

Proposal:

Integrated Practice: Expert-Informed Physical Exercise Regimens to Enhance Vocal Athlete Performance

Context:

As a singer, vocal coach, and personal trainer (CPT), my professional journey propels the inception of this study. Vocal athletes (VAs) (LeBorgne and Rosenberg, 2019), high-performing artists with rigorous vocal and physical demands, inspire this research to unite vocal performance and physical fitness. My dual expertise uniquely allows me to navigate this dynamic intersection and address the unique challenges VAs face (Malde *et al.*, 2020; Chandler, 2022). While exploring the interdependence of physical and vocal health and performance, I aim to contribute meaningful insights that enhance the training, well-being, and performance of VAs, applying my diverse skill set to tailor a physical exercise regimen (PER) that optimises full vocal and physical performance potential (Friedlander & Dawson, 2006; Byrne, 2020).

The study will serve as a collaborative space where the expertise of professionals in exercise physiology and vocal athletics (VACs) converge, fostering a conducive environment to develop a holistic program (LeBorgne & Dal Vera, 2015). Committed to advancing the well-being and performance of VAs, this study draws its strength from fusing practical experience, theoretical knowledge, and dedication to vocal-body balance (Lee *et al.*, 2020).

Research Questions:

How can insights from voice and sports science experts inform the development of optimised PER for VAs while safeguarding vocal health? What changes or adaptations do VAs perceive in their training and performance before, during, and after implementing the expert-informed PER, and what are their thoughts on the overall PER experience?

Justification:

VAs often face challenges maintaining physical health while preserving their unique vocal abilities (Heyman *et al.*, 2019), such as compensation or lack of stamina throughout performance. The absence of specialised PE programs tailored to this demographic's needs (Friedlander, 2018) underscores the necessity for comprehensive research (Holden, 2023). This study aims to empower VAs with sustainable and integrated practices that foster interdependence between physical exercise (PE) and vocal training. By investigating the collaborative process, this study seeks to understand and refine the effectiveness of the PER in enhancing the holistic training, well-being and performance of VAs. Balancing PE with vocal

performance is crucial for VAs (Chandler, 2022). This study addresses a significant gap by leveraging experts' insights from exercise physiology and vocal athletics (VAcS) to develop a balanced PER that enhances the fusion of these essential, interdependent elements (Lee *et al.*, 2020).

Table 1: Intentions:

Aims:	Objectives:
• Explore expert recommendations and guidelines to customise a PER that aligns with unique VA needs and demands • Consider performance goals, demands, and vocal well-being • Investigate VA perceptions on PER impact • Explore the reported experiences, benefits, challenges, adaptations, and effectiveness	• Gain insight from experts to understand the specific design criteria for an ethical and effective PER for VAs • Facilitate a collaborative process between field experts and VAs • Understand how to ethically create an effective PER that aligns with the specific requirements, demands, health and goals of VAs

Intended Impact:

This project aspires to profoundly impact VAs through specialised PER-tailored exercises, informed by expert consultations, to amplify physical fitness and vocal abilities, well-being, and professional longevity (Friedlander, 2018) without sacrificing vocal technique, health, or practice (Richie, 2013; Nesbitt, 2023).

As the investigator, this study provides an opportunity to deepen my understanding of interdisciplinary collaboration and the nuanced relationship between PE and vocal aptitude (Primov-Fever *et al.*, 2014). It offers a chance to apply theoretical knowledge to practical settings, fostering a more comprehensive understanding of my field (Booth *et al.*, 2012; Booth *et al.*, 2021).

Beyond personal development, the study aims to contribute valuable insights into VAcS, voice science, exercise physiology, and their interdisciplinary collaboration, potentially improving VAs' overall training and performance at personal and field levels. Figure 1 and the following methodology section will delineate how these values and intentions will manifest in hopes of justifiably answering the research questions.

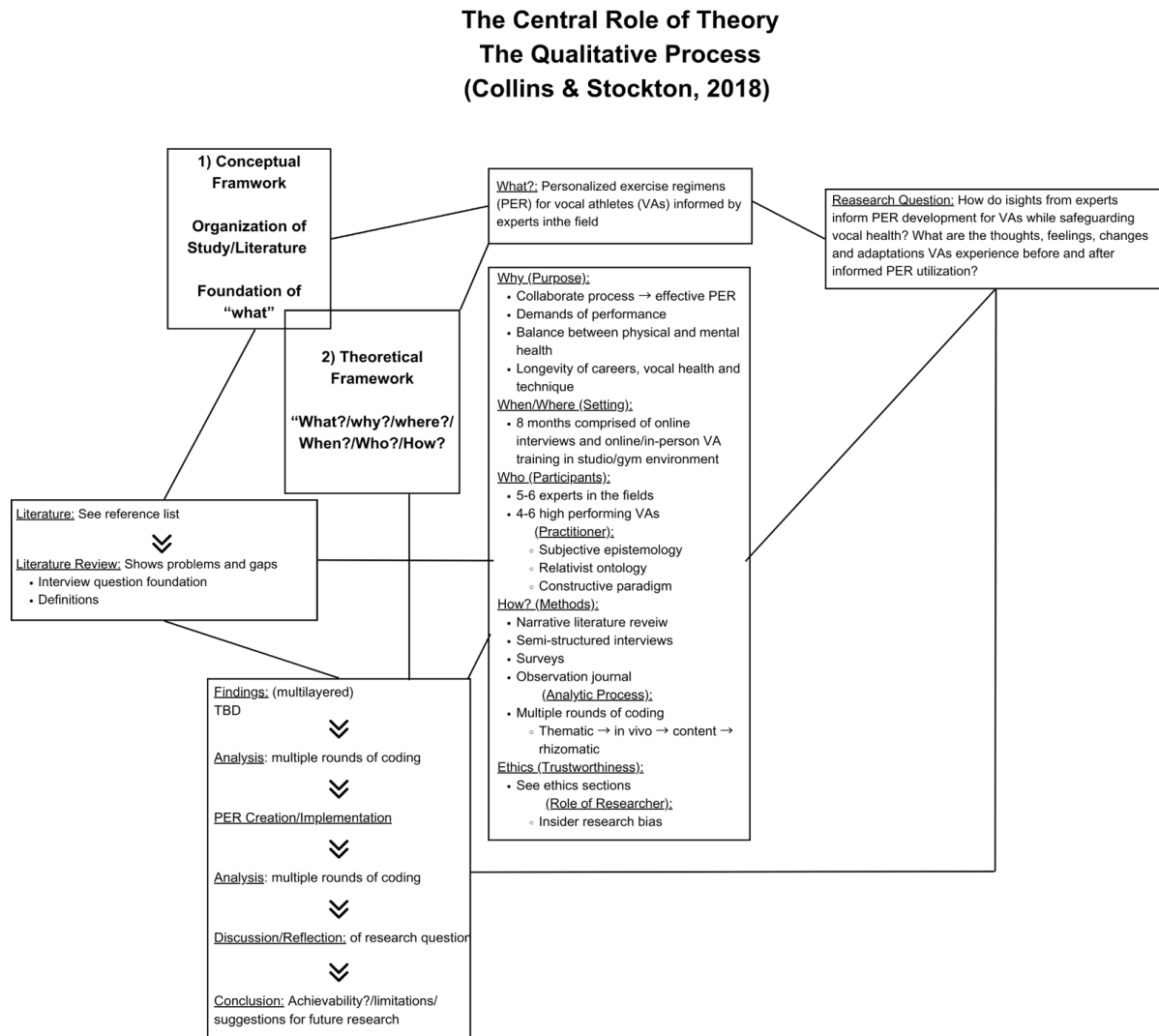


Figure 1: Research-Creation Process through Collins and Stockton's (2018) Central Role of Theory (App.20)

Methods:

The study's exploratory, qualitative approach facilitates in-depth insights into the expert knowledge and VA experiences (Braun & Clark, 2008). Grounded in subjective epistemology, relativistic ontology, and the constructive paradigm (Killam, 2013), it values diverse individual experiences and perspectives. Recruitment will involve sampling five to eight field experts based on their credentials and publications and selecting four to six healthy, currently performing VAs within my studio.

A narrative literature review will efficiently gather current information on PERs for VAs by exploring recent studies in vocal training and sports science (Ferrari, 2015; Booth *et al.*, 2021).

This foundational knowledge will inform expert discussions and PER formulation, with thematic coding and mind mapping (Braun & Clark, 2008) distilling critical insights. Integrating the latest research and practices ensures an ethically formulated PER that aligns and synthesises existing knowledge and understanding of diverse perspectives (Kiteley & Stogdon, 2014).

Semi-structured interviews with experts will provide specialised insights (Briggs, Coleman & Morrison, 2012). Thirty-minute discussions, based on literature and experience, will explore tailored PER intricacies, embracing a relativistic ontology and allowing for the exploration of diverse viewpoints. Multiple thematic and in vivo coding rounds will ensure nuanced exploration (Saldaña, 2021). Embracing a relativistic ontology (Killam, 2013), these sessions will explore their perspectives, recommendations, and nuanced understandings, contributing to a comprehensive grasp of the considerations necessary for optimising exercise routines in VAcism. The PER will be developed using inductive data from expert interviews (Pohl *et al.*, 2015), allowing for an informed regimen using collective insights, advice, and experiences from field-leading professionals.

Three qualitative surveys will capture VAs' sentiments, thoughts, and experiences regarding the PER (Dearnly, 2005). Baseline information is obtained through an intake survey at the start of the research, along with health factors, previous experience, expectations, concerns and preconceptions. A mid-program survey will mark their progress and allow the practitioner to address any issues. A post-research survey will gather feedback and reflections on perceived improvements, employing a combination of in vivo and process coding for systematic data extraction (Saldaña, 2021). This data will offer valuable insights into the athletes' perspectives, aiding in assessing the regimen's efficacy and their holistic experiences throughout the research period (Punch, 1994). This approach, aligned with the constructive paradigm, allows participants to contribute actively, fostering a collaborative understanding of the nuance between PE and vocal performance.

A supplementary practitioner observation journal will document VAs' training performance, capturing nuances, improvements, reflections, and potential outcomes, using Kolb's Experiential Learning Theory (1984) to encourage a cyclical and experiential approach to navigate the complexities of insider knowledge (Bonner & Tolhurst, 2002; Mercer, 2007; Costly *et al.*, 2012). This critical resource fosters a comprehensive understanding of exercise regimens' direct impact on performance, using content and thematic coding for systematic categorisation (Saldaña, 2021). Moreover, the journal will serve as a tool for future research hypotheses. Confidentially securely stored, this will uphold ethical standards and protect validity (Punch,

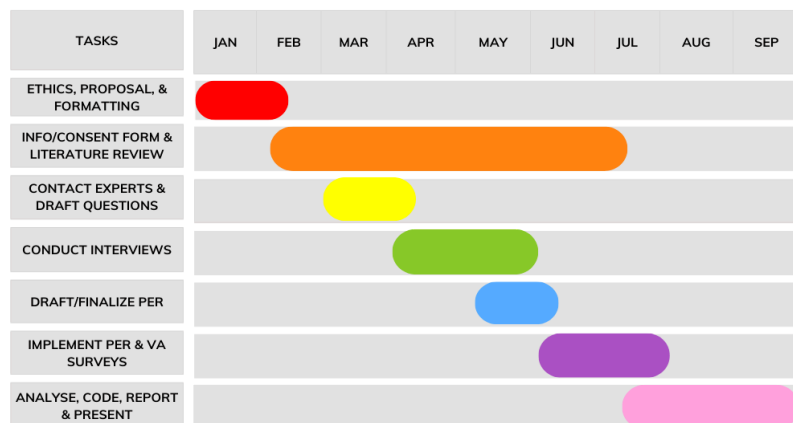
1994; Israel, 2014). The journal will undergo a coding process, employing content coding (Pohl *et al.*, 2015) to systematically categorise explicit details and thematic coding (Castleberry & Nolen, 2018; Saldaña, 2021) to identify overarching patterns and themes while comprehensively analysing the experiences and reflections documented.

For achievability, this study will select a manageable number of participants, allowing for in-depth exploration (Denscombe, 2003). However, limitations operate within an emerging and cooperative field, where standardisation in expert qualifications may vary (Leavy, 2014). This could introduce creativity or differences in opinions among experts, influencing the interpretation of findings (Pohl *et al.*, 2015) and, ultimately, the PER. Additionally, generalizability (Leavy, 2014) may be impacted by the sample size and variations in the experiences of VAs, potentially limiting the broader applicability of the study's outcomes (Ofli *et al.*, 2015). Confirmation bias (Leavy, 2014) with VA participants is also possible, as our existing professional relationship may influence their responses and perceptions. The study's success relies on participants' active engagement and cooperation and how potential biases will be mitigated through transparent reporting of methods and findings (Punch, 1994; Denscombe, 2003; Israel, 2014).

