Singing After Childbirth: Physiological, Psychological, and Occupational Changes

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Abstract

Pregnancy provokes many physical, hormonal, and emotional adjustments which affect the singing mechanism, respiratory system, and general welfare of a singer. Occupational factors specific to professional singing add to the unique challenges of returning to a career after childbirth. A literature review on how the postpartum period affects the voice revealed a lack of comprehensive knowledge of this complex time of life. The following research question was developed: What are the physiological, psychological, and occupational changes experienced by professional classical singers in the year following childbirth and how do they perceive these changes (both positive and negative)? This dissertation first examines the existing literature on hormones and the voice; breathing changes during pregnancy and postpartum; the brain during *matrescence*; maternal psychology; and singing during the postpartum period. Then, to better understand the individual experience of postpartum singers, qualitative interviews were conducted with ten North American participants with children between the ages of one and seven. They had a minimum of five years professional classical singing experience prior to giving birth and returned to their career within the year after giving birth. After institutional ethics approval, data was acquired from mothers aged 33-44 during fall 2023. Analysis noted positive and negative experiences in core themes. **Physiologically,** an improved understanding of the body resulted in better breath management, a rounder vocal timbre and gained strength (particularly in the low range of voice), in addition to further implications regarding pelvic floor health and breastfeeding. Significant **psychological** findings included changed priorities (improved wellbeing; artistic maturity); a changed relationship to their voice (due to both stressors and positive emotional changes); and challenges linked to peripartum depression and anxiety and a perceived decline in cognitive function. Key **occupational** considerations were not surprising, but more individual: some had to cancel contracts, others had to fight to retain their contracts during pregnancy and postpartum; childcare and travel generated challenges as did finding time and energy to practice; supportive colleagues and exercise positively influenced the postpartum experience. The results offered several applications for improved wellbeing after childbirth, addressing the gap of information surrounding this complex time of life. This study lays the groundwork for further study on the voice and better understanding of the myriad of changes facing new singing mothers.

Résumé

La grossesse entraîne de nombreux ajustements physiques, hormonaux et émotionnels qui affectent le mécanisme vocal, le système respiratoire et le bien-être général d'une chanteuse. Des facteurs professionnels spécifiques au chant s'ajoutent aux défis uniques liés à un retour au travail après l'accouchement. Une revue de la littérature au sujet de l'impact de la période postpartum sur la voix a révélé un manque de connaissances sur cette période complexe de la vie. La question de recherche suivante a été formulée : quelles sont les modifications physiologiques, psychologiques et professionnelles vécues par les chanteuses classiques professionnelles au cours de l'année suivant l'accouchement et comment perçoivent-elles ces changements (positifs et négatifs)? Cette thèse synthétise les concepts de base au sujet des hormones et de la voix, des changements respiratoires pendant la grossesse et le postpartum, de l'effet de la *matrescence* sur le cerveau, de la psychologie maternelle et des études sur le chant après une grossesse. Ensuite, afin de mieux comprendre l'expérience individuelle postpartum des chanteuses, des entrevues qualitatives ont été menées avec dix participantes nord-américaines ayant des enfants âgés d'un à sept ans. Les participantes avaient au moins cinq ans d'expérience professionnelle en chant classique avant l'accouchement et ont recommencé à chanter professionnellement dans l'année suivant l'accouchement. Suite à l'obtention de l'approbation éthique institutionnelle, les données ont été recueillies à l'automne 2023 auprès de mères âgées de 33 à 44 ans. L'analyse a révélé des expériences positives et négatives dans chacun des thèmes. Sur le plan **physiologique**, une compréhension accrue du corps a entraîné une meilleure gestion de la respiration, une sonorité vocale plus ronde et un gain de force (particulièrement dans les registres graves), en plus d'autres changements au niveau du plancher pelvien et de l'allaitement. Les principaux résultats **psychologiques** ont démontré des changements de priorités (bien-être amélioré; maturité artistique); une relation à la voix transformée (en raison de facteurs de stress et de changements émotionnels positifs); et des défis liés à la dépression et à l'anxiété périnatales, et à une perception d'un déclin des fonctions cognitives. Les résultats quant aux **considérations professionnelles** clés n'ont pas été surprenantes, mais plus individuelles : certaines participantes ont dû annuler des contrats, d'autres ont dû se battre pour conserver leurs contrats pendant la grossesse et le postpartum ; la garde d'enfants et les voyages ont généré des défis tout comme le fait de trouver du

temps et de l'énergie pour pratiquer; des collègues attentionnés et l'exercice physique ont positivement influencé l'expérience postpartum. Les résultats de l’étude offrent plusieurs suggestions pour améliorer le bien-être après l'accouchement, comblant le manque d'informations entourant cette période complexe de la vie. Cette étude jette des bases pour d’éventuelles recherches sur la voix et offre une meilleure compréhension des innombrables changements auxquels sont confrontées les nouvelles mères chanteuses.

Dedication

To Henri and Scarlett: you motivated this research and make me the person I am today

To my fellow mothers: may we continue to create as artists, embrace our motherhood, and inspire our children

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They say it takes a village to raise a child, and I would extend that sentiment to say it takes a village to produce a doctoral degree.

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List of Acronyms

In chronological order:

GnRH: gonadotropin-releasing hormone

FSH: follicle-stimulating hormone

LH: luteinizing hormone

PMS: premenstrual syndrome

PMDD: premenstrual dysphoric disorder

PMVS: premenstrual vocal syndrome

ENT: ear, nose, throat doctor (otorhinolaryngologist)

MPT: maximum phonation time

OCP: oral contraceptive pill

IUD: intrauterine device

PTP: increased phonation threshold pressure

CTP: collision threshold pressure

NHR: noise to harmonics ratio

TV: tidal volume

IRV: inspiratory reserve volume

ERV: expiratory reserve volume

RV: residual volume

FRC: functional residual capacity

PFM: pelvic floor muscles

PF: pelvic floor

GM: grey matter

GMV: grey matter volume

CT: cortical thickness

PPD: postpartum depression

VHI: vocal Handicap Index

SHI: singing Handicap Index

ATRI: amplitude Tremor Intensity Index

GPD: gross domestic product

PFPT: pelvic floor physical therapy

Introduction

Context and Rationale

For many generations, professional singers faced a taboo when contemplating starting a family. Getting married, let alone having children, was seen as a nail in the coffin of a classical singing career. Of course there were exceptions, but anecdotally, many singers felt they must be married to their voices or lived in fear that they would be passed over for opportunities once they became mothers. This is changing over time, but our understanding of the body is still limited when it comes to recovering from childbirth and returning to a singing career postpartum. The realm of voice science is scarcely decades old and is only recently looking to women's health over the lifespan and how life events may affect the voice.

Following a decade of professional singing and delivering two children of my own, I felt the relationship with my body and my voice changed after having children. Discussions with countless professional singers and pedagogues substantiated the strong need for a body of performing science research in this area.

When I meet young singers and students in university settings, or at young artist programs, I am asked a lot of questions (often in rather anxious undertones) about my experience of motherhood and singing. I have realized they do not have much information about this part of their career, and that the unknown is causing them a lot of worry in an already unpredictable career. I personally was met with conflicting responses when I publicly shared news of my first pregnancy. Before I even began showing a "baby bump", announcing the pregnancy to certain people invoked criticisms regarding my desire to be a singer (or lack thereof), possibly as I was at the beginning of my singing career. Although I knew my energy and focus would be divided from then on, with time I also came to realize that being a mother brought favourable aspects to my singing, not only negative ones as so many anticipated. As my body grew, so did my love of singing and my understanding of my voice and artistry. These positive changes (in addition to the difficulties) brought me to consider returning to school to analyze these considerations in a more academic way.

I wanted to learn more about the singing instrument, to better understand the phenomena that occur both during pregnancy and the very nebulous postpartum period, and to be able to share this with the singing community. My hope was that this knowledge would help me not only as a singer,

a teacher, and choral conductor, but also as a friend and ally to next generations who are looking to embark on their own journeys of singing and parenthood. I firmly believe that knowledge is power, that knowing how the body can adapt to the fascinating experience of having a child will assuage fears and sense of lack of control for all.

Pregnancy provokes many physical, hormonal, and emotional adjustments which affect the singing mechanism, respiratory system, and general welfare of a singer. An early literature review in 2020 revealed a good number of studies on how pregnancy affects these elements, but I quickly realized that most of them are designed for the speaking voice only. Postpartum sung measures were taken with professional classical singer populations in only three of the reviewed studies: aerodynamic and acoustic changes in the voice were documented in pregnant and postpartum singers (Dickson 2014; Lã & Sundberg, 2012); and modifications of lung capacity and loss of vocal range during pregnancy have been noted (Pitman Will, 2013). Some of these studies measured changes up to twelve weeks postpartum but very little is written on singing in the postpartum period beyond these three months. Research from other disciplines produced literature on the immediate postpartum, but barring postpartum depression research, very little else covers any period beyond a few weeks to three months postpartum. Most singing literature of the postpartum period is based on hypotheses from our knowledge of the menstrual cycle and pregnancy, especially the effect of changing sex hormones (e.g., Abitbol, 1999; Sataloff, 1987; Lã & Sundberg, 2012; Khare, 2016; Dickson, 2014; Hancock & Gross, 2015, Lã & Davidson, 2005, Pitman Will, 2013). Dr. Anthony Jahn, otorhinolaryngologist for the Metropolitan Opera in New York City, has published the only articles and chapters easily available for singers that concentrate mainly on pregnancy; very few other publications dedicated to the postpartum topic exist.

While 20th century voice science research and pedagogy books tended to overlook how pregnancy affects the voice, a series of doctoral dissertations in the last decade by female singers have illustrated the desire singers have for a clearer picture. In 2013, Andrea Pitman Will began the trend with her paper “Pregnancy and Postpartum: A Guide for Singers” where she studied the effect of pregnancy on abdominal muscles and offered suggestions for postpartum rehabilitation; Marion Dickson published a case study in 2014 to measure acoustic and aerodynamic changes in the classical voice during pregnancy with one test completed at 10 weeks postpartum; Vindhya Khare

(2016) studied the impact of sex hormones on the voice, with some information on the pregnancy and postpartum period; Catherine Gardner wrote her 2017 DMA dissertation on "Singing for Two: Experiencing Pregnancy as a Classical Singer" which looked especially at the physical and emotional implications of pregnancy; in 2019, Sarah Elizabeth Harper studied what changes pregnancy effects on the voice and if what singers experience match what they've been told to this end; and finally, in 2023, discovered well into my literature review and study, I discovered a dissertation dedicated to rehabilitation from pregnancy and childbirth for singers by Cara Williams. These are all insightful papers that have inspired and shaped this present study on singing after childbirth.

Research Questions

To better understand this significant period of life and the complexities of a return to professional singing, a multidisciplinary examination of individual postpartum experience is needed. Through a literature review and a qualitative study, my research asks the following question:

What are the physiological, psychological, and occupational changes experienced by a professional classical singer in the year following childbirth? How do singers perceive these changes (positive and negative)?

To answer these research questions, this dissertation will contextualize background concepts and existing research surrounding classical singing and the changing body following childbirth and will also present new qualitative research on the realities of returning to a singing career postpartum. Chapter one offers a frame of reference on the voice in relation to the body and lifecycles. Sections on hormonal studies, breathing, mental health and neuroplasticity, literature on singing postpartum (including musculoskeletal considerations) and how singing can be beneficial in the postpartum will be addressed. The second and third chapters outline the qualitative study of the thesis: *Singing After Childbirth*. Context, methodology, participant population and results will be discussed. Following a chapter offering helpful applications and resources, the final chapter will discuss limitations, future studies and conclusions. Two appendices give background detail about how hormones act in the body, and basic breathing function at rest and for singing.

Researcher Positionality Statement

As a professional singer and mother of two, I am intrinsically invested in this research. Although my own experiences were not considered in this *Singing After Childbirth* study, my interest in the subject grew from maintaining an active singing career while changing diapers and rediscovering my instrument (sometimes simultaneously!) after being stretched and tested physically and emotionally around-the-clock. To the best of my ability, I conducted the study and analysis without any personal bias towards the subject, despite being thoroughly touched to hear the participants' stories. As pregnancy and postpartum recovery is such an individual experience, the goal of the research was to capture the true experience of each singer without any agenda or point of view. My advisors and professors helped me shape the interview schedule and study design with this in mind and I am very grateful to them for sharing their expertise in performance science studies.

Chapter 1 Background Concepts

1.1 "Whose Body is This?"

1.1.1 Definitions of Terms and Language

The word "mother" is like an onion, it is made up of many layers and carries many meanings. Is it a term of identity or a physical descriptor? A mother can be biological or adoptive or figurative: grandparents, foster-parents and men can all take on the role of mother. A biological mother might have a uterus and ovaries but rather identify as a father; and the term mother might be used by a female-identifying person with testes. Not all people who give birth want the role of mother. Some women yearn to become pregnant but cannot. The path to parenthood can be lengthy, painful, and take a toll physically and psychologically on mothers and those who support them.

It must be recognized that terminology is inadequate when it comes to gender and sex. Terminology needs to evolve: inclusive terms which encompass people who have given birth but whose gender does not match their sex are required. For clarity, and in keeping with current practices, this research paper will use the term *mother* to denote a person with ovaries and a uterus who gave birth to a biological child. The term *woman/women* will be used to refer to people with ovaries and a uterus. In the literature review, *breastfeeding* is used instead of *chestfeeding* to respect the parameters of the research cited in this paper. In the *Singing after childbirth* qualitative study, all participants identified as cis-gender women who breastfed, and so the term is preserved. However, chestfeeding is a more inclusive term used today in society.

In this dissertation, scientific terms will be used with a simple definition in the text. Two appendices include fundamental explanations of how hormones work in the body, and the breathing mechanism at rest and for singing.

1.1.2 Delimitations and Organization

This dissertation attempts to highlight the main changes that could affect a singer while pregnant and following childbirth using the most recent research. It is divided into two large sections: background concepts central to singing while pregnant and in the postpartum year; and *Singing after childbirth,* a qualitative study on the experience of professional singers in the postpartum year. The

first chapter identifies the main aspects of singing, pregnancy and the postpartum period based on a literature review of each topic. It is not exhaustive, but establishes key physiological, psychological and occupational concepts (1.2 Hormonal studies on the voice; 1.3 Breathing considerations in pregnancy/postpartum; 1.4 *Matrescence* and the brain; 1.5 The psychology of *matrescence*; 1.6 Recent research on singing postpartum). While it is impossible to encompass all aspects of maternity and singing in one chapter, current research from multiple disciplines will be presented. The narrative-style review will be divided in sections by subject, each category organized as following:

1) **Core Concepts** of the subject, presented in vignette
2) **Q & A:** Common questions raised on the subject
3) ➡ How each concept affects the **voice**, introduced by an arrow
4) **Mitigating Symptoms** offer solutions for issues relating to each subject
5) **Spotlight on Studies** feature studies of interest
6) **Discussion on Research** closes each section with final thoughts and highlights knowledge gap

Basic language will be used for discussions on physiological and psychological functions. For a baseline understanding of pregnancy and postpartum, only healthy, phenotypical (most common) experiences will be discussed unless especially stated. Other effects of pregnancy, such as gestational diabetes, preeclampsia, or pelvic floor disfunctions, or diastasis of the pubis bone (pubis symphysis), will not be examined in this document. Opinions on the decision behind chestfeeding, caesarean sections or parenting styles will not be discussed other than when presenting the results of specific studies.

Finally, the parenting experience is not equal for all. Racial biases and intolerances of non-binary, queer and trans communities can make the process of becoming parents arduous for these populations, many are not even able to access quality healthcare. Lack of inclusive scientific language is problematic. Another major limitation of the literature and current qualitative study is the lack of diversity in the participant populations and data. Moving forward in this research, I hope and endeavour to ensure diverse populations will be included to offer a more complete idea of this time of life as a singer.

1.2 "Feeling hot, hot, hot": Hormones and the Voice

The larynx is a unique hormone-responsive secondary sexual organ very sensitive to hormonal fluctuations. Vocal fold mucosae possess sex hormone receptors including androgen, estrogen, progesterone, and thyroid hormone receptors (Afsah, 2024). Therefore, throughout the human lifespan, endocrinal changes in the body affect laryngeal makeup and consequently, the quality of the voice (Plexico & Sandage, 2018). While pubertal changes are most evident in men's voices, for the remainder of the lifespan, women experience very important hormonal events (reproductive/menstrual cycle, pregnancy, menopause) which can cause obvious vocal fluctuations. To understand how gestational and postpartum hormones affect the singing voice, it is first necessary to examine why hormones influence the voice at all.

For a general explanation of how hormones act in the body, please see Appendix A: "Hormones"
As a reminder, this paper discusses only phenotypical development: every person experiences these changes and life events differently.

1.2.1 Puberty

During puberty, the vocal mucosae become dependent on hormones. Hormonal changes are responsible for altering the size and structure of the larynx, specifically cartilages, intrinsic laryngeal muscles and vocal folds (Plexico & Sandage, 2018, 47).

How Does Puberty Affect the Voice?

In bodies with testes and testosterone dominance, the voice change at puberty is distinct: fundamental frequency drops an octave on average, and thickening vocal muscle, folds and cartilage create an obvious timbral change (Anderson et al., 2017). With the variable muscular and cartilage growth, the larynx is constantly having to retrain its mechanisms which causes pitch changes and voice breaks which cannot be controlled.

For those with ovaries and a uterus, thyroid and cricothyroid membranes do not change drastically during puberty. The upper airways and vocal tract grow, transforming the quality of the voice from childlike to adult. The fundamental frequency drops by a third of an octave during puberty.

In terms of vocal quality, there is an increase in amplitude (loudness), and fundamental frequency perturbation (jitter) and amplitude perturbation (shimmer, or the intensity of a sound wave; Amir & Biron-Shental, 2004). However, vocal folds stay narrow and supple, thickening only a little.

1.2.2 Menstrual Cycle

Most menstrual cycles are between 21 and 45 days, with 3-7 days menstruation. This so-called healthy or typical menstrual cycle is called eumenorrhea. The first half of the cycle is the follicular phase, beginning with day one of menstruation (see Figure 1). In the brain, the *hypothalamus* releases gonadotropin-releasing hormone (GnRH) which is sent to the *anterior pituitary gland* to release follicle-stimulating hormone (FSH) and luteinizing hormone (LH). FSH travels to the *ovaries* and stimulates growth of the ovarian follicles which grow the ovum (egg). FSH also encourages follicular cells to produce estrogen. Bursts of LH are sent to the *ovaries*. These bursts increase until the level of LH is high enough to release the egg from ovary. FSH, LH and estrogen are all highest just before ovulation.

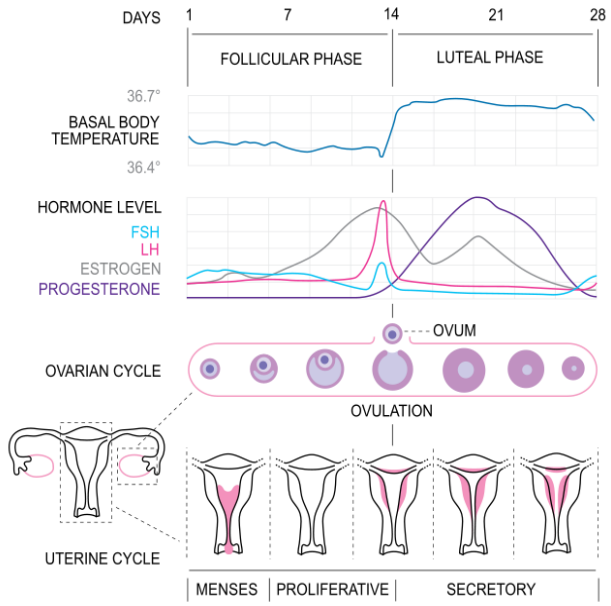


Figure 1

Graph of the Menstrual Cycle and Hormone Levels

As shown in Figure 1, ovulation occurs around the middle of the cycle. Once the ovum is released, the luteal phase begins. The follicle which released the egg begins to grow the *corpus*

luteum (a temporary collection of cells whose job is to prepare the uterus for pregnancy, by producing and releasing progesterone, that support implantation of egg in uterine lining.) If the egg is fertilized and successfully implanted in uterine lining, pregnancy occurs. If not, the corpus luteum shrinks and progesterone drops away. Towards day 28 (the end of an unfertilized cycle), all hormones are at very low levels. The endometrium drops, beginning the cycle all over again with menstruation.

What Impact do Hormones Have on the Voice? Although for generations, singers in many 19th century European opera houses were not required to perform on days of their menstrual cycle, *how* women's voices were affected by the menstrual cycle was little understood (Shoffel-Havakuk et al., 2017). The seminal publication of Abitbol et al. from 1999 on sex hormones and the voice has revolutionized our general understanding of how hormones affect the voice and paved the way for more recent studies. The menstrual cycle causes cyclic voice and hormone changes throughout life: increasing and decreasing levels of estrogen and progesterone can have an impact on vocal quality and comfort. In comparison, for men after puberty, testosterone typically stays rather steady, declining by 1% per year after the age of 30 (Afsah, 2024). Because of this general hormonal stability, voices experience fewer fluctuations throughout the lifespan.

Premenstrual Syndrome (PMS). While not all women suffer from premenstrual symptoms, a 2024 review on Premenstrual syndrome (PMS) found that 47.8% of menstruating people around the globe suffer from the disorder (Modzelewski et al., 2024). Premenstrual syndrome is diagnosed with the appearance of multiple symptoms severe enough to affect daily life and relationships during the luteal phase (and no symptoms in the follicular phase) in ovulating women (LeWine, 2024). Some women suffer PMS after a hysterectomy if they still experience ovarian function (LeWine, 2024).

Q: What are the symptoms of PMS?

A: Physical: bloating, breast tenderness, headaches, acne breakout, fatigue, dizziness, palpitations, backaches or muscle pain, swelling of feet and ankles, fluid retention and weight gain, painful uterine cramps.

Emotional: Mood swings, irritability, depression, aggressiveness, crying, forgetfulness, increased appetite, difficulty concentrating and forgetfulness mark psychological and emotional symptoms (LeWine, 2024).

Q: How long do the symptoms last?
A: To be considered PMS symptoms, they onset during the luteal phase and resolve within the first days of menstruation (Shoffel-Havakuk, 2017).

Q: My symptoms often incapacitate me, is this normal?
A: A more debilitating form of PMS is **Premenstrual dysphoric disorder (PMDD**), affecting 3-8% of reproductive-aged women (Modzelewski et al., 2024). Recognized in the Diagnostic and Statistical Manual of Mental Disorders (DSM-5), an occurrence of at least five physical symptoms and at least one additional emotional symptom must occur in the week before menstruation for at least two menstrual cycles for this disorder to be diagnosed (Modzelewski et al., 2024).

Q: What if I also have symptoms during my menstrual cycle?
A: Discomfort *during* the menses, **dysmenorrhea**, can negatively affect support and well-being also for the singer (abdominal bloating, cramping and spasms, lower back pain, headache, dizziness, nausea, diarrhea, fatigue, vomiting and insomnia; Afsah, 2024). According to Anderson et al., uterine muscle contractions, or cramps, affect ½ to ¾ menstruating women, and 10% of women are "disabled for 1 to 3 days monthly" (2017, 280) due to dysmenorrhea.

Premenstrual Vocal Syndrome (PMVS). In the days leading up to menses, singers may experience Premenstrual Vocal Syndrome, or *laryngopathia premenstrualis* (Abitbol et al., 1999). PMVS is "considered to be a result of the mutual effect of estrogen and progesterone on the vocal musculo-mucosal complex" (Shoffel-Havakuk, 2017, p. 230). Indeed, smears of the cervix and the larynx will show identical sex hormone levels at any given moment (Abitbol et al., 1999). Endocrinal fluctuations cause secondary physiologic and psychologic changes, in turn producing vocal changes (Anderson et al. 2017), and discomfort and frustration for the singer in the perception of their voice (Shoffel-Havakuk, 2017).

Q: How do I know if I have PMVS?

A: Clinical signs include vocal fatigue (after only 25-30 minutes of singing), general dysphonia (abnormal or dysfunctional voicing), hoarseness and periodic aphonia (loss of voice); loss of range (especially high notes), dynamic range (especially pianissimo) and decreased vocal power; timbral changes (colourless, flat timbre, huskier or more metallic voice). Studies disagree whether these vocal changes are evident to the listener or only to the singer (Ryan & Kenny, 2007).

Q: How many women are affected by PMVS?

A: It is suggested that 50% of women who suffer from PMS also suffer from PMVS, and one third of singers (33%) are affected by the syndrome (Abitbol, 1999).

Q: What causes vocal symptoms?

A: Table 1 highlights how the symptoms of PMS effect changes in the voice.

Table 1

Voice Implications of PMS

PMS symptom	**➡ Implication for the voice (PMVS)**
Increased progesterone causes mucosal dryness (epithelial desquamation and decreased mucosal secretions at the edges of vocal folds); vocal folds (VF) have higher level of acidity; laryngeal muscle has less tonicity	Dry, swollen vocal folds, less vocal amplitude (perceived as softer, lack of vocal strength); fatigue after 25-30 minutes phonation)
Break-down of polysaccharides into smaller molecules in VF (edema of Reinke's space, the superficial lamina propria)	Thick mucous, vocal fold congestion (more throat clearing), VF less supple, affecting ability to vibrate normally
Estrogen and progesterone work together to relax smooth muscles	Vasodilatation (widened blood vessels) = increased blood flow
Dilatation of micro-varices (tiny veins) in the vocal folds	Risk of forming a hematoma on the fold and hemorrhaging (= fatigued speaking voice, difficulty singing); reactionary edema
Reduced capillary permeability; Allergic inflammatory changes (increased allergic response)	Tissue congestion; Extra nasopharyngeal and respiratory mucous; Breast, lower abdominal/pelvic and VF tissue congestion
Increased acid reflux (relaxation of cardiac muscles)	Posterior laryngitis (due to swelling of a third of the vocal folds; stiff cricoarytenoid joints)
All striated muscles lose tone (vocal muscles, abdominal muscular belt and intercostal muscles)	Reduces pulmonary power (breath support) and vocal range.

(Abitbol, 1999; Afsah, 2024)

Mitigating Symptoms for PMS, PMVS and Dysmenorrhea. Suggestions for combatting symptoms include:

a) Regular exercise 30 minutes most days of the week (many studies have found that yoga and aerobic exercise can reduce symptoms of PMS. Yoga can support a focus on feelings—which correlates with some of the components of behavioral-cognitive therapy—and has proven to have better results than aerobic exercise, likely due to the combination of *pranayama* (breath control), *dhyana* (meditation) and *asana* (postures) which alleviate both physical and psychological symptoms in a more comprehensive way (Modzelewski et al., 2024).
b) Adequate sleep; stress reduction techniques (meditation or long bath; LeWine, 2024).
c) Hydration (drinking 6-8 glasses of water a day); reducing caffeine, alcohol, red meat, dairy, spicy and salty foods, which stimulate acid reflux and mucous production; Kaye, 2020).
d) Balanced diet low in refined sugars; and regular meal schedule for stable blood sugar levels (LeWine, 2024).
e) Pain relievers: Commonly, NSAIDS (nonsteroidal anti-inflammatory drugs) are used for pain relief, especially those like ibuprofen which inhibit prostaglandin (believed to trigger cramps; Anderson et al., 2017). However, they also reduce coagulation: compounded with the vascular changes of the larynx during this phase (venodilatation due to increased blood volume, for example), singers and professional voice users should avoid them to diminish the risk of vocal hemorrhage. Acetaminophen is considered a better option (Kaye, 2020).
f) Antidepressant medication such as serotonin reuptake inhibitors (SSRIs) or serotonin-norepinephrine reuptake inhibitor (SNRI) or oral contraceptives might alleviate severe symptoms (the former for predominantly psychological symptoms, the latter for physical; Modzelewski et al., 2024). Doctors should prescribe the type of SSRI based on each individual's needs. Intermittent-dosing studies do not report any issues with withdrawal; however, there are common side-effects of SSRIs: headaches, nausea, sexual dysfunction and sleep disturbances (Modzelewski et al., 2024).
g) Natural options, including calcium B6, Vitamins D, E, Zinc and Magnesium supplements can be helpful for alleviating various symptoms, with varying adverse effects (Modzelewski et al., 2024).

