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"The Way We Do Things is Unsustainable"—Exploring Symptoms of Burnout Among Healthcare Professionals in Prenatal Genomics

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ABSTRACT

Objectives: This research explored a cross-country comparison of qualitative and quantitative data assessing the experiences of prenatal genomic healthcare professionals (HCP) in Australia and the Netherlands.

Method: The interview script included open-ended questions on work experience, validated scales on compassion fatigue and stress, and demographic details. Content analysis with an inductive coding approach was used for the coding and analysis of qualitative data. Quantitative data were compared between professions and countries, using a one-way ANCOVA.

Results: Quantitative data were obtained from 93 participants and qualitative data from a subset of 63 participants, recruited from the departments of clinical genetics, maternal-fetal medicine and genomic laboratories. The following themes were constructed: (1) Advancements in prenatal genomics increase diagnostic rates but cause increased workloads; (2) Benefits and drawbacks of the current healthcare system; (3) The burden of equivocality: high stakes and ambiguous findings; and (4) Multidisciplinary teamwork, support and supervision may improve working conditions. There were no significant differences in compassion fatigue between professions, but Australian HCPs experienced significantly more symptoms of burnout and secondary traumatic stress than Dutch HCPs.

Conclusion: Although participants had overall positive views and experiences, with high levels of job satisfaction and low levels of compassion fatigue, additional resources are required to minimize professional burnout while dealing with increasing demands.

1 | Introduction

Over the last decade, prenatal screening and diagnostics have advanced in sensitivity and accuracy. Many countries have implemented ultrasound screening programs, with detailed ultrasound scans also being provided in the first trimester [1]. Globally, non-invasive prenatal testing (NIPT) for common aneuploidies is being increasingly implemented, and questions have been posed as to whether this modality should be used for expanded genomic screening of fetuses [2]. Genomic testing using Exome sequencing (ES) or Genome sequencing (GS) is becoming the standard practice in pregnancies where ultrasound detects fetal anomalies, with high diagnostic yields [3–5]. Two to three percent of all pregnancies are affected by fetal

The last two authors contributed equally.

Key Summary

- What is already known about this topic?
  - The implementation of prenatal genomic screening and diagnostics has greatly increased in the past decade.
  - Healthcare professionals acknowledge the potential of new DNA-techniques, but the toll these advancements may take on work performance and job satisfaction is unknown.
- What does this study add?
  - This study explored the experiences of prenatal genomic healthcare professionals in Australia and the Netherlands assessing qualitative and quantitative data to enable a cross-country comparison.
  - Australian healthcare professionals experienced significantly more symptoms of burnout and secondary traumatic stress than Dutch healthcare professionals.
  - Overall, prenatal genomic healthcare professionals in Australia and the Netherlands had high levels of job satisfaction and low levels of compassion fatigue, but additional resources are required to minimize professional burnout while dealing with increasing demands.

structural anomalies [6], with a genomic diagnosis significantly impacting prognosis and parental decision-making regarding pregnancy management and reproductive planning. Prenatal healthcare providers are aided in their work, but also challenged by these advancements, especially against the backdrop of time pressure of advancing gestation and the high stakes regarding parental decision-making. The challenge of incomplete phenotypes in fetal life and the risks of ambiguous genetic testing results such as Variants of Uncertain Significance (VUS) or unsolicited findings place serious strain on healthcare professionals [7].

Previous research has shown that healthcare professionals exposed to patient traumatic experiences are at risk of developing compassion fatigue [8], which is defined as healthcare professionals' diminished capacity to care as a consequence of repeated exposure to the suffering of patients (also known as secondary traumatic stress). This can impact the health and effectiveness of healthcare professionals - and thus patient care. Compassion fatigue may result in an increased risk of burnout. The other end of the spectrum is compassion satisfaction, which is the positive emotional reward (such as fulfillment and purpose) that results from helping others and feeling effective in their role. Compassion fatigue is a significant vulnerability to healthcare professionals working in genetics [9] and fetal medicine [10, 11]. However, published literature about compassion fatigue and work-related stress in healthcare professionals working in prenatal medicine is outdated given the current technological advancements in genomics. Recent studies have focused on the opinions of healthcare professionals regarding new DNA-techniques such as prenatal ES [12–19] but did not investigate the toll these advancements may take on work performance and job satisfaction. In addition, no international guidelines are available regarding the implementation of these novel technologies [20], resulting in differences in implementation between countries. Therefore, comparative international research is especially important as it allows investigation of the consequences of these different implementation choices. This study aimed to explore the experiences of healthcare professionals in the current prenatal genomic landscape and to compare the risk of compassion fatigue and burnout between Australia and the Netherlands since these are both industrialized Western countries with similar inclusion criteria for offering prenatal genomic testing. We assessed both qualitative and quantitative data to allow for an in-depth exploration of quantifiable results. The ultimate goal was to suggest methods to improve the support of healthcare professionals involved in prenatal genetics care.