Figure 2: Research Timeline:

Each research task will have allocated time within the nine-month window. The timeline will be reviewed and adjusted between tasks for unforeseen circumstances (Saldaña, 2021).

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Ethics:

The study and its successful ethical review (App.1) prioritise participant safety, informed consent, privacy, and intellectual property. Participants will be allowed to withdraw without consequence. Data retrieval and coding processes adhere to ethical standards, ensuring confidentiality and anonymity (Punch, 1994; Bell & Waters, 2018). Personally identifiable information, expert and VA responses, and reflections will be carefully safeguarded through secure coding and storage. Ethical considerations guide data handling, ensuring that the

research is transparent, rigorously conducted, and aligns with established standards of validity (Israel, 2014).

As an inside researcher, my dual role as a CPT and voice coach offers a unique advantage, providing VAs with highly specialised and informed guidance. However, this involvement could introduce bias (Costly *et al.*, 2012), particularly in the subjective evaluation of literature, relevant information, participant progress and potential influence of personal expectations on the results. From a health standpoint, my certifications ensure that the PER will be grounded in safe, evidence-based practices promoting overall well-being (Schlabach & Peer, 2020). However, as a non-medical professional, I cannot address medical issues; therefore, any such concerns will be referred to qualified healthcare professionals for appropriate care (Pauline *et al.*, 2006).

Intended Outcomes:

Personal growth opportunities, such as addressing insider research ethics, refining qualitative research skills, and fostering interdisciplinary collaboration (Denscombe, 2003; Grant, 2012; Merriam & Tisdell, 2016), will enhance my professional development in the emerging voice and exercise integration field. This research integrates multiple approaches, adheres to ethical standards, and leverages my expertise to significantly contribute to VAs, empowering VAs to unlock their full potential.

Report:

**Integrated Practice: Expert-Informed Physical Exercise Regimens to
Enhance Vocal Athlete Performance**

Introduction:

The community of interest for this study, vocal athletes (VAs), are described by leaders in the field, LeBorgne and Rosenberg (2019), as high-performing professionals subjected to rigorous vocal and physical demands. VAs encounter various challenges to preserve vocal integrity during vigorous physical performances, requiring endurance and strength to avoid fatigue, strain, compensation, and inconsistency (Saxon & Berry, 2009). The intricacies between physical health and vocal performance have garnered increasing attention within the realm of vocal athletics (VACs) to mitigate these challenges and maintain optimal health while preserving vocal capabilities (Snell *et al.*, 2020), a balance critical to longevity and well-being (Heyman *et al.*, 2019). General exercise regimens, most exercise professionals, and many vocal modalities do not adequately address all facets (Friedlander, 2018; Van Overmeiren *et al.*, 2018; Chandler, 2022). Integrated training practices - e.g. the holistic alliance of physical exercise (PE) and vocal training - must address the essential interconnected demands of modern VAC performance.

With multipotentiality as a performer, vocal coach, and certified personal trainer (CPT), I can uniquely navigate this intersection through research and application (Friedlander, 2018). Challenges arise when practitioners lack expertise in both fields (Friedlander & Dawson, 2006; LeBorgne & Dal Vera, 2015; Rumbach *et al.*, 2019), which may have repercussions of compensation, fatigue, misuse, or injury for the performer (Røksund *et al.*, 2014). This research aims to develop a safe, balanced physical exercise regimen (PER), a structured PE plan designed to improve VA-specific tasks, with a comprehensive understanding of voice and physical training needs, to provide customised solutions that enhance the well-being and performance longevity of VAs.

This study focuses on filling gaps in existing research by scientifically developing and implementing a comprehensive PER and training model for VAs, incorporating interdependent aspects of physical exercise (PE) to complement vocal training. The PER will focus on form and exercise science principles (ESPs) (Johnson & Sandage, 2021; Nesbitt, 2023) to holistically train the entire performer through integrated practice, a combination that has yet to be thoroughly and systematically explored. The lack of specialised PERs tailored for VAs portrays the importance of an investigation (Friedlander & Dawson, 2006; Friedlander, 2018). This study

will explore expert opinions to advise developing and implementing a PER tailored specifically for VAs. Building on established research and extending on previous modules (Holden, 2023a; 2023b) on the necessity of physical exercise and dynamic engagement for VAs, this study's goal is to optimise training, health, and performance of VAs by integrating practical experience, theoretical knowledge, and a commitment to balancing physical health with vocal capabilities (Lee *et al.*, 2020). This will be reflected in the integrated PER, providing coaches and VAs with the tools and knowledge to achieve full training potential and enhance performance and career longevity.

The initial aim is to investigate how insights from experts with voice and sports science experience, knowledge, and training can inform an optimised PER for VAs while safeguarding vocal health (Haldane, 2018; Van Overmeiren *et al.*, 2018; Summitt & Weidner, 2022). Subsequently, this study will explore VAs' perceptions of the developed PER and adaptations they observed in training and performance, aiming to enhance dynamic and holistic well-being while providing VAs with sustainable, integrated practices.

This research offers opportunities for professional growth by deepening my understanding of interdisciplinary collaboration (Snyder, 2019) and the nuanced relationship between PE and the voice (Naito & Niimi, 2000; LeBorgne & Rosenberg, 2019). The implications of this study extend beyond vocal training and exercise science, offering possible valuable insights and a practical model and PER aimed at improving VA training, performance, and health, as well as interdisciplinary strategies that could foster greater collaboration and further research between these disciplines.

The following literature review will explore these issues in-depth, highlighting the voids in current training methodologies and modalities (Leavy, 2014), how they address concerns, the limitations, and how much they fill the gaps (Leavy, 2014). I intend to build on the literature's foundation to develop the PER that integrates the fields and ultimately enhances VA training, well-being, and performance. This research will aim to answer the research questions of how expert insights from both fields can inform the development of an optimised PER that safeguards vocal health and subsequently examine the changes and adaptations VAs perceive in their training and performance throughout the implementation of the PER, as well as their overall experience.

Literature Review:

By employing an inductive approach, this literature review will identify and synthesise relevant knowledge and gaps on topics surrounding VAs (Paul & Criado, 2020; Castleberry &

Nolen, 2018), providing a comprehensive overview of current methodologies and findings and areas for future research (Kiteley & Stogdon, 2014; Snyder, 2019; Peters *et al.*, 2020). To answer the research questions and hit the target aims, themes from Table 2 will be discussed to create questions for expert consultations.

Table 2: Literature Review <u>Themes</u> and <i>Subthemes</i>	
1) <u>VAc Demands</u>	
a) <u>Current Training</u>	
b) <u>VA Needs</u>	
i) <i>Load vs Demand</i>	
ii) <i>Muscular and Biomechanical Knowledge</i>	
iii) <i>Stamina and Endurance</i>	
iv) <i>Dynamic Structure and Alignment</i>	
(1) <i>Kinesthetic Awareness</i>	
(2) <i>Tension</i>	
2) <u>VAc Training Requirements</u>	
a) <u>Programming Essentials</u>	
i) <i>Exercises</i>	
ii) <i>ESPs</i>	
iii) <i>Challenges</i>	
iv) <i>Recommendations</i>	

VAc Demands:

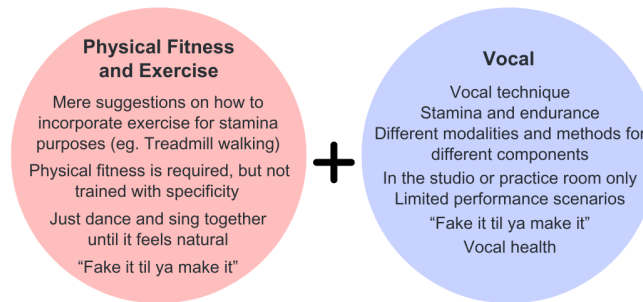
As discussed earlier, VAs are expected to meet various demands for successful performance, including vocal and physical endurance, agility, and technique (Thibeault *et al.*, 2004) while delivering flawless and emotion-evoking performances (Titze, 2006). These combined demands place immense stress on the vocal body systems (Røksund *et al.*, 2014), and Sataloff (2017) and Morton (2020) suggest that training approaches and regulation tactics must reflect these challenges.

Current Training:

Current VA training recommendations often treat physical exercise and voice training as separate entities, leaving VAs to manage these demands independently despite high expectations and pressures from the industry (Smeltzer, 2017; Snell, 2020; Chandler, 2022). This separation creates significant challenges, as conflicting or improper muscular alignments, recruitment strategies or forms, and habits can arise, increasing the risk of injury (Morton, 2020). Framework 1 models some current recommendations VAs are given, mainly by vocally

focused coaches, and expected to manage, typically unassisted by dual-trained professionals (Saxon & Berry, 2009; Morton, 2020).

Current VA Training Recommendations Model



Framework 1: Current VA Training Recommendations

The industry's requirements for PE and dynamic movement necessitate a level of physical conditioning that traditional vocal training alone does not provide (Fontan et al., 2017; Snell et al., 2020; Summitt & Weidner, 2022; Zeine & Walter, 2002; Van Overmeiren et al., 2018). Traditional vocal and movement training methods such as the Alexander technique (1890) (Weiss, 2005; Tarr, 2008) and Linklater Technique (2002) (Linklater, 2006; 2018), among others, must be challenged (Cranton, 2006; Sataloff, 2017) to incorporate exercises past mere alignment and awareness (Friedlander & Dawson, 2006; Friedlander, 2018). To meet the rigorous VAc demands explained below, these standard training modalities and recommendations must be challenged to integratively address vocal and physical performance needs by incorporating cross-training strategies to support the health and longevity of VAs. An integrated practice can help VAs manage the physical demands of performance, potentially reducing the risk of injuries and vocal fatigue (Snell et al., 2020).

VA Needs:

As performers who rely on their vocal bodies as their primary tool, VAs face significant demands due to the vocality and physicality of performance, the length of performances, and the cumulative wear and tear on the voice and body (Nesbitt, 2023). The complex and ever-changing performance environment necessitates that VAs train for vocal and physical requirements (LeBorgne & Rosenberg, 2019), as success and longevity hinge on the delicate balance. VAc professionals must address several critical factors: simultaneously manage vocal and physical load and demand, understand biomechanical and muscular structures of vocal

body systems, foster kinesthetic awareness, develop vocal and physical stamina, optimise dynamic alignment, and mitigate overall tension. Recognising these interconnected demands (Chandler, 2022) is essential to train VAs to sustain peak performance while preventing injury, compensation, or fatigue (Nanjundeswaran et al., 2017).

Load vs Demand:

A study by Hunter *et al.* (2020) clarifies the distinction by resolving the ambiguity of vocal load and demand: "vocal load," the phonatory effort exerted over time, and "vocal demand," which refers to the vocal requirements of a given scenario, independent of the vocalist's technique or physiology. These concepts are crucial for understanding the challenges VAs face, as high vocal load, especially under high demand, can lead to fatigue, strain, and injury (Solomon, 2008; Sivasankar & Fisher, 2007). The terms "load" and "demand" in vocal and physical contexts are not directly analogous, which complicates the development of integrated training protocols (Orlikoff, 2008; Rumbach, 2013; Primov-Fever et al., 2014; Schoenfeld & Contreras, 2016; Hunter et al., 2020; Snell et al., 2020). Similarly, physical load and demand differ but are interrelated, with physical exertion often exacerbating vocal strain (Chandler, 2022). Integrating training programs that address vocal and physical demands is essential to prevent injury and optimise performance, ensuring longevity in vocally demanding careers (Snell et al., 2020; Orlikoff, 2008; Primov-Fever et al., 2014).

VAs often lack specific training for managing vocal and physical loads resulting from performance demands (Morton, 2020), leading to strain, compensatory habits, and fatigue. This gap can be addressed through evidence-based training programs designed to enhance performance and protect vocal body systems and health by understanding, managing, and tailoring to symbiotic vocal and physical demands. To develop these programs effectively, a deeper understanding of the muscular structures and biomechanics involved in VA performance is crucial (Andersen & Aagaard, 2010; Nanjundeswaran *et al.*, 2017) to targeting unique demands, preventing injury, and enhancing training and performance while ensuring longevity. Without this knowledge, training programs risk being ineffective or harmful, as they may not adequately prepare the vocal and physical systems for the complex interactions and stresses encountered during performance (McHenry & Evans, 2016).