Vocal Rest for PMVS:

Vocal rest is very important as a prevention, but that does not necessarily mean *no* singing. Shorter practices, multiple times throughout the day is healthier than rehearsing for long periods of time. Using head-dominant resonance or descending an octave is also helpful (especially for higher voices; Fleming et al., 2017). Proactively paying attention to your stamina and energy levels is also important and resting when needed (Modzelewski, 2024). Healthy voice habits (avoiding "abusive vocal tendencies"; Kaye, 2020, p. 60) and strong technique helped mitigate swelling and irritation, lessening PMVS symptoms.

Discussion on Research. Seeing as progesterone decreases arousal and activation levels in the body, the high levels of this hormone during the luteal phase could explain lower vocal intensity and lower airstream pressure (Banai, 2017). Secondary effects of PMS (both psychological and physiological) likely add to weaker respiratory efforts and laryngeal tension, in addition to dissatisfaction and heightened stress for the singer due to their commonly lowered self-perception at this premenstrual and menstrual phase (Shoffel-Havakuk, 2017). It should also be noted that symptoms similar to PMVS can be experienced at ovulation as well as in the luteal phase (Anderson et al., 2017); however, a great majority of studies conclude that higher levels of estrogen at ovulation result in better vocal quality (Saltürk et al., 2016). Not all studies surrounding the effect of the menstrual cycle on the voice concur with the above acoustic variations nor does every woman experience these changes. However, most of those studies were conducted on non-singer populations and cited this as a limitation. The studies with singing measures do align with the above table and offer a more complete view (Shoffel-Havakuk, 2017).

Finally, sex hormone fluctuations are not the only hormonal factors that contribute to vocal change. Laryngeal tissues possess thyroid hormone receptors as well, so thyroid gland dysfunction (hypo- and hyper-thyroid disorders, for example) also alter vocal function. Pituitary dysfunction (excess or deficiency of growth hormone) can affect the resonant qualities and pitch of a voice as can excess androgen levels (Plexico & Sandage, 2018).

Research on the contraceptive pill and voice. For most who suffer from PMS, PMDD, PMVS and/or dysmenorrhea, hormonal contraceptives have been found to help alleviate symptoms (Anderson et al., 2017). As they stabilize the fluctuation of hormones, they also tend to create a more

stable vocal environment. Modern third-generation monophasic oral contraceptive pills (OCPs) in Canada and the United States do not tend to contain androgenic progesterone anymore (which could permanently affect the voice), but singers should convey to their doctors the importance of taking a non-androgenic OCP (Anderson et al., 2017). Doctors should help find the type of OCP that works best for a singer's body and voice. Hormonal intrauterine devices (IUDs) have minimal systemic absorption and have undetectable hormone effects: they are unlikely to have negative effects on the voice but have not been studied (Anderson et al., 2017). Injections such as Depo-provera contain medroxyprogesterone acetate which might accelerate osteoporosis and mimic menopausal effects on the voice (e.g., lower fundamental frequency, diminished breath control, fatigue, pitch inaccuracy, laryngeal atrophy; Anderson et al., 2017).

Literature about hormonal contraceptives is inconsistent, but many recent studies, which reflect the advancing medications, suggest that singers who suffer from PMS and PMVS symptoms could benefit from today's monophasic oral contraceptive (OCP) or intrauterine device (IUD) use. A 2007 case study by Filipa Lã et al. found that in addition to stabilizing the vibratory pattern throughout the cycle, fewer intonation problems were perceived by listeners, and the singer perceived better vocal control while using OCP's compared to a natural cycle. Amir et al. (2003) similarly found improved acoustic voice parameters with monophasic OCP's; and while Kunduk et al. (2016) found no vibratory characteristic change on the vocal folds with OCP use, they did find OCP-users had richer harmonics than non-users (measured by the harmonic-richness factor, HRF). In 2009, Lã et al. also studied contraceptive pills with drospirenone: they did not record any systematic effect. This means that while they may not "help" the voice, they should not have a negative impact either (corroborated by Amir et al., 2005).

In contrast, a 2017 study by Banai (2017) found that although eliminating progesterone peaks might help the voice, high levels of estrogen promote higher voice quality, and higher minimum pitch (fundamental frequency) and voice intensity. Using an OCP might therefore inhibit some of these positive benefits from estrogen.

Self-perception also plays an important part in understanding the discussion surrounding symptoms of PMS and PMVS, and the role OCPs can have. Ryan and Kenny (2009) found that singers perceived their recordings to be of lower quality in sound and stability during their menstruation but

that expert listeners could not identify changes between recordings during menstruation and non-menstruation. The timeframe of these perceived lesser quality recordings also matched journal entries from the singers corresponding to a noted decreased mood. This suggests that trained singers might feel down, and perceive their singing to be less stable, during the premenstrual phase due to their own perceptual judgments but these fluctuations may not be as evident to others (otolaryngologist and vocal scientist Robert Sataloff argues the same point; Khare, 2020).

The issue could be raised that singers may perform better if their general state is more stable, but most current studies only include acoustic measures. The Ryan and Kenny study is noteworthy in this regard. Monophasic OCPs might also alleviate intense abdominal cramping, which does not directly affect the vocal folds, but does negatively affect breath support for singing (Khare, 2020). The lack of uniformity in study design is thus a major limitation to the discussion on OCPs: variations between studies using singer vs. non-singer populations, professional vs. amateur singers, and sung vs. spoken measures could account for many of the above discrepancies (Kaye, 2020).

Finally, it is important to also consider the side effects of OCPs: nausea, decreased libido, mood swings, headaches, breast tenderness. Most of the common side effects subside with prolonged use (Cooper & Patel, 2024). Singers should check with their doctors about negative drug interactions with other medications and contraindications (e.g., women prone to blood clots, hypertension, smokers) before deciding if OCPs could help their symptoms.

1.2.3 Pregnancy Hormones

> A professional singer can sing remarkably well while being 2 to 7 months pregnant. The vocal folds are then nicely plump and perfectly lubricated. The quality of the vibration is actually improved. The hormones that accompany pregnancy confer special warmth to the voice's harmonics. The voice is rounder; it carries well. It seems that pregnancy does beautify the voice (Abitbol, 2015, p. 64).

Pregnancy is a life event which generates extraordinary hormonal changes: the levels of many hormones peak higher during pregnancy than at any point in the lifespan. While pregnant, periodic fluctuations due to the menstrual cycle cease; however, because of a plethora of endocrinal changes, voice changes are still observed. Both the placenta and foetus create additional steroids which in turn stimulate other glands to release further hormones and add to the mother's hormonal circulation (Kosztyła-Hojna et al., 2018). Sex steroid hormones act on the genital tract, larynx, mucosa, muscles as well as bone tissue and the cerebral cortex during pregnancy (Khare, 2020). While very few studies have been able to measure whether these hormones affect the singing voice, we do know that a proliferation of circulating hormones cause most of pregnancy's physiologic changes. The following hormonal changes are reported by Hamdan et al. (2009):

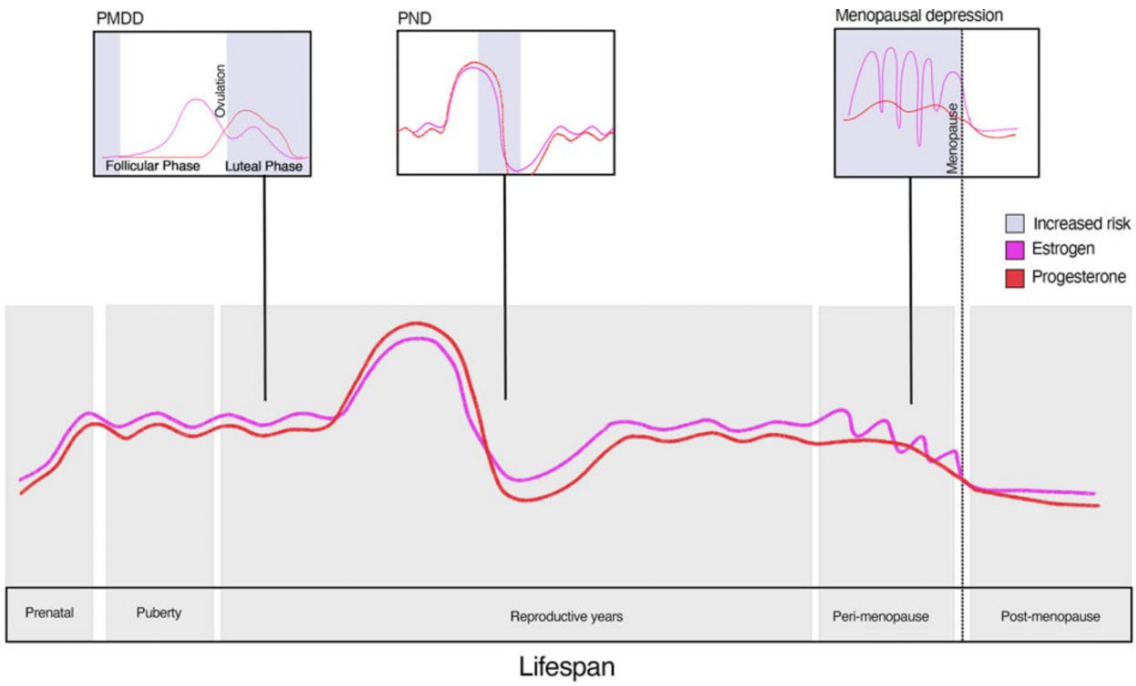
a. **Estrogen** and **progesterone** levels rise early in pregnancy, then steadily increase again around 9-10 weeks gestation at which point the placenta itself also begins releasing the hormones, in increasing doses. By the end of the gestational period, these hormones are higher than at any point in the life cycle. To give perspective, a nonpregnant woman begins her menstrual cycle with progesterone levels of less than 1mg/day. In the second half of the menstrual cycle, the apex of progesterone levels, it increases to 20-30 mg/day. By the end of a pregnancy however, levels of progesterone are as high as 200-400 mg/day (McKenzie & Buster, 2004).
b. **Relaxin** is released to allow joints and ligaments to loosen, gain flexibility (especially in the pelvis, to accommodate the growing uterus and to promote softening of the birth canal (Kepley et al., 2024). Secondary symptoms such as backpain and decreased blood pressure are common (relaxin mediates the release of nitric oxide which leads to systemic vasodilation, meaning lower blood pressure).
c. **Cortisol** increases by 2.5 times, necessary for normal development of the fetal brain. Adrenal glands produce *aldosterone* and cortisol to help kidneys regulate how much fluid to excrete, increasing water content in the body.
d. The thyroid gland releases 50% more **thyroid** hormones, causing faster heart beats which might lead to palpitations, heightened perspiration and mood swings.

e. The pituitary gland grows by 135% and promotes **prolactin** development (increases tenfold throughout pregnancy), preparing the body for lactation.
f. **Oxytocin** amplifies by the end of pregnancy to prepare the body for childbirth.

Very quickly after childbirth (48 hours following delivery), many of these pregnancy hormones drastically drop off and the mother is left with very low levels of estrogen and progesterone for many months. The postpartum period brings with it then a very different hormonal environment than not just the previous nine months, but the whole adult lifespan up to this moment. Figure 2 (bottom large chart) shows the estrogen and progesterone levels and their general fluctuations from birth to post-menopause. The second small box at the top, labeled PND (postnatal depression) shows the quick climb of estrogen and progesterone during pregnancy, and the ensuing rapid drop after birth.

Figure 2

Estrogen and Progesterone Over Woman's Lifespan



Effect of Pregnancy Hormones on the Voice

Some women experience acoustic or aerodynamic changes affecting their singing during pregnancy. As reported by Lã & Sundberg (2012), a 1984 survey on vocal health during pregnancy found that in the first trimester, 62% of singers noticed no change while 16% found improvement and 22% complained of morning sickness-related vocal issues. In the second trimester, 49% of those singers felt no change, 45% experienced improvement and 15% experienced worsened vocal changes. By the third trimester, 26% noticed no vocal change, 47% cited a positive change due to pregnancy, and 26% felt a decrease in vocal quality (Lã & Sundberg, 2012). Since 1984, various researchers have measured the voice during pregnancy, as exemplified in Tables 2 and 3. Unfortunately, variations in methodologies and participant samples complicate efforts to compare findings across studies. Correlations can be made from our knowledge of how sex steroid hormones affect the voice during the menstrual phase, but the exact levels and various interactions between the hormones are not yet fully understood during pregnancy and postpartum. These confounding variables can greatly alter a singer's experience. The tables below give a brief overview of the vocal changes that can occur during pregnancy, both negative (Table 2) and positive (Table 3). As PMVS is referred to as largyngopathia premenstrualis, the term for the collection of voice problems related to pregnancy are called *laryngopathia gravidarum*.

Table 2

Negative Voice Changes During Pregnancy

Negative voice change	Explanation	Months (if specified)	Reference
Hoarseness; fatigue	Similar to PMVS; due to edema of the superficial layer of lamina propria (vocal folds)	Progressively worsening	Hamdan et al., 2009; Cassiraga et al., 2012; Anderson et al., 2017; Kosztyła-Hojna et al., 2018 (Third trimester)
Reduced vocal fold mobility	Increased phonation threshold pressure (PTP: smallest amount of subglottal pressure needed for vocal fold oscillation) and collision threshold pressure (CTP: lowest amount of subglottal		Khare, 2020

	pressure needed for vocal fold collision)		
Decreased vocal brightness *in contrast from Sataloff and Abitbol's findings	Higher tissue viscosity; laryngeal dryness due to high progesterone and estrogen levels		Lã & Sundberg, 2012
Voice aperiodicity; lower fundamental frequency; uncontrolled timbral changes	High estrogen/progesterone; vocal fold edema	3rd trimester; throughout	Lã & Sundberg, 2012; Saltürk et al., 2016; Kosztyła-Hojna et al., 2018
Change in vocal timbre	Rhinitis can impair nasal patency (how open the cavity is); closed rhinolalia (hyponasality: loss of resonance on nasal consonants)		Kosztyła-Hojna et al., 2018
Breathiness	Suggested breathiness is a result of increased effort due to reduction in air loss		Cassiraga et al., 2012
Voice irritation; hoarseness; sore throat	Gastroesophageal reflux (due to lower gastric motility and esophageal sphincter tone because of high progesterone)	3rd trimester	Lã & Sundberg, 2012; Anderson et al., 2017
Voice irritation	Vomiting ("morning sickness")	1st trimester	Saltürk et al., 2016; Anderson et al., 2017
Hemorrhaging, hematoma on VF	Increased vascularity plus overuse/misuse		Lã & Sundberg, 2012
Reduced respiratory support; high, clavicular breathing	Decreased thoracic and abdominal volume		Cassiraga et al., 2012
Reduced maximum phonation time (MPT)		3rd trimester	Hamdan et al., 2009; Cassiraga et al., 2012; Saltürk et al., 2015; Saltürk et al., 2016; Ghaemi et al., 2018; Kosztyła-Hojna et al., 2018; Rechenberg et al., 2022; Ulkumen et al., 2022

Table 3

Positive Voice Changes During Pregnancy

Positive voice change	Explanation	Months	Reference
Better quality vocal fold vibration	Optimal lubrication of VFs	2-7 months	Khare, 2020
Well-rounded voice; supple; good timbre	Increased estrogen: greater vibratory amplitude of voice due to slight thickening of VF mucosal membranes; desquamation of superficial cells and mucus in larynx are reduced; better permeability of blood vessels and capillaries on VF		Hamdan et al., 2009
Stable maximum phonation time (MPT) *contrary to above studies	Case study on a professional voice user who might have been practicing safe vocal hygiene	Throughout	Hancock et al., 2015
No acoustic changes (no irregularity of frequency, vibrato, or amplitude)	f_o (fundamental pitch); jitter; shimmer; NHR values (noise to harmonics)	3rd trimester	Hamdan et al., 2009; Cassiraga et al., 2012; Hancock & Gross, 2015; Saltürk et al., 2016; Ghaemi et al., 2018; Kosztyła-Hojna et al., 2018; Rechenberg et al., 2022

Q: What causes the possible negative acoustic and aerodynamic changes and what solutions are available?

A: Table 4 illustrates what causes these vocal changes and the appropriate solution for each.

Table 4

Causes of Vocal Change and Their Solutions

Cause of vocal change	Solution
Nasal congestion (from mucosal hypersecretion); pregnancy-induced rhinitis; Laryngopharyngeal dehydration (from vocal fold edema); Oral breathing due to these upper and lower respiratory tract issues (Hamdan et al., 2009)	Reduce nasal discharge and blockage with saline solutions is helpful. Use of oral decongestants if necessary (Shiny Sherlie & Varghese, 2014); Use humidifiers to mitigate dryness; Attempt to breathe through the nose as much as possible; Breathing exercises and healthy singing habits during 2nd and 3rd trimesters to combat respiratory discomforts (Afsah, 2024).
Gastroesophoageal reflux (experienced by 50-75% of all pregnant women) (Shiny Sherlie & Varghese, 2014).	Small, frequent meals and antacids are most common ways to treat reflux (Shiny Sherlie & Varghese, 2014)
Loss of vocal endurance; "malregulative glottic closure patterns" (Denizoglu & Cukurova, 2022, p. 927)	Daily vocal exercising using semi-occluded vocal tract (SOVT) exercises, which offers massage effects for the vocal muscles (to be continued in the postpartum, also) **(**Denizoglu & Cukurova, 2022)
Musculoskeletal changes or lack of exercise leading to reduced MPT (Rechenberg et al., 2022)	Exercising regularly (Rechenberg et al., 2022); Modifying vocal technique to circumvent changes (see 1.3 on Breathing for further discussion)

Q: Given the known effects estrogen and progesterone each have on the voice during the menstrual cycle, what reaction do their high levels have on the voice during pregnancy?

A: The fluctuating relationship between progesterone and estrogen plays a vital role in voice production. From studies on the menstrual cycle, we know that elevated estrogen levels promote the production of mucous, while reducing its viscosity and dilating blood vessels; in contradiction, progesterone dehydrates, reducing mucosal production and increasing its viscosity (Kosztyła-Hojna et al., 2018). In the menstrual cycle, these two hormones peak at different moments, while in contrast during gestation, they climb steadily, jointly. In his 2006 book, Jean Abitbol relates that when they are fluctuating *in* balance (their levels are increasing at a similar rate), the voice is very healthy, with good interstitial fluid distribution (across the vocal folds). When they fluctuate *out* of balance, progesterone will stop the capillaries in the vocal folds from draining fluid, resulting in interstitial swelling. The two unbalanced hormones create an asymmetry in vocal fold vibration and irregular

oscillatory pattern (perceived as unstable vibrato), and vocal fold edema. This delicate relationship could explain the variations in results both anecdotally and across studies.

Spotlight on Studies. Lã and Sundberg's 2012 case study offers insights on the endocrinal-vocal relationship in pregnancy. While direct causality between sex hormones and vocal changes could not be drawn, the study provided evidence that their pregnant singer experienced increased glottal adduction and reduced vocal fold motility during pregnancy; and as the pregnancy advanced, an increasing loss of vocal brightness was perceptible.

One longitudinal study by Rechenberg et al. in 2022 found a relationship between decreased maximum phonation time (MPT) and lower physical activity level. Participants who were sedentary, regardless of the trimester, had lower MPT values than active participants. No other acoustic variable reflected this relationship. This demonstrates how possible vocal changes during pregnancy and postpartum might be counterbalanced by other variables like exercise. Singers might be encouraged to incorporate regular exercise during pregnancy to mitigate symptoms.

Discussion on Research. Singing at a professional level is a result of a delicate yet complex balance between aerodynamic conditions, biomechanical makeup of the larynx, and musculoskeletal considerations. The impact of endocrinal fluctuations of sex steroids on the voice remain largely unclear for pregnant and postpartum singer populations. As evidenced by Hancock and Gross' 2015 study, if voice users are prepared, and practice healthy vocal hygiene, it is possible that the effects of pregnancy hormones and secondary symptoms can be minimized (Kosztyła-Hojna et al., 2018). While singers may need to concentrate more on vocal technique in response to vocal changes, they should not be put off: claims that singers should not sing during pregnancy are systematically unfounded (Lã & Sundberg, 2012). The lack of literature surrounding the effects of pregnancy on the voice adds to the stress a singer may experience when faced with "even minor vocal difficulties" (Lã & Sundberg, 2012, 432); however, this gap in knowledge only solidifies the need for more research and should not detract professionals from singing during pregnancy and postpartum.

1.2.4 Postpartum Hormones

There is no official timeline for the postpartum period, various disciplines use different measures:

a) an immediate or acute postpartum in the first few days.

b) three months following childbirth, the colloquial "fourth trimester".

c) literature surrounding postpartum depression often encompasses the first six months (Hendrick et al., 1998).

d) one year, the time that includes the period of breastfeeding/bottle feeding, the many developmental changes for baby and hormonal changes for the mother, and in some countries, a maternity leave from work following childbirth.

Immediate Postpartum. The placenta (the main warehouse of pregnancy hormones) is birthed in delivery, instigating a drastic decrease of hormones. By two days following birth, placental steroid levels (including estradiol, progesterone and cortisol) have plummeted by 80% (Henry & Sherwin, 2011). Pregnancy affects the endocrine system for a long time: it is believed that estrogens, androgens and prolactin circulate at decreased levels for years (Barha & Galea, 2017).

Breastfeeding Hormones.

Prolactin: After giving birth, a breastfeeding body produces a large amount of prolactin, which encourages the production of breast milk. If a mother is not breastfeeding, prolactin levels drop off to pre-gravid levels by three weeks postpartum. In breastfeeding women, prolactin drops away only once lactation is well-established (Hendrick et al., 1998).

Oxytocin: Higher levels of the hormone oxytocin are present in a breastfeeding body (The Physiological basis of breastfeeding, 2009). Oxytocin tends to help lower blood pressure and reduce levels of stress and anxiety. Although it may not have a direct effect on the voice, this likely has a positive effect on the mother's energy, confidence, and thus, voice.

Estrogen (low levels): Suckling at the breast suppresses pulsatile GnRH secretion (including FSH and LH), which in turn inhibits the ovaries from producing estradiol: the body is in fact tricked into thinking it is still pregnant (McNeilly, 2001). By one month postpartum, FSH and LH are released, but the patterns are too infrequent, and estrogen levels are therefore still suppressed.

Intensity of breastfeeding is only one factor in the suppression of GnRH. The mother's nutrition and body-mass composition also contribute to *lactational amenorrhea* (lack of menses) or *oligomenorrheic* (irregular menses) for a period of up to one year (Ryniec & McGee 2020, 124). Anecdotally, it is believed that exclusive breastfeeding naturally protects the body against another immediate pregnancy. In their chapter on "Ovarian function during pregnancy and lactation," Ryniec and McGee point out that delayed menarche can be attributed more precisely to the intensity of breastfeeding (occurrence and volume) rather than exclusivity (2020). Generally, once suckling patterns slow below a certain threshold (reduced breastfeeding), GnRH pulsatile release patterns return to normal (including estrogen), and the menstrual cycle will resume (Ryniec & McGee 2020).

For women who do not breastfeed, ovulation tends returns between 45 and 94 days postpartum (Ryniec & McGee 2020). Ovulation returns roughly 112 days postpartum for a breastfeeding mother. For this reason, lactational amenorrhea is not an effective form of birth-control beyond six months postpartum. Up to 3 months postpartum, there is less than a 3% risk of pregnancy if the mother is amenorrheic and exclusively breastfeeding. Progesterone oral contraceptive pills (OCPs) and intrauterine devices are considered safe for lactation by Ryniec and McGee.

Effect of Postpartum Hormones on the Voice. Very few voice science studies have measured voice changes during the postpartum period. Very little data is available as to the extent of the hormonal drop on the voice. It is believed that estrogen depletion during the breastfeeding period can effect vocal changes akin to the difficulties experienced with premenstrual vocal syndrome or menopause (Emerich, 2000). Symptoms similar to those in the luteal phase of the menstrual cycle (the phase with lowest levels of estrogen) are possible, including "difficulty with smooth register transitions, breathiness, weakness, an inability to phonate on certain pitches, a lack of flexibility or inability to sing certain scales and/or arpeggios quickly and easily; and an inability to adequately support tones" (Emerich, 2000). Otorhinolaryngologist Dr. Anthony Jahn maintains that the low estrogen levels during breastfeeding negatively affects the colour, resonance and flexibility of the voice, but that the overall benefits of breastfeeding outweigh these changes (2011).

Following the decreased levels of MPT in the third trimester, Hamdan et al.'s 2009 study found that MPT rates bounce back significantly during the first two days postpartum, supported by Ulkumen et al. (2022).

Spotlight on Studies. A study by Pisanski et al. (2018) found that for a year following childbirth, mothers' voices lower in pitch and become more monotonous when speaking naturally amongst adults. Before and after pregnancy voice recordings were used and compared against a nulliparous control group (non-pregnant women of similar age and professions). Findings from the postnatal period included 1) less pitch variation (more monotonous); 2) lowered pitch (by 1.3 semitones or 15 Hz); and 3) maximum pitch lowered by an average of 2.2 semitones. Recordings of the participants talking to their babies were not included, as mothers often use a higher-pitched, artificial voice when speaking to a newborn. The study suggests that as research has linked high levels of estrogen during ovulation to increased pitch and low levels during menopause to decreased pitch, the postpartum suppression of estrogen is likely to have a similar effect as the menopausal phenomenon on the voice. It also cites fatigue, mood changes and behavioural modulations as possible causes.

A recent study from Li and Xu, published in the *Journal of Voice* in 2019, similarly suggests a lowering of pitch throughout pregnancy and well into the postpartum period (for most participants, pitch never returned to pre-gravid levels). Twenty-nine pregnant participants with complaints of pitch reduction were studied. Medical history, acoustic characteristics, laryngoscopy and hormonal changes were considered, although not all these clinical characteristics were available for each participant (an important limitation of the study). For over half the women, the drop in pitch occurred during the second trimester; 72.4% showed signs of mucosal edema of the vocal folds while three participants presented laryngeal lesions or nodules. Continuing discussions about lowered fundamental frequency should be considered with larger populations (see Pisanski et al., 2018 in postpartum hormone section), especially in light of recent studies (e.g. Ulkumen et al., 2022) which found *higher* fundamental frequencies at gestational term.

Ulkumen et al. provide the other long-term study in literature, with objective voice measures continuing into the 3rd month postpartum (2022). This study used non-voice professionals (not singers) and specifically only included mothers who had delivered vaginally (49 in total). Between

the 3rd trimester and the 3rd month postpartum measure, important increase of fundamental frequency, MPT and vocal intensity were found. Both VHI-10 (self-perceived effects of voice disorder on daily tasks) and GRBAS score (standardized auditory-perceptual scale for voice quality) decreased in the 3rd trimester (except for roughness and breathiness in voice samples, which continued into the postpartum). In pregnancy measures, their study aligns with that of Li and Xu and Pisanski et al.; but contrastingly no change in jitter, shimmer or noise to harmonics (NHR) was reported. In addition, they report increased fundamental frequency in postpartum (reflecting a decreased edema by 3 months postpartum) which also stands in contrast. It should be noted that none of these three longitudinal postpartum studies included sung measures.

Discussion on Research. While breastfeeding can have psychological and physiological benefits, these same factors can equally create stress. As stated in the previous paragraph, breastfeeding might extenuate vocal issues due to suppressed hormones, but it can also bring joy, connection, and wellness for both mother and child. Breastfeeding is an intensely personal decision: physical and emotional complications, lack of moral support and sleep deprivation, and logistical difficulties/benefits must all be weighed.