2 | Methods

Data collection took place between March 2024 and December 2024. A waiver of approval was obtained by the institutional review board of the Leiden University Medical Center and the human research ethics committee of the Royal Children's Hospital Melbourne. The interview script (Supporting Information S1) was composed by professionals experienced in research on prenatal genetics (M.K., S.L., T.R., G.S., M.S.) and psychosocial research (H.E., L.K.). The interview consisted of three parts: (1) open-ended questions, (2) validated scales (The Professional Quality of Life Scale [21] (ProQOL) and the State-Trait Anxiety Index (STAI-6) [22, 23]) and (3) demographic details (age, gender, ethnicity, marital status, professional group, years of experience and full time equivalent (FTE) work hours). The interview script is provided in the Supporting Information S1.

2.1 | Open-Ended Questions

The first part of the interview consisted of seven open-ended questions about work experience in general, work-related stress and compassion fatigue, and coping mechanisms.

2.2 | ProQol

The ProQOL [21] is a widely used and validated scale in both English and Dutch, measuring the positive and negative aspects of professional caregiving on three separate subscales (compassion satisfaction, burnout and secondary traumatic stress). It comprises ten statements for each subscale about the participant's work experiences in the last 30 days. The ProQol is measured on a 5-point Likert scale ranging from “1—never” to “5—always”. After reverse-scoring several items accordingly, the aggregated raw score is derived by summing all individual responses and can thus range from 10 to 50. Lower scores on the compassion satisfaction subscale (cut-off value 23) represent a lower pleasure being derived from work, while higher scores on the burnout subscale (cut-off 41) and secondary traumatic stress subscale (cut-off 43) indicate higher risks of burnout and work-related secondary traumatic stress, respectively [21]. Internal reliability for the current sample for each subscale was acceptable, with Cronbach's alpha ranging from 0.75 (burnout subscale) to 0.86 (compassion satisfaction subscale).

2.3 | STAI-6

The STAI-6 was used to explore stress in general and is a commonly used cross-population stress measurement tool, validated in both English and Dutch [22, 23]. It includes six statements about how a person is currently feeling and items are scored on a 4-point Likert scale ranging from "1—not at all" to "4—very much so". After reverse-scoring several items accordingly, the final score is derived by summing all individual responses and multiplying by 20 divided by 6. Scores can range from 20 to 80, with higher scores indicating higher levels of stress. Internal reliability for the current sample was good: Cronbach's alpha 0.85.

2.4 | Participant Recruitment and Procedures

Participants were recruited via purposive sampling in Australia and the Netherlands. To increase the sample size of the Dutch cohort for the quantitative analysis, Part 2 (validated scales) and 3 (demographic details) of the interviews were also distributed as digital questionnaires to the Dutch Working Party for Prenatal Diagnostics and Therapy. The inclusion criteria were healthcare professionals who were currently or until recently engaged in prenatal genetics and affiliated to one of three different disciplines: clinical genetics, maternal-fetal medicine and molecular genetics. Interviewees could be either in training or board-certified staff specialists. Potential participants were invited via e-mail and provided with participant information and an informed consent form. Interviews were preferably conducted in-person but were conducted via telephone or videocall if in-person was not possible. Australian interviews were conducted by the primary author and Dutch interviews were conducted by a medical student (MdV) under supervision of the primary author. The primary author is a Dutch PhD-candidate and medical doctor with experience in genetic counseling and prenatal research, who had no previous interaction with the participants. The interviews lasted between 18 and 51 min (mean 30.4 min). Interviews were audio-recorded and transcribed verbatim by either Transcription Australia [24] (Australian interviews) or by MdV (Dutch interviews) and subsequently translated to English. The electronic data capture system Castor was used for sending out questionnaires for quantitative data collection.