Muscular and Biomechanical Knowledge:

Plotkin *et al.* (2021) mentions that muscles respond to how they are trained and maintained, proving that the skeletal and laryngeal anatomy relationship, particularly their

muscle fibre compositions, bioenergetics (Sandage & Smith, 2017) and training demands, present a fascinating study area for understanding VAc performance. To effectively train VAs for enhanced performance, it is crucial to understand how demands affect their distinct and interconnected laryngeal and skeletal musculature and their intricate coordination (LeBorgne & Rosenberg, 2019). Given the biomechanic disparities between laryngeal and skeletal muscles and the VAc demands placed upon them, there is a critical need to address gaps in the literature concerning their specific and integrated training and maintenance practices (Hoh, 2005).

Laryngeal muscles experience unique stress during vocal performance (Hoh, 2005; Tellis *et al.*, 2004; Friedlander, 2018). They are less understood than skeletal muscles and a challenge to study due to their intricate nature and inaccessibility to assess in vivo without potential harm or interference with natural function. Most information about laryngeal musculature is often generalised from skeletal limb muscles (Sandage & Smith, 2017). Laryngeal muscles are subject to significant vocal load, compounded by physical load, necessitating precise control, flexibility, and endurance to combat fatigue and compensation (Hunter *et al.*, 2020). They exhibit fibre type, capillary density, and metabolic features similar to limb muscles, containing a mix of Type I, Type IIa, and Type IIx fibres (LeBorgne & Rosenberg, 2018) that enable rapid and fatigue-resistant functions essential for phonation, respiration, airway protection and nuanced control of vocalisation (Verdolini *et al.*, 1994). They are particularly vulnerable to fatigue and injury if not correctly conditioned (Sandage & Smith, 2017; LeBorgne & Rosenberg, 2018).

Skeletal muscles, which are generally more robust and capable of handling greater loads involved in gross motor movement (McCall, 2019), are well studied (LeBorgne & Rosenberg, 2018), with fast-twitch type II fibres for power and agility and slow-twitch type I fibres for stamina and endurance (Hoh, 2005). These muscles benefit from well-established strength training protocols, cardiovascular conditioning, and mobility exercises in typical training modalities (McCall, 2019).

These demands highlight the need for specialised training that addresses the differences in muscle composition and function between the larynx and the rest of the body (Friedlander, 2018). Further investigation must comprehensively understand laryngeal musculature and how their differences to skeletal muscles can be addressed to effectively tailor training programs for VAs (Rumbach *et al.*, 2019) for desired regulation results. By developing new integrative definitions, modalities, and research approaches, future research can better support the health,

performance, and longevity of VAs, ensuring their sustained vitality in demanding careers (LeBorgne & Rosenberg, 2018; Chandler, 2022).

Stamina and Endurance:

Vocal and physical stamina are critical for the long-term health and sustainability of VAc performance. Since performance relies on proper breath control and support, it is considered an aerobic activity (Sandage & Smith, 2017). Research indicates continuous, high-energy performance demands can lead to vocal and physical fatigue if not adequately managed and trained (Morton, 2020). However, current vocal training models often fail to sufficiently prepare VAs for these demands. For instance, merely instructing VAs to sing while walking on a treadmill (Williamon, 2004), a common practice meant to simulate performance stamina (Røksund *et al.*, 2014), is insufficient to build the stamina and endurance required for the rigorous demands of professional performance. This approach lacks the comprehensive training to develop the cardiovascular and muscular endurance essential for sustained performance.

A more holistic training regimen integrating targeted physical conditioning with vocal practice is necessary to enhance vocal and physical endurance. By incorporating exercises that build overall stamina and promote efficient breath support, VAs can improve their resilience against fatigue, maintain vocal health, and sustain high-performance levels throughout their careers. Stamina and endurance also have physical manifestations during VA training and performance, where dynamic structure and alignment play a crucial role in maintaining form and energy while preventing fatigue.

Dynamic Structure and Alignment:

Static posture refers to a fixed, rigid body alignment (Schneider *et al.*, 1996), often seen in traditional vocal training and studio settings (Chandler, 2022). However, this approach can be detrimental to VA performance. Prolonged static alignment often leads to lower kinesthetic awareness and proprioception (Schneider *et al.*, 1996), muscle stiffness, restricted breathing, and decreased flexibility, all counterproductive in dynamic performance settings (Lee *et al.*, 2020). This rigidity can increase compensatory tension in the vocal apparatus, generally negatively impacting both vocal and physical performance.

In contrast, dynamic posture and alignment involve adaptable movements that allow the body to respond fluidly to performance demands. Maintaining dynamic posture supports better breath control, efficient muscular engagement, and balanced physical effort (Sandage & Smith, 2017). For VAs, dynamic alignment enhances breath management, reduces unnecessary strain, and promotes fluidity in both vocal production and physical movement. This flexibility enables

rapid changes in vocal technique and style, allowing VAs to perform with greater agility and less risk of injury. Additionally, dynamic posture, by supporting the natural biomechanics of the body, helps VAs sustain energy throughout their performance, thereby avoiding muscular fatigue or vocal strain (Holden, 2023).

Kinesthetic Awareness and Proprioception:

Current vocal training models often fall short of adequately developing kinesthetic awareness and proprioception, which are essential for VAs. Kinesthetic awareness refers to the ability to sense and control the position and movement of the body in space. At the same time, proprioception is the body's internal sense of position, movement, and balance (Malde *et al.*, 2020). These skills are critical for VAs as they allow for real-time adjustments in posture and alignment, enhancing the body's ability to respond to the demands of dynamic performance. Lastly, the ability to maintain stamina and flexibility during vocalising and performance is supported by the integrity and structure of the vocal body (Friedlander, 2018), which requires manageable tension, as discussed below.

Tension and Release:

Balancing tension and release is another crucial aspect of training that is often overlooked in traditional models. Excessive tension, particularly chronic or unmanaged, can lead to detrimental effects of strain, pain and fatigue (Primov-Fever *et al.*, 2014), which can impair vocal production and overall physical performance (Lee *et al.*, 2020). Tension often arises from improper posture (Lee *et al.*, 2020), technique (Sandage & Smith, 2017), and form (Chandler, 2022), as well as excessive physical and vocal exertion (Snell *et al.*, 2020) or inadequate preparation (Friedlander, 2018). The demanding nature of VA performances can exacerbate this tension if not adequately released or managed (Orlikoff, 2008). When tension accumulates in the body, it can restrict the flexibility of the vocal apparatus, leading to decreased vocal agility, increased likelihood of vocal strain, and physical compensation or imbalance (Hunter *et al.*, 2020; Schoenfeld & Contreras, 2016). This tension can also disrupt breath control, which is essential for maintaining consistent quality and stamina throughout VA performance (Primov-Fever *et al.*, 2014; LeBorgne & Rosenberg, 2018).

Managing tension is crucial for VAs to avoid the detrimental effects it can have on their vocal and physical performance. By understanding the causes and impacts of tension and implementing targeted strategies to release it, VAs can achieve greater vocal and physical freedom, ultimately enhancing their performance quality and longevity (Rumbach, 2013; Holden, 2023). These components are essential for a comprehensive approach to VA training. However,

current models do not fully address these demands, highlighting the need for more integrative and evidence-based training strategies that align with the physical and vocal challenges faced by VAs in today's performance environments (Ray *et al.*, 2018).

VAc Training Requirements:

The preparation required for athletically demanding performance extends beyond simple and static approaches or recommendations (Friedlander, 2018). As proven above, these demands necessitate comprehensive methods that include PE conditioning and vocal exercise to balance the symbiotic nature of performance (Lawrence, 2022). It is suggested by (Morton, 2020) that VAs who engage in both physical and vocal training are better equipped to handle the rigours of performance without experiencing compensations or fatigue.

Programming Essentials:

Exercise Forms:

Effective VAc programming requires a multifaceted approach that integrates various training components to support optimal performance and long-term health while preventing injury. Integrating strength training (Chandler, 2022), cardiovascular conditioning (Corsi *et al.*, 2022), flexibility exercises (LeBorgne & Dal Vera, 2015), and specific techniques that enhance respiratory strength (Chandler, 2022), stamina (Friedlander 2018), posture (Pettersen & Westgaard, 2004), core strength (Rumbach *et al.*, 2019), coordination and proprioception (Snell *et al.*, 2020), and overall physical fitness (LeBorgne & Rosenberg, 2018), support vocal performance (Friedlander & Dawson, 2006; Friedlander, 2018). However, few functional and holistic models or programs exist (Morton, 2020). Integrated training is vital for maintaining the balance between vocal and physical demands, ensuring that both systems support each other rather than compete.

A well-rounded regimen (Sandage & Smith, 2017; McCall, 2019; Blake & Solberg, 2023) should begin with dynamic warm-ups that incorporate specific mobility exercises and integrated breathing techniques to prepare both the body and voice for the demands of performance (McHenry & Evans, 2016). Strength and resistance training is essential for developing the muscular power endurance needed to sustain performance efforts (Friedlander & Dawson, 2006), while cardiovascular conditioning enhances overall stamina and supports the aerobic nature (Nanjundeswaran *et al.*, 2017). Core development is another critical element, as a strong and stable core provides the foundation for dynamic structure, effective breath support, and vocal control (Corsi *et al.*, 2022). Following the main workout, a cool-down phase (Ragan, 2020) with vocal body flexibility-focused exercises and static stretching helps to release tension and

promotes muscle recovery, reducing the risk of strain or injury (LeBorgne & Rosenberg, 2018). Incorporating meditation or relaxation practices into the cool-down further aids mental recovery and stress management, which is vital for maintaining healthy and sustainable practices (Nesbitt, 2023). Finally, translating recovery strategies from sports athletes, including proper rest and active recovery, is necessary to prevent injury and ensure the longevity of a VA's career (LeBorgne & Rosenberg, 2018; *Chua et al.*, 2022). These programming essentials are crucial for creating a balanced and effective training plan that addresses the unique needs of VAs.

Challenges:

However, integrating fitness and vocal training poses significant challenges despite its benefits. One major issue is practitioners' potential need for cross-disciplinary expertise (Rumbach, 2013). Voice coaches may lack the knowledge in physical training necessary to design effective and safe exercise programs, while fitness trainers may not fully grasp the nuances of vocal health and technique (Røksund, 2012; Rumbach, 2013; Fontan *et al.*, 2017; Spivey & Saunders Barton, 2018). This knowledge gap can lead to ineffective or even harmful training regimens, including inappropriate exercise selection, incorrect form cues, and inadequate conditioning (Schlabach & Peer, 2020). Consequently, such gaps may result in muscle imbalances, increased injury risk and tension, and poor recovery management (Pauline *et al.*, 2006), all of which compromise vocal and overall health (Heyman *et al.*, 2019).

ESPs:

VAs, akin to professional sports athletes (LeBorgne & Rosenberg, 2018; Lawrence 2022), must incorporate ESPs, such as progressive overload, specificity, adaptability, and regulation (Sandage, Connor, & Pascoe, 2013; Schoenfeld & Contreras, 2016; Johnson & Sandage, 2021), for skill acquisition and upregulating the vocal body, while enhancing training and performance of VAs (Nesbitt, 2023). These principles provide a scientific foundation for designing training regimens specifically tailored to the unique demands of the performance sport, ensuring that VAs bioenergetically develop the proper musculature, endurance, strength, and flexibility necessary to sustain high levels of performance. Just as sports athletic training relies on ESPs to achieve peak physical condition (Holden, 2023) and prevent injury (LeBorgne & Rosenberg, 2018), VAs must also adopt and translate these principles to upregulate the vocal body, maintain overall health and career longevity (Chandler, 2022)

Recommendations:

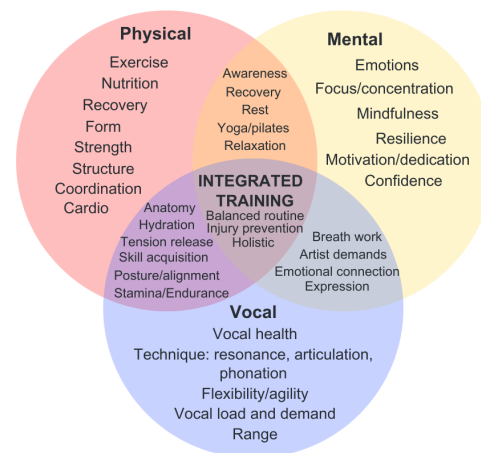
To promote both vocal and physical health in VAs, training programs must be clearly defined and tailored to meet their specific needs (Chandler, 2022). This includes setting realistic

goals, providing adequate instruction and supervision, and ensuring that the type, intensity, and duration of exercises are appropriate for upregulating on a specific biomechanical level (Amonette *et al.*, 2016) and maintaining overall integrity of the exercise control, form, and posture (Schoenfeld & Contreras, 2016). Avoid harmful practices such as the Valsalva manoeuvre and high subglottic pressure (Rumbach *et al.*, 2019), and it is best to abstain from programming heavy, slow lifts (Chandler, 2022). The literature mentions that VA programming must allow for comprehensive conditioning from all angles, increasing physical strength, cardiovascular endurance, and vocal agility, and control, is done by incorporating exercises that address all aspects of both vocal and physical conditioning to support a well-rounded VA (Sandage & Smith, 2017; Friedlander, 2018; LeBorgne & Rosenberg, 2018).

