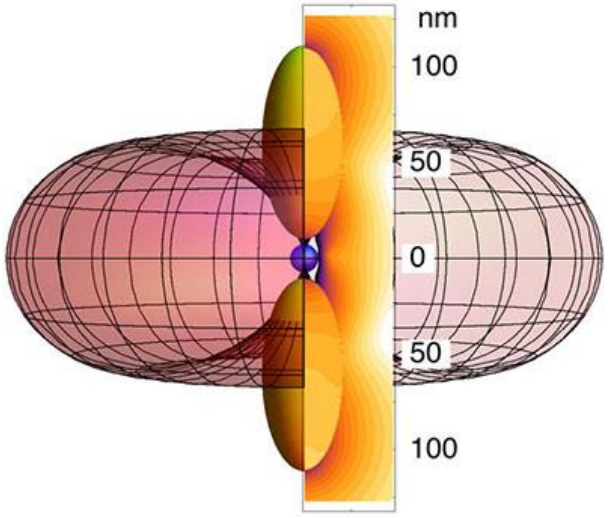
MP1403
COSTACTION

# COST Action MP1403
# Nanoscale Quantum Optics (NQO)

# Gender Survey 2019

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EUROPEAN COOPERATION
IN SCIENCE AND TECHNOLOGY

# COST NQO Final Gender Survey 2019

## 1 EXECUTIVE SUMMARY

In 2016 the COST Nano Quantum Optics Action, a group of scientists from academia and industry with a traditionally unbalanced gender make-up, ran a survey of its members related to gender equality topics. The survey revealed some interesting results about the attitudes of its members towards gender equality issues, many of which were at odds with statistical evidence and well-known studies of gender in STEM. As a result of this survey, we ran a series of information sessions and discussion workshops including both women and men during scientific COST Action meetings.

Now in 2019, we have undertaken a second survey. The purpose was two-fold: firstly to monitor any changes in opinion that may have resulted from the actions we have taken, and secondly to probe some of the answers in more detail.

**Revealing results from the second survey: conferences, sexual harassment and scientist fathers**

In this survey we have asked several new questions in light of the partial information we received in 2016. Much of this was to gain information about seniority and family status, while other questions focused more on sexual harassment and the environment at conferences and project meetings. Amongst the most striking outcomes, we found:

- Early career women report overwhelmingly that **women are not treated equally at conferences** and project meetings. **ALL 9 female postdoc respondents agreed, many strongly.**
- A very large number of women (over 65%) report experiencing **sexual harassment** at work. 40% say this has happened to several people they know.
- While **senior women** overwhelmingly believe that **having children does not affect men's careers**, **early career men report a negative impact** on their careers of having children.

**A summary of the key changes in reported opinions between 2016 and 2019:**

- More **changes in the opinions were apparent by women**, whereas men's opinions appear to have remained largely unchanged.
- More women believe that in the community as a whole and their own department they are not treated equally. In **2016, 50% of women felt that their department treated them equally, this number has now decreased to 31% in 2019**.

However, some changes were apparent in 3 years

- We observe a **large increase in men reporting that they personally undertake activities to support gender equality** from 33% in 2016 to 60% in 2019.
- In 2016 both groups felt that the focus should be on supporting women via leadership training, networking, mentoring, whereas in 2019 **men felt that the focus should be on supporting male members**, via **raising awareness**, and **providing male leaders with training**. This is in line with studies that show that the most effective change happens when senior leaders receive training and make gender equality a priority.

# 2 WHY DID WE RUN A SECOND SURVEY?

**Why do we have a gender balance action as part of COST NQO?**

Of all the members of the COST NQO network, only approx. 16% are women. Even though this is "usual" for a physical science discipline it is still a worrying and unacceptable trend. Most worrying in the STEM disciplines (STEM = Science, technology, engineering, maths), is the fact that as women and men progress in their careers, more women than men leave academia, and more men progress to higher level appointments (tenure and full professor) than women. Even in subjects where the male:female ratio is equal (or where there are more women) at postgraduate level, men begin to overtake women in numbers from postdoc-level onwards, a phenomenon known as vertical segregation. What is more, these numbers have not significantly changed over the past decade. Until now, much of the work on gender balance has been somewhat top-down. Heads of institutions and of academic bodies (overwhelmingly men) implement policies that are clearly not working.

In this COST Action we ran an initial survey in 2016 to gauge the attitudes and opinions of both men and women in the Action, and to compare their attitudes to well-established studies in gender equality in STEM. We found several areas where women and men showed diverging attitudes, for example, in our 2016 most women did not feel that they have equal opportunities for career advancement whilst most men felt that they did (overwhelming evidence from studies shows that the women were right that they face discrimination [1,2,3,4,5,6,7,8,9,10]). We also found areas where scientists' opinions diverge from well-known gender studies, for example, it is known that the best way to achieve equality is if senior men in charge of recruitment and promotion are trained in implicit bias and actively support early career women [10]. In contrast, the scientists surveyed here believed that direct training of women, and focus on girls in schools should be targeted, which are known to have only limited benefits.

After completing the survey it became obvious that many scientists were not supportive of gender balance measures taking place, and that they were unaware of the well-known effects of implicit bias. We implemented information sessions during scientific meetings for COST, that gave details of the scientific studies that showed clear evidence for severe implicit bias in STEM. We also ran discussion sessions. In these sessions we chose controversial topics around gender equality (such as whether sexual harassment is prevalent, whether positive discrimination or quotas should be used, whether men should be allowed to express sexist opinions at work in the name of free speech, whether scientist fathers are also at a career disadvantage). By separating the discussion into male and female groups we were able to highlight the difference in opinions across gender lines and initiate discussions around this.

**Why have we asked you to complete this second survey?**

One of the objectives of the actions we took were to monitor whether the activities we did were valuable and led to changes in attitudes of the scientists and engineers in the COST Action. In addition, as a result of the discussions during the COST meetings we highlighted more issues. These included the effect of seniority on attitudes, the very high prevalence of sexual harassment amongst women during the early stages of their career, and the effect of dual career relationships and parenthood on the careers of many early career scientists. We therefore increased the number of questions from 10 to 21 to study these issues in more detail.

**Notes on the second 2019 survey**

**Gender make-up of survey participants**

In the survey, Q18 revealed 32 responses from women and 66 responses from men, with 4 as "prefer not to say". No respondent selected "other", and one respondent skipped the question Thus 32% of respondees were women, and 65% men. Compared to 16% average numbers of women, proportionately, women were twice as likely to complete the survey as men.

Note that the reason for including options "other" and "prefer not to say" is to ensure we capture the views of any transgender or non-binary scientists in the survey. While not common - 0.3% of individuals are said to be transgender – one might expect one or two transgender people in the COST action community of approx. 400. We have not included any breakdown of survey results of respondees who selected "prefer not to say" due to the low numbers and to ensure that their identify is protected.

**Discussion of external statistical studies used in this report**

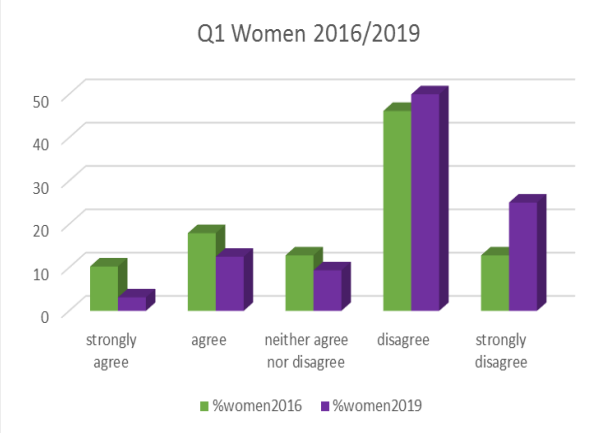
As in 2016 we cite peer reviewed statistical studies of gender issues of a wide variety. This is to allow us to contrast attitudes and opinions to statistical evidence chosen for its reliability. The motivation is not to provide definitive answers, but to highlight the complexity of some of these issues and give the interested reader an avenue for further reading.

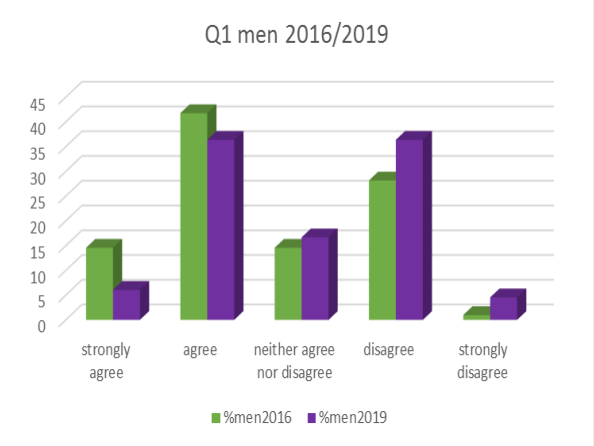
**Breakdown of results in terms of seniority and family status**

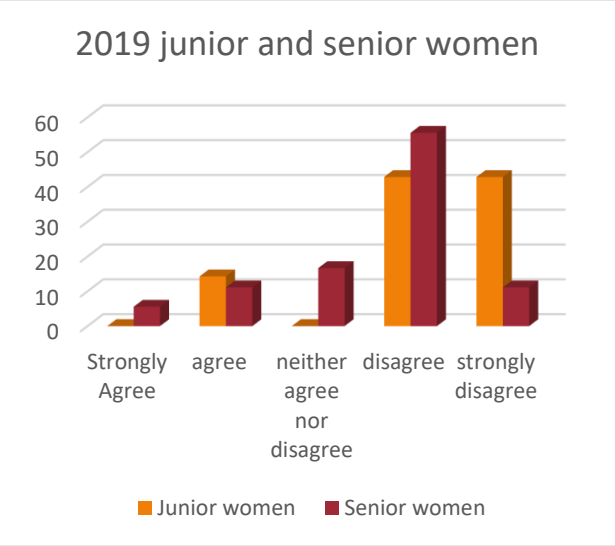
We have broken down the statistics into sub-sections of the community at some points in this report, for example, on seniority, relationship and family status. The term "early career" refers to Masters level, PhD, postdoc and tenure track scientists. "senior" refers to established scientists with a permanent position.