2.5 | Data Analysis

Both qualitative and quantitative data were assessed for this research, to allow for an in-depth exploration of results. The paradigmatic orientation that guided this study was pragmatism with a narrative inquiry [25]. Content analysis with an inductive coding approach [26, 27] was used for analyzing the answers to the open-ended questions. The Consolidated Criteria for Reporting Qualitative Studies (COREQ) guidelines [28] were used as a framework. Data saturation was reached when no new themes could be elicited from the interviews [27]. All transcripts were read and coded by at least two authors independently (MdK and SL all interviews, MdV only Dutch interviews) using NVivo software version 12 and Atlas.ti software version v.7.9.0. Transcripts were first read multiple times to obtain familiarity with the data. Transcripts were then read line-by-line and content codes were constructed. The codes were subsequently combined into subthemes and grouped by overarching concepts. Researchers met to reach consensus on the identified codes, and themes were accordingly adjusted for agreement and internal consistency.

A one-way ANCOVA including the Bonferroni correction for multiple testing was conducted to determine a statistically significant difference between the different subscales of the ProQol (compassion satisfaction, burnout and secondary traumatic stress) on either professional group (clinical genetics, maternal-fetal medicine and genomic laboratories) or countries (Australia and the Netherlands), controlling for STAI-6, age of the participant and the prenatal genomics workload expressed in FTE. Relevant covariates were determined based on the qualitative data collection. Based on the sample size calculations, a minimum of 40 participants needed to be included per arm to reach sufficient power. Analysis of quantitative data was performed with IBM SPSS Version 29 with significance assumed when $p < 0.05$.

3 | Results

Participant demographics are provided in Table 1. In total, quantitative data were obtained from 93 participants and qualitative data from a subset of 63 participants.

3.1 | Qualitative Analysis

Saturation was reached for four different themes constructed from the interviews: (1) Advancements in prenatal genomics increase diagnostic rates but cause increased workloads, (2) Benefits and drawbacks of the current healthcare system, (3) The burden of equivocality: high stakes and ambiguous findings and (4) Multidisciplinary teamwork, support and supervision may improve working conditions. In Table 2, these themes are divided into subthemes and illustrative quotes are provided.

3.1.1 | Advancements in Prenatal Genomics Increase Diagnostic Rates But Cause Increased Workloads

Most participants mentioned the technical advancements they have witnessed during their careers (quote 1), including their positive experiences of these advancements, but leading to added workload and increasing referral rates. Many participants speculated about how to manage a further increase in workloads. Interviewees spoke about the increasing possibilities of what they could offer prospective parents with regard to genetic screening and diagnostic testing (quote 2) in addition to the demand for decreasing test turnaround times, calling this development *"spectacular", "extraordinary"* and *"dramatic"*. Participants discussed having an increase in referrals because genomics is becoming a *"core"* part of prenatal care (quote 3). Moreover, counseling patients about the complexities of genomic testing is time consuming, while its higher resolution causes molecular geneticists to evaluate an abundance of

TABLE 1 | Participant demographics.