A study by Van Hoyer *et al.* (2015) mentions that regular monitoring and feedback are essential for optimising performance and health outcomes, allowing for necessary adjustments. Ethical programming, highlighted by Pauline *et al.* (2006) and Schlabach and Peer (2024), must also ensure accessibility and adaptability to various skill levels and physical conditions, recognising the diverse backgrounds and needs of VAs (Shannon & Zizzi, 2017). The program should be scalable, offering modifications for different levels of physical fitness and vocal capability (Friedlander & Dawson, 2006; Friedlander, 2018), thus minimising the risk of injury or undue strain (LeBorgne & Rosenberg, 2018). Ongoing research and adaptation are crucial for maintaining the program's relevance and effectiveness (Van Hoyer *et al.*, 2015). By continuously evaluating its impact and incorporating new insights and participant feedback, the program can evolve to support the long-term success and well-being of VAs, ensuring it remains comprehensive, safe, and beneficial (Pauline *et al.*, 2006; Van Hoyer *et al.*, 2015; Schlabach & Peer, 2024).

Finalized VA Integrated Training Model for Performance Enhancement

Framework 2: Updated VA Integrated Training Model for Performance Enhancement Based on Literature and VA Needs. To ethically test this updated framework, relevant methodologies must be employed (Merriam & Tisdell, 2016). The following section will delineate the procedure and choices best suited for this investigation.



Methodology:

This qualitative study will employ a multifaceted methodological approach to gather in-depth insights from experts and VAs about developing and implementing a tailored PER. The methods will align with the study's exploratory nature to understand the emerging interplay between PE and vocal training. The research methods employed in this study will be grounded in subjective epistemology, relativistic ontology, and the constructive paradigm to appropriately capture the complex and nuanced experiences (Creswell, 2018; Leavy, 2014; Saldaña, 2021) of experts and VAs. Goulding (2002) and Leavy (2014) mention that epistemologically subjective knowledge is co-constructed between the researcher and participants. This, along with relativistic ontology - promoting multiple perspective-oriented realities (Creswell, 2018) - emphasises the importance of understanding and reporting individuals' unique perspectives (Goulding, 2002). The constructive paradigm will further support this approach by prioritising participants' meanings and interpretations of their experiences (Leavy, 2014) rather than seeking objective truth, leading to a more ethical and balanced study (Almeida *et al.*, 2021). These methodological foundations ensure that the research reflects and is sensitive to varied experiences within the field of interest (Almeida *et al.*, 2021). By valuing the diverse perspectives, the study can produce more holistic and contextually relevant insights (Leavy, 2014) into creating and applying an ethical (Horn, 2011) PER for VAs.

Research Design:

This study adopts a qualitative approach, particularly suited for exploring complex, context-dependent phenomena (Creswell, 2018; Merriam & Tisdell, 2016; Almeida *et al.*, 2021), such as creating evidence and experience-based PER and its impact on VAs. This approach allows for a rich, nuanced understanding of participants' knowledge, experiences, and perceptions (Leavy, 2014; Collins & Stockton, 2018), facilitating the development of and reflection on a comprehensive and effective PER (Horn, 2011) as seen in the proposed Figure 1 (App.20). The exact research methods will be discussed further in the following sections.

The design basis of this research is rooted in ethical and value considerations (App.1) to ensure well-rounded and prudent research for the VAc field (Harriss *et al.*, 2019). For transparency and moral standards, all participants were fully informed about the study's aims, methods, and potential risks (Field & Hole, 2013; Schlabach & Peer, 2024), as seen in appendix #, where they provided written consent, understanding their outlined rights as participants. This process ensured ethical standards and participant comprehension, contributing to the data

collected and the study's integrity (Fischer, 2009). With this in mind, the following sampling strategies are chosen to gather diverse insights from professionals and practitioners directly involved in the intersection of VA training and PE.

To fully consider the demands and needs of VAs, purposeful sampling (Field & Hole, 2013; Creswell, 2018), was employed to select five or six experts in the fields of exercise physiology, vocal training, and sports science based on the credentials in table 3. The criteria and high inclusion standards ensure that selected experts possess robust theoretical knowledge, practical experience, and professional recognition (Merriam & Tisdell, 2016) to gather credible, impactful data, significantly contributing to integrated practice for VAs (Warburton *et al.*, 2011; Leavy, 2014). These experts were selected by reviewing literature and social media presence to ensure their qualifications and were sought out virtually to engage in the semi-structured interviews explained below. Ten expert professionals were contacted, but due to professional constraints and scheduling, only four were interviewed within three interviews (App.7). Luckily, these experts were able to share a plethora of information and experience, as delineated in the findings section, which was able to be triangulated (Saldaña, 2021; Flick, 2017) to develop the PER for VAs (App.15).

Rather than solely gaining expert insight, highlighting the perceptions and experiences of the VAs via PER implementation is paramount to the holistic aim of this study (Denscombe, 2003; Saldaña, 2021). Strict criteria for VA eligibility are delineated in Table 3 to gather consistent, reliable data (Harriss *et al.*, 2019; Pauline *et al.*, 2006; Schlabach & Peer, 2024) on tailored PERs' effects on vocal performance. Six healthy, professionally performing VAs from my studio were recruited to ensure a range of perspectives. Unfortunately, due to the time commitment and intensity of the PER implementation, only three VAs were willing or able to participate. From a research facilitation perspective, the small group was welcomed as I could provide more personalised feedback on form and modifications (Op den Akker *et al.*, 2014; Ofli *et al.*, 2016) throughout the month-long PER implementation phase. The findings section will further discuss the small sample size and its implications.

Table 3: Participant Criteria and Eligibility - ensures safety and ethical data (Leavy, 2014)

Expert	VA
• Advanced degree in relevant field • Professional experience with VAs or program development • Collaboration or research reflecting an integrated and collaborative approach	• Healthy performers between 18-45 • No underlying medical or vocal conditions (non-smokers) • Minimum three years of vocal training or professional singing • Commitment to add PE to their lifestyle or routine

To remain within the practitioners' scope (Pauline *et al.*, 2006; Haff & Triplett, 2016; Schlabach & Peer, 2024) and adhere to ethical and resource restrictions (Israel, 2014; Harriss *et al.*, 2019), this qualitative study involves healthy VAs without physical, vocal, or respiratory diagnoses. The initial intake survey (App.12), modelled with questions from the Physical Activity Readiness Questionnaire for Everyone (PAR-Q+) (Warburton *et al.*, 2011; Harriss *et al.*, 2019) for health and well-being analysis, was a deciding factor in VA participation. Due to practitioner scope, ethical limitations, and time constraints, if any health concerns arose on the initial survey, the VA's involvement would have been terminated from the study and referred to their general practitioner for further guidance (App.11). Fortunately, all the VAs willing to participate were healthy (S1 App.12) and able to continue with PER implementation, which is further considered in the data collection and findings sections.

Other data collection designs or literature review approaches would be less pertinent to this study as they may not adequately capture the complexity and contextual nuances (Kiteley & Stogdon, 2014; Snyder, 2019) necessary for understanding PER creation for VAs. Quantitative methods would likely reduce participants' rich, subjective experiences to numerical data (Field & Hole, 2013), overlooking the depth of insights critical for this study. Similarly, a systematic or meta-analytic literature review would prioritise existing empirical generalisations (Kiteley & Stogdon, 2014) over the inductive discovery of new themes and theories, potentially missing the diverse and context-specific knowledge that is vital for informing the research questions and PER development. The consequent section will note how the results of this study are derived and how they pertain to VA performance enhancement.

Data Collection:

The data collection process was carefully structured, using the values, research design, and ethical considerations discussed above to select methods that ensure a comprehensive and nuanced understanding of VAs' needs and experiences.

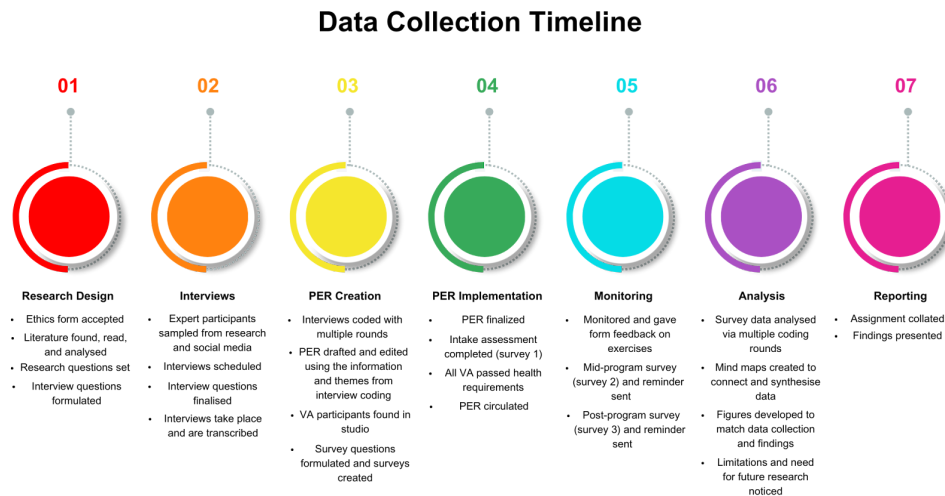


Figure 3: Data Collection Timeline (App.20 Figure 4) based on Research Timeframe (Figure 2)

A narrative literature review using inductive coding (Goulding, 2002; Fereday & Muir-Cochrane, 2006; Ferrari, 2015) was conducted to gather current information on PERs for VA as it allows for the emergence of themes and patterns directly from the data, facilitating the development of a theory that is deeply rooted in the nuanced experiences and practices of this specialised and emergent community. The preceding, extensive literature review was necessary as it provided the foundational framework for the entire project (Goulding, 2002), guiding the design, formulating interview questions, and cyclically informing the PER development.

<u>Key Words:</u>	Vocal athlete, vocal performance, vocal health, physical exercise, interdisciplinary collaboration, exercise science, laryngeal/skeletal bioenergetics, physical and vocal synergy, programming	Chosen to focus on vocal performance and PE intersection, holistic programming, and interdisciplinary work
<u>Search Engines:</u>	Google Scholar, JSTOR, ScienceDirect, ProQuest, EBSCOhost, ResearchGate	Chosen on academic rigour and the number of relevant papers accessible
<u>Exclusions:</u>	Non-peer-reviewed sources, outdated publications, and anecdotal evidence without	

	practical application	
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Table 4: Literature Review Development and Criteria

Using the terms, search engines, and exclusions above, this review ethically explored recent vocal training and sports science studies, forming a foundational knowledge base aligned with research objectives (Paul & Criado, 2020) to inform expert discussions and PER formulation. Thematic coding and mind mapping (App.6) distilled key insights, ensuring the PER was informed by the latest effective practices (Castleberry & Nolen, 2018). From Kyngäs' (2020) suggestion, the themes and theories derived from the literature review were systematically integrated into the semi-structured interview questions, ensuring that these questions effectively elicited the expert participants' lived experiences, practical knowledge, and insights.

Expert Consultation:

Expert consultation involved undertaking semi-structured interviews, using questions (App.6) based on themes and theories from the literature review (Kyngäs, 2020), and consisted of forty-five-minute discussions on open-ended questions designed to explore tailored PERs and experts' experiences (Adams, 2015). Expert conversations were transcribed verbatim with filler words but without behaviour annotations (Saldaña, 2021). These transcriptions are coded inductively to develop a new framework, the resulting PER, via thematic analysis (Castleberry & Nolen, 2018). One round of reading with a thematic coding lens (App.7) was followed by an in vivo process (Leavy, 2014) (App.8-10) before developing and finalising themes. Using rhizomatic (Gravett & Winstone 2019) (App.20 Figure 6) coding, themes were connected to show the intertwined and complex findings and then attached to quotes for organisation and presentation (Gravett & Winstone, 2019).

Program Creation and VA Survey Evaluation:

The PER (App.15), developed from inductive themes insights gained through the literature review and interviews, was generated to apply the data derived from the expert consultations to enhance holistic VA training and performance. To ensure active involvement and track progression while capturing VA sentiments, thoughts and experiences, three qualitative, longitudinal, and semi-structured (Leavy, 2014) surveys were administered to VAs at different research points (Lynn, 2009) to saturate results (Leavy, 2014). An initial survey (App.12) established VA participation criteria and captured baseline health, previous experiences, expectations, concerns, and preconceptions, incorporating questions from the PAR-Q+ 2023 (Warburton *et al.*, 2011) to ensure legitimacy and address ethical health concerns. Following the confirmation of the VAs' eligibility, the PER was introduced, and the

program's framework, objectives, exercise methods, and key points were clearly outlined to them.

A mid-program survey (App.13), completed after the program's second week, gathered feedback on their ongoing experiences, adjustments to the regimen, and any emerging improvements or issues. Throughout the month-long program, I was accessible to the VAs (Pauline *et al.*, 2006), offering support during their weekly lessons to monitor and review exercise forms, provide tips, and discuss any challenges they encountered between surveys to mitigate health and safety concerns (Van Hoya *et al.*, 2015; Schlabach & Peer, 2024). If any concerns arose, VAs would be referred to a qualified healthcare professional, ensuring that their well-being and safety are prioritised (Pauline *et al.*, 2006). The post-program survey (App.14) collected detailed reflections on perceived improvements and overall satisfaction and suggested additions or refinements to the PER.

Data from these surveys were deductively analysed utilising in vivo and process coding (Saldaña, 2021) (App.12-14) using themes from the interviews, yielding valuable evaluation of and insights into the regimen's efficacy and evolution (Van Hoya *et al.*, 2015) while ensuring VA opinions and experiences are authentically represented. Together, these methods provide a detailed and dynamic understanding of the survey data and are methodologically coherent to the study's objectives, essential for assessing the PER's impact and VA's holistic experiences.

Auxiliary Data Collection:

A detailed research and observation journal, excerpts structured using Kolb's Experiential Learning Theory (Kolb, 1984), documented VAs' exercise and voice training performance and practitioner experience (App.19). This supplementary data provides a comprehensive analysis and triangulation of lived experiences and reflections from all parties to note deviations, reduce bias, and spark hypotheses (Belaggoun & Djouima, 2024). This method was chosen as it allows for a richer, more detailed understanding of and connection between individual experiences within their specific contexts (Belaggoun & Djouima, 2024) by challenging the data and ensuring adherence to ethical constraints, overall enhancing the credibility and transparency of the research process (Almeida *et al.*, 2021).

Ethical Considerations:

Ethical standards and insider research boundaries were paramount in this project's planning, implementation and analysis. The study adhered to established ethical standards, with the research proposal passing ethical review (App.1) and ongoing monitoring ensuring compliance. As the principal investigator, maintaining objectivity and ethical standards, with

health rigour (Pauline et al., 2010; Schlabach & Peer, 2024), was crucial with insider research constraints (Denscombe, 2003; Leavy, 2014) mitigated by transparency (Fereday & Muir-Cochrane, 2006), confidentiality (Schlabach & Peer, 2024) and reflective journaling (Almeida *et al.*, 2021). Participants were fully informed about the practitioner's certifications and the study's aims, methods, and potential impacts, provided written consent, and understood their rights to confidentiality, including withdrawal without consequence (App.5). To mitigate insider research biases (Leavy, 2014; Saldaña, 2021), transparent reporting, regular reflective practices (App.19), and critical self-assessment were implemented to ensure objectivity and maintain the integrity of the research process and findings.

By leveraging expert insights and capturing VAs' experiences, the study aims to develop a specialised PER that enhances VAs' training, well-being, and performance longevity. To meet these aims, the carefully chosen research foundation, values, methods, diverse analysis procedures and rigorous ethical framework ensure the research's integrity while safeguarding participant interests and ensuring the validity and reliability of findings portrayed and discussed at length below.

Findings:

The culmination of the research values, design, literature review, methods, ethics and execution of this study will be discussed through content and thematic data analysis grounded in research objectives to reveal key thematic patterns and connections (Castleberry & Nolen, 2018). This section thoroughly examines expert and VA experiences surrounding the PER creation and implementation, noting its construction and efficacy. Drawing evidenced-based connections and conclusions will illuminate the implications of this research within the emergent field (Saldaña, 2021) and the limitations to address with further investigation. The findings will be structured to present the results from the expert interviews, followed by a discourse on the creation of the PER and an analysis of the VAs' thoughts and feelings on the PER, concluding with a discussion on its efficacy and areas for improvement.

Expert Interview Results:

It was apparent during the literature review that PE and its effect on vocal training requires more evidence-based understanding and implementation to meet the intense demands of performance genres. The experts, chosen by their experience shown in Table 5, discussed a myriad of topics that considerably informed my understanding of the field and, thus, the resulting PER for VAs.

Table 5: Expert Participants and Experience

Expert (E)	Experience
E1	Vocal Athlete Coach (voice focused)
E2	Personal Trainer for Vocal Athletes (PE focused)
E3	Movement Specialist: Strength and Conditioning, Functional Range Conditioning, Neurokinetic Therapy (PE focused)
E4	Vocal Athlete Coach (voice focused) and Researcher (PE focused with vocal lense)

Key themes, shown in Table 6, resounded throughout the interviews and emerged from inductive, thematic, in vivo, and rhizomatic analysis (App.20, Figures 6-7). The findings reflect a growing consensus on the importance of a broader, more holistic approach to VAc training that aligns with the complex needs of VAs, promoting their health and longevity.

Table 6: Expert (E) Interview Themes and Subthemes

- 1) Advocacy for VAs as Athletes
 - a) *Necessity of PE Programming*
 - b) *Genre-Specific Demands*
 - c) *Myth-bust via Evidence-Based Research*
- 2) Program Creation Guidance
 - a) *Health Information*
 - b) *Structure and Exercises*
 - c) *What to Avoid*
 - d) *General Advice*
- 3) Unclear Information
- 4) Broader Scope

Advocacy for VAs as Athletes:

All four experts noted that VAs are athletes and need to be trained as such. The need for advocacy in integrating PE into VAc training emerged as a significant theme in the interviews. All experts highlighted the need for more general awareness and support of this holistic approach within VA training and performance. There is a strong call for vocal coaches, VAs, and the wider field to advocate for including physical fitness in VA training at various levels (E2) to “navigate different bodily and technical aspects...[via] knowledge of the body and athletics and science and biomechanics...[to] reach their full potential” (E3, p.92). By doing so, we are

“invest[ing] in [VAs] and...in the future of what we do [for VAs]...[As a coach, the goal is to] be able to guide them to make the healthiest choices for them and their craft” (E4, p.100). This advocacy promotes a healthier approach to vocal training and ensures that VAs are equipped with healthy and sustainable tools needed to “foster a connection with the full singing body” (E4, p.100). In tandem with the necessity of VA training, genre-specific clarity, busting myths through continued research, and broader implications for the field of VA training, this advocacy can foster a new generation of VAs who recognise and understand the importance of PE conditioning incorporation within vocal training and performance.

Necessity of PE Programming:

A common theme throughout the expert interviews was that PE for VAs is beneficial and necessary for modern performance, as well as the advocacy for a healthy and balanced career-focused lifestyle (E4). “Singing is a set of physical conditions...[a] skill acquisition coordination process...[yet VAs] are often used to standing still and focusing on precise breath control...and posture” (E4, p.103) in the voice studio. E2 mentioned that a majority of VAs they work with don’t know what they’re doing movement-wise, “so they really don’t have a baseline body awareness at all...they don’t know what their posture looks like...and it’s very apparent” (p. 87). Furthering this point, E1 stated that VAs might be “seemingly kinesthetically aware from what they can do on stage, [but] it’s often a ‘fake it till you make it’ way that they got there” (p.89), rather than structured upregulation and maintenance of the strength (Orlikoff, 2008; Ray *et al.*, 2018), stamina (Ray *et al.*, 2018; Wilson *et al.*, 2012), and flexibility (Petterson & Westgaard, 2004) required. As a whole, “vocal performance...is...super taxing on the body and [it is necessary]...to harness [the] body instead of experiencing a lot of fatigue...[strength training tools]...foster a connection with the full singing body in a healthy and sustainable way with using...exercise science and physical exercise” (E4, p.100). E3 agrees on the necessary body upregulation stating that for productive training and high-level performance, VAs’ muscles “need to be turned on...and connected to the brain and the vocal body” (p.99).

The goal is “making sure vocalists [and coaches] understand the real benefits of incorporating strength training and aerobic exercises into their routine. It’s about supporting your voice for the long haul...ensuring you can perform at your absolute best” (E4, p.109) while “enhancing your muscles’ use of oxygen, which is crucial for maintaining...function under pressure” (E3, p.99). “If you can have [a VA] become more aware with their body...you’ve given them a lot” (E2, p.87). Lastly, E4 mentioned how coaches must require knowledge of the full vocal body system in order to train VAs effectively. Since many exercise professionals lack this

understanding, this dual scope is necessary. “Singers should have different fitness goals and training programs...focusing on strength, mobility, flexibility and lean muscle mass rather than...muscle building” (E4, p.104) that is typically seen in programming from fitness professionals without laryngeal and VA awareness. This overarching message underscores the need for a paradigm shift in VA training approaches, advocating for integrated and comprehensive training methods for coaches and VAs to enhance performance and overall well-being.

Genre-Specific Demands:

Experts 1, 3 and 4 also discussed the necessity of understanding the varying demands across specific vocal genres, underscoring the need for genre-specific awareness in VA training and PE programming. For instance, “VAs with a background in classical singing...tend to have specific needs that are different from...those in musical theatre” (E3, p.94). This is analogous to sport-specific training requirements with sports athletes (Andersen & Aagaard, 2010). E1, talking about triple-threat VAs, or “artists [who] are required to sing, dance, and act” (Morton, 2020, p.295), are rare and “they feel weak in one or more of the other [areas]” (E1, p.89). This idea is reinforced by Morton’s (2020) argument stating that triple-threat performance requires “conflicting body alignment and muscle recruitment...[yet despite this,] programs continue to offer separate skills training” (p.296), which can lead to injury, rather than integrated programming. In terms of genres, E3 coins them as “high velocity, high duration but low load sports” (p.96), and with the “right balance...exercises are functional and directly related to the demands of...performance” (p.96). E3 and 4 go into more detail on how each VA training should “mimic their stage movement” (E4, p.105), “so when they’re under stress and load, they can manage (p.106) without risk of injury or compensation. Both experts 3 and 4 mentioned that classically focused VAs need to incorporate exercises specific to slow-twitch muscle fibres or aerobic muscle fibres to minimise tension and enhance control over long phrases (E3; E4) and to upregulate “low load tissue tolerance...and lower chances of support compensations” (E3, p.94). On the other hand, musical theatre-concentrated VAs must “sing and dance simultaneously...[and require] cardiovascular endurance and strength...to move fluidly and sustain” (E3, p.96) and must “focus on fast-twitch muscle fibres [that] help with explosive movements and stamina” (E4, p.105). Overall, “understanding...the specific demands of their genre...[the] different set of challenges and strengths compared [to other genres]...helps [coaches] create...effective...[and] sustainable...training programs” (E3, p.105). Although the study’s small design, constraints, and VA accessibility prevented the PER from being

genre-specific, this opens up opportunities for future research to explore tailored approaches in greater detail. It is highly hypothesised that aligning physical training to genre-specific needs will result in greater performance mastery and longevity of VA vocal and physical health.

Myth-bust via Evidence-Based Research:

Interviews also noticed that advocating for VAs included the importance of dispelling common myths to ensure accurate information guides effective training strategies. A prevalent misconception is that VAs can achieve peak performance solely through vocal practice (E4), neglecting the physical demands of their craft. The voice is part of a more extensive system and must be upregulated to avoid vocal strain, tension and injury while enhancing control, stamina, agility and recovery (E4). On the flip side, myths of strength training and cardiovascular training being “harmful to the voice” (E3, p.99) due to tension being inherently bad (E4) were dispelled by E3 and E4. “it is important to understand that unfamiliar movement patterns cause excess tension or stiffness. This is because the body must expend...more resources to adapt to new movements and will manifest in more tension, soreness and nervous system fatigue” (E3, p.98). “Tension development is...useful in the voice...[as a variety of] techniques...need structure and [relative] pressure as much as relaxation. Structure of the body...needs tension, so strength training...[allows] the vocal body...to stay steady...under pressure” (E4, p.108). In the same vein, E1 mentions that VAs “have to know what it feels like to be tense...to know what it feels like not to be tense, and then find the middle...[VAs] can’t strain within [the] voice, but sometimes...[it’s] okay with knowing what [the] boundaries are. That sort of kinesthetic awareness” (E1, p.91). These findings make it clear that a fresh breath of holistic and evidenced-based advocacy needs to be introduced to the field to reframe the understanding of balanced exercise form effects on tension and successful VA training.