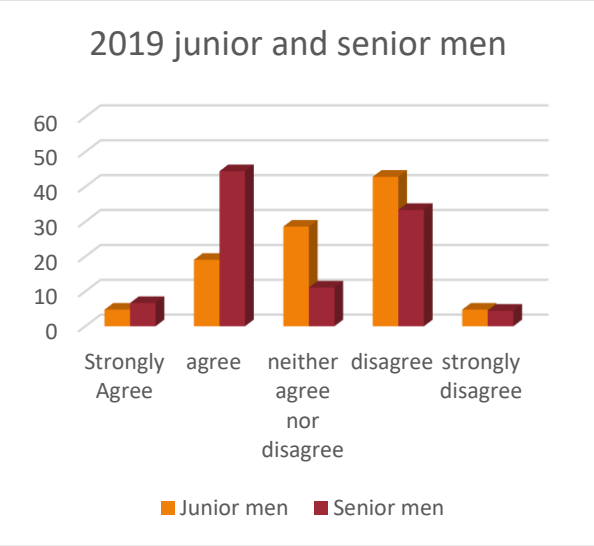
# 3 SURVEY RESULTS

## 3.1 QUESTION 1: WOMEN AND MEN IN MY FIELD HAVE EQUAL OPPORTUNITIES FOR CAREER ADVANCEMENT.



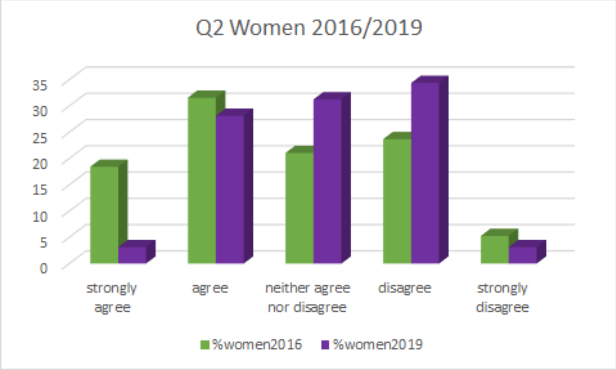



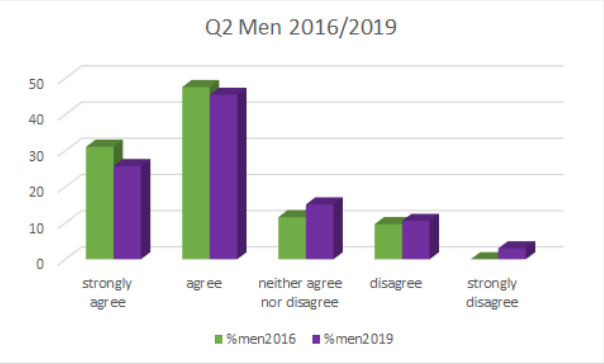




| | Women 2016 | Men 2016 | Early career women 2019 | | Senior women 2019 | Early career men 2019 | Senior men 2019 |
|---|---|---|---|---|---|---|---|
| **strongly agree** | 4 | 15 | 0 | | 1 | 1 | 3 |
| **agree** | 7 | 43 | 2 | | 2 | 4 | 20 |
| **neither agree nor disagree** | 5 | 15 | 0 | | 3 | 6 | 5 |
| **disagree** | 18 | 29 | 6 | | 10 | 9 | 15 |
| **strongly disagree** | 5 | 1 | 6 | | 2 | 1 | 2 |

- **The majority of both men and women in 2019 disagree with this statement,** a change from 2016 where the majority of women disagreed but the majority of men agreed.
- The opinions of women has become stronger. Now**, 75% of women disagree** or strongly disagree with the statement, with **25% strongly disagreeing**, up from 12% in 2016.
- **Men's opinions seem to have changed**. In 2016 the majority of men, 56%, agreed or strongly agreed with the statement, in 2019 a minority, only 40% agree or strongly agree.
- The breakdown in terms of seniority revealed that both **early career women and men were more likely to disagree with the statement** than senior women and men.
- **50% of senior men agree** with the statement, but only **24% of early career men do**.
- **42% of early career women strongly disagree** with the statement compard to only **11% of senior women**.

## 3.2 QUESTION 2: IN MY DEPARTMENT, STAFF ARE TREATED EQUALLY REGARDLESS OF GENDER

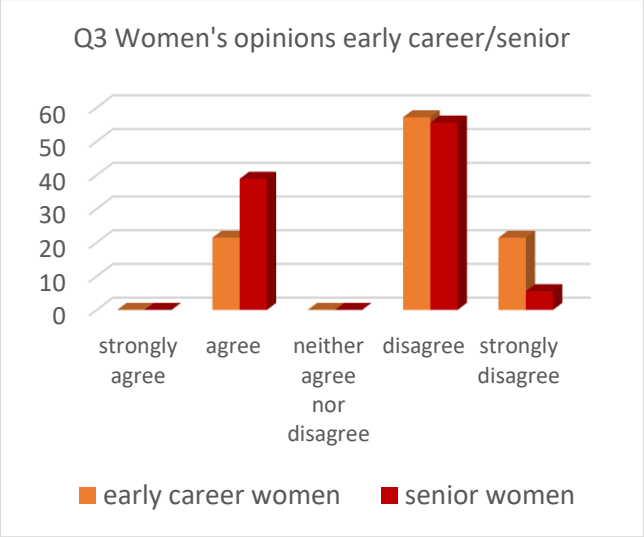


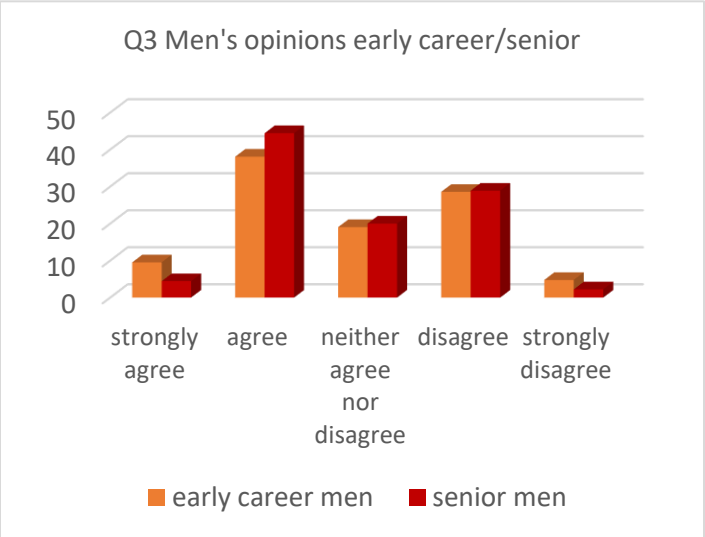



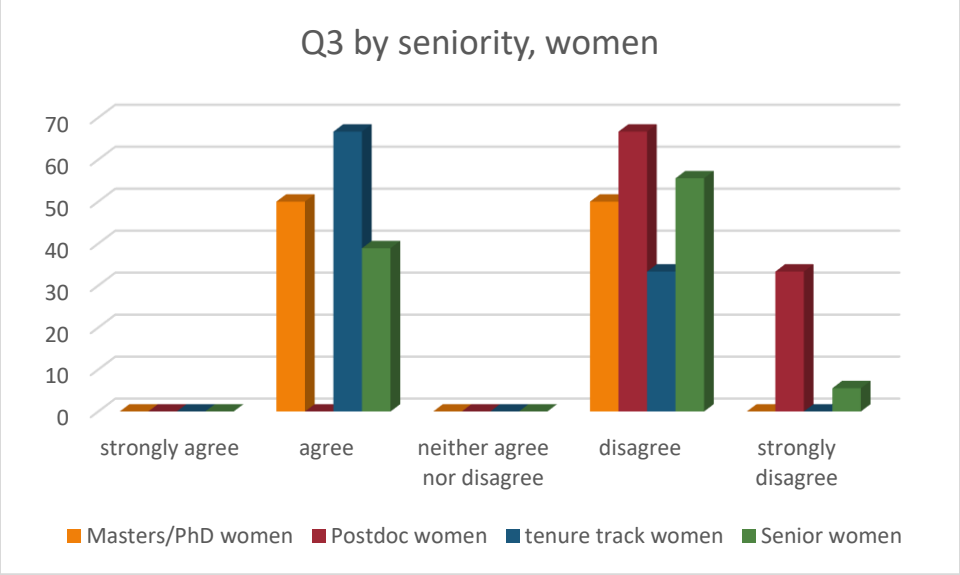

| | Women 2016 | Women 2019 | Men 2016 | Men 2019 |
|---|---|---|---|---|
| **strongly agree** | 7 | 1 | 32 | 17 |
| **agree** | 12 | 9 | 49 | 30 |
| **neither agree nor disagree** | 8 | 10 | 12 | 10 |
| **disagree** | 9 | 11 | 10 | 7 |
| **strongly disagree** | 2 | 1 | 0 | 2 |
| 2019 data only | **Early career women** | **Senior women** | **Early career men** | **Senior men** |
| **strongly agree** | 0 | 1 | 4 | 13 |
| **agree** | 4 | 4 | 6 | 24 |
| **neither agree nor disagree** | 3 | 7 | 5 | 5 |
| **disagree** | 3 | 6 | 1 | 6 |
| **strongly disagree** | 1 | 0 | 0 | 2 |

- **Women are more likely to disagree that they are treated equally** in their department in 2019.
- **Men's opinions have not changed significantly since 2016**: they feel that in their departments men and women are treated equally. This was true for both early career and senior men.
- **Many men, both senior and early career, were confident (ie 25% strongly agreed)** that both genders were equally treated in their department.

## 3.3 Question 3: In my wider network (outside my employer, eg conferences, project meetings etc) men and women are treated equally regardless of gender




| 2019 data only | Masters /PhD women | Postdoc women | Tenure track women | Senior women | Early career men | Senior men |
|---|---|---|---|---|---|---|
| **strongly agree** | 0 | 0 | 0 | 0 | 2 | 2 |
| **agree** | 1 | 0 | 2 | 7 | 8 | 20 |
| **neither agree nor disagree** | 0 | 0 | 0 | 0 | 4 | 9 |
| **disagree** | 1 | 6 | 1 | 10 | 6 | 13 |
| **strongly disagree** | 0 | 3 | 0 | 1 | 1 | 1 |

- **These results are amongst the most stark of the whole survey. 69% of women disagreed** that women are treated equally in their wider network.
- **ALL nine female post docs disagreed with this statement. 33% of them strongly disagreed**.
- In contrast, 57% of men agreed that women are treated equally in their wider network, with only 48% disagreed and many were unsure. There was no strong difference between early career and senior men.

**Discussion on Q1-3**

Questions 1-3 concerned the general level of belief surrounding the equality of opportunity for men and women. What is clear from the answer to these questions is that, broadly, women and early career men do not believe in equality of opportunity, whereas most senior men did. And when questioned about where this inequality in opportunity arises, it appears that although some women did feel that they faced discrimination in their home departments, it was in Q3, concerning the wider network (conferences and other scientific meetings) where many women reported a perception of discrimination.

**Q3 gave one of the most striking results of this survey: all nine of the female postdocs surveyed did not feel that their wider network treats them equally.** In contrast only four of the same nine postdoc women surveyed felt that they were treated unequally in their home institution. And over two thirds of all women felt that the wider network did not treat them equally.

This result requires more exploration. The examples mentioned were conferences and project meetings, but we did not explicitly mention factors such as journal submissions, funding bodies, professional bodies, involvement with industrial or start-up companies, or other factors. What this shows is that women feel that it is their networks outside of their home institutions that is holding back their career. And studies of gender discrimination support this negative view by female researchers. Studies have shown that women are less likely to be given invited or contributed talks [11], are less likely to be accepted for publication if they are first author [8], and are less likely to receive funding in competition with men of proven equal or weaker track record [1,4], and are less likely to receive glowing letters of reference from previous supervisors and employers [6].

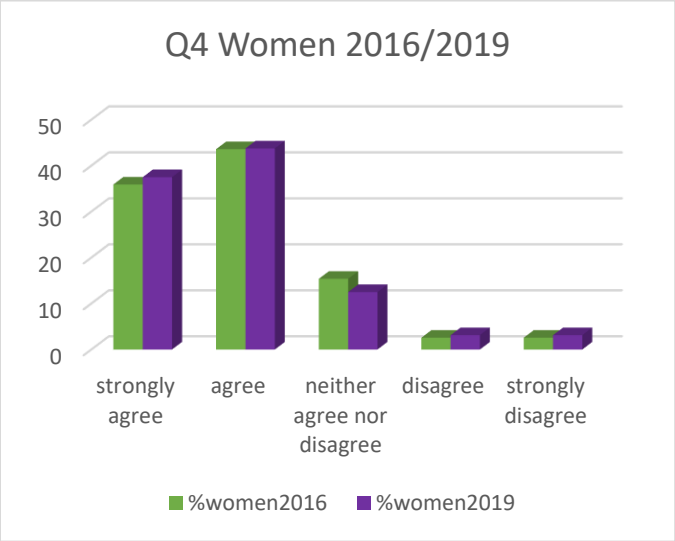
**We suggest that this result implies suggest two immediate courses of action**.