Low vocal quality in the postpartum tends to be blamed on low estrogen in the few studies that exist. However, progesterone is also low during this time, so it could therefore be assumed that the vocal problems that are associated with the luteal phase should also be diminished during the postpartum. Because the length of breastfeeding varies from one person to another, no systematic studies have explained how the return of the sex hormone cycle affects the voice in the time it takes to install a regular menstrual cycle following childbirth. We know that the balance of estrogen and progesterone are important for healthy singing, but we do not know how they interact during the postpartum year, when there are so many other variables at work.

1.3 "Hee, hee, hoo": Breathing Considerations in Pregnancy and Postpartum

Inspiration | ˌinspəˈrāSH(ə)n | *n.*

1 the process of being mentally stimulated to do or feel something, especially to do something creative.

2 the drawing in of breath; inhalation (Oxford English Dictionary).

Inspiration and expiration—two simple words. Ask a young singer if breathing is simple and they will likely tell you, NO! Ask a pregnant woman who has just walked up a set of stairs if breathing is simple, she might still be catching her breath before she can say, NO!

Breathing at rest is a simple essential human function, an exchange of gases in our body. In singing, the inspiratory and expiratory muscles must work together in precise coordination to produce efficient breath management throughout the breath cycle. For an overview of the respiratory system and mechanics during quiet breathing and singing, please see Appendix B.

Breath management is an important part of voice pedagogy, referring to how singers control their breathing. It is also often called breath support. There are multiple schools of thought on how to breathe during singing which have passed through generations of singers. Techniques vary for different body types and a multitude of terms and imagery are used: this discussion is personal to each singer and their teachers. However, there is one certainty when it comes to breathing: pregnancy provokes considerable changes to the breathing apparatus and function. Adaptations to breath management will likely be required throughout gestation and into the postpartum year.

1.3.1 Physiology: Chest Wall and Diaphragm

Common sense would tell us that the mechanical and anatomic changes in the thoracic cage, abdomen and diaphragm must cause discomfort as pregnancy advances and that the distension of the abdominal muscles and postural difficulties must likely affect a singer's breathing. The considerations are not as straight-forward as one might think.

Pregnancy. As the baby grows and the uterus expands over the course of the pregnancy, the circumference of the thorax grows by 5-7 cm; the diaphragm's mid-position is elevated by 4-5 cm (Jensen et al., 2007); and the subcostal angle (the angle between the xiphoid process—the bottom

point of the sternum—and the lowest point of the ribcage on one side) widens by roughly 35 degrees. It is assumed that these changes are also partly due to the increase of the hormone relaxin, which remodels bones and muscles during pregnancy and relaxes the pelvic and lower rib cage ligaments (Nassikas et al., 2022)

Due to the widening of the chest wall and higher mid-position of the diaphragm, the length-tension relationship of the diaphragm (diaphragmatic dome excursion) maintains inspiratory muscle strength (Nassikas et al., 2022). Respiratory muscle function therefore is not compromised nor is lung compliance (elasticity), despite the chest wall compliance being affected in the third semester by the growing uterus, and also possibly by breast size.

Postpartum. Chest wall increases gradually return to baseline configuration over a period of 24 weeks (Nassikas, 2022). Very little information regarding the subcostal angle is available, but it seems it never in fact fully returns to its baseline angle, rather remaining 20% wider than before pregnancy, which is very interesting from a singer perspective (Hegewald & Crapo, 2011).

1.3.2 Cardiac Function

Pregnancy. When the smooth muscles of the blood vessel walls relax, the blood vessels are widened, called vasodilation (Ramanlal & Gupta, 2023). Vasodilation lowers blood pressure which helps the heart pump blood throughout the body. Vasodilation therefore triggers systemic vascular resistance and increase of capillary perfusion (blood flow). During the first 8 weeks gestation, the heart pumps out 20% more blood (cardiac output) due to peripheral vasodilation (Kepley et al., 2023). During pregnancy, the increased levels of nitric oxide, prostaglandins and progesterone are partly responsible for this vasodilation. Over the course of the pregnancy, cardiac output increases by 30-50% (Artal-Mittelmark, 2022), increasing the heart rate from roughly 70 beats per minute (non-pregnant) to 90 beats per minute (pregnant). There is a short reprieve around 30 weeks, when the heart produces slightly less blood, only to increase by 30% again during labour. An immediate decrease occurs just after delivery, before slowly continuing to decrease to pre-pregnancy levels approximately six weeks postpartum.

Cardiac levels are higher with multiple fetuses (e.g., 20% higher if carrying twins) and is affected by body position (Nassikas et al., 2022). For example, moments of low blood pressure due to decreased cardiac output can occur if a woman is laying on her back (supine position). In this position, the uterus compresses the vena cava and, to a lesser extent, the abdominal aorta. This compression decreases venous return (interfering with blood flow) and cardiac output, resulting in a drop in systemic arterial pressure (Goodman, 2003). Analogously, if standing still for long periods, the gravid uterus (with its volume of 6-7 L) compresses femoral veins and decreases venous return from the legs to the vena cava. This results in a decline of cardiac output, a fall in blood pressure, and can cause fainting. Incidentally, the same increased venous pressure in the legs (due to femoral veins being compressed by the uterus) causes edema of the legs. This build-up of extravascular fluid commonly causes discomfort in late pregnancy.

- Both fainting and lower extremity edema are aggravated by prolonged standing, especially in one position, which is a concern for singers.
- Increased blood volume is accompanied by increased fluid volumes during pregnancy. Sodium and water retention in the renal system increases extracellular fluid by approximately 6.5 liters (Harper et al., 2022). Abitbol suggests this can affect the vocal folds, causing both a vibratory rate and fundamental frequency reduction in the voice.

Mitigating Symptoms. Swollen legs and ankles can be alleviated by resting occasionally on the left side of the body; resting with the legs raised; wearing loose clothing and comfortable shoes; and wearing elastic compression socks (Bunce & Heine, 2024). Comfortable footwear and occasional stretches and ankle rolls can improve circulation.

Postpartum. In the immediate postpartum, cardiac output increases 60-80% compared to levels before labour due to “autotransfusion” (blood no longer diverting to uterus/placenta) and release of aortacaval compression, but rather quickly, the cardiac output drops. There is some discrepancy as to the exact timeline for the return of cardiac output to baseline measures. Some reports state a return to baseline measures at 2 weeks (Nassikas et al., 2022); others cite an important reduction by 2 weeks postpartum with more normal cardiac levels attained between 12-

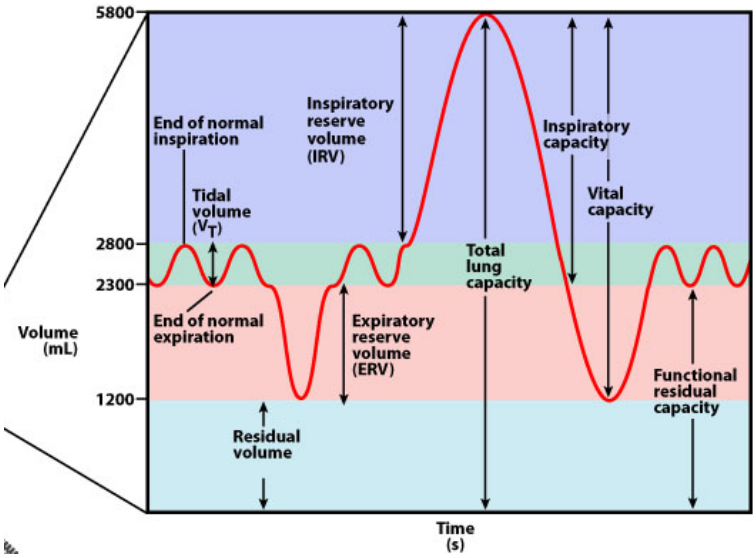
24 weeks postpartum; still others find elevated cardiovascular levels present at 12 weeks postpartum (reported by Hegewald & Crapo, 2011).

1.3.3 Pulmonary Function

To understand the changes in lung volumes and capacities during pregnancy, it is helpful to review these capacities in a non-pregnant person, illustrated in Figure 3. Total lung capacity is comprised of four main parts: tidal volume (TV), inspiratory reserve volume (IRV), expiratory reserve volume (ERV) and residual volume (RV; Watson, 2009). Tidal volume (green in the figure) represents the amount of air moving in and out of the lungs in quiet breathing (when we are breathing at rest). It accounts for approximately one tenth of the total lung capacity in non-pregnant people. Expiratory reserve volume (pink) is the amount of air exhaled beyond tidal volume (e.g., for speaking or singing a long phrase). There is always an amount of air left in the lungs, even after a full exhalation, called the residual volume (blue). ERV and RV together are called functional residual capacity (FRC).

Figure 3

Lung Volumes and Capacities



FRC is also often referred to as the resting volume, at the end of an expiration during quiet breathing. Inspiratory reserve volume (purple) is the amount of air we can inhale in addition to the tidal volume (if we inhaled our biggest breath possible after a typical breath during quiet breathing). Vital capacity is the fullest amount of air that can be used between maximal inhale and maximal exhale (IRV, TV and ERV together).

Pregnancy. Beginning in the first trimester, increased progesterone levels and oxygen demand cause the tidal volume to increase by 30-50% (Kepley et al., 2023; Harper, 2022). As the uterus grows in pregnancy, ERV is decreased by 10-20% (Lee et al., 2017), and the FRC between 10-30% (Hegeweld & Crapo, 2011). RV has been reported at a decrease of 20-25% (Hegeweld & Crapo, 2011). In compensation, IRV increases in pregnancy by 5-10% (Hegeweld & Crapo, 2011). Recent reviews and studies (E.g., Kepley et al., 2023; Lee et al., 2017; Nassikas et al., 2021; Jensen et al., 2007; LoMauro & Aliverti, 2015; Hegeweld & Crapo, 2011) report that the increased IRV has an equalizing effect, resulting in a constant vital capacity (or even slightly increased). Some studies report a small reduction in TLC (Hegeweld & Crapo, 2011), but because the IRC "increases at a rate proportional to the decreasing FRC", TLC in fact tends to stay relatively stable (Nassikas et al., 2021).

Spirometry, which measures lung function, is not affected during pregnancy or postpartum either: measures of forced expiratory volume in 1 second; ratio of forced expiratory volume in 1 second to forced vital capacity; and peak expiratory flow remain normal (Nassikas et al., 2021). In summation, despite the anatomical changes during pregnancy, pulmonary function is not greatly impaired in healthy pregnant women.

Upper airways are affected by hormonal changes, (e.g., increased estrogen) including airway mucosal hyperemia (inflammation), edema (swelling), hypersecretion and friability (irritation due to bleeding, tearing, etc.; Lee et al., 2017). Notwithstanding, the upper respiratory tract function is not diminished, and gas exchange remains stable.

Marion Dickson, in her 2014 dissertation on acoustic and aerodynamic impact of pregnancy on singing, suggests that the lowered ERV, RV and FRC affect singers: less available air for expiration might require more frequent inhalations. This is a very interesting point to consider for further research or reflection while singing pregnant.

➡ Point of contention: it has been hypothesized that a TLC decrease could explain a decline in maximum phonation time (MPT) that occurs especially in the third trimester (Zamponi, 2021). As discussed in chapter 1.2, there is still no consensus on the decrease in MPT: studies are conflicting as to whether there is indeed a decreased MPT and TLC in the last weeks of pregnancy or not.

➡ Lã & Sundberg suggest that posture and alignment are affected by the growing abdomen, and singers may be compensating for this discomfort (or responding to a feeling of lack of breathing support) by engaging other muscles (throat, jaw, tongue, neck, head) and causing tension (2012). This could be partially to blame for any reduced MPT, also.

➡ For singers, *gestational rhinitis* (identified by nasal congestion) is a common implication of inflammation and hypersecretion, affecting 20% of pregnant women (Nassikas et al., 2022). The discomforts of rhinitis often lead to oral breathing which causes dehydrated vocal fold mucosa and in turn compromises voice quality (Zamponi, 2021).

Postpartum. Lung volume changes (IRV, TV, ERV and FRC) return to pre-gravid rates within 48 hours of childbirth as the diaphragm and lungs decompress (Nassikas et al., 2022).

1.3.4 Ventilation Changes

Pregnancy. During pregnancy, while tidal volume increases by 30-50%, the respiratory rate does not change (Kepley et al., 2023). Minute ventilation (the amount of air that enters the lungs per minute) is the product of tidal volume and respiratory rate, so it also increases by 30-50% during pregnancy. Alveolar ventilation (the amount of air that reaches the alveoli for gas exchange) rises 50-70% throughout pregnancy, with oxygen consumption increasing 20-33% in each trimester (Lee et al., 2017).

Increased progesterone concentrations (and symbiotically acting estrogen) affect ventilation. Increased levels of estrogen circulate just before, or at the same time as progesterone, acting as a mediator to the ventilatory response to progesterone (Jensen et al., 2006). These increased progesterone levels are partly responsible for hyperventilation (more air exhaled than inhaled), an increased basal metabolic rate (14%), and an increased sensitivity to carbon dioxide

(Nassikas et al., 2022). It also explains why a woman can feel out of breath climbing the stairs in the beginning trimesters but not yet be experiencing a distended abdomen (LoMauro & Aliverti, 2015).

Q: What are the most common respiratory complaints during pregnancy?

A: *Asthma* is very common and affects up to 13% of pregnant women (Nassikas et al., 2022). *Dyspnea* is the awareness (sensation) of breathlessness or respiratory distress (Lee et al., 2017) and is believed to be common in pregnancy, affecting nearly 70% of all pregnant women (LoMauro & Aliverti, 2015). Dyspnea can occur at any point in pregnancy, in various intensities, for a variety of reasons (studies are currently conflicting as to the causes).

Labour and Postpartum. As can be expected, labour and delivery bring about drastic fluctuations in respiratory and pulmonary functions (Nassikas et al., 2022). Hyperventilation is common; tidal volume varies widely (between 330-2250 mL) as does minute ventilation (7-90 L/minute; Nassikas et al., 2022). Increased minute ventilation is likely due to anxiety, pain from uterine contractions and various breathing techniques used (Hegewald & Crapo, 2011). However, high minute ventilation will decrease if the mother is given narcotic analgesics (opioids) or lumbar epidural analgesia (Von Ungern et al., 2004). Immediately after childbirth, minute ventilation drops by 50% to return to normal values after a few weeks.

Spotlight Study. In her 2019 DMA dissertation, Sarah Harper surveyed singers who had experienced pregnancy. She asked about the many possible changes they noticed about their singing and if they had been aware before getting pregnant of these changes. A few of the questions centred around breathing. Of the 368 responses, 29% (*n*=108) cited sustaining long phrases as the most difficult breathing change. Following closely in second was difficulty getting a full breath (28%; *n*= 104). The third most prevalent answer was a positive change, with 11% (*n*=41) noting an ease of breathing in singing. Difficulty controlling exhalation (10%; *n*=35) and no noticeable changes (9%, *n*= 32) lined up next, followed by experiences of new sensations in the back (8%; *n*=28) and new sensations in the chest (5%; *n*=20). Only 11% (*n*=20) of the participants noticed the onset of these

changes in the first trimester; 33% (*n*= 61) in the second; the majority (39%; *n*=73) in the third; and 17% (*n*=31) did not say.

1.3.5 Musculoskeletal Considerations for Breathing and Singing While Pregnant/Postpartum

Appendix B discusses the physiologic basics of breathing at rest and singing.

Abdominal Wall. The abdominal wall is made up of anterolateral and posterior abdominal walls and are enclosed, like a canister, by the diaphragm and the pelvic floor. The posterior abdominal wall is composed of the three back muscles (latissiumus dorsi, lateral iliocostal lumborum and quadratus lumborum; Hixon, 2006). The anterolateral abdominal wall consists of four abdominal muscles (rectus abdominis, external and internal oblique muscles and transversus abdominis) which run along the sides and front of the abdomen (see Figure A-2 in Appendix B). They have postural functions (they retain the organs in their proper position, control movement of the trunk in many directions, and stabilize body posture in collaboration with the muscles in the lower back), support expiratory functions (speaking, singing, coughing, sneezing), and assist in giving birth and excretory functions (Pitman Will, 2013). Its active force effects only expiratory force: when contracted, the abdominal muscles pull the abdominal wall inward and (except for the transversus abdominis) the lower ribs down. Their contraction compresses the abdominal viscera and creates a pressure which pushes the diaphragm back to its resting position (Pitman Will, 2013). In volume, this abdominal expiratory force can account for 60 to 80% of the air exhaled. The strongest expiratory power comes from the transverse abdominus, the lowest of the abdominal muscles. The transverse muscles wrap around the body, acting with the obliques as a corset for the abdominal wall. Some singers use a breathing technique called *appoggio* which is described as an "internal support" (da Fonseca, 2023) or "lean[ing] down upon the abdominal viscera to control the rate of air flow during singing" (Pitman Will, 2013, p. 13) which is combined with the abdominal wall activation during expiration. The abdominal wall can also exert passive force: when it is at a small size, the abdominal wall will recoil and help inspiration and when at a large size, expiration is supported by its return to its resting position (due to its elasticity; Hixon, 2006).

Abdominal Wall During Pregnancy. As the uterus grows, the abdominal wall distends, and the abdominal muscles must stretch over the growing abdominal contents (Pitman Will, 2013). This lengthens and weakens both abdominal muscles and lower back muscles (Gardner, 2017). The transverse muscles offer an enormous amount of support for the abdominal contents during pregnancy. They are also extremely useful during labour (Pitman Will, 2013). The diaphragm encounters resistance from the growing uterus, which might change the way singers experience their breath control (Pitman Will, 2013). This can be experienced as a difficulty if the diaphragm ascends faster than normal in response to the increased abdominal viscera; however, singers might instead encourage employing *appoggio.* Some singers feel *appoggio* is easier to feel while in the first two trimesters, since the diaphragm is contracting against a larger quantity of abdominal viscera, "like a corset they can push against" (da Fonseca, 2023). By the beginning of the third trimester, singers will likely find breathing more restricted (Jahn, 2011). The uterus is at its highest point (typically at the xiphoid process) in month seven but lowers in the 8th and 9th months as it begins to protrude further forward. This move away from the diaphragm can help with breathing, but will require rebalancing posture (Jahn, 2011).

- Lã and Sundberg suggest that the abdominal distension of pregnancy affects breathing, posture and alignment and can make the voice feel "heavier" or "more difficult to 'support'" (2012, p. 431). In response, singers sometimes over-compensate and create tension in the "muscles of the neck, head, throat, jaw, and tongue", leading to misuse and injury (p. 431).
- Some singers report that changing their breathing technique slightly during pregnancy had positive effects. "You learn to use a wider base of breath support including the back muscles…which I think every singer is trying to access, but I have been forced to" (da Fonseca, 2023). This trickles into awareness of posture and changed centre of gravity of pregnancy, which can have positive outcomes, not only negative ones.
- Williams, in her 2023 dissertation, reminds singers to be conscious about any technique, postural or breathing changes integrated during pregnancy. While some new habits might be helpful, any that include compensatory tension (it might be inevitable) should be 'unlearned' after birth.

Abdominal Wall in Postpartum. Weakened muscles and compensation, postural changes, and pain or trauma from delivery do not go away immediately after birth (Williams, 2023). In addition to the fatigue and postural demands of caring for a newborn, breathing, and therefore singing, can remain difficult into the postpartum period. Unfortunately, few studies have measured how posture and breathing changes affect the voice in the postpartum. Nevertheless, Williams suggests that a good portion of the "timbre, range, and flexibility [changes] can certainly be attributable to changes in posture and breathing" (2023. p. 14).

Breastfeeding affects breathing through the added musculoskeletal factors of holding and caring for the newborn, as well as a larger breast-size (and weight). Neck, shoulder and upper back pain can impede on breathing as well as add daily discomfort (Williams, 2023).

- Stretching of the abdominal muscles as the uterus grows is the cause of worry for many singers who wonder if they will be able to get back in shape, both vocally and aesthetically (Pitman Will, 2013).
- While some singers struggle with possible maladaptation (e.g., introduction of bad habits) following pregnancy and into the postpartum, others feel that new concepts and awareness of "support and alignment creates a stronger foundation for the breath, and that can result in a richer tone" (da Fonseca, 2023).

Pelvic Floor. The pelvic floor muscles (PFM) are made of three layers—superficial, intermediate and deep—and are the "only transverse load bearing muscle group in the body" (Sapsford, 2004, p. 4). The pelvic floor in women includes openings for the vagina, urethra and anus (Williams, 2023).

A multidisciplinary literature review published in 2018 on the role of the pelvic floor in respiration found that physical medicine literature assigns the pelvic floor "an important role in respiration, as a key player in the generation of intra-abdominal pressure, and as a primary expiratory muscle" (Emerich Gordon & Reed, 2020, p. 243) and is referred to as the pelvic diaphragm. In addition to their indirect role in breathing, the pelvic floor muscles serve a musculoskeletal function as part of the trunk stability mechanism (Sapsford, 2004), anchoring the perineal body, and supporting the pelvic viscera (organs; Primal Pictures, n.d.-f). Pelvic floor muscle activation

coordinates engagement of abdominal muscles, especially the external obliques and transversus abdominus (Sapsford, 2004). While the PFM does not contract itself independently, it activates transverse abdominis and internal oblique muscles to react and effect changes in intra-abdominal pressure (Park & Han, 2015).

In contrast, musical performance physiologist and respiratory specialist Alan Watson disagrees. Unless a singer suffers from pelvic floor weakness (for example, if they experience incontinence following childbirth), and specific exercises are needed to address the issue, Watson holds that there is no anatomical reason to contract the pelvic floor muscles. Singing should not require further contraction of the pelvic floor or buttocks according to him (2009).

- The activation of pelvic floor muscles for singing remains elusive and is not unanimous amongst voice scientists. Anecdotally, many teachers, YouTube videos and blogs are discussing the involvement of the perineum, but very little is written on the subject in published pedagogy or voice science literature.
- Inspiration: In medical literature, research supports the idea that the diaphragm will more efficiently contract and allow more air to enter the lungs if the abdominal muscles *and* PFM are relaxed during inspiration (Park & Han, 2015). This supports the idea of optimal breath management in singing but further studies are required to confirm the exact correlation of muscle power and pulmonary function (Park & Han, 2015).
- Expiration: PFM activate symbiotically with transverse and oblique muscles, which are the muscles principally engaged during expiration for singing (Emerich Gordon & Reed, 2018). Further research is needed to determine if the benefit of the added muscular support of the PFM extends to singing and if this affects phonation.

Pelvic Floor in Pregnancy. Pregnancy causes the PFM to stretch, weakening them (Van Geelen et al., 2017). Then in labour, vaginal births can lead to further stretching, pain and injury (tearing) or episiotomy (incision of the perineum and posterior vaginal wall) to the perineal region (Ince & Albar, 2021). For the first week or two, the vulva is typically engorged and swollen. By 6 weeks postpartum, the pelvic floor musculature (PFM) has almost returned to its pre-pregnancy tone and typically continues to ameliorate over the next few months, although for some, pelvic floor

dysfunction persists beyond this. It used to be that women had to accept incontinence as a part of motherhood, but the field of pelvic floor health has progressed greatly and we now understand that with professional help, all kinds of pelvic floor disorders are treatable. It is still debated as to whether the pelvic floor tonicity ever returns to "normal", and many suggest this is dependent on the level of trauma during childbirth (Ince & Albar, 2021).

- Dr. Anthony Jahn cites lost tonicity of pelvic floor muscles in the postpartum period as an issue for singers' vocal health. He suggests Kegel exercises but admits that the abdominal and pelvic muscles will not be in singing form for several months following childbirth. The stretching of the abdominal muscles and pelvic floor affect vocal support as they suddenly have "nothing to push against when you sing" (Jahn, 2011).
- "[I]t is well-known that the PFM relax during inspiration to help the diaphragm move downward, allowing inspiratory flow to increase" (Park & Han, 2015, p. 2114). Therefore, if injury (e.g., tearing, pain, tightened PFM) or pelvic floor disorders (e.g., nerve damage, incontinence) are impeding proper PFM function, this could be an issue for singing health and optimal breathing.
- "Pelvic floor disorders are stigmatizing conditions causing great physical and emotional suffering" (Huber et al., 2021). For singers returning to career following childbirth, decrease of quality of life due to pelvic floor injuries and disorders is a concern.

Discussion on Research. What do these respiratory and musculoskeletal changes mean in lived experience as a singer?

> While many body systems are affected by pregnancy, the mechanical changes to the respiratory and musculoskeletal systems have the most obvious negative consequences for singing. Pregnant singers must overcome feelings of breathlessness and adjust to postural changes (and potentially pain) that may interfere with nuanced expiratory airflow regulation. Pregnant singers who continue to sing throughout their pregnancy should be especially mindful to not adopt maladaptive compensatory strategies. (Harper et al., 2022, p. 1521.e2)

Body type and the size and rate of growth for both the baby and the mother are individual and each singer will experience these changes differently. Singing technique may help mothers adapt to the mechanical and anatomic changes in a more advantageous way than a non-singer. On the other hand, even small physiological changes can be frustrating to a trained singer. Perhaps knowledge that the mechanism is not necessarily impaired—that the body is dynamically adapting to these changes also—will allow singers to experiment to find more optimal ways to breathe and sing.

Sarah Harper's study on "Pregnancy and the singing voice: A survey of what singers report" (2019) investigated how singers perceived their singing and if it matched what they were expecting. She found that of the 321 singers surveyed, only half of them had been properly informed for the respiratory changes of pregnancy. Hopefully, moving forward, teachers and singers will continue sharing their stories, voice scientists will continue studying this period of singing, and together, will create a body of pedagogical and scientific knowledge to better arm the singing community for the realities (of both challenging maladaptations and miraculous adaptations of the body) of singing during pregnancy and through the postpartum period.

1.4 "What's the Matter with Grey Matter?": Matrescence and the Brain

matrescence | mæˈtres.ənts | noun

- the process of becoming a mother (Cambridge Dictionary)

grey mat·ter | ˈgrā ˌmadər | noun

- the darker tissue of the brain and spinal cord, consisting mainly of nerve cell bodies and branching dendrites (Oxford English Dictionary)

neuroplasticity | ˌnoo͝rōplaˈstisədē | noun

- the ability of the brain to form and reorganize synaptic connections, especially in response to learning or experience or following injury

> During puberty, sex steroid hormones have neurological effects, in addition to their influence on the reproductive system. They reorganize the brain, both structurally and functionally. The adolescent bombardment of gonadal sex hormones "initiates a spectrum of behavioral, cognitive, socio-emotional, physical and neural changes, including extensive reductions in GM [grey matter] volume, surface area and cortical thickness" (Hoekzema et al., 2017, p. 294). This synaptic "pruning" effect allows for the brain to re-network and refine its circuitry (Woodley, 2021, *A strong cocktail*, p. 5)

Matrescence. The word matrescence was first used by medical anthropologist Dana Raphael in her essay 'Matrescence, Becoming a Mother, A "New/Old Rite de Passage"'. While the origin of the term has anthropological implications which continue to have merit today ("who is mothering the mother?"; Raphael, 1975, p. 69), the term was recently reinvented by psychologist Aurélie Athan and soon after, reproductive psychiatrist Alexandra Sacks, to describe the life-altering developmental evolution into motherhood. By adopting a term with etymological roots to the well-established *adolescence,* Athan and Sacks attempt to give significance to this important psychological/physiological/social transition. The term *matrescence* has gained popularity in recent

years with arrival of the journalistic novel of the same title (Jones, 2023). Jones' accessible book combines scientific research, examples of maternity in the natural world, sociology and personal experience. Athan, Sacks and Jones, by highlighting psychosocial contexts of early motherhood, are also encouraging compassion for those experiencing the transition to motherhood. While the Oxford English Dictionary still does not recognize the term, medical articles, especially in the field of neuroscience, have adopted the term *matrescence* to refer to the synaptic pruning of maternal neuroplasticity (similar to that of adolescence).

Cognitive manifestations during *matrescence* and adolescence are very similar: the brain repatterns itself to encourage behavioural adaptations and make room for better communication between various regions of the brain in both transitional periods of life (Pritschet et al., 2024).