Program Creation Guidance:

To meet the performance demands and VA needs delineated above and throughout the literature review, information on program creation derived from expert surveys offers valuable insights into the key elements that shaped the PER. Results encompass expert recommendations on gathering health information, structuring and prescribing exercises, aspects to incorporate or avoid, and general advice. These findings provide a foundational understanding of the evidence-based practices that informed the design of the PER implemented into VA training for performance enhancement.

Health Information:

The importance of gathering and handling health information through thorough intake and assessment processes emerged as a crucial foundation for VA training that ensures safety, efficacy, and well-being (Haff & Triplett, 2016). Experts unanimously agreed that gathering comprehensive baseline information is essential to develop a well-rounded, ethical, balanced and personalised training regimen (E1; E2; E3; E4). The intake process is the foundation for understanding each VA's unique background, and while each expert had their own method for conducting intakes, several common, critical themes were identified. Physical movement assessments (E2; E3) and vocal evaluation (E1; E4) are conducted, and collaborative discussions on past training experiences (E1; E4), previous injuries (E1; E3), lifestyle (E2; E4), performance demands and schedule (E3; E4) and overall goals (E3), allow for a tailored physical and vocal conditioning approach to programming. E3 mentioned that the “body is a map of the individual’s history” (p.93), so a “full [vocal] body scan” (p.#) must be connected to the VA’s background intake information to gain an encompassing overview of health and well-being to plan how it can be regulated through training.

Structure and Exercises:

Valuable insights regarding the structural and exercise elements of program creation for VA training were gained during expert conversations. E3 mentioned that they program “just like [they] would a professional athlete” (p.93) and that the ESPs of specificity (E2; E3) and progressive overload (E2; E3) should be applied so exercises are “balance[d],...functional, and directly related to the demands of...performance” (p.93) to develop and upregulate the vocal body overtime while preventing injury. Programming should be structured to be relatively simple (E2), form-focused (E4), controlled (E2), and accessible (E2), with exercises focusing on endurance (E2), strength stimulation (E3), relaxation (E3), recovery (E4), flexibility (E4) and fatigue resistance (E3). Overall, program scheduling for VAs should pay attention to routines and demands, making sure to have lighter exercise on performance days to avoid fatigue (E4) and follow a pattern of “tension simulation and tension reducing [days to]...not overwhelm...vocal practice” (E3, p.96) or the body. Other general aspects, such as prescribing repetition, proper form checks, and progress tracking, were mentioned and will be discussed in further sections.

Specific exercise forms, movements and their intended effects on the vocal body were discussed. Integrating strength training (E2; E3; E4), cardio (E3; E4), core work (E3), flexibility and mobility (E4), and recovery exercises (E2; E3; E4) are necessary to develop balanced vocal and physical power and structure. E2 mentioned that “You can’t have the exact same type of

exercises that you would do in a normal group fitness class” (p.86) or personal programming. Each exercise must have a vocal and career focus to ensure specificity and efficacy. Overall, “training upper and lower body, core, and cardio is to help resist fatigue onset...and this will...greatly extend vocal endurance and lower changes of...compensations during the stressful performance” (E3, p.95)

In terms of strength training exercises, tempo-based (E3), heel-elevated (E3), isometric (E2), side-lying (E3; E4), unilateral (E3) and alternative lift exercises (E3) were recommended for upper body, lower body, and core movements. These exercise categories help decrease pelvic floor tension (E3), increase range of motion (E2; E3), allow for different postural stances (E3), relax the ribcage for dynamic inhalation capacity enhancement (E3), promote thorax and pelvic expansion (E4) and “boost...oxygen utilisation rate to preserve function under stress” (E4, p.106). Squat (E2, E3, E4), deadlift (E4, E3), lunge (E3), row (E3), press (E3), and plank (E3, #4) positioned exercise patterns are beneficial, if correctly executed, for VA training. With these exercises, it is paramount that “pushing exercises [be] complemented by pulling exercises to prevent muscle imbalances” (E4, p.102). In terms of repetitions of these exercises, different ranges should be used, mainly focused on “lower repetitions with alternating activities...[but generally] be[ing] mindful of what stress the body is under so that it doesn’t get in the way of...demands” (E3, p.97).

Cardiovascular training with nasal breathing (E3; E4), including steady-state aerobic cardio and short aerobic intervals (E4), or Alaric threshold sprints (E3), were suggested to boost elasticity (E3), explosiveness (E3) and endurance (E2), vital for sustaining long performances without fatigue. Nasal breathing (E3; E4) and steady-paced tempo (E3; E4) are essential for VA regimented cardiovascular exercise in order to “not become fully anaerobic” (E3, p.98) and lose sight of VA performance demands. Aerobic cardiovascular conditioning can be in various forms: e.g. running (E2; E3; E4), jogging (E2), sprinting (E3; E4), jumping with or without a box (E3), skipping (E3), biking (E4).

Flexibility, mobility and relaxation exercises were deemed essential for maintaining a full range of motion and to “keep the muscles supple...prevent[ing and releasing] any tightness” (E4, p.108) that can hinder performance. This can be tied into a physical, vocal, or integrated cool-down (Ragan, 2020) to support holistic training and recovery. It was also noted by E1 that “yoga...is the number one thing you’re possibly going to ever be able to do for the longevity,... sustainability,... quality and resonance of your voice” (p.89), which was also suggested by E3

and E4. This can also be done by full-body stretching (E4), foam rolling (E3), and post-workout dynamic breathing (E3), which serve as mindful recovery tactics as well.

Experts also stressed the importance of integrating exercise science principles (E2) of progressive overload and specificity (E2), recovery strategies (E3; E4), and making appropriate modifications (E2) to the program as needed. This ensures that performers are not only building strength and endurance but are also allowing their bodies time to recover and adapt (E3; E4) in a healthy manner, reducing the risk of injury (E2; E3; E4) and burnout (E4). These findings collectively accentuate the necessity of a carefully tailored approach to program creation that supports the VA's overarching physical and vocal health.

What to Avoid:

In addition to program creation suggestions, experts also gave crucial guidance on exercises and approaches to avoid in programming. A key recommendation was to prevent excessive intra-abdominal pressure (E4) via bracing and Valsalva techniques commonly found in heavy weightlifting. Holding one's breath or grunting while exerting force causes undue pressure on the vocal folds and can lead to potential harm (Chandler, 2022; Rumbach *et al.*, 2019). Similarly, experts advised against exercises that generate excessive pressure and compression on the ribcage (E3), particularly those that involve heavy, slow lifts with weight stacked on the shoulders. Anaerobic cardiovascular exercises were also stressed as potentially problematic by E3. While beneficial in specific contexts, they can lead to excessive fatigue and strain and have little avail for VA demands (E3). E3 mentioned programs that lack repetition and regulation, such as high-intensity interval training (HIIT) and heart rate zone-focused workouts, similar to widely popular group training classes (McCall, 2019), are ineffective for VA training. Without consistent repetition and progressive overload, these workouts fail to support the gradual improvement and upregulation needed for functional VA training (E3). Finally, experts (E2; E3; E4) stressed the importance of pacing the training appropriately. Starting too fast or pushing the body too quickly can hinder necessary regulation and adaptation processes, preventing adequate progress and increasing the risk of injury, soreness and inconsistency in VA adherence (E2). These findings highlight the need for careful, informed programming that avoids practices detrimental to both the voice and the body, ensuring a safe and sustainable path to VAc excellence.

General Advice:

Experts shared vital and overall advice for developing and refining a VAc PER, emphasising the importance of adaptability (E2; E4) and continued movement improvements

(E3), which includes variety, adaptation, modification, and progression. Experts recommended starting slowly (E2; E3), allowing the body to adapt to new routines gradually and for the regimen to be individualised to the VAs unique background and skill set. This approach helps prevent injury (LeBorgne & Rosenberg, 2018) and ensures that VAs build a solid foundation (E2) before progressing to more challenging exercises. E4 stressed that listening to the body is a crucial principle advising VAs to pay close attention to signs of fatigue, strain, or discomfort and for coaches to be conscious of this to adjust training accordingly (E2). Further, the interviews underscored the need for future research to improve tracking methods (E1; E2) and expand the impact of VA training on a broader scale. Experts noted that there is still much to learn about the most effective ways to measure progress (E1; E2) and outcomes in this unique field. They encouraged pursuing studies that could provide more precise data and insights (E1; E2), enhancing the ability to tailor programs to individual needs and measure their effectiveness. This study serves as a cue for the ongoing exploration of how best to track and assess the impact of VA training. The findings suggest that while we have a strong foundation, there is still much to uncover about the most effective approaches, making this an exciting and evolving study area with the athlete at the centre (Fagan *et al.*, 2017).

Unclear Information:

It is also pertinent to note the unclear and differing recommendations that emerged (Kirkpatrick & Kirkpatrick, 2016), underscoring the field's complexity, variability and disputation. The discrepancies below accentuate the ongoing challenges in developing a standardised, evidence-based approach to PER integration for VAs in an ever-evolving, emergent field. For example, some experts consider HIIT exercises and workouts beneficial (E4) for endurance and stamina. In contrast, E3 warns it may cause excessive fatigue, and breathing issues, and is untransferable to aerobic VA demands. Similar variability exists in exercise selection, such as programming (E4) or avoiding deadlifts (E3) and squat variations (E2; E3). Each exercise has strengths if done correctly and mindfully, but to what length they will help improve VA performance and general health is unclear from expert interviews. These differences note the need for more research, particularly in tracking exercise effectiveness and performance outcomes (E1; E2), with a VA scope. Evidence-based tools and performance evaluation processes are crucial for refining training practices (Kirkpatrick & Kirkpatrick, 2016; Harris *et al.*, 2018). The need for further research is evident (E1; E2; E3; E4), reinforcing the importance of studies like this one to bridge gaps in knowledge and refine best practices. As the field evolves,

ongoing research and adaptation will ensure VA training remains effective and safe for performance enhancement.

Broader Scope:

Lastly, the Experts revealed a broader vision for future holistic VA training with PE and overall well-being as core components. This approach not only promotes enhanced vocal performance readiness and longevity (E1) but can reduce injury risk (E2), burnout (E4) and fatigue (E3). The broader scope also includes the potential for more extensive interdisciplinary collaboration (E1; E2), where voice coaches, fitness trainers, nutritionists, physiotherapists, psychologists and other health professionals create comprehensive lifestyle training programs for practical VA use. By expanding the field in this way, VA training can evolve to meet the diverse needs of performance, with the voice, body and mind at the forefront, ensuring VAs are physically, vocally and mentally prepared for their craft.

PER Creation Process:

A month-long PER for VAs (App.15 p.143) was developed by integrating key themes and insights meticulously coded from expert interviews, knowledge from the literature review, details from practitioners and my CPT expertise. This triangulation ensured that the final PER addressed crucial elements such as accessibility, modifiability, and progressive overload. Following expert recommendation, the regimen was structured around five workout days - three “tension stimulating” and two “tension releasing” (E4, p.96) - that corresponded to the VA’s daily vocal routine. This five-day split was complemented by two active rest days for recovery. Each session incorporated warm-ups, dynamic pre-breathing exercises, mobility work, strength and resistance training, cardiovascular conditioning, core development, and flexibility and recovery-focused cool-downs, with optional vocal function exercises. The PER was developed and coded (App.15) to explicitly show which elements were drawn from expert interviews, ensuring that the program was grounded in both practical expertise and evidence-based research.

VA Survey Results:

Findings garnered from the three VA surveys, taken by the three healthy, professionally performing VAs, provide critical insights into their lived experiences, directly informed by the interview results and the PER creation process. These results reveal the training program's interconnectedness with the VAs’ history, goals, difficulties, and improvements across physical, vocal, and mental dimensions, as well as their advice on broader field integration and

accessibility. This comprehension examination portrays the PER's positive and negative impacts and offers guidance for future applications and studies within the wider VA community and field.

