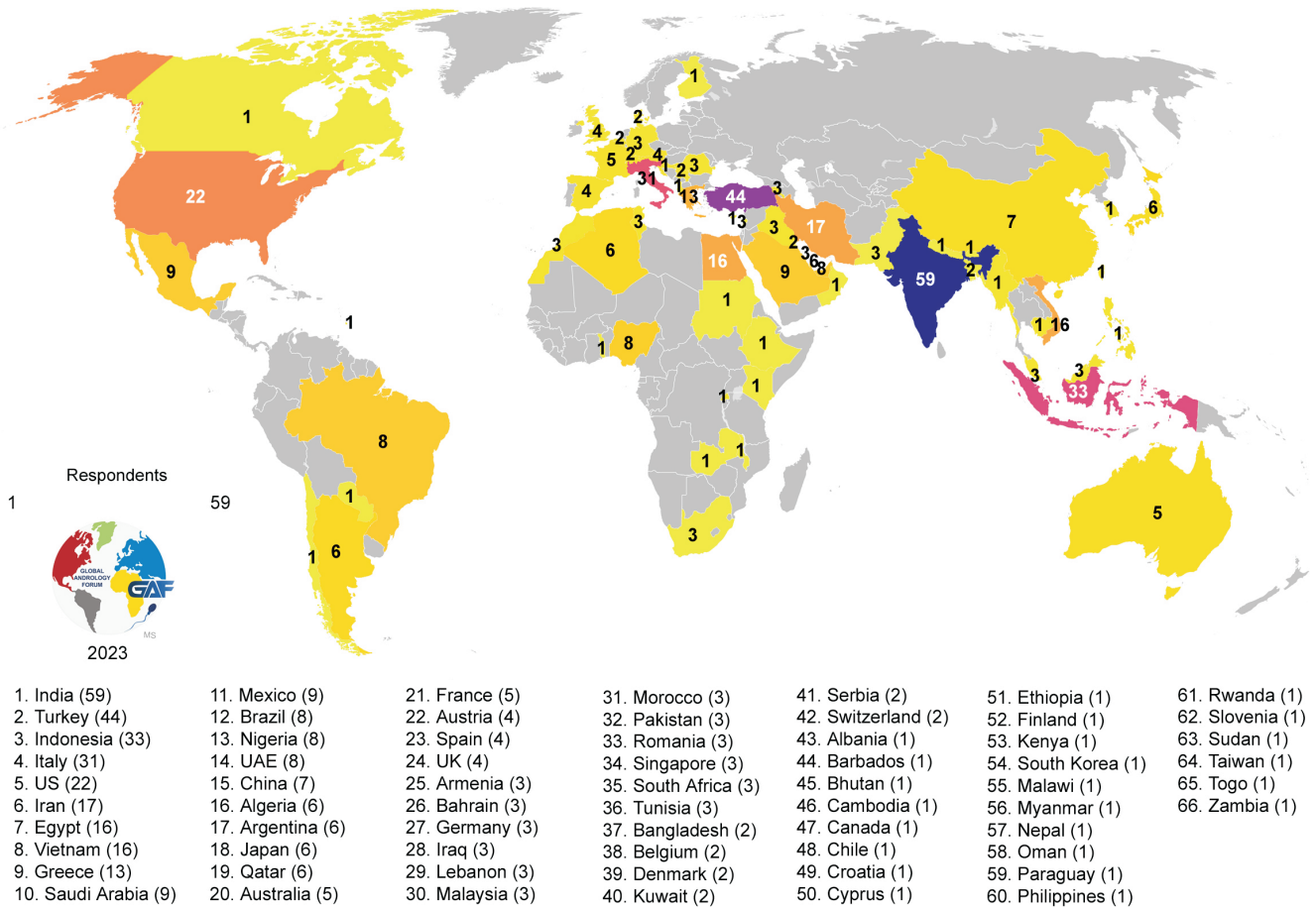
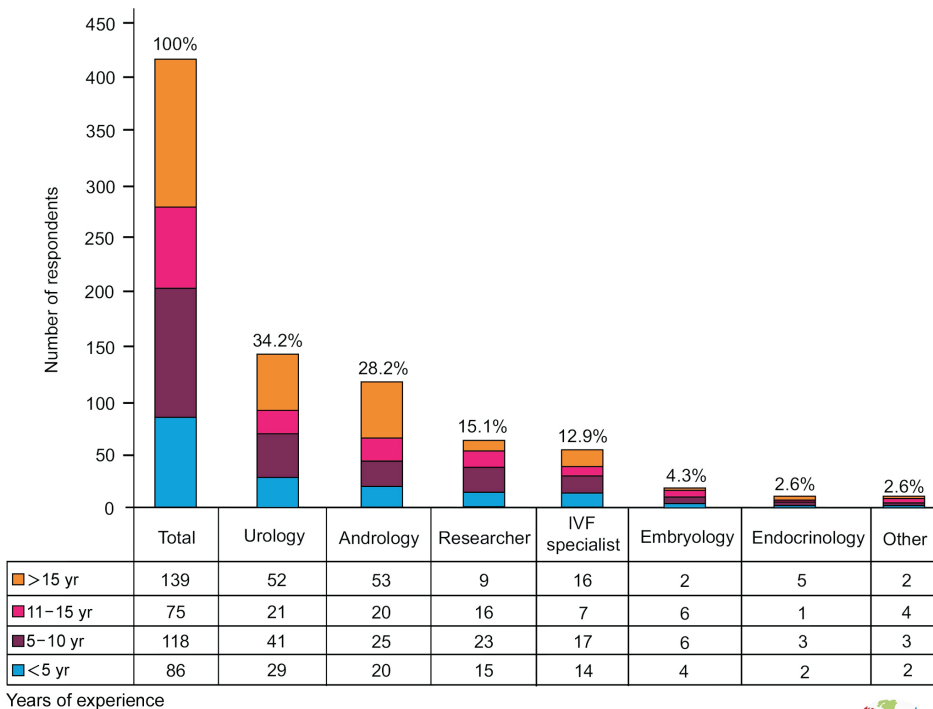


Fig. 3. Geographical distribution of members.



Years of experience



Fig. 4. Members' professional backgrounds and years of experience. IVF: *in vitro* fertilization.

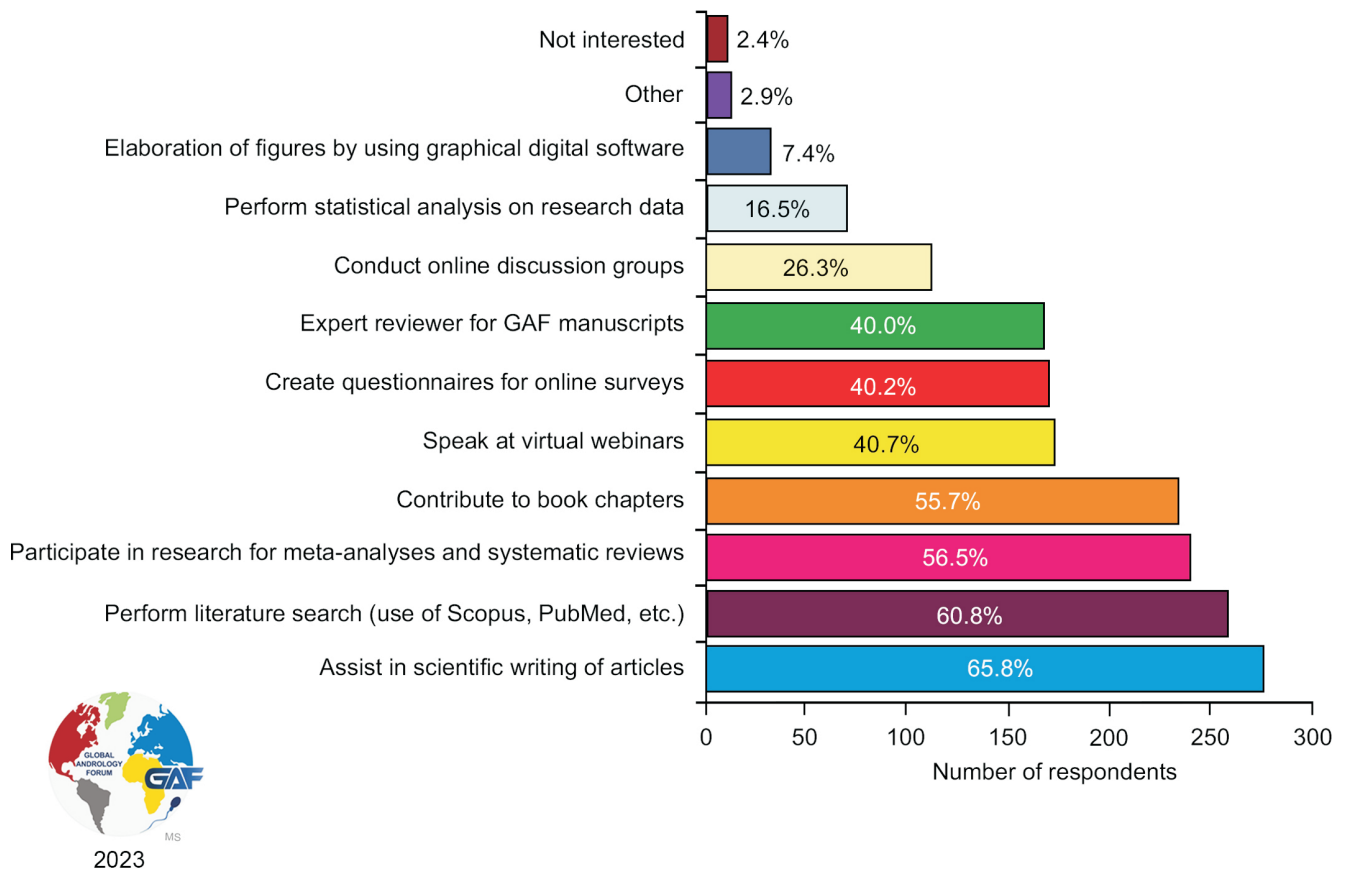


Fig. 5. Members' preferred activities.

(33.3%) of the members reported >15 years' of experience.

2. Interest in research activities

Fig. 5 shows that members were interested in research-related activities, including performing literature searches (use of electronic literature databases) (60.8%), and participating in conducting systematic reviews and meta-analyses (56.5%). Fewer members reported undertaking statistical analysis or preparing figures for publication. Conducting collaborative research was appealing to most of the sample (95.9%), with a large proportion (86.1%) expressing interest for active engagement in writing scientific articles. Members' mean rating of the extent of interest in GAF research projects was 8.4±1.9 on a scale from 0 (no interest) to 10 (extreme interest).

About a third (37.1%) of the sample could dedicate 4 to 6 hours/week, with few members (3.1%) able to commit >10 hours/week to GAF activities (Fig. 6). Similar findings were observed in the subgroup analysis by professional background; however most of the androlo-

gist, urologist and embryologist members could only devote 4 hours/week.

Most (84.9%) members were interested in joining research teams with expected roles as active researchers (61.9%) (Fig. 7). Those who articulated a wish to be team leaders were mostly andrologists (n=11/30, 36.7%) or urologists (n=9/30, 30.0%), exhibited >15 years' of experience (n=10/30, 30.0%), and could commit 4 to 6 hours per week (n=11/30, 36.7%).

3. Scientific knowledge and other skills

The sample reported a statistical knowledge level of 5.1±2.1 (scale of 1–10), and 62.7% of respondents had a score of <6 for statistics. Similarly, mean knowledge in graphical work was 4.4±2.2, and 78.2% of respondents expressed a score of <6 for preparing graphics for scientific publication. The most popular statistical software used were SPSS (n=116), Graphpad (n=16), and Excel (n=11). Microsoft Excel the most popular software used for creating graphic content for scientific purposes (n=28), while softwares less frequently used included Microsoft PowerPoint, Adobe Photoshop and BioRen-

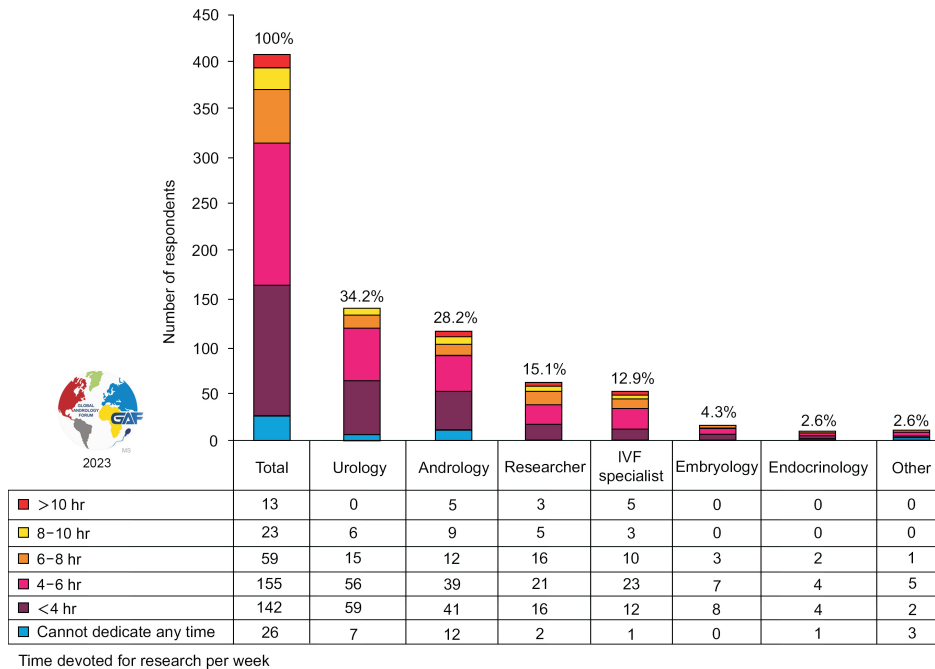


Fig. 6. Hours devoted per week to the Global Andrology Forum (GAF) research projects. IVF: *in vitro* fertilization.

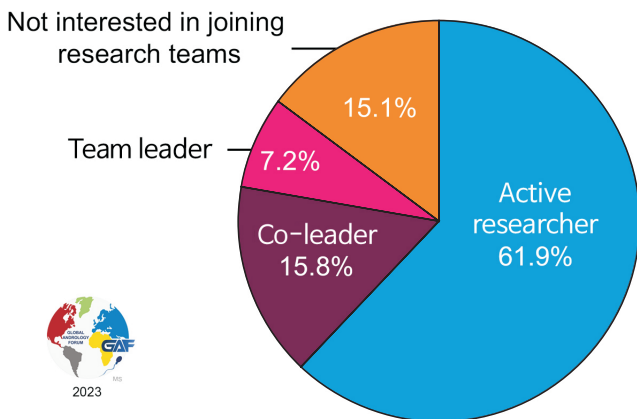


Fig. 7. Members' expectation of their roles in research projects.

der.

Fig. 8 shows that almost half the sample (45.2%) had experience in writing/editing manuscripts, and 79.7% expressed enthusiastic interest in receiving training.

4. Interest in administrative activities

Mean interest in administrative roles such as research coordinators was 5.3 ± 3.4 , with 47.4% reporting interest between the scores of 6–10. A third of those who could devote time to administrative activities could spend 1 to 2 hours (30.1%), and only 5.5% respondents could spend >6 hours weekly (Fig. 9).

5. Outputs

Table 2 [3,22,24-50] illustrates that 23 articles were published in prestigious peer-reviewed journals by author contributions representing 46 countries. Broadly classified, these articles tackled contemporary challenges in andrology spanning across topics of sperm DNA damage, semen analysis, laboratory issues in relation to assisted reproductive technique (ART), sperm recovery, etc.

DISCUSSION

Time commitments and logistics are significant barriers to international research [51]. Hence, a global online research group is an innovative conduit to connect experts from around the globe to collaborate on scientific projects [21]. Other studies have highlighted a range of preparatory, methodological, operational and structural challenges faced by such cross-national research consortia so that interprofessional collaborations can ensure that projects are developed and sustained [11,14,52]. These considerations are particularly important in the field of andrology where multiple disciplines, professionals and specialties work together to solve a common problem [1]. The current paper described a worldwide online research collaborative in andrology, GAF; outlined its structure and management, members' demographic and professional characteristics, and its scientific achievements. Below we

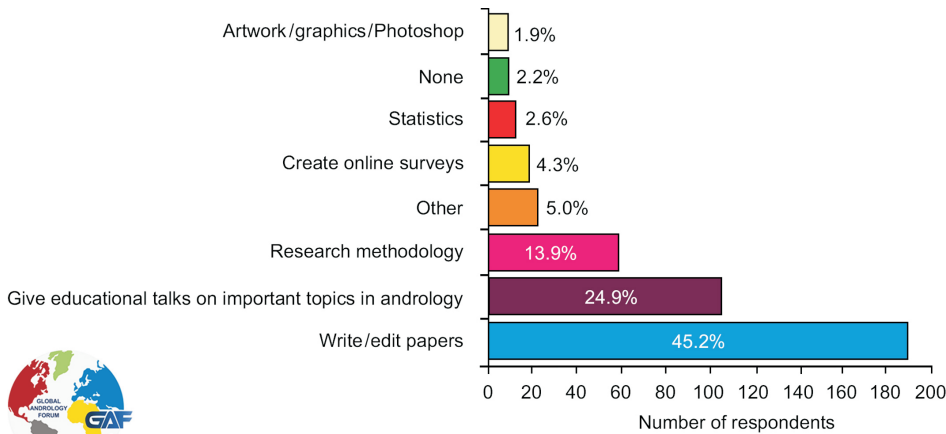


Fig. 8. Other skills of the respondents.

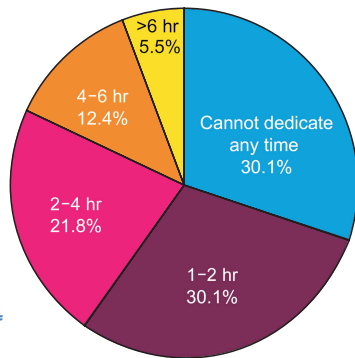


Fig. 9. Possible hours devoted to administrative activities per week.

discuss each in detail.

1. Geographic spread

The current study observed responses from 418 members across 66 countries, primarily India, Turkey, Indonesia, and Italy, with less representation from China, Brazil, and UK. However, scientometric analysis of male infertility research and assisted reproductive technology found that much of the published outputs were from USA (23.8%) and UK (7.59%) [7]. Similarly, a scientometric study on erectile dysfunction reported that the USA ranked first in record count (34.3%), followed by Italy, UK, Germany, and Canada [53].

Given our members' geographical spread, on the one hand, GAF might require to be more promoted and popularized among those countries that remain under-represented in its membership in order to draw members from these regions. On the other hand, recent bibliometric/visualization analyses of the ecology of men's sexual and reproductive healthcare (SRHC) research across MENA (Middle East and North Africa) reported

the paucity of published outputs and that more SRHC research is needed across MENA [5]. Research and publications are critical for researchers to advance their careers and attain grant funding, and low/middle-income countries often face barriers to publishing their work [54]. Therefore, being part of an international research collaborations aids researchers to contribute to publications and have impactful outputs [10,11]. As GAF's members in the current study represent countries that could increase their research outputs, this suggests that in reality, GAF is playing an important role and is in a key position of being 'in the right place at the right time' in order to assist in the development of andrology research emanating from such countries that have traditionally not contributed substantially to the published andrology literature. In today's digital age, a global online research forum such as GAF serves as an opportunity for members from such nations to expand their research publications profile, which may explain the higher participation that we observed from countries such as Indonesia and India.

2. Specialty/discipline

Most of our members were andrologists or urologists, consistent with that these groups deal with andrological issues daily, especially in IVF settings [55]. The increased use of ART could result in cases of male infertility often not being fully evaluated, therefore, urologists/andrologists are key to investigating severe conditions related to infertility, treating reversible causes of infertility, defining untreatable causes, and performing sperm retrieval where indicated [56,57]. The basic-clinical sciences interconnections are pronounced

Table 2. Outputs: published peer-reviewed articles (December 2021–January 2023)

Characteristic	Value
Total number of articles published	29
Average number of articles per month	2.07
Total number of authors participated	283
Maximum number of authors per article	187
Mean number of authors per article	31.3
Range of authors per article	2–187
Range of authors per article excluding 2 outliers	2–69
Topics	
Varicocele	4 [24-27]
Oxidative stress/antioxidant	3 [28-30]
Sperm DNA damage/fragmentation	2 [31,32]
Semen analysis and male infertility	7 [33-39]
Oocyte and embryo	3 [40-42]
Lab for ART/male infertility evaluation	3 [43-45]
GAF/GAF research training	2 [22,46]
Other: e.g., andrology, non-obstructive azoospermia, sperm recovery, vasectomy	5 [3,47-50]
Number of countries involved in authorship	
Africa	5 (Algeria, Egypt, Morocco, South Africa, Zambia)
Americas	6 (Argentina, Barbados, Brazil, Canada, Mexico, USA)
Asia	20 (China, Hong Kong, India, Indonesia, Iran, Iraq, Japan, Jordan, Kuwait, Lebanon, Malaysia, Oman, Philippines, Qatar, Saudi Arabia, Singapore, South Korea, Turkey, UAE, Vietnam)
Europe	16 (Austria, Croatia, Denmark, France, Germany, Greece, Italy, Lithuania, Montenegro, Portugal, Serbia, Spain, Sweden, Finland Switzerland, UK)
Oceania	1 (Australia)

ART: assisted reproductive technique, GAF: The Global Andrology Forum.

in andrology, thus multidisciplinary approaches are critical in managing male infertility and other andrological conditions [58]. This is echoed by the professional profile of our sample representing a range of professions other than urologists/andrologists who are as important to andrology, e.g., IVF specialists, endocrinologists, embryologists, researchers. Furthermore, anecdotal evidence suggests that in some countries (e.g., Italy, Egypt), the figure of the ‘Andrologist’ is not clearly established and may be covered by urologists (surgeons) and/or endocrinologists (clinicians). Our findings reflect the breadth of GAF’s membership comprising the diverse professions that are collectively involved in andrology.

3. Experience

One-third of GAF’s members were senior experienced professionals (33.3% with >15 years of experience). Generally, considerable responsibilities are given to those

with significant experience in research. As novice/early career researchers encounter obstacles and unfamiliar situations [59], experienced members assume more critical roles to provide advice and guidance, and train/mentor their less-experienced counterparts.

4. Roles

Most members (84.9%) were enthusiastic about joining research teams, with 7.2% expressing a desire to be team leaders. These findings are consistent with that leadership and management are substantial to conducting excellent research [60], and that both leaders and team members mutually benefit from the interactions when creating a project [61]. Leaders provide guidance, as a framework of professional support is vital in a research group [62].

5. Time commitments

As GAF forges research teams with structured

agenda for training and engages members in active research roles, our members expressed that they could devote 4 to 6 hours/week to research, and for most urologists/andrologists <4 hours per week, due to clinical duties. Our findings concur with others where time commitments were challenges to undertaking research [63-65]. Physician/surgeon-scientists are key for translational/clinical research as they transmit clinical information for research and return it to the bedside for patient care [66,67]. However, they face challenges in conducting research due to busy clinical requirements [68]. Protected research time through partnerships is recommended to improve the strain on physician-scientists [68]. Through GAF's collaborative nature, research workload is divided among group members resulting in high-quality research that consumes the possible minimal time of each member.

6. Skill sets

Most members stated they could write scientifically, deliver educational talks on important andrology topics, understand research methodology, and create online surveys. Despite this, up to 79.7% were interested in training in research methodology. Research training in GAF is ongoing and will contribute to preventing unnecessary pitfalls in future planned research. Indeed, research methodology and analysis flaws may lead to the retraction of published articles [69]. For GAF, there have been no requests for any of its published articles to be retracted.

Earlier GAF research training focused on conducting systematic reviews and meta-analyses. The training was effective and is detailed elsewhere [45]. Research methodology training is mandatory for members involved in the research team, mainly because even well-trained clinicians may need an understanding of systematic reviews and meta-analysis methodology [45]. We found that few members expressed interest in statistics and graphical preparations, suggesting a need for training in these areas. Statistical competencies include understanding bias, variations, limitations of statistics, and strengths/limitations of study designs [70]. While involvement in research projects develops scientific literacy skills [71], training in statistics ensures that researchers effectively utilize the data [72]. Our findings also support others that SPSS was the most widely used statistical software [73]. Likewise, graphical preparations for publication are critical es-

pecially when the data is numerous and complicated [74,75], highlighting the importance of such skills for good-quality scientific papers [74-76].

Managing many members in a non-profit scientific society requires a well-planned organization. Directing the workflow within any global research team calls for organizational abilities and scientific competence. With GAF's members rapidly increasing, the need for a more consolidated staff is critical. About 47.4% of members rated their interest in administrative activities >5 out of 10, sufficient to be able to select some research coordinators. Multiple coordinators are important as administrative duties may put physicians at a higher risk of burnout [77,78]. Notwithstanding, as a global forum, GAF members come from many countries, and hence local databases (especially China) can be used to find articles, and capitalizing on members' expertise in translating articles into English where required is feasible. Moreover, many members are academicians, hence accessing full articles through their many institutional accesses represents an extra bonus.

7. Outputs

GAF's focus is to produce high-quality research. Our members expressed that they were interested in research-related activities, primarily assisting in writing scientific articles, performing literature searches, and participating in meta-analyses and systematic reviews (95.9% interested in collaborative research, 86.1% in actively engaged in writing scientific research articles). Members' interest to participate in a research project was also high (8.4±1.9 on a scale of 0–10). Furthermore, we noted curiosity in some non-research activities, e.g., speaking at virtual webinars and conducting online discussion groups. These activities are optional, especially for the corresponding members. On the ground, research interest was translated into a formidable output of 29 articles published in prestigious peer-reviewed journals, with authors from 48 countries contributing (Table 2). Others have similarly highlighted the important benefits of multi-national research consortia including the scientific gains and increase in published outputs [11,14].

8. Final thoughts

Cross-national research consortia can contribute to various research opportunities for the collaborating members/countries [11]. They can bring synergies that

result from the collaborative working of large teams of multidisciplinary investigators who share their strengths, disciplines and expertise to bear on the same research question across multiple countries and diverse populations [14]. For GAF, in about a year, such collaboration resulted in 29 published articles and many others under review. Our experience suggests that creating a successful global online research group can be accomplished by formulating research teams, selecting experts to review and proofread articles, appointing team leaders to train members, analyzing and interpreting the findings of research articles, and selecting coordinators to facilitate the administrative tasks. Others have similarly highlighted the importance of both coordinators and teamwork within research consortia [11,14]. Increasing the engagement and active roles of the members by identifying talent and nurturing it is equally critical. The process is sparked by identifying the group members' interests, resources, and skills.

This study has its limitations. About 80% of GAF members participated and thus generalizations should exercise caution. The availability of members' ORCID number (or H index) would have been beneficial as a reflection of their research experience. The study has many strengths. To the best of our knowledge, this is the first study to describe an international collaborative online research group with a focused interest in male sexual and reproductive science. The study outlines the demographic and professional characteristics of its members, communicates its structure and management, and highlights its scientific achievements accomplished to date. Such findings can furnish fundamental understandings for those wishing to create similar online research groups for other medical disciplines. Future research would benefit from a detailed depiction of members' interests in andrological research with more comprehensive and detailed questions to assess members' experience with publications and appraise any previous roles in research groups.

CONCLUSIONS

GAF is an innovative global online andrology research collaborative that has diverse representation of clinicians and researchers across the world. Members take up different roles to create a systematic framework for research projects. The skills of the current members are utilized to train other members and op-

imize the workflow. The success of the GAF model is possible, as evidenced by the number of scientific articles published. Given its effectiveness, adopting such a model could be useful for other disciplines that wish to create and coordinate successful international online research groups.

Conflict of Interest

The authors have nothing to disclose.

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Author Contribution

Conceptualization: WEA, AA. Formal analysis: MS. Methodology: WEA, RS, AA. Project administration: MS, AA. Supervision: AA. Writing – original draft: WEA, WA, MS. Writing – review & editing & final approval: All authors.

Supplementary Materials

Supplementary materials can be found via <https://doi.org/10.5534/wjmh.230101>.

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