	Dutch cohort ($N = 44$)		Australian cohort ($N = 49$)	
Demographic details				
Age (mean years, SD)	49 (± 9)		50 (± 11)	
Gender (% female)	88.6%		61.2%	
Work setting				
Department	Quantitative data	Qualitative data	Quantitative data	Qualitative data
- Clinical genetics (%, *N*)	43.2% (19)	52.2% (12)	59.2% (29)	60.0% (24)
○ *Clinical geneticist*	*95% (18)*	*100% (12)*	*86% (25)*	*83.3% (20)*
○ *Genetic counselor*	*5% (1)*		*14% (4)*	*16.7% (4)*
- Laboratory (%, *N*)	18.2% (8)	26.1% (6)	26.5% (13)	27.5% (11)
○ *Genomic scientist*	*100% (8)*	*100% (6)*	*54% (7)*	*45.4% (5)*
○ *Genetic pathologist*			*31% (4)*	*36.4% (4)*
○ *Bioinformatician*			*15% (2)*	*18.2% (2)*
- Obstetrics (%, *N*)	38.6% (17)	21.7% (5)	14.3% (7)	12.5% (5)
○ *Maternal-fetal medicine specialist*	*94% (16)*	*100% (5)*	*100% (7)*	*100% (5)*
○ *Midwife*	*6% (1)*			
Years of experience (median years, range)	20 (5–38)		18 (4–38)	
Patients per week (median, range)	6 (0.5–16, $N = 1$ missing value)		3 (0–50)	
Fulltime equivalent				
- Overall (mean, SD)	0.8 (± 0.1)		0.9 (± 0.2)	
- Prenatal (mean, SD)	0.4 (± 0.2)		0.3 (± 0.2)	
State trait anxiety inventory (median, range)	33.3 (20–56.7)		33.3 (20–76.7)	

variants in search of a diagnosis. Additionally, interviewees described the high administrative load as excessive (quote 4) and they raised concerns about bureaucracy, especially considering the ongoing progression and increase in referrals, stating that "*bureaucracy shouldn't stop the advance of science*". Examples of bureaucracy that were mentioned were excessive paperwork (e.g., filling out forms in triplicate for requesting trio analysis of proband and both parents) and the added administrative burden of using dated IT systems. Participants speculated about methods of keeping up with the challenges of increased workload and bureaucracy, such as using Artificial Intelligence (AI) for dictating counseling sessions (quote 5), improved IT systems for tracking the status of genetic testing, and additional administrative support. Also, the employment of genetic counselors in Australia was mentioned as being helpful in resolving clinical genetics' staffing issues.

3.1.2 | Benefits and Drawbacks of the Current Healthcare System

The experiences of healthcare professionals were closely related to the healthcare system in which they worked. While many interviewees talked about the benefits of an optimized workflow with intensified multidisciplinary care (quote 6), several drawbacks were also brought up such as staffing issues (quote 7). The communication between departments and the importance of multidisciplinary care was frequently described by interviewees as being increasingly important. Rapid and close collaboration between the maternal-fetal medicine units and the clinical genetics departments was established by either frequent multidisciplinary meetings or by embedding a genetics service within the maternal-fetal medicine unit. Many healthcare professionals ($N = 23$) however, discussed persistent problems in their healthcare system. Several people voiced their fears of not being able to maintain their current standards of care because of prolonged staff shortages, with one participant saying, "*either the staff would give or the system would give or the quality of care would give*". These staffing issues made participants worry about the sustainability of prenatal genetics, such as "*I think the way we do things, it feels unsustainable, and if it keeps getting busier and busier, then I think these things, like compassion fatigue and stress and the impact on healthcare will become even more of an issue than they are now.*"

3.1.3 | The Burden of Equivocality: High Stakes and Ambiguous Findings

Although interviewees often commented on the positive aspects of working in prenatal genomics, including the substantial clinical utility, many challenges complicating their work were mentioned, including time pressure, ambiguous results and ethical dilemmas. Healthcare professionals felt they had a large impact on parents during an anxious time, underlining the substantial clinical utility of prenatal genomics (quote 8). Genomic testing can make a difference in helping parents to decide whether to continue a pregnancy, with participants

TABLE 2 | Themes, subthemes and illustrative quotes.

Theme	Subtheme	Quotes
Advancements in prenatal genomics increase diagnostic rates but cause increased workloads	Experiences of advancements	"We're pushing boundaries with these new techniques, so we keep finding new things"—NL21 (quote 1) "Being able to use genomics and genome-wide techniques such as microarrays and exomes and genomes has been absolutely amazing, I think for the patients and the diagnostic rates"—AUS10 (quote 2)
	Workload and increased referrals	"So our work is becoming increasingly complex, but our referrals don't reduce; they increase and then the workforce is not increasing"—AUS18 (quote 3)
	Administrative load	"With all the testing that we do nowadays, there's so much paperwork, consents, request forms, emails, so you see one patient and you want to organize a quick test in their pregnancy, you have to spend a lot of time doing lots of forms and lots of emails and lots of coordination with the labs, and with the patients, and families and colleagues"—AUS12 (quote 4)
	New ideas	"Maybe in the future, there could be more standardized tasks that can be handled by AI but we're not there yet"—NL4 (quote 5)
Benefits and drawbacks of the current healthcare system	Optimizing workflow of multidisciplinary care	"I like that it's multidisciplinary because you work with gynecologists, lab specialists, social workers [...] you often work together in a short and intense period"—NL18 (quote 6)
	Staffing issues	"The wheels start to fall off when there's staffing shortages and too much falls on to fewer people"—AUS21 (quote 7)
The burden of equivocality: High stakes and ambiguous findings	Clinical utility	"The information that they [parents] are seeking is sometimes hard to get, very much needed and highly charged. I think those are the three biggest reasons why you're often able to make a difference"—AUS1 (quote 8)
	Time pressure	"Prenatal keeps you very focused; you have to figure it out now because the pregnancy keeps moving forward"—NL2 (quote 9) "Drop everything and do the prenatal first"—NL17 (quote 10)
	Ambiguous results	"The real difficulty here is that prenatal exomes are pushing the boundaries of genetics, which there's very little evidence to classify variants of uncertain significance or even likely pathogenic variants in the prenatal sense and what this might mean postnatally"—AUS23 (quote 11)
	(Ethical) dilemmas	"I also see how the boundaries are shifting and we're going further with prenatal testing [...] so with prenatal WES, I find it difficult, personally"—NL1 (quote 12) "Just because you can do it doesn't mean you should do it"—AUS3 (quote 13)

(Continues)

TABLE 2 | (Continued)

Theme	Subtheme	Quotes
Multidisciplinary teamwork, support and supervision may improve working conditions	Support from colleagues	"So that ability to be able to seek other people's opinion on it I think is absolutely critical for being able to deal with these kinds of very stressful situations"—AUS14 (quote 14)
	Supervision	"But under supervision particularly, I think there's a chance to actually reset those buttons and to remain professional. So I feel that I've been able to continue to have that ability in my counseling due to the supports that I have around me, and that's where the clinical supervision, I think, is very important."- AUS17 (quote 15)
	Work-life balance	"I try not to work all the time, and I make an effort to keep my evenings, weekends, and regular days off as time for myself"—NL20 (quote 16)
	Employee assistance program	"There's an employee assistance program that we can ring if we're feeling overwhelmed, and that's just an external person to talk to about things and possibly coming up with strategies to deal with workplace stresses"—AUS38 (quote 17)

saying they often find themselves "*making a difference in a helpful way*" but also that "*the stakes are higher*" in prenatal care. Interviewees mostly liked working in a fast-paced field (quote 9), but the time pressure of advancing gestation was also frequently mentioned as one of the main challenges (quote 10), especially with regards to varying national laws on the upper limit timing for pregnancy termination. The risk of ambiguous genetic testing results was mentioned by numerous participants (quote 11) from both clinical departments and laboratories. The interpretation of genetic variants in the prenatal setting is complicated by limited phenotypic information, which "*makes the phenotype-genotype correlations particularly difficult*" or even "*like doing your analysis blind*". These challenges made some healthcare professionals wonder whether it could still be considered good care when uncertainty is increased (quote 12 and 13), by saying "*then you think, 'is the uncertainty you provide still good care? Are you really not harming people?'*".

3.1.4 | Multidisciplinary Teamwork, Support and Supervision May Improve Working Conditions

With regard to these challenges, participants were asked about possible opportunities to improve their working conditions and to ensure sustainability of this type of care. Teamwork and support from colleagues were mentioned in almost every interview as being *"very important"* to improve working conditions and to ensure a sustainable prenatal genomics workforce (quote 14). Supervision was another significant contributor to a positive working experience (quote 15). Both supervisors and trainees or genetic counselors brought this up, with one participant saying, "*you have some supervision which is quite good because you have something to fall back on if you're not sure*". As such, supervision was a way to help counteract uncertainty or ambiguity, not only in how to address this with families but also regarding the direct impact of uncertainty on healthcare professionals. Moreover, maintaining a healthy work-life balance was brought up, not just in terms of flexibility in hours but having the capacity to switch off after work as well (quote 16). Twenty-one out of forty Australian participants mentioned their national Employee Assistance Program. This is a free, confidential counseling and support program offered by the Australian government, which was often not utilized by participants, but they were aware of its existence (quote 17).