<u>Table 7: VA Survey Themes and Subthemes</u>
1) <u>Intake Survey (S1)</u> a) <i>Baseline and Prior Experience</i> b) <i>Goals</i> 2) <u>Mid-PER Survey (S2)</u> a) <i>Vocal Experience</i> b) <i>Physical Experience</i> c) <i>Mental Experiences</i> d) <i>Challenges</i> 3) <u>Post-PER Survey (S3)</u> a) <i>Vocal Outcomes</i> b) <i>Physical Outcomes</i> c) <i>Mental Outcomes</i> d) <i>Overall Advice and Sentiments</i>

Intake PER Survey (S1):

The initial intake PER survey provided a comprehensive foundation for understanding each VA's baseline health, prior experience, and personal goals. Health assessment-focused questions, based on the PAR-Q+ (Warburton *et al.*, 2011), were instrumental in determining physical readiness and VA eligibility (S1, Qs 1-3, 6 & 9), and all participants were successfully cleared for study involvement (App.14). While some VAs disclosed underlying conditions such as asthma (S1, VA1) or allergies (S1, VA3), their eligibility was not impacted due to the management and seasonal aspects described and their responses to other health-focused questions. By evaluating prior experience, the survey provided a clear understanding of each participant's perceived vocal and physical condition (Q7&8), performance demands (Q4), and their aspired goals and intentions (Q10) - whether physical, vocal, or well-being focused - to achieve following study completion.

Baseline and Prior Experience:

Diverse VA baseline information was gathered during S1. VA1, a musical theatre and CCM singer with 15 years of experience engages in circuit/HIIT training, jogging or walking, and workout and dance classes 3-4 times per week. This VA rated her vocal health at 9/10, indicating a high level of confidence in their vocal condition, while her physical health and fitness were rated at 7/10, reflecting a moderate level of physical wellness and fitness.

In contrast, VA2 has 10 years of performance experience and 5 years of professional work. VA2's exercise routine includes gym sessions 3-5 times per week, depending on consistency and motivation. This VA rated their vocal health at 9/10 and physical health at 8/10, suggesting strong self-reported well-being and physical fitness.

VA3, who has been operatically trained for 6 years and is currently exploring other genres, reported recent inconsistency in exercise routines. Previously involved in running and gym workouts, VA3 is now seeking a new fitness regimen. They rated their vocal health at 8/10 and physical health and fitness at 7/10, highlighting a need to reestablish a consistent exercise routine to support their vocal and physical health.

Understanding these baseline assessments and previous vocal and physical experience provides a benchmark for tracking VA progress over time. By comparing these initial metrics with subsequent survey evaluations, the overall efficacy of the PER in enhancing performance and health can be gauged, ensuring the program remains effective and responsive to each VA's needs and aspirations.

Goals:

The main goals were popular and focused on throughout the intake survey results. Interestingly, most were non-physically focused (S1, VA1; VA2; VA3). This likely stems from the artistic and career-driven mindset that VAs have cultivated throughout their performance professions (Lingo & Tepper, 2013). Overall, the goals were centred around meeting general VAc performance demands. However, specific goals can be categorised under vocal, physical, mental, and well-being focus. Vocally, VAs desired performance enhancement via core strength underscored by breath support, vocal control, stamina and endurance for long performance stints, flexibility and agility in their ranges, and postural alignment of the vocal body. The only physical aspect derived from a vocal lens is the core strength and awareness mentioned to upregulate breathing. The other main focus of VA goals highlighted in the intake survey was the intention of confidence (S1, VA3) and comfort via released tension (S1, VA2) through a process that is maintainable (S1, VA1) and progressive (S1, VA1) through ESP and evidence-based programming. After the eligibility of VAs was confirmed, the PER (App.15) was introduced to the VAs and the structure, objectives, exercise form, and critical considerations were explained.

Mid-PER Survey (S2):

The mid-PER survey focused on assessing VA participants' adherence to the program and their progress in the first two weeks of implementing the prescribed exercises. It explored their ongoing vocal, physical and mental experiences, as well as the improvements and

challenges they observed midway through the programming. The findings from this survey reveal how VAs were adapting to the program while accentuating any adjustments needed to ensure continued progress.

Vocal, physical and mental improvements began being reported in the mid-program surveys, especially from the VAs with higher adherence to the exercises and programming schedule (S2, VA3). With the help of form tips and modifications (S2, VA1), more engagement, confidence and comfort were reported (S2, VA3) and were taken as possible indicators or led to vocal and physical improvements to come. Multiple VAs also reported their body being more grounded (S2, VA1), having more energy (S2, VA2), and being “activated for work” (S2, VA1) to tackle singing tasks. VA1 appreciated the balance of the program, specifically the lower and higher vocal demand days, noticing that the varied intensity, based on the corresponding PE workout, helped maintain vocal health while still progressing their training (p.131).

Vocal Experiences:

Vocally, breathing improvements were prevalent in the mid-program surveys, with VAs reporting sustainability in breath (S2, VA1), breath control and stamina (S2, VA2), new breath awareness or sensations (S2, VA2), flexibility (S2, VA2), projection (S2, VA1) and energy (S2, VA3) to sustain (S2, VA1) phrases. This was primarily marked by increased core strength and engagement with the dynamic breathing and abdominal exercises programmed in the PER. Other significant vocal results in the mid-program survey were the reports of flexibility and freedom of the vocal range (S2, VA1) and confidence in the vocal body (S2, VA3).

Physical Experiences:

During mid-program surveys, VAs reported significant, though non-visual, physical improvements. With modification and form tips where necessary, many noticed an increase in consistency with the program (S2, VA3) as well as decreases in soreness (S2, VA2; VA3), with better recovery times (S2, VA1) seen by being less winded after sprints (S2, VA1). Increased activation, engagement (S2, VA1; VA3) and stability (S2, VA1) of key muscles left them feeling more stable yet flexible (S2, VA2) with their bodies and better prepared to undertake singing and performance work (S2, VA3). VAs also reported increased physical stamina, experiencing less shortness of breath (S2, VA1) from sprint training and lower energy drain (S2, VA1) during and after workouts. They felt more grounded and upregulated (S2, VA1! for both physical and vocal demands, with many able to complete and adhere to workouts more effectively (S2, VA2; VA3), with heavier weights (S2, VA1), reflecting their progressive overload, growing strength and competency with the programming.

Mental Experiences:

Mentally, VAs described a sense of energised confidence and comfort (S2, VA3) following the consistency of the programming (S2, VA3) and expressed their hopes to experience more physical and vocal changes to follow. A sense of accomplishment, control and progress (S2, VA2) was also noted while being able to prioritise the PER integration into hectic routines and performance schedules. VA2 noticed that performing all five programmed days was beneficial. They mentioned, “the lighter days helped me, and [only performing the hardest workouts (S2, VA2) due to time restraints] was a mistake I made on week one” (p.133). The two lighter and more relaxed workouts ended up helping VAs to recover and decrease soreness (S2, VA2) while also helping consistency and dedication (S2, VA2). This, along with VA accounts of vocal and physical groundedness and preparedness described above and the mental clarifying effects general PE has been proven to provide (Purcel *et al.*, 2019), mark positive trends for mental well-being results and benefits from this PER integration for holistic VA training protocols.

While these vocal, physical, and mental improvements highlight the regimen's success at the mid-program mark, it's equally important to address the difficulties VAs face. These challenges provide invaluable insights for refining and enhancing future training protocols and any immediate adaptations or modifications to ensure VAs' safety.

Challenges:

Prevalent in the mid-program survey, VAs faced difficulties adjusting to the PER demands (S2, VA 3) and exercise form (S2, VA1; VA3) while also trying to fit it into their existing routine (S2, VA2). New movements and programming as a whole is a learning curve experience expected for this study, but soreness (S2, VA2; VA3) and form confusion (S2, VA1; VA3) were not anticipated as much. At this point, after the first and second weeks of programming, the form was reviewed, and VAs were asked about their experience with the exercises and recovery. With tips and modifications, it was noticed that during the form check-in and discussion during their lesson (V2), there was more exercise adherence (V2), sense of stability (S3, VA1), accomplishment (S2, V2), and improvement (S3, VA1; VA3), accompanied by more confidence (S3, VA3), comfort (S3, VA3) and recovery (S3, VA2; VA3), which will be analysed in more detail below.

While distinct in their data and outcomes, the mid-PER and post-PER surveys are closely linked in their explorations of participants' experiences across vocal, physical and mental

well-being domains. Both surveys addressed the three sub-themes, vocal, physical, and mental, capturing VAs' ongoing experiences, difficulties, and improvements they observed throughout the program. To illustrate the progression and process undertaken, the survey results will emphasise the evolution of VAs' experiences. A more detailed examination of the post-survey findings will provide additional insights into the final stages of PER implementation.

Post-PER Survey (S3):

The post-survey results emphasise the growth and experiences observed between surveys, particularly in the same sub-themes of vocal, physical, and mental well-being discussed above. Additionally, these results incorporate participants' overall perceptions, suggestions, and guidance for broader field integration, including accessibility factors and future directions regarding incorporation, resources, research, and community development. Generally, VAs reported significantly positive experiences with the PER (S3, Q1), with all VAs' responses indicating a satisfaction level above ninety percent. Additionally, all VAs expressed the desire to continue PE training (S3, Q8), noting "the benefits...are undeniable" (S3, V1, p.137), and it has become a part of their lifestyle (S3, V2) and routine (S3, V2). This is also reiterated in the vocal, physical and mental advancements and refinements delineated in the post-program survey findings below.

Vocal Outcomes:

Vocally, all VAs disclosed an increase in their vocal health status from the intake survey (S1, Q7) to the post-program survey (S3, Q3). Although this is merely self-pronounced progress (Leavy, 2014), it is still positive news for the efficacy and safety of the PER for VAs. Significant improvements in breath control, wider vocal range (S3, VA3) and overall stamina were also noted by VAs. They reported enhanced dynamic breathing, core strength, and structure stability, factoring into intensified sustainability of phrases, posture, flexibility (S3, VA2) and consistent tone quality across their ranges (S3, VA2). VA2 expressed that the breath support and dynamic exercises had become "second nature" (p.139), leading to quicker vocal and physical recovery after intense sessions. Overall, VAs felt their voices were more engaged or activated, powerful, healthier, and possessed more stamina, allowing them to be prepared to perform at a higher, upregulated level.

Physical Outcomes:

Physically, the post-program survey revealed unanimous positive physical improvements among VAS. Participants reported increased muscle tone (S3, VA2; VA3), which contributed to enhanced core strength (S3, VA2), better posture (S3, VA2; VA3) and thus improved vocal

breathing and projection (S3, VA3). VA3 noted a newfound awareness and sensation of their breathing technique, and VA2 mentioned that the dynamic breathing “techniques...have become second nature” (p.139). The PER and practitioner emphasis form improvement and modifications, supported by continuous feedback (Van Hoyer *et al.*, 2015). This led to participants noticing greater control (S3, VA2), skill acquisition (S3, VA1), and flexibility (S3, VA2). Subsequently, VAs experienced decreased rigidity (S3, VA2) soreness (S3, VA3) between the mid- and post-program surveys, reducing neck and shoulder rigidity (S3, VA2) and reducing tension during recovery (S3, VA1; VA1). They also expressed increasing comfort, enjoyment, and development with sprinting exercises, feeling less winded (S3, VA1) and having energy reserves left after workouts (S3, VA3), which carried through into their daily lives with sustained vitality throughout the day (S3, VA2) - helping them feel accomplished (S3, VA3), confident (S3, VA1), and comfortable (S2, VA3).

Mental Outcomes:

Reflecting this sense of comfort (S3, VA3), confidence (S3, VA1), progress (S3, VA1, VA3) and accomplishment (S3, VA2), the post-program survey findings show significant improvements among VAs. VA2 reported that their dedication to the program became a driving force behind consistency “instead of relying on [lacking] motivation” (S3, VA2, p.139). This mindset shift fostered a more resilient and committed approach to their training and lifestyle. The consistency (S3, VA2) in their training and the positive impact on recovery (S3, VA3) further reinforced their mental resilience, contributing to an overall sense of well-being and readiness to tackle both physical and vocal challenges with greater assurance (Purcell *et al.*, 2019). Lastly, all VAs expressed their intention to continue using VA-tailored programming after completing the month-long PER created for this study (S3, Q8). The positive impacts on their vocal, physical and mental well-being convinced them of the program’s value in sustaining and enhancing their skills. The PER improved their immediate technique and performance and provided them with a framework and knowledge they could experiment with and integrate into their ongoing routines (S3, Q8). This commitment to continuing underscores the lasting benefits of a holistic approach to PE-equipped VA training to support long-term performance success via knowledge and experience.