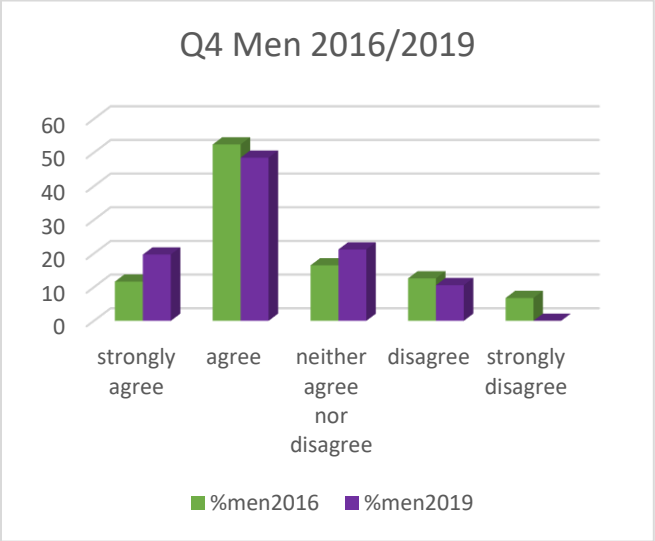
First of all, any future exploration of the issues for female scientists and engineers must examine the wider network that one must interact with in order to progress in one's career. Action on an institutional level will not be enough. Organisers of conferences, editors of journals, funding and professional bodies must take implicit bias and other discriminatory factors into account, strongly considering, for example, double-blind reviewing of manuscripts and abstracts, and an establishment of a database of researchers for invited talks and membership of professional bodies.

Secondly, at an institutional level, one cannot operate on the assumption that it is fair and equal to compare a woman's and a man's track record on an equal footing. A woman will very likely have faced more difficulties in establishing collaboration networks, in having her work accepted for publication and for presentation at conferences, will be statistically less likely to receive research funding, and is less likely to be invited to key positions on professional bodies (unless it is in direct relation to her gender). However, all of these factors, essentially the opinions of one's peers in one form or another, provide the key criteria upon which academics are judged.

Therefore, hiring and promotion committees should consider how they should take this into account. We do not believe there is an easy answer to this: lowering the threshold criteria for female candidates or implementing a quota system would certainly be perceived by many as unfair, perhaps with justification: one should also remember that men can be part of disadvantaged minorities (race, disability, sexual identity and orientation, social class) which can be difficult to factor in. An alternative might be to consider how to reduce the reliance of the assessment criteria on peer opinion – for example, plenary and invited talks are often one of the criteria assessed, but rely purely on being known and respected within the community. In any case, a well-informed debate should take place widely within the community to establish new best practice.

## 3.4 Question 4: Women in my field with young families or caring responsibilities are disadvantaged in their career.



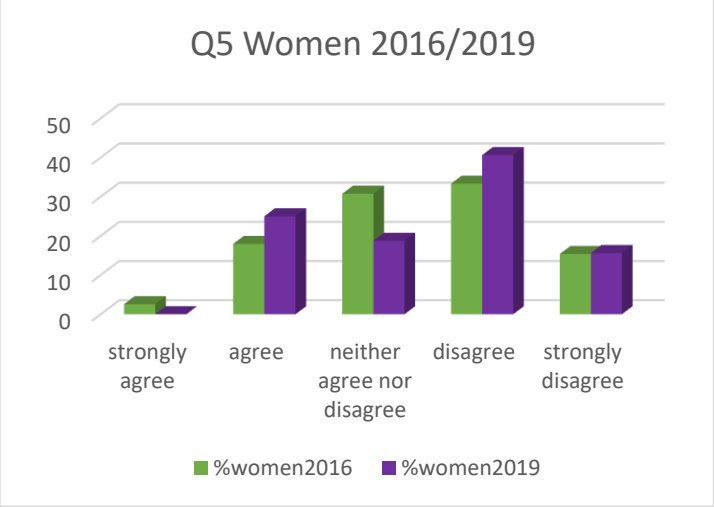



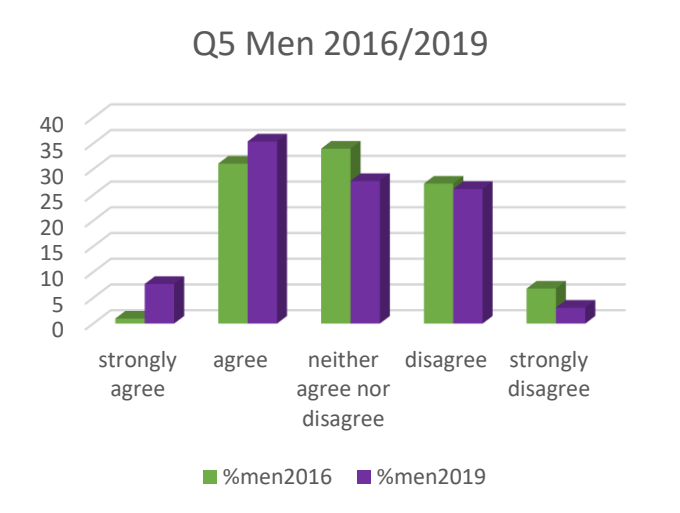

| | Women 2016 | Women 2019 | Men 2016 | Men 2019 |
|---|---|---|---|---|
| **strongly agree** | 14 | 12 | 12 | 13 |
| **agree** | 17 | 14 | 54 | 32 |
| **neither agree nor disagree** | 6 | 4 | 17 | 14 |
| **disagree** | 1 | 1 | 13 | 7 |
| **strongly disagree** | 1 | 1 | 7 | 0 |

- We observed no significant changes to the opinions here between 2016 and 2019, both men and women felt that women with caring responsibilities are at a disadvantage, with women feeling more strongly about this than men.
- We did note that early career men were as likely to strongly agree with the statement (33%) as women of all seniorities (37%), while only 13% of senior men strongly agreed (data not shown). There appeared to be no large differences in opinion between those with or without children themselves.

However, surprisingly, as we will see when discussing Q8, only a minority of women reported that having children had affected their own career personally. This is an apparent contradiction that is difficult to explain.

## 3.5 Question 5: Men in my field with young families or caring responsibilities are disadvantaged in their career.




| | Women 2016 | Women 2019 | Men 2016 | Men 2019 | Early career men | Senior men | Early career women | Senior women |
|---|---|---|---|---|---|---|---|---|
| **strongly agree** | 1 | 0 | 1 | 5 | 3 | 2 | 0 | 0 |
| **agree** | 7 | 8 | 32 | 23 | 7 | 16 | 4 | 4 |
| **neither agree nor disagree** | 12 | 6 | 35 | 18 | 4 | 14 | 3 | 2 |
| **disagree** | 13 | 13 | 28 | 17 | 5 | 12 | 3 | 10 |
| **strongly disagree** | 6 | 5 | 7 | 2 | 2 | 0 | 1 | 2 |

- Many early career men perceive a strong disadvantage for fathers: **47% feel that fathers are at a disadvantage in their career**, 14% feel this strongly.
- Senior men perceive a problem: 40% agreed with the statement, and 27% disagreed.
- There appears to be very little sympathy for fathers from **senior women: 66% of them did not think fathers had a disadvantage**, with only 22% of them believing that they did.
- Both early career men and early career women are equally divided on whether fatherhood is a disadvantage.

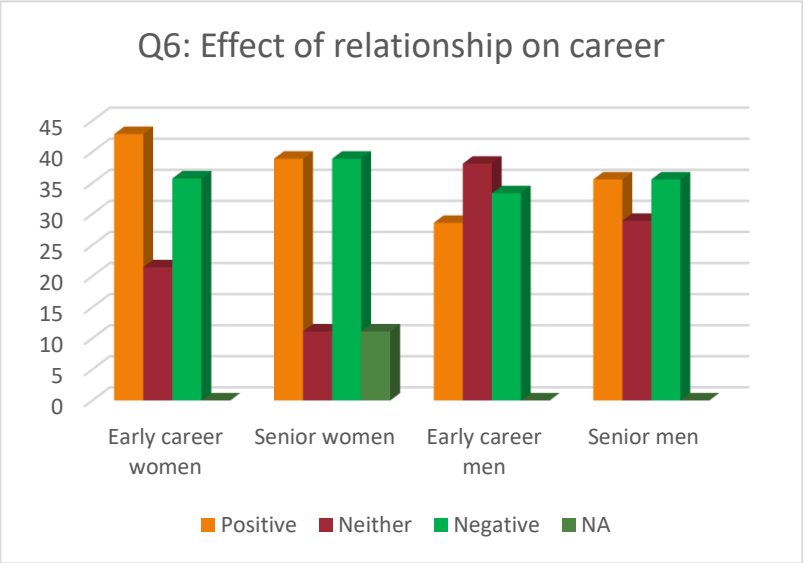
Again, there was no real difference in opinion observed between 2016 and 2019 for this question. In the 2016 report we commented that the situation for fathers in academia is complicated. It appears that once men have an established permanent position, fathers are more likely to be promoted than men without children [5]. However, no studies have been made for men with children who do not have permanent positions. Anecdotal evidence from members of the COST Action NQO suggests that men face similar barriers to women in mobility (ie needing to relocate their family) when they have children that may impact severely on their career. It could be that a focus on mainly established academics does not tell the whole picture.

This survey allows us to examine the opinions of early career men to see whether they feel this is an issue. **A breakdown of men's and women's opinions by seniority highlights a different story**. Almost half of early career men feel that fathers are at a disadvantage, with 14% feeling this strongly. Many senior men (40%) also hold this opinion. We note that there may indeed be many disadvantages regardless of career stage for men's careers if they take an equal or greater part in childrearing as their partner, in particular lower available working hours, difficulty in attending conferences etc. But this might translate to a significant disadvantage for early career men who are at the career stage where they are expected to move location for each new position. This can be destabilising for families and many early career men in particular may be compromising on their career prospects for the sake of their family.

However, while senior women believe that mothers face a significant disadvantage, they do not believe the same of fathers - most senior women (66%) felt that men were not at a disadvantage. This result is perhaps surprising. It could be that when asked about this issue, most women are comparing the situation to their peers (senior men who do not face the same difficulty in moving location) and have neglected to consider early career men. This result is important as it shows that it is easy to neglect a disadvantaged community if it is not explicitly visible.

The next questions address the role of relationships and family on career explicitly and allow us to explore these issues. For clarity we present data broken down in terms of gender and seniority.