1.4.1 Effects of Pregnancy on the Brain

While research is ongoing and ever-changing in the relatively new arena of neuroscience, studies from the last few years agree that maternity brings about vast and lasting changes in the brain. While researchers are not in agreement about if, how, or when the pruned grey matter remodels itself after childbirth, new research suggests that maternal brains never return to their original state.

Neuroplasticity. The external layer (surface) of grey matter is called the cortex, or cortical matter. Studies from the last decade concur that pregnancy provokes neuroplasticity, with clear changes in grey matter volume (GMV), cortical thickness (CT) and surface area (Pritschet et al., 2024). Global grey matter volume continually decreases linearly as pregnancy advances. Specifically, grey matter volume and cortical thickness reductions are concomitant with increasing estrogen and progesterone levels throughout pregnancy. Conversely, during first and second trimester gestation, white matter *increases* before returning to baseline in the postpartum. A clear dynamic repatterning occurs during pregnancy (Pritschet et al., 2024).

In particular, the areas of the brain which are reduced were identified by Hoekzema et al.'s groundbreaking study as the social cognitive regions (2017). They demonstrated a link between the reduced neural regions and heightened emotional maternal response: when mothers were shown

pictures of their babies, the regions of the brain which were most reduced in fact demonstrated the most substantial neural responses. This supports the idea that while these regions are diminished in size, they are still active and actually exhibit stronger postnatal attachments (Barha & Galea 2017, 135). The synaptic changes serve adaptive purposes to help mothers transition to caregiving.

It appears that GMV and CT reduction is inherent to the biological act of pregnancy: fathers tested in the same Hoekzema et al. study did not exhibit these neuroanatomical changes (2017). Barha and Galea also state that while fathers exhibit reductions of testosterone and increased prolactin once they become parents, these endocrinal changes do not correlate to neural change (2017).[1]

Cognition. In addition to neuroplasticity, pregnancy also incurs cognitive changes (Orchard et al., 2023). Subjectively, 80% of new mothers have reported experiencing a cognitive decline during matrescence, including absentmindedness, and declining memory and concentration. Objective reports concur that cognitive changes occur during pregnancy, especially in the last trimester, although not to a point of disruption (general cognitive functioning is still "within the normative range"; Orchard et al., 2023, p. 304). On a positive note, mothers in the 3rd trimester registered "a general enhancement in learning and retention and a specific enhancement in memory of infant-related stimuli…as well as general improvements in hippocampal-dependent memory [auto-biographical or episodic memories]" (Orchard et al., 2023, p. 307).

Q: What causes this cognitive decrement?

A: The cause of cognitive impairment does not overwhelmingly appear to be hormone-driven in late pregnancy/postpartum, but rather due to the drastic environment and psychosocial changes which accompany pregnancy (Orchard et al, 2023). Preoccupation with the emotional preparations of a baby's arrival and added stressors (e.g., changing relationships, worry about the birth) might contribute to the decrement.

[1] For the purposes of this dissertation, studies on non-biological mothers or other caregivers have not been included although research is available on this subject. The findings from the studies above on fathers is solely included to represent the control groups of the studies and to illustrate the complexities of the maternal brain. The 2023 review by Orchard et al. contains further references (listed in the publication's discussion in Box 3) on the subject.

1.4.2 Effects of the Postpartum Period on the Brain

Neuroplasticity. Much is yet to be understood regarding what happens to synaptic pruning after the arrival of a baby. At first glance, recent postpartum studies seem to contradict each other with two competing theories: 1) the brain is forever changed and 2) some areas of the brain remodel, and grey matter increases, either through regenerating/rejuvenating cellular tissues or by reorganizing itself. These are discussed in more detail in the Spotlight studies below; however, research seems to agree that a map of the postpartum brain does not perfectly match the nulliparous brain map (Martínez-García et al., 2021). Some regrowth occurs, but the cortical changes are dynamic and may include factors such as the type of delivery. Future studies will hopefully offer a clearer picture (Luders et al., 2020).

Cognition. As in pregnancy, mothers also regularly report memory impairment into the postpartum period. However, when measuring objective performance, no decrements are revealed in the vast majority of studies (Orchard et al., 2023). This is contradictory to the consistent measures and subjective reporting during pregnancy. A few studies found poorer cognitive measures between 3-8 months postpartum while others show improvements in cognitive function a year or more postpartum. It is suggested this may be related to the reduction of breastfeeding/weaning (Orchard et al., 2023). Environmental factors include an increased cognitive load for new mothers (e.g., more responsibilities, flexible planning of naps and feedings, long checklists of things to prepare just to leave the house), in addition to lack of sleep and low mood-related difficulties (there are strong links between mood and memory as well as sleep and memory; Orchard et al., 2023). This increased cognitive load leads to lapses in concentration or memory and simultaneously creates a heightened awareness or sensitivity of these exact lapses (Orchard et al., 2023).

While objective cognitive decrements are not fully understood for the postpartum period, there do seem to be *positive* adaptations in cognitive function. Tools, strategies and mechanisms develop to compensate for the cognitive challenges that present postpartum (Orchard et al., 2023). In one recent study, it was shown that mothers demonstrate better executive function and attention even up to the 3 years studied (Miller et al., 2020). Being able to resolve conflict, manage competing demands as well as self-regulate, improve executive functioning which in turn strengthens cognitive

abilities (Orchard et al., 2023). Studies also suggest that the brain responses change following childbirth, either through neural compensation (networks are activated differently) or by enlisting additional neural mechanisms (Orchard et al., 2023). Mothers are not able to see these changes perhaps, but the brain is able to adapt to the new challenges facing mothers.

Q: What effect does having more than one child have on the brain?
A: Cognitive benefits due to motherhood are likely long-lasting or even permanent (Orchard et al., 2023). They are also cumulative which suggests that multiparous women (more than one child) outperform primiparous (one child) women. Not only is the maternal brain readapting with each baby, but as the children grow, behavioural adaptations will only continue to respond to these developments. No child is the same, so parenting is constantly evolving with each child and each stage (Orchard et al., 2023).

➡ At this moment, no studies have been found on how the adapting brain relates to singing. Transferable knowledge can naturally create links as to how a singer returning to a highly variable career is dealing with even more environmental change and likely added stress. Perhaps understanding that postpartum cognitive decrements are mostly subjective and being aware of the multitude of ways the brain is adapting to new environmental, behavioural and cognitive loads could be reassuring. Understanding matrescence as a normative period of transition might help singers feel confident that the brain is endlessly adapting and transforming with the new caregiving role (Athan, 2024).

Spotlight Studies. The seminal Hoekzema et al. 2017 study is often cited for its contribution to understanding how neuroplasticity promotes maternal behaviour. However, since its publication, subsequent studies offer somewhat contradictory ideas as to the permanency of the synaptic changes. When Hoekszema et al. followed up on their study two years postpartum, only one area of the brain which had previously decreased during pregnancy showed regrowth (the hippocampal cluster): all other regions remained at their reduced surface area (2017). The study did not follow-up on all areas of the brain, so it is possible that remodeling happened in other brain regions (Luders et al., 2020). Martínez-García et al. (2021) also found that the gestational cortical changes remained—

even up to six years postpartum. When they compared scans from mothers to a nulliparous group, the maternal brains were clearly differentiable. Barha and Galea support the idea that pregnancy changes a woman's brain, proposing that these changes last even into old age (2017).

In contrast, the postpartum measures of the 2024 Paternina-Die et al. study found that although there were still instances of reduced cortical matter, the reductions affected fewer regions postpartum than in the gestational period. The scans suggest that at some point following childbirth, the decreasing trajectory is reversed, and some areas of the brain remodel. Furthermore, they found the postpartum increase in cortical matter does not seem to happen at the same rate for everyone. Correlations were discovered between the global postpartum cortical changes and the way the mother laboured and gave birth. The cortical change reversals were different between mothers who had planned caesarean section births and mothers who initiated labour (regardless of whether they gave birth naturally or by emergency C-section in the end). The authors of the study hypothesize that during dilatation in the first stage of labour, pro-inflammatory signals are released and, in tandem with estrogen, oxytocin, and prostaglandins, they precipitate the next stages of delivery. This onslaught of hormones and immune responses seem to elicit neuroplasticity, effecting possibly greater decrease in grey matter before rebuilding gradually. This study illustrates the dynamic trajectory of cortical changes that maternal brains experience and suggests that factors such as type of delivery may contribute to variations of when, where and how these decreases and increases occur in the brain (Paternina-Die et al., 2024).

Discussion on Research. While the Hoekzema et al. study did not specifically measure memory loss, the authors propose that the reduction and regrowth of the hippocampal cluster are also responsible for memory deficits that mothers often experience, (including verbal recall) but which are reported to return around two years postpartum. As memory plays a large part of a singing career, further studies will be interesting to follow, as we seek to better understand postpartum brains. It is important to note that research is constantly developing, and new studies are increasingly adding to our knowledge on perinatal neuroplasticity and neurogenesis ("growth and development of nervous tissue"; Oxford English Dictionary). In 2024 alone, multiple new studies were published which offer insights into this sensitive area of maternal health. Yet there is much left to understand, especially across larger and more diverse population samples.

1.5 "Who am I?": The Psychology of *Matrescence*

Understanding more fully the tsunami of physiological and psychological changes a new mother experiences is imperative in supporting both baby and mother. Indeed, "[t]he neuroanatomical changes that unfold during matrescence may have broad implications for understanding individual differences in parental behavior vulnerability to mental health disorders and patterns of brain aging" (Pritschet et al., 2024, p. 2258). Being aware of the adaptive and maladaptive properties of neuroplasticity promotes self-compassion during matrescence and promotes a gentler and kinder way to experience this life-altering transition.

1.5.1 Postpartum Anxiety and Depression (Perinatal Depression)

The well-known onset of depressive episodes in the postpartum period have been referred to in medical literature "since Hippocrates" (Trifu et al., 2019, p. 410), but despite the growing body of research on postpartum depression (PPD), it is still not fully understood. Recently, the term has been changed to perinatal depression to reflect the fact that onset is now understood to start in pregnancy for some women (Carlson, et al., 2025). The majority of the literature cited used postpartum depression (PPD) but this will likely change in future studies.

Similar to other forms of depression ("diminished pleasure, feelings of worthlessness, and recurrent thoughts of death"; Schwab-Reese et al., 2016, p. 109), PPD also includes symptoms of negative thoughts towards the baby. Symptoms begin during pregnancy or the postpartum (called *peripartum*—up to four weeks postpartum*; or perinatal*—up to a year postpartum). Endocrinal imbalances, psychosocial changes, and cultural factors are suggested as main factors. Age (mothers under 25 are especially at risk for mental disorders) and sleep disorders (insomnia is linked to suicidal thoughts) are also risk factors (Schwab-Reese et al., 2016).

It is reported that 15-25% of mothers suffer from perinatal (pregnancy and postpartum) depressive episodes. An average of 18% of mothers experience postpartum anxiety in the three months after delivery. Symptoms include "racing thoughts, excessive worry, and tension" (Schwab-Reese et al., 2016, p. 110). Mild transient dysphoria experienced in the week following childbirth is commonly called "baby blues" but is not considered PPD (Trifu et al., 2019). Varying rates of reporting show that 25-80% of all mothers experience baby blues (O'Hara & Wisner, 2014). Despite

these high numbers, it is believed that maternal depression is under-recognized, and symptoms are too often left untreated. Many mothers are afraid to admit their "depressive state during a time of expected happiness" (Brummelte & Galea, 2009, p. 767). This is compounded by the fact that many signs of depression (e.g., changes in appetite or sleep pattern) are synonymous with being a new parent.

The effects of maternal depression are numerous on both mother and child. It affects the attachment and interaction between them, as well as between romantic partners. Cognitive and emotional capacities and development of motor and social skills of the child can be diminished if left untreated (Brummelte & Galea, 2009). Treatments for women who are breastfeeding are under-researched due to the possibility of passing medications through milk to the baby but increasingly, researchers are looking to hormonal treatments in response to the strong endocrinal link to PPD. Speaking to health professionals is important for women to receive the help they need to cope with this stressful time of life (Brummelte & Galea, 2009).

Spotlight Studies. A study by Schwab-Reese et al. (2016) has shown that returning to employment can reduce the odds of women experiencing PPD symptoms. This study investigated maternal depression, anxiety and stress in relationship to a return to employment. Financial security (which in turn diminishes stress levels), heightened sense of competence, and added support at home from friends and family were cited as possible factors contributing to this improved mental health, although inversely, an absence of one of these factors would create less favourable conditions. Contrary to previous research, they did not find job strain to be a factor influencing wellness. They did find psychosocial environments to be the most indicative of wellbeing at work: social environments that were warm and caring reduced rates of anxiety more than social environments that were focused on output and tasks. Mothers' perceptions of "coworker relationship[s], improved communication and sharing of knowledge were associated with reduced odds of above usual anxiety and stress" (Schwab-Reese et al., 2016, p. 116).

Mitigating Symptoms. "Women with higher levels of physical activity were less likely to report depressive symptoms. Conversely, women with depressive symptoms were less likely to meet physical activity guidelines than those without symptoms. Exercise remains a promising therapy

option for perinatal depression" (Temme, 2015, p. 260). Eating well and regularly and accepting help from family and friends, especially with domestic work is also important (Bertrand, 2008). Talking with a loved one you trust, or a health provider or therapist is beneficial, and if need be, antidepressants are available for moderate or severe depression (Bertrand, 2008).

In a guide for health professionals in British Columbia, Lynn Bertram discusses the importance for women to maintain and build adult relationships (2008). Caring for a baby full-time can lead to loneliness. Social support groups and relationships with other mothers can provide a shared experience, connection, validation and safe space for discussions. Many types of support groups exist and take many forms, but maintaining adult relationships of any sort is beneficial, and can reduce vulnerability to PPD (Bertrand, 2008).

The general well-being of a mother is of importance when considering a return to professional work after pregnancy. The choice of when to return to a singing career is personal, based on each mother's situation, but creating open, caring environments for a new mother is certainly beneficial and should be easily implanted into any workspace.

Discussion on Research. It is easy to say that women should not feel afraid to seek help; however, research shows that it is rare that a mother is able to recognize her own symptoms of PPD (Bertram, 2008). Many times, family members and general practitioners alike do not ask enough questions or assume that the mother is coping well until she asks for help. However, she may be feeling guilt (especially if she or others in her circle have had any problems with fertility); shame (self-judging and low self-esteem can worsen this); be discounting her feelings (blaming them on fatigue, for example); or be expecting herself to "snap out of it" (Bertram, 2008, p. 28). This is especially common with women who are used to feeling in control, organized perfectionists, or those who feel a responsibility to be the strong emotional partner. Difficult emotional issues like previous abuse and loss (of previous pregnancies or loved ones) can compound the feelings of depression and overwhelmingness (Bertrand, 2008).

1.5.2 Psychological and Occupational Considerations of Matrescence

> Women who transition through preconception, pregnancy and birth, surrogacy or adoption, to the postnatal period and beyond, experience a[n] acceleration in multiple domains true of any developmental push: bio-psycho-social-cultural-spiritual. A theory of matrescence provides a destigmatizing and agentic lens for mothers of all kinds to identify, explore, cope with, and shape their destinies according to their own individual differences (Athan, 2019).

The decision to become a mother might be long-awaited or be a complete surprise. In either case, as pregnancy progresses, changes to the body and to the psyche instigate a lifetime of worry, love and other complex emotions. Too often, the wellbeing of a mother is measured solely by the absence of mental illness and discussions about the baby's health, ignoring completely the growth and positive attitudes maternity can bring for the mother (Athan, 2024). There is a recent call from maternal psychologists to a) create a framework based on strengths and self-development; b) to research the resiliency of mothers; and c) in the words of the 2018 World Health Organization, to highlight how women "flourish" during *matrescence* (Athan, 2024, p. 2). Motherhood encompasses both positive and negative transitions across all body systems and psychological/sociological narratives. Athan suggests that to fully understand the complexity of motherhood, multidisciplinary collaboration is needed to redefine the "developmental transformation that is biological, neurological, psychological, social, cultural, economic, political, moral, ecological, existential, and spiritual in nature [and] should also involve classifying both the developmental challenges *and* opportunities possible within each of these domains" (2024, p. 3).

Spotlight Studies. Athan (2024) manifests the need to go beyond clinical perspectives and include developmental ones when discussing the experience of mothers. This sort of theoretical innovation requires that conventional bio-psycho-social domains be expanded to include ideological domains. Conventional domains which define the motherhood experience include *biological* (hormonal changes, physical challenges); *neurological* (neuroplasticity, derogatory colloquial 'baby brain'); *psychological* (possibly maladaptive rumination, perfectionism,

hypervigilance; extended responsibilities, mental and emotional load); positive adjustments over time, resilience); *social* (new anxieties, boundaries of belonging, peer pressure; changing relationships; issues of parenting styles); *cultural* (inclusion of all family-types and child-rearing models; respect for cultural/regional practices); and *economic* (gender biases, premature workforce exit, availability to family-leave and equitable pay practices). Athan suggests that the following domains should also be included: *moral* (reflections on systemic oppression within childcare, healthcare and workforce; increased awareness and compassion for realities of others); *ecological* (environmentally-driven behaviours; new habits and attitudes against overconsumption, climate change); *existential* (reassessing priorities, responsibilities, personal choice; changing perspective of self-sacrificing mother to a mother-child relationship of mutual interdependence); and *spiritual* (motherhood sometimes rekindles spiritual practices or comfort in a larger meaning).

Discussion on Research. Assessing the totality of motherhood through the wider lens of these domains offers a more realistic view of the changes a mother might be experiencing. While Athan's suggestions are geared towards healthcare, understanding motherhood through this larger framework is important for society and mothers alike when considering the challenges *and contributions* mothers experience and offer (2024). Since mothers also continue to exist as adult human beings beyond their maternal roles, this kind of holistic research is important. Not only the clinical aspects of physiological change but the lived experience of occupational and emotional changes as well must be considered in voice literature on peripartum women.

Occupational Implications for Singers. Gardner, in her 2017 dissertation, offers a similarly multidisciplinary framework for discussing the social pressures and possible taboos pregnant singers are facing. These physiological, psychological and societal issues may be positively overcome by an individual, but situating the singer in this "broader ecological system" (Athan, 2024, p. 5) acknowledges the added psychological load singers might be carrying. The following is a summary of examples of social pressures reported by Gardner as related to singing.

Balance. Work-life balance is always of relevance, but for pregnant singers, balance between health and work and life is of utmost concern. Singers so often: want to be a good performers, giving

performances at the level they are used to achieving while the instrument is changing; want to prove being pregnant is not “problematic” while simultaneously caring for their own health (p. 42); must organize contracts around the birth and recovery time (while not knowing how much time they will actually want or need); want to protect and promote their careers so as to have work to return to; want to be good mothers and carry the baby to term without any actions that could endanger its health; have to choose between “physical well-being and fulfilling performance obligations”; p. 92); balance a public life as a singer with the private life of a family. To the latter point, Gardner offers examples from singers who were surveyed, highlighting how all these juggled balls of responsibilities and stressors are further magnified by the public nature of a singing career.

Security (Financial and Career). In North America, singers are most often self-employed. Job security means having enough contracts to pay rent, and there is no maternity leave that requires an employer (because there isn’t one!) to save a job for you when you return. While this is a reality for all self-employed workers, singing, as evidenced in discussions on physical health and hormones, relies on the body for its work. Much like athletes, career security is linked to the one thing we cannot control: our health. This engenders a great deal of stress, on top of the financial instability of needing to take time off to birth a child. Canada now includes self-employed workers in their Employment Insurance Plan; however, it requires registering and paying premiums for 12 months for access to the program, which is not always practical (Government of Canada, 2025, Self-Employed). In Québec, all self-employed people and wage-earners pay into the Québec Parental Insurance Plan and so this 12-month premium-paid wait is not required. The plan is administered differently in this province (Government of Canada, 2025, QPIP).

Job Security for Artists. Gardner tells the story of Audra McDonald taking time off for pregnancy from *Shuffle Along* on Broadway, a hiatus which prompted the show being cancelled. McDonald (or precisely, her time off for pregnancy) was blamed for an entire company losing work. Controversy regarding the timing of her pregnancy announcement and the blame of the show not being viable without her highlights the responsibility and stress that a high-profile singer might experience surrounding pregnancy. In contrast, singers who are less established than Audra

McDonald are afraid of not being hired once pregnant. Gardner relates the response the blog broadwayblack.com gave about this story:

> Equal rights for women in the work place [sic] is an uphill battle. When you add on pregnancy you usually end up rolling back down that hill wild and fast. Audra McDonald's only job security is the fact that she is "AUDRA MCDONALD". If she were anyone else, the possibility of her returning to the show after her pregnancy probably wouldn't have been an option. (2017, p. 36)

This quote illustrates the fear for job security many singers experience. In addition, timing pregnancy within fertile years in a competitive career haunts singers, especially in the face of such public stories as McDonald, or Julie Fuchs (French soprano fired from contract of *Die Zauberflöte* at the Hamburg Staatsoper in 2018 for being 4 months pregnant; Hewitt, 2018).

Outward Appearances. Pregnancy is a physical representation of sex. For those in jobs of authority, Gardner suggests this can elicit disapproving responses (e.g., a pregnant university professor reports being treated with less respect from her students once she is visibly pregnant; 2017). For singers, the look of being pregnant might go against the physicality of the role (e.g., Cherubino, Octavian) or the physical demands of staging (da Fonseca-Wollheim, 2023). Not all singers wish to be active on stage during pregnancy, but the question of physical safety also ends up being a "safe" way for companies to un-hire a singer who's pregnant (soprano Kathryn Lewek was removed from a role when she arrived with a "visible baby bump. Citing safety concerns involving the set, the company urged her to withdraw…even though she felt comfortable with what the production required of her"; da Fonseca-Wollheim, 2023).

In a discussion on how medical and technological advances have revolutionized women's health (Gardner mentions continuous use of birth control for athletes and performers as a way of staving off menstrual cycles; combined planned caesarean sections and tummy tucks), "[t]echnological advances have provided us with the sense that we can control many aspects of our life and health, and have perhaps contributed to a separation of our instinctual, basic needs from the glossy veneers of our professional personas" (38). Imperfections (e.g., growing stomach,

morning sickness) in a world of airbrushing might be adding stress to a singer, actor, performer, woman, as societal norms impinge on her own inner dialogue.

Career Taboo. Singers are sometimes told, evidenced by Gardner's own experience, *not* to get pregnant. Likely a combination of the aforementioned stressors and fears of a career having to "compete" with family, anecdotally, generations of singers have been warned off the temptation of motherhood in favour of 'dedicating' oneself to a long, successful career. Luckily, more and more singers are choosing to disregard this advice, as evidenced by Gardner's survey of 444 women, or the 2023 New York Times article on successful mothers with international singing careers (da Fonseca-Wollheim).

Q: What did Gardner's 2017 study reveal about the psychology of singing pregnant?

A: While she did not ask specifically about the psychological impact of pregnancy and postpartum, she did find that when asked for further information about their physical changes, several mothers mentioned episodes of panic attacks, an increase of depression, stress, anxiety and hallucinations. As for emotions pertaining to singing, 70% of her respondents felt that psychological changes not only influenced their daily emotions, but "impacted their interpretation and emotional connection to their repertoire" (p. 105). Thirteen percent felt that anxiety increased after childbirth, but the majority of her participants reported no change, and in some cases, reported less performance anxiety.

Q: Were there other notable psychological changes?

A: Gardner's study also found that 71% of the singers studied attributed a change of priorities to pregnancy. Firstly, singing started to play second fiddle to the impending birth, which sometimes reduced stress; and 50% experienced a change in perspective on competitions and rejection (whether for the better or worse was not mentioned). Secondly, for many of the singers, their bodies imposed a change of priority. Health and wellness had to come first, and many of them reduced singing activities for this reason.

The Gardner study offers a fantastic base for future research. Broad questions covered many topics and brought to light many challenges that singers have faced silently over the years. It also helped clarify next steps: asking specific questions to elicit in-depth nuance, and the targeting of a specific population so that comparisons could be made from women who had recently given birth and could talk about the postpartum period specifically. Focusing on experiences of holistic rehabilitation following childbirth seemed to be a natural next step.

Discussion on Research. Recently, research has expanded to include qualitative, subjective experiences of motherhood in various disciplines, including nursing/midwifery, sociology, and anthropology. This research offers "refreshing and welcomed invitations into the lived experiences of women who in their own voice narrate how they negotiate motherhood" (Athan, 2015, p. 6) in addition to the growing body of scientific studies on the experience of matrescence.

This approach is reflected in the present study *Singing After Childbirth,* which encompasses the lived experience of occupational and emotional changes, as well as physiological change. It responds to the need for a larger framework when considering the complex experience of matrescence for postpartum women in voice literature.

1.6 "The Show Must Go On": Recent Research on Singing Postpartum

Over the last decade, several North American singers pursuing doctoral studies have sought out more information on how life cycles affect the voice and singing career, dedicating their research to the experience of singing through pregnancy. The highlights of their research are outlined in this section.

1.6.1 Literature Gap: Pedagogy

Catherine Gardner, 2017, Doctor of Musical Arts Dissertation, University of Toronto. As part of Gardner's initial literature review, she surveyed a plethora of pedagogical books for teachings on how to sing through pregnancy (2017). She found one single mention of pregnancy in all the pedagogy books she reviewed—one small entry in volume five of the series *Excellence in Singing*. The volume, dedicated to vocal health and disorders, listed the ailments and physical changes that accompany pregnancy with the admonishment that singers should be discouraged from singing if abdominal support is jeopardized. While not wrong (singers do need "abdominal support" to sing—this is not something that is new to pregnancy), the pedagogy resource did not offer examples or detail on how to be careful. It is no wonder that singers have had to look to each other for answers. Gardner cites the many online forums and blogs dedicated to performing and pregnancy. She posits "[g]iven the lack of holistically centred resources and research available to pregnant classical singers in scholarly research and pedagogical resources, it is not surprising that the topic of pregnancy comes up repeatedly in various online forums" (p. 44). Thankfully, more and more teachers have experienced childbirth or are aware that it is physically possible to carry a child and continue singing in a healthy way (Gardner, 2017); and, as evidenced by the earlier chapter on hormones, voice science is finally catching up to vocal changes through the woman's lifespan.

In a study deciphering where singers receive information on singing during pregnancy, it was found that most singers turned to teachers and colleagues rather than to health care providers (Harper, 2019). The author advises that this "should encourage vocal pedagogy programs to include the responsible dissemination of information regarding pregnancy-related voice changes for future voice instructors", and that "interdisciplinary outreach and education between the medical and the

vocal performance and education fields might facilitate a better understanding of the changes and experiences of singers who are pregnant" (Harper, 2022, p. 1521.e9-10).

1.6.2 Musculoskeletal Considerations Postpartum

Throughout pregnancy, relaxin loosens the "protective tendons and ligaments of the lower back [which] become looser than normal" (Williams, 2023, p. 9) In addition, the abdominal muscles are working harder for postural maintenance, often making them both less responsive and more tense. The centre of balance shifts forward with the weight of pregnancy, which changes posture and possibly breath support for singers (Williams, 2023).

> The progressive increment of the anterior abdominal dimension leads to morphological adaptation of the abdominal muscles by lengthening their fibres up to 115%, changing their line of action, altering their angle of insertion and reducing their thickness. The consequences are compromised functional ability, poor torque production and reduced ability to stabilise the pelvis against resistance. The latter may be implicated in back pain during pregnancy. (LoMauro & Aliverti, 2015, p. 299)

The hypermobility and change of gravity due to hormones and the growing uterus affects the spine (Harper et al., 2022). The back muscles increase their support, and the result of these changes is often back and pelvic pain. A study from the European Spine Journal in 2015 documented the very common phenomenon of spinal deviations during pregnancy. They suggest that although abdominal weight decreases rapidly following childbirth, the musculoskeletal system takes a while to return to pre-pregnancy levels (Betsch et al 2015).