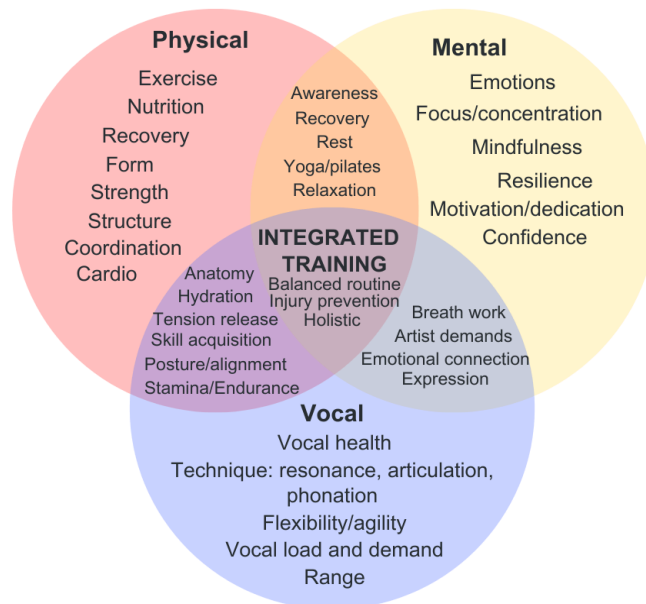
Overall Advice and Sentiments:

VAs also provided valuable thoughts and advice for future PERs and the integration of PE training into the broader VA performance field. They emphasised the need for more accessible information and resources, including a comprehensive form library with exercises

(S3, VA1; VA2), cues and video instruction (S3, VA2). They also suggested offering different starting points (S3, VA2) or “intensity levels...[to accommodate] different fitness stages” (S3, VA3, p.141), along with a more extensive variety of exercises (S3, VA1) to keep the training fresh and engaging. VAs also accentuated the importance of incorporating a science-based perspective (S3, VA1), linking evidence-based practices in nutrition and lifestyle (S3, VA3) to the VAc field and regimen. Ultimately, VAs stressed the substance behind building a supportive community (S3, VA1) within PE and VA integrated training to foster social connection (S3, VA1), share resources (S3, VA3) and promote accountability (S3, VA2) to help individual VAs stay committed and informed. These findings have informed the development of Framework 3 below, designed to enhance training by addressing the multifaceted demands of VAcism and incorporating the crucial elements identified throughout this research.

Finalized VA Integrated Training Model for Performance Enhancement

Framework 3: Finalised VA Integrated Training Model for Performance Enhancement based on Expert Insights



Discussion:

The profound VA requirements and difficulties delineated above show insight into the multiple dimensions of VAc training. The intertwined findings suggest that integrating structured PE into VA training can significantly enhance the physical capabilities, vocal performance, and mental resilience of VAs, as portrayed and finalised in Framework 3. This model is loosely based on Purcell *et al.* (2019) model for elite athlete mental health and Fagan *et al.* (2017)

frameworks on person-centred approaches and keeps the VA's holistic needs, health, well-being, and longevity at the forefront of training. This holistic approach to VA training marks a pivotal shift in the field, acknowledging the symbiotic relationship of holistic physical, vocal, and mental well-being.

It is crucial to recognise that the framework and PER developed in this study are not rigid or definitive solutions but rather starting points in an evolving field. Flexibility within the framework is essential (Shannon & Zizzi, 2017), allowing it to adapt to the unique needs of individual VAs and the varying demands of different performance contexts. This iterative process ensures that training methods remain relevant, effective (Kirkpatrick & Kirkpatrick, 2016), and responsive as new advancements between physical exercise and vocal performance arise (Lawrence, 2022). VAs and their coaches must remain open to new evidence (Cranton, 2006) and education, continuously seeking clarity and improvements in training practices. By fostering a culture of inquiry and adaptability, the field can move towards more precise, personalised, and effective approaches to supporting the health and performance of VAs.

For the VAs themselves, the study's findings indicate that even those accustomed to less regimented forms of physical training can experience substantial improvements when introduced to a structured program (S1; S2; S3). The reported enhancements in form and structure, breath control, stamina, muscle tone, and mental resilience illustrate the transformative potential of this approach. The fact that all participants expressed a desire to continue with the VA-tailored programming post-study further highlights the perceived value and effectiveness of the regimen. The study provides evidence that structured physical exercise should be more widely adopted as a standard practice within the field (Byrne, 2020). The suggestions from VAs for greater accessibility of resources, such as form and video libraries, varying levels of exercise programming and diverse movement types, suggest that there is a growing demand for more comprehensive and inclusive training tools (Friedlander & Dawson, 2006; Friedlander, 2018; Ragan, 2020). Furthermore, the call for a science-based perspective that integrates sleep, nutrition, and lifestyle factors into vocal training points to a broader, more holistic understanding (Lawrence, 2022; Nesbitt, 2023) of what it means to train a VA as a whole. While these findings underscore the substantial benefits of integrating physical exercise into vocal training, it is essential to acknowledge the study's limitations.

Limitations:

Several limitations must be acknowledged in this study. Firstly, all VA clients had previously worked with me in a vocal capacity, which introduced bias as they were already

familiar with my methods and advice, potentially affecting their responses to the PER via confirmation bias (Roulston & Shelton, 2015). Before this study, VAs in my studio were provided with exercise suggestions and tips but were not given specific exercises or programming. This may have influenced the thoughts and perceptions (Roulston & Shelton, 2015) of VAs and the resulting survey responses.

Another significant limitation, characteristic to qualitative study, is the absence of a control group (Maxwell, 2008), which raises concerns about the quality of the findings. Without a control group, it is challenging to determine whether the observed outcomes were due to the PER or other external factors. The varying fitness levels of the VAs further complicate the interpretation of the results, as differences in baseline physical conditioning could have influenced how participants responded to the exercise regimen. Furthermore, since no widespread, evidence-based programming is available (Friedlander, 2018; Byrne, 2020; Chandler, 2022), VAs had no external benchmark for comparison, which may have impacted their assessment of the program's effectiveness. The generalisability of the findings is also of concern, as the study's focus on a small group of VAs and short time period may not extend to all VAs or across all genres for longer periods (Leavy, 2014), which may have different demands and outcomes. While immediate improvements may have been noted with the VAs present, the sustainability of these gains over an extended period remains unclear. Future studies should consider longer-term follow-ups to evaluate whether the benefits observed are maintained over time and to explore potential long-term impacts on VAc training, vocal health, and performance.

The reliance on self-reported data introduces another layer of limitation (Almeida *et al.*, 2021). Self-reports are inherently subjective and may be influenced by individual perceptions, biases, and relations. VA participants might have overestimated or underestimated their progress, vocal or physical condition, and adherence to the program when completing the surveys. This subjectivity can result in data that is less accurate and harder to validate against objective measures. The lack of objective assessment tools (Kirkpatrick & Kirkpatrick, 2016), such as physiological measurements or third-party evaluations, means that the findings are heavily dependent on the participants' personal reflections (Leavy, 2014; Almeida *et al.*, 2021), which may not fully capture the true effects of the PER.

Given these limitations, the findings should be interpreted with caution, and their generalizability to a broader population of VAs remains uncertain. These constraints highlight the need for further genre-specific research with more rigorous methodologies, including control groups, objective assessment tools, and longer study durations. Transitioning from these

limitations, it is essential to explore recommendations for future research to address these gaps and continue refining integrative exercise programming for VAs.

Recommendations:

There are several vital areas that warrant further study to advance the field of VAc training. Firstly, investigating the laryngeal view of the intrinsic musculature (Sandage & Smith, 2017) and its adaptations during exercise (Naito & Niimi, 2000; Orlikoff, 2008) - and optional concurrent vocalising through advanced techniques such as endoscopy or MRI (Røksund, 2012) - could provide crucial insights into how specific exercises impact vocal fold function and training. This research would enable the development of exercise protocols that are precisely aligned with the physiological needs of VAs (LeBorgne & Dal Vera, 2015; Hunter et al., 2020), potentially reducing the risk of injury and enhancing performance outcomes even further. Additionally, exploring genre-specific training regimens is paramount (Spivey, 2018; Chandler, 2022), as VAs with different performance styles face unique demands. Research should focus on optimising training protocols tailored to various genres to address each style's distinct technical and physical requirements. This approach would ensure that training programs are more effective and relevant to the specific needs of vocalists across diverse genres.

Future plans for this research involve expanding the development of customisable, accessible, and scalable training plans for VAs, emphasising creating flexible regimens that cater to individual needs and performance demands across various genres. This initiative includes (Cranton, 2006; Kirkpatrick & Kirkpatrick, 2016) building supportive communities facilitating resource sharing, expert guidance and feedback, evidence-based resources, and networking possibilities. Additionally, educational resources like workshops and webinars would help VAs understand ESPs and the fundamentals behind integrated PE and VAc training. By embodying these elements, future research must work to balance practical methods, ultimately supporting VAs in giving them training tools to support long-term health and enhanced performance through professional and holistic development.

Conclusion:

The implications of this study for the emergent field of integrative exercise training for vocal performance are significant, offering practical advancements and theoretical contributions. The knowledge gained portrays the necessity of a holistic approach that addresses the physical and vocal health and well-being of VAs, demonstrating the efficacy of a tailored PER in overall performance and training. More broadly, this research underscores the importance of bridging the gap and encouraging knowledge sharing between the exercise science and vocal

performance fields. Similarly to the necessity of PE for VAs, exercise and athletic professionals could benefit from vocal health awareness and professional monitoring to curb the frequency of voice disorder and misuse (Newman & Kersner, 1998; Hamdan et al., 2021). By fostering interdisciplinary collaboration, this integrative approach promises to improve training and maintenance strategies, aiding VAs and exercise professionals across various disciplines who face similar vocal and physical demands.

The broader ramifications of this project extend beyond the immediate development of a PER for VAs, influencing both the field of vocal performance and the integration of vocal health practices training realms. This study has contributed to a growing recognition of the interconnectedness between physical and vocal wellbeing in exercise and vocal performance by synthesising expert knowledge with practical application. This project underscores the necessity of a multidimensional approach to training that acknowledges the diverse and evolving needs of VAs. On a personal level, this research journey has facilitated significant growth in understanding the complexities of performance training, the critical role of evidence-based practice, and the necessity of inter-field cooperation and discussion to adaptively and ethically address holistic VA training. Engaging with VAc experts and VAs has not only enriched the program's development but has also elucidated the value of diverse perspectives and networking within the collaborative field. This project has reinforced the belief that the future of VA training lies in a comprehensive, well-rounded approach that prioritises holistic health and the continuous evolution of methods to meet the demands of an ever-changing field.

Reflection:

As a practitioner navigating this research project, I grappled constantly with imposter syndrome, often questioning my expertise and the validity of my contributions to the field (Clance & Imes, 1978). This self-doubt was particularly challenging given the high stakes of discussing with the experts in the field and developing a specialised PER for VAs. To address these concerns, as mentioned previously, I utilised the observation journal and Kolb's (1984) reflective framework to document the practical aspects of the research and training processes and my personal experiences and struggles. I could critically analyse and reframe the doubts and obstacles I faced (Belaggoun & Djouma, 2024), transforming feelings of inadequacy into opportunities for growth and learning (Kolb, 1984). I ended up having the confidence to complete the expert interviews through my fear to gain valuable insights on how to best train VAs and enhance the field of VAcS. Overall, this process of reflection allowed me to acknowledge and address my uncertainties, reinforcing my commitment to the research and the

community of interest (Cranton, 2006). By confronting and overcoming these internal obstacles, I maintained a clear focus on the relevance and impact of the project, ensuring that the findings remained as unbiased as possible through a practitioner lens (Mercer, 2007) while being grounded in both practical experience and rigorous academic inquiry.

Closing:

This study successfully developed and implemented a holistic PER tailored for VAs, demonstrating its effectiveness in enhancing their physical and vocal performance and holistic well-being. The research accentuates the importance of a comprehensive vocal training approach incorporating physical exercise practices. The findings contribute to a growing body of knowledge on PE for VAs and provide a foundation for future research and practice. As the field continues to evolve, building on these findings and exploring new ways to support the health, longevity and performance of VAs through targeted exercise regimens is essential. The study's emphasis on individual experience and evidence-based practice serves as a model for future research and underscores the value of holistic approaches to training in VAc performance.