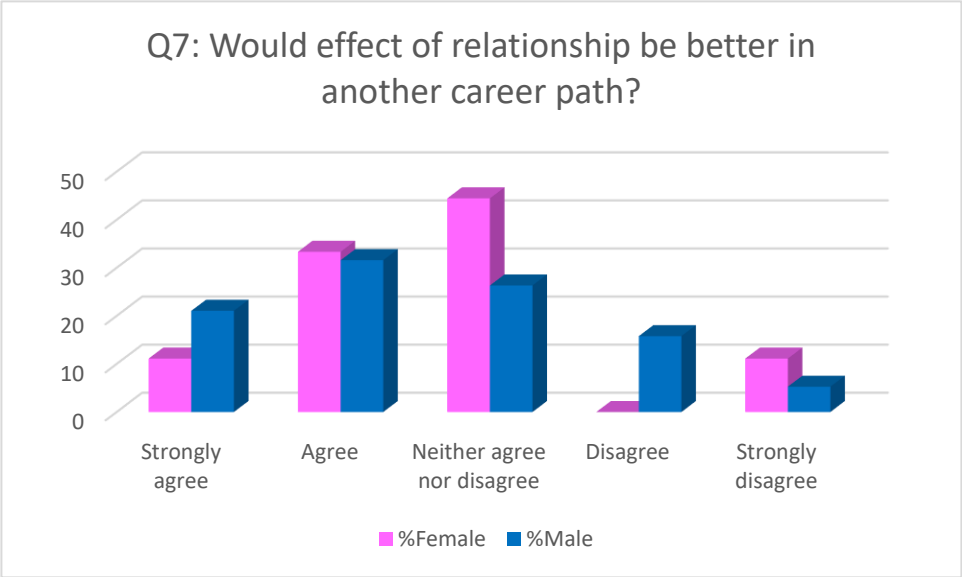
## 3.6 Question 6: My personal relationship has had an impact on my career (eg due to (in)flexibility in mobility)




| | Early career women | Senior women | Women total | Early career men | Senior men | Men total | Early career total | Senior total |
|---|---|---|---|---|---|---|---|---|
| **Strongly positive** | 2 | 1 | 3 | 3 | 4 | 7 | 5 | 5 |
| **Positive** | 4 | 6 | 10 | 3 | 12 | 15 | 7 | 18 |
| **Neither** | 3 | 2 | 5 | 8 | 13 | 21 | 11 | 15 |
| **Negative** | 3 | 5 | 8 | 6 | 14 | 20 | 9 | 19 |
| **Strongly negative** | 2 | 2 | 4 | 1 | 2 | 3 | 3 | 4 |
| **Not applicable** | 0 | 2 | 2 | 0 | 0 | 0 | 0 | 2 |
| **Total** | **14** | **18** | **32** | **21** | **45** | **66** | **35** | **63** |

- **A range of experiences was reported here**. Both men and women of all seniorities report positive and negative effects approximately equally (36% positive, 36% negative, 27% report no effect).
- **Men were most likely to report that a relationship had not affected their career**. 30% of men reported that it had neither a positive nor negative effect compared to just 15% of women
- 38% of women and 35% of men reported a negative/strongly negative effect of their relationship on their career.

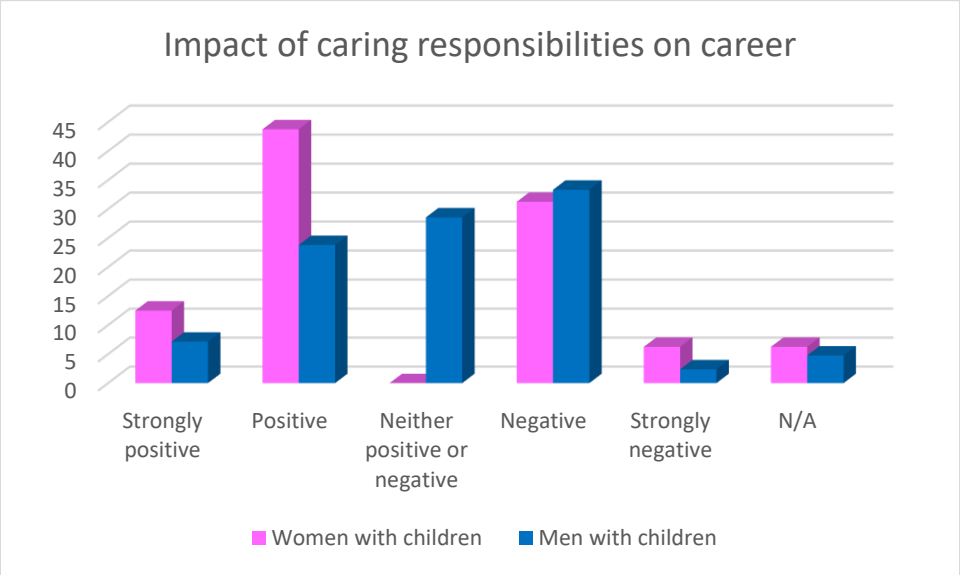
## 3.7 Question 7: If Q6 is applicable, do you believe the impact would be less on your career in another (eg non-academic) career path?




| For those answering negative to Q6 only | | | |
|---|---|---|---|
| | Female | Male | Total |
| **Strongly agree** | 1 | 4 | 5 |
| **Agree** | 3 | 6 | 9 |
| **Neither agree nor disagree** | 4 | 5 | 9 |
| **Disagree** | 0 | 3 | 3 |
| **Strongly disagree** | 1 | 1 | 2 |
| **Total** | **9** | **19** | **28** |

- For those who answered Q6 negatively, **50% of respondents felt that the impact of the relationship would have been less in different career**.
- 44% of women and 52% of men either agreed or strongly agreed that the effect of their relationship would have been less in a different career.

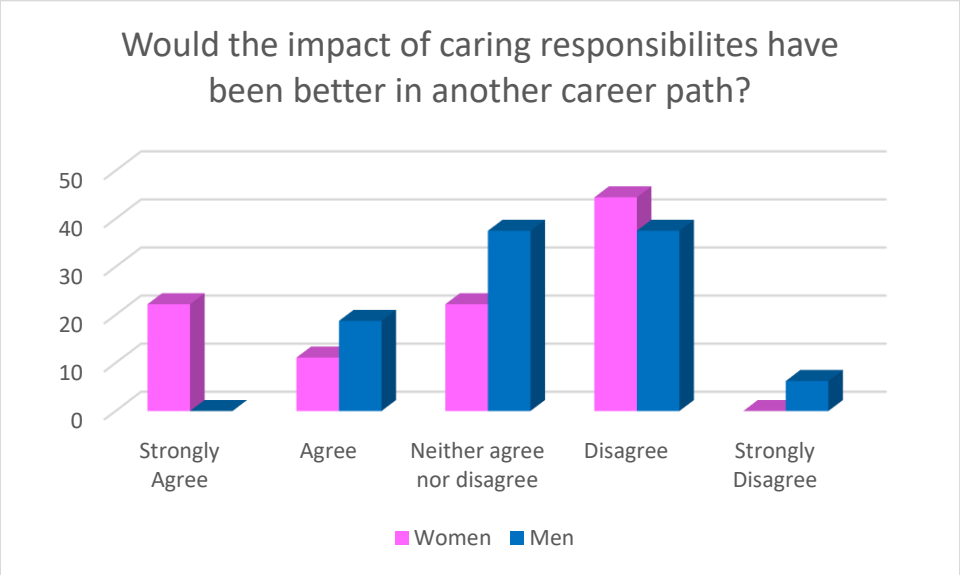
## 3.8 Question 8: Childcare or other caring responsibilities has had an impact on my career




| | Women with children | Women without children | Men with children | Men without children |
|---|---|---|---|---|
| **Strongly positive** | 2 | 0 | 3 | 0 |
| **Positive** | 7 | 0 | 10 | 1 |
| **Neither positive or negative** | 0 | 2 | 12 | 2 |
| **Negative** | 5 | 3 | 14 | 3 |
| **Strongly negative** | 1 | 1 | 1 | 2 |
| **N/A** | 1 | 9 | 2 | 16 |
| **Total** | **16** | **15** | **42** | **24** |

- Both fathers and mothers report a range of experiences
- **56% of mothers 31% of fathers** say that caring responsibilities have had a **positive impact**
- However, **38% of mothers and 36% of fathers** say that caring responsibilities have had a **negative impact**
- 27% of women without children and 25% of men without children report an impact on their career nevertheless.

## 3.9 Question 9: If Q8 is applicable, do you believe the impact would be less on your career in another (eg non-academic) career path?




| | Women | Men | Total |
|---|---|---|---|
| **Strongly Agree** | 2 | 0 | 2 |
| **Agree** | 1 | 3 | 4 |
| **Neither agree nor disagree** | 2 | 6 | 8 |
| **Disagree** | 4 | 6 | 10 |
| **Strongly Disagree** | 0 | 1 | 1 |
| **Total** | **9** | **16** | **25** |

- Of the 9 women that said that caring responsibilities had had a negative impact on their career, 33% of them believed that the impact would have been less in another career
- Of the 16 men that reported a negative impact, 19% believed that the impact would have been less in another career.
- However, **the majority, 76%, did not agree with this statement**, implying parents do not think academia is particularly bad for families.

**Discussion of Qs 6-9**

These four questions, Qs 6-9, have surveyed the impact reported of relationships and families on career. About a third of respondents said that their relationship and their caring responsibilities had had a negative effect on their career. However, while 50% of these people felt their relationship would have had a less negative impact in another career, they felt that the impact from childcare and other caring responsibilites would have been the same.

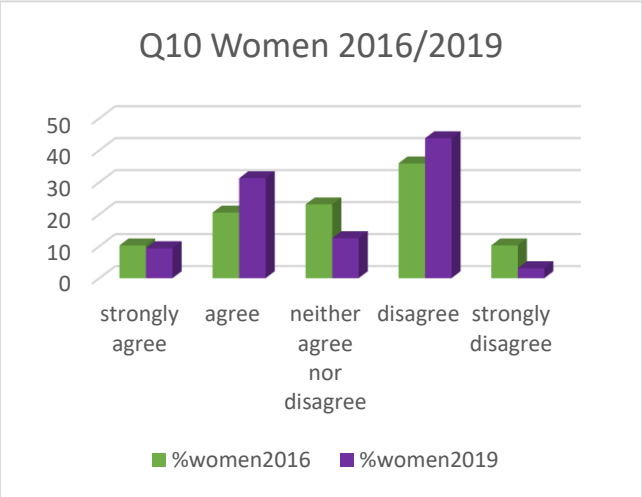
These important results begin to unpick some of the perceived barriers for women in their careers. Often it widely perceived that an academic career is difficult for women who want a family, as Q4 clearly shows.

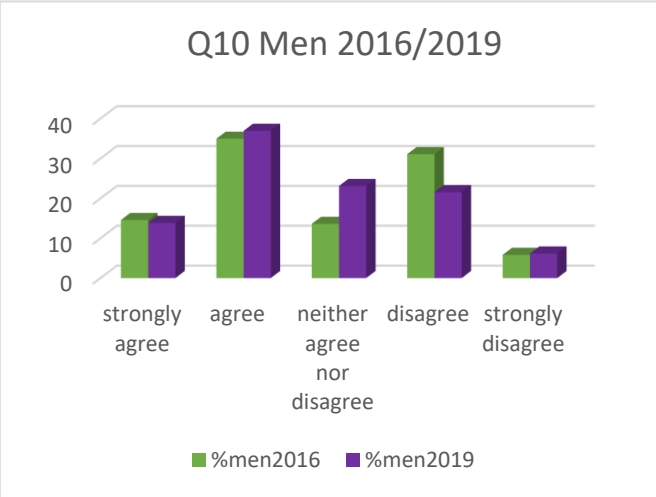
The results here do not reflect this: some mothers (36%) and some fathers (38%) report an impact on their career, but approximately two thirds report that having children did not have a negative effect.

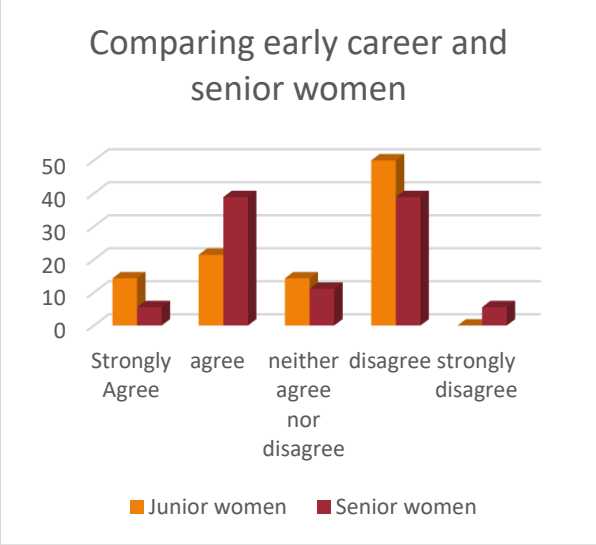
However, personal relationships do appear to have a significant influence, with women reporting a stronger influence (either positive or negative) than men, who are more likely to say it had no influence. Women and men who report a negative influence do believe that in an alternative career their relationship would have had less impact. Again, it is often widely perceived that because women in technical careers tend to be in relationships with men with similar careers (eg a poll by the UK Institute of Physics revealed that 50% of female physicists are married to a physicist). This means that the so-called two-body problem, where one tries to find two suitable jobs in the same location, becomes a greater issue for women. What these results appear to indicate is that this is an issue for many men as well. Is this a result of changes in gender equality, and that women in all walks of life in 2019 are no longer satisfied to be the so-called "trailing spouse", compromising on their own careers? It is difficult to tell here, unfortunately no respondent commented on their own relationship in the general comment section. One should also bear in mind that the nature of state care for children and the elderly, and the availability of (paid) leave for fathers varies widely in Europe, these factors can have a huge influence.

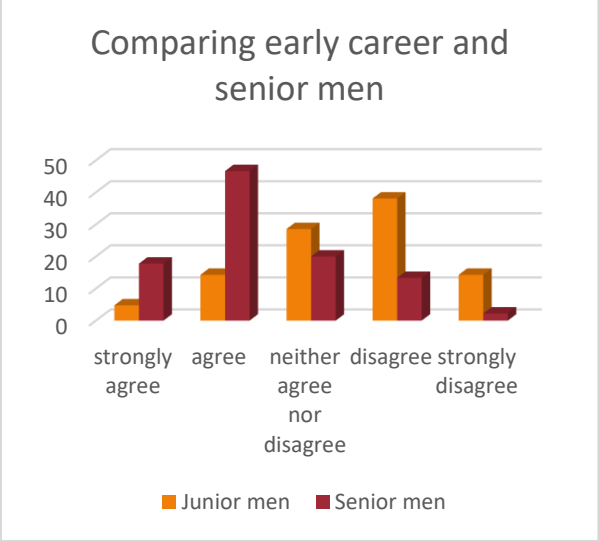
It is difficult to interpret the results of those without children who say that caring responsibilities have affected their career. Q19 specifically asked about this: no respondent said that they had caring responsibilities. Perhaps respondents may have been caring for elderly or sick relatives in the past, but without further detailed questions it is difficult to tell. Finally, we do not probe whether the career has had an effect on the family or relationship.

## 3.10 Question 10: I am familiar with my institution's sexual harassment policies and would be confident of what to do if approached by a junior colleague with a complaint.



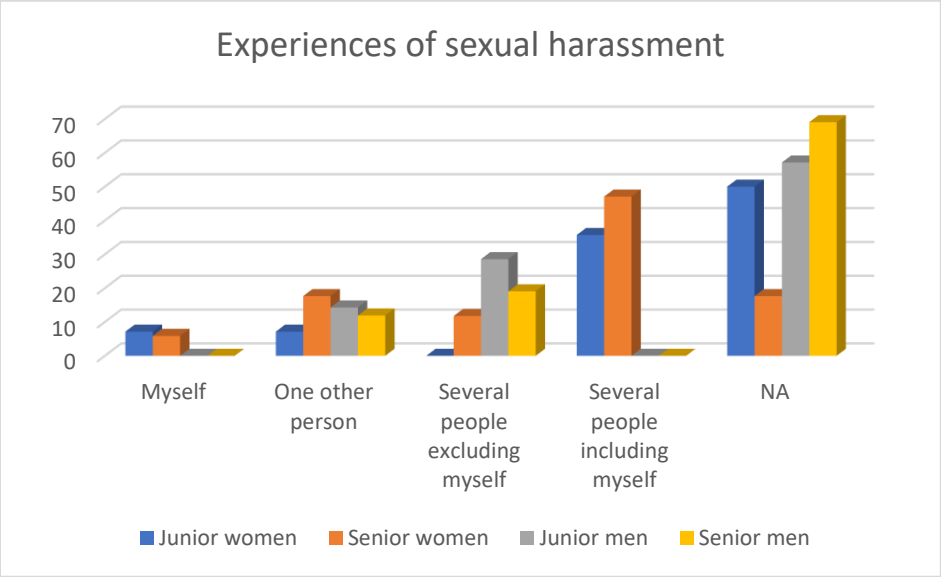




| | Women 2016 | Men 2016 | Early career women 2019 | Senior women 2019 | Early career Men 2019 | Senior men 2019 |
|---|---|---|---|---|---|---|
| **strongly agree** | 4 | 15 | 2 | 1 | 1 | 8 |
| **agree** | 8 | 36 | 3 | 7 | 3 | 21 |
| **neither agree nor disagree** | 9 | 14 | 2 | 2 | 6 | 9 |
| **disagree** | 14 | 32 | 7 | 7 | 8 | 6 |
| **strongly disagree** | 4 | 6 | 0 | 1 | 3 | 1 |
| **total** | **39** | **103** | **14** | **18** | **21** | **45** |

- More women in 2019 seem sure of what to do in this circumstance than in 2016. While In 2016, only 30% reported that they would know what to do, this has risen to 40% in 2019.
- However in 2019, approx 45% of women still say they would not know what to do.
- While the number of **men** agreeing with the statement in 2016 remains approximately unchanged, **the number who report they would not know what to do has decreased from 37% to 26%.**
- A breakdown in terms off seniority shows that early career women are less likely to agree with the statement (35%) than senior women (44%).
- **Early career men appear to be the least certain**: **less than 20% agree or strongly agree**, compared to **64% of senior men.**
- A further analysis of the very senior academics (>10yrs tenured) shows that **while 65% very senior men agree or strongly agree, 46% of very senior women disagree**, a surprising result.

## 3.11 QUESTION 11: I HAVE, OR KNOW SOMEONE WHO HAS, EXPERIENCED SEXUAL HARASSMENT BY A PEER AND/OR SUPERIOR (IE UNWANTED TOUCHING,PERSISTENT HARASSMENT BY PEER, INAPPROPRIATE COMMENT BY SUPERVISOR/LINE MANAGER, PERSISTENT SEXIST/SEXUAL COMMENTS IN GROUP).




| | women, Masters, PhD | Women postdoc | Women, tenure track | Women, tenure <10yrs | Women, tenure >10yrs | Women total |
|---|---|---|---|---|---|---|
| **Myself** | 0 | 1 | 0 | 0 | 1 | 2 |
| **One other person** | 0 | 1 | 0 | 1 | 2 | 4 |
| **Several people excluding myself** | 0 | 0 | 0 | 1 | 1 | 2 |
| **Several people including myself** | 1 | 3 | 1 | 1 | 7 | 13 |
| **NA** | 1 | 4 | 2 | 1 | 2 | 10 |
| **Total** | 2 | 9 | 3 | 4 | 13 | 31 |

| | men, Masters, PhD | men postdoc | men, tenure track | men, tenure <10yrs | men, tenure >10yrs | Men total |
|---|---|---|---|---|---|---|
| **Myself** | 0 | 0 | 0 | 0 | 0 | 0 |
| **One other person** | 0 | 3 | 0 | 1 | 4 | 8 |
| **Several people excluding myself** | 3 | 1 | 2 | 0 | 8 | 14 |
| **Several people including myself** | 0 | 0 | 0 | 0 | 0 | 0 |
| **NA** | 3 | 6 | 3 | 15 | 14 | 41 |
| **Total** | 6 | 10 | 5 | 16 | 26 | 63 |

- **Almost half of all women (48%)** report some experience of sexual harassment. **Only 32% of women had no direct or indirect experience of sexual harassment.**
- A large number of women (42%) reported that they knew **several people, including themselves, that had been sexually harassed.**
- Sexual harassment is an almost universal experience by the time women become senior. Only 17% of senior women did not report knowledge of sexual harassment to either themselves or others.
- **No men reported having been sexually harassed** themselves.
- The experiences of the most senior academics (with >10yrs since tenure) was hugely divided on gender grounds. **53% of women said that they knew of several people affected whereas 70% of senior men did not know of it happening to anyone**. Only 20% of men knew of several people affected.

**Discussion Q10-11**

Questions 10-11 show another very striking result of this survey. **Sexual harassment is very very common amongst women, and senior men are by and large almost fully unaware of it happening**. Many groups, including early career men and senior women, are not sure what steps to take should it happen to a junior colleague.

The results of Q11 perhaps are not surprising, particularly given wider awareness of these issues in 2019. In the intervening period after our first survey, sexual harassment at work and otherwise has become the focus of much attention world-wide. The Harvey Weinstein scandal and the subsequent #metoo movement of 2017 [12] revealed that serious sexual harassment of women is commonplace in the West, and a debate rages globally on the issue of sexual harassment. We should therefore view any changes to Q10 between 2016 and 2019 in this light.

The incidences of sexual harassment are not isolated. Only 17% of senior women did not report any knowledge of sexual harassment, demonstrating by the time female scientists reach senior positions, sexual harassment is an almost universal experience. This issue was discussed in one of the COST Action NQO meetings in Marseille. Anecdotal reports from women-only discussions revealed that almost universally, senior women reported sexual harassment only when they were in their early career – in particular sexual assault stops once the women is an independent academic. These women reported that it was often senior men who perpetrated sexual assault. It is clear that power dynamics are at play in many of these cases. In other cases, sexual harassment from peers (lewd sexual comments from the group) was reported, and this appears to arise in a micro culture that arises in some (but not all) groups of young men.

The results reported here also agree well with wider studies of sexual harassment at undergraduate level and beyond at many universities. A survey of undergraduates in physics in the US [13] showed that three quarters of women undergraduates experienced sexual harassment, in line with results from a study of graduate level astronomers and studies on scientists doing field work [14, 15]. The 2018 McKinsey Report on Women in the Workplace [16] reports sexual harassment levels of women at work at around 35%, increasing to 45% in technical areas. 48% of women in this survey repored direct experience of

harassment, reflecting the wider statistics for women working in technical areas. And these experiences can have a profound effect on the career of the affected person: it has been shown that experiencing sexual harassment increases the likelihood of that woman leaving a STEM career [17]. Respondees report a sense of not belonging to the broader physics community.

However, also very clear from this survey is the almost complete lack of knowledge of such experiences amongst men themselves, particularly senior men. **70% of senior men reported no knowledge of sexual harassment at all and no men reported being sexually harassed personally**. When conducting the discussion group on sexual harassment in the COST meeting in Marseille, many men in a later discussion reported surprise that women did not report such incidences more widely.

It is therefore important to **reflect upon and provide feedback to the community** regarding why women do not report such issues. There are many serious reasons why women would not report such issues that include their career, personal safety and dignity:

- **Complaints about sexual harassment will be dismissed by peers and supervisors as trivial and unimportant**. Anecdotally, this experience is very commonly reported amongst women who try to report such issues.
- **Complaints can cause backlash.** They fear ostracism from their day-to-day co-workers.
- **The perpetrator holds power within the community and possibly substantial grant income.** Senior academic peers are often reluctant to take action.
- If the perpetrator(s) are co-workers, or worse, a supervisor or line manager, the woman may feel she cannot carry on in her position if accusations come to light, it can, and has **led to women giving up their PhD's**, for example.
- Women fear that their **wider scientific network will be harmed** if they report harassment by their supervisor/line manager.

All of these issues point to the significant power imbalances at play that encourage sexual harassment. Power imbalance includes both the power a senior academic will have over a early career one, and also the power the male peer majority has over the female minority. We would suggest it is a worthwhile exercise for the male scientific community to reflect on the power imbalances in place in their workplace. In particular, early career men often are unaware that of the power they have as a majority group over their female peer minority: a micro culture of low-level but persistent sexually inappropriate comments can isolate women in the community who may not complain. Senior men should reflect on the power imbalance in any supervisory relationship they have. They should also reflect on influential they can be for their early career colleagues who will certainly be strongly influenced by their behaviour, good or bad.

**But what happens if women do report such an incident**, either via formal procedures or informally to a colleague? Do most scientist know what they would do or advise in this circumstance?

This was the subject of Q10. What the results show is that some men and women some seem confident about what they should do, but many others not. Early career respondees seem far less certain than their senior colleagues about what they should do. In particular the fact that less than 20% of early career men would know what to do compared to 64% of senior men is rather striking. Reasons for this might be in the nature of the respondee's current role. Senior respondees are more likely to have dealt with such cases in a formal capacity as part of their leadership role. Nevertheless, in response to Q20, 80% of respondees said that they had some level of line management or supervision responsibility, including

many of the early career men. It is therefore important that these men know what to do in such circumstances.

A range of responses is perhaps expected due to the very varied level of formal training on sexual harassment issues in different institutions in Europe. Some respondees have probably receive quite clear formal training from their home institution (particularly if they are in leadership roles), while others have likely received none at all. Of the four respondees who work in Industry, three reported neither agreeing nor disagreeing with the statement, and only one reporting agreeing. This is perhaps surprising as industrial employers would be expected to have more rigorous training in place. Thus either there is no formal training for employees, either in university or in industry, or the formal training they undergo is ineffective, undermined by the actual day-to-day behavior of colleagues, or there is little trust in instutitional procedures.

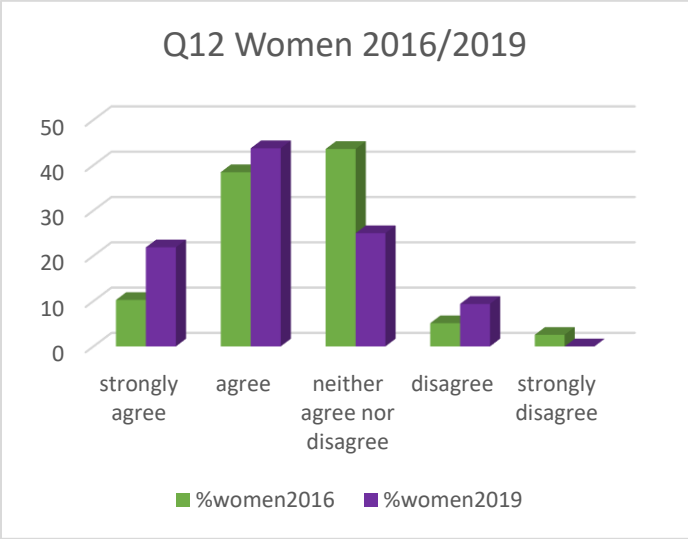
Finally, another suprising result is seen when examing the opinions of respondees with greater than ten years since tenure (which we will call “very” senior). One might think that these respondees are the most likely to have senior leadership roles beyond leading their own research groups (eg head of department etc), and therefore most likely to have formally encountered such issues. However, while 65% of very senior men reported being confident of knowing what to do, most senior men report not knowing of any incidents personally. In contrast, 45% of very senior women disagree that they would know what to do. The response to Q11 showed that over half of the senior women report knowing a large number of people that have experienced harassment. The fact that these women report not knowing what to do points to either a lack of formal procedures to deal with such incidences, or a lack of confidence in such formal procedures.

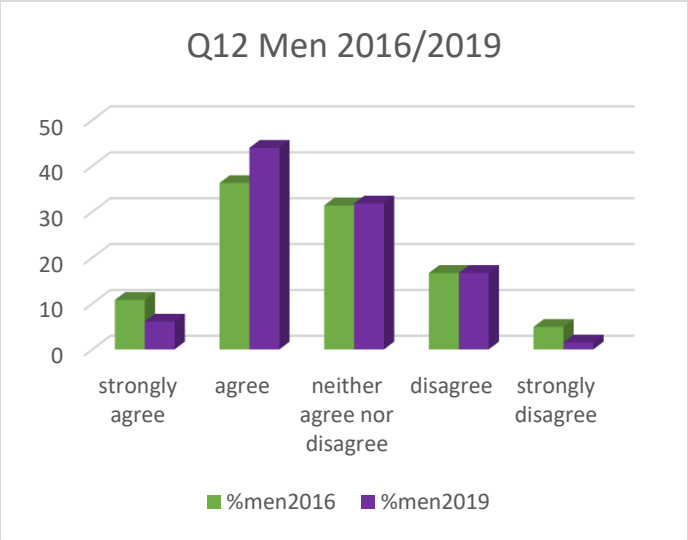
We suggest that the issue of sexual harassment in the scientific community deserves immediate attention. We recommend:

- A **review of instutition policies towards reporting of sexual harassment**, taking into account the privacy of all parties concerned and the effect on careers of reporting the harassment. Are current policies effective? Does everyone know how to implement these policies?
- **Raising awareness and a discussion** of what is and is not acceptable behavior in the workplace that involves women and men to contribute their views with equal voice. In addition, a discussion of existing institutional policies will reveal why many seem to be so ineffective.

An important issue to note when beginning to tackle these issues is that any discussion sessions need to be conducted very carefully. In particular, women who have experienced sexual harassment are unlikely to wish to discuss their experiences widely with their male colleagues. An open letter to the community addressing exactly this issue proposes some alternative ways of gathering information and opinions about this difficult but important issue [18].

## 3.12 QUESTION 12: I BELIEVE THAT THIS COST ACTION COULD CONTRIBUTE SIGNIFICANTLY TO ADDRESSING GENDER EQUALITY ISSUES IN MY FIELD.

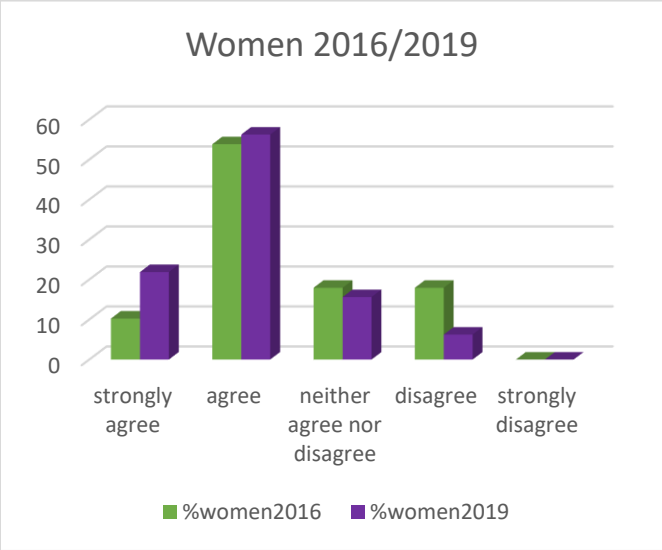


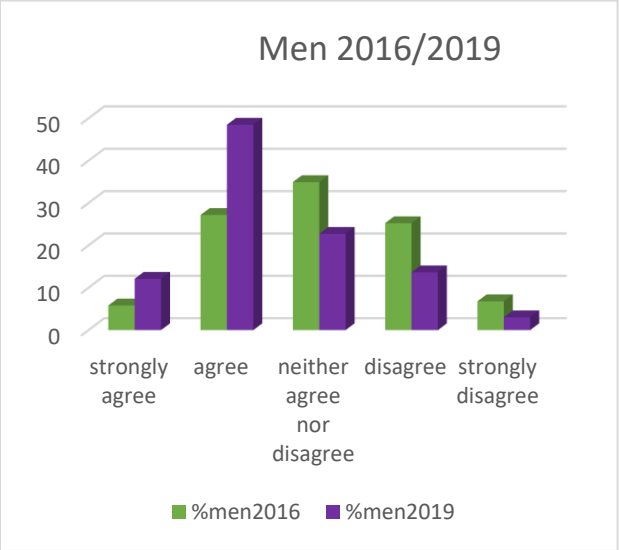




| | Women 2016 | Men 2016 | Women 2019 | Men 2019 |
|---|---|---|---|---|
| **strongly agree** | 4 | 11 | 7 | 4 |
| **agree** | 15 | 37 | 14 | 29 |
| **neither agree nor disagree** | 17 | 32 | 8 | 21 |
| **disagree** | 2 | 17 | 3 | 11 |
| **strongly disagree** | 1 | 5 | 0 | 1 |
| **total** | **39** | **102** | **32** | **66** |

- In 2016 approximately half of women and men felt that this COST Action could contribute to gender equality in the field. This number has not changed in 2019.
- The number of women that feel they strongly agree with the statement has increased, while the numbers neither agreeing nor disagreeing has decreased.

## 3.13 Question 13: I personally undertake activities to support gender equality (eg mentoring, raising awareness, gender specific outreach)




| | Women 2016 | Men 2016 | Women 2019 | Men 2019 |
|---|---|---|---|---|
| **strongly agree** | 4 | 6 | 7 | 8 |
| **agree** | 21 | 28 | 18 | 32 |
| **neither agree nor disagree** | 7 | 36 | 5 | 15 |
| **disagree** | 7 | 26 | 2 | 9 |
| **strongly disagree** | 0 | 7 | 0 | 2 |
| **Total** | **39** | **103** | **32** | **66** |

- **Many more men (60%) reported personally undertaking activities in 2019**, compared to 33% in 2016
- Women reported a slightly increased level of engagement in 2019 (78%) as in 2016 (64%).

Respondents were invited to give details of actions they undertook. A summary of common responses were:

Women: 14 gave details. These include:

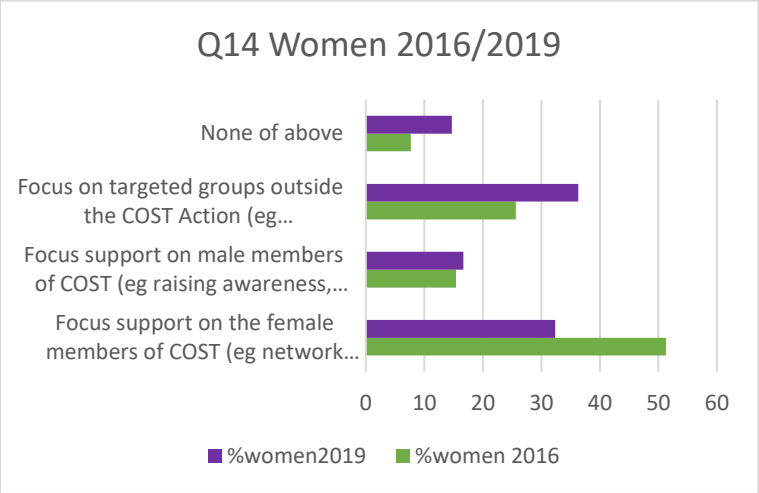
- 8 reported mentoring early career (female) colleagues or students, either formally or informally
- 4 women report raising awareness of gender issues
- 4 women reported running or being involved in formal networking events
- 5 reported formal leadership roles involving gender balance activities
- 2 reported female specific outreach events

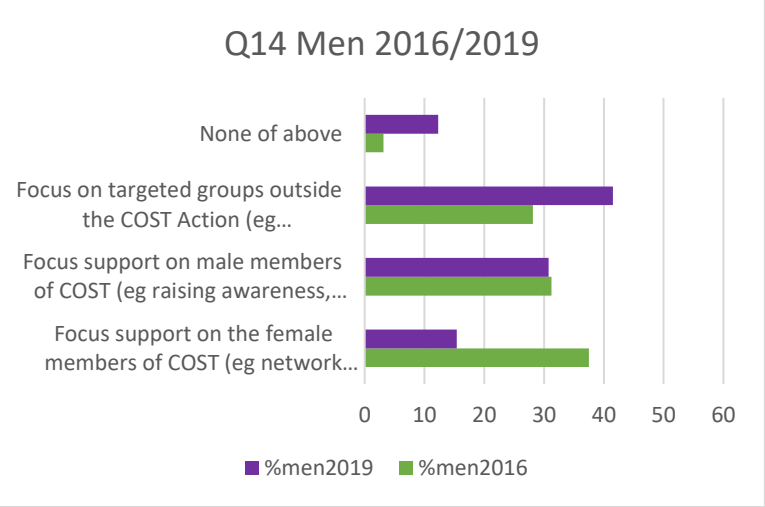
- 1 reported taking care of gender balance for organised events

Men: 20 gave details. These include:

- 5 men reported mentoring early career female colleagues
- 4 men reported striving to achieve gender equality in their group
- 5 report raising awareness of gender issues in general
- 3 report checking their own unconscious bias
- 3 reported formal leadership roles involving gender balance activities
- 3 reported running outreach events.

## 3.14 QUESTION 14: IF WE WERE TO FOCUS EFFORT ON ONE ACTIVITY TO IMPROVE GENDER EQUALITY IN THIS COST ACTION IT WOULD BE:

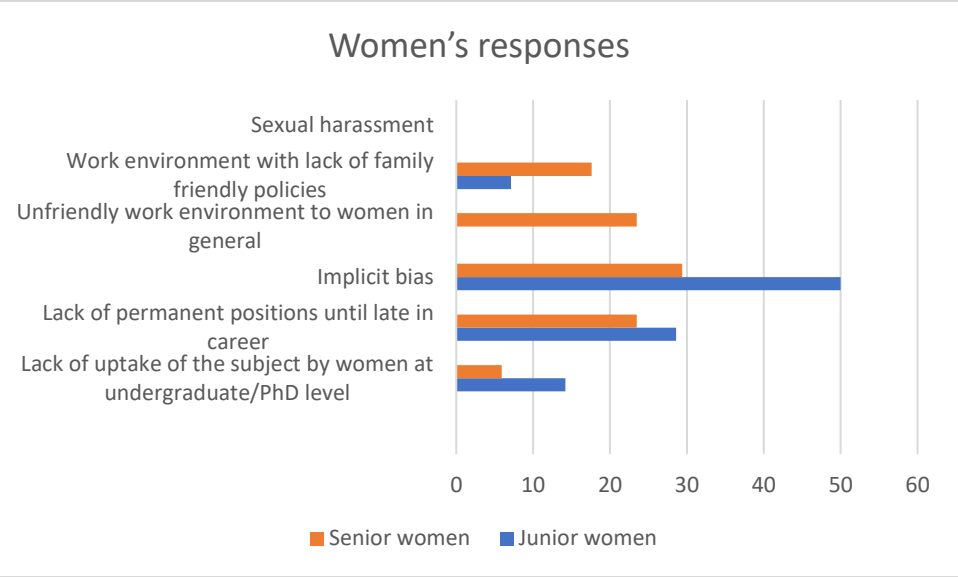


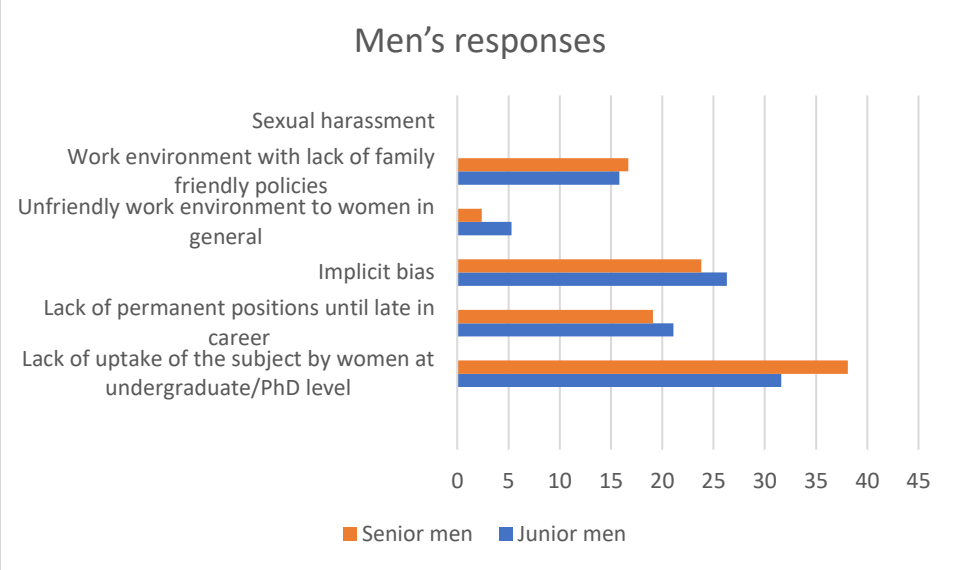




| | Women 2016 | Men 2016 | Women 2019 | Men 2019 |
|---|---|---|---|---|
| **Focus support on the female members of COST (eg network training, mentorship, leadership training)** | 20 | 33 | 12 | 10 |
| **Focus support on male members of COST (eg raising awareness, providing leadership training)** | 6 | 17 | 10 | 20 |
| **Focus on targeted groups outside the COST Action (eg undergraduates, policy makers, schools)** | 10 | 37 | 9 | 27 |
| **None of above** | 3 | 15 | 1 | 8 |
| **Total** | **39** | **102** | **32** | **65** |

- In 2019 both genders now believe that the **focus should be on policy makers, undergraduates and schools**, while **in 2016 both genders believed the focus should be on women**.
- In both years, more men than women felt that the need for focus on training of male members was important.
- Only 15% of men felt that a focus on women is important in 2019, halved from 32% in 2016.
- Similarly, over **half of women (51%) believed that women should be the focus in 2016, while in 2019 this number reduced to 32%.**

QUESTION 15:WHAT DO YOU BELIEVE IS THE SINGLE MOST IMPORTANT FACTOR IN THE LACK OF GENDER EQUALITY IN THE AREA OF NANOSCALE QUANTUM OPTICS?



| | Early career women | Senior women | Early career men | Senior men |
|---|---|---|---|---|
| | | | | |
| **Lack of uptake of the subject by women at undergraduate/PhD level** | 2 | 1 | 6 | 16 |
| **Lack of permanent positions until late in career** | 4 | 4 | 4 | 8 |
| **Implicit bias** | 7 | 5 | 5 | 10 |
| **Unfriendly work environment to women in general** | 0 | 4 | 1 | 1 |
| **Work environment with lack of family friendly policies** | 1 | 3 | 3 | 7 |
| **Sexual harassment** | 0 | 0 | 0 | 0 |
| **TOTAL** | **14** | **17** | **19** | **42** |

- There is a huge difference in the opinions of men and women for this question
- The most popular choice for men (30%) was a lack of uptake at undergraduate level. In contrast only 6% of women felt this was the most important reason.
- Implicit bias was felt to be the most important reason by women: in particular 50% of early career women chose this.
- While 23% of senior women felt that the general environment for women was unfriendly, only 1% of senior men, their peers, felt that this was the most important reason.

A section for free comments was added to this section. The comments received are given below:

(female, one comment): *Lack of role models*

(male, 6 comments):

1. *Implicit bias is also a factor I fear. At my institute, women tend to leave academia right after PhD. I am not sure whether this is because for instance the uncertain prospects is a deterrant, or if there is an implicit bias in our mentoring of students. Implicit bias is usually understood to mean "when hiring staff". I am concerned it could also mean "day to day when mentoring, without any groupleader being (made) aware"*
2. *Lack of take-up and encouragement for natural sciences by girls in school (starting in pre-school, all across high-school)*
3. *Very competitive and requiring more committment than some people can or want to give. Often requires long hours in the lab which can not be done elsewhere (e.g. at home like email in the evening)*
4. *too few women in the field*
5. *the problem starts at the high school level*
6. *I'm afraid I object to the silent conflation of perceived gender equality and equal opportunity here. It is certainly true that there are more men than women in this field, but the question implies that they are somehow unequally treated which is certainly not true in my working environment and statistically is largely untrue in the 'western' world. A less loaded question would talk about the disparity in numbers between men and women.*

**Discussion: Q's 12-15**

These four questions concern the major reasons for gender inequality in NQO and STEM in general, what and who should be the main focus of intervention, and what interventions and activities responders personally report.

**It is important at this point to reiterate what well-known and large-scale studies say are the reasons for gender inequality and what interventions do and do not work in order to contrast them to these views**.

First of all let us consider the underlying reasons for gender inequality, the subject of Q15. In fact, the gender studies literature does not give one definitive reason for gender inequality in STEM subjects. However we can nevertheless make several observations. First of all, one should **differentiate between "horizontal" and "vertical" gender segregation**. Horizontal segregation describes the gender segregation at entry level for different disciplines (eg STEM undergraduate intake being dominated by men, and humanities being dominated by women). This is one cause of gender segregation. However, perhaps more important, and easier to influence, is "vertical" segregation. This is the very well-documented phenomenon [10] that **regardless of gender distribution at entry level, the percentage of women decreases with seniority across almost all sectors**. For example in the UK, only 12% of primary school teachers are men, but men make up 32% of the senior management and 23% of primary school head teachers are men. While there is not one clear cause of vertical segregation, many incidences of implicit bias against women indicate that this is an important cause. Second, whether motherhood in particular has a negative effect is unclear in the literature. But studies have shown that in fact the largest effect of motherhood on career might be a negative implicit bias against mothers (with studies showing that **while mothers are *considered* to be less committed after having children, the reverse is true for men with children [19,20]**).

Is this knowledge reflected in the response to Q15? **Only 6% of women** felt that taking up the subject at undergraduate level (horizontal segregation) **was the main cause of gender inequality, but 38% of senior men still believe this is the main issue**. In contrast 50% of early career women believe that implicit bias is the most important issue, while about 20% of both men and women cited lack of family friendly polcies as the main cause. In fact, answers to Q8 regarding mothers' experiences showed a mixed opinion about whether motherhood had a negative effect. Finally, no-one selected sexual harassment as being the main cause. In fact, as we have discussed sexual harassment is widespread and in individual cases has caused many women to give up their careers in their chosen subject, thus while it may not be the most important cause, it likely has more impact that one might realise at first.

Next we consider the activities of the community as a whole and the actions of individuals. The good news is that at least half of the COST Action NQO members had confidence that the COST Action could contribute significantly to gender equality issues and only a minority disagreed. In terms of what actions would be most beneficial, the answers have changed from 2016, where most felt that the focus should be on female COST members, with a focus on men being the least popular option. In our report in 2016 we reflected that there is **well-documented evidence that targeting senior men at the top of organisations is by far the most effective intervention.** The McKinsey study [10] shows that three interventions are important: (i) the institution should make gender equality one of its top three goals, (ii) mentorship programmes between senior men and early career women are very effective, giving women access to the

senior man's network and making senior men aware of barriers faced by early career women (iii) task forces to look at specific institutional barriers for early career women.

**In 2019 the opinions reported had changed on this topic**. While women continued not to perceive the importance of raising awareness amongst men (suggesting a focus on women), **many more suggested that targeting areas outside COST should be the main focus**. Whether there is evidence that focusing outside of one's own immediate environment is effective is questionable. For instance, a focus on girls in schools by academics is now known not to be effective overall: the academic to schools ratio is too low to make a considerable impact and in addition will not impact on vertical segregation. However, impact on policy makers may have considerable impact. **One of the important interventions that can be made is to carefully examine institutional barriers**. In the field of NQO, this includes not only universities and companies but also funding bodies and professional bodies. This is reflected in earlier answers to Q3 where women reported the perception of an unequal environment at conferences.

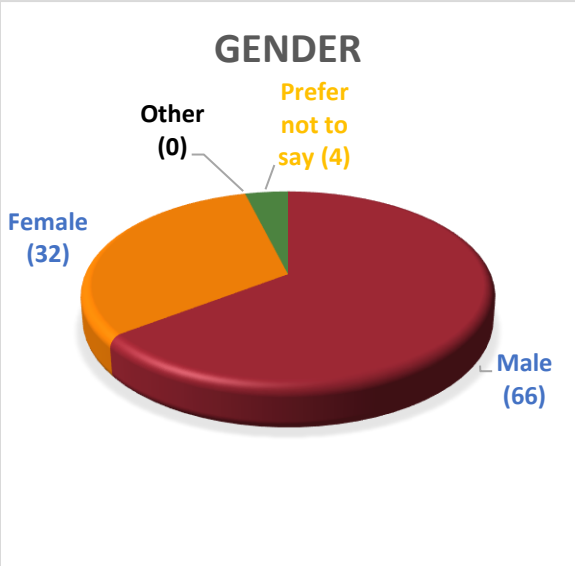
Finally, we now address how engaged women and men are personally in gender equality issues. It is very promising **that the precentage of men reporting being actively engaged in activities to support gender equality has increased dramatically**. From a much lower level in 2016**, the level of men's engagement is almost at parity with women's in 2019**.

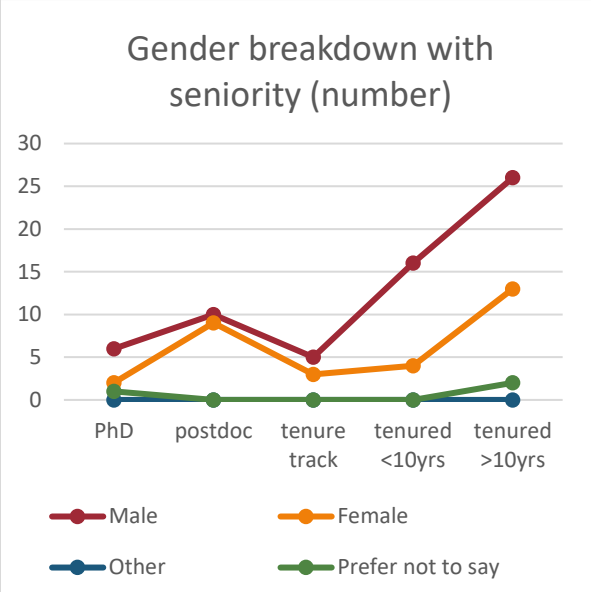
In 2016 we noticed that while more women reported being active engaged than men, none of the women reported activities such as trying to counteract bias in recruitment and in running of events such as conferences, whereas many men reported undertaking these types of activities.

In 2019 we notice more balance: women as well as men report more formal roles in gender balance activities, such as on committees, awareness raising and checking unconscious bias. **We still notice a larger number of women than men reporting mentoring early career women**. This is perhaps not surprising, as they are able to discuss female specific issues, the most obvious of these being family and maternity issues. However, it is still very important that the mentoring of early career women is not left to senior women only. Senior men can offer a great deal of useful experience and insight to almost all aspects of their roles that are not gender specific, and it is a good sign that 5 men say they mentor women. It should also be noted that mentorship is not just a one-way street. **Many men who report mentoring early career women note that they have increased awareness of the issues that their mentees face [10]**. Finally, it is important to ensure that senior women also mentor early career men. When early career men are aware of women in leadership roles it can counteract much of the unconscious bias that stops women being considered for leadership roles: this is important for when these early career men take on leadership roles themselves.

# 4 WHO ANSWERED THE SURVEY?

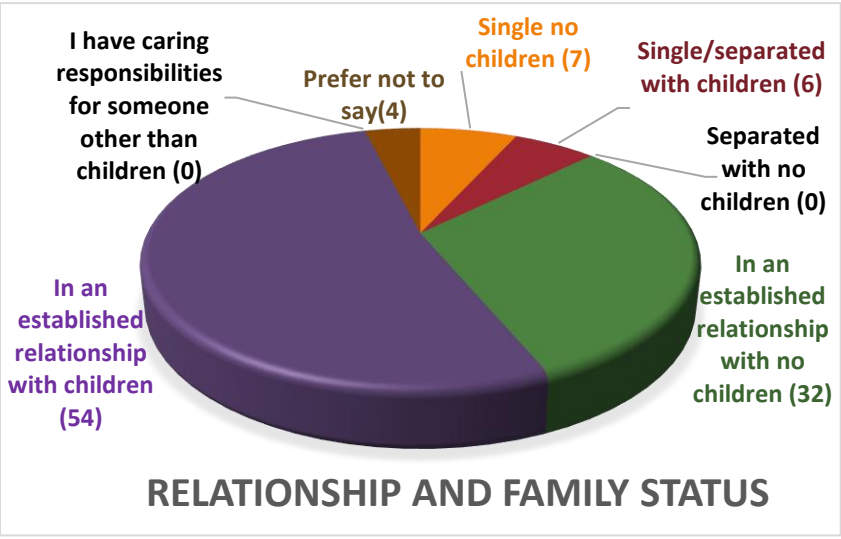
**Gender:**

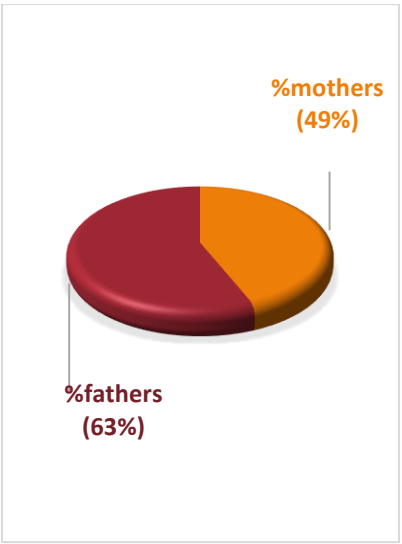



Women represented 31% of the 103 respondees. We believe that approximately 15-20% of the overall COST NQO membership is female, this therefore represents an overrepresentation of women compared to this number. There is no evidence for the drop off in numbers of women with seniority as seen in STEM overall, but this is likely again due to the self-selective nature of the study.

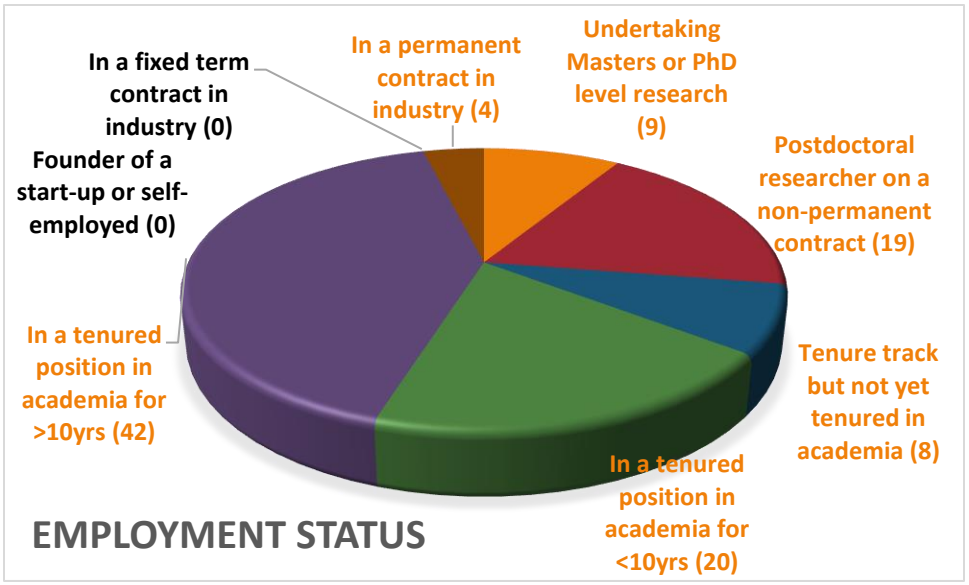
**Relationship and family status:**



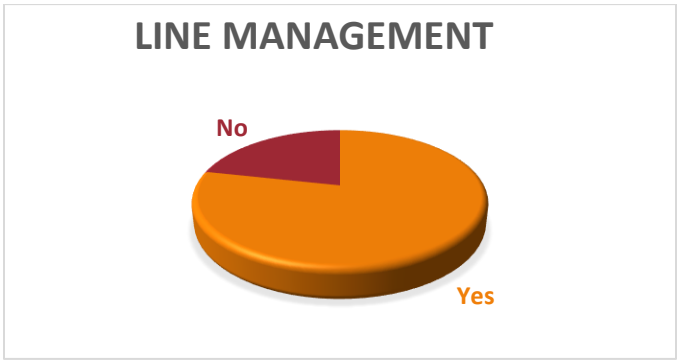




An overwhelming number of respondees were in an established relationship, most with children. The percentage of men who are fathers is somewhat larger than the percentage of women who are mothers. Relationship status is important and respondents report this affects their career, as we saw in Q6.

**Employment status and seniority:**




Most of our respondents were senior academics: approximately two thirds has a permanent position.




Approximately 80% of the respondents said that they were responsible for line management. This includes some postdocs and even PhD students. Line management is important when it comes to issues such as reporting sexual harassment.

# 5 SUMMARY OF FINDINGS AND RECOMMENDED ACTIONS

**FINDING 1**: Early Career women, particularly those at postdoctoral stage, report a perception of inequality at conferences and other scientific meetings.

**ACTION:** The pan-European Quantum Technologies Flagship should take swift action to investigate this phenomenon in more detail. Early career women should be consulted to investigate in more detail the reasons for this perception of inequality. An action plan to counteract issues arising should occur within the next 12 months, with recommendations to be made to stakeholders, i.e. funding bodies, journal editors, conference organisers etc.

**FINDING 2**: Sexual harassment is commonplace, with anecdotal evidence suggesting that this occurs mainly to women in the early stages of their careers. Formal procedures to deal with harassment are not well-understood by much of the community.

**ACTION**: Institions should first act to ensure that the formal procedures in place are fit for purpose and well-understood by all the community. All members of the community (women and men) should be consulted (with caution in format, see [18]) to identify barriers to reporting harassment and ensure fair processes arise. Conference organisers should consider procedures for harassment events at conferences.

**FINDING 3**: Men as well as women report an effect on their career when starting a family, particulary during the early stages of their career.

**ACTION**: Funding bodies should consider providing specialist support for all parents, particularly for those without tenure. The unwritten requirement for early career scientists to demonstrate mobility before the independent career stage should be carefully reconsidered by universities and funding bodies. We suggest considering instead a requirement to demonstrate “mobility of ideas” rather than location. We also suggest that lack of mobility can slow down progress in a career (lack of mobility may result in fewer opportunities to work in well-established labs around the world), and so age limits and limits on years after PhD on fellowships (eg ERC grants) should be reconsidered. Such an action would be similar to that taken in the DORA Declaration [21] that acts against the use of impact factor for funding, application and promotion considerations.

**FINDING 4**: After several sessions on the issues in gender equality in STEM, the number of men reporting taking part in gender balance activities is now on a par with the number of women.

**ACTION**: We believe these results show that our methods, i.e. widespread awareness-raising and direct engagement of the whole community in addressing the issues is effective in engaging the whole community. These methods can be used in many scientific communities.

# 6 About the Authors

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**Dr Döndü Sahin** is a Lecturer at the Quantum Engineering Centre for Doctoral Training at the University of Bristol, UK. After obtaining her PhD at the Technical University of Eindhoven on waveguide-integrated superconducting nanowire single photon detectors, she moved to University of Bristol as a Marie-Curie researcher, and her research contributes to the integrated single photon detectors and filters. She has organised several conferences including a young scientists conference on quantum information with photons in 2016. She participated in the 66th Lindau Physics Nobel Laureate meeting and was awarded a Marina van Damme grant.

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