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SCIENTIFIC PAPER

# Women and men in the Australasian College of Physical Scientists and Engineers in Medicine: workforce survey

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## Abstract

A survey was designed to determine aspirations, motivations and workplace experiences of both female and male members of the Australasian College of Physical Scientists and Engineers in Medicine (ACPSEM). The survey collected both quantitate and qualitative data, including open ended questions. This paper reports the survey's qualitative results. The research was approved by Ethics at University of South Australia and endorsed by ACPSEM. All 205 women (30% of total membership) and 440 men were invited to complete the survey online. The data for the qualitative analysis were responses to open-ended questions within the survey. 102 women and 150 men completed surveys were received, with 66 surveys analysed, before data saturation was reached. The survey revealed a number of themes that reflect concerns and opportunities identifying the direction for improving work-life balance and gender equity within the medical physics profession in Australasia. Issues around managing challenging workloads and professional development were amplified for women with children and child-rearing responsibilities, directly contributing to a reduction in work capacity and a reorientation of work-life priorities. The survey provides direction for strategies to improve work-life balance and enable equitable engagement in the profession. The first is to identify and develop role models that actively model successful work-life balance and flexibility in gender roles and in professional conduct. The second is to improve the management skills of current and emerging administrators, advocating for improved work conditions for medical physics professionals at an organisation level. Finally, efforts need to be made to establish flexible professional development and career progression opportunities amongst those that are unable to commit to large workloads, which is common for those with child-rearing responsibilities. The realisation of these strategic goals will reduce the identified barriers to full female participation in the workforce, and shift gender-based subcultures within the workplace.

**Keywords** Women in health · Women in medical physics · Work-life balance

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## Introduction

According to the recent data collected by the Australian Institute of Physics, Australian schoolgirls still prefer the life sciences to the physical sciences at a 2:1 ratio, decreasing to a ratio of 4:1 at university. The proportion of women in senior science positions is improving at just 1% per annum, and even going backwards at lower levels of seniority [1].

To determine gender composition in medical physics globally, the International Organization for Medical Physics (IOMP) conducted two surveys in recent years. The first survey (2015) had 66 countries participating in the study [2]. This was the first time that global data on female representation in the field of medical physics were reported. Results showed that the total number of MPs

was 17,024, with 28% being women (4807). Median % of women MP were 21% in the USA, 47% in Europe, 35% in Asia, 33% in Africa and 24% in Latin America. In 2017, a new survey was attempted to collect data not only on the percentage of women but also on issues related to leadership and high level professional or scientific roles [3]. Initial results showed that the total number of MPs was 29,086, with 20,421 being men and 8665 women (30%). The percentage of women has slightly increased since the first IOMP survey in 2015 but in both surveys data were lower than the European Commission (EC) target of 40% [4] and the United Nations 50% target for 2030 [5].

In the case of medical physics within Australia and New Zealand, there have been some positive developments in the enrolment of women into medical physics training and women now account for 30% of trainee medical physicists [6]. This can be considered an achievement considering that 15–20 years ago many departments would not have any or only a few female medical physicists.

However, there is still underrepresentation of women at senior roles and consequently, a potential lack of role models for women earlier in their career [7]. There is also a lack of suitable part time positions (especially at senior levels) for women who would like to balance family and work commitments.

In order to identify solutions for challenges female medical physicists face in their workplaces in Australia and New Zealand, a membership survey (titled: the Men and Women in Physical Sciences and Engineering in Medicine Australia and New Zealand Workforce Survey) was conducted in 2015 to determine the aspirations, motivations and workplace experiences of both male and female members of the Australasian College of Physical Scientists and Engineers in Medicine (ACPSEM). The survey collected both quantitative and qualitative data, including open-ended questions. This paper reports primarily on the survey's qualitative results, with some quantitative data included. The qualitative data analysis was in part funded by ACPSEM.

## Methods

The research was approved by Ethics at University of South Australia and endorsed by ACPSEM.

### Data collection

All 205 female (~30% of total membership) and 440 male members of the ACPSEM were invited via email to complete the survey online within a 3 week period in 2015.

### Data analysis

Completed surveys were received from 102 female and 150 male members, with responses from a subset of 66 surveys analysed thematically until data saturation was achieved (see below). Because a limited number of female respondents were originally identified with a senior managerial role (i.e. those with a position of Chief/Manager/Head of Department), further analysis was performed by purposively sampling women in these roles in order to account for any potentially relevant variations in the data.

The data for the qualitative analysis were the written responses to open-ended questions contained within text in the survey. A qualitative approach was considered useful given the aims of the survey to better understand workforce needs and issues within the context of healthcare organisation and gender relations [8].

Questions considered within the qualitative analysis included:

- Tell us briefly about how your role models have affected you and your career choices
- Are there other actions or conditions that would help you achieve a better work-life balance? How important are these factors?
- Are there other actions or conditions that hinder your ability to achieve a better work-life balance? How important are these factors?
- If you have children, how has this affected your career?
- What changes or actions, if any, do you feel are required to ensure an equitable workplace?
- What do you think are the most positive aspects of working as a medical physicist/biomedical engineer/radiopharmaceutical scientist?
- What have been the primary challenges of your career? Please note any factors that exacerbated these challenges.
- Do you have any additional comments after considering what you think would be most helpful in supporting your wellbeing, as a man/woman, in the medical physics workforce?

In addition to this textual data, key socio-demographic indicators (age, gender, household structure, economic role, employment role, and work status) were also recorded in order to contextualise the data.

The data was thematically analysed twice. First, by the survey authors and secondly by a single researcher, who is a male allied health researcher not involved in the development of the survey or data collection. During the process of analysis, a preliminary coding frame was developed from the analysis of several survey responses. Codes were

then assigned to the remainder of the surveys using constant comparison, with revision of the coding scheme following further analysis. Codes were then subsumed under themes that formed units of shared latent meaning [9].

Answers to several quantitative questions, closely related to open qualitative questions, were also analysed, using responses from all answering respondents (as not all questions in the survey were compulsory, the numbers of respondents may vary). Likert scale rating system, generally applied to assign quantitative value to qualitative data, was used for a number of survey questions to measure members' attitudes and opinions.

## Results

The following themes were identified from the data in response to questions raised in the survey.

### The influence of role models

For men and women, role models were found to play distinct roles in three aspects of career development. The first related to raising interest in the field of physics and medical physics, in which high school science teachers or university lecturers would appeal to the intellectual curiosity of students.

Secondly, professional role models were found to be important in developing an implicit ethical code of conduct for medical physics professionals, demonstrating that medical physics professionals are hardworking, self-motivated, persistent, passionate, knowledgeable, and respectful of others. Among female respondents, role models that actively modelled a high standard of professional conduct alongside non-work responsibilities in promoting work-life balance were considered to be highly beneficial.

Thirdly, role models proved to be important in facilitating career advancement and access to further work and study opportunities. In particular, access to quality ongoing education was considered important, a concept explored further in this presentation of results.

### Gaining satisfaction from work

Among male and female respondents, work satisfaction was related to providing high quality care to patients, satisfaction from working in teams and across healthcare disciplines, being intellectually stimulated and challenged, and being able to perform a variety of work tasks. The stacked bar charts in Fig. 1 show received responses to provided statements on work aspirations ranging from not applicable and strongly disagree to strongly agree (i.e. quantitative data obtained from a 5-point Likert scale) expressed as percentages of the total responses.

### Career progression

Although not specifically asked for within the surveys, career progression and professional development emerged as an issue for many of the survey respondents, both men and women. Professional and career progression did not always imply a progression to higher duties, but rather recognised that professional development activities were required to cope in a practice context characterised by rapid change.

Keys aspects of professional development included the completion of accreditation training programs, attendance at conferences and learning events, and contribution to research. Because these requirements were regarded as additional to routine and expected work duties, full engagement in professional development remained difficult for those households with dependents. This was particularly so for women following maternity leave or caring for young children, who reported substantial difficulties in finding the time for professional development activities.

Career development was also made difficult for men and women with dependents, attributed to workplace biases that favour the advancement of those working full-time loads and with the capacity to absorb increased workload at short notice. It was felt that career progression could be made more equitable by providing greater advancement opportunities to part-time roles and managing workloads better (particularly with advanced planning strategies) so that staff may devote time to work and non-work commitments in a more consistent and planned manner.

For career development involving a transition from practitioner to manager, it was suggested that managers and administrators receive additional training and development activities to equip themselves with the skills required for the effective management of staff. The lack of training for managerial staff was seen as a contributor to excessive and unpredictable workloads experienced by practitioners.

### The profession in an organisational context

There were several of organisational factors that were found to impact on work satisfaction and work-life balance. Three of the most cited factors included recognition and value placed on the medical physics role in patient care, difficulties in managing demanding workloads, and the extent to which their employer could offer flexibility in accommodating child-rearing and family responsibilities (Table 1).

A lack of professional recognition impacted on work satisfaction by limiting the allocation of resources (staff and medical equipment) required to carry out duties at a high standard. This created significant work place stress and was often an area that members felt ACPSEM could provide advocacy to organisational bodies and governments, particularly around legislative requirements.


**Fig. 1** Comparison of male and female medical physicists' professional aspirations

**Table 1** Major work challenges experienced by female and male medical physicists

| | Women | Men |
|---|---|---|
| Too much work/not enough staff | 14% (13) | 7% (9) |
| Poor management | 14% (14) | 9% (12) |
| Training/certification issues | 26% (8) | 16% (21) |
| Work-life balance | 16% (10) | |
| Sexist behaviour and attitudes | 10% (17) | |
| Getting a job | 7% (7) | 6% (8) |
| Difficulty with working with people of different specialists and recognition of MP by other specialists | | 10% (13) |
| Keeping up with skills; (technical) learning in the workplace; keeping up with rapidly changing technology | | 8% (10) |
| Not many opportunities for promotion | | 5% (7) |
| Not answered | 15% (17) | 22% (29) |

The responses have been identified in open text answers; multiple answers for a single respondent are possible

This lack of professional recognition, together with poor management and scarce financial resources, appeared to have placed additional workloads onto existing staff, something that was noted to have a significant detrimental effect on work-life balance. Poor management practices meant that staff were expected to accommodate inconsistent and unrealistic workloads, which were noted to detract from work satisfaction and work-life balance. This also meant that less time was available for professional development activities and training, which were in practice regarded as out-of-hours activities.

Inflexible employment conditions also acted to detract from work-life balance, particular among those with child-rearing and family responsibilities. Demands for greater flexibility in work arrangements included: having formal out-of-hours pay schemes, supporting work relocation or flexible schedules to minimize the time taken to travel to and from work, supporting part-time working arrangements whilst maintaining professional development opportunities, and providing return-to-work support for mothers following maternity leave.

## The impact of children on work

Having children clearly resulted in a shift in work priorities for both men and women, with the additional responsibilities of child-rearing reducing the capacity of individuals to respond to the challenges of managing large and inconsistent workloads whilst contributing to their own professional development (Fig. 2).

However, men and women responded to this shift in work priorities and reduced work capacity in very different ways, generally in line with the options available to them through gendered norms. As assumed primary caregivers, women often responded by reducing work hours/availability and sacrificing additional professional development activities (e.g. additional study, attendance at conferences, contribution to research), which negatively impacted on their work satisfaction and ability to progress their career (Table 2).

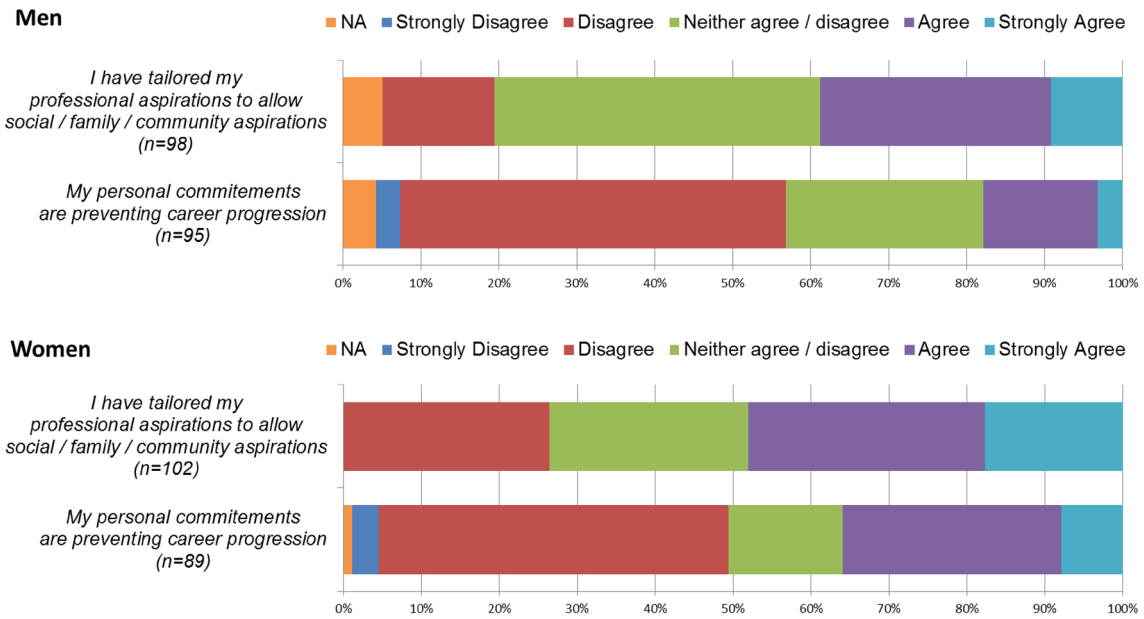


**Fig. 2** Responses of male and female medical physicists on how personal commitments affected their career progression

**Table 2** Major work challenges experienced by female and male medical physicists with dependents

| | Women | Men |
|---|---|---|
| Too little time/work hours | 24% (13) | 9% (12) |
| Part-time work | 25% (14) | |
| Interfered with research | 15% (8) | |
| Interfered with travel (CPD) | 18% (10) | |
| Changed priorities | 31% (17) | 5% (7) |
| Discriminated against/lost job/missed opportunity | 7% (4) | |
| No children currently but still seen as a risk or expect issues | (2) | |
| Career delay | 15% (8) | 2% (2) |
| Not as flexible at work | | 3% (4) |
| Haven't pursued opportunities that require relocation (interstate/overseas) | | 6% (8) |
| Little impact | | 10% (13) |
| Not applicable | | 9% (9) |
| Positive effect (e.g. motivated to develop career to provide for family, have received support from family, or developed a better work-life balance) | | 10% (13) |
| Not answered | (65) | 49% (63) |

The responses have been identified in open text answers; multiple answers for a single respondent are possible

As assumed primary economic providers, men responded by attempting to reduce the impact of work on family life by relocating and maintaining employment in facilities near to their residence, sacrificing the opportunities offered by employment in other facilities that also required a longer commute. Limits were also placed on out of hours work to protect 'family time'. Because these accommodations did not impact on work role to the same extent as women, there was generally less talk of unfair work arrangements and inflexible organisational practices from men.

The survey also asked the respondents about potential solutions that would assist in managing workplace challenges experienced by female and male medical physicists with dependents. The response of most and least desirable solutions are shown in Table 3. Perhaps surprisingly, most of the desired workplace support and opportunities (e.g. flexible working hours) were the same for both women and men. Similar patterns/responses were found for the least desired solutions, with the exception of part-time work availability (desirable for women but least desirable for men). This suggests that any changes that a workplace implements to improve work participation and satisfaction of women benefit their male professional colleagues in equal measure and as a result the entire workplace benefits.

## The impact of gender on work

The previous section highlighted a gendered response to family commitments and child-rearing practices. However, the issue of gender was raised further, both directly and indirectly, by respondents. The majority of female respondents made a direct claim to gender inequality in the workplace, claiming that the workplace environment itself was centred around the gendered needs and preferences of men. This revealed hegemonic masculinity, where the default mode of behaviour in the workplace was framed according to masculine terms, which included dominating styles of interpersonal interaction and expectations of work being prioritised over child-rearing responsibilities.

**Table 3** The most and least desirable solutions, proposed by the respondents, to resolve workplace challenges experiences by female and male medical physicists with dependents (in the order of importance)

| Women | | Men | |
|---|---|---|---|
| Most desirable | Least desirable | Most desirable | Least desirable |
| Supportive manager | Working out of clinical hours | Flexible working hours | Not having to travel interstate |
| Flexible working hours | Not having to travel interstate | Supportive manager | Working out of clinical hours |
| Working close to home | Working standard office hours | Working close to home | Ability to work part-time |
| Ability to work part-time | | Ability to take leave during school holidays | |

It was clear that gendered norms were being reproduced in professional life, with mothers expected to assume child-rearing roles and fathers expected to become primary economic providers. Female respondents tended to remark on the unfairness or inequity of this arrangement, particularly when child-rearing duties acted to exclude them from valued professional development and career development opportunities.

There were also counter claims of gender equity in the workplace, which tended to be related to a belief in individual responsibility for success. The belief here was that individual persistence could overcome the effect of gender. There was also evidence that men and women perceived bias in the workplace in very different ways, with men perceiving the workplace to offer equal treatment of individuals irrespective of gender and women (particularly those assuming a carer's role) perceiving differential treatment due to entrenched attitudes and structures that acted to favour one group over the other.

Because of the issues raised by several female respondents regarding gendered barriers to management, further analysis was conducted comparing the perspectives of men and women in managerial positions. It was interesting to note that while female managers tended to cite gender as a source of work-place inequity, there was no mention of gender-based inequities by male managers.

## Interpretation and discussion

This survey arises in response in to broader actions within fields of science, technology, engineering, and mathematics (STEM) designed to address occupational segregation and move women into occupations traditionally perceived to be 'male' roles. Part of this involves increasing the participation of girls in STEM subjects during secondary school in order to transform cultural stereotypes. However, there remains barriers to the participation of women in the STEM workforce, attributed to the effects of career breaks, working part-time, a lack of women in leadership roles, and discriminatory practices in the workplace. These factors can contribute to a greater proportion of women leaving STEM professions, offsetting gains achieved through greater enrolment of women in STEM subjects [10].

This qualitative analysis of a subset of survey responses from the Men and Women in Physical Sciences and Engineering in Medicine Australia and New Zealand Workforce Survey revealed a number of themes that reflect concerns and opportunities for improving work-life balance and gender equity within the medical physics professions.

One finding was the influence of professional role models in developing an implicit ethical code of conduct for medical physics professionals. The standard established was for medical physics professionals to be hard working, self-motivated, persistent, passionate, knowledgeable, and respectful of others. Given the significant influence of role models in establishing a professional ethic, practitioners may benefit from interactions with role models that actively model a high standard of professional conduct alongside non-work responsibilities in promoting work-life balance. This has implications for how professional mentors, supervisors, and role models are identified and developed.

Another important finding was that increasing and poorly managed workloads were consistently driving workplace stress and detracting from the time available for mandated and discretionary professional development activities. This juggling of workloads meant that more work-related tasks were being performed out of hours for some, or for others sacrificed in order to minimise the impact of work on spouses and/or dependents. Poor management practices were regarded as a key contributor to expanding workloads, particularly related to inadequate material and equipment resourcing, inadequate staffing levels, and failing to manage the flow of tasks to ensure a consistent workload. Although not discussed by respondents, it is possible that the work-ethic-oriented virtues championed by medical physics professionals in these surveys have acted to compensate for poor management practices to the detriment of work-life boundary setting.

The issues around managing challenging workloads and professional development were amplified for professionals with children and child-rearing responsibilities, attributed to a reduction in work capacity and a reorientation of work-life priorities. Caring for young children tended to drive a shift in work priorities for both men and women, who responded in a manner consistent with gender norms, with women assuming a caring role and men assuming the role of primary economic provider. Women more so than men expressed dissatisfaction regarding their default assignment to child-rearing responsibilities and the effect of this at reducing their capacity for professional development and career advancement.

There was also evidence of gender inequities being reproduced within the professional context. Female respondents, in particular those assuming a carer's role, perceived these inequities to be the entrenched attitudes and structures that acted to favour one group over the other. For some women, this gender bias meant that it was difficult to engage fully in the profession when indicators of success (often reported as meeting the inflexible needs of organisations through working long hours, work hour flexibility, and travel) favoured those without caring responsibilities.

In contrast to female respondents, male respondents perceived the workplace to offer equal treatment of individuals irrespective of gender, race, etc., and that individuals are responsible for their own success and

advancement within the profession. This would be true if there was no underlying gender disadvantage; however, female respondents did report a systematic disadvantage organized by gender. The concept of hegemonic masculinity [11] is a concept that can be used to understand this process, where work practices and structures are normalised according to male preferences. In this case, gender equality in the workplace is more likely to be achieved when work practices are adapted to better match the needs of both men and women. Within this study, an important first step was identified in promoting more consistent workloads and flexible working arrangements for both part-time and full-time staff, so that both groups might experience similar levels of work satisfaction and access to opportunities for professional development and career advancement.

This study also highlights the compounding impact that traditional gender roles, poor management practices, and inflexible organisational structures have on the occupational participation of both men and women. It is important to recognise that occupational participation is not limited to work or employment, or even a simple dichotomy of work and life, but encompasses participation in a range of activities including rest and sleep, education, play, leisure, and social life [12].

The survey revealed a number of themes that reflect concerns and opportunities identifying the direction for improving work-life balance and gender equity within the medical physics profession in Australasia. Issues around managing challenging workloads and professional development were amplified for women with children and child-rearing responsibilities, directly contributing to a reduction in work capacity and a reorientation of work-life priorities. Some evidence of gender inequities in the professional context were reported. Female respondents, in particular those assuming a carer's role, perceived these inequities to be the entrenched attitudes and structures that act to favour one group over another. For some women, this gender bias meant that it was difficult to engage fully in the profession when indicators of success (e.g. meeting the inflexible needs of organisations through working long hours, work hour flexibility and travel) favoured those without carer responsibilities. Inefficient management practices contributed to an environment where unreasonable time demands are placed on staff with carer responsibilities, limiting opportunities to engage in career development activities. In contrast, male (and some female) respondents perceived the workplace to offer equal treatment of individuals irrespective of gender and that individuals are responsible for their own success and advancement within the profession.

## Recommendations

It is clear that more work needs to be done to mentor and support young women into sustainable careers in the physical sciences and engineering, including medical physics and biomedical engineering. Strategies need to be developed that will allow both women and men to successfully balance their family and work commitments both in public and private sectors. The ACPSEM workforce survey provides direction for such strategies to improve work-life balance and enable equitable engagement in the profession. The first is to identify and develop role models that actively model successful work-life balance and flexibility in gender roles and in professional conduct. The second is to improve the management skills of current and emerging administrators, advocating for improved work conditions for medical physics professionals at an organisation level. Additionally, efforts need to be made to establish flexible professional development and career progression opportunities amongst those that are unable to commit to large workloads, which is common for those with child-rearing responsibilities. The realization of these strategic goals will reduce the identified barriers to full female participation in the workforce, and shift gender-based subcultures within the workplace. While Australian and New Zealand female medical physicists are passionate about their work, wishing to contribute to patient treatment, education and research and development, there is ongoing need for changes in attitude and work practices; with supportive managers essential to foster both women and men in their careers and achieving life-work balance.

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## Compliance with ethical standards

**Conflict of interest** All authors declare that they have no conflict of interest.

**Ethical approval** The research was approved by Ethics at the University of South Australia and endorsed by ACPSEM. All data analyses involving survey participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

**Informed consent** Informed consent was obtained from all survey participants included in the study. Consent acknowledgment was included in the survey introduction.

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