During pregnancy, lateral deviation (scoliosis) is decreased, creating a more upright position which seems to continue into the postpartum (Betsch et al., 2015). The authors postulate that women develop increased back muscle strength and muscle mass to compensate for the extra weight of pregnancy which likely continues into the postpartum period. However, in contrast, a significant increase was found in thoracic kyphosis (a pronounced anteroposterior S-curve in the higher spine) between the second trimester and postpartum measures. This pronounced forward spinal curve in the upper back worsened between pregnancy and three-months postpartum,

according to the study. No hypothesis was offered; however, caring for a newborn requires many new positions. It is likely this exacerbates the already pronounced increase of a "hunchback" in pregnant women (Betsch et al., 2015, p. 1287). No significant changes are reported by Betsch et al. as to the pelvic position in postpartum.

Lower back pain (LBP) is very common, affecting two thirds of women in pregnancy (Temme, 2015) although reports vary between 20-90% prevalence (Betsch et al., 2015). Women with prior LBP are 50% more likely to experience it during pregnancy (Temme, 2015). Roughly 85% of women with LBP in pregnancy will experience recurrence in later pregnancies and 10% of women who experience chronic LBP (beyond pregnancy) trace the onset of their issues to pregnancy (Temme, 2015). Unfortunately, LBP can incapacitate women and is linked with depression and lower activity levels (Temme, 2015). Pelvic girdle pain (pain between the posterior iliac crests and gluteal folds) is also very common, both on its own and in conjunction with LBP (Temme, 2015). Any major discomfort in the body will cause issues for singers. Postural discomfort means that breathing might be hampered, and ease of movement will decline.

➡ Poor habits or compensatory tension that have accrued during pregnancy might continue into the postpartum and require conscious effort to remediate. On the other hand, helpful technique changes that were employed during pregnancy might be further explored postpartum.

➡ While studies have not offered information as to exactly *why* or *how* these changes arrive, there are very likely musculoskeletal considerations involved in addition to major endocrinal changes and lack of sleep, nursing and caretaking. These factors can all lead to dehydration, and causality is difficult to measure (Dickson, 2014). Dehydration affects all postpartum women, but singers should especially be conscious of ensuring regular hydration for healthy vocal folds.

➡ According to otolaryngologist Dr. Anthony Jahn, it is advisable that singers wait at least two weeks before singing, to allow rest and healing (Williams, 2023). At that point, being patient and mindful is the best practice: after weeks of rest, the larynx will be in a higher-than-normal position and vocal fold edema or hemorrhage might still be present (Jahn, 2011).

➡ Williams reports (based on advice from otorhinolaryngologist and voice scientist Robert Sataloff) that most postpartum vocal strain is generated from a singer creating tension when running out of breath in extended phrases. It might take time for the body to return to singing longer phrases

while the abdominal muscles recover. He suggests consciously taking extra breaths rather than poorly adjusting breath control in an attempt to regain pre-pregnancy strength and stamina.

Mitigating Symptoms. Exercise both while pregnant and in the postpartum has been shown to reduce prevalence and severity of LBP (Temme, 2015). Postpartum backpain can be pre-emptively and greatly diminished with exercise (especially water-based) in the second half of pregnancy.
See section on exercise in Chapter four “Things I wish I had known”: Applications and resources.

➡ Using the mirror for consistent visual feedback, stretching, and possibly using a binding garment (high-waisted binders with flexibility) can help a singer retrain posture and abdominal muscle strength that might be less responsive in the early postpartum (Williams, 2023).

1.6.3 Delivery and Recovery as Considerations

Pregnancy and delivery experiences are very individual. The type of labour and delivery impacts recovery even weeks or months after the birth as does the level of perineal trauma and overall health of both baby and mother (Harper, 2019). Most deliveries are positive experiences with relatively easy recoveries. However, some vaginal deliveries leading to episiotomy (surgical cutting of the perineum), or which use forceps or vacuum, can result in maternal trauma and prolonged healing time (Muraca et al., 2023). Caesarean sections can traumatize the recti abdominis which can affect recovery (Jahn, 2013). Postpartum discomfort and numbness of the scar area and feelings of “total disembodiment from the lower half of [the] body” can be experienced, even after uncomplicated surgeries (Neely, 2020).

Cara Williams, 2023, Doctor of Music Dissertation, Louisiana State University. Cara Williams dedicated her doctoral dissertation to rehabilitation following childbirth, especially pelvic floor rehabilitation. Labour and delivery can be very taxing on any person, but for singers, certain aspects can impact vocal health. Intense pushing required in labour can cause vocal fold edema and even hemorrhage (Williams, 2023). Trauma to the laryngeal mechanism (e.g., from screaming, throat clearing, holding breath and pushing) is possible with vaginal births (Ulkumen et al., 2022). Williams suggests that preparing and practicing healthy methods of breathing and vocalizing while

pregnant can be helpful, so that the body responds in like manner during labour. While reality may not line up with what you practiced (the body might need a different method), having practiced “lip trills, low moans, vocalizing on vowels, or singing along to meditative or empowering songs” will arm a singer with healthy techniques to try throughout the labour and delivery (p. 11). Elizabeth Noble suggests moaning in the moments before delivery: “sounds is [sic] energy and energy flows” (2003, p. 157).

Stretching and injury to the perineal region is common during delivery; and the vulva is engorged following childbirth, which tends to resolve within a week or two. By six weeks, muscles return to a nearly normal level of tonicity, depending on “how much trauma to muscular, neural and connective tissue was sustained in childbirth” (Ince & Albar, 2022, p. 31). The process of the organs returning to their non-pregnant state is called involution. Immediately following birth, rapid contractions in the uterus begin the process, which the mother feels as cramping. At this point, the uterine mass is 1kg; by one week postpartum, it is 500g; and by six weeks, approximately 50g; but it never fully returns to its pre-pregnancy size (Ince & Albar, 2022).

➡ The voice needs time to rest at the same time the body is healing. The amount of time that will take is extremely individual: pregnancy health, weight gained, difficulty of labour and type of delivery are all factors as well as the ease with which the mother adjusts to parenting (sleep, ease in feeding and partner involvement as well; Williams, 2023).

➡ Any important postural adjustments (and musculoskeletal pain) should be undertaken with help from an orthopedic physiotherapist; and pelvic floor physical therapists can help with rehabilitation to the perineal floor, which will ensure healthy return to singing. Williams suggests singers consult with their voice teacher and a medical professional if needed after first self-assessing (2023). The pelvic floor for example, when healthy, stretches with inhalation and contracts with exhalation. Singing with support and beauty of tone is best done with properly functioning coordination between the diaphragm, abdominal wall, and pelvic floor (Neely, 2020).

➡ “Singing is an excellent isometric exercise targeting the weak postpartum abdominal muscles, and so singing can rehabilitate both the body and the spirit when the new mother feels ready to do so” (Pitman Will, 2013, pp. 22-23).

Mitigating Symptoms. Williams' thesis offers helpful information about how to properly engage the pelvic floor following childbirth, the importance of pelvic floor rehabilitation and offers helpful assessments and exercises. Every person is different: while most people anecdotally talk about needing to 'firm up' muscles following pregnancy, sometimes it is the opposite. Williams shares her experience that her pelvic muscles were too tense, and she required physical therapy and breathing exercises to relax them (2023).

Andrea Pitman Will, 2013, Doctor of Musical Arts Dissertation, Arizona State University. Pitman Will's pioneering 2013 dissertation is focused on singing and the prevention of and recovery following a caesarean section and diastasis recti (a separation between the rectus abdominus due to a weakened linea alba). While this present dissertation will not focus on disorders, it is important to mention that prevention is the best way to avoid disorders such as diastasis recti (see mitigating symptoms).

Pitman Will's cited sources recommend returning to *non-singing* work (e.g., teaching) post-caesarean at a reduced workload at 6 weeks; and to full-time non-singing work at 8 to 10 weeks. She suggests that singers rest for six weeks following caesarean sections before beginning short (10 to 15 minute) singing sessions a day. Increasing the practice sessions in time and vocal range allow for a return to singing roles and recitals as of six months, according to her.

Mitigating Symptoms. It behooves a singer to exercise regularly, if possible, during pregnancy. Abdominal work helps not just the pregnancy (counteracting postural discomfort and enabling efficient breathing), but ensures a faster recovery. Pitman Will quotes Elizabeth Noble's guide "Essential exercises for the childbearing year" (2003) which suggests that healthy, active, supple muscles will recover faster. Both Pitman Will's dissertation and Noble's guide are wonderful resources on how to effectively and safely exercise, from the hospital bed to home.

Immediate recovery can begin with deep breathing. Moving the lower extremities (stretching feet and bending knees in alteration, circling the ankles, isometric exercises) will improve circulation, prevent thrombosis and prepare for walking, which is beneficial as soon as it is permitted. Pitman Will suggests many exercises in preparation for sitting, standing and walking following a caesarean section. Movements that will not exacerbate the incision and carefully chosen

and initiated exercises to restore abdominal function will ensure a faster recovery. Aerobic exercise is not recommended until six weeks following surgery, but breathing and walking exercises with rest, when necessary, are suggested.

1.6.4 Acoustic and Aerodynamic Considerations in the Postpartum

"[A]n essential part of a professional singer's skill must be the ability to produce sound of high timbral quality even under adverse phonatory conditions" (Lã & Sundberg, 2012, p. 437).

Background on Acoustic and Aerodynamic Measures on Voice. Marion Dickson (2014) describes efficient, quality sound production as a combination of the function of the extrinsic and intrinsic laryngeal muscles and proper airflow. Phonation is created by the vocal folds' vibratory cycle (specifically created by the lamina propria and superficial layer of vocal folds). The vibratory cycle is sustained by continuous airflow: 1) vocal folds close thanks to the lateral cricoarytenoid muscles; 2) when just enough air pressure has built up beneath the folds (subglottal pressure) to separate them, the phonatory threshold pressure is reached; and 3) a pulse of air is emitted which becomes acoustic energy; 4) multiple pulses of air are created as airflow continues and the vocal folds continue to vibrate; 5) the pulses of air become acoustic pulses which travel through and are shaped by the vocal tract; 6) the acoustic pulses are released at the lips; and 7) the folds close again through muscular elasticity (Dickson, 2014). The vocal fold function, along with the vocal tract resonator, creates sound that contributes to voice timbre.

Voice scientist Johan Sundberg describes the acoustic result of the vibratory cycle as having threefold characteristics (1987): fundamental frequency (pitch), amplitude (loudness) and spectrum (timbre). The quality (beauty) of the voice is subjective, and so the efficiency of vocal production becomes an important part of acoustic analysis. Onset, agility, range and vibrato are used as vocal characteristics to describe the quality of a voice. "Vocal qualities that include balanced onset, agility, and appropriate vibrato, when produced with sufficient energy, consistent thoracic support, and with proper pharyngeal configuration, result in increased beauty and efficiency of tone" (Dickson, 2014, p. 20).

Marion Dickson, 2014, Doctor of Musical Arts Dissertation, University of Houston. In her doctoral thesis on acoustic and aerodynamic changes in pregnancy and postpartum, Dickson designed a self-administered case study. She studied how the airflow, phonation and acoustic measure adapt through pregnancy and into the postpartum. She took acoustic and aerodynamic measurements at 28, 30, 34, 36, and 39 weeks gestation, followed by one postpartum test at 10 weeks following a natural, vaginal delivery. She also administered the Vocal Handicap Index (VHI) and Singing Handicap Index (SHI) to include qualitative, self-perception assessments of psychological and physiological measures. Dickson found that at ten weeks postpartum, some acoustic measures were problematic:

a) Frequency tremor intensity index (what is heard as vibrato) was slightly less stable than during pregnancy.

b) Agility measures decreased by 10% from the relatively stable gestation rates.

c) The loudness variation during vibrato (measured using amplitude tremor intensity index—ATRI) registered low values despite an increase of 6% from the 39th week gestation, which were already the lowest in the pregnancy. Dickson felt the decreased values (amounting to a lower quality voice) were due to dehydration and fatigue in caring for a newborn, and the singer was likely suffering from vocal fold swelling and laryngeal tension at the ten-week postpartum test.

Aerodynamic postpartum measures at ten weeks postpartum suggested a return to more normal laryngeal and respiratory function values than during pregnancy, likely due to a healthy, uncomplicated delivery and recovery. The changes included:

a) Laryngeal resistance dropped from a high value in pregnancy to a more typical measure.

b) Laryngeal valving (how effectively and efficiently the vocal folds open and close to regulate airflow) at ten-weeks postpartum decreased also from the very high 39-week gestation level, showing improvement, but was still higher than the first gestational test. High levels are reflective of increased vocal effort and tend to reduce endurance and impel fatigue.

c) Vital capacity increased by 7% between 39 weeks gestation and 10 weeks postpartum, returning the singer's levels to her more normal capacity by 10 weeks (this is interesting as most literature does not report a change in vital capacity: the author cites the singer's small stature and fatigue as reasons for lower vital capacity levels).

d) A 12% increase in phonatory threshold pressure (heightened aerodynamic effort needed to initiate vocal fold vibration) at 10 weeks postpartum. This likely reflects increased vocal fold swelling, which Dickson attributes to fatigue or dehydration (a negative change).

The acoustic measures align with a slightly higher VHI score (meaning the singer perceived a lower voice quality) at 10 weeks postpartum. While the change from a score of 1 during weeks 34-39 increased to a 2 during week 30 and week 10 postpartum, likely due to laryngeal tension (Dickson), these scores are not considered high overall. Her SHI tests in the final weeks of pregnancy showed a decrease in vocal functioning comfort but were improved by 10 weeks postpartum. Dickson posits that fatigue and dehydration were the main causes of the acoustic and self-perceived changes; and that the aerodynamic changes were possibly hormonally driven, reflected in the laryngeal efficiency and breath management, concomitant to the body returning slowly to its pre-pregnancy state.

Dickson's case-study offers rare longitudinal data on pregnancy and postpartum singing, with the benefit of self-perception tests. Further study beyond 10 weeks is now necessary to better understand if the immediate changes and fatigue of the postpartum drop away or whether these acoustic and aerodynamic considerations persist. More systematic, aeroacoustic studies measuring both physiological and perceptual measures are needed for broader populations of singers to allow for more comprehensive understanding of the many factors related to singing.

Sarah Harper, 2019, Doctor of Musical Arts Dissertation, University of Memphis. Harper's study asked singers (*n*=264) about their experience singing while pregnant, and whether their experience matched information they had been given prior to pregnancy. Participants were professional singers (choral and solo), voice teachers, and schoolteachers. A portion of the study's questions asked for the participants' perceptions of various measures affecting their singing while pregnant.

a) Timbre: Of the 264 total responses, 139 singers reported vocal quality changes in timbre. A darker/warmer timbre was experienced by 31%, (*n*=82); 20% (*n*=52) experienced a fuller/heavier timbre and 2% (*n*=5) a brighter timbre (2019).
b) Vocal quality: Difficulties were experienced by 81 singers. 11% (*n*=30) experienced hoarseness, 9% (*n*=25) breathiness, 8% (*n*=20) found it difficult to sing with a 'clear' tone,

and 2% (*n*=6) reported a brassy/stringent vocal quality. No change in vocal quality was reported by 46 singers (17%).

c) Phonation changes: 21% of the participants reported phonation issues during pregnancy: (*n*=62 of the total 308). Main complaints were perceived loss of vocal range, agility (affecting coloratura) and "difficulty sustaining in the upper register". Quiet singing was difficult for 5% of the participants, and 9% had difficulty singing in the *passaggi* while 6% gained high notes. The results illustrate a wide variety of experiences.

d) Breathing: Difficulty sustaining long phrases was experienced by 58% and difficulty breathing deeply by 56% (Harper et al., 2022).

In the postpartum period, 89 of the 164 singers (54%) who answered the question felt voice changes lasted beyond pregnancy (Harper, 2019). No lasting changes were experienced by 45 (28%) of the singers while 30 (18%) were unsure. Neither time of onset nor duration of vocal changes were asked in the survey. While the data reported lacks specificity (especially regarding duration), the large population sample is a useful way to document a large variety of issues and perspectives. The fact that many participants felt their experience did not line up with what they had been told to expect clearly emphasizes that not one pregnancy is exactly like another.

Gardner, 2017. Gardner's survey (*n*=444) reported further vocal changes during pregnancy. Regarding voice type, or *fach*, 31% of the participants reporting a voice type change following pregnancy and 43% of those felt the change continued into the postpartum, and in fact, were permanent. Soubrette sopranos had the highest reported change (52%), then coloraturas (48%); mezzo-sopranos and lyric sopranos each were reported at 20% and contraltos were the fewest to experience change at 10%. While the lighter sopranos reported the most vocal change, their changes tended not to be permanent. The vocal changes mostly occurred following the participants' first pregnancies, only 28% reporting them after a second pregnancy, and 12% after three or more. Most of the singers who experienced vocal change reported their voices shifting down a *fach* in tessitura, while a few contrastingly found more ease in higher notes and thus shifted up. These are interesting trends, despite lacking statistical data: even if Gardner's questions concentrated on pregnancy changes, the answers given clearly note certain changes that continued into the postpartum period.

In closing, as stated by Harper in her 2022 article, “there is a need for more accessible (both tangibly and cognitively), evidence-based information and increased awareness regarding pregnancy and singing so that singers can more aptly prepare for their pregnancy journeys” (p. 1521.e10). Luckily, the trend is moving towards a better understanding of singing throughout a women’s lifespan. These studies begin to shine a light on issues that were previously treated as taboos.

1 .7 Pregnancy and Postpartum During the COVID-19 Pandemic

Many studies have begun looking at the pandemic’s various implications. Depending at what time during the pandemic a woman gave birth, restrictions and rules implemented in hospitals varied greatly between countries, provinces and hospitals. In the first wave for example, in most hospitals, partners were not allowed at the birth, visitors were restricted, and there was generally a great deal of stress surrounding being at a hospital at all. In later waves, visitors were sometimes restricted, but partners were permitted. The act of bringing a child into the world, already fraught with uncertainty, was often even more physically and emotionally difficult during these unpredictable times.

Physical Considerations for Pregnancy During the COVID-19 Pandemic

Compared to non-pregnant women of similar age, it is suggested that pregnant women have different susceptibilities due to how the body changes during pregnancy (e.g., changed respiratory dynamics, weaker immune system, higher risk for thromboembolism—blood clots). This leaves them more sensitive to COVID-19 (Buonsenso et al. 2022).

While COVID-19 impacted people around the world, pregnant women faced further complications which included worries about the health of the fetus, as well as the long-term possible consequences of an infected newborn (illness, congenital malformation, death) and mixed messages surrounding vaccinations (Buonsenso et al., 2022).

In the early months of pandemic, mothers who were infected by COVID-19 while pregnant were more often separated from their child at birth and fewer mothers breastfed. They often delivered alone or were confined to their room following delivery. Once discharged, families with

newborns could not socialize with family and friends, because of the many restrictions in place in most cities and countries (Buonsenso et al. 2022).

Psychological Considerations for Pregnancy During the COVID-19 Pandemic

Mothers who contracted COVID-19 while pregnant, in addition to being ill themselves, displayed more symptoms of postpartum depression (Buonsenso et al., 2022). This trend sadly extends to a greater occurance of depression and anxiety in all mothers, not only those who had COVID-19 while pregnant (Buonsenso et al., 2022). In Belgium, data shows that during the early phases of the pandemic, depressive symptoms and anxiety rates were much higher than pre-pandemic levels (Ceulemans, Hompes & Foulon, 2020) which was mirrored in a Swiss study specifically measuring the effects of first wave pandemic on pregnant and breastfeeding women (Lambelet et al., 2021).

As for relationships with medical professionals, many women complained of lack of support, cold atmospheres and restricted medical visits while pregnant and breastfeeding (Lambelet et al., 2021).

Occupational Considerations for Pregnancy During the COVID-19 Pandemic

During pregnancy, mothers who had older children often had to care for them at home due to closed schools and daycares (or removed by choice for fear of bringing COVID-19 into the home). The Lambelet et al. Swiss study mentions both positive and negative influences involved: Juggling work from home and children being home was difficult (one could imagine this extends to partners also), while also allowing more time to rest (2021). This is compounded by the nature of singing as a performing art: due to lockdowns and social restrictions, real GPD (gross domestic product) and jobs dropped drastically, between 50-70%, in the Canadian performing arts sector in 2020. The sector experienced very limited recovery, remaining the lowest in Canada until second quarter 2021 (Government of Canada, 2022). It took until the third quarter 2021 to increase and has yet to recover to pre-pandemic indicators (COVID impact statistics, 2023). This has had a major impact on the occupation of professional classical singing, regardless of gender or parity.

Chapter 2 Singing After Childbirth:
Context and Research Question

2.1 Context

What to expect *after* you're expecting...

The present-day classical singer faces a myriad of complications when returning to a career after becoming a mother. The full complexity and interconnectedness between physiological changes, emotional factors and involvement required to maintaining an active singing career on top of vocal health and caring for a newborn have not yet been considered.

Research shows that although the current literature review reveals tendencies across full populations of mothers, singers are underrepresented in most postpartum studies, even voice science. Literature also specifies that because singers rely on their bodies for their careers, they are likely more in tune to changes than most populations, and may respond differently to these changes than non-singer populations (and each experience is unique). Current published studies on sung vocal changes following childbirth have mainly not measured beyond the first three months: e.g., one study includes a sample at 10 weeks postpartum (Dickson, 2017) and one study measured vocal changes up to 12 weeks postpartum (Lã & Sundberg, 2017). Hormonal fluctuations during the menstrual cycle and their effect on the singing voice have now been studied with more rigor and a clear relationship between sex steroid hormones and voice fluctuations are now better understood (Abitbol et al., 1999; Chae et al., 2001; Lã & Davidson, 2005; Ryan & Kenny, 2007; Raj et al., 2010; Kunduk et al., 2017; Shoffel-Havakuk et al., 2018). However, no studies have similarly measured hormonal levels and the voice for the postpartum year.

Spoken voice (as opposed to sung voice) has been studied during pregnancy by a few researchers (Cassiraga et al., 2012; Ghaemi et al., 2018; Kosztyła-Hojna, 2018; Ulkumen et al., 2021; Rechenberg et al., 2022). Spoken voice during the postpartum period has been studied by only a handful: at 24 hours postpartum (Hamdan et al., 2009); during pregnancy with only one sample at 21 weeks (Hancock & Gross, 2015); up to two years postpartum (Li & Xu, 2019); and five years postpartum (Pisanski et al., 2018). While it is a step in the right direction, measures on the spoken voice alone offer an incomplete picture of what professional singers experience: measures tend not to challenge the instrument via complex vocal tasks required for singing professionally (Ryan &

Kenny, 2007). It is plausible that small changes in the speaking voice might become amplified when singing, and consternate voice professionals who are sensitive to vocal changes. However, sometimes without realizing it, singers are trained to overcome fluctuations caused by physiologic conditions (menstrual cycle, sickness, low energy, pregnancy) and might be trained to compensate for small vocal changes that an untrained voice would not.

More study is needed to comprehensively understand the postpartum period of transitions and changes and whether these changes in the spoken voice are reflected in sung measures as well. From the performing science angle, a longitudinal study examining hormone levels *and* acoustic and aerodynamic measures of the classical singing voice in the months following childbirth that covers all breastfeeding months and the return of the menses would be ideal. However, this type of study is invasive and must consider many variables in its design. This is perhaps why such an investigation has not yet been published and why it is not covered in the present dissertation.

While physiological considerations are integral to singing, other competing complex factors affect singing during the postpartum period. Major changes in neuroplasticity, cognitive function and memory recall can affect the performer's ability to rehearse or memorize (Pritschet et al., 2024; Orchard et al., 2023; Miller et al., 2020) and add to the potentially stressful emotions that can accompany caring for a newborn (e.g., with respect to breastfeeding, sleep issues, crying). Postpartum anxiety and perinatal depression are common, and environmental factors such as cultural expectations or a lack of emotional support systems also affect psychological wellness. Typically, psychological and neurosocial factors of wellbeing are linked to the development of the baby: the wellness of the mother is often overlooked by both herself and society (Athan, 2024).

The realities of a professional classical singing career are not especially conducive to life with a newborn. Travel demands involve childcare organization in various cities, and incur added financial costs (e.g., childcare, transportation). Costumes and staging may not be convenient for postpartum physiological changes (including full, heavy breasts and pelvic floor issues); and rehearsal schedules which include late nights and last-minute changes add extra challenges.

While these considerations all appear to be negative, there is a potentially positive aspect that is overlooked in the existing literature. Currently, a multifarious understanding of how the three overarching variables (physiological, psychological and occupational) interact is almost exclusively

anecdotal—studies are siloed within each research area. Comprehensive resources are significantly lacking for expectant singers as well as the teachers and professionals supporting them. Catherine Gardner's 2017 study asked 444 participants about their experience singing while pregnant. My project seeks to continue this work into the postpartum period to fill this gap of knowledge, and in turn help keep the arts sector vibrant and to aid singers in navigating a healthy postpartum return to singing. The present *Singing After Childbirth* qualitative study comprised of in-depth interviews was devised to this end.

2.2 Research Question

What are the physiological, psychological, and occupational changes experienced by a professional classical singer in the year following childbirth? How do singers perceive these changes (positive and negative)?

Chapter 3 Singing After Childbirth:

Method

To more comprehensively understand the multitude of factors that contribute to a singers' wellbeing returning to a professional singing career, an in-depth study detailing the experience of women who have recently given birth and continued their singing careers seemed the most beneficial way to document the individual, subjective experience of today's singing mothers. A qualitative, bottom-up approach supported this detailed quest for understanding the wide variety of factors that affect how each participant experienced the year following childbirth.

3.1 Participants

Participants were recruited starting in August 2023 and were classical singers with children between the ages of one and seven. Participants who had been singing professionally for five years prior to giving birth and who returned to sing professionally within the year after giving birth were considered. Singers who were fewer than twelve months postpartum were excluded so to limit undo stress on a mother who might be experiencing physiological and psychological postpartum difficulties. The interviewees' removal from the year being studied allowed for a more comprehensive reflection. Only North American singers were included to allow for comparison; however, some of the singers had contracts in Europe during the year following childbirth.

Data was acquired between September 2023-December 2023 from mothers aged 33-44 who all identified as cis-gender women using the pronouns "she/her". Five of the participants had given birth to one child, the other five had two children each, for a total of 15 babies included in the data. When asked to give their current occupation (in 2023), four responded with singer; six identified as singers and teachers; three answered as singer/producer/teacher; one added researcher to the list of singer/producer/teacher; and one identified as a student.

3.2 Procedure

Following ethical approval, participants were invited to participate, through purposive sampling based on the specific criteria, and added snowball recruitment through these contacts completed the participant sample. An initial form asking baseline information on the participant's

demographics was given (age, occupation, years of experience as a professional singer and when they returned to a singing contract following birth, number of children and their dates of the birth, whether the mother breast/chest fed and for how long, and whether the pandemic was a factor in any of their responses, e.g., did it affect when they were able to return to work postpartum). Appendix C contains the full background questions as part of the Interview schedule.

Ten professional classical singers who experienced childbirth in the last one to seven years participated in semi-structured interviews of 75 to 180 minutes in either French or English. Interviews were held and recorded on Teams video conferencing for lingering COVID-related reasons and to accommodate the fact that many singers travel for work or live outside the researcher's area. A predetermined list of questions was prepared to ensure even data collection across the participant sample, while room for detailed responses and nuanced reflection was given (interview questions are also provided in Appendix C – Interview schedule). Spontaneous follow-up questions individual to each interviewee added clarification and an attempt was made to make the interviewees feel comfortable in keeping a relaxed and intimate atmosphere considering the possibly delicate subject matter. The semi-structured quality allowed for freedom of discussion and ensured that individual experience was well-represented and understood.

Questions about changes pertaining to the physiology of singing, the emotional stressors and desire to sing as well as the reality of travel, childcare, financial implications, balancing preparation around sleep and feeding schedules of a newborn and whether singers perceived changes in their relationships with teachers, directors, conductors, agents and companies were asked. As discussions surrounding the year postpartum could possibly recall some discomfort or trauma, participants were reminded during the interviews that they could decline to answer any question they wished, and that they could leave the study at any time without consequence. A document with links to support groups was shared with the participants immediately following the interviews.

3.3 Ethical Approval

The *Singing After Childbirth* study was approved by McGill University's Ethics Board REB: 22-12-063 (see Appendix C). Participants all gave informed consent via a consent form which laid out the purpose of the study, the procedure, the possible risks and benefits of participating, the promise

of confidentiality and stated clearly that participation could be withdrawn at any time until publication, (see Appendix C). Participants were not paid to participate in the study.

3.4 Analysis Strategy

Each data set (interview) was transcribed, first using the Teams transcription tool, then corrected by hand. French transcriptions required much editing as the transcription tool was not efficient for French, nor for musical terms/references in either language. Analysis began with reading the transcripts multiple times: notes were taken to highlight large themes and important reflections. Recurring themes and important comments were reported in a log first within each data set, and then between participants throughout the data corpus.

Thematic analysis happened in two segments and treated two ways. First, using NVivo, data codes were created: first within one data set, then across the data corpus, adding further codes when necessary. From these codes, larger themes were identified to regroup and streamline the analysis. At this point, discussions with my supervisor led us to return to the research question of positive and negative perceptions of the physical, psychological and emotional changes and we decided to run another full analysis with the themes and narratives that arose from the information of our first analysis. For this second analysis, we moved to Dedoose to facilitate collaborative work. By organizing codes further into subgroups, aspects of a singer's experience could be categorized in more than one section, as negative *and* positive in some cases. Between data sets, this allowed for more detailed analysis of each theme and leave room for tensions or disagreements within and between data sets. In both segments (NVivo and Dedoose), analysis was treated both comparatively as explained above, and as ten case studies (treating each participant uniquely to capture highly personal and subtle aspects of each).

The interview schedule of prepared questions allowed for logical themes within the following categories:

- Physiological changes – musculoskeletal, respiratory and motor-sensory considerations
- Psychological changes - emotional and mental health awareness
- Occupational changes – the perception of work-related relationships (with agents, companies, and colleagues) as well as financial and travel considerations.

In addition to these three overarching categories, a few other "large" themes emerged, including breastfeeding experience, voice changes, helpful tips and pregnancy. The following table (Table 5) indicates the themes and their subgroups of the analysis conducted.

Table 5

Description of Themes and Codes

OVERARCHING THEMES	SUB-THEMES	CODES
Physiological Changes	Labour/Delivery	Labour/Delivery Positive Labour/Delivery Negative
	Musculoskeletal Changes	Musculoskeletal Pain
	Fatigue	Fatigue
	Exercising	Exercising
	Breathing	Breathing Positive Breathing Negative
Voice and Singing	Pregnancy	Singing Pregnant Negative Singing Pregnant Positive
	Voice Changes	Agility Colour Ease Fach Range Voice Changes Positive
	Voice Health	Vocal Health Vocal Health Negative Vocal Connection to Body
	Relationship with Career	Relationship to Voice and Career Changed Priorities Stage Fright/Stressors
Occupational Changes	Travel	Travel Positive Travel Negative Percentage of Gigs Away
	Organizational	Baby Backstage Childcare General Childcare Negative Scheduling – Practice Time
	Career	Cancellations due to Baby Changed Financial Priorities Pandemic Considerations Negative Pandemic Considerations positive

		Reactions from Teachers, Managers, Companies, Colleagues, inc. Taboo Reactions from Teachers, Managers, Companies, Colleagues (Positive) Return to Work Special Accommodations (Costume, etc.)
Helpful Tips	Health	Pregnancy Health Postpartum Health Helpful Exercising in Postpartum
	Singing	Organization on Gigs Regular Voice Lessons
Feeding Baby	Bottle-Fed	Negative Positive
	Breastfeeding	Breastfeeding Negative Breastfeeding Positive

In addition to detailing each participant as a case study, comparing these codes across the sample meant that thematic analyses were possible, despite the highly nuanced and individual subject matter. Since the study was qualitative in nature, cause and effect could not be proven, but the detailed nature of the interview discussions meant that perceptions from the singers offered full descriptions of their experience returning to a career in singing.

Finally, excerpts which highlighted important themes were chosen to be shared in the results portion, organized by theme. These sample quotations will appear in vignette, to set them apart from the analysis, or in chart form, organized by sub-theme or code. Discussion for each section will be introduced by an arrow.

In order to maintain confidentiality, participants were assigned a letter-ID (A-J). In the results section, quotations will be identified using these letters to assure confidentiality while still informing the reader that the quotes come from different participants. In some tables, these identifications are used as well, to illustrate prevalence of the issue being discussed.

Chapter 4 Singing After Childbirth:

Results

4.1 Participant Demographic Characteristics

A total of 10 singers participated in the study: five had two children each, bringing the total number of babies to 15. Three of the mothers gave birth to their first child at ages 30-31; five between 34-35; and two at 38-39 (see Figure 4). As of 2022, the average age in Canada at delivery for a first child is 31.6 (Statistics Canada, 2024, May 27). Figure 5 illustrates how many years professional experience each participant had before giving birth. Four participants had 10-13 years experience, three had 7-8 years experience and three others had 5-6 years professional singing experience.

Figure 4

Age at Which Participants First Gave Birth

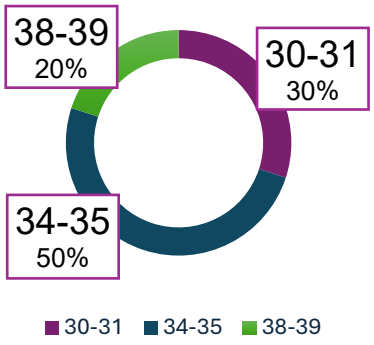


Figure 5

Years Professional Experience Before Birth

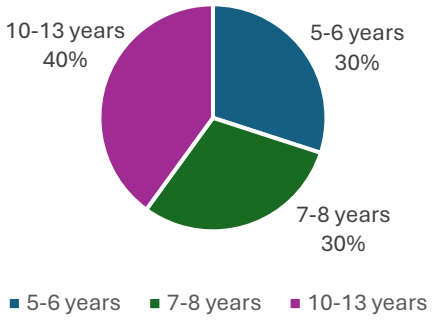
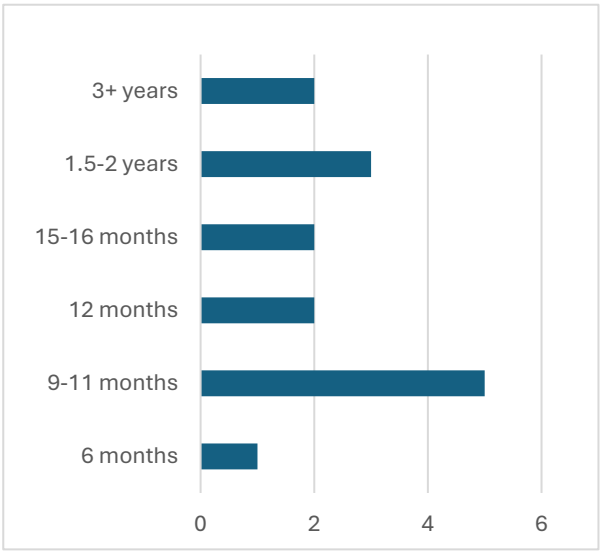


Figure 6

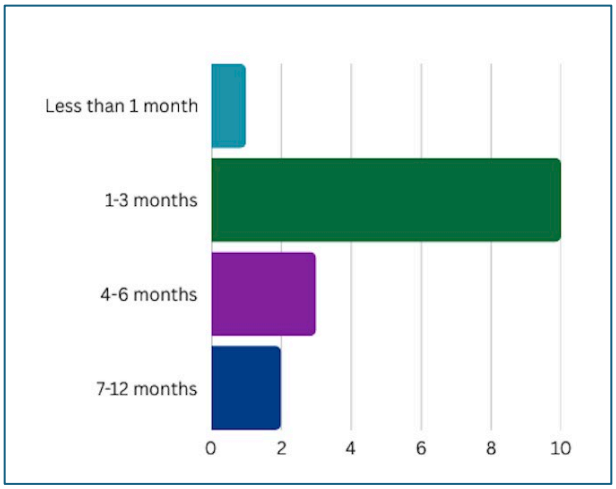
Age Baby was Weaned From Breastfeeding



All 10 participants breastfed their babies. Figure 6 illustrates the age at which the 15 babies were weaned from breastfeeding. The majority were breastfed (or pumped breast milk) for over a year (9 babies); five babies were breastfed to 9-11 months old; and one was weaned at six months. Five mothers needed lactation consultants within the first month; and found breastfeeding very painful in the early weeks. All participants experienced intense fatigue and some form of musculoskeletal pain due to breastfeeding.

Figure 7

Age of Baby at First Professional Contract



All participants sang a professional contract within a year postpartum. The majority of the singers returned to work between 1 and 3 months after childbirth (10 babies); three returned between 4-6 months; two between 7-12 months; and one returned at three weeks postpartum (see Figure 7). The three singers who returned at six, seven, and 12 months postpartum cited COVID-19 as the reason: their earlier contracts had been cancelled due to the pandemic.

Today in Canada (2025), if a mother has paid into at least 12 months of the Employment Insurance Plan, standard maternal leave is 15 weeks; and standard parental leave offers up to 52 weeks partly paid leave (see Chapter 1.5, p. 62).

The latest published statistical information on parental leave in Canada dates to 2022: 77.1% of Canadian employed mothers aged 20-49 who had a child three years or younger participated in a government of Canada parental leave, in proportion to 22% of Canadian self-employed workers. In contrast, all of the singers in this study returned to work within a year, which is strikingly different from both employed (77%) and self-employed (22%) mothers who participated in a maternity leave as of the last statistical data. For further comparison, Statistics Canada reports that Québec has tended to have the highest rates of working mothers with children under one (the 2022 report shows Québec's maternity leave rate at 73.3%, compared to the highest rate of 78.4% in Nova Scotia and the lowest rate in British Columbia at 68.6%), which is still in stark contrast to the study. Interestingly, Quebec reports the highest rate of paternity leave, at 11.7%, compared to Canada's average of 7.3%.

4.2 Thematic Results and Discussion

Results will be presented by theme for clarity. Quantitative data will be shared first, followed by qualitative results for each theme, and punctuated with participants' quotes to illustrate the data. Letter-IDs are used to differentiate between the excerpts, yet ensure confidentiality. Discussion will follow in each thematic section, for clarity.

Interviews were held in English and in French. For reasons of confidentiality, all quotes that are presented below from interviews in French were translated by the author into English so as not to identify anyone's background.

4.2.1 Physiological Changes

Sub-Theme Pregnancy. While the focus of the present study was the postpartum period, the experience of singing during pregnancy was discussed during the interview, in case a relationship to singing postpartum was identified.

Two participants suffered multiple miscarriages before successfully becoming pregnant. Over half the participants enjoyed singing while pregnant, despite certain discomforts. The participants experienced common pregnancy symptoms. Three of them experienced nausea (one lasting the whole of first trimester of both pregnancies), one suffered from reflux, one participant mentioned reduced breathing capacities by the end of the pregnancy, one experienced anxiety and another enjoyed singing until her activities were restricted; however, all six found singing pregnant to be a positive experience. Three encountered difficulties singing during pregnancy: endurance and discomfort breathing belaboured one participant, another suffered extreme nausea, migraines and depression, and the third experienced heavy vaginal bleeding and was on vocal rest at six months due to intense reflux. However, all three had good periods of singing at various moments. Two suffered from intense fatigue and had a bed placed in their dressing rooms to be able to rest backstage (one felt in good shape after the first trimester and went on to sing very well until the end of the pregnancy).

Because of complications with pregnancy, one participant had to cancel several singing contracts, and another cancelled as the date was too close to the birthdate, but otherwise, the other eight participants sang successfully late into the pregnancy which is positive to report.

Sample examples of singing during pregnancy include:

"I found that [the pregnancies] were very hard on my body. However, the mid-months, like the second trimester in both cases, felt like really great singing months, really great. I have some of my most memorable singing experiences from those months where I was doing some pretty marking concerts in my career in that period and being like, 'wow, I wish I could always sing this way!'" [D]

"I had to go on vocal rest around my sixth month because I got such severe acid reflux that I actually had." [E]

"The baby was always calm during the whole show. Right up to the fifth act when I was laying on my back and not moving anymore. Oh wow, that's when he let loose! You know, I'm trying to look dead here?! He'd kick, punch [she boxes with her hands] 'Hey mom, why aren't you singing anymore?!'" [J]

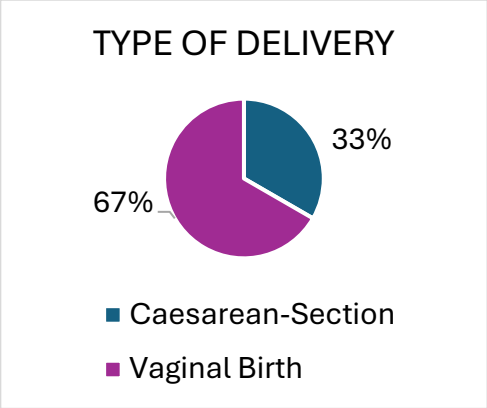
➔ **Discussion.** The most common negative effect that appears in the literature of reduced maximum phonation time (MPT; see Table 2 of Basic Concepts, section 1.2.3) are not especially reflected in these real-life experiences. The majority (*n*=8) did not experience any breath control issues despite singing late into the pregnancy which reflects the findings of the sole study not reporting change in MPT (Hancock et al., 2015). One participant complained of occasional breathing issues near the end of pregnancy, and another found that she had trouble breathing by the end of both of her second trimesters due to her large babies. Along with reduced maximum phonation time, musculoskeletal challenges are frequently cited in literature but were surprisingly only reported by one of the participants (she felt she was not able to relax the abdominal wall to get a good breath; Lã & Sundberg, 2012). It is possible that the participants' attention to healthy breathing technique or attempts to find different ways of breathing which impede less on the repertoire was beneficial in their ability to sing late in the pregnancies (for most).

Issues with reflux were experienced by some participants, but no hoarseness was reported. Given the prevalence reported in the literature (Lã & Sundberg, 2012; Anderson et al., 2017), a higher occurrence of reflux with vocal discomforts was expected. Extreme health crises for two participants (major nausea accompanied by depression and activity reduction) were the anomaly. Overall, I was surprised with how positively the participants spoke of singing pregnant, which was very encouraging.

Sub-Theme Labour/Delivery.

Figure 8

Type of Delivery



In the sub-theme of labour/delivery: five of the 15 babies were delivered by caesarean section (which is in proportion to Canadian statistics of 33.9% in 2022; PHI). Ten were vaginal births (See Figure 8). Table 6 outlines the various types of deliveries (vaginal, without intervention; vaginal, with intervention; planned Caesarean section; and emergency Caesarean section) and the ease and rapidity with which the mother recovered from the delivery.

How the participants perceived quality of care from health professionals during labour and delivery was not part of the interview schedule and was therefore not discussed with all participants. However, four participants mentioned that good quality of care had a positive impact on their recovery: three perceived the care they received as positive, reported experiencing healthy, fast recoveries. One participant had a mixed experience: she gave birth twice at the same hospital with large babies and tearing and sutures both times. She had a negative experience with care once (with a longer recovery) and attentive care once (with an easy recovery), which illustrates the importance of perceived quality of care. Table 6 outlines the participants' various delivery experiences (the type of delivery and type of intervention required, if applicable) for the 15 births and how well they recovered, including any complications.

Table 6

Types of Deliveries and Recoveries

Type of Delivery	**# participants experienced**	**Ease of recovery**	**Type of intervention or Complications**
Vaginal No intervention	*n*=6	Easy *n*=2; Easy but slow *n*=1; Long *n*=2; Did not specify *n*=1.	*n*=1 Vaginal birth after caesarean; *n*=1 diastasis recti and small tear; *n*=1 Severe tearing; *n*=1 diastasis recti.

Vaginal
Intervention
	n=4	Fast and easy;
		Long and difficult;
		Long and difficult;
		Easy.
			n=1 epidural;
			n=1 epidural, pitocin + sutures;
			n=1 forceps and sutures;
			n=1 sutures.

Planned Caesarean	*n*=3	1 easy; 1 did not specify; 1 had pain standing for a few months.	
Emergency Caesarean	*n*=2	Both long: 1 experienced numbness in abdomen for 6 months; 1 still experiences scar tissue pain.	

The following quotes demonstrate how nuanced the experience of childbirth is, and how personal the path to recovery is, and encompass many factors:

"[First child] was an emergency C-section so it took a lot longer to recover from that. [Second child] was a VBAC and natural birth. So I was able to recover much more quickly with [the second], which made a huge difference." [D]

"It was easier for me to get back in shape vocally after the Caesarean than after the natural birth." [D]

"I think the biggest psychological loss or kind of reckoning was that I didn't expect or anticipate to be having a C-section when I had imagined pregnancy and I would recommend to anybody who is having that to at least like, reckon with that to the best of one's ability you know, because it is a different version of, a different narrative about birth that we don't hear or see as as often. So, you know, there was a bit of a sadness that I never went into labour." [I]

"My two experiences with childbirth were so different. The first was during the pandemic, and we couldn't leave the room. It was such a weird experience, the whole ambiance, the whole team was on edge, there was a stress. With [my second], I gave birth at the same hospital, but it was a completely different experience. Everyone was so nice, and the gynecologist who delivered the baby was young, had just gotten out of school, and gave great care. She did a great job. I felt so much more respected and supported with the second." [F]

➔ **Discussion.** Mother and baby's health are of utmost importance during delivery. Emergencies cannot be avoided and while planning is essential for all mothers (to allow the most personalized care possible) one can never predict how a labour will progress. Mothers need to be open to flexibility and prepared to change plans when necessary, yet know in advance how to advocate for oneself and promote one's wellbeing. Many birthing techniques exist, and each mother should find and practice the method that works best for her. However, singers particularly could be mindful of how their area of expertise can both help delivery and mitigate difficulties in recovery. Employing vocal techniques that they are already familiar with might calm the mother and raise her

confidence (due to familiarity), help with pain management and the physical delivery itself, and ensure a healthy use of the voice. Singers can prepare by practicing breathing exercises (that do not forcefully hold back the breath or build up subglottal pressure) and use their voice in healthy, helpful ways like singing, moaning or lip trilling through delivery (Williams, 2023).

Self-advocacy takes many forms. Discussing all eventualities (including Caesarean-section possibilities) with healthcare support in advance of delivery will inform both mother and team of the concerns involved in the types of delivery and arm mothers with more information prior to the stress of delivery. Dialogue during delivery continues to be beneficial, for example, mentioning that the pelvic floor is an important component of breath support and singing health and requesting careful care before a perineal suture. The experiences of some of the participants encourages increasing dialogue between the mother and healthcare provider about the role of the body in their livelihood, whenever possible.

Sub-Theme Musculoskeletal Changes. All participants experienced some form of musculoskeletal pain, including back, neck and shoulder pain and abdominal muscle pain or weakness. Musculoskeletal changes include forward-leaning posture and pelvic floor weakness or tightness.

Following birth, two participants suffered diastasis recti (a stretching of the linea alba, creating a gap between the rectus abdominis) and five required pelvic floor physical therapy (PFPT). Three of the singers specifically did not require PFPT; one other regretted not being treated; and one did not mention needing pelvic floor rehabilitation. Two singers experienced such perineal pain that walking was affected for some time. Table 7 provides a summary of musculoskeletal issues reported by all participants (for a total of 15 births).

Pregnancy-related postpartum pain: one participant was prescribed activity restriction during pregnancy and experienced various resulting postpartum discomforts including lumbago, hip and leg pain; one participant had sciatica issues during pregnancy that continued; and one experienced a displaced sacrum in the postpartum year.

Table 7

Musculoskeletal Issues

PFPT	**Back, neck, shoulder pain**	**Forward-learning posture**	**Abdominal muscle pain/weakness**	**Other complaints**

5 participants sought therapy;
 	
n=3 did PF exercises on own;
n=2 did not require PFPT;
 	
n=1 regretted not;
n=2 did not mention.
	8 participants (after both children when applicable);
	
	2 participants experienced none.
		4 participants.	8 participants:
			n=3 "no tonus"
			n=3 issues from Caesarian section surgeries
			n=2 Diastasis recti.
				2 participants had wrist injuries;
				
				1 had jaw tension issues (saw physiotherapist).

The following quotes illustrate some of these musculoskeletal issues:

"I think just because I like didn't want to put her down a lot, I ended up with this wrist... like I had to wear a light brace on it just to help it. It's called Mommy wrist here. And I did end up with just like weird shoulder, neck stuff for months." [G]

"I'd like to now [have PFPT] because I really wish I had. The midwife had suggested that I do it. And of course I was like, 'I have a newborn baby at home and I have a toddler, I don't have time for that'! I want to now, because I'm scared of sneezing." [D]

"In everyday life, uh, I couldn't hold back my flatulence! It complicated, just that! Not to mention jumping, jogging, I'd pee myself! So you know, it was clear that I needed pelvic floor training. So yeah, singing, obviously I had to be careful to support well, not sing on the larynx." [B]

[Speaking of perineal pain after sutures] "I was in a lot of pain. Just trying to walk, you know, I would go around the park and still have to stop. It was throbbing, pulling. It really hurt!" [F]

"Neck, shoulder, the right side—you know, you always hold the baby the same way—ah! And [name of baby] was so hard to put to sleep, it always took me so long to put him to sleep, I had to 'shush' for like an hour, then put him in his crib, and the moment I put him in the crib, I was like, 'Oh my God, if I do anything wrong, he's going to wake up for sure!' Oh yes, I had neck pain, shoulder pain, a lot. I didn't do a lot for it—I would do a lot of stretching on my own, like yoga, but I didn't have a lot of desire to do much, honestly. So I endured the pain, but it's ok, it didn't keep me from singing, it was just uncomfortable." [A]

"My shoulders were like this [hunched forward, affecting back, also] so I had to work to bring back my posture, you know, to replace the top of the body. And when I sang, also, to realign myself because it was like I was getting pain. I did a lot of osteopathy which helped free up my back and shoulders. You know at one moment, I was completely stuck on one side—my babies were heavy, you know, having to breastfeed them!" [F]

Sub-Theme Fatigue. The most common complaint was fatigue (coded negatively 46 times). All 10 participants experienced extraordinary fatigue, either mental and/or physical, which was considered the most difficult part to overcome for most. Breastfeeding was cited as a cause of fatigue by four participants, and nine participants blamed simple lack of sleep (or interrupted sleep).

The following quotes illustrate how profoundly participants felt fatigue was the biggest challenge of motherhood:

"We're up about 4-5 times a night. And that disruption of sleep is just brutal. I don't have the amount of sleep that I used to, like [first baby], always could sleep wherever you put him. And so that was very easy. Whereas [second], if you change anything, he won't sleep." [E]

"I had the child to look after and nursing and you know, the just exhaustion of post-pregnancy. But the first few months are not usually the hardest months, the exhaustion sets in later." [D]

"But yeah, at a very young age she wasn't sleeping and she didn't wanna do anything. She hated cars, so we couldn't put her in anything… like, even like a swing or all these things in the house or, you

know, you're cooking and you put them in a little transit [rocker]? Never put her in one of these, she cried. She was a very difficult baby. So that I thought was really hard. She was very attached to me and so if I left the room she would like freak out. And so there was a lot of, it made for a lot of anxiety in my life. Like even grocery shopping was, you know, very difficult, like just driving the car seven minutes because she used to cry." [H]

"I was there for my job, and I found it difficult, in fact. You know, I could have, there are things I could have done differently, not to exhaust myself so much, also. But for me, it was really, in that first year, really just the total physical exhaustion [that was difficult]." [A]

"It was so, so intense. I really had all my vocal capacities, physically and technically, you know, even if I was far from being perfect. But you know, this, I felt this incredible fatigue, so intense." [J]

General Physical State. A general change (as compared to pre-pregnancy) in their menstrual cycle was found by four participants when they resumed menstruation following breastfeeding, one citing increased discomfort with menses, one mentioning much heavier, intense periods, and another citing drastic emotional changes. Another participant was disappointed with the return of her menstrual cycle at six months postpartum despite full-time breastfeeding. Hair texture change was mentioned by one singer (straight hair became curly) when she stopped breastfeeding.

Sub-Theme Exercise. Postpartum exercising was popular as both a way to positively boost emotions and as a physical necessity. Walking was important to four participants, yoga or yoga-inspired stretching was practiced by five participants (one cited that yoga was helpful but did not make the time to practice it regularly); cardiovascular training was exercised by five participants. One participant did not make time for any kind of exercise and two found it hard to find the motivation to exercise as working mothers but exercised regularly when pregnant.

Many positive comments were made about exercising, including the benefit of finding "moments for self"; the benefits of stretching and strengthening exercises (yoga) to relax *and* get in shape; a few participants enjoyed the social aspect to group mother-baby classes such as stroller-walking ("stroller-cardio") and dance classes with babies. Nine participants found that to feel

comfortable singing, they needed to incorporate regular stretching into their warm-ups, due to physical discomforts: this was mentioned as a positive outcome despite the fact that the need arose from discomfort or unease.

Two examples about incorporating exercise:

"I tried to find little moments for myself, as I said, naps or stroller walks—sometimes just getting out walking with the stroller or doing cardio." [B]

"A lot of it was not just stretches, but opening, opening things up and then working on the pelvic floor without tightening the muscles around it. Because, in my opinion I was not muscular. But…[the performance kinetic consultant] is like, 'you're very strong'. And so it's strengthening the right things: I would like tighten my glutes or tighten my leg which did not allow a lengthening in the spine or whatever… so I started going more toward Pilates-based exercises. I needed it, for my mental health, to be doing something…Pi-yo, I don't know if you know what that is, but Pilates/Yoga and it gives you the stretch, but also the pelvic floor strength." [E]

Sub-Theme Breathing. Breathing was specifically mentioned by most the participants (*n*=9). Six experienced positive aspects related to breathing for singing after childbirth. Four of these six participants perceived better breath management or connection to vocal support. For example, one felt her understanding of breathing was improved (allowing for freer, less aggressive breathing) and another felt she was able to sing longer phrases than before pregnancy. Several reasons were given for these ameliorations: the presence and weight of the baby changed conceptions of breath support, promoting a stronger connection to this support; new understandings about efficiency helped change previously negative habits (e.g., one participant realized she did not need to be inhaling as much as she normally did); new breathing techniques introduced to mitigate issues with breathing to sing during pregnancy continued to be helpful in the postpartum (pregnancy forced the participant to try a new organization of breath management which ended up being very efficient); and pre-pregnancy tightness in the muscles and body were perceived as having released after childbirth, permitting a better breath management. Two participants felt reassured that there was no change in their breath capacity following childbirth, which they perceived positively. Of the two who

did not experience a changed breath capacity, one did mention needing to concentrate on releasing the pelvic floor muscles when inhaling to more successfully allow the diaphragm to contract down and organize her breathing optimally.

Contrastingly, on the negative side of breathing changes, six participants experienced some difficulties relating to breathing. Postural problems from difficult deliveries, long breastfeeding sessions and carrying heavy babies interfered with their breathing habits and impacted optimal breath management. Two mentioned issues related to diastasis recti: one particularly was concerned that working on *appoggio* for singing would affect physiotherapy work that she was doing for the diastasis recti. Two participants found releasing the pelvic floor to be a problem and one mentioned needing to do stretching exercises to open the ribcage and relax the lower back, both in connection to breathing. The need to stretch came up often with regards to singing throughout the data corpus; however, only one mentioned it as specifically connected to breathing. Similarly, a lack of abdominal muscle tonus was mentioned frequently (as discussed in musculoskeletal issues) as a problem for singing, implying a link to breath management. This lack of tonus was a change which was very difficult to overcome for many. Several participants described these changes as alienating, causing dissociative feelings of the body not responding like normal. One participant linked her trouble getting through musical phrases with both COVID-19 illness and a perceived change of vocal *fach* that she felt was precipitated by pregnancy. She felt that her heavier postpartum voice made breath management more precarious, sometimes resulting in shorter phrases than before pregnancy.

Interestingly (and encouragingly), all six participants who reported issues breathing in the postpartum were able to overcome their difficulties, and in fact, felt more secure with breath control than before the pregnancy. In the long run, the postpartum difficulties led to stronger breath management. Table 8 highlights examples from each participant (multiple participants, if stated) of the perceived changes related to breathing that were reported.

Table 8

Examples of Perceived Changes in Breathing for Singing During Postpartum

Examples of perceived positive changes	Examples of perceived negative changes
Felt more released in body/muscles for breathing than before pregnancy (*n*=2)	Stretching exercises necessary for opening the ribcage and relaxing lower back
Weight of baby paved way for better support, connection	Conscious release of the pelvic floor needed to allow diaphragm to contract down
Reworking breath management during pregnancy allowed for better breath control in postpartum	Diastasis recti made breathing more complicated (*n*=2)
Better breath control: came to understand that singing required less of a large inhale	Difficulty releasing pelvic floor
No reported change = positive (*n*=2)	Postural problems influenced ease of breathing for singing

Some of these changes are reflected in the following quotes:

[How pregnancy affects postpartum posture] "I really felt like my back was arched. You know, like with a hollow here [participant lets stomach hang forward, arching her lower back]. I wasn't aligned like normal, but I had this stomach still, like a pregnant woman, like all crooked for a long time. You know, I felt it for a longtime and it didn't help my breathing. I just felt always so crooked, instead of being aligned in my column of air, so it was hard."

"I don't need to take such huge breaths anymore, I can control them better. You know, obviously, I had a better understanding of how to manage my air." [C]

"At four months, I sang [name of title role]. It went super well, even for breathing. I remember at a certain part of the role, I did the whole line without breathing. The conductor was always like 'what the [expletive]?! When is she going to breathe?' But I just didn't need to." [A]

"If I am not stretched and open, my capacity to sing longer phrases is probably shorter than before because it is just a bigger instrument. There's more air moving and so because of that I have to be really open to support that amount of air and movement." [I]

[JW]: "You mentioned the breathing was easy?"
[participant]: "Yeah, I never really noticed a difference with the breathing". [H]

➔ **Discussion.** Research suggests that while the body returns to pre-pregnancy shape throughout the year postpartum, certain physiological measures do not fully return. It is possible that the flexibility of the rib cage, the intercostal muscles, and the widened subcostal angle which allows for the diaphragm to retain its force of contraction during pregnancy, do not restore completely (e.g., it is suggested that the subcostal angle remains 20% wider long-term; Hegewald & Crapo, 2011). Combined with circulating relaxin which loosens ligaments in the lower rib cage according to the literature, it is possible that the participants either experienced a return to normal measurements by 24 weeks postpartum but were still able to sustain the more open feeling or experienced an increased flexibility that lasted: it is not possible to say. Either way, the perception of increased flexibility is very interesting and heartening. The perception of weak abdominal muscles was to be expected, and while recovery required regular exercise for many, it was possible for the singers to regain control and coordination of the inspiratory and expiratory muscles. Together, this allowed singers to enjoy a new, more flexible and therefore stronger breath control after a few months of gentle exercise and practice. It was interesting to note that embracing change, listening to the body and working gently and patiently resulted in positive breath management for most, as those who had difficulties with breathing in pregnancy, or in early postpartum were able to overcome their challenges. Many found that these early postpartum setbacks led to a more optimal breath management in the end. For example, the participant who specifically mentioned having to engage more back muscles for breathing during pregnancy which she then continued exploring in the postpartum, illustrates what Da Fonseca (2023) and Gardner reported about adaptations for pregnancy turning into healthy, welcome changes in breath management.

Of note were the multiple discussions surrounding the effect of poor pelvic floor health on breathing, considering the current lack of research regarding the involvement of the perineal floor in

singing. Several singers experienced pelvic floor disfunction and found it led to discomfort or difficulty singing, which could be a sign that when one feels there is an issue with their pelvic floor, breathing may feel affected, and help should be sought out.

Surprisingly, compared to literature suggesting musculoskeletal maladaptation (changes or compensations) during pregnancy affects singing in the postpartum, this was not a major concern for most participants (Harper et al., 2022). Positive effects pertaining to adaptive practices, and deeper understanding of breath support outweighed and outlasted negative changes. The need to exercise and enforce healthy technique was related more to diastasis recti, pelvic floor issues, and general postpartum discomforts rather than bad habits from pregnancy postural changes as suggested in literature (the exception was the participant who was on bedrest; da Fonseca, 2023).

Overarching Theme of Breastfeeding. All ten participants breastfed, with reactions that varied and evolved throughout the year. All participants also expressed (pumped) milk over the course of the year for various reasons (for use during childcare, for use while traveling, while healing from mastitis and because of difficulties breastfeeding). Half of the mothers found breastfeeding to be the easiest method, requiring less organization and time (e.g., sterilizing bottles). Three participants enjoyed co-sleeping for ease: one would arrive as late to concerts as possible to nurse baby to sleep in hotel first; and all three cited improved sleep (for both mother and child), proximity and bonding as the benefits. One participant was constrained by severe dietary restrictions as her baby had many food allergies; despite this, she enjoyed breastfeeding. One participant mentioned being pleasantly surprised not to have any issue breastfeeding based on experiences from her social circle.

Some participants mentioned being surprised with how difficult breastfeeding was, when it seemed that it should be natural. Half the participants needed lactation consultants and had initial negative experiences with either pain, trouble latching or infections. One of these participants needed to express milk for five weeks until the baby began successfully feeding, and one continued pumping for nine or ten months as her baby preferred a bottle. Four of these five mothers eventually found breastfeeding physically comfortable.

➔ **Discussion.** Breastfeeding or pumping breastmilk can be very demanding and exhausting. It is also known to affect hydration: it was interesting that dehydration was not mentioned by a single participant as a problem (Van Wyk, 2016). This might be explained by the fact that hydration was not a question posed directly, but it might also be that singers tend to hydrate well and perhaps the dehydrating effect of breastfeeding was not perceived as an issue. Some participants' preconceived expectations or beliefs regarding breastfeeding made adapting to the reality more difficult, and some wished they had sought out help earlier, which suggests perhaps it would be helpful to research support groups and techniques while pregnant to mitigate later stress.

4.2.2 Voice and Singing

Sub-Section Voice Health. This sub-section had a very large amount of coded material (147 excerpts labeled vocal health). Of those, 80 were in reference to the vocal connection to the body. The other 67 were shared between positive and negative vocal health changes.

***Positive Embodiment and Understanding*.** The most important vocal changes were grounded in a more profound understanding of the singing instrument and body. Nine participants (90%) reported a deeper connection to their body, which had a positive effect on their singing. Increased physical flexibility, new physical sensations and an overall improved physical connection to support were cited as having grounded their voices in their bodies. A better understanding of different singing mechanisms (e.g., breath management or pelvic floor engagement or relaxation) and exploring or taking advantage of new technical ideas (and more optimal physical coordination) were also experienced. Despite the unfamiliarity and discomfort of first weeks, most felt they grew to embrace and use their body in a stronger way following pregnancy and childbirth.

One participant had worked prior to pregnancy on posture and on finding a better physical connection to her singing. She felt that although she needed to work a little on support following childbirth, she was able to return to a comfortable and familiar postpartum bodily connection for singing, which was therefore not a huge change. However, she did cite that she felt a much lower sense of support during pregnancy as she was much more aware "of my vagina" [H]. Another participant who reported confidence in her singing both pre- and post-pregnancy also gained a

deeper understanding of support following childbirth. She felt that having felt the weight of the baby helped her support and later, understanding her body better. Another affirmed that she finally physically felt the lower vocal support that her teacher had been talking about. She also found that her voice finally felt untethered and free following childbirth. This was echoed by another participant, who felt that her gentle, progressive postpartum practice empowered connection to air, allowing the voice "to go" [E]. She also felt her vaginal birth helped her understand a lower point of vocal support.

One participant felt that her voice became less "fussy" or less "placed" [C], rather allowing it to feel more natural, grounded yet released in a healthy, spacious way. Previous problems with abdominal tension were replaced with a more optimal breath control due to the incurred changes. This helped "embody" her high notes and sing less aggressively. One participant felt she had to relearn how to use her instrument: her imminent prestigious contract meant she had to get to work right away with her teacher, she did not "wait around to see if her voice would come back" [J]. She cites this physical challenge as the reason she now feels she has an even better command of her technique than before pregnancy.

One participant believes that the body remembers how to sing. She was not concerned about being able to sing postpartum for this reason. She trusted that her body and voice would take over and as her first contract postpartum was a role she had learned while pregnant, this was the case: her body quickly "remembered" how to sing it and she was very comfortable, vocally [A].

One participant felt she became more tolerant of variations within her body and emotions, and when she felt changes within her body (e.g., hormonal fluctuations with the return of the menstrual cycle; fatigue), she would remind herself that she was fully capable of singing well regardless, thanks to her gained physiologic knowledge from pregnancy and to her heightened connection to her feelings.

One exception to the improved voice-body connection was a participant who lost a lot of weight following childbirth. She struggled to feel vocally supported by her body due to this weight-loss and missed the natural support offered by being pregnant.

While this voice-body connection was a common theme, it took some participants longer to adapt to the postpartum challenges than others. Non-singing exercise (lip trills, physical warm-ups, speaking; breathing exercises; and/or quiet mental preparation) was required by 70% of the

participants as part of their warm-up routine to feel in control of their voices. Three participants specifically mentioned needing to work on postural habits (which were affecting laryngeal position and breath management) or needing to practice stretching-based exercises to be able to find ease in their singing. One mentioned needing to change her physical exercise regime as she came to better understand the needs of her body as a singing instrument. Her connection to her body as a whole was changed and she realized she was choosing workouts which were unhelpful to singing technique and her physical postpartum wellbeing (e.g., she changed from strenuous, high-intensity exercises to Pilates or yoga).

Three participants experienced problems with vocal health throughout the year postpartum which caused them important doubts and worries. All three were able to continue singing carefully, guided by otorhinolaryngologists and working slowly, with deliberate, thoughtful technical work. Hormonal hoarseness prevailed for some although dryness and fatigue were also big factors.

Sample excerpts on the experience singing after childbirth:

"I was getting really tired because I didn't know how to manage my voice anymore…for the first year, I didn't know what the hell was going on with my body or voice." [E]

"After having a child, you realize you're a lot stronger than maybe you thought before. We're less delicate, right? Yep!" [G]

"I'd say like the first couple months after pregnancy in both cases were great singing periods. I think partially because I was really relaxed, partially because I was not putting any pressure on myself. I was just like, 'let's get back into this'. I mean, I had to, I had to get myself into shape pretty quickly, but I had had the experience of the first time around in order to do that." [D]

➔ **Discussion.** This gained knowledge was anticipated as be an outcome, but the prevalence was surprising. Singers with solid technique who had already been working professionally were themselves perhaps surprised that their connection to their bodies could change so positively after undergoing such extreme changes during pregnancy. While the path to discover new sensations or a renewed connection to the body was perhaps not easy, the gained

understanding or slightly improved connection occupied a large part of the postpartum singing experience (positive breathing changes were reported in this vein of causality by Gardner, 2017; and da Fonseca, 2023). Pregnant singers might be reassured to know that despite early challenges, most singers do eventually enjoy the physical aspect of singing after childbirth (fatigue aside!)

Sub-Section Voice Changes. Participants all perceived both positive and negative vocal quality changes during the year following childbirth. Results were grouped into five categories of change: agility, range, colour, ease of singing and overall *fach* (type of roles sung). Table 9 illustrates these changes, and each category will be discussed following the table.

Table 9

Perceived Vocal Changes Following Childbirth

Result	Agility	Range	Colour/Timbre	Fach	Ease of singing
Positive	Remained easy (*n*=4)	Gained lower notes (*n*=6)	Deeper, richer sound (*n*=3)	Changes to size, weight or flexibility affecting type of repertoire (*n*=6)	Long, lyric lines with ease (*n*=2)
	Had to work at flexibility, agility, staying "slim", but could (*n*=3)	Gained strength and comfort in medium (*n*=2)	Rounder, full-bodied (*n*=6)	Explored heavier *fach* (*n*=5)	Accepting vocal changes brought ease to singing (*n*=2)
		Ease in high notes (*n*=3)	More open sound (*n*=2)	Explored lower roles (*n*=3)	Easier use of chest voice (*n*=1)
				Larger parts of usual roles got easier (*n*=4)	"Thrust"/ power of voice stronger (*n*=2)
					Voice "opened up" (*n*=2)
Negative	Loss of flexibility (*n*=1)	Needed to work harder for high notes (*n*=4)	Difficulty focusing sound (*n*=2)	Gradually stopped singing coloratura roles (*n*=2)	Decreased endurance (*n*=2)
		Loss of or difficulty with high notes (*n*=3)	Difficulty regaining squillo (*n*=1)		Sustained, high singing (floating) (*n*=1)
		Less projection in low range (*n*=1)			Fatigue affecting ease (*n*=5)

Agility. One participant mentioned having difficulty with vocal flexibility; whereas four participants felt there was no change in agility. The other participants did not mention agility at all.

Colour Changes. Changes in vocal colour or timbre were specifically mentioned by 70%. The majority felt their voices gained in richness, roundness or became more full-bodied, deeper in timbre. Two found that it was initially difficult to focus the voice or to attain *squillo* (also called "ping": the resonant, ringing, vibrant quality to a voice which aids in projection).

Changes in Range. Gained low notes or gained added comfort singing in the middle voice were perceived by 60% of the participants. Two felt they lost ease in the high register (one cited swelling and mental fear, which diminished over time) while one felt a new comfort with her high notes: "it's all just going. There's nothing tethering it down. I was singing really high all of a sudden—which is not my voice!" [E]

The gained lower range that was experienced was not reported as being detrimental, rather as a positive change. The few who felt the need to work harder on both agility and high notes were likely affected by fatigue and perhaps by low hormonal levels (especially estrogen; Emerich, 2000). For one participant, the loss of a few high notes remained beyond the postpartum period. Another regained her high notes but has lost pleasure in singing them. The others' range changes seemed to last but were perceived as positive changes.

Considerations of Fach (Type of Repertoire). All but three participants mentioned changes relating to *fach*. Some felt their voices lowered (*n*=2), others felt they gained in vocal size (*n*=5) or in comfort with larger, heavier parts of their regular repertoire (*n*=4). Many of those who reported changes in range (gained low notes) also mentioned that it would have been possible to change *fachs*, but chose not to. A few did not feel their colour or range changes were evident enough to warrant a change of *fach* (*n*=3).

Emotional reactions to the perceived changes tended to be divided by voice type. A few participants with lighter voices mentioned worry about the optics of having a baby. "Will I be looked over now for the role of a young woman", or "if I lose my high notes, who am I?" This was in contrast to those with heavier *fachs*: two participants felt that their voices finally settled after childbirth into the size and weight that they were meant to have. Having been told to wait patiently for their voice to grow as they get older, they both felt pregnancy and childbirth precipitated the change and were able to embrace their suddenly larger instruments. They finally felt psychologically and vocally mature

enough to step into the roles their voices were meant to sing, worrying less about continuing to be cast in roles of young girls like many of their colleagues. One participant felt vocal maturity was likely going to happen over time, but that it came very quickly and immediately while pregnant and just after childbirth of her first child. Prior to pregnancy, she was often told she sang "too heavily" and had the habit of lightening her vocal colour. Then, "everything just dropped without my permission or knowledge! [and she] couldn't fake it any longer". [E]

Ease/Difficulty with Singing. Six participants mentioned changes that brought ease to their singing, including embracing technical changes, improved long lyric lines, a gained vocal thrust, and an opening up of their voice. Some of these six participants reported more than one category of ease. The difficulties of these six participants were perceived as induced by hormonal changes or fatigue. Difficulty floating (high, soft singing) was mentioned specifically by two, and endurance specified by two. One of these latter two singers mentioned needing to be very careful (rest frequently, long warm-ups) while on a recital tour due to fatigue: she likened it to singing on her period. One singer experienced vocal health issues (hemorrhages, varix) impacting ease of singing and inducing hoarseness which she felt was due to suppressed and fluctuating hormones. Another felt she had swollen vocal folds during the postpartum period which affected focus and high notes.

When considering the repertoire and ease of first contract after childbirth, most participants sang roles or concert work they knew well already (having been able to prepare it well during pregnancy or having sung it before) or sang small roles that were not taxing, vocally or physically. Exceptionally, one participant sang a concert which was required very delicate high notes, a demanding piece that she found challenging to manage. While she enjoyed the contract, she realized it was a difficult piece to sing as a first contract. Many mentioned needing more time than before to feel comfortable vocally with new works. Another had compounding family issues that added to her mental and physical fatigue, and she tended to push vocally, which resulted in vocal fatigue. She had to learn to pace her first opera role to be able to sing the final scenes. Regular lessons, practicing and speech therapy exercises allowed her to sing with a slimmer, healthier voice (for if she sang too heavily, her endurance suffered).

➔ **Discussion.** It is welcome news that negative vocal changes tend to resolve with time and effort, and (excepting the participant with vocal health issues), most participants felt they regained control and beauty of voice throughout the year. It seems that the first contract has its challenges, no matter when it comes in the year, since vocal rest can cause both physical and psychological difficulties (high larynx and increased nerves due to lack of practice, as supported in the literature; Jahn, 2011). However, singers should feel encouraged by this data which shows that overcoming these challenges in fact solidifies technique and encourages exploration towards new vocal colours and increased ease of singing.

While the answers were highly individual, the two most common positive changes (deeper, rounder colour; and ease in mid-low range) were each reported by 70% of the participants. These two findings were expected and are reflective of the general anecdotal information surrounding postpartum vocal change. It was pleasantly surprising that not many participants complained about agility, which tends to be an anecdotal fear in postpartum singing and is supported in previous studies (Dickson, 2014; Gardner, 2017). Loss of range is consistent with the few existing studies on postpartum voice which find the fundamental frequency drops after childbirth (Pisanski et al., 2018; Li & Xu, 2019). While many experienced this increased comfort in lower ranges, only three had difficulty in the high register, which begs the question as to whether the fundamental frequency was lowered, or whether vocal roundness or ease was rather the main change. The loss of high notes and difficulty floating experienced by certain participants reflect the findings that phonating certain pitches may be difficult (Gordon & Reed, 2020). Combined with complaints of fatigue, decreased hormones and mood changes, as suggested by Pisanski et al., the findings of this study align with the literature. I was surprised that not more participants complained of breathiness, considering the prevalent complaints of fatigue and lack of abdominal tonus. It is possible that regular practice or prolonged warm-ups helped, or that the other issues were more significant over time.

It is interesting that the main complaints in vocal quality likely brought about by physiological factors (fatigue, lack of abdominal strength, and low sex hormone levels possibly affecting focus and hoarseness), were quickly overcome with practice and exercise. This might coincide with the return of hormonal levels; however, it points more probably to being physically in shape, since the majority of the participants breastfed well into the year and therefore likely still experienced low sex hormone

levels at the time of the vocal recovery for most. The participant with vocal health issues did feel that hormonal fluctuation was to blame, as she was breastfeeding regularly and lacked hormonal homeostasis. This study's finding that negative changes mostly reversed during the year postpartum while positive changes tended to remain is rather novel. Voice literature has not yet been published to this effect. A timeline of vocal change and reversal would be fascinating to study, using a control population of similar age and voice-types.

The following table (Table 10) illustrates data collected regarding the moment each participant stopped singing professionally, at what moment they began vocalizing again, the timing of the first contract postpartum and the moment when they felt the voice and body responded well. These questions were not all included in the background form, nor were they officially in the interview schedule: some answers are thus incomplete, but the table is included for its valuable information.

Table 10

Timeline of Singing From Pregnancy Through to Year Postpartum

	Time of pregnancy stopped singing	**Age of child when started vocalizing**	**Age of child at first professional contract**	**Age of child when voice felt in control, good**
A	7 months	2 months	4 months	Quickly
B	Restricted activity early pregnancy	3 weeks	3 months; 2 months	
C	38 weeks		10 weeks; 3 months (pandemic)	
D			3 months; 5 weeks	
E	8 months	2 weeks		Body took up to year, but voice felt good prior
F	35 weeks (2nd)	6 weeks (2nd)	1 year (COVID-19) 3-4 months	
G		3 weeks	3.5 weeks	3 months
H		2 months	3 months	Survival mode up to 8 months; fully back by 1 year
I	8 months	2-3 months (C-section, no gigs due to COVID)	6 months	
J	Last month	2 months	3 months	Quickly but worked hard

4.2.3 Psychological Changes

Sub-Theme Cognitive Function. Brain fog was experienced by half the participants including trouble focusing and difficulties memorizing. These participants struggled to find time and mental space to learn roles, found they had to learn in different ways than they used to, and felt it was harder to juggle so many balls and stay focused on music. Fatigue and brain fog were linked clearly in the perceptions of two singers. One participant found that getting more sleep helped when she was feeling that her brain was not functioning properly. The second participant also found that when she was solely responsible for her children (either on a contract or at home), she was more tired, which resulted in more stress, and memory or distraction issues when performing.

A need to learn music differently was mentioned by four participants. Rehearsing in small segments helped with brain fog for one participant, which in the end, brought clarity to her music learning (positive outcome). She felt that layering in the learning with small bites was helpful: each vowel and element was clear then when she was performing. For this particular performer, the pandemic was a factor: as she could not coach as often as she would normally, she was forced to find new ways to learn her music. This quote humorously captures her thoughts regarding these memory issues: “My brain just did not want to absorb information…and I'm aware I'm older, but I'm like, I don't have dementia yet, what is wrong? [laughing]” [E]

Some participants did find that although the windows for practicing or learning music were small (and this was a cause of stress), the shorter periods were good for concentration and forced them to be very focused on small goals. This ties in with psychological as well as occupational factors.

The need to focus their energy on cognitive and physical tasks required for singing was liberating for some, but for others, required practice:

“I live much more in the moment, before—I anticipated a lot. I’d say what having kids adds, is to live *now,* in the moment! I don’t have time when the kids get to home to work alone, I’m with the kids 100%. When I’m working, I’m there 100%. It helps, instead of being all over the place, it makes

me focus, I have to be efficient, I can't be elsewhere [mentally]...I think I'm sometimes more efficient than I was before, strangely enough!" [F]

On learning earlier and differently: "I had to be open and honest in a way about my deficiencies" [G]

"I did feel like half my mind was still worrying [about the baby] because I knew she wasn't drinking...so of course I knew my mind was a bit there...my mind was elsewhere. I couldn't focus exactly on what I was doing" [H]

"OK, this is my role as a mother [gesturing to one side]. OK, here is my role [gesturing to an opposite side, meaning career]. I had to be capable of compartmentalizing, to be efficient. Sometimes I found that hard." [F]

"We sang through it, I went upstairs, came back down and I looked at it [the score]. I was like, 'I've no idea how this goes', 15 minutes later! I'm like, 'my brain is gone'. [I]

➔ **Discussion.** It was interesting that not all participants experienced issues with memory, considering we hear about "mommy brain" so often, anecdotally. However, positive changes in cognitive function were not shared, either: despite the adaptive properties of improved executive function, no one perceived or mentioned experiencing any positive changes which include self-regulation, better conflict resolution, and improved managing of competing demands (discussed in section 1.4, p. 54, of dissertation).

Perhaps the increased cognitive load, environmental factors and decreased sleep and mood in the postpartum (which often cause memory slips or difficulty concentrating) more directly affect singing. Heightened awareness of lack of focus and memory lapses was mentioned by multiple participants, which is in line with the findings of Orchard et al. 2023. Correlations between fatigue and small cognitive impairments reported by participants also align with this research (lack of sleep increases the prevalence of cognitive difficulties). Nonetheless, it is inspiring to hear how the participants were able to overcome, or find new ways, to work efficiently despite these complaints. This speaks to both the maladaptive and adaptive properties of neuroplasticity and cognitive function.

One question which arose during analysis was whether these memory issues persist, as research suggests, for a period of only 3-8 months postpartum (Orchard et al., 2023): It seems many participants continued to struggle with focus and memory beyond this timeframe. More specific questions and discussions would be needed to say with certainty.

Sub-Themes Emotions.

Desire to Become a Mother. The majority of participants had a previous desire to become mothers (*n*=8). Two participants were not initially sure they wanted children and had not specifically planned the timing of having children. All participants experienced great joy in motherhood.

***Positive Emotions*.** All participants reported some form of positive emotions linking singing and motherhood. All participants reported positive changes in the perception of their identity due to motherhood. All participants experienced joy and success singing at some point in the year following childbirth, some even citing a stronger motivation or connection with their voice. Nine participants felt that despite the challenges of reconciling family and singing, their desire to continue a singing career was strengthened. Eight of the participants cited feeling a need to sing following childbirth. The following table (Table 11) highlights the perceptions of positive changes as relating to singing brought on by becoming a mother. The first row shows which participants experienced a particular change, and the following rows offer detail through thematic examples. Many of the columns are interrelated: an increase in one area might have promoted a similar boost or change in another.

The two aforementioned affirmations (desire to continue a singing career; and a yearning to sing) are reflected in the column “desire to sing”. “Identity as mother *and* singer” was a category wherein all participants felt that aspects of identifying as a mother and a singer entwined and were mutually beneficial. Many felt that motherhood heightened their “confidence” while singing, and others described a major “change in priorities” that was advantageous to their singing. “Selectivity in choosing work” is related to a change in priorities specific to turning down work (and the acceptance and assertion required to do so) and “singing as comfort/therapeutic” highlights the contentment and fulfillment that singing provides (see Table 11).

Table 11

Positive Emotional Changes Experienced Following Childbirth Relating to Singing

Positive emotion	**Change in priorities**	**Improved confidence**	**Identity as mother *and* singer**	**Selectivity in choosing work**	**Desire to sing**
ID	D, E, F, J	A, C, D, F, J	A, B, C, D, E, F, G, H, I, J	B, D, E, J	A, B, C, D, E, F, G, H, I, J
Examples of positive emotional changes	Feeling of less to prove; Having baby in mid-30s meant relationship was solid, had life experiences, now able to prioritize family; Something more important than singing made singing more enjoyable; No time or energy to overthink in singing.	Several experienced an initial dip in confidence, but by the end of the year, felt more confident and capable as a singer, and mother/human; Feelings of pride, accomplishment; Never doubted capability to return to great singing, believed in self; Singing got better, could sing despite difficult conditions.	Increased maturity, life experience; Someone is relying on you, their life and wellbeing is in your hands; Joy as mother *and* singer, fulfilling; Needed to do gigs and competitions to have goals and still re-situate self as "a singer"; Hyperfocus on performing isn't possible, changed perspective as mother promotes balance.	Worried at first about appearance of not being busy, then realized that it is ok to say no to work; Work needs to fulfil something, not just work for working; Found balance between pushing through and resting/setting limits.	Love of singing remained present; Desire to sing outweighed stressors; One felt less motivation to sing, but still enjoyed singing; Increased need to invest in career; Singing became solace/haven; Excited to sing with colleagues.

Selected quotes which illustrate the above positive transformations are offered in the following table (Table 12).

Table 12

Excerpts Highlighting Positive Emotions Regarding Singing

Change in priorities	"Your priorities change, and I found when my priorities became less about being perfect and the perfect singer, I became a better musician because I was—I had something else that was more important." [E] "I don't know if it's the result of having a kid or also being a little more experienced. Maybe, but they don't feel as like "life and death situations" as much as before. You know, before I was like, 'Oh my God, I made an ugly note'. And you know, now I'm kind of like, 'well, no one died'…[I became] less anxious about it because I'm: one, older; two, I have more experience; and three, have something else that's way more important to me than then singing a note that's pretty." [H] "I love singing, but at the end of the day, if I get nervous, I think about my kids and then I'm like, 'OK, it's for them', you know? And then my mind is open to a different possibility. In that performance, it's not about me anymore and that's what's interesting. Your priorities change. And I found when my priorities became less about being perfect and the perfect singer, I became a better musician because I had something else that was more important." [E]
Improved confidence	"It changed also, psychologically…it gave me confidence in myself, to have had children…it made me grow and evolve…it brought me a lot of good." [F] "I'm just like if you want me, then you get like all of me. Right. You get all of it. You get great artistry, you got great emotional content. My voice might crack, that high C might be loud, but you got all of that, you know? …I think people are more comfortable with that person because they know what they get." [E] "I felt better, I would even say I felt more confident!" [A]
Identity/perception as mother *and* singer	"[A]n acknowledgement that you know, without my family none of this stuff matters anyways, you know, without my kids or without my husband or without this this life that we've made together, none of the other stuff matters." [D] "I'm not just [given name], I'm now a mother, you know, I have experience now as a teacher, I've grown in experience as a woman, there's a maturity now, how we present ourselves artistically, our…maturity, sensitivity… there's more experience to share. It's important to take that into consideration, I think." [F]
Selectivity in choosing work	"I didn't want her to have to sacrifice or feel like, even though she's a baby, feel like she was being sacrificed in some way because of my job. I love singing. I feel so lucky that I get to do it as my job, but I love her more and that's part of the reason that I'm not doing more opera. I don't want to be gone for that long.

	I want to be gone for four or five days and then come back. I think I would do it again the same way." [G] "You know, it's not 'I want to sing at any price', no! I started being so much more selective as to what I wanted to do…because it's taking time from me being at the house, time not with my family… there was a big change in my vision of what that is…. [E]ven if I still have a lot of fun singing, I'm less hungry… it's just a question of priorities. In fact, my priorities really changed 180 degrees! And it feels good". [J]
Desire to sing	[After returning home from a stressful postpartum contract] "I was so grateful, and in fact, it annoyed me because when I got home, I was like [expletive]! I can't stop!" [singing; C] "I was so happy to be singing. Really, really, happy. I had practiced a whole new Swedish song cycle, I'd learned my text, I'd given myself the challenge to learn it all by heart. I practiced my text on stroller walks". [C] "I love my job and I love going to rehearsals and to a show. It's just like, you know, time for me and it's what I love to do. That's the part of the job I love." [H] "I was so excited to sing that I just told myself 'No! I'll be ready, I will do this contract' because you know, it had been almost nine months that I hadn't sung, so I felt this urgency to get back on stage, to make music with colleagues, really, I was so excited." [B]
Singing as comfort/ therapeutic	"I found a lot of solace in singing and getting back to singing early" [I] "Singing is my meditation" [C] [After discussing feeling resentful to be away from her children on a contract] "Then I start singing and I'm like, "ohh yeah!", like it is visceral and it is therapeutic, the sound coming out of your body, especially when it's a sound that you feel happy with, you know, and then you're just like 'ohh yeah, I forgot, I forgot'. And then especially when you start making the sound waves with other people- like orchestra or even just other singers, you, there's a synergy there that you're just like, 'OK, this is, it's very, there's something supernatural about it." [E]

One participant brought up a very beautiful point (which was not asked of the other participants, regrettably), that she perceives her singing career as *benefitting her children*. She said, "it's good for them to see something that you're very passionate about because then they think, well, there is more to life than video games or whatever!" [E]

Negative Emotions. Being a new mother brought up several themes or aspects of motherhood that could be categorized as negative emotions which affected the participants' psychological wellbeing, their relationship within the couple, and singing. The negative emotions are categorized into five prevalent themes: an increase in performance anxiety (due to doubts and worries, amount of time not singing—due to both COVID-19 and/or pregnancy—and changed habits or relationship to voice); priorities that have shifted out of balance causing unhappiness (feeling like singing or self comes in last with the new responsibilities, difficulty prioritizing singing); psychological fatigue (feeling overwhelmed, weight of responsibilities, speed and quantity of changes), difficulty communicating with partner (feelings of frustration and jealousy, need to better advocate for self); and symptoms of anxiety and rumination (separation anxiety, environmental factors, pressure to feel or seem in control). Table 13 outlines these emotional changes and offers examples from the interviews.

Table 13

Negative Emotional Changes Regarding Singing Following Childbirth

Negative emotion	**Performing stress/ Stage fright**	**Unbalanced priorities**	**Psychologically Tired**	**Communicating with partner**	**Anxiety/ rumination**
ID	B, C, D, E, F	A, C, D, H	A, C, H, J	A, B, C, D, F, G	B, C, D, E, F, H, I
Examples of negative emotional changes	"Will I still be good? Can I do this?" Fatigue created doubts, exhaustion; Vocal rest between end of pregnancy and first contract heightened stage fright due to being out of shape; Performance anxiety aggravated by Covid-19 Vocal changes, unfamiliarity with voice created stress; Changed habits create instability and stress	Singing is always coming in last place, even if it brings joy; If partners have inflexible jobs, hard to prioritize singing; Baby comes first, then family/partner, then me as woman/singer; Needing to decide to spend energy on singing again, less on anxiety as a parent (once past the initial postpartum period)	Around the clock baby care taxes emotions; Being first (or in some cases, only) respondent to baby's needs; Lack of motivation to do things (hard to prioritize practicing); Feeling fragile Many changes come at once (change in career pace, buying home, becoming mother)	Jealously of partner, who could go back to work and live adult life; Frustration/ bitterness that partner did not have same responsibilities (e.g., breastfeeding, emotional stress); Learned to ask for help finding time to practice; Shorter patience with partner when stressed about singing	No personal/ quiet space; Unable to control surrounding environment; Separation from baby; "Baby blues" for first six weeks; Worry about keeping up appearances, comparing self to others' online presences; Lack of mental capacity to do things that are beneficial and usually enjoy (e.g., exercising) Anxiety about illness (aggravated by COVID-19)

Perceptions of negative emotional changes were felt by all participants, although no category included experiences by all participants, as was the case in the positive changes. The largest category of negative emotional changes was anxiety/rumination. While this included depressive or detrimental thoughts, lack of joy, feelings of inadequacy, it also included participants who

experienced postpartum anxiety (*n*=5), two of whom had anxiety with both of their children; or perinatal depression (*n*=6). They were not all diagnosed by medical professionals, but depressive symptoms and anxiety affected quality of life for these participants. Three participants were prescribed medication to deal with anxiety and depression which they reported being helpful. One participant experienced "Baby blues". One mentioned that after 16 years of having a certain performance routine, it was stressful to only have a few moments behind the curtain before going onstage. Anxiety over getting sick (*n*=2) was aggravated by the COVID-19 pandemic, longer periods without singing contracts, concerns for the health of their children and ability to sing contracts.

Issues arose for many participants in communications or conflictual feelings towards their partners. For example, one participant felt bitter that her husband continued his career uninterrupted, yet when he offered to take care of the baby so she could travel for her contract, it was unthinkable for her to leave her baby. Despite the stress and fatigue of traveling alone with her baby, or disappointment at cancelling a contract, she was at peace with her decisions. Another participant resented her partner when he arrived home feeling accomplished after a day of work and a rapport with his colleagues (social interactions being even more precious during COVID-19 lockdowns), while she spent the day alone with the baby. Compounding these feelings of jealousy of his fulfillment and her lack thereof, was the fact that she had to practice at less optimal times of day, starting her work only when he got home and could take charge of the baby. This was later mitigated by hiring help for a few hours a week to allow her to practice during daytime hours and enjoy time with her partner/children in the evenings.

Half the singers experienced an increase in performance anxiety or stage fright as outlined in the chart above and four participants felt psychological exhaustion impinge on their wellbeing.

Table 14 includes a sample of excerpts which highlight the various negative themes that stood out from discussions on emotions and singing.

Table 14

Excerpts Highlighting Negative Emotions Regarding Singing

Performing stress/ doubts about voice	Right away after the birth, I was nervous as I didn't know what was going to come out. [F] "The show would come and I was like, my inner dialogue was literally 'just do this one thing and then you can quit.' And then I would just take the first step on stage and say the first word and then I'd be fine. But that, up until there I was like, 'I don't want to, I don't want to! This is the worst thing. Why am I doing this? I'm gonna be awful.' And then I would just breathe, say a prayer, and then I would just say, just one step and one word- and then go from there. And then within 5 minutes I will have forgotten about it, that moment, at that moment was so significant before every show. But the first year, yeah, I would say [it lasted] the first year." [E]
Unbalanced priorities	"But now, like I'm like, yeah, I'm finding it hard to be motivated to do things. Maybe because I'm so like, there's so much stress in my life and there's so much things that I need, so many things that I need to talk about, to think about that. Like even when I do have time to practice, I'm kind of like, OK, I need to watch something." [stress avoidance] [H] "I think at the beginning, like feeling, probably actually until she started school, like feeling like I needed to practice but not wanting to take so much time away from her because she wasn't in daycare or anything. And like I couldn't really ask my husband during the day to take 30 minutes with her so much." [G] "[Around] nine months postpartum where the exhaustion sets in and you're starting to look for yourself again and trying to find your identity again and that's when like all the doubt comes back where it's like how much? How much of this energy should I be spending on all of the little anxieties that you have as a parent and how much of this energy should I be spending on trying to figure this thing out again? [D]
Psychologically tired	"I have to prove to the entire world that nothing can stop me. And that's, I think that's me. But then add to that a baby. Where you also wanna be the best mom to that baby and not, I don't want them to feel like second or like, like they're not part of your world, you know?" [E]
Communicating with partner	"I think it definitely probably had an effect in that time on my partnership because it was just a challenging thing to go through as a partnership and like... again, I'm grateful that we, I have a very supportive partner, but it's a challenging thing to go through." [I] "It took a long time for me to understand that it was OK for me to take space for myself." [D]

	"I'm sure that I was really short with my husband, and we probably had more like arguments and stuff than we would have if I hadn't been having these vocal issues." [G]
Anxiety/ rumination	[The participant constantly felt] "a mix of pride, stress, and exhaustion... [singing] is always accompanied by a lot, a lot, of guilt, and separation pain, separation anxiety, that's for sure." [B] "But it was very acute postnatal in terms of like - I was terrified of air of water, of very bizarre things that I never would have imagined." [I] [Upon the return of menstrual cycle] "I became a super anxious person. Like, every month suddenly I could have rebuilt whole life, like I should start all over again. Each month, I told myself 'stop, you can't do this career. It's too hard. I'm not capable, I'm too sensitive, too emotional'. Then two weeks later, I was all good again. It was so hard to follow." [C]

➔ **Discussion.** Anticipated negative stressors like baby blues, increased performance anxiety and lack of motivation were expected, considering the massive life changes and physical changes of the postpartum period. Even when taking these negative emotional changes into account, all the singers felt that they would still always choose motherhood. Many offered the caveat that they chose or felt responsible for their parenting choices or maternal responses which fostered these emotions (e.g., continuing to breastfeed despite difficulty and stress, feelings of attachment, traveling alone with baby for contracts despite fatigue). Notwithstanding anxiety, depressive symptoms and rumination, the singers found solace in singing, which was perhaps helpful to their overall mental health. It was heartening that all the participants felt continued or renewed love of singing despite the challenges of reconciling family life and psychological stressors following childbirth.

Previous research has mainly looked at stressors and perinatal mental health through a negative lens, and this study is the first to have methodologically asked singers about the positive emotional changes they experienced, and how this translated into their professional lives. I was surprised that many participants felt a welcome decrease in performance anxiety due to their new perspectives. Gardner (2017) similarly found a decrease in pre-performance nerves in her study (41% of 444 participants; although 9% perceived an increase). Positive priority changes were also mentioned by Gardner: It is reassuring that a return to singing offers positive changes, not only challenges, considering the anecdotal fear in the industry surrounding postpartum changes.

The year following childbirth is known to be difficult, and the challenges are not to be trivialized. However, it is important to balance the negative and positive aspects to fully understand the complexity of motherhood. As emerging *matrescent* psychology posits, it is essential to recognize and celebrate how women flourish during the postpartum. The above perceptions of the year following childbirth help specify the positive aspects of being a new singing mother and how that translates to life and singing. Seen through the lens of Athan's suggestion of the maternal framework (2024), these findings support her addition of moral, existential and spiritual markers. These considerations promote wellness and counterbalance the more challenging aspects of motherhood.

Overarching Theme of Breastfeeding. Breastfeeding engendered several psychological implications, both positive and negative. 50% of the participants enjoyed breastfeeding especially for its proximity and intimate connection to the baby. One participant mentioned, though, that the added attachment meant that she found it harder to be away from the baby.

Many encountered stresses related to breastfeeding. One mother felt relief only when she stopped pumping (baby never took to feeding from the breast), another had a baby who cried nonstop, even while feeding. Four mentioned being distracted and worried while working, as they knew their babies were crying, waiting for milk and refusing the bottle. One participant experienced anxiety and depression until she finished breastfeeding; and one participant struggled to breastfeed until five weeks postpartum, which caused a lot of stress and feelings of incompetency (she also felt pressure from family to breastfeed despite the difficulties feeding). The latter two felt, nonetheless, that the benefits both they and the babies experienced with breastfeeding compensated for these negative emotions.

The following quotes encompass the dynamic relationship—the highs and the lows—many experienced with breastfeeding:

"There's such an energy that comes when you're breastfeeding, which for me was looped into some of the anxiety and the depression that lasted probably until I finished breastfeeding and then it was just like, "boom" [bomb explosion with her hands], "ohh I'm back! Weird!" Like, that's magic.

> But then there's the kind of body magic that you get when you're breastfeeding. Then that goes, and then you're left with your body in a different relationship to it, because you go from this body as yours, to this body as shared, to this body as magic, to then just, "what's left?!" [I]
>
> "I just couldn't breastfeed, and I had this feeling 'it's supposed to be *your* job, but you can't even do it!" [F] [This participant then continued to breastfeed successfully for over 15 months, citing its simplicity].
>
> "I found it such a beautiful moment, a connection with your child, a link that's unique. So I really found it beautiful, once it worked! But it's really special to be able to experience that proximity with your child". [F]

➔ **Discussion.** It is surprising when hearing about some of the participants' difficulties breastfeeding, that all the participants breastfed for at least six months until solids were introduced. While it can help the body recover and is certainly a lovely way to connect with the baby, StatsCan found that only 34% of mothers breastfed exclusively for six months (Statistics Canada, 2024). This rises to 40% in mothers over 35 which is interesting, as 80% of the study participants were in this demographic during their postpartum year.

It seems natural that something as time-consuming and complex (physically and emotionally) as breastfeeding engenders both positive and negative emotions. As shown in the above quote, the woman who felt that breastfeeding is magic also recognized that it was somehow responsible for her postpartum anxiety and depression, since all symptoms disappeared once her baby was weaned. Understandably, many participants wondered to what degree hormonal fluctuations were responsible for mood and negative emotions. As one participant pointed out, the hormonal loop that promotes lactation inhibits hormonal homeostasis, which may affect mood and psychological wellbeing, as well as physical health. Considering that singing literature mentions mainly negative effects on voice and maternal literature mainly positive, it is helpful to know how working singers balanced the two and forged paths that were best for them and for their babies.

4.2.4 Occupational Changes

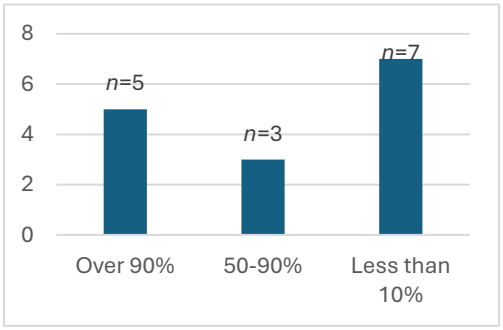
The reality of the career makes scheduling and childcare very difficult in addition to the emotional toll of returning to work postpartum. Opera contracts are especially challenging due to the length of contract (typically 1-2 months) and the unpredictable schedule which requires evening rehearsals and last-minute changes. Concert work equally requires extensive travel.

Sub-Themes Travel and Organization. Various elements of travel for contracts during the first year were discussed during the interviews and many share variables with other occupational sub-themes (e.g., financial considerations and childcare). Challenges and positive aspects for these two sub-themes will be discussed together for this reason.

Figure 9 illustrates the percentage of time away from home for work (the x-axis) with the number of births represented by the bars. Measuring births and not participants allowed for a clearer representation.

Figure 9

Percentage of Contracts Away From Home in First Year Postpartum



During the year following childbirth, five participants were away from home for over 90% of the time of their total contracts with one baby each, two participants were away for between 50-90% of their contracts (one participant had two babies) and four participants left home (with a total of seven babies) for under 10% of their contracts (one for a week, and the others only for auditions or short concerts). Three of these latter participants had two babies and did not travel for work in the year following childbirth with either baby. Two participants with two children had very different experiences with the nature of contracts between their children (one traveled less than 5% with her first, but over 50% with her second; another traveled 50% of time with her first and around 80% with her second).

Figure 10

Number of Singers who Bring Their Baby to Their Contract

Four participants brought their babies with them on contracts because of lack of support at home but would have preferred to be alone on their contracts to better concentrate (illustrated in Figure 10). Five always brought their babies with them to contracts as a preference, with help from their partner, family members, or sitters. One prefers not to bring her baby and was able to leave the baby with sitters for short periods as she does not travel often for her work.

Organizing travel depended on many factors, both external and personal:

1. **Childcare:** Typically depended on who was available. Most singers (*n*=6) tended to prefer traveling with their partners, and if that was not possible, then four of the participants used sitters and four others had family members travel with them. Two never had their partners or family with them and would hire sitters or nannies. Some used both family and sitters depending on availability.

   Half the participants had no family close by to help: one would fly her mother to the city of her contract to help her when singing away from home; one participant had a family member move in with her partner who stayed home with the baby during a shorter trip; one did not travel often, but found hiring sitters at home very difficult as she had two babies very close in age (often two young sitters would need come at the same time or with their parents). One participant worked for companies which offered to offset childcare costs or help hire childcare. This was an exception when compared to the other participants.
2. **Wellbeing:** Three singers found themselves alone on opera contracts with their baby as their partners could not travel with them. This caused extreme fatigue: being the sole responder through the night and singing rehearsals or performances the next day was very taxing

psychologically and physically. One of the three tends to sing mainly concert work because her partner cannot travel with them often and she did not wish to the leave the baby. Another had a parent or friend travel with her when she could, but found the lack of sleep and increased stress to be a challenge as she spent nights alone with the baby.

3. **Financial:** in the first year when it is more difficult to leave the baby at home to travel, the cost of travel with a nanny or partner (or to travel home for visits if on tour) and family-sized accommodation had to be factored into whether they accepted the contract and if they were able to have a partner or family member come rather than to hire sitters or nannies. One participant mentioned that it would have been much easier to hire a live-in nanny but that it was not financially possible, despite working for large companies.
4. **Accommodation:** In the first year, the singers singing opera contracts rented apartments close to work to help facilitate feedings and maximize time with their babies. One singer worked for a company which had apartments inside the opera house for families which is rather unusual but was greatly appreciated. Concert singers similarly looked for accommodations that were close by although traditionally companies organize hotels for concert work. One singer began routinely asking for a stipend for an apartment or hotel closer to the hall, citing the need for a kitchen, even if it meant the accommodations were less fancy.
5. **Ritual:** Some singers found it easier to keep as many variables the same as possible when traveling. One singer returned often to the same city for contracts and would rent the same apartment each time. She and her partner organized their work (her partner reduced work for the year) to allow for them to travel together as a unit. When reachable by car, even if long distance, they chose to drive and bring all their own things with them to offer stability (e.g., toys, foldable bed). Another participant joked about buying multiple IKEA cribs for her baby, in various cities, to be sure the baby would be comfortable in the same bed no matter the city. Once she found a good nanny, she also hired them for all contracts away for familiarity.
6. **Backstage babies:** Bringing babies to rehearsal or backstage was a divisive point between participants. Type of contract and familiarity with the organization were important factors, as was the baby's ease with taking a bottle. In early months, most had caregivers at home who

would bring the baby for breastfeeding at breaks, except those who already accepted a pumped bottle. Later, participants brought the baby to a gig only out of personal choice.

A few singers asked permission to bring the baby backstage or to rehearsals and were never refused by the company. One could not request for her baby to accompany her as the company had implemented a strict COVID-19 no-visitor policy at the time. She found this difficult for organizing breastfeeding. Three singers did not ask permission but brought the baby with their partners which was possible as they knew the companies they were working for well. One specified that she always brought her child with her until she was sure the baby was ok to be left at home with sitters or family.

All singers sing both opera and concert, although some specialize more in one than the other. The nature of an opera vs. concert contract was a factor for ease of having babies present. Singers on opera contracts tended to see their babies for feedings at breaks, but did not tend to have them attend rehearsals, with one exception. Some singers did bring their babies with childcare to concert rehearsals: two participants brought the baby right into the room as the team was open to this; some had them stay in a backstage room; and one chose specific rehearsals that were conducive to bringing the baby. One singer who always brought her children on contracts with her said that if there was a concert that caused her a lot of stress, she would exceptionally arrange for the children to stay home so that she could concentrate. Two specifically preferred separating their job of mother from singer, to be able to concentrate on singing, never bringing their babies backstage but leaving them at home with milk.

The following quotes highlight the highly personal views about how to organize work and family, presented according to the participants preferences of having their babies with them at work, or not:

Babies at work - examples:

"I said, 'look, don't stop the rehearsal.' I nursed and continued working anyway. I always had a friend or family member who came to help me. So I would organize it to have someone who could stay close to me, but yes, I nursed both my babies while singing, doing the staging at the same time!" [B]

"I would say 'I would like to be able to do this, can you let me know if it's OK' and nine times out of 10, I mean, I could probably say 10 times out of 10, I can't remember somebody saying 'no, she can't come here', like for any period of time. They maybe said 'yes, but it would be best if she could leave by such and such a time' or something." [G]

"Well, I arrived to the dressing rooms much earlier, way earlier than anyone else on the team. I was always the first to arrive. I took my time to warm up, nurse the baby, put on makeup, nurse the baby, that's it, each time." [B]

Babies and family not at work – example:

"I realized that it did not interest me [to bring babies to rehearsal/backstage]. I did not want my family to turn around my person. I don't have it in me, the desire to make everyone follow my rhythm….When I leave the house, now I can concentrate. I preferred to leave bottles at home, and it stays family with family, and work with work [dividing gesture with hands]". [C]

Babies who travel:

"The only thing that was really hard was the contract I had in [European city] for two months and you know, I was, she was not sleeping. I was sleeping like 4 hours a night. Not even consecutively. She like, never adapted to the new schedule. I don't know what it was. We were sleeping in the same room. She wasn't used to that. It was horrible and I ended up having a mastitis." [H]

[On the difficulty of having babies with you on opera contracts] "It's the schedule that you get the night before or the being away 2 1/2 months. I really honestly feel like this is not a profession that's been thought of for mothers." [H]

"My baby traveled like a dream, and still now: train, plane, car, whatever—pff, it doesn't bother him at all! He was always like that". [A]

Overarching Theme of Breastfeeding. 70% were able to pump for bottle-feeding while away working. One prepared stores of milk over the course of four months in advance of a long contract away from home, which worked well for her. She was proud that she could continue offering

breastmilk in her absence. Another expressed milk when arriving home late from contracts, which she felt was an easy organizational ritual. 30% found breastfeeding/pumping to be difficult when working: two of the babies refused to drink from a bottle, which was very demanding on the mother—interrupting sleep schedules and causing stress while working. They also found needing backstage childcare was stressful and distracting. On the other hand, 50% found breastfeeding to be the easiest method for work.

Two mentioned singing rehearsals with their babies in front carriers, so that they could nurse them on demand. Another did this while preparing music (in rehearsals with a coach, but not during the official contracted rehearsals).

One issue with breastfeeding related to work was the lack of time and place to pump. Being offered only "dirty" work environments for pumping milk was reported by three participants ("dirty hallway" was mentioned twice, and "dirty toilet" and "dirty closet" each once). One also felt rushed to pump, store the milk and get back to rehearsal but happily stated she was never late after a break. No one reported asking for accommodations due to breastfeeding, although one participant mentioned she wished she had asked for a convenient fridge or a clean place to pump her milk.

Scheduling. All participants experienced a drastic change to their practice schedule and organization. Early postpartum was a learning curve for many: physically recovering and getting used to lack of sleep, breastfeeding, and finding energy and time to practice was a struggle. Inner struggles to find motivation, stress surrounding getting back into vocal shape, and new communication challenges with partners were cited (as mentioned in psychological factors). Naps were mentioned by most as the best time to practice, but the inherently erratic nature (lack of regularity) also promoted anxiety for many, as this time could not be guaranteed.

Changed modes of practicing were necessary for all. Many were forced to rehearse mentally ("table work" as one participant called it: memorizing, translation, visualization) during naps or at night. One participant practiced breathing exercises during naps to relax and practice. A few worked on their music during stroller walks.

The following are quotations from two participants that express those changed modes of practice:

"Learning [happened] in the night and then practicing it in, in the day…I think I maybe spent a bit more time having to actually concretely learn music than I did previously, because I just retained things less easily." [I]

"We had a lot of text to memorize. And I really had to work on my memory. If I was walking the stroller, my head was full at each moment, you know, each little moment is so, so precious! The brain doesn't get any rest because if you finally get a minute to rest, you have to learn your stuff, you know?" [B]

Three were able to sing full-out during naps (although one participant's first baby slept for only 20 minutes at a time while her second slept for three hours, so it was only feasible for her second). Three were able to sing with the baby awake, either in the playpen or laying on the ground while they sang. Shorter periods of time to practice also forced many of the singers more efficient in their practicing. As mentioned under the sub-theme of cognitive challenges, one participant felt having to learn such small sections, or elements, at a time resulted in better music learning despite the stress. The most well-sung contracts (for voice and preparation) were often the ones that were prepared prior to the arrival of the baby. It took less time to feel comfortable vocally in the music once the participants returned to singing after childbirth.

A lack of routine was an issue for some, compounded by lack of motivation to practice and more time off between end of pregnancy and first contract than usual. This translated into a lower level of preparation than usual for a few. Some singers struggled without structured routine as they were used to. Lack of appropriate space for rehearsing was also problematic. One participant was able to borrow keys to a neighbour's backyard cabin and practiced there during her baby's naps. She eventually made arrangements with a local church for practice time.

Actively carving out and scheduling practice time with partners was a necessity for some:

"I tried to communicate clearly [with my partner], in the right way, to say how I truly felt, and I learned to clearly explain my needs—not wait for him to guess". [F]

Table 15 shows the types of relationships the participants had with practicing and if a solution was found. The columns are not mutually exclusive, some participants fell into multiple categories.

Table 15

Organizing Practice Time

Struggled to find practice time (lack of help)	**Actively organized practice time with partner**	**Hired help**	**Prioritized practicing**
n=3	*n*=4	*n*=4	*n*=3
1 rehearsed very little; 1 practiced breathing and table work mostly; 1 lacked motivation, missed routine	All four needed daytime practicing; Asked partners to give them quality time to practice or could hire help; Communicated their needs regularly	3 hours/3 times a week; 3 hours/every few days; Family help was also organized by two	Three felt prioritizing singing time was necessary. These particular three also had babies who enjoyed (or tolerated) singing and allowed the mother to sing while spending time with them

➔ **Discussion.** Two distinct experiences relating to balancing work and baby took shape over the course of the interviews. Those with present partners who could travel as a unit and shared schedules and responsibilities had a much easier time balancing singing and motherhood, and found greater joy and less fatigue than those who had busy partners, traveled alone or stayed home alone with the baby. While this is individual to each singer and family, the nature of a singing career (requiring regular practice and travel) imparts special challenges for new mothers. Cost of childcare varies wildly across provinces and countries and personal preference is sometimes outweighed by this financial cost. Further, as stated earlier, the participants of this study returned to work much earlier (between 1 month and 12 months) than most mothers who are not singers (77.1% of employed mothers take parental leