NIST Technical Note 2143

Voices of NIST: A Study of Gender and Inclusivity

Findings from In-depth Interviews

Mary F. Theofanos Sandra Spickard Prettyman Jasmine Evans Susanne Furman

This publication is available free of charge from: https://doi.org/10.6028/NIST.TN.2143



NIST Technical Note 2143

Voices of NIST: A Study of Gender and Inclusivity

Findings from In-depth Interviews

Mary F. Theofanos Office of Data and Informatics Material Measurement Laboratory

> Sandra Spickard Prettyman Culture Catalyst, LLC

Jasmine Evans Susanne Furman Information Access Division Information Technology Laboratory

This publication is available free of charge from: https://doi.org/10.6028/NIST.TN.2143

March 2021



U.S. Department of Commerce *Gina M. Raimondo, Secretary*

National Institute of Standards and Technology James K. Olthoff, Performing the Non-Exclusive Functions and Duties of the Under Secretary of Commerce for Standards and Technology & Director, National Institute of Standards and Technology Certain commercial entities, equipment, or materials may be identified in this document in order to describe an experimental procedure or concept adequately. Such identification is not intended to imply recommendation or endorsement by the National Institute of Standards and Technology, nor is it intended to imply that the entities, materials, or equipment are necessarily the best available for the purpose.

National Institute of Standards and Technology Technical Note 2143 Natl. Inst. Stand. Technol. Tech. Note 2143, 74 pages (March 2021) CODEN: NTNOEF

> This publication is available free of charge from: https://doi.org/10.6028/NIST.TN.2143

Abstract

In the fall of 2019, the National Institute of Standards and Technology (NIST) funded threes studies to better understand equity and inclusivity. This report documents phase two of a three phased sequential, exploratory mixed methods study designed to provide an in-depth look at the population of NIST federal employees to identify factors, attitudes, and processes that might result in gender- specific barriers at NIST. Phase 1 analyzed human resources demographic data, compensation data, and performance data of NIST federal employees from 2011 to 2019 to determine any relevant trends. Phase 1 informed the development of an in-depth interview protocol designed to identify the differences, if any, in the ways in which men and women experience work at NIST. A total of 40 (36 female and 4 male) participants were interiewed.

Three interconnected themes emerged in the data: 1) a culture at NIST that creates a "Chilly Climate" for women; 2) gendered experiences that contribute to and are outcomes of that chilly climate; and 3) gendered outcomes that influence women's experiences in the organization. The culture has evolved from NIST's scientific roots, scientific excellence, a strong belief in mertitocracy, and as a Federal agency. Each of these characteristics contribute to a gendered social structure and the perception that change is not needed. This backdrop sets the stage for the characterizations of NIST from the interviews as a "Boys' Club" and an "Elitist" environment. The radically different perspectives of men and women based in the culture result in experiences and outcomes that provide advantages and opportunities for men while erecting barriers to survival for women, including isolation and possibly exclusion. These barriers result in consequences of discrimination as well as lack of trust and resignation. Participant quotes are used as exemplars to provide details related to each of these themes. Overall, the interviews demonstrate that women and men experience a very different NIST.

Key words

Diversity, Inclusivity, Gender, Interviews, Qualitative, Women

Table of Contents

1.	INTRODU	ICTION	1			
1	.1. BAC	KGROUND	1			
1	.2. GEN	DER RESEARCH AT NIST	2			
1	3 GEN	DER CONTEXT: DEMOGRAPHICS TODAY AT NIST	<u>רייי</u> ביייי			
-			5			
2.	RESEARC	H DESIGN	4			
3.	METHOD	S	5			
3.1. SAMPLING STRATEGY						
3	3.2. PAR	TICIPANT DEMOGRAPHICS	6			
	3.2.1.	Data Collection	8			
3	3.3. DAT	A ANALYSIS	9			
	3.3.1.	Qualitative Coding	9			
	3.3.2.	Thematic Analysis	. 10			
4.	RESULTS		10			
			11			
-	A 1 1	Pooted in Maritagragy	. 11 12			
	4.1.1.	Rooted in Meritocracy	. 12			
	4.1.1.1	Meritocracy and Hiring	14			
	4.1.1.2	Meritocracy in Performance Evaluations	15			
	412	The Role of Flitism	17			
	4121	Prestige-Maximizing in Hiring	. 10			
	4.1.2.2	Prestige Across NIST	10			
	4.1.2.3	Elitism of Academic Degrees and Discipline	20			
	4.1.3.	Based in "Science"	. 22			
	4.1.3.1	Excellence and Intellect: We Can Figure This Out	22			
	4.1.3.2	Objective and Rational: Visions of a Scientist or Leader	23			
	4.1.3.3	Science as Competitive	24			
	4.1.4.	Dominated by Patriarchy	. 24			
4	.2. GEN	DERED EXPERIENCES	27			
	4.2.1.	Micro-Aggressions	. 27			
	4.2.2.	Unwanted Physical Attention	. 28			
	4.2.3.	Gendered Harassment				
	4.2.3.1	Comments on Appearance and Dress	30			
	4.2.3.2	The Subtle Put Downs	31			
	4.2.3.3	Lack of Respect	32			
	4.2.3.4	Questioning Competence	33			
	4.2.3.5	Isolated and Invisible	34			
	4.2.3.6	The Mommy Track	35			
	4.2.3.7	Housekeeping Chores	36			
4	.3. GEN	DERED OUTCOMES	. 37			
	4.3.1.	Hiring and Promotion: Getting There and Moving Up	. 37			
	4.3.2.	Equal Pay and Equal Opportunity	. 39			
4	.4. Wн	Y WOMEN CHOOSE NOT TO REPORT	. 40			

4.5.	THE FALSE IMAGE OF A GENDER-NEUTRAL WORKPLACE: THE DEVELOPMENT OF GENDER FATIGUE	43					
4.6.	THE BOYS' CLUB VERSUS THE CHILLY CLIMATE	44					
5. DISC	CUSSION	46					
6. CON	ICLUSION	48					
6.1.	NEXT STEPS	51					
ACKNOWLEDGEMENTS							
REFEREN	CES	52					
APPENDIX A. RESEARCH DESIGN							
PROBLE	M, PURPOSE, AND RESEARCH QUESTIONS	54					
RESEAR	CH DESIGN	54					
APPENDIX B. METHODS							
APPENDIX C. QUALITATIVE AND QUANTITATIVE METHODOLOGICAL DIFFERENCES							
APPENDIX D. INTERVIEW QUESTIONS							
APPENDI	K D. INTERVIEW QUESTIONS	51					
APPENDIX APPENDIX	X D. INTERVIEW QUESTIONS	51 52					
APPENDIX APPENDIX APPENDIX	X D. INTERVIEW QUESTIONS	51 52 53					

List of Tables

Table 1. Participant Representation by OU (N=40)	7
Table 2. Overview of Data on Desired Outcomes as Stated by Participants	48
Table 3. Quantitative Versus Qualitative Definitions	58

List of Figures

Figure 1. FY 19 NIST Employee Population by Career Path (N=3,334)	4
Figure 2. Number of Interviewed Participants by Years of Service (N=40)	7
Figure 3. Number of Interviewed Participants by Career Path and Pay Band (N=40)	8
Figure 4. Model of Results	10
Figure 5. Depiction of Gendered Harrassment	28
Figure 7. Phases of Research Design	55
Figure 8. Iterative Nature of Qualitative Process	56

1. Introduction

The term diversity is broad and far-reaching and can refer to a variety of different dimensions or characteristics that contribute to identity, such as gender, race, ethnicity, age, or social class, among others. Today, research shows there are many benefits that a diverse workforce brings, including enhanced creativity and productivity [1] [2, 3]. A diverse workforce does not imply that all groups and/or individuals have similar experiences or have access to equitable opportunities, treatment, and outcomes.

While there are many populations at the National Institute of Standards and Technology (NIST) that could benefit from a study examining diversity, equity, and inclusivity, this project focuses specifically on gender. The gender gap is well-documented in science, technology, engineering, and mathematics (STEM) with respect to numbers in the workforce, especially in senior positions, but also with respect to salaries and opportunities for advancement [4]. Without interventions, the gender gap in computer science, physics, and math will not reach gender parity this century [5].

Women in STEM still experience a "chilly climate" [6] that continues to affect their work experiences. In general, women working in STEM today contend with organizational cultures, structures, and practices that construct barriers to their advancement and acceptance as professionals. To combat these barriers, it is imperative to understand how men and women experience the workplace at NIST. As a metrology institute, NIST depends upon data to understand phenomena. This project applies a qualitative methodology to collect data examining how NIST Federal employees experience work at NIST, and the role that gender discrimination might play in their experiences. Qualitative data can help provide insight into whether and how gender discrimination operates at NIST and the effects it has on how NIST Federal employees experience work. The goal of this study is to provide data that can help NIST achieve its goal of gender equity and inclusivity and realize the many benefits that a gender-diverse workforce brings.

1.1. Background

Today most US organizations have policies and procedures in place to combat *active* discrimination. However, most of today's discrimination against women is subtle, referred to as *second-generation* discrimination due to the lack of discriminatory intent. This "bias erects powerful, often invisible barriers for women that arise from cultural assumptions and organizational structures and practices" [7]. Research has demonstrated that both implicit and explicit bias influence women entering STEM fields in many ways, from obtaining a position, to managing family obligations, to even leaving the field [4].

Gender biases are generally attributable to stereotyping and belief systems. Some of these belief systems underpin conduct of science itself, such as beliefs in meritocracy and objectivity. As scientists and engineers, we take pride in the objectivity and neutrality of our disciplines, and we believe we advance only those individuals with exemplary talent and dedication. We assume that those with the requisite training, experience, and drive will succeed in a meritocratic society, while those who do not succeed have only themselves to blame. Yet the processes and procedures implementing meritocracy introduce bias. Consider for example performance-based evaluations and merit-based pay plans and bonuses—a study of technology companies' performance reviews found differences in adjectives that describe women and men. Women were described as bossy, abrasive, strident, aggressive, emotional, irrational, and unpredictable. In fact, some reviews advised women to watch their tone, to step back, or back off [8]. Perez refers to this inequity as the "myth of meritocracy" [8].

Bias has many forms. Williams [9] interviewed 60 women scientists and surveyed 557 women in science. They identified 5 biases that women face in the workplace: the need to continually prove their competence; the struggle between femininity and masculinity; the maternal wall; the competition among women for the one opportunity for women; and the isolation from being one of a few women on the team.

Micro-inequalities also contribute to second-generation discrimination. Rowe defines micro-inequalities as "Tiny, damaging characteristics of an environment that affect a person not indigenous to that environment" [7]. For example: women in meetings and on panels get interrupted and cut off by their male counterparts; thus, women's ideas and comments are not heard. Of course, that assumes there is a woman on the panel. Research shows that women are offered fewer opportunities to participate. Women receive fewer speaking invitations, fewer invitations to sit on panels, fewer editorial board positions, and fewer editor positions than men [4] . In many STEM organizations, publications are critical in evaluating performance and success. Studies have found that women are less likely to receive authorship credit and more likely to experience harsher peer reviews. Papers with women as first or last authors are cited less than those with men as first or last authors. Men are also more likely to receive first authorship or last authorship than female colleagues. Men's papers are accepted to more prestigious journals and men are more likely to be invited to serve as reviewers. Finally, the composition of review panels also influences rejection rates. All-male reviewing panels are more likely to reject papers from women[4].

Many organizations that have embarked on diversity and inclusivity initiatives are sharing their strategies and lessons learned [10, 11]. Diversity and inclusivity representatives from Microsoft, Google, Amazon, Facebook, and Uber participated in panel discussions at the 2020 Grace Hopper Conference and at the National Academies' 2020 workshops on the underrepresentation of women in color in STEM. A key component for success in *all* of these organizations is continuous data collection and monitoring across all of the phases of program implementation with a particular focus on recruitment, retention, and advancement of women. The first step in promoting systematic changes to address gender inequities is to understand the problem by measuring and establishing a baseline of the organization, without which it is impossible to establish measurable goals. The organization must then continue to monitor both qualitatively and quantitatively to measure against the goals.

1.2. Gender Research at NIST

NIST leadership has recognized the underrepresentation of women and minorities for at least 30 years. In July of 1992, NIST Director Lyons wrote "I am not comfortable with our progress in correcting underrepresentation ... in two areas – women and African -Americans" [12]. Given these concerns, Dr Lyons established two ad hoc committees at NIST: one to address the gender-gap of women in the scientific and engineering fields and another to address the disparities for African-Americans at NIST [13].

The Ad Hoc Affirmative Employment Committee for Female Scientist and Engineers was composed of seven members and was chaired by Katharine Gebbie, Director of the Physics Laboratory. The report [12] presented by the committee in August 1993 was based on a survey of all women in the Scientific and Engineering (ZP) career path. The committee found that in 1992, women represented 32% of the total workforce at NIST. At the time, there were 310 women in the ZP career path (14%), and of these, 6% had PhDs. At the time most women in the ZP track at NIST were in band II or III, and most of the women with PhDs were ZP-IIIs. Women held few leadership positions. Only 10% of all Division Chiefs were women, and

in the technical laboratories only 6% of the Division Chiefs were women. Women held just 4% of the Senior Executive Service (SES) positions.

The 1993 survey found that 79% of the women surveyed were satisfied with their jobs and would recommend NIST to other female scientists for employment. But only one-third believed they had equal opportunities and the same professional future as their male colleagues.

The committee had three primary recommendations, which are still relevant today.

- 1. Top management should demonstrate commitment to diversity both in word and in deed
- 2. Training in diversity should be required for all line managers and recommended for all staff
- 3. Each Organizational Unit (OU) should be held responsible for developing and implementing its own plan for increasing the representation of female scientists and engineers and for ensuring equal opportunity for advancement.

The committee recognized that: "If NIST is to meet its new challenges, it must embrace a diverse work force and take advantage of the best talent regardless of race or gender. To exclude or discourage half the population from contributing is a waste of potential resources that the U.S. can ill afford [12]. This may be even truer today, as the competition for research scientists in STEM has increased [14].

Since this report in 1993, much has been done to address the underrepresentation of women at NIST. Progress has been made on many of the of the recommendations including a focus on training and awareness about diversity, the implementation of NIST Diversity Day and the NIST Diversity Award, the establishment and encouragement of employee groups such as the NIST Committee for Women (NCW), the NIST Association for Black Staff (NABS), the Association of NIST Asian Pacific Americans (ANAPA), NIST & NOAA Pride Group, and the identification of core values such as inclusivity.

Despite all these efforts, the core value of inclusivity is still aspirational at NIST, in part, because to date the focus has been on superficial change rather than substantive cultural change. NIST still has a long road ahead to truly achieve the goal of inclusivity as evidenced by the current data on the underrepresentation of women and minorities, the feeling of resignation of many women that the situation will never really change, and the emphasis this year on many projects studying diversity, equity, and inclusivity at NIST. It is past time for NIST to change its culture.

1.3. Gender Context: Demographics Today at NIST

As of fiscal year 2019 there are approximately 3,334 employees at NIST across Laboratory Programs (LP), Innovation and Industry Services (IIS), Management Resources (MR), and the Director's Office (DO). A review of this data shows that 65% of federal employees are male, and 35% are female. The percentage of women has been fairly consistent over the past nine years, and unchanged for almost the last 27 years when women represented 32% of the workforce at NIST in 1993 [12]. Of the 3,334 employees, 2209 are in LP (68% male, 32% female), 1027 are in MR (59% male, 41% female), 98 are in IIS (45% male, 55% female), and 85 are in DO (34% male, 66% female).

In its 120 years history, there has been only one woman Director of NIST out of 16 total Directors. In 2019, the three Associate Directors (AD) were men. (In July 2020, a woman was hired as AD for IIS.) Currently, there are 19 OU Directors, and 4 are women. There are 4 women in the Senior Executive Service (SES) out

of a total of 25. There are just 2 Scientific or Professional (ST) or NIST Fellows out of a total of 38. Of 471 supervisors, 136 are women (29%), while 335 (71%) are men. Currently, 38% of Division Chiefs at NIST are women (N=88) and 22% of Group Leaders are women (N=228). If we also examine portrayal in the notable NIST portrait gallery of distinguished scientists, engineers, and administrators for outstanding career contributions to the work of NBS/NIST just 29 (9%) of those portraits depict women out of 339 total.

To explore career paths in the 2019 data, we examined the number of men and women in each. Figure 1 shows that there is a concentration of men in SES at 85%, Senior Research Scientist or Fellow (ST) 93%, and only one Senior Level Executive (SL), a male. Women predominate in the Administrative Staff (ZA) and Administrative Support (ZS) roles at 70%, and 77%, respectively. Men also dominate NIST's largest career path, Scientific Staff (ZP), at 75%. The percentage of ZP women has increased significantly since 1993, from 14% to 25%. It should be noted that the highest representation of women is in the secretarial or ZS path. A complete analysis of the demographics for this effort is available in the phase 1 report, NIST Workforce Demographics Analysis [15].



Figure 1. FY 19 NIST Employee Population by Career Path (N=3,334)

2. Research Design

Given NIST's identity as a metrology institute and the importance it places on data and scientific rigor, this study uses a well conceptualized research design that is data-centric and multi-method in order to address the problem, purpose, and questions under study. The multi-method approach includes both quantitative and qualitative data collection and analysis, which provides a holistic view of gender at NIST today. This document focuses specifically on Phase 2, the qualitative interview phase. Phase 2 used in-depth interviews to address the following research questions:

- (R1): How do NIST employees (women and men) describe their work, the environment, and opportunities for career advancement and promotion?
- (R2): In what ways are the work experiences of women and men similar and/or different?
- (R3): What practices/systems contribute to limiting or facilitating career opportunities for women?

a. What do women find is missing in their current environment that is inhibiting success and contributing to the imbalance?

Appendix A describes the research design for the overall project.

3. Methods

Qualitative research is iterative in nature and focuses on the importance of participants' voices and perspectives to drive the research process. The process consistently returns to the research questions to inform future elements of the process, particularly data collection and data analysis. It is also constructivist in that the focus is on how participants, in this study women and men, conceptualize their worlds—based on their individual understanding as well as based on shared meanings and social constructs. A case study approach was used, which Yin defines as "an empirical inquiry that investigates a contemporary phenomenon (the 'case') in depth and within its real-world context [16]". Yin argues case study is most appropriate when exploring "how" questions where contextual conditions are relevant to the phenomenon under study. The phenomenon of study here is "experience of gender at NIST."

Appendix B provides more detail on qualitative methods. While Appendix C describes the qualitative and quantitative methodological differences and the strengths and goals of qualitative and quantitative methods.

3.1. Sampling Strategy

The approximately 3,300 federal employees at NIST differ organizationally and culturally and have different interpretations of procedures and processes as well as the influences of the different cultures of their academic disciplines. Thus, this project demands a well-thought out and rigorous sampling strategy in order to draw upon as many perspectives as possible. Since demographic factors such as age, years of service, and gender may play a role in participants' views related to diversity and inclusivity in the workplace, the sampling strategy was designed in order to obtain participants who represented a range of employee experiences.

Two approaches to sampling were used. The first approach was purposive random sampling to avoid any bias in both the selection of participants and their experiences. Using this approach, 25 participants (20 women and 5 men) were randomly selected from the human resources files of federal employees at NIST. The list was ordered by gender and then by salary. A random interval was selected and each entry at that interval was identified. From this, 20 women and 5 men were selected. A mathematical statistician in the Information Technology Laboratory (ITL) working on the project identified the interval and determined that the 25 participants were distributed appropriately across the OUs, career paths, and sites (Boulder and Gaithersburg). The randomly selected individuals were emailed to determine willingness and availability. If a total of 20 women and 5 men were not available or uninterested in participating, then an additional random search was conducted to generate additional participant names. If a randomly selected individual was recently separated from NIST and provided forwarding information that person was contacted.

The second approach applied purposeful and snowball sampling and involved reaching out to specific individuals who had either self-identified as being interested in the study or who had particular stories to tell, or they were individuals who had been recommended by others as potential information-rich cases. In these cases, the PI reached out to these individuals with information about participating in the interviews.

This resulted in an additional 25 participants (20 female and 5 male) who were contacted to participate. There were many more possible participants on this list, but the 25 participants selected were chosen because they represented information-rich cases based on their experiences or interest in improving diversity and inclusivity at NIST. These participants also represented employees across a spectrum of variables including OU, career path, and time at NIST.

The sampling plan provided for more women than men from each of two approaches since the research questions were looking for descriptions of work context and similarities and differences for men and women. Research question three specifically focused on women and looking at barriers and facilitators and what inhibits and contributes to success. Given this focus it was important to look at more women. It was also important to give "voice" to women whose voices are often ignored—one of the findings in the data.

The original sampling plan provided for 20 women and 5 men from each of two approaches. After conducting 40 interviews the data had reached saturation—the point when no new information or themes are observed in the data. Since further data collection would yield similar results, the decision was made that no additional interviews were required.

3.2. Participant Demographics

A total of 40 NIST employees across various disciplines were interviewed. The interview sample consisted of 55% (N=22) randomly selected individuals and 45% (N=18) purposeful, information-rich participants. All participants are current or recently separated NIST federal employees. Demographic statistics of the sample are presented below.

Overall, 85% of the participants, 34, were female and 15%, 6, were male. The majority of NIST staff are located in Gaithersburg, MD (84%) and Boulder, CO (15%), with less than 2% of employees being located in other duty stations. Interview participants were randomly chosen from the Gaithersburg (83%) and Boulder (18%) locations, consistent with the overall distribution of employees found at each of these locations.

NIST employees across age groups were also interviewed, providing opportunities to explore whether and how age might affect their perceptions and experiences. The majority of participants were between 40 and 49 years of age (32%), followed by 50 and 59 years (30%), 30 and 39 years (20%), 60+ years (13%), and 21 and 29 years (5%). Similarly, participants were interviewed with a wide range of years of service at NIST, from those with at least a year at NIST to those with over 30 years of service, with the largest group of participants, 25%, having 6 to 10 years of service (Figure 2). Generally, those with more years of service were often in positions of authority, having advanced during their careers. This provided valuable insights into the ways in which position might impact one's perspective related to inclusivity at NIST. Interviewing a wide variety of employees, with a diverse range of positions, responsibilities, years of experience, and other variables was intentional to address potential coverage and representation issues (Table 1).



Figure 2. Number of Interviewed Participants by Years of Service (N=40)

NIST Organization	OU	% of Interviewed Participants	% of NIST Population
Director's Office			
	DO	5.0%	2.5%
Laboratory Programs			
	LP	7.5%	2.1%
	NCNR	5.0%	4.6%
	MML	15.0%	18.2%
	CTL	5.0%	3.2%
	PML	20.0%	17.7%
	EL	7.5%	8.7%
	ITL	10.0%	11.7%
Innovation & Industry Services			
	MEPP	2.5%	1.5%
Management Resources			
	MR	12.5%	5.7%
	OFRM	7.5%	3.7%
	OAAM	2.5%	2.7%

Table 1. Participant Representation by OU (N=40)

Individuals were contacted from the randomly generated list and asked to participate in an interview. A few of the participants had left NIST, others did not respond, and several chose not to participate. In these cases, an additional random search was conducted to generate additional participant names. Participants represent the ZP, ZA, ZS, Scientific and Engineering Technician Technical (ZT), SES, SL and ST career paths. Any interviewees who were SES, SLs or STs, or Fellows were placed in the ZP-V or ZA-V category to ensure they were not identifiable. Figure 3 shows the number of participants by career path and pay band. A large number of participants were from the ZP and ZA path, with 25 (63%) and 11 (28%) participants, respectively. Similarly, a large number of participants were from pay band IV and V, with 19 (48%) and 14 (35%) of participants, respectively. These numbers reflect the population distribution at NIST. The majority of employees at NIST are in the ZP and ZA career paths. Finally, some of the interviewed participants were supervisors, while others were individuals who had recently separated or retired from NIST.



Figure 3. Number of Interviewed Participants by Career Path and Pay Band (N=40)

3.2.1. Data Collection

The in-depth, one-on-one, semi-structured interviews took place between January and March 2020. Most of the Gaithersburg interviews took place in the Visualization and Usability Group's small usability laboratory, while a few took place in individual offices. Boulder interviews took place over the phone. Each participant was provided with and signed a copy of the Informed Consent. Participants were also informed verbally that:

- their participation was voluntary,
- they could stop at any time without penalty,
- they could decline to answer any question(s),
- the interview would be audio-recorded,
- all data would be de-identified,
- the interview would take approximately an hour, and
- the study had been approved by the NIST Research Protection Office (RPO).

Participants were asked for permission to audio record the session. Only one participant declined, in this case the researcher took notes on participant responses, which the participant agreed could be used.

The audio-recordings were transcribed by an external transcription service. While participants were asked not to use names during the interviews, occasionally names (or people or locations) were mentioned. As a result, transcripts were redacted where necessary. Names of people were replaced by generic titles such as colleague, friend, or Group Leader and references to specific locations or groups were replaced with generic references.

As previously noted, 40 participants were interviewed for this project. This resulted in 37 hours of audio data, and 587 pages of transcripts. The average interview lasted approximately 55 minutes. The interview questions are provided in Appendix D and the demographic questionnaire is in Appendix E.

3.3. Data Analysis

The data for this project consist of interview transcripts, demographics, field notes, and analytic memos. The interviews and field notes provide an in-depth and overarching look at employees and their experiences at NIST in their own words. The transcripts form the major dataset for analysis. In addition, the interviewer wrote field notes related to interviews, which serve as additional data for analysis. Coding and data analysis for this study involved both individual and research team coding sessions, in order to ensure consistency in application of the codes. Finally, analytic memos were written and shared with research team members in order to explore the data more deeply, identify themes and relationships in the data, and abstract from the coded data to a more nuanced understanding of it.

3.3.1. Qualitative Coding

Qualitative data analysis is composed of two distinct activities: *qualitative coding* (or simply 'coding'), and data extraction for each code. Qualitative coding is a process of labeling sections or chunks of narrative data capturing the essence and/or salient features to group, compare, and/or manipulate similar chunks. Coding reduces the data in an organized and meaningful way.

The coding process for this study began with the development of an *a priori* code list. The *a priori* codes are a set of labels based on the research questions, relevant literature, and an understanding of the NIST environment.

Four researchers participated in coding the transcripts. Each researcher used the *a priori* codes and coded (labeled) the same four randomly chosen transcripts to ensure that the codes were being used in similar ways and to identify needs for additional codes. Identifying convergence and divergence among the researchers' coding allowed the researchers to explore the data more fully. The code book was revised, and the codes were operationalized based on ongoing discussions, ensuring that multiple points of view were captured, and that consistency was used in the process. Operationalizing a code consists of providing the definition of the code, when to use it, when not to use it, and examples for each code. Examples from the codebook illustrate the level of detail associated with each code (Appendix F).

The second step of qualitative data analysis is data extraction. Data extraction refers to a process where all data associated with a particular code are put into a separate document. This process of breaking apart the data is a technique to manipulate the data and study it in different ways, providing access to the "whole" and to the "parts" to determine whether and where relationships exist or what themes might be developing across codes.

3.3.2. Thematic Analysis

Qualitative data analysis is the process of exploring relationships within the data and the codes to identify broader themes that connect ideas and develop relationships. The use of analytic memos provides a mechanism to document themes and relationships within the data and the codes. The iterative process of going back and forth between data and codes, between the full data set and extracted data files, facilitates the identification of themes, relationships, and outlier data, and provides an overall impression and understanding of the data.

During the research team coding and analysis discussions, several concepts emerged that the team continued to explore by writing analytic memos that linked the concepts to the data. Early memos focused on how the culture of science (and thus of NIST) was built on a foundation that was perceived as neutral, but which often operated to obscure inequitable access and outcomes for women. Ideas such as meritocracy, elitism, objectivity, and patriarchy were explored as memo writing continued. Subsequent memos revolved around how these structural ideas often served to create gendered experiences at NIST that often resulted in gendered outcomes that benefit men more than women. Research team discussions of our analytic memos continued to extend our ideas about the data and resulted in a model of these relationships (Figure 4).

Qualitative research is an iterative process, where successive iterations of analysis continue to delve into the data and explore ideas. While there are many interesting and important possibilities for exploration in this data set, this report focuses specifically on the characteristics of NIST culture that contribute to gendered experiences and outcomes.

4. Results

Three interconnected themes that emerged in the data: 1) a culture at NIST that creates a "Chilly Climate [6]" for women; 2) gendered experiences that contribute to and are outcomes of that chilly climate; and 3) gendered outcomes that influence women's experiences in the organization. Figure 4 below shows how particular components of the culture at NIST contribute to gendered experiences and gendered outcomes. What is created is a "Boys' Club" for men and a "Chilly Climate" for women.



Figure 4. Model of Results

The sections below provide details related to each of these themes, using the words of participants to support the ways in which they operate within the NIST environment. The quotes used here are provided as exemplars to convey a general overview of multiple participants' perspectives and should not be viewed solely as the thoughts of a single participant. At the end of each quoted response is a notation that represents where the data can be found. The notation is composed of three parts: the first represents the participant number and whether they were from the random sample (begins with a P0) or from the purposeful and snowball sample (begins with a P1), the second refers to the gender of the participant (F or M), and the third represents the time stamp of the quote in the transcript. For example, (P101:M—5:35) refers to a quote from purposefully selected participant 101 who is a man, and the quote appears at time stamp 5:35 in the transcript. All quotes in this report are verbatim and come from the transcripts of the audio recorded interviews. They are presented in blue, indented text.

4.1. Perceptions of NIST Culture

In this section, we discuss findings from the data that describe the culture at NIST. We refer to "culture" here as the implicit and explicit customs, behaviors, norms, and values that guide an organization [17]. Things like physical structures (such as office spaces), policies (such as family leave policies), underlying values (such as meritocracy), and social norms create and perpetuate an organizational culture that shapes an employee's awareness and understanding of organizational standards and expectations, as well as of an employee's sense of belonging.

The study participants overall noted that they enjoy working at NIST, like the work they are doing, and are excited by the contributions to science that they and NIST make. Many articulated how NIST provides a good work—life balance and how they have developed positive relationships with colleagues.

If it's about my work, I am excited. Always. Yeah. (P003:F-20:48)

I mean, I'm happy. And I mean, I'm happy professionally. I like what I do. I like where I do it. (P017:F-46:23)

Okay, I think NIST is a tremendous place to work. We have lots of opportunity. We have lots of talent and people who really care about what they're doing. (P118:F—14:29)

And the other good of it is, for the most part, NIST is a pretty big family of people that care about each other. And you see that in their willingness to be helpful, and it's kind of exciting. (P115:M-20:59)

While NIST is an exciting, interesting, and rewarding place to work, many study participants noted that issues of equity and inclusion, specifically related to gender, continue to plague the organization.

The findings related to the culture of NIST include the ways in which certain ideologies that science and NIST rely on and take for granted contribute to a system where particular ways of being and doing become normalized and "natural," and thus are seen as neutral rather than as contributing to an inequitable system that has the capacity for discrimination and exclusion.

Over the last 119 years, the culture at NIST has evolved, influenced by broader social and cultural norms and assumptions. For example, the following characteristics of NIST have implications for the type of culture that has developed:

- NIST is a federal organization,
- NIST is a scientific organization,

- NIST is an organization of scientific excellence, and
- NIST has a strong belief in meritocracy.

Each of these characterizations contributes to the role of gender at NIST. Federal agencies find comfort in the status quo and resist change or are slow to change given the many levels of regulations, requirements, processes, procedures, and approvals that govern their operations. As a scientific organization focused on measurement, the perceptions of who and what a scientist looks like is defined by the fact that in the first 100 years all of the confirmed NIST Directors were physicists. Even now only 2 of the 16 Directors have not been physicists. Only one woman has been confirmed. And only one man of color has been confirmed. While scientific excellence established NIST as a premiere scientific organization, this value also inhibits change under the pretense that somehow change will erode the achieved excellence. "It's working so don't change it." Finally, the NIST belief in meritocracy (that talent, effort, and achievement are rewarded rather than who you are) also contributes to the gendered social structure and the perception that change is not needed.

This backdrop sets the stage for the current characterizations of NIST from the interviews as a "Boys' Club" and an "Elitist" environment. This environment sees men as scientists, as leaders, and as competent and as a result valued. On the other hand, it often sees women as clerical and thus not as scientists, as leaders, or as competent, and therefore they are less valued. The Principal Investigator model encourages individual work and competition, values the individual before the team and projects over people and relationships. Yet women value teams, collaboration, and mentoring [18]. Women are loyal to people over projects and emphasize the good of the organization versus competition. These radically different perspectives result in experiences and outcomes that provide advantages and opportunities for men while erecting barriers to survival for women, including isolation and possibly exclusion. These barriers result in consequences of discrimination as well as lack of trust and resignation.

4.1.1. Rooted in Meritocracy

Americans believe in meritocracy. It's the American dream – anyone can succeed with hard work regardless of their race or gender. According to Gallup polls, 67% to 70% of the general public believe that "merit" should be the primary factor in college admissions and hiring practices [Error! Reference source not found.]. We even celebrate meritocracy in the popular Broadway musical, "Hamilton," where Alexander Hamilton fights his way from poverty and squalor to "rise-up" to become a founding father and a scholar. But unfortunately, the promise of meritocracy is a myth [8, 19].

Much research has focused on the paradox of meritocracy [7, 20-22] where managers with strong beliefs in meritocracy demonstrate *more* bias in their evaluations of women and minorities. Managers' underlying assumption that they are fair and unbiased clouds their judgement and prevents them from questioning their behavior and the accuracy of their evaluations. Unfortunately, research has also shown that stereotypes including gender, race, age, and disability are lenses that influence evaluations that benefit dominant populations and disadvantage under-represented populations.

Research studies [19, 23, 24] including those where resumes are randomly assigned to a female name or male name continue to demonstrate that focusing on meritocracy provides unfair advantages to men. In these studies, a resume with a male name is consistently more highly rated than the identical resume when the name assigned is a female name. Women are held to a higher standard. Emphasizing meritocracy as

the driver for achievement and reward also results in the notion that by hiring or promoting someone other than a white male lowers the bar or is focused on meeting quotas [19].

Our interview data support the paradox of meritocracy and the resulting impacts on hiring decisions, performance evaluations, and opportunities for advancement and promotion for women at NIST. While many of the participants referenced working hard to achieve success, only two participants (both male) specifically referenced meritocracy. The first participant described the beliefs of the administrative staff and the experiences of NIST associates as the "meritocracy trap."

But there are certain categories of workers that seem to be-- they seem to have been left behind, let's say. For example, there's this pay grade of a ZS or our administrative staff who-- They generally tend to be very loyal and assume that this is a meritocracy and that they will be rewarded for hard work. And that's not how the world works sadly. And I've met people who've just broken out in tears explaining to me their frustrations, and they feel very limited in what they can do. But a lot of people in those roles, because they're service roles, they're service provider roles, they fall into this meritocracy trap. (P117:M—11:10)

A female participant described her loyalty and hard work and limited opportunities fully supporting the observation described above.

I am similar to a puppy dog. I'm loyal to a fault. I came in to work ... as a group secretary. Although I had many opportunities to take details, my reputation follows me that I'm a good worker, a good dependable, all the Girl Scout motto type things. (P006:F—01:50)

She continued:

... within the operating unit, there was an unwritten rule that no secretaries could be promoted above a level three. Regardless of your effort, regardless of your loyalty, regardless of your devotion, you're only ever going to be a three. (P006:F—3:32)

P117:M also commented on a second group of employees, NIST associates, and how they fall into the meritocracy trap. He describes how associates don't understand how their careers will be affected by years of service without the benefits of federal employment.

Well, certainly I think there's a group of people, probably extends beyond the administrative staff, that assume (this is a) meritocracy. I'm aware that there are associates here who have been here for many years when really, they should only be here for maybe three years-is. Maybe a couple more. But they're not really fully aware, necessarily, of how their career could be impacted adversely if they stay as an associate. So, I'm certainly aware of that. And I'm aware of the disparity in pay that occurs when that happens. (P117:M-31:04)

In fact, several of the female participants described their experiences of working for years as post-docs and then as associates in an effort to become a federal employee. One described working long hours and looking forward to the promise of a federal position.

I was really excited to come into work. I found myself working well beyond 40 hours without even realizing it because it was really fulfilling. It was something I was really excited for. (P101:F—12:55)

That was the reason why I'd even stayed for a post-doc there was because they said there was a federal position, and I would be a shoo-in for it and had negotiated salary and everything for it. And it seemed

like they were very supportive, and they were pushing me in this direction to stay on as a permanent member of NIST. (P101:F—24:03)

P101-F worked for seven plus years before finally quitting because:

"This time around they happened to get more qualified people and that it would be unfair to offer me the job I had been working there for." (P101:F-24:03)

Others described working as associates for years before becoming a federal employee. One woman was at NIST 14 years before transitioning to a term employee. Another, an associate for 4 years, describes how she became resigned to the situation.

So, I guess, at times frustrating. Just not sort of feeling like I knew the path to get to where I thought I wanted to be. I think that over time I've sort of-- I don't know the best way to describe it, but I think I've either adjusted to sort of the procedures and processes here for people growing in their career, or I have -- or I've just sort of come to accept it is what it is. (P114:F—4:19)

Finally, a female post-doc who after a few years became a NIST employee described her frustration when she discovered the salary difference with similar colleagues with a similar background and time from degree.

I started looking how I'm doing in terms of the salary I saw that within my group, I was three standard deviations below the mean of all the other people that are comparable to me when I fitted that line on a salary versus years-since-PhD. And so, anyway, I was appalled, and I couldn't reconcile (P110:F—11:33)

For these participants and others in the interviews, the belief in hard work and loyalty was not enough to counter the effects of the paradox of meritocracy.

4.1.1.1. Meritocracy and Hiring

While the previous examples describe hiring post-docs and associates once associated with NIST, the process of identifying potential post-docs and new hires was also a topic of concern. Another male participant described how the process of meritocracy works at NIST to identify new hires.

It's easy to go back to the professors that's given you five students because they've worked. Now from a mission perspective, it is working. So it's not that what your result is bad, but you have no idea of knowing whether it could be better because the issue with that and what our best teams right now, which are more interdisciplinary, are showing is that when you do put people together of different thought, different background, different experiences, it is a much more creative environment as opposed to getting groupthink and doing incremental science. And to expand those networks I think is something that quite frankly, we need help with. it's a lot easier for them to just take what's coming in. So yeah. I definitely see the meritocracy problem. (P103:M—42:02)

P103:M observed that it is "tough to get into the pipeline" (42:02) and that the organization must work to expand the network and the pipeline rather than rely on "the Easy Button" (42:02). In fact, several female participants believed the hiring process benefits white men.

Regardless of where they came from, it's still a very academic-oriented mindset where you-- what have you done before in terms of papers, pubs, talks in a way that may not necessarily be completely in line with skill but it rewards the resume?- again, going back to the networking conversation, we do have the trusted network that we keep going back to all the time. And expanding our reach will be better there because a lot of it is, we expect to have the following result because we have a pipeline. I would say it's kind of tough to get into the pipeline, and we either have to make a conscious effort to go out to places we haven't gone, make a name for ourself, recruit, etc. And that's kind of that Easy button thing (P103:M—40:50 & 42:02)

Yes. -- my mantra has been, they hire people like themselves. And they look after their own. (P102:F— 1:25:29)

Much like these examples, where affiliation and gender seem to influence hiring, a study in Sweden measured this bias. The Swedish study examined whether women and men were evaluated equally by the peer review system of post-doc applications of a primary funding agency for biomedical research. The study found that both gender and who you know or your affiliation with a research group had a significant impact on competence and productivity. In fact, in order for women to be rated as competent as their male counterparts the women had to be 2.5 times more productive [25].

4.1.1.2. Meritocracy in Promotions

Throughout the interviews, many participants commented on the gender differences in promotions. The theme of advancing those that look like you continued.

NIST promotes people that look and think like them and there should not be one accepted norm. (P014:F— Field Notes)

And that shouldn't be. They should be-- we should be as groomed as much as the white male.... Yes. ... they hire people like themselves. And they look after their own. (P102:F-01:24:51 & 01:25:29)

Others discussed specific examples of promotions of a comparable man and woman where the woman was denied the band, yet the man's promotion was approved.

I've seen it in promotion discussions. I've seen people being talked about in promotion who are women, who didn't have a traditional path. And they did not get promoted because they didn't have a traditional path. But I've seen men not follow the traditional path and get promoted. And I can't prove that it was biased. But I looked at this write-up and I thought this person was wholly qualified to be a ZP5, came from industry with lots of experience, and credentials, and did lots of things. Hadn't been at NIST a really long time so didn't have all the publications, and they threw it back and said, "Not ready." And then different promotion time, guy comes up, same kind of deal, didn't have a lot of time at NIST, didn't have the H-index but lots of cred from industry, was promoted. (P013:F—41:41)

Many women described taking much longer to be promoted and falling behind in their career paths. Unfortunately, one participant recognized this as a pattern that had not changed in 40 years.

I know one staffer that has eleven years under her belt. She came here as a post-doc. This will be her 11th year, came as a post-doc. And she has not been promoted from a three to a four yet. But yet the male that came in with her has been promoted twice. He's now a five. (P102:F—41:21)

Women described fighting to get a band increase even writing their own paperwork. When asked to "Describe ways or times you believe you've had to advocate for yourself" one female participant described her journey to her Band V and the years of advocating for the increase even after she was a successful Group Leader.

"So, what do I need to do?" And I got the, "Well--" he didn't say I was young, but he said, "You need some more seasoning. I would say in the next 5 to 10 years, you'll be a 5." But he didn't give me anything concrete to go on, just that I needed more seasoning. And I left there thinking, "I'm too young. And yet there are people my age that are getting promoted. So, what the hell did that mean?" I don't know. (P013:F—34:39)

And a few years later she went back:

"And I think I deserve it based on impact, accomplishments..... I think I deserve it now." And he was like, "Okay. You write up the package and I'll support it." "Fudge. Okay. I have to write up my own package. Maybe that's normal. I don't know." (P013:F—34:39)

Others in similar situations tried to address the additional requirements but as in the example above the bar kept moving. Participant P102:F confronted her immediate supervisor when he informed her that he would not submit her paperwork from a III to a IV, even though there weren't any additional requirements to fulfill.

I did say something very-- now that I think about it, I did say something very sarcastic when my promotion was denied. Well, when my inherited supervisor told me that he wasn't going to advocate for me, I asked him, after I asked him several times, why-- and trying to guess and help him to verbalize, and I just finally said, "Why? Is it because I'm not blonde? And my hair is-- I'm not blonde and my eyes are not blue?" I had nothing to lose at that point because he wasn't-- But I hit it. I hit it, right on-- the nail on the head, I believe, from his reaction. He didn't flinch. (P102:F—1:25:42)

As a result of that conversation, she decided to reach out to her Division Chief and prepared a package describing her accomplishments. The Division Chief recommended a few other areas for improvement before submitting the paperwork. She recognized that would probably be the case, but also believed her gender played a role.

They're not going to tell you, "Oh, you are magnificent." No, not me. I wasn't a white male. So anyway, he did that. I said, "Well thank you. At least now I know what I need to do." So, I went off. And I did those things. And so, I went back to him. And I said, "Okay. I've completed these things. You think my package will—(inaudible) put my package through now?" He says, "Oh yeah." So, he did that. He took it up because he was a Division Chief. So, he took it up to the management meeting. And he came back and he says-- and that was back during the-- the was during the fall. (P102:F— 46:29)

And he says, "Ah well, there are a few more things that they want you-- we want you to do. And we'll resubmit. We'll table your package until you get those things done. And we'll resubmit it in March." And I said-- disappointed, ... "Okay. I'm going to go ahead and play these little games. And then next time, it's on." And so, I diligently did what I-- jumped through the hoops, resubmitted that package ... for him to take up. Mind you, my ... manager was out of the loop because he had washed his hands of the whole thing. (P102:F— 47:25)

When she had completed all of the new requirements, she decided she should take the package up to the next level.

"Okay. Before I have this resubmitted, let me go up ..., and let him know how much I really appreciate this game that I am--" so we have a nice-- I scheduled a meeting with him. And we had a nice little-- it's an awakening, awareness meeting..... (P102:F—46:29)

"But let me tell you what the real issue is. You're asking me to play a game that I don't even know what the rules are. And every time I think that I have reached the finish line, you keep moving the finish line. And as a matter of fact, let me make it a little bit more clearer. It's like blowing bubbles, you go to catch it, and it disappears." He was silent. He got it. And my promotion went through. But I had to have-- that talk with him. He was at the top. (P102:F—50:00)

Even with just these few examples, it is not surprising that many participants share the feeling that the promotion process is a game with unknown rules for women.

Here's why this is a problem. And I don't feel like the men have the same rules (P013:F-4:08)

Women continue to struggle with how best to navigate the system for promotions.

4.1.1.3. Meritocracy in Performance Evaluations

Much like hiring and promotions, the participants expressed many concerns about performance evaluations. Across the organization women believe they are evaluated differently than their male counterparts.

I got a performance rating that I thought was unjustified..... I felt like my performance was really being judged based on me as an individual and it didn't take into account-- and so I had to sit down with my boss and explain all of this. I said, "I really just think you're holding me to a different standard even though from a role and an impact perspective, I'm responsible for everything that goes on good or bad. And so, you need to have my rating reflect that." (P105:F—31:07)

The female participants believe they must work harder than their male colleagues to be recognized and rewarded. They also believe women are judged more harshly in the event of a mistake.

You have to work twice as hard; you have to be twice as good, and that sort of thing. And you're not as able to make mistakes because the focus gets put on you a little bit more quickly than a white male for example. So, part of that is something that's ingrained in our community. (P008:F-49:39)

Thus, many of the female participants do not believe in the concept of pay for performance, a core tenet of NIST's Alternative Personnel Management System (APMS) system.

I had been told specifically that I was rated so that-- whatever my rating was, was because of the money that they were allowed to give me. ... Yes. And I was told that specifically by my former supervisor. And so, when we say NIST is a pay for performance, I think that's BS. We're not paid for performance. (P016:F—32:03 & 32:17)

The underlying premise of meritocracy is to hire, promote and compensate the "best" person for the job without lowering the bar or raising the bar for women. Unfortunately, meritocracy managers have not considered that their perception of who is best for the job may be inaccurate.

4.1.2. The Role of Elitism

Meritocracy supposedly promotes equality of opportunity, but meritocracy can also result in elitism depending on how "merit" is interpreted. In a meritocracy, opportunity is based on skills and talent while elitism favors prestige. Both play roles in our society. Often, we confuse one with the other. Assumptions about the underlying reasons (talent or prestige) for decisions lead to problems within organizations. Systems of elitism are often protected as meritocracies. In this case those who are excluded resent the elites. Yet if a meritocracy is incorrectly perceived as elitist then those who are the most talented are undermined [26].

Similar to the economic theory of profit-maximizers, the term "prestige-maximizers" has been used to describe the practices of non-profit colleges and universities for hiring faculty. A study examining the implications for diversity in graduate education of top-ranked university programs found that elite programs hire graduates from other elite programs resulting in a statistical clique [27]. "Prestige in higher education is like profit is to a corporation" [27].

4.1.2.1. Prestige-Maximizing in Hiring

We found similar practices of "prestige-maximizing" described by our participants when reviewing candidates for positions. We see examples of the academic mindset and the reliance on established pipelines (Section 4.1.1 Rooted in Meritocracy). Those without the prestigious academic credentials in many cases are not even considered.

I get summer students and I notice you don't see--HBCU students applying. And the few that do apply they normally don't get picked. And I think it's again the perception of They try to choose students from certain universities. "I want Harvard, Purdue, MIT. These are the best of us." But I've worked with some students from the best universities. That's not always the case. They'll go through resumes. They'll look at the university first like, "What is-- no." They won't even continue. (P011:F—53:49 & 54:49)

Bias ... But just that alone, that tells me there is preferential treatment to men, okay. You can't tell me in all those years of watching post-docs apply for the positions and ... Right. Okay. So are we always looking for the brightest and the best and the, "Oh, he's from Cornell, or he's from this university." How about somebody that it doesn't matter where she's from. She has good grades. She has a good CV. She's completed numerous publications. Why are we only looking for certain types? And that's just my opinion--my impression of watching 15 years of post-docs go through those doors. (P006:F— 44:41 & 45:07 & 45:38)

Hiring with prestige-maximizing as the organizational practice limits the opportunities for women and minorities but also limits the opportunity for organizational change. Changing the culture requires new people with diverse ways of thinking, backgrounds and values. In a study of colleges and universities prestige-maximizing resulted in closed systems raising concerns about the need to incorporate new ideas to address difficult new challenges [27].

4.1.2.2. Prestige Across NIST

Unfortunately, prestige-maximizing extends beyond hiring into many of the interactions of staff across NIST. Participants describe an elitism bias between Gaithersburg and Boulder, among the Directorates, the OUs, and programs. Others described the preference for certain types of degrees, levels of academic achievement, and the career series of employees, and age bias.

When describing the differences between the two campuses, a participant from MR who has worked both in Boulder and Gaithersburg used the phrase "redheaded stepchildren" to describe the relationship.

The most interesting thing that I can tell you about being able to work on both the campuses is that Boulder administrative people feel like because they're away from main campus here at NIST that they're treated more like redheaded stepchildren, for lack of a better way to describe it. So I have to keep reassuring them. (P001:F—57:35)

Others focused on the prestige of the science OUs. A participant from MR used the phrase "second-class citizens" to describe the relationship of MR staff to LP staff. Another participant from IIS felt like their programs were "lost in the shuffle." Finally, a participant whose program is funded by other agencies described her work as "looked down upon."

So I see the bias with science. I see bias here, actually. We didn't even talk about that. The scientific staff versus the-- or the technical versus non-technical staff. We don't talk about that enough. There're definitely barriers there. (P109:F—1:03:11)

I feel like working in operations, NIST is set up with a bit of a second-class citizen type view. ... And so, you're going to-- I always tell people, "You're going to need-- expect that you're going to hear that from some people, and it's something that you're going to have to deal with. I think that is part of our culture." (P104:F-7:08 & 7:59)

I mean, I think with NIST, the extra, we'll call them like the extramural programs, get lost in the shuffle. So people always try and figure out how are-- if I explained our program, and they said, "Well, how in the world do you fit in with NIST?" And trying to understand how a manufacturing program fits into that. ... Just trying to explain how commerce as a whole works to describe how our program fits into NIST overall. (P016:F—14:19)

But sometimes it gets looked down upon. Even though a quarter of NIST is actually funded by other agencies. Yeah. And I think those are based on pockets, too. But those who are in that management chain may not necessarily-- it has an impact on male, female, whatnot. But sort of in some respects a level of discrimination. Because they're not being acknowledged for the work. Because it's not viewed as Nobel prize winning work. (P109:F-23:51)

A participant reminisced about how the then NBS Director walked into the new employees' orientation and said "Welcome to NBS. I expect you to be perfect eight hours a day" (P115:M— 4:34) and then turned around and walked out. The participant commented that "it set an aspirational goal" but did it also promote the "arrogant" nature of NIST?

And I think some of that misunderstanding is that we think that NIST created all of them because clearly NIST is-- remember, NIST is extremely arrogant by nature, right? "I work at NIST, I'm always right." (P115:M-49:33)

One participant who works in many cross-agency working groups even described NIST's reputation among other agencies as "intellectual snobs" with the desire to prove we are always right.

We have lots of talent and people who really care about what they're doing. We have been described, by other agencies, as intellectual snobs. I think sometimes that's fair. I think sometimes they want to prove why we are right instead of maybe what is best. We'll get into why we are right. So I think a little bit of that criticism is fair, but we have the opportunity to really be some of the experts around the world, and that's a great thing. (P118:F—14:29)

Participants also discussed the bias within the MR side and the LP side.

There're more biases in the MR side than there are in the LP side. I see biases towards wage grade staff that only exist here on the MR side that don't exist in the ... And I've seen changes in the-- and perhaps it's more time in the laboratory program areas. I've seen the biases start to fade more than they were before towards staff. And part of that is in NIST's messaging of, "Hey, everybody is part of the mission, and do you understand that?" (P115:M-47:44 & 47:51 & 48:04)

So, I think that there's a lot of people who are biased against certain OUs (laughter). I've seen a lot of that. And I think some of it's-- some of it is maybe not totally unwarranted. Some of it is. There are some (scientists) who have an immediate reaction when you say certain OU names. They immediately react a certain way. And you're like, "Yeah. Okay." And I understand sort of where their bias comes from. And I know that some of it is warranted and some of it is not. (P002:M-22:00)

Finally, elitism associated with the implicit bias that men are leaders limits leadership opportunities for women.

Just from conversation and what I've been told by even some of my male coworkers that some people in upper management don't like listening to women. (P011:F—25:28)

And I will tell you, I mean, I work in an administrative field. So I then have sort of two strikes against me at NIST, right? then, being a woman-- and I will also say, I am on the younger side. I became (a supervisor) in my late 30s. And closer to middle 30s, actually. And so, I was young. And I'm a woman. And that, I think, was--. So, I mean, there's just all kinds of Xs across there. (P105:F—19:08)

The explicit and implicit biases of elitism affect all of the staff at NIST, but the culture of elitism further marginalizes women and minorities.

4.1.2.3. Elitism of Academic Degrees and Discipline

Most of the discussion of bias and elitism focused on degrees or scientific disciplines and the perceptions of status based on career path and education.

There's more one-upmanship here in Gaithersburg than there is in Boulder. Here in Gaithersburg, you hear more of the scientists talking about, well, I got my PhD from this place or that place. (P001:F— 56:11)

The good is it's a very collegial environment where you can work really closely with people of different backgrounds like PhDs, and technicians, and whatnot and really do cool things. The bad is it's very monoculture. It's a lot of PhDs. And there's a little bit of elitism in that where, "You're not a PhD? Oh."..... So sometimes you get that, "Oh, I'm a PhD." I'm like, "Nice for you. But you're still calling me for help because you don't know how to do this," so. (P013:F—15:43)

Even if you have a PhD, the discipline appears to matter, NIST favors science degrees to social science degrees, sometimes irrespective of the requirements.

But it's, again, we want that science is king, which I think, from programmatic NIST perspective, that's right. We do science. And then, when it comes to the execution of that, we need to have people in roles that make sense. (P105:F—1:03:18)

All right. So it's just the disrespect of the discipline really. They don't want to hear, and it's a shame because it's a wonderful place, but I think it's a wonderful place for physical scientists. I think it's an okay place for social scientists. (P111:F—16:30 & 17:26)

Another participant described how her female SURF student was ridiculed by male SURF students because she was studying international relations and not science.

I can't tell you how many times she came to me, almost in tears, because of the crap she was getting from the male SURF students. And for a couple of reasons. One, because she wasn't a scientist. So they said, "You don't have any business being here." And it incensed me like you wouldn't believe. Because, one, it means that they don't know this organization..... They saw her as just this beautiful, tall, blonde--and that's what they saw. So they said, "Oh. It must be nice to be an international relations student. You must party all the time and not have to go to labs." And "Are you from a party school?" The things that she was coming back at me-- let me tell you. She was such a hard worker. And I sat her down many a times. And I'm like, "Here is what's going to happen." I said, "That guy from MIT that's giving you crap--" I'm like, "Doesn't matter what school you graduate from." (P109:F—1:00:59)

The young woman in the quote spoke eight languages and had traveled the world. She has gone on to win a research Fulbright scholarship. Another female student who was an economist experienced a similar bias in the question and answer session of her presentation.

And one of the females from She said something along the lines of, "Do you think this was a harder thing for you because you're from a liberal arts college?" Or something like that...or she said it as a non-pure-science major, or something. I was like, "What?" (P109:F—1:04:26)

Others described how career paths play a role in status or how the lack of a degree will hold them back.

But it's not even just women - it can be job title ... "I'm a researcher and you're a technician?" (P011:F-23:02 & 23:27)

I guess I would say back to the whole conversation on you can't elevate because you don't have an advanced degree yet other people around me had been-- as a matter of fact, years prior, a male counterpart was promoted who didn't have a degree. (P021:F-35:42)

ZS staff are particularly susceptible to the education bias despite having a degree. Overall, administrative support staff feel excluded, like they are not part of the team.

I think maybe there's even a little bit of bias with educational status. I mean, I've a bachelor's degree. I have an associate degree from a community college, therefore I have six years of college. ... And I had in the past, engineers who also have a bachelor's degree. So because of the nature of the work they do, they think that they can talk down to me, or that they're somehow better, and I'm like, .. but it would really make me dread seeing them walk through the door, and I don't like that feeling. But I think in those cases, it's been mostly age and education. (P022:F—19:48)

But it was just one of those-- I really got trapped in the secretary pay band, which I'm willing to bet that's not unusual for people at NIST to want to move out of the administrative track and into the more scientific or technical, because we don't have a good bridge pay band. It's like you're a secretary, you're a scientist, you're a scientist, (P108:F—6:51)

I think we could do a better job from my perspective of including the admin and the support staff in the goals of the organization, and to let them know that they are part of things (P004:F-15:06)

The female research scientist that described the SURF students' experiences is angered by the prestige and elitism among the staff and the organization and expressed her frustration by emphasizing our common mission and the need for an inclusive environment.

So I have seen a lot of that over the years here that bothers me more that this perception that-- and my background is, I'm a scientist. But nobody's any better than anybody else. Whether you have a bachelor's, PhD, whatnot. You're all contributing to this organization equally. It's a federal agency. We're all here for the same mission. But there's a lot of that. And then it transcended through the SURF program and the students there. (P109:F—1:04:26)

Prestige-maximizing and elitism affects all NIST staff, however, these two competitive belief systems continue to disproportionally affect women.

4.1.3. Based in "Science"

As noted in the previous section, NIST culture is rooted in meritocracy and elitism. These contribute to ways of doing and being that seem neutral on the surface yet tend to favor men, giving them opportunities for advancement, while having very specific consequences for women that create barriers for advancement. NIST culture is also rooted in broader ideas about the culture of science that produce similar results. For example, science is seen as objective, rational, and highly competitive. These foundational beliefs about science again seem neutral, but often produce different experiences and outcomes for men and women. They also contribute to an acceptance of the status quo and a resistance to change. In addition, in its role as one of the premiere science organizations in the world NIST is committed to excellence, which also contributes to a lack of impetus to change. Why would you change something that is already excellent? These norms mitigate against seeing gender at all or at the very least against acknowledging the ways in which they maintain unequal systems of access and outcome. Britton notes that the culture of science itself contributes to gender inequality [28]. "Masculinity is invisibly embedded in ideas about the mindset and career path of the ideal-typical scientist, and yet at the same time science supports notions of valuefree inquiry and purely meritocratic standards of achievement" [28]. Alternative ways of being and doing are not valued and thus not rewarded. These norms contribute to mechanisms that support both institutional and individual discrimination, in this case based on gender (although they clearly also contribute to and support other forms of discrimination). This discrimination is often veiled by perceptions of excellence, objectivity, rationality, and competition.

4.1.3.1. Excellence and Intellect: We Can Figure This Out

When there is a belief that you are excellent, there is little impetus to seek alternative perspectives or insight. NIST's identity as a scientific organization of excellence leads to an assumption that we must be excellent at everything they do.

Our mission is critical to the United States. We are engaged in cutting-edge-- I mean, things I don't even understand myself. So it's got to be cutting-edge. You know what I mean? It's just we're helping society. (P006:F-24:40)

I think my perception is NIST in general feels -- and this is a cultural thing. I think the feeling is there's a lot of smart people here and we can figure stuff out. (P117:M—50:39)

NIST is a premiere science institution engaged in cutting-edge research, an organization that is filled with "a lot of smart people" who "can figure stuff out." Given these descriptions, there is an assumption that the organization should be able to figure out and fix issues and problems they face, including issues revolving around diversity, equity, and inclusion. There is no need to look outside the organization for ideas and aid, or to seek alternative perspectives about how to approach and address problems faced.

The quote below highlights how "science is king" (P105:F—1:03:18), in this case in the search for leaders.

But again, we've got to hire leaders differently. And we have to be intentional. I actually had a conversation with somebody - it was a couple years ago now - that they were recruiting for a Division Chief position. And the first thing that my management said they wanted was somebody with a PhD. And I remember laughing and saying, "Oh, did you want a PhD in organizational development or psychology or human resources or sociology, philosophy? You'll take any of those?" "No, no, no, no, no. We have to have a PhD fill in the blank hard science." And I said, "But why? This is a management position. This is a position--" "Well, they have to have the scientific chops to command the respect of the staff." And I said, "But what if the scientific chops don't come with good administration skills, good money management, good people skills, interested in developing others?" "Oh, that's okay. They can learn all of that." No, they can't. I've just decided flat out, if you're not interested in being a people manager, you shouldn't be in this job. (P105:F—1:03:18)

P105:F notes how scientific knowledge, background, and skills are valued more than others (in this case knowledge, background, and skills in management or administration). Even when the requirements and responsibilities of a position are not related to doing science, but rather to managing people, NIST places precedence on science. In part, because as P117:M notes above, a lot of smart people work at NIST who are able to figure things out on their own.

4.1.3.2. Objective and Rational: Visions of a Scientist or Leader

Science is also seen as objective and rational, and scientists, therefore, should embody these characteristics. Objectivity and rationality are most often associated with men rather than with women, creating gendered assumptions about who is a scientist [29]. As Settles [30] argues, "the cultural stereotype of the scientist as objective, rational, and single-minded is consistent with prescribed norms for men, but counter to stereotypes and prescribed norms for women" making it difficult for women to be seen as scientists. Leadership, as well, is generally premised on these same masculine norms, as well as on notions of power and control most associated with men [31].

And so one day I was doing something in the lab. I was washing a graduated cylinder. And it kind of slipped and made a noise. It didn't break. It just slipped. And they looked up. And they laughed. And they said, "See? I told you. Women should be at home." In other words, they were saying that I have no place in science. ... And I was like, "That is not funny. (P102:F— 21:12 & 22:59)

You sit in a meeting, you look around, you're like, "I'm the only woman. I'm the only technical woman. I'm the only manager woman." And we did that when we had the discussion about data. All the Deputies were there, and all the Division Chiefs were there, and all the office chiefs were there, and the OU Director's there, and the Deputy was there, and the AOA was there, and the SMA was there. So there were some women in the room. When you looked around you were like, "Of all the managers, there's 2 women and there's 16 men." (P013:F—1:05:55)

Women are not perceived to be either scientists or leaders.

4.1.3.3. Science as Competitive

The culture at NIST is perceived by many participants to be competitive, and work is seen as a solo endeavor that gets rewarded based on individual accomplishment rather than as part of a group or team effort. This resonates with research on how men and women scientists respond to competition. An experimental study of scientists found that having groups compete against one another is stimulating to the creativity of groups composed largely or exclusively of men but detrimental to the creativity of groups composed largely or exclusively of women. Within-group collaboration can mediate the joint effects of competition and sex composition on group creativity. Women thrived when the environment was collaborative, and when teams worked with one another [32].

And I think actually that teamwork atmosphere is something that NIST is not good at motivating and propagating because we have these individual performance plans, which are really isolationist. (P103:M-1:06:40)

The bad part is that there still are pockets of this, what I call one-upmanship or, unfortunately, what I would say is people who think that they have ownership of a certain thing....So, again, getting back to the bad part is that where we have people who think of themselves as individual teams within NIST where they're competing with one another for resources instead of us presenting a united face and realizing that even if this person get some additional funds, it benefits all of NIST. (P113:F—15:56 & 20:35)

This focus on science as a competition where the individual is most important is a contributing factor to some of the discontent felt by women who want to work more collaboratively.

But there's no group involvement. It's not us all pushing forward. (P005:F-5:35)

I want to be part of the team, and I've said almost these exact words, "I want to be part of the team because it gives me a sense of purpose about the work I do." (P004:F—4:09)

Some researchers today argue that science organizations could benefit from a structure that promotes cooperation, collaboration, and creativity and that doing things such as changing the criteria for advancement to include common rather than just individual goals and recognizing things like mentoring would help in this endeavor [18].

4.1.4. Dominated by Patriarchy

The concept of patriarchy has been central to many ideas around gender inequality. In this research we define patriarchy as the social system in which men hold primary power and predominate in roles of leadership. This is described by many theorists as a systemic bias against women. Patriarchy is an attempt

to explain the stratification of power and privilege by gender that can be observed by many objective measures. We break down these measures by a collective analysis of the data.

Throughout history there have been two main stereotypes prevalent toward gender and science: girls are not as good as boys in math, and scientific work is better suited to boys and men. These stereotypes exist as early as elementary school [33]. Socially, girls are taught, directly and indirectly, to steer clear of studies and jobs typically pursued by boys and men. Furthermore, women have been found to be aware of, and adversely affected by, the stereotypical image of a scientist as a man [34].

Our data show that gender inequality is often due to gendered perceptions: social and cultural perceptions of men and women. A common question that reoccurs is, what are the factors holding women back from advancing in the workplace. A common theme that most women articulated was about stereotypes and preconceptions of women in the science field. For example, a common perception was that of a woman being too sensitive or just not fitting the "look" of a researcher. This often acts as a barrier to advancement in women's careers.

P101:F is a tremendous example of this in our data. This participant addressed many issues related to patriarchy, and her words serve as an exemplar of this situation.

And it's really frustrating to try to feel like people take you seriously and treat you like a real researcher with potential. If anything, it seems like a lot of the women get treated like they are the secretary equivalent in a lab of doing the necessary but unimportant unimpressive task. (P101:F—6:59)

Compared to men, women face gendered perceptions and structural barriers preventing their opportunities for growth or simply their ability to have a comfortable work environment.

Another patriarchal stereotype that many women face in "masculine" fields, such as most science-related fields, is that they are either competent or likable, but not both [35]. This stereotype also penalizes women for their assertiveness. This may lead to the belief that women are less worthy and less qualified for higher level positions in an organization. Competence and likability matter in terms of advancement and studies have found that competent employees were more highly recommended for special opportunities and higher salary.

Surprisingly, research shows that when women do have success and show undeniable competence in their field, they are penalized for their success and are faced with the perception of being viewed as cold, assertive, or too "masculine." It is only women who pay the price of social rejection for success in a nontraditional work situation [36].

Women don't seem to get taken seriously. And if you do try and stand up for yourself, you get labeled as troublesome. Even if all you did was say "Hey, I think I would be really good at this, and this is kind of the research I've been doing, so why don't I fulfill that role?" That would be considered aggressive. (P101:F—5:55)

These results suggest that being disliked can have disadvantageous effects in the workplace. Positive evaluations and promotion are at risk once you are disliked by many. Doing the same job as a man and sometimes doing it better does not seem to be enough. Women are held to higher standards and additionally must prove their competence.

To summarize, the male stereotype of science and of a scientist is persistent with the idea that women are not viewed as competent enough for such roles. This leads to women not being perceived as qualified to be a scientist or a leader; women are not considered to be "good" enough workers. When asked what the best outcome of this project would be, P101:F answered,

I would love for women at NIST to not have their souls sucked out of them over time from working there...And to deal with the kind of issues women at NIST face that make it hard for them to stay in science and excel there, you really need to have a way for them to talk to someone. (P101:F-32:04)

As noted by P101:F above it is difficult for women to excel at NIST. This participant articulates the identity interference of being a woman and a scientist and how difficult it is to hold the two identities in an organization like NIST where the two do not seem to be compatible.

Additionally, we explore how hegemonic masculinity also translates into gender inequality. Hegemonic masculinity identifies how gender power (based on gender) operates at multiple levels. This provides an overarching framework for understanding how gender inequalities are produced and reproduced [37]. We look at the normative ideology that to be a man is dominant in society, and this specific masculinity works to position men in a space of power. This may lead to the thought that in order to keep men in power it requires the subordination of women.

It comes from various places. If you're a spiritual person and you believe in the Bible, the women are supposed to be submissive to the men. So that's part of it. It can be a cultural thing where women are to be behind the man, and they are to be subservient to them in that respect. And I think it also comes from an area where we as women weren't allowed or thought of to be such heavy hitters in the workforce, regardless of what area you want to be proficient in. It's always been a man's world. (P001:F -40:30)

Women often find themselves excluded from meetings, emails, and important decision making as discussed in Section 4.2.3.3 Lack of Respect. Something as small as a Group Leader unintentionally addressing only the men in the room or even as little as eye contact only towards the men, shows that unfortunately there still exists a "Boys' Club" mentality. Across the data, we listened to similar stories of women being passed over for promotions, watching their female counterparts struggle to move up in leadership, or facing sexual harassment. Their stories are a necessary reminder that even though we have made advances for women, the gender dynamics women face today are often the same as those faced by generations of women before them.

While gender bias does exist, some of it may be unconscious. The Boys' Club reveals our human biases, as part of it is the practice of surrounding oneself with those who share similar characteristics. Given that leadership in STEM is dominated by white men, one can understand how white men hire more white men. It might not be intended as malicious decision making, but it ends up creating gender discrimination and lack of parity.

Consider that while the overall numbers of women in STEM have increased in several disciplines even reaching parity in some sub-fields of medicine and biology, women remain underrepresented in senior leadership positions. We presume that this would become a self-correcting problem as the number of women entering the workforce increases, however, research shows this is not the case. For the last 25

years, 40% of medical students have been women, yet in 2018 only 18% of hospital chief executive officers and 16% of medical school deans and department chairs were women [38].

Most of the overt bias against women in the sciences has been reduced through corporate and government measures. However, a chilly climate that is less friendly to women remains and is often still so taken for granted that it tends to be invisible.

4.2. Gendered Experiences

The culture of NIST is heavily influenced by meritocracy, elitism, scientific excellence, and patriarchy. This establishes an environment leading to gendered experiences for both men and women of NIST. The culture tends to provide advantages and opportunities for men while the climate is more "chilly" to women. The culture in many ways disadvantages women by erecting barriers with negative outcomes for both the women and the organization. This section explores the gendered experiences described in the interviews.

As previously noted at the beginning of the section on Perceptions of NIST Culture, overwhelmingly, most of the participants of both genders love their jobs. The reasons given were many and varied from NIST's science mission, to the impact and value of their work to the US and the world, to the benefits (pension and healthcare), to work-life balance, and colleagues and personal relationships. This may be why NIST employees have a reputation for long careers. In fact, one female participant who was here over 40 years said NIST was her dream job.

Despite, loving their jobs the women experienced a very different NIST than their male colleagues.

I love my job. I mean, honestly, if I didn't love my job, I would not still be here. I put up with all the BS because of that. (P016:F-2:44)

Another emphasized how happy and proud she was to be a public servant even though other elements of the interview did not portray positive experiences.

So I can say 100% that I am-- regardless of everything I've told you, I am very satisfied, very happy, very proud to be a public servant, and very proud to work at NIST. That's really how I feel. (P006:F-28:05)

For many women the job itself, the impact and value of the work, and the relationships with their colleagues is enough to compensate for the "chilly climate" and the broader culture, so they stay. Several of the women had consulted career coaches to help them decide whether to stay or leave. One female participant stayed despite input from her career coach that she was compromising her career. Another decide to leave. Most of the women we interviewed were able to "put up with" the environment to focus on what they enjoyed and what gave them satisfaction: the job. However, several who had separated or retired had reached their limits and left NIST.

4.2.1. Micro-Aggressions

The documentary *Picture a Scientist* [39]and the National Academy of Sciences (NAS) [40] report used an iceberg metaphor to differentiate among forms of harassment. The more obvious forms of sexual harassment, sexual coercion and unwanted sexual attention, appear at the top of the iceberg above the surface. These forms are specifically addressed by discrimination law, and women have the ability to file formal complaints. But the most common form, gender harassment, appears below the surface. This type of harassment is for the most part, non-actionable. It is difficult to file a formal complaint that you were

excluded from an email. Thus, gender harassment is composed of micro-aggressions and micro-inequalities that reinforce stereotypes and undermine women's confidence [41].

Here [42], microaggressions have been further categorized into three forms: (a) gender micro-assaults (e.g., blatant sexist slurs or catcalling); (b) gender micro-insults (e.g., subtle negative comments about women); and (c) gender micro-invalidations (e.g., subtly dismissing and devaluing women). These categories are differentiated by both the level of harm and the degree of subtlety, where the gender micro-assaults are the least subtle and the micro-invalidations are the most harmful. These put downs make women feel like they don't belong. In fact, Dr. Paula Johnson, President of Wellesley College and Co-Chair of the NAS [40] report on sexual harassment of women, stated in the documentary that "consistent gender harassment actually has the same impact as a single episode of unwanted sexual attention or coercion" [39 timestamp 22:33].

The following depiction of the iceberg (Figure 5) represents the microaggressions experienced by the NIST women in the interviews.



Figure 5. Depiction of Gendered Harrassment.

4.2.2. Unwanted Physical Attention

According to the NAS report on sexual harassment [40], 58% of women experience sexually harassing behaviors at work. The report also emphasizes that the rates of sexual harassment have not significantly decreased from the 1980s. Given the widespread nature of sexual harassment in the workplace, we would be naïve to believe that sexual harassment in its various forms does not exist at NIST and indeed our female participants described experiencing such behaviors. It is also important to emphasize that the experiences described in the following sections are not just describing instances in the distant past but describe current events as well.

Our participants described instances of unwanted sexual advances, of touching, and of invasion of their physical space. Most described their own experiences. One participant described a colleague who reached out for help in communicating her situation to supervisors.

We were on a work trip, and she's like, "I want to tell you about what's going on here, and I would like this to be communicated up the chain, but not formally." So, what happened was she was-- so one of her Group Leaders was basically just making sexual advances to her all the time. ... It was crazy. She finally complained after years of enduring it, right? And then she decided to complain when another girl came to her and said, "This has been happening to me, too."(P008:F—42:09 & 42:29)

"I've been tracking how you inappropriately touch me, and it will stop now. You will not touch me again." He used to rub my hair. He would rub my shoulders. He would rub my upper back. He would rub my lower back when I would walk through doors. Incidentally, everyone knew that he did this, because he was a "Southern gentleman" and that's, wait for it, just how he is. And it was absolutely excused by everyone at the time. (P105:F—12:24)

Okay. When I started here there was a guy down the hall who was older, probably could've been my grandfather, and he was a known creepy dude. We called him a space invader. So, he would walk up to you in the hall and if you were a woman he would get closer, and closer, and closer, and closer as he was talking to you until he could touch you. And then he might reach out and pat you on the shoulder and he would tell you you were pretty, and that he really liked your work, and you were so pretty. And how could you be so pretty and do such a good job? And he had multiple sexual harassment grievances against him. ... And we had secret codes where if that guy came in the office we had two-way pagers, we could be like 911. And then somebody would zoom in and be like, "We've got to go to that meeting. Let's go." (P013:F—45:46)

Other participants described inappropriate public sexual remarks about body parts.

There's been some sexual harassment, one of them which I called, and there was a suit. I'm not going to-- it was what it was. I'm not going to make it seem-- it was embarrassing,... It was something that happened, and it was on a trip, and it was something that had been said to me, and it was embarrassing, right? P111:F—27:06 & 28:18)

I think the ugliest is that when I have seen nastiness happen at work, a lot of people-- I've had comments made about my crotch in front of other coworkers. (P108:F-28:17)

Now, one of my employees did tell me the other day that a guy came into her office, she has an officemate, and he was talking to her and he was looking down here. And she was like, "Excuse me. My eyes are up here." I was like, "No way." That happened last week. (P013:F— 49:16)

One participant described her office environment as a "meat market."

And I'll throw this in here. It's also very upsetting in the environment ... where you have three or four men catcalling when we'd have a new female coming in ... Whenever we'd have a female post-doc come in through our doors, it was always - I don't know how else to say it - a meat market or, "Let's check this one out," or when we have high-schoolers come through, it's I mean, it's so horrible. (P006:F—56:17 & 58:26 & 58:43)

Just like women described in the NAS report, many of the victims of sexual harassment were afraid to speak up or formally address the situation.

I think the real problem with sexual harassment is that it's really hard-- I guess I'm never surprised, right? Because in any organization, and the reason why, is because it's really hard for women to come

forward, I think. It's really scary. It takes bravery. I have been there. You don't know if it's a career killer for you, right? Listen, you have to be in a safe, safe environment. (P111:F— 31:03)

One woman shared how she was in some sense comforted to learn that "Okay, it's not just me." In this case, the perpetrator had already been identified and other women warned her to stay away. It is hard for women at NIST to come forward to discuss and report the instances of sexual harassment. They discussed concerns about how they would be potentially perceived and the potential for impact on their careers. Those who were supervisors described how it was hard for managers to deal with it, especially for those who were conflict avoidant. Until NIST can provide a safe environment where victims can feel that they will not suffer repercussions for speaking out NIST will continue to be an environment where this behavior persists.

4.2.3. Gendered Harassment

The following sections describe experiences of NIST women and gendered harassment or microaggressions. These are the subtle but harmful behaviors against women. These are the actions that are hidden below the surface of the iceberg. These are the actions that add up over time. In the PAS film Dr. Jane Willenbring commented on the impact of micro-aggressions by reminding the audience that a "ton of feathers is still a ton [39, timestamp 1:05:50]." According to the NAS report gender harassment is a much more common experience [40]. Most women describe some encounter with gender harassment.

4.2.3.1. Comments on Appearance and Dress

Women in the interviews have received all sorts of comments about their appearance. Some about the way they dress or don't dress, others about their hair and makeup. Sometimes the comments are couched in the form of advice, to help the women be taken more seriously.

Where I've been at a project where I've been out in traffic at NIST, and a comment was made about how I might cause an accident... They were referring to my looks, I'm guessing. (P106:F—39:26)

I walk out and this person walks up behind me and says, "Do you know when you walk in there they just see a little girl. You should really dress a little nicer. If you wore business-casual that'd be good. And you should wear some makeup because if you wear some makeup you'll look older and they'll respect you more." (P013:F—38:45)

There was also a woman who got told that if she didn't take her nose ring out at work, no one would take her seriously, where they would comment on how people were dressed. And there are people in NIST do walk around, like guys at NIST, who walk around in their yoga pants and their workout outfits and things, but if a girl decides to not wear a dress shirt or wears pants that are a weird color, it gets commented on, and people talk about it. (P101:F—22:39)

The women struggled with these comments. Several of the participants described how they obsessed about what to wear and what not to wear. Many of the women interviewed spend a great amount of time and energy about what to wear at the office. The women want to be judged on their abilities and not their looks or dress.

Early in my career, it had an impact on how I dressed, and the thought that I put into it, where I was very careful to make sure that I wasn't wearing anything-- my husband even jokes, how I acted and how I dressed in my 20s was much more reserved. And I said, "Because I needed to at that point." I needed people to see me for my abilities and nothing else. But I feel like I've got enough now under my belt
that I don't have to worry as much of wearing my boots to go to meetings. Or wearing something a little more form-fitting, and not thinking, "Oh. She doesn't know what she's--" There's no way. You know what I mean? I have consciously thought of that my entire career, of how I look and what I need to-- "Maybe I shouldn't wear that to that meeting. That's probably a little more-- I probably shouldn't do that." Or the click-clack of my shoes down the hallway.... (P109:F—41:34 & 43:31)

That when people treat me in a certain way at work they treat me that way because of what I can do about my job, my expertise, they want my opinion, not because of what I look like, or how old I am, or how tall I am, or what clothes I wear, how much makeup I wear, my hair. It's what can I do? Why am I here? (P013:F—40:23)

One participant shared that comments were always made about her appearance yet never heard comments about the appearance of her male colleagues. All of these instances left the participants feeling uneasy and wondering if they were somehow too sensitive. The added burden takes significant energy and focus away from their work. But more importantly in every comment they hear the message that they can't be themselves.

4.2.3.2. The Subtle Put Downs

The women also discussed all sorts of ways in which they are subtly reminded they are different and do not fit into the work environment. Women described conversations where men called them "My dear" and "My love" (P104:F—48:58).

Like I said, I've certainly gotten-- I get the honeys, and I still do. And I get touched, called-- "Well, oh, beautiful, I'm glad you're here," sort of stuff. And I'm like, "You don't need to tell me those things." That's happened here. (P109:F-41:34)

Many described meetings where their ideas and input were not acknowledged until a male colleague repeated it as his own. Others experienced constantly being interrupted and talked over, or even "yelled at" for trying to participate in the discussion. Another participant described behaviors such as "a lot of eye rolling" (P101:F—6:43) when women are talking.

It feels like an old lady's tale, but you'd be asked for your input, and you would say it, and the person sitting next to you, who in most cases is a man and in my case is basically always a man, would say the exact same idea, and someone would complement the man for that. That never felt very good. And my other favorite is bias....Well, if I'm not mistaken, the person asked for an answer to a question that's in my domain space. You just answered it. And then you asked me if you got it right. Why didn't you just keep your mouth shut and let me answer it? But again, part of that is the whole, when you're the only person in the room, it can be disconcerting. (P105:F—42:00 & 43:12)

I've seen things where I've seen women talked over routinely. I've been talked over routinely. I've been yelled at because I didn't know my place. (P113:F-37:46)

Several women described how they are treated like children.

And for the first time, I feel like I have a supervisor who wants to problem-solve, and wants to hear what's actually going on, and doesn't want me to bring solutions only, and doesn't treat me like a little kid ... There's a perception on my part, and other people have sort of confirmed that they see the same thing from the outside, that some male supervisors treat women like they're children, but they talk to

men differently, like, "We're together. We're working on this thing." And when you walk in as a woman they're like, "Okay. Yes. Oh, okay. You work on that. That's good." And you're like, "Why are you talking to me like I'm five?" (P013:F-2:54 & 3:20)

I would say that an age-based thing, where someone, say, picked up a sample that was labeled 1988. And went, "1988, were you even born then?" And turns to me and makes those comments. I think, yeah, for some reason, I'm definitely more aware of those types of comments than people would think maybe and gender-based comments. Yeah. (P005:F—25:22)

This same relatively young participant shared her experience of being compared to a "valley girl."

My PI brought in someone to critique our presentation style. And that person said I spoke like a valley girl. And that sort of held on to me. I mean, I held on to that a little bit. But this person, I could easily disregard them as just having a particular personality. (P005:F—31:29)

The women in our interviews continue to "put up with" the subtle reminders of how they are different and don't fit in at NIST.

4.2.3.3. Lack of Respect

While both the unwanted physical attention and the put downs are forms of lack of respect, the participants shared many more experiences that demonstrate a lack of respect for their accomplishments and their professional status. Women described times when they were called cleaning ladies, were laughed at and dismissed.

"Oh, there's a {XXX} cleaner lady," and laughing. So they thought it was a great joke, and I just like-- this is so offensive, right? (P116:F-25:33)

"Hey, when I come to my boss asking about gender discrimination, I expect to be taken seriously. And the fact that I just was laughed at was not okay." (P101:F-23:13)

Many experiences were described as the "little things that happen" (P116). Unfortunately, little things included generalizations and stereotypes of women's skill sets and reasons for hiring women.

We were working on a project, and it wasn't automatic, so it needed to be done. And one of the gentlemen in the group assigned it to another person. And I was standing there looking, and he looked at me, and he said, "Well, you know that men are better at math. No women are." (P116:F—19:04)

"You were hired because the person who hired you, a woman, was on a hiring women streak." I've heard that. (P111:F—27:06)

Women shared stories where they were specifically ignored and excluded from meetings and emails. But also examples of where men refused to participate in projects if she was leading the effort.

And so, the beginning, it was a little tension. I remember folks actually saying to me, "I'm no longer going to be a part of the program because you came here." And yes, just having to hold the face up and go, "Great." And I would always say, "If you're interested in returning back, we'll always accept you back," even in the midst of the anger, the upsetness. (P010:F—3:54)

Unfortunately for this participant the tension lasted two years. But this woman persisted despite being informed early in the program that they preferred another to lead the program.

"You can be the person that's the lead on paper, but there's this other person that we'd like for them to actually manage the program." And to this day, I always remember that. (P010:F—5:09)

There are many examples where women when invited to meetings were subsequently ignored. But one participant in administration described an incident where a male applicant, despite refusing to acknowledge or answer questions from the female interviewer, was hired. As a result, the participant is forced to continue to tolerate his lack of respect.

And I had one person in particular get interviewed who didn't seem to care who was interviewing him. And it was one of those things where a female would ask him a question, and he would only address the males in the room. And when the female said, "I'm sorry. I need to stop this for a second. You realize I'm also hiring for this position. We're sharing this vacancy." And the person goes, "Yeah. So?" And this person still gets hired. (P022:F—23:11)

But to completely make a concerted effort to not even acknowledge my existence or to-- in a meeting when a question is asked, not to take stock in the answer that I have given. Or if I'm giving a training, not to pay attention and then complain later when you weren't sure about how to do something because you decided because I was female, not to pay attention. (P022:F-24:21)

For many women the lack of respect results in feelings that they are viewed as property or possessions. One participant referenced "chattel."

But it's very sad that within my operating unit, the consensus is we feel as though we're chattel. We can be replaced. I am nothing but a warm body and a pair of hands. (P006:F-10:41)

Women continue to tolerate insensitive comments and behaviors and struggle to feel respected.

4.2.3.4. Questioning Competence

The women in the interviews presented a picture of a continual battle to prove their competence irrespective of their positions. As described in the preceding sections, women must fight to be included in meetings, to be heard in meetings, to establish their credibility, and to be accepted as leaders.

To some extent as a woman I always have to ... be able to advocate for myself because people who don't know me just by first impression, looking at me, they don't take me too seriously. So, it's kind of you have to prove yourself again. People who know me that's fine (P003:F-21:51 & 22:11 & 22:23)

But establishing your credibility is only the first step. Women fear they can't make mistakes. They believe they are continually being scrutinized and judged.

And I can't make mistakes. That's the other thing I feel. I am not allowed to make a mistake. Especially when I was a term. There's no way. If I make a mistake I'm out of here. That was always my perception too. (P011:F—37:11)

Women's competence is questioned and undermined in a variety of ways. Many times, in public as in the following example where a male colleague turns to another male colleague to confirm the woman's answer.

And this guy was asking us a question. And I answered it. And he looked at the guy and said, "Is that true? Is that correct?" And the guy was like, "What? She just gave you the answer." "I know. But I want

to make sure it was right," like I didn't know the answer. And he was only looking at the guy and I'm answering the question. (P013:F—48:28)

Even as they are promoted, women's competence is questioned and tested.

"I want you to take her under your wing because she's a new Group Leader. And take care of her and make sure that she does okay." He took that as micromanage the hell out of everything I do and treat me like I'm an idiot. So I went several years as a Group Leader asking for permission for everything. If it was over the credit card limit,... (P013:F—4:34)

One administrative officer felt as if some female scientists adopted male behaviors in order to successfully compete in the male-dominated environment. This adaptation is described as the "Henry Higgins effect [8]. Women in leadership and women's leadership practices are explored in [31].

My experience with some of my female scientists are that they are very forceful. They're very stern. They're very structured. They don't put on platitudes for anything. Okay. So, they are right in your face, "This is what we're going to do. This is what I need you to do," and they're all about business. It's not a mean thing. It's not a bad thing. They're just all about business. Because I feel they're trying so hard to fit into what most people deem to be a male-centered area that they have to almost put pretenses on being more masculine, more strong. (P001:F— 51:28)

Unfortunately, some women who have proven themselves find their success questioned and undermined by rumors. As a result, once again their qualifications and competence come into question. There are three different examples in the transcripts of rumors suggesting that women who had been promoted into leadership positions were sleeping with their bosses.

My supervisor and my Division Chief started talking poorly about me to their staff, and their staff was still not only people that I had worked closely with, but I had formed friendships with. And I remember having to go to the {a manager}, and I walked into his office without an announcement, and I shut the door behind me, and I said, "If you can't get these two people and their tongues under control, I will have no choice but to go and file an EEOC complaint. So, I'm giving you advance notice. You have this week to make it stop happening, or I will take matters into my hands and take care of it." And it was pretty disparaging remarks that were being made about me. (P001:F—30:14)

These examples suggest that women are measured against a tougher standard.

4.2.3.5. Isolated and Invisible

According to a male participant science can be lonely, referring to the long hours both day and night collecting data in a lab followed by staring at a computer analyzing data leading to the solitary task of report writing. Another female participant described it as working in a "Bat Cave." Given this context and the overwhelming male environment, women used terms like isolating to describe their situations. One shared "I felt like an island." (P013:F-23:30)

The participants described looking around and quickly realizing they were alone.

Yeah. I mean-- well, look at our leadership team. All freaking white men. Look at NLB. I think there's 23 people in NLB. There's three women. (P104:F-47:01)

A male participant hadn't noticed there were so few women until a female colleague pointed it out. He was shocked.

But a few months ago, we had a meeting in our direct team, ... and everyone was going around kind of giving a little factoid about themselves and something like that. And it got to the one person, and she says, "And I'm the only female in the team." And I was like, "Wait, what?" It shocked me (P007:M—28:49)

Not only do women in these positions feel marginalized and feel like tokens but they also feel a responsibility to represent all women and to be a strong example for the women in the organization.

That's the cutoff. They're older, right? How welcome and encouraged do you feel? I mean, I can tell you, for many years-- I was one of two, three, four females Well, when you're a token, it's really hard because you're then sort of saddled with this you've got to be an example for all those other women at the same time, in some sense, being marginalized (P105:F—19:08)

While women felt isolated, especially in meetings, they also realized they were invisible.

When visitors would come in, they automatically assumed that I was a secretary. And they would either acknowledge me if they want a cup of coffee.... And so, once that was revealed to them, the visitors would come in and I noticed that, although everyone's-- because we would give presentation, they want to know what we did and all. And regardless of how many presentations I would talk about-- give to talk about my work and all, they would direct questions to the male, whoever the male was that was standing there. (P102:F—19:25)

Numerical underrepresentation and social isolation contribute to negative environments for women in STEM.

4.2.3.6. The Mommy Track

Women expressed all sorts of concerns about having children and working at NIST, from the lack of role models to the challenge of finding appropriate lactation space. One young woman is currently struggling with wanting to start a family.

I'm in an interesting spot. The next phase in my life would be, I want to start a family. And I feel a ton of pressure in-- I don't know if it's just in STEM or in doing that. I can't say I've ever been to a big talk where an individual was pregnant visibly, where I could tell she was maybe far along....So I don't know how being out of here for, say, maternity leave will impact people's impression of me or my work performance at that time. (P005:F—49:04)

She was not alone in her fears. When asked about having children while working another participant replied:

Yes. Oh, my gosh. That scared me to death. (P013:F-1:06:29)

A researcher whose children are older now remembered discussing the "mommy track" and the potential impact on your career and your ability to lead a team.

We often talked about that around the hallways as the mommy track. So now you're going to be mommy tracked. Yeah. And so that was a real thing back then that you could get on this track where

people no longer took you seriously as someone could lead research, lead research teams. (P112:F— 4:53)

Another participant became alarmed when her team lead started joking about her pregnancy and conveyed his assumptions about maternity leave.

Oh. Sure. We went into a meeting together. And it was, I think, going to be a contentious meeting or a long meeting. Something along those lines. And he kind of nudged me and said, "Well, if this is going bad, you can always pretend that you're going into labor." Or, "When you're on maternity leave, you can take training, since you're basically going to be on vacation for three months." Really awkward things that in some ways I thought he was kind of just trying to lighten the mood and joke about it. But it wasn't. And a coworker had caught some of the things. And I was documenting it all. Because I didn't know, down the road, where it would go, or how things would be once I had my child. If he was going to give me a hard time while I was on maternity leave, or when I returned, or anything like that. (P109:F—14:57)

Others described how their careers did suffer by going part time for a while. When one participant reduced her schedule to three days a week her pay band was downgraded even though she performed the same job duties.

You can stay in your current job at a pay band IV, working four days a week like this other person was doing, or you can revert to a pay band III with a three-day a week schedule, and we will move you back to operations." So, it took me about 12 seconds, and I said, "I will take the pay band III in operations." And my boss was shocked that I'd willingly take a downgrade and move into a different job because I wanted part-time. She did not understand this whole concept of different career goals. (P105:F—8:33)

At least two women were surprised by their supervisors' enlightened views of working mothers. Both were provided opportunities soon after returning from maternity leave. One shared the supervisor's sentiments.

"Well, that's a personal consideration. That was for you to figure out. I figured that if you applied for the job, that meant you wanted the job and you would figure out a way to manage any kind of external obligations." (P113:F—6:13)

A review of US longitudinal survey data found that approximately one-half of new mothers and almost onequarter of new fathers leave full-time STEM employment after having children [43]. Motherhood is seen as a driver of gender imbalance in STEM employment.

4.2.3.7. Housekeeping Chores

All federal organizations need people to organize tours, assist with Combined Federal Campaign (CFC) or coordinate birthday preparations for staff. All meetings must be scheduled and generally require note takers. However, most of the time these tasks are disproportionally assigned to women. One female scientist described how she is always assigned the task of organizing tours.

But for example, when we have tours, the person that is in charge of making sure that things are organized is me. And now, I don't understand why that cannot be assigned to another member of the staff, right? When they request of organizing an activity for the building, they will come to not only me but some of the other females in the building. Like we are the only ones that can order soda or pizza -- so it's strong proficiency that we have. (P116:F—16:38)

Many women described taking on mothering roles. In fact one woman described her work as "adult daycare."

I sometimes feel frustrated in my lab environment because-- a coworker, just the other day, described it as adult daycareHe said that's what his wife calls it, him working here. And I just said yes, because sometimes I do feel like the only woman and the youngest woman in my direct circle, there is a lot of like, "Have you done this? Did you remember that we had to do this? Did you remember we have a meeting?" I schedule the meetings most of the time. And it's this double-edged sword that I think probably a lot of women would recognize, in that probably if I had overtly said out loud to everybody, "Has everyone noticed that the young woman on the project is scheduling all the meetings all the time?" They'd all be like, "Oh my God. That's not acceptable." ... So sometimes I do feel like a mom of people who are twice my age. ... And the project has a history of women in that position and it being kind of-- I've heard from other women who were in the position before me, that it is frustrating and it does feel like being everyone's mom. (P108:F -15:36 & 15:49)

Another referred to herself as a "den mother."

So I always call myself the den mother. So anybody could come into my office. ... and they say, "What am I going to do about my kid? My kid's doing this in school. I did this to my wife. What should I do (laughter)? I forgot that today's our anniversary, what--" so it's been part of me as a life coach for these folks, okay, "Well, you better take care of your wife. If she doesn't like flowers, at least, does she like perfume or jewelry or anything?" (P006:F—30:15)

A young woman described starting her position and wanting to fit in and make a difference. The group was all men so she made cakes for everybody's birthday. But then she realized she was supporting the men's behavior.

So I just feel like that's a silly example of just another opportunity where I didn't even realize that I was supporting these men in a kind of a weird------ mother-like way. We all do it, and I was feeling like, "Oh, they love my cakes." And after that, I was like, "Oh, no. Oh, no, no. That's not good." (P111:F—30:25 & 30:40)

Many take on additional roles and responsibilities to be good team players, to fit in, to make a difference, but most realize that these housekeeping chores only take up valuable time and enable the gendered stereotypes to persist.

4.3. Gendered Outcomes

The gendered experiences that women have at NIST result in a variety of different outcomes for men and women. These outcomes often have lasting impacts on women's careers, affecting their ability to get and retain positions, to receive higher pay increases and bonuses, and to move into more advanced positions.

4.3.1. Hiring and Promotion: Getting There and Moving Up

One of the findings in this study is that men are able to develop connections and then use those to get hired and move up in the organization. This contrasts with the isolation and invisibility women often experience, as well as assumptions they face about their level of competence. A male participant, P103:M, speaks below about how "backroom policy, backroom politics" often determine hiring decisions.

I see that as an issue, and I feel guilty about it. And even though it's working out really, really well and probably better than anybody expected, that's kind of the backroom policy, backroom politics that I

think can limit opportunity for people here and can-- in this case, it didn't because I know the players, but it can be a recipe for limiting the amount of people that are on the team or the great fit as they say, right, because when you don't compete and you just name a successor as Group Leader or Division Chief or my role, what you have is kind of pressing the Easy button and not going through a process to determine who would be valuable based on what you're looking for. They are more or less picking personalities, and that is a concern of mine.... it becomes we select from the people we trust. And so there could be a lot of different reasons for why they have that, but I think that's definitely a thing that happens here. (P103:M—11:40 & 12:58)

It is difficult for women to be successful when they are not in the "backroom," when they are not part of the "players" who are known and trusted by those who make decisions about hiring and promotions. When women are not in the room, their voices are not heard, and they are not as likely to be hired or move up in the organization. P102:F succinctly captures the same idea.

...they hire people like themselves. And they look after their own. (P102:F-1:25:29)

I think because the majority of the leads are men, it's this impression-- it's that they're moving-- people tend to hire and promote people that look like them. (P116:F-35:13)

The end result is that fewer women are hired and retained.

In one interview, P105:F ponders whether NIST hires enough women and is "totally representative." As she thinks about this, she concludes by noting there is only one woman who is a Division Chief—a situation that is not especially representative.

Because if I just look out and take stock, we definitely have more men than women. And I think that's true if you look at the demographics of people graduating with PhDs in physics. And that's pretty much what we have here. And so is it totally representative? Does NIST hire enough women? I think they do a decent job of bringing on women post-docs. And then do they hire them on, and then I guess really the one thing I can say if I'm just taking stock of the lay of the land, is that we only have one woman Division Chief. (P105:F—31:09)

Many women in this study, and some of the men, recognized multiple ways in which the career paths of women did not advance in the same ways as those of their male colleagues. P104:F speaks about a female colleague's career.

Her career moved much slower than the men – looking at NIST culture – never diverse and never inclusive (P014:F—Field Notes)

She recognizes that the lack of diversity and inclusivity has affected women's careers. When it takes women longer to move up, they stay in pay bands longer, meaning they earn less over the course of their careers.

When women do seek promotion, they often face barriers, such as P112:F describes below.

One time I was going in for a promotion. And the person told me that, even though I had gone through the process to get this promotion and they had a committee for it and everything, and I came out as the top person for the promotion, they said they didn't want to offer me the job. Well, they wanted to offer me the job but they didn't want to give it to me. They wanted to give it to me on a contingent basis—... so I could prove myself, right? And I said, "Would you ever offer a man that? Would you ever,

after a man went through all that and won this position, would you ever offer that to a man? As a contingent position with constraints?" And they said, "No." (P112:F—19:20 & 20:00)

In this instance, a woman was being asked to "prove" herself capable before the promotion would be finalized. These types of barriers continue to block the advancement of women at NIST.

4.3.2. Equal Pay and Equal Opportunity

Hiring and promotion practices often result in fewer women being hired and promoted at NIST. In addition, some participants described situations where salaries, bonuses, and other opportunities were different for women than for their male colleagues.

After I became a NIST employee, I was very surprised and disappointed to find out that my salary was \$20,000 less than the salary of another peer who had been hired the same month as me with the same years of experience. And when I talked to my boss about it {inaudible} my Group Leader at the time, his response was, "Your husband has a good job. You don't need to make any more money." (P113:F—6:13)

In the quote above, not only was P113:F receiving a far lower salary than her male peer, but her Group Leader rationalized the lower pay, using traditional patriarchal arguments. When women start at lower salaries, this follows them throughout their careers, influencing their long-term finances—such as their retirement—for the rest of their lives.

Participants spoke not only about lower salaries, but about how bonuses for women were also not equitable, as P105:F notes below.

So I don't think that my bonuses were where they should've been. So theoretically, one could argue, given how much money they were saving of my salary, that whatever my performance rating was, a maximum bonus would make sense. And that didn't always happen. (P105:F—36:01)

This same participant also goes on to note how opportunities for career development were not offered to her.

Equitably, I can talk about developmental assignments. I can't say I've ever had a supervisor, with one exception, actually talk to me about developmental assignments and whether or not we should pursue them. So for example, I've never been through any of our leadership development programs. (P105:F—36:01)

When women are not offered development opportunities, or assignments that help them develop knowledge and skill sets, they are less likely to be considered for promotions, which again limits their long-term earning potential.

Other participants noted that they had been rewarded in their own careers, but still recognized that this may not be true for all employees.

But I do feel like I have been in a situation where I've worked hard and I've delivered on things, and that's been recognized and that has influenced my career path. And I think that's a really great situation to be in, because I'm sure lots of people feel like they've done those things and it hasn't influenced their career path. (P104:F—12:33)

P104:F notes here how her hard work has been recognized. This recognition allowed her to be successful at NIST. Yet, she recognizes that meritocracy might not benefit all employees. There may be others who have worked just as hard, but whose work and efforts are not recognized.

As previously noted in this document, the HR report from this project provides a quantitative analysis that shows different outcomes for men and women [15]. For example, that report found that women in the ZP career path started out making considerably less at NIST than their male counterparts with the same educational background. In addition, the data show a consistent trend of women being in a lower pay band and having a lower salary compared to men. While this varies depending on pay plan and grouping, it is clear that the most consistent and significant salary imbalances occur among the ZP staff, though this varies by year and OU. In addition, even though there is a larger population of women in secretarial and administrative roles, men have a greater chance of becoming a supervisor. Women are less likely to be offered positions with high visibility and decision-making capabilities, creating a barrier for women who want to reach the highest levels of leadership.

4.4. Why Women Choose Not to Report

In the face of all of these gendered experiences and outcomes, one must ask, why women do not say or do something. In part, this is because women just want to focus on their science—on their work, they do not want to have to focus on gender. However, women in this study also expressed serious concerns about what might happen if they did report. Some feared they would be labeled as too sensitive, whiny, bossy, angry, or worse, while others feared their careers might be negatively affected.

And if you do try to stand up for yourself, you get labeled as troublesome. (P101:F-5:55)

Whether standing up for oneself in the face of microaggressions or when asking about a bonus or promotion, women are often labeled in negative ways. P113:F below speaks about the various ways that women, especially those in leadership, are labeled.

I mean, I think this idea of-- a lot of people-- I don't know if it's problems. I would say it's characterizations, right? When you're a female leader, you get called bossy. You get called a bitch, right? Nobody ever calls a strong male leader bossy. They're authoritative, right? (P113:F-40:25)

These labels position women in particular ways in comparison to their male colleagues (bossy versus authoritative, for example) and often make it more difficult for them to lead.

I feel like there is a view-- and it's not just by the people who actively spread rumors. The initial reaction, including the reaction of senior leaders, was to immediately accept that rumors must be true. Because obviously since I am a woman, I'm in this role because I must be sleeping with someone. As soon as that's presented as a possible option, it's like, "Oh, well, that makes sense." And that to me is horrifying. (P104:F—34:30)

Once labeled, it is difficult for women to dislodge these images of themselves. And others, including leadership, assume they are true because the labels often portray women in stereotypical ways that resonate in a patriarchal culture.

Even in the face of more serious behaviors such as sexual harassment, several participants described their angst when deciding whether to participate or not in the cases. The process for bringing and following

through with discrimination cases is generally long, on the order of years for many cases, and women are resigned to the fact that "no discrimination will be found." Given this, why subject yourself to the process?

She came to me and she said, "Do you want to be part of this sexual harassment case that we're bringing to the attention of the lab director?" And I just was like, "I don't know. I don't know, because what will I be then? Will I be characterized as the complainer? Or will it really make a difference?" And so I eventually just ended up, yeah, saying that I would contribute to this and I would have my voice heard and I would sign on to it. And the person ended up leaving, and I think it was the first time in my memory that somebody left because of that. And it was egregious behavior, really egregious behavior. But before that, I think everybody was really afraid. (P112:F—10:06)

Note that in this situation, the participant was concerned about how she would be characterized if she moved forward with participating in the case. She also wondered whether it would make a difference at all—demonstrating a sense of resignation about the utility of it. Perhaps most of note here, though, is that she and others were "afraid." It is difficult for employees to be effective workers when they operate in a climate of fear.

In this next instance, another employee articulates similar resignation about the process.

I knew how the system worked. And someone advised me-- when the group was having issues ..., advised me to file a complaint ... I was hesitant to do that because I knew how the system worked. I knew that it would be hard for me. ... So I thought about it and thought about it. And I was like, "I don't really want to do this." ... "I don't want to go that route." But ... I said, "Okay. I'll do it." And so I filed a complaint. So first I started out informal, thinking that, "Okay. Give him a chance." Lies, lies on top of lies, lies-- I mean, outward lies, it was like, "Oh, it's on now. It is on now......" So I filed a formal complaint... And I knew what the response was going to be, that they would not find any discrimination. But it took on-- this is how the system-- people get worn down because this is a long process. It was like three years before it even got a reply from downtown. And the response came back, "No discrimination found." But I thought it was very funny that no discrimination was found. But the agency did find mismanagement. (P102:F—1:17:13 & 1:17:38 & 1:17:59 & 1:18:35 & 1:18:59 & 1:19:18)

Given the time and energy that women would have to (or do) spend on bringing and following through with these complaints, it is not surprising that some women might choose not to do so. In addition, there is a sense of resignation about the process—that nothing will happen as a result, so why bother.

As a result of the negative experiences they have had with the system, many women in the interviews have learned it is important to pick their battles, recognizing that not every battle is worth fighting. One female participant realized that by choosing the right battle she was more likely to affect change.

"Okay. If I use my voice, there are people here who will hear you and will make a change." That helped me go from what I-- seeing somebody held accountable makes you go from a position of maybe defensive, where you're feeling defensive, to a position where you feel empowered. And I did realize it's really important to use that judiciously, right? I didn't want to complain frivolously about every little thing that I considered a slight. I know that sounds terrible, but I did pick my battles because I wanted to make sure they were winning battles, right? And I felt that we were trying to really change culture. It's important to make sure that you have impact. Because otherwise the words get lost. So we went after the things that could, from then on, really make a difference and show people that you were part of at least a small culture at NIST, a place at NIST, a division at NIST, that took it seriously. (P112:F— 11:13)

The NAS report [40] finds that women are not likely to report the sexual harassment and other gendered experiences they encounter. In fact, women respond by ignoring the individual and the incident. They often do not confront the individual and generally try to maintain a working relationship. Further analysis shows that 74% avoid the individual, 70% do not attempt to address the situation, and 30% make up excuses to explain the man's behavior.

The NAS report [40] recognizes that men also experience gender harassment. However, the rates are significantly lower for men. A Department of Defense survey referenced in the NAS report found that of active-duty military men and women that 47 % of women experienced gender harassment while only 15 % of men experienced it. None of the men in our interviews described gender-based harassment. However, one male participant described an incident of harassment and how he confronted it with his Division Chief.

I had an opportunity to go to another country on detail for three months, work in the national lab there, help them with some of the research I was doing. And the supervisor at a meeting that I wasn't at because I was at another conference teaching made a comment to the group, "{participant} can't go on the detail. I know you all have heard about it. But he wouldn't be able to survive in that country. So I'm going to tell them no." (P115:M—57:21)

After the participant discussed the incident with his Division Chief the situation was resolved immediately.

"That person wasn't a Group Leader anymore. By the end of that day, that person was actually out of the division." But that one hurt more than....and that created a very toxic work environment. (P115:M—59:52)

This example clearly highlights the differences between the experiences of male and female participants. The male participant did not tolerate the behavior and chose to report it. He was not afraid of being dismissed because he was being too sensitive, nor did he fear retaliation. In addition, once the toxic behavior was reported to leadership it was addressed immediately, unlike the experiences of the female participants.

Many women not only described their resignation with the harassment, but also recognized how tolerance of bad behavior and lack of accountability impacted the entire work environment. Just as P115:M used the adjective "toxic" when describing his work environment at NIST, a female participant used the same term.

...the best word I can think to use to describe it is toxic and immature.... Because I don't see effective management. And I see bad behavior being rewarded and encouraged..... So again, I think the rewarding and promoting of bad behavior, particular to how we treat other people. (P105:F—15:01 & 16:16)

Later, P105:F discusses how "bad behavior" is "rewarded and encouraged." She argues that microaggressions and other gendered experiences and outcomes need to focus on both the "aggressor" and the "target."

It's not only about the berated. It's about the berater also. It has to be about the aggressor and the target. And we have to do better. But for so many years, it was always about that person because, "I'd worked with that person for the past 30 years, and they just have really high standards," or, "They just work so hard. Their job is so important to who they are and their identity that when people fall short, they just snap." Well, just snapping isn't acceptable, right? But again, there was this concern. And again, in most cases, the people who would be in charge of the accountability for that berater couldn't get over the relationship. (P105:F—59:38)

Here, P105:F notes how one would expect the concern to be for the victim, and not on the person responsible for the bad behavior. She describes how the connections that exist between those "in charge of the accountability" and the men who are responsible cause leadership to excuse their behavior. Leadership rationalizes their behavior.

Later in the interview, P105:F questioned whether or not NIST had the right to claim it was an equitable organization, given how it often tolerated these types of incidents.

And I really wonder, as an organization, how can we claim that we really are equitable, that we really are inclusive if we are not holding bad behavior to account (P105:F—01:01:17)

Another woman used the term "blind spot" to describe how the organization ignores gendered experiences and outcomes and the inequity they represent.

...but I do think as an organization we ignore that it {inequity} exists. I do think that we have a huge blind spot for both, I'll say, the equity side of advancement and the impact. I think it's impossible to correct when all of our leadership is men, because I think it's just-- it is things that they don't even think of because they just haven't been in the situation... (P104:F—50:48)

Another woman was willing to actually tell her male boss that he does not (really cannot) know how she feels about the gendered experiences and outcomes she has had.

...like I said, from a leadership perspective, when we have all men, I just don't think they see that {sexual harassment}, because it is-- it's this-- and whether they mean well or don't mean well doesn't really matter. It's just your-- it's really-- and I will say I have a—I have a lot of respect for and I do have a good relationship with my boss. And we were talking about this the other day. And he made a comment of, "I know how you feel." And I said, "In all due respect, you don't. (P104:F—56:05)

In all of these instances, female participants argue that the men in charge are unable to see or understand what women experience—the gender harassment, the microaggressions, and the lack of ability to advance, among others.

When leadership at NIST tolerates and ignores bad behavior, and the subsequent gendered experiences and outcomes women face, it creates an image that gender is not involved in these issues, again making women less likely to report.

4.5. The False Image of a Gender-Neutral Workplace: The Development of Gender Fatigue

While almost all of the female participants in this study described incidents of gendered experiences and outcomes, they do not believe all men at NIST are part of the problem. However, they do wonder how many are willing to be part of the solution, especially given the composition of leadership at NIST.

I don't think it's pervasive in-- it depends on how you define pervasive. I certainly don't think it's everyone. I don't think that's a fair statement at all. I think there are lots of wonderful men at NIST who do not-- who help to advance women's careers, who at worst are neutral, at best are advocates, and I do think that's the majority of men at NIST. I think there are probably a handful of people - and I don't know how many a handful is - that have really terrible behaviors. And then I think there's a larger group that in some-- I think they have no idea that what they're saying. (P104:F—49:49)

Here, P104:F argues that gender discrimination is not pervasive at NIST, that not all men participate in treating women badly or inequitably. Perhaps most important is that P104:F wants to believe that gendered experiences and outcomes are not pervasive at NIST. Instead, she believes that it is important to consider the environment to be gender neutral, with perhaps just a few bad apples.

Constructing the workplace as gender neutral allows women to believe that their hard work matters and will pay off. Kelan [44] argues that women face an ideological dilemma: they want to see their workplaces as gender neutral but know that gender discrimination occurs. This creates a type of "gender fatigue" for women.

It appeared that interviewees were losing the energy to acknowledge and potentially oppose gender discrimination. It seemed that they were suffering from *gender fatigue:* interviewees appeared to be tired of constructing their workplaces over and over as gender neutral in spite of the fact that incidents of gender discrimination either had at one time occurred within their workplace or could again occur [44].

The resignation many women expressed above when discussing the decision to report or not creates the same kind of fatigue.

Men, as well, often construct the organization as gender neutral. When asked whether they believed they had any advantages at NIST because of their gender, most men responded like P002:M: "I don't think so" (P002:M—23:29). Men want to believe the system is neutral as well, since they do not want to call into question the very systems that have advantaged them. Constructing the culture as gender neutral also allows leadership to continue to rationalize men's behavior and not disrupt the status quo.

4.6. The Boys' Club versus the Chilly Climate

Ultimately, men and women experience two different NISTs—the Boys' Club for men and the Chilly Climate for women. The former privileges men and masculine ways of being, while promoting a veneer of neutrality. For all of the reasons laid out above, the barriers and facilitators for men and women are different. Few barriers exist for men related to gender, while many invisible advantages act as facilitators, such as objectivity, meritocracy, and connections developed with people who look like them, to name just a few. This creates a type of Boys' Club, where men and masculinity are valued and rewarded. This results in men hiring and promoting those who look, act, and think like them, as described in previous sections, as well as men accepting the bad behavior of men they know.

Some of the supervisors, especially in the finance area, are all products of the good old boys' club that was really rampant when I first came to NIST. And they believed that once you were on their team and they were your supervisor, that they owned you. And woe be it to you to want to move out, move up, move forward. (P001:F-2:02)

As P001:F notes above, not only does the Boys' Club provide advantages for men, it often operates to actively discriminate against women, especially those who want to move or advance or those who choose to complain.

Some of the things that act as facilitators for men function as barriers for women, such as assumptions of objectivity and meritocracy. Other barriers for women include many of the microaggressions and gendered experiences previously described. Isolation and invisibility, lack of respect, focus on body/dress rather than intellect and work, among others, all function to create barriers for women at NIST. P101:F describes in detail the Chilly Climate women experience at NIST.

I probably, over the years, worked with three or four different women, total, out of a group of 50 or so people. And I can't recall a single woman I worked with ever being, like, "Oh, yeah. This is a great environment," or having them not have these types of issues at some point and feeling very--- like, everything you say gets interpreted in the stupidest way you could have possibly meant it. And it's really frustrating to try to feel like people actually take you seriously and treat you like a real researcher with potential. If anything, it seems like a lot of the women get treated like they are the secretary equivalent in a lab of doing the necessary but unimportant and unimpressive tasks. And so a lot of the women I know who do work at NIST, wind up getting pigeonholed into these projects that go nowhere, don't have a lot of publishing capabilities, and then NIST seems surprised that these women are frustrated and having trouble really promoting their careers further, when to an outside observer or somebody who actually is aware of the situation, it's pretty obvious why they're now having problems with it. And they're kind of expected to shut up and just take that role. And if you try to do anything different or expand or improve yourself, you get a lot of blow back. And people act like you're crazy, and you're too emotional to do this, and like, "Why is she upset, now?" (P101:F—6:59)

I remember this plain as day. That's when he says, "You must learn how to toot your own horn young lady." That was his advice to me. And I said, "As you can see here, I have no problem tooting my own horn.".... "But let me tell you what the real issue is. You're asking me to play a game that I don't even know what the rules are. And every time I think that I have reached the finish line, you keep moving the finish line. And as a matter of fact, let me make it a little bit more clear. It's like blowing bubbles, you go to catch it, and it disappears." He was silent. He got it. And my promotion went through. (P102:F—49:40 & 50:00)

These two participants lay out what the Chilly Climate looks like and feels like for women, including the consequences women face when they choose to question or disrupt the climate.

There are also facilitators for women, but they are different than those that support men. For women, the ability to network, develop relationships, engage in teamwork, and have the support of mentors all provide support for women's acceptance, advancement, and success at NIST.

But I have noticed my Group Leader in particular, and the women that I have worked for in particular, really do focus on mentorship here. And I've always said about NIST that women here actively seek to help other women in a way that I don't necessarily see men doing, even for other men, kind of. (P108:F—8:58)

These facilitators help women to survive, and sometimes to thrive, however they are often not enough to combat the Chilly Climate that is present at NIST for women.

In the previous section, P104:F makes an important point about how one defines pervasive when speaking about gender discrimination at NIST. She further elaborated on the culture:

I think there are only a handful of people at NIST that engage in really egregious behavior and I don't believe egregious behavior to be pervasive at NIST. I think most men mean well and even want to help, but they don't really see the problem or when they do see a problem, they don't know what to do about it. I think most people at NIST think they treat staff equally and that they create a gender neutral environment, but they don't realize that there is an underlying culture and unconscious bias that negatively impacts women. (P104:F—50:48)

Throughout this report, we have argued that it is the culture at NIST that helps create and produce gendered experiences and outcomes. From this perspective, gender discrimination is pervasive, as it permeates the very culture of the organization. It is not only the men who actively discriminate, it is also all those men (and women) who sit on the sidelines and do and say nothing when they recognize discrimination is happening. This acceptance of the status quo is what contributes to the ongoing acceptance and perpetuation of the two different NISTs, of the Boys' Club and the Chilly Climate.

5. Discussion

This research study is the first of its kind at NIST. It is the first to explore the differences in the ways in which men and women experience work at NIST and how those differences result in different opportunities for women that affect things such as career advancement, value in the organization, and other work experiences. While NIST has participated in the Federal Employee Viewpoint Survey (FEV) since the inception, the FEV does not focus specifically on gender but on employees perceptions of conditions and characteristics of successful organizations present in their agencies. In fact the FEV results do not include sex disaggregated data. The NIST affirmative action survey of women in 1993 [12] did specifically address gender but did not pursue a holistic approach including both qualitative and quantitative methods for a complete perspective.

Our study findings are consistent with other qualitative research such as that of Cabay [45] in STEM doctoral programs and the comprehensive reports from NAS on the Underrepresentation of Women and STEM [38]. Our results provide a unique glimpse into events that influence women's career opportunities and advancement at NIST. Overall, women do experience NIST differently than their male counterparts. The experiences and incidents reveal impediments that women at NIST encounter from historical structures including the patriarchal and male dominated structures of the federal government and masculinized STEM culture to meritocracy and work life balance. The data on micro-aggressions and tolerance for bad behavior depict how the climate becomes and remains chilly. These stories remind women that they are unwelcome, do not belong, and are viewed as being less capable and less valued than their male colleagues, all of which affects their ability to succeed at NIST.

An additional theme emerged from the results: participants' resignation that the culture at NIST appears resistant to change. As described in Section 4.1 the resistance to change at NIST is influenced by two factors. Part of the resistance is due to the nature of government. Federal organizations in general are slow to change based on the bureaucracy required to implement changes. However, a significant contributor of the resistance at NIST is rooted in the role of, and value of, excellence. This value inhibits

change using the argument: "It's working so don't change it." In fact several participants bemoaned the resistance to change.

This was just a, "Well, we've always done it this way. It's always been this way, so we can't change it." (P006:F-13:18)

And there's also a lot of the, "I'm the only woman in the room." And you look around and it's a lot of whiteness and a lot of male. I'm like, "How do we fix this?" And they have to want to contribute to fixing it, otherwise, you can't fix it by yourself. (P013:F—15:43)

Excellence is the argument used to defend meritocracy and elitism, to defend hiring from preferred schools, to defend the performance evaluation system, and to tolerate bad behavior from otherwise excellent performers. Excellence has been and should always be an important component of NIST's culture. But, the focus on excellence should not overshadow other key values at NIST and should not prevent organizational growth.

Consider the recommendation to establish an ombudsman position from the Affirmative Action Report of 1993 [12] – that recommendation was enacted just this year (27 years later) when an Ombud's position was finally established and filled. The transcripts demonstrate the reluctance to organizational change even when the organizational culture is responsible for the gendered experiences and outcomes leading to different standards for men and women. One participant specifically addressed how it was incumbent on the leadership to embrace inclusion and promote change.

I think there were some tremendous, tremendously evolved people in leadership. As times changed, as positions changed, I saw really evolution in the people who were there at the table. But not always the case. I mean, one of the things that I think people could do better on is when-- One of the things we never really highlighted very much was really asking them about how they dealt with a situation like that. Their thoughts on that. Or what about them demonstrated in their role that they took that seriously. Because I did still continue to see people who were promoted who didn't consider inclusion to be important, and who seemed very, I don't know, like it was not an important topic. I mean, it's important to really ask, "How have you demonstrated this in your life and in your leadership?" Especially if people are getting promoted. (P112:F -13:15)

So I do think there is bias. And so the question is how to repair that, and how to make sure we can get people in more leadership positions. And I do think it has to come down to the fundamentals of opportunities. You can't just say, "Okay, now we need 10 women in these positions." They have to have grown. We have to prime them for them. We have to make them visible. We have to put them out there. We have to show confidence in them. We have to put them in front of people, even if they're better than us. Some people aren't very good at that. If somebody's going to outshine you, then you might not like that. I know that sounds terrible, but I've seen lots of examples of that. And so I think really, being very, very deliberate about positioning people. Because you can't just say, "Now we need 10." They have to be people that are ready and that we have made visible and visibly ready. So yeah, there's bias, but I think there's just groundwork that really has to be done to repair that. (P112:F—8:08)

Yet, everyone at NIST must contribute to and participate in the cultural changes required to underpin a diverse and inclusive environment. Men and women need to be part of the solution; leadership and staff

need to be part of the solution—the changes need to be far-reaching and organization-wide. Overall, women said they do not want to be treated differently, they just want to be treated fairly.

6. Conclusion

As discussed throughout the report, previous attempts at NIST to address issues of diversity, equity, and inclusion have resulted in some changes. However to a large extent, outcomes for women at NIST have remained relatively stagnant since the NIST 1993 [12] report was published (with the exception of a significant rise in the percentage of women in the ZP ranks, from 14% to 24.54 %.) Clearly, NIST has additional work to do in order to achieve its goals related to equity and inclusion for women.

As part of their interviews, participants discussed specific actions they would like to see as outcomes from this study. There were 86 different pieces of data coded as "Desired Outcome." There were 10,322 words in this set of extracted data, with an average of 120 words per response. Clearly, participants provided a lot of input on next steps, indicating they care about what happens after the study. Participants described the need for cultural change in addition to targeted actions.

A recognition that I think there is a cultural-- I'm going to use the word systemic, and that's too big of a word. But a systemic issue on the treatment of women at NIST. Maybe systemic isn't too big of a word. And that we as an organization have to do something to address it. And I don't-- there is no easy answer. And I completely recognize that. (P104:F—57:54)

From this set of extracted data, we originally identified 13 categories of participant ideas related to the impact they would like to see from the study. The 13 primary categories were further divided into various sub-categories (Appendix G contains the full list). Subsequently, we collapsed this list into three broad tracks that represent participant ideas for potential improvement. These ideas about impact all relate to how NIST can change the culture addressing the Chilly Climate for women. Perhaps most important to participants was the need to see action for change and the need for accountability for change. This includes:

- holding leadership and staff accountable for actions;
- enforcement and follow-up;
- having a plan for how to create and sustain change;
- minimizing bias and creating policies to address them;
- and providing transparency in policies, processes, and their application.

Visibility, balance, and accessibility were also important to participants—in the recruitment, hiring, retention, promotion, and advancement of women. Finally, many participants highlighted the need for overarching cultural change that recognized the systemic nature of the problem(s).

Categories and subcategories are presented in Table 2 below, along with counts of how many data extractions are associated with each sub-category and exemplar quotes that represent them.

Changing the Chilly Climate for	Number of	Exemplar Quotes
Women:	Relevant Data	
	Extractions	

Table 2. Overview of Data on Desired Outcomes as Stated by Participants

Categories and Sub-Categories of Participant Responses					
Taking Action and Providing Accountability					
Hold leadership and staff accountable for actions, enforcement, and follow- up	27	Yeah. And I think that a recognition that, yeah, we have a systemic issue in how women are treated. I think the other thing that really exists and this might be a little outside the scope of the study. But also the recognition of what one toxic person does to a work environment. And some of that ties to this, because you {get to?} treatment of women. But it's a regardless. And one toxic person, just the impact they can have, is massive. And I don't think we as an organization deal with that well. I think we ignore it. And all that does is say that that's okay. And, yeah, we don't address those behaviors. And so, yes, to me an outcome of a recognition that we actually have a problem, an acceptance of the fact that there's a problem. I don't expect anyone to come forward with an easy solution. It doesn't have one. But I do think, yeah, a recognition, an acceptance, and a willingness to say, "We'll make changes. We don't know what they are yet. And we might make some changes that don't help it. We might try things." But I think a willingness to say, "We're actually going to address it and make changes as a result." So that'd be {mine?}. (P104: F – 59:04)			
Have a plan of action	16	So I realized that that is the only thing that's going to make people feel I won't say trustworthy because they're not going to feel trustworthy until they actually see some action. But if they don't know what actions that you're going after for, let's see, whatever the timeline is, this fiscal year, two years from, six months from now, I mean, you're just going about it willy nilly, they have no knowledge of what you're trying to accomplish. So I would suggest that from all of this data, and that's what I did for the coach {inaudible}, to have the managers to come up with some type of strategic plan that's public, accessible, by the staff, with identifiable milestones, reasonable timelines, short term, long term, and who's going to do this. (P102: F – 1:06:15)			
Minimize biases and create policies to address them, including addressing inappropriate behavior quickly and directly	15	I would love to see biases become minimized. I would love to see people having the mindset of being on a team. I would like for people to take their blinders off and not be so narrowly focused. I think those are the biggest things that I would love to see happen with inclusivity. (P001:F—1:03:00)			
Provide transparency in policies, processes, and application of them	13	An increased awareness of staff. That they can all make a difference in everybody else here in a positive way. And that it doesn't have to be about them all the time. And that if they can do that, then everybody gets in a better place. That it's that awareness, that learning, and that we understand that culturally, we need to improve to get there and that we can't be influenced by the politics of the weak or the beliefs of this religion or whatever. I've always said NIST needs to learn to see itself as a family and that we know families can be dysfunctional at some point, but at the end of the day, they're family. (P115: M – 1:04:20)			
Commit resources	5	We got to put our money where our mouth is. (P102:F-1:11:00)			

Creating Visibility, Balance, and Accessibility						
Identify pathways and possibilities for advancement of women	21	I think if it's more career advancement. Right? And that a woman can have the same advancement as a man. (P019: F – 15:31)				
Challenge notions of meritocracy in hiring and promotion practices	21	But for some reason, we still again, that's that meritocratic problem where we still are thinking things in a build-the- numbers-per-person case instead of build the impact for the organization. As long as we still have that part, we're going to have a lot of these other systematic problems. (P103:M— 1:07:43)				
Address biases in recruitment and retention of women	14	So it's like, I feel like the only answer really is representation. I just feel like it's more women have to be in leadership positions here. Period. And whether that be increasing hiring I mean, everyone has to be qualified. I think, usually, that's the case. Even with affirmative action, you're qualified. (P106:F—44:26)				
Changing the Culture	Changing the Culture					
Recognize that problems are systemic and institutional, not just individual, and that they run throughout the organization	32	But for some reason, we still again, that's that meritocratic problem where we still are thinking things in a build-the- numbers-per-person case instead of build the impact for the organization. As long as we still have that part, we're going to have a lot of these other systematic problems, which we know are an issue throughout academia. Actually, there are couple of people that have come in this is kind of shocking, but a couple of people have come in that have said that we are not as bad in any of these things as, say, academia, which they're not even having the conversation. It's perspective, but it's not a win. Right? I mean, we have to be very careful of any of the studies that we're doing. Any of the analysis that comes out, any of the results, any of the improvements we make, they're winning battles. They're not winning wars. Right? And it's a marathon for another analogy, but I mean, I was a sprinter actually in and that took a lot out, but it's a whole game here. We're trying to make it better. And there's always going to be new we're always going to come up with new data of something new to improve upon, and so I want to make sure that we don't ever put the mission accomplished banner up. (P103: M – 1:07:43				

While the participants were eager to share their visions for the future, unfortunately many participants expressed concern and were resigned to the fact that nothing would be done. This report, like the NIST 1993 [12] report, would be forgotten.

Well, it goes back to check a box, and it also goes back to-- what I have noticed is if it's ever implied subconsciously, consciously that an alternative path or an alternative set of rules to how you got there are thrown out, it can kind of be seen as an indictment on you. And mirroring the general populace as a whole, it's an implicit attack on the white guy. We're going to fight that for some time because it makes people uncomfortable because the reality is if you redid theirs, they might not be where they're at. So there's some protectionism that goes into these Easy-button decisions and this checking a box because it doesn't disrupt the status quo. (P103:M—51:22)

I think it's a top down because I don't think it's bottom up because you see the participation. There's still interest from the bottom up. But the bottom up, in the trenches-- the trenches still don't-- they don't know what the vision is from the top. Is this just another paper exercise? (P102:F—1:10:29)

In 40 years, hasn't changed. (P102:F-42:58)

These participant ideas provide a roadmap for NIST about how it might rethink its approaches to diversity, equity, and inclusion as the organization works to improve the Chilly Climate that many women described in the interviews.

6.1. Next Steps

The results of this qualitative study enabled the development of a NIST-wide survey focused directly on the experiences of women at NIST. The survey provides a mechanism to quantitatively address the research questions for the larger project. The survey results will allow for the quantification of data and the generalization of results from the sample to the entire population at NIST. Together the Demographic Analysis Report [15], the qualitative interviews, and the survey will provide a holistic perspective of the experiences of women at NIST and the barriers that women face.

This year could be the catalyst for change given the renewed interest in equity and inclusion as evidenced by the Office of the Associate Director for Laboratory Programs funding three research studies to better understand the current issues at NIST. Other positive signs include the establishment of the Ombuds Office, the development of a strategic plan specifically for diversity and inclusivity, and the initiative to appoint a diversity coordinator to lead efforts to improve diversity and inclusion at NIST. Finally, there have been numerous seminars sponsored by the CRDO office and the employee resource groups.

Momentum is building. The staff is ready and waiting for the next steps. The time for intervention is now.

Acknowledgements

We would like to acknowledge and thank those who have made this study possible. First, we would like to acknowledge the Associate Director of Laboratory Programs, Dr. James Olthoff, for the funding support and opportunity to perform this research. Additionally, we would like to thank the 40 employees who took time out of their busy schedules to participate in the in-depth interviews and share their experiences of working at NIST. Finally, we thank Kimberly Sharp for her administrative support and organizational guidance throughout the study.

References

- Ali, M., C.T. Kulik, and I. Metz, *The gender diversity–performance relationship in services and manufacturing organizations.* The International Journal of Human Resource Management, 2011.
 22(07): p. 1464-1485.
- 2. Herring, C., *Does diversity pay?: Race, gender, and the business case for diversity.* American sociological review, 2009. **74**(2): p. 208-224.
- 3. Muchiri, M.K. and O.B. Ayoko, *Linking demographic diversity to organisational outcomes.* Leadership & Organization Development Journal, 2013.
- 4. Colwell, R., A. Bear, and A. Helman, *Promising Practices for Addressing the Underrepresentation of Women in Science, Engineering, and Medicine*. 2020.
- 5. Holman, L., D. Stuart-Fox, and C.E. Hauser, *The gender gap in science: How long until women are equally represented?* PLoS biology, 2018. **16**(4): p. e2004956.
- 6. Hall, R.M. and B.R. Sandler, *The Classroom Climate: A Chilly One for Women?* 1982.
- 7. Rowe, M.P., *Barriers to equality: The power of subtle discrimination to maintain unequal opportunity.* Employee Responsibilities and Rights Journal, 1990. **3**(2): p. 153-163.
- 8. Perez, C.C., *Invisible women: Exposing data bias in a world designed for men*. 2019: Random House.
- 9. Williams, J.C., *The 5 biases pushing women out of STEM*. Harvard Business Review, 2015. **24**.
- 10. Automation, R. *Culture of Inclusion and Diversity*. March 2020]; Available from: <u>https://www.rockwellautomation.com/en-gb/company/about-us/integrity-sustainability/culture-inclusion-diversity.html</u>.
- 11. Kafoury, D., *Multinomah County Workforce Equity Strategic Plan*, M. County, Editor. 2019.
- 12. Gebbie, K., *Report by the Ad Hoc Affirmative Employment Committee for Female Scientists and Engineers* 1993, National Institute of Standards and Technology p. Appendix A : A1.
- 13. May, W., *African American Affirmative Employee Committee Report* 1993, National Institute of Standards and Technology
- 14. Theofanos, M. 2020.
- 15. Evans, J., Koepke, A., Lund, S.P., Theofanos, M.F., *NIST Workforce Demographics Analysis.* Draft 2020, National Institute of Standards and Technology.
- 16. Yin, R., *Case study research: Design and methods*. 5th ed. 2014, Thousand Oaks, CA: Sage.
- 17. Council, N.R., *Learning science in informal environments: People, places, and pursuits*. 2009: National Academies Press.
- 18. Fang, F.C., A. Casadevall, and A.J. Bäumler, *Competitive Science: Is Competition Ruining Science?* Infection and Immunity, 2015. **83**(4): p. 1229-1233.
- 19. Johnson, S., *Inclusify: The Power of Uniqueness and Belonging to Build innovative Teams*. 2020, New York: Harper Collins.
- 20. Cooper, M., *The False Promise of Meritocracy*, in *The Atlantic* 2015.
- 21. Mijs, J.J. and M. Savage, *Meritocracy, elitism and inequality.* The Political Quarterly, 2020.
- 22. Rice, J.,

The Difference Between First-Degree Racism and Third-Degree Racism in The Atlantic 2020.

- 23. Colwell, R., Women Scientists Have the Evidence About Sexism, in The Atlantic 2020.
- 24. Moss-Racusin, C.A., et al., *Science faculty's subtle gender biases favor male students*. Proceedings of the national academy of sciences, 2012. **109**(41): p. 16474-16479.
- 25. Wennerås, C. and A. Wold, *Nepotism and sexism in peer-review*. Nature, 1997. **387**(6631): p. 341-343.
- 26. Gale, T., T. Molla, and S. Parker, *The illusion of meritocracy and the audacity of elitism: Expanding the evaluative space in education*, in *Policy and inequality in education*. 2017, Springer. p. 7-21.
- 27. Freeman Jr, S. and D. DiRamio, *Elitism or pragmatism? Faculty hiring at top graduate programs in higher education administration.* Journal of the Professoriate, 2016. **8**(2).
- 28. Britton, D.M., *Beyond the chilly climate: The salience of gender in women's academic careers.* Gender & society, 2017. **31**(1): p. 5-27.
- 29. Pavco-Giaccia, O., et al., *Rationality is Gendered*. Collabra: Psychology, 2019. 5(1).
- 30. Settles, I. *Women in STEM:Challenges and determinants of success and well-being*. 2014; Available from: <u>https://www.apa.org/science/about/psa/2014/10/women-stem</u>.
- 31. Kruse, S.D. and S.S. Prettyman, *Women, leadership, and power revisiting the Wicked Witch of the West.* Gender and education, 2008. **20**(5): p. 451-464.
- 32. Baer, M., et al., Intergroup competition as a double-edged sword: How sex composition regulates the effects of competition on group creativity. Organization Science, 2014. **25**(3): p. 892-908.
- 33. Farenga, S.J. and B.A. Joyce, *Intentions of young students to enroll in science courses in the future: An examination of gender differences.* Science Education, 1999. **83**(1): p. 55-75.
- 34. Buck, G.A., et al., *Examining the cognitive processes used by adolescent girls and women scientists in identifying science role models: A feminist approach.* Science Education, 2008. **92**(4): p. 688-707.
- 35. Hill, C., C. Corbett, and A. St Rose, *Why so few? Women in science, technology, engineering, and mathematics.* 2010: ERIC.
- 36. Heilman, M.E., et al., *Penalties for success: reactions to women who succeed at male gender-typed tasks.* Journal of applied psychology, 2004. **89**(3): p. 416.
- 37. Jewkes, R., M. Flood, and J. Lang, From work with men and boys to changes of social norms and reduction of inequities in gender relations: a conceptual shift in prevention of violence against women and girls. The Lancet, 2015. **385**(9977): p. 1580-1589.
- 38. National Academies of Sciences, E. and Medicine, *Promising Practices for Addressing the Underrepresentation of Women in Science, Engineering, and Medicine: Opening Doors.* 2020: National Academies Press.
- 39. Cheny, I.a.S.S., *Picture a Scientist*. 2020.
- 40. National Academies of Sciences, E. and Medicine, *Sexual harassment of women: climate, culture, and consequences in academic sciences, engineering, and medicine*. 2018: National Academies Press.
- 41. What are Microaggressions. Available from: https://www.uml.edu/research/advance/about/microaggressions.aspx.
- 42. Yang, Y. and D.W. Carroll, *Gendered Microaggressions in Science, Technology, Engineering, and Mathematics.* Leadership and research in Education, 2018. **4**: p. 28-45.
- 43. Cech, E.A. and M. Blair-Loy, *The changing career trajectories of new parents in STEM.* Proceedings of the National Academy of Sciences, 2019. **116**(10): p. 4182-4187.
- 44. Kelan, E.K., *Gender fatigue: The ideological dilemma of gender neutrality and discrimination in organizations.* Canadian Journal of Administrative Sciences/Revue Canadianne des Sciences de l'Administration, 2009. **26**(3): p. 197-210.
- 45. Cabay, M., et al., *Chilly climates, balancing acts, and shifting pathways: What happens to women in STEM doctoral programs.* Social Sciences, 2018. **7**(2): p. 23.

Appendix A. Research Design

Problem, Purpose, and Research Questions

Research today shows that a diverse workforce brings a multitude of benefits, yet many organizations struggle with how to increase, integrate, and take advantage of diversity. Increasing the numbers of diverse populations is one approach. However, increasing numbers alone does not address core problems of equity and inclusion that many organizations, including NIST, continue to face. There are differences in the ways in which men and women experience work at NIST that result in different opportunities for women, affecting things such as career advancement, value in the organization, awards, and other work experiences.

The purpose of this research effort is to explore the experiences of NIST Federal employees, at all levels, to identify the ways in which differential opportunities and outcomes might exist, in this case related to gender. The goal is to provide the organization with data about how inequities manifest themselves to find ways of providing more equitable and inclusive experiences for all employees.

A set of research questions guide the study and provide a framework for design, data collection, and data analysis. The questions below form a foundation for the research and continually guide our work.

Overarching/Integration Questions

- 1. What are the barriers and facilitators, if any, that impact women's opportunities at NIST?
- 2. In what ways do the quantitative and qualitative data converge?

Qualitative Questions

- 1. How do men and women describe their work experiences?
- 2. What do opportunities for men and women look like at NIST?

Quantitative Questions

- 1. To what extent are differences in opportunities present?
- 2. Are there differences in the ways in which men and women perceive and describe gender inequities at NIST?

Research Design

Given NIST's orientation as a metrology institution and the importance it places on data and scientific rigor, this study uses a well conceptualized research design that is data-centric and multi-method in order to address the problem, purpose, and questions under study. The multi-method approach includes both quantitative and qualitative data collection and analysis, which provides a holistic view of gender at NIST today. Specifically, the study can be described as a sequential, exploratory multi-method design comprised of three phases. Phase 1 consists of a quantitative examination of data from Human Resources in order to examine where women are located at NIST, as well as how their salaries, promotions, awards, and other indicators compare to those of men in the organization. This phase was utilized to develop an interview for Phase 2, which is a qualitative component comprised of interviews with approximately 40 randomly selected employees from a range of positions and career paths. Results from both Phase 1 and Phase 2 informed the development of Phase 3, which is an organization-wide quantitative survey. Ultimately, data from the three phases will be integrated for analysis to provide for a more holistic understanding of the role that gender plays at NIST (Figure 6).



Figure 6. Phases of Research Design

This document focuses specifically on Phase 2, the qualitative interview phase. Appendix A describes the strengths and goals of qualitative and quantitative methods. This phase used in-depth interviews to address the following Research Questions:

- (R1): How do NIST employees (women and men) describe their work, the environment, and opportunities for career advancement and promotion?
- (R2): In what ways are the work experiences of the women and men similar and/or different?
- (R3): What practices/systems contribute to limiting or facilitating career opportunities for women?
 - a. What do women believe is missing in their current environment that is inhibiting success and contributing to the imbalance?

Appendix B. Methods

Qualitative research is iterative in nature and focuses on the importance of participants' voices and perspectives to drive the research process. The process consistently returns to the research questions to inform future elements of the process particularly data collection and data analysis. It is also constructivist in that the focus is on how participants, in this study women and men, conceptualize their worlds—based on their individual understandings as well as based on shared meanings and social constructs. A case study approach was used, which Yin defines "an empirical inquiry that investigates a contemporary phenomenon (the 'case') in depth and within its real-world context". Yin argues case study is most appropriate when exploring "how" questions where contextual conditions are relevant to the phenomenon under study. The phenomenon of study is experience of gender at NIST. The qualitative process can be further refined as in Figure 8.



Figure 7. Iterative Nature of Qualitative Process

Appendix C. Qualitative and Quantitative Methodological Differences

Qualitative and quantitative research approaches rely on different paradigms. They utilize different methods of data collection and analysis, and they represent data differently. Thus, their purposes, processes, and products are different. Often, there is a perspective that quantitative research is "objective" while qualitative research is "subjective." This is an oversimplification and misunderstanding of the strengths and weaknesses of each approach. Instead, each approach has different processes for ensuring rigor and for providing validity and reliability of the research.

Qualitative Research

Qualitative research is guided by an interpretivist paradigm that relies heavily on naturalistic methods in order to describe and understand the human condition from the participants' perspectives. It assumes a reality that is dynamic and negotiated. Qualitative research seeks to describe or explore a group or phenomenon in a comprehensive way. It is often exploratory or investigative and may or may not utilize hypotheses to guide it. Research questions are broad and focused on including voices and perspectives of participants. Data are collected by engaging directly with participants and analyzed by systematically identifying key ideas and concepts that occur across the data set, and then exploring the relationships amongst these. Although some erroneously view qualitative research as anecdotal, when a rigorous research design is in place, qualitative research can provide a deeper understanding about the group under study and may reveal information that is impossible to obtain through a survey or more mechanistic methods.

It is not appropriate in qualitative research to generalize to the population at large, however readers are able to make decisions about a study's generalizability to their own situations based on how well the researchers describe process and outcomes of the research. Instead of validity, qualitative researchers choose to discuss the "trustworthiness" of their work, focusing on methods of triangulation. Approaches to triangulation may include: methods to ensure honest responses from participants (such as informing them they can voluntarily withdraw or refuse to answer a question at any time); Iterative questioning (to ensure consistent data from participants); frequent debriefing sessions amongst researchers (to explore gaps in the process and/or product and ensure exploration of varied and alternative ideas); and experienced investigators who are knowledgeable about the content and the population. Reliability in qualitative research process and providing detail about each step. This creates a model of the research that others can utilize as a template to conduct a similar study.

Quantitative Research

In contrast, quantitative research is generally guided by a positivist paradigm that sees the world as comprised of facts that are observable and measurable. It assumes a fixed and measurable reality. In this paradigm, it is important to delimit phenomena into measurable and/or similar categories that can be generalized to a larger population. It is explanatory in nature and relies on the quantification of data which allows for the generalization of results from a sample to an entire population of interest. Research questions in this approach are narrow and specific, and based on hypotheses that guide the research. Quantitative methods focus on collecting measurable, numeric data that works to place the diverse perspectives and experiences of people into a limited number of predetermined response categories.

Data are analyzed through numerical comparisons and statistical inferences. Validity is the extent to which an instrument accurately measured what it is supposed to measure. Reliability in quantitative work demonstrates that similar results would be obtained if the research was repeated in the same context, utilizing the same methods, and with the same participants. Statistical tests and measures assess validity and reliability in quantitative studies, lending to their credibility as objective methods.

Validity and Trustworthiness in Qualitative Research

Qualitative and quantitative methods apply different approaches to validity. Even similar terminology has different meanings. Table 3 illustrates how qualitative and quantitative methodologies use the same terminology in different ways.

Term	Quantitative Definition	Qualitative Definition
Significance	The number that expresses the probability that the result of an experiment could have occurred by chance.	Identification of trends or ideas in the data that are not obvious, but which point toward a new, emerging, and/or interesting understanding of the data
Reliability	The overall consistency of a measure	The dependability of the process and product of the research, which can be provided through an inquiry audit or other means of demonstrating consistency
Validity	The method of power analysis used to detect a relationship	The trustworthiness provided by transparency in study design and process, including the delineation of analytic processes that are systematic and rigorous
Sample size (N)	The number of samples necessary to reach a certain statistical power	The number of participants or cases needed to reach saturation in the data

Table 3. Quantitative Versus Qualitative Definitions

Qualitative methods rely on trustworthiness as a measure of validity where trustworthiness consists of four different components: credibility; transferability; dependability; and confirmability.

Credibility refers to a belief that the findings are congruent with reality (specifically with the reality of the participants). This is accomplished through a variety of measures, including the use of:

Well-established research methods (such as interviews and observation field notes),

Triangulation (across time, person, location, and organization),

Practices to encourage accurate responses from participants (such as informing them they can voluntarily withdraw or decline to answer a question at any time, and data are collected without identifiers),

Iterative questioning (to ensure consistent data from participants),

Frequent debriefing sessions among researchers (to explore gaps in the process and/or product and insure exploration of varied and alternative ideas),

Experienced investigators who are knowledgeable about the content and the population,

Member checking (the use of participants and subject-matter experts to review research interpretations),

Detailed description of the phenomena under study and the use of participants' own words. As **Geertz** said, "A good interpretation of anything...takes us into the heart of that of which it is the interpretation. The goal is to provide readers with a "thick description" or "densely textured" account of the phenomenon or group under study. In fields such as sociology and human-centered design, a thick description of a human behavior is one that explains not just the behavior, but its context as well, such that the behavior becomes meaningful to an outsider.

Transferability refers to the extent to which findings from this study could be applied to other situations. In quantitative methods generalizability is built into the research design and occurs at the time the research is conducted. In qualitative methods, it is incumbent on the researchers to use rich, thick description of the research process, including a focus on the participants, to provide readers with a good understanding of participants and experiences delineated in the research. The detailed description of the methodological process promotes the transferability of research findings to the readers.

Dependability, or reliability in quantitative terms, refers to the likelihood that if the work were repeated in the same context with the same methods, and same participants, similar results would be obtained. In qualitative research, dependability is provided by ensuring transparency in the research process and providing detail about all research processes. This creates a model of the research that others can utilize as a "prototype" to conduct a similar study. In this report, specific detailed descriptions of the research design, data collection methods, tools, timelines, and analysis processes are provided.

Confirmability is about ensuring that the findings presented are based on the knowledge, beliefs, and experiences of the participants and not on what the researchers believe or prefer. Confirmability is about providing objectivity—in the data collection and in the data analysis. One key to this is recognizing researcher biases and pre-dispositions. The research team reflected about how the team's backgrounds and disciplinary training might influence their thinking about the project. For example, the sociologist/qualitative methodologist on the research team grew up in a family of police officers and fire fighters, and several members of her family continue the family tradition today. Her experiences and background knowledge were monitored so as not to bias the results. The team documented self-reflections in analytic memos as a technique to monitor biases and pre-dispositions. Another important component is the provision of detailed methodological descriptions of the decisions about the data collection and analysis to provide transparency in the process and in the product (the interpretations). This type of data audit trail provides a step-by-step guide to what was done, when it was done, how it was done, and why it was done. A 'theoretical audit trail' (the analytic process and how different tools were used to interpret the data) was also constructed. Together, the data and theoretical audit trails provide a strong foundation for confirmability of the research.

Just as the purpose and processes are different for qualitative and quantitative research studies, the products or results are different as well. Qualitative results include descriptions of contexts and participants, along with extensive quotes from the data. These quotes are meant to serve as exemplars of key concepts, ideas, and themes identified in the analysis rather than as just singular examples of data. Quantitative results are presented generally as statistical reports with correlations, comparisons of means, and calculations of statistical significance.

Appendix D. Interview Questions

- Tell me about your Journey to NIST. Why a job at NIST?
 Follow-up: What were your expectations for your career?
- 2. Tell me about (describe) your career journey here at NIST.
- If you were to describe your particular work environment to a good friend how would you describe it? (Not just physical space, the culture (age composition, science geeks/nerds, lack of social skills), levels, pay, awards, progression)

Describe (if any) interactions with NISTers off the campus (outside the gate)?

(Example for happy hours with colleagues, play golf/bowl)

- 4. How would you describe NIST to a colleague at another organization the good, the bad, and the ugly?
- 5. What types of relationships, if any, have you developed with people here at NIST? (Who do you go to with problems/concerns/questions?)

How do you identify those who support you and your career? (your advocate/champion?)

- 6. When you wake up in the morning and think about going to work, what's your first reaction? What emotions come to mind?
- 7. Describe ways/times you believe you have had to advocate for yourself?
- Describe a time(s) when things haven't been equitable?
 Follow-up: In this environment, what does equitable mean to you?
- 9. Tell me about a time (if any) when you experienced or witnessed bias here at NIST? Follow-up : What problems (if any) have you experienced because of your gender?
- 10. In your time here at NIST has there been a point in which you considered leaving? Why did you consider leaving? Why did you stay?

Did you reach out to someone at NIST to discuss? Were they influential in why you stayed?

- 11. Tell me about a time if any when you reached out to someone at NIST?
 - For support/help
 - To support/help someone else

When has someone reached out to you for support/help?

- 12. What would be a great outcome of my project for you?
- 13. Anything else you would like to share?

Maybe re-ask: How would you describe NIST to a colleague at another organization – the good, the bad, and the ugly?

Appendix E. Demographic Questionnaire

Sex:	F 🗆	мП								
Age:	Under	20 🗆	21—3	29 🗆	30-	—39 🛛	4	49 🗆	50—59	60+□
Years a	at NIST:	under 5		5—10		11—15 🗆]	16—20 🗆	20 — 29	Over 30 🛛
OU wh	iere you	work:				_				
Pay ba	nd:									
Title:										

Appendix F. Operationalization of Codes and Codebook

Overarching question: What are the barriers and facilitators, if any, that impact women's opportunities at NIST? How do men and women describe their work experiences?

Gender Perceptions of Self

Descriptions of how the participant views themselves. This can be related to competency, self-motivation, perceptions of level of work effort (i.e., overworked, hard worker), does the person see themselves as a problem solver or a mentor, and whether they accomplished something just by being lucky.

Gender Perceptions of Others

Descriptions of how the participants thinks others view him/her (e.g., co-workers, managers). This can take the forms including perceiving the person as a secretary versus a researcher or as only a secretary or technician as compared to the prestige of a researcher (i.e., the person is viewed as less), the level of work effort (e.g., hard worker or NOT), seen as a leader (or NOT), seen as competent (or NOT) seen as valued (or NOT), or seen as aggressive vs assertive.

Structure of NIST or Science

How the participant sees the culture of NIST or Science and the relationships of its members, the complexity of its many parts and how it is organized. The structure of either science or NIST can lead to elitism, competitiveness, meritocratic success (i.e., if I work hard will succeed), whether the participant views themselves or their work as isolated and/or individualistic work, and whether their PI views them as a possession, or the environment does not provide the ability to advance.

How to Survive or Thrive at NIST

When a participant describes ways or mechanisms that facilitate their career journey at NIST. To survive/thrive at NIST, employees need to develop connections or network; use connections to advance, find mentor/sponsors; advocate for self; be part of a team or team player; be seen as a value to the organization; having visibility; or adopt what is seen as masculine ways of being.

Reasons to Stay at NIST

When a participant provides reasons why they would like to continue working at NIST. Reasons may include: the participant loves their job; because of their job they can see the impact, value, or contribution they make to science and/or the world; they appreciate the benefits (e.g., pay, prestige, pension, healthcare, etc.); the work-life balance, they like their colleagues and the relationships they have built; the nonmonetary or nonmaterial satisfactions that accompanies an occupation.

Consequences of Discrimination

The result or effect of when a participant expresses the unjust or prejudicial treatment on grounds of race, age, or sex. The outcome may include a: a loss of talent for the organization; the person may leave NIST or leave their position; result in a lack of trust; individual has to work harder to overcome the discrimination; they experience less advancement including awards, pay, bonuses; fear; and resignation that the situation will not change.

Gender Experiences

Events described by participants that they or someone else went through related to their gender that resulted in feelings of isolation; lack of respect; that the individual is in competition with others; or harassment (i.e., intimidation or aggressive pressure).

Barriers to survival or the ability to thrive at NIST

When a participant expresses obstacles to succeeding or continuing/remaining at their job at NIST. Barriers can take the form of: feelings of isolation; experiencing other's elitism (exclusivity or snobbery); competition; harassment; resignation; feeling overlooked, ignored, or lack of visibility; or no ability to advance no matter how successful they may be.

Reasons to Leave NIST

When a participant provides justification, cause, or an explanation of why they may leave or are leaving their job at NIST. Reasons include: their emotional health; lack of long term earning power at NIST; they have reached their tipping point and can no longer stay at NIST; they feel overworked; they are experienced or have experienced a lack of respect; or from the feelings of anxiety or stress they are feeling because of their job.

Reasons to Hire

When a participant expresses the circumstances leading up to being hired at NIST. Reasons may include connections at NIST or others who had connections at NIST; or a merit-based hire.

Impact of this Effort

When a participant responds to what they would like to see as a result of this research project.

Emotion

When a participant expresses an intuitive feeling, such as fear, fatigue, happiness, or sadness, etc.

Gender(ed) Perceptions—Self	Gender(ed) Perceptions—Others
Competent OR Not as competent—self doubting	Secretary/not researcher—technician—etc
Self motivated—take adv of opportunities, risk taker	Not as hard working OR Hard working
Overworked	Aggressive—assertive
Work hard	Leader—Seen as a Leader OR NOT
Lucky (it's just luck)	Competent—Perceived as competent OR NOT
Problem solver	Valued—Valuable OR NOT
Mentor (being a mentor)	
Structure of Science—NIST	Gender(ed) Experiences
Individual work	Isolation
Isolation—Self or Systemic	Lack of respect
Meritocratic (if I work hard, I will succeed)	In competition with others
Competitive	Harassment
PI Model (leads to possessiveness)	
Elitism	
No Ability to Advance	
How to Survive—Thrive at NIST	Barriers to Survival—Ability to Thrive at NIST
Develop connections—Network—Get involved	Isolation
Use connections (to move up, do something, etc.)	Elitism
Find mentors/sponsors	Competition
Advocate for self	Harassment
Team—player/part of	Resignation
Value to the organization	Overlooked—Ignored—Lack of visibility

Codebook

Visibility +	No Ability to Advance
Male model (adopt masculine ways of being)	
Reasons to Stay at NIST	Reasons to Leave NIST
Love my job	Emotional health—care for self
Impact—value—contribution (to science—world)	Long term earning power
Benefits (pay, prestige, pension, healthcare, etc.)	Tipping point
Work—life balance	Overworked
Colleaguesrelationships	Lack of respect
Environment (psychic salary: other intangible benefits)	Anxiety—stress
Consequences of Discrimination	Reasons to Hire
Loss of talent for organization	Connections
Leave NIST	Merit-based hire
Leave position	
Lack of trust	Impact of this Effort
Have to work harder	Collect these
Less advancement (awards, pay, bonus, etc.)	
Less advancement (awards, pay, bonus, etc.) Fear	Emotion

Appendix G. Categories of Participant Comments Related to Outcomes of the Study

- 1. Team mindset
 - Think team not individual
 - Take blinders off and not be so narrowly focused
 - Team includes technical and admin these are not two teams
 - Isolation vs connectivity
 - Everybody is important and worth your time
 - Bring in different perspectives and backgrounds on teams
 - Acknowledge differences exist, use the differences to advantages
- 2. Change culture
 - Recognize we have a systemic cultural problem and not just one offs
 - Make inclusivity part of the culture
 - Establish trust
 - Org must become people-oriented vs function/project oriented
 - Recognition, acceptance, and willingness to say "We have a problem we will make changes".
 - Diversity is more than gender or race; it is also diversity in education we need to avoid "group think"
 - Recognition to say the old way of doing things has not been effective
 - Create an environment of respect and trust
 - Gender addressed across the org not just lab or science side
 - Realize that we are risk averse and that gets in the way
 - Because we are smart people, we don't need help we need help
 - This is not a training problem but a cultural change problem
 - Stop focusing on winning battles and focus on winning the war
- 3. Minimize biases
 - Just want to blend in
 - Stop comparing people and be respectful
 - Get through to those who don't recognize the problems
 - Recognize everyone as a person and respect them
 - Value people for what they bring to the org
 - Need to be blind when see the staff
 - Increase awareness and sensitivity
 - Share stories, talk frankly
 - Recognition of how institutional bias impacts the most vulnerable populations
 - Training is predominantly taken by women everyone needs to take it like safety training crease representation of women
- 4. Increase representation of women
 - Identify pathways/possibilities for advancement for women
 - More women in leadership
 - More representation of women across the org
 - Actively advocate for women
- 5. Provide opportunities for everyone not just white males
 - Getting women in the pool for consideration
 - Appropriate opportunities and competition for all positions
 - More competitive approach to NRC to include women (currently who you know)
 - Understand who we are hiring or promoting and why
 - Still looking at building the numbers vs impact and benefit to the org -- the meritocratic problem
- 6. Hire women because they are the best fit for job and not just because women
 - Careful with hiring quotas/goals
 - Prevent backlash
 - If we are counting women, we are not there yet
 - Don't want special want equity
 - Not a check-the-box exercise
 - Don't focus on the numbers
 - Don't want men to feel they are being attacked but need to be part of the solution
- 7. Resources for women to reach out
 - On topics of motherhood
 - Role models for women
 - Safe space to talk
 - Mechanism to connect people with similar backgrounds/issues/challenges
- 8. Leadership accountability
 - Top must lead
 - Senior person in room must address the bias/problem immediately and in front of others and not behind closed doors
 - Leadership must be on the committees not their representatives
 - Changes in how leaders treat people leaders need to model the values
 - Accountability and recognition for decisions (opportunities, protection, promotions) especially if long-standing friendships
 - Inclusivity and diversity is leaderships job not someone else's job
 - Lead by example
 - Leadership team needs to drive the change
 - Leadership must connect with staff (senior leadership doesn't leave 101)
 - Stop focusing on winning battles and focus on winning the war
- 9. Staff accountability
 - Too many people with heads-down not my problem
 - Everybody needs to stop and help
 - Each staff member must be accountable and recognize can make a difference and is part of the solution
 - Replicate safety initiative, where everyone has the responsibility to call it out
 - Accepted, respected and appreciated when call out problems like safety
 - Change mindset from I am not part of the problem to I am part of the solution
- 10. Do something
 - Don't just recognize the problem
 - Commit money and resources
 - Strategic plan with identifiable and measurable milestones
 - Hard part now, things are broken but not obvious—need to talk about these things
 - Put money where mouth is
 - Share equity data and stories don't overly generalize and abstract stories have the power
 - Share information on promotions and positions to build credibility
 - Be upfront and honest with information
 - Don't run another study
 - Improve communication on diversity/inclusivity
 - Choose low hanging fruit and deliver
- 11. Resignation what can this project do
 - Over studied the problem
 - Don't see any next steps in place

- Won't help me
- This won't go anywhere
- Leadership team won't do it.
- 12. Bad behavior
 - Need to hold bad behavior accountable, irrespective of the person or position they hold
 - Make leadership accountable even if long-standing friendships
 - Recognition of impact that one toxic person has on work environment
 - Concern for outcomes for the victims not the perpetrators
 - Behavioral issues must be addressed and not ignored
 - Establish and safe and trusting environment for reporting

13. Hiring

- Challenge definition of "Best" best fit for the job, for hiring, and for promotions (what skill sets do we really need for the job)
- Pick people with the best skill set
- Management is about managing people, not programs or projects (this is backwards)
- Differentiate between management positions and program positions -- different skill sets
- Associates trap