3.2 | Quantitative Analysis

Unadjusted mean values of each ProQol subscale for every subgroup are presented in Figure 1A–F including 95% confidence intervals. Adjusted mean values of compassion satisfaction ranged between 40.5 and 42.5 (cut-off value < 23), of symptoms of burnout between 20.2 and 22.9 (cut-off value > 41) and of secondary traumatic stress between 19.4 and 22.5 (cut-off value > 43). No significant effect could be identified between the different professional groups on any of the three ProQol subscales or between the different countries on the compassion satisfaction subscale after controlling for covariates. However, there was a significant effect of country on levels of burnout symptoms ($F(1, 88) = 14.32$, $p < 0.001$, eta squared = 0.14) and on levels of secondary traumatic stress ($F(1, 88) = 14.37$, $p < 0.001$, eta squared = 0.14), with Australian healthcare professionals experiencing significantly more symptoms of burnout and secondary traumatic stress compared with Dutch healthcare professionals. None of the covariates had a significant contribution to any of the statistical models, apart from the

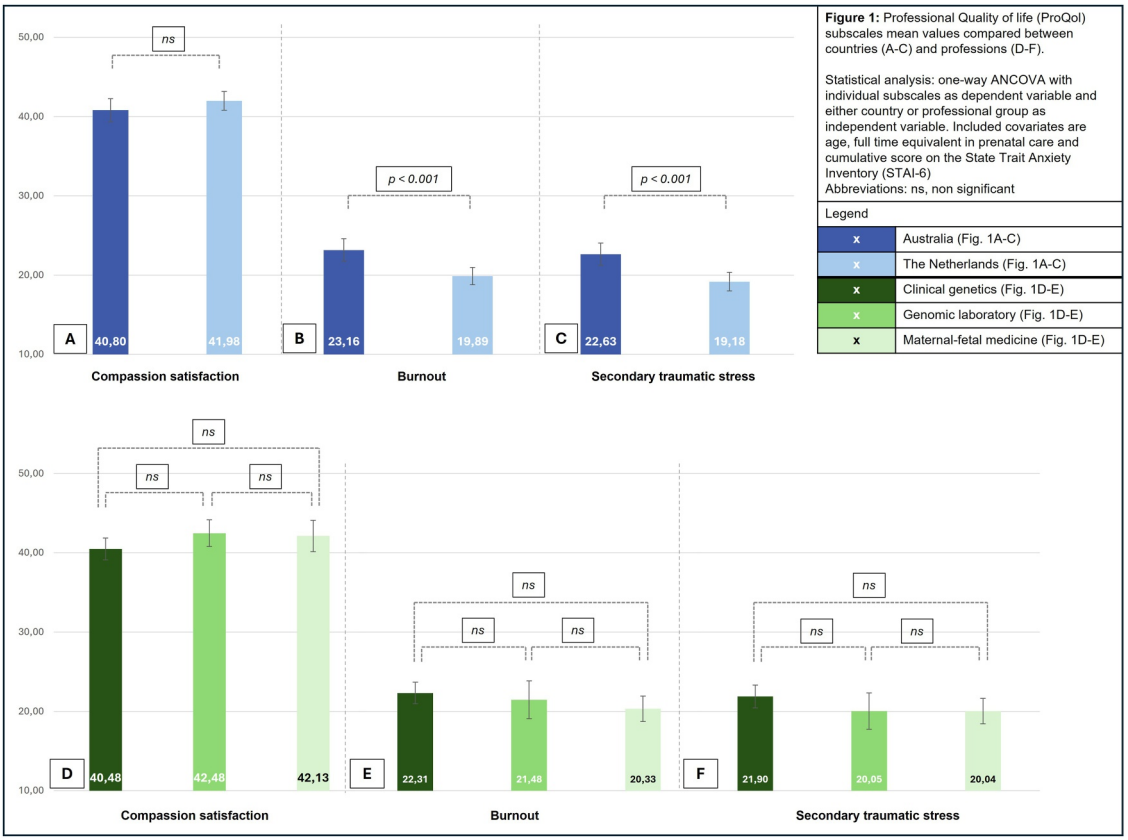

FIGURE 1 | Professional quality of life (ProQol) subscale mean values compared between countries (A–C) and professions (D–F). Statistical analysis: one-way ANCOVA with individual subscales as dependent variables and either country or professional group as independent variables. Included covariates are age, full time equivalent in prenatal care and cumulative score on the State Trait Anxiety Inventory (STAI-6). ns, non-significant. [Colour figure can be viewed at wileyonlinelibrary.com]

STAI-6 (p-value ≤ 0.001 for all analyses), measuring stress at the moment of conducting the interview. Higher values on the STAI-6 were significantly correlated with lower values on the compassion satisfaction subscale and higher values on the burnout and secondary traumatic stress subscales.

4 | Discussion

Although most healthcare professionals from both countries described positive experiences of advancements in the field and the substantial clinical impact of their work, they also mentioned drawbacks of working in prenatal genomics. Each qualitative theme therefore contains both positive or rewarding aspects and negative or challenging aspects.

The high workload together with the significant administrative burden was mentioned in theme 1, which poses a challenge in maintaining a high standard of care while simultaneously managing their own work-related stress as described in theme 4. This is applicable to all healthcare disciplines [8], but specific factors that can add to stress in the prenatal genomics field are the risk of ambiguous results and the time pressure of advancing gestation, which were mentioned in theme 3. On top of that, the excessive burearucracy [7, 14, 29] and especially the increasing referral rate is of concern with many participants ($N = 32$) across different departments mentioning the lack of adequate staffing to deal with the increase in demand of prenatal genomic testing (theme 2).

The many positive aspects of working in prenatal genomics that were mentioned align with the overall high level of compassion satisfaction on the ProQoL subscale. Interviewees talked about the substantial clinical impact of prenatal genomic testing and their role as counselors, making this a very rewarding field in which to work (theme 3). The importance of peer support in sharing the load and debriefing was mentioned many times (theme 4) as well as the appreciation of multidisciplinary care (theme 2). The dynamic nature of prenatal genomics, regarding the high acuity of day-to-day care and the ever-evolving techniques of genomic testing, was often brought up during the interviews as well (theme 1). These qualitative themes are important to consider as they provide complementary insights to the stresses of prenatal genomics not captured completely by quantitative results.

In the quantitative data, Australian healthcare professionals experienced significantly more symptoms of burnout and secondary traumatic stress than Dutch healthcare professionals. Nevertheless, it should be noted that all the median values were still in the lower range. This illustrates an overall low level of work-related stress including positive feelings about the ability to be effective at work (burnout subscale) and little burden of compassion fatigue (secondary traumatic stress subscale). In

line with this, median values of compassion satisfaction were in the higher range for all professions across both countries, showing a high level of pleasure being derived from work. These scores are comparable to previous research administering the ProQol scale in other genetic healthcare workers [30], with our data showing slightly higher levels of secondary traumatic stress. However, when comparing these scores to other taxing medical professionals such as emergency department physicians [31] or nurses across different departments [32, 33], it is evident that healthcare professionals working in prenatal genomics experience more compassion satisfaction and less compassion fatigue in general.

The significant differences in our quantitative data stand out because of the similarities in qualitative themes and could be explained by differences in the healthcare system. One major distinction is the funding of prenatal genomic testing and coverage by healthcare insurance. In the Netherlands, all genomic testing (screening and diagnostics) including counseling by healthcare professionals are covered by obligatory insurance. In Australia, funding differs per state and some genomic screening or testing modalities might not be covered and only accessible through research protocols or out-of-pocket expenses for patients [34]. These budgetary constraints could explain why Australian healthcare professionals experience significantly more symptoms of burnout and secondary traumatic stress, potentially caused by a lack of resources. Moreover, the workflow of multidisciplinary care is complicated in Australia because of the separation of the genomics laboratory, clinical genetics department and maternal-fetal medicine unit between individual healthcare organizations. In the Netherlands, these departments are more often located within the same hospital, enabling quick and easy collaboration. Several Australian interviewees suggested embedding a genetics service within the maternal-fetal medicine unit to overcome this problem. The lack of resources and challenges of multidisciplinary collaboration when being cared for across multiple hospital sites has been previously described as challenging by British research as well [29]. Another approach to reduce stress levels for Australian healthcare professionals could be the employment of more genetic counselors. Genetic counselors can relieve work pressure by seeing specific cases autonomously—such as common chromosomal aneuploidies—as they already do in some parts of Australia, thereby easing some of the burden off clinical geneticists. Genetic counselors also support clinical geneticists when co-counseling fetal anomalies and with prenatal diagnosis by providing the patient with emotional support during the process, leading to better outcomes for the patient [35]. Their work was mentioned as being helpful by several Australian healthcare professionals and increased employment of genetic counselors might therefore help resolve clinical genetics' staffing issues.

4.1 | Strengths and Limitations

This research has several strengths and limitations. By including healthcare professionals from three different departments in two different countries, this cohort provides a diverse sample. Healthcare professionals in all stages of their careers were included to capture a wide range of experiences, from trainees to staff specialists. A limitation of this study, as for any participative research, is that this research relied on willing participants, thus being vulnerable to self-selection bias with people who have strong opinions regarding the subject being more inclined to voice them. Also, because the mode of conduct of interviews varied, differences in follow-up responses elicited by non-verbal cues could be present between interviews conducted in-person or via phone or videocall. Additionally, the sample size for the quantitative comparison between professions was not enough to reach sufficient power; therefore, although no significant differences between professions could be discerned, these results should be interpreted with caution. As work experience could be closely linked to the local health district or hospital to which the HCP is affiliated, we tried to overcome this potential bias by inviting participants from all over the Netherlands and Australia. However, about half of the participants were still linked to the primary affiliation of the first author. This might have impacted the data by participants experiencing a conflict of loyalty in voicing dissimilar views as the authors. To minimize this possibility, all interviews were conducted by a person who had no previous interaction with the interviewees. Moreover, the limited experience of the interviewers with the healthcare system in which the participants operated allowed for more in-depth, explorative and open interviews.

4.2 | Future Implications

Several of the issues and ethical challenges raised by participants working in prenatal genomics are expected to be resolved with future innovation. Improved IT systems and integrative speech to text software might reduce time consuming administrative tasks. Moreover, AI variant prioritization analysis could be key in limiting the number of variants genomic scientists need to interpret and thus reducing workload [36]. We are gathering more knowledge about prenatal presentations of rare syndromes and new prenatal disease genes are being identified with the expanded usage of genetic testing during pregnancy [37]. It will be possible to reclassify an increasing number of VUSs by international data sharing [38–40]. However, novel genomic testing techniques are being validated for the prenatal space such as Genome Sequencing [41] and RNA-sequencing, which will bring about new challenges. These are similar to the issues that were raised when chromosomal microarray analysis was first introduced into the prenatal space and what we are currently dealing with for prenatal ES [7, 12–19, 29]. Although international guidelines for prenatal genetic testing might be undesirable or even impossible to define due to societal, cultural and political differences as described above and elsewhere [7, 42], global collaboration is key in overcoming current issues, such as establishing testing indications and methods for dealing with ambiguous results. This research highlights numerous similar experiences of healthcare professionals working in the dynamic field of prenatal genomics around the world. Overall compassion satisfaction is high and compassion fatigue is low, although additional resources need to be made available to withstand the increase in demand at present before technological innovations can be developed and implemented to possibly alleviate work pressure in the future.

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Ethics Statement

A waiver of approval was obtained from the Institutional Review Board of the Leiden University Medical Center (13th of February 2024, reference number nWMO-D4-2024-001) and the human research ethics committee of the Royal Children's Hospital Melbourne (21st of March 2024, HREC Reference Number HREC/74465/RCHM-2021).

Consent

Written or verbal informed consent has been obtained from all involved participants and they have given approval for these data to be published in this report.

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

All data supporting the results of this study are available in the manuscript and Supporting Information S1. Participants did not give consent to publish their entire interview online; however, sections of the data are available from the corresponding author on request.

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Supporting Information

Additional supporting information can be found online in the Supporting Information section.

Supporting Information S1: pd70080-sup-0001-suppl-data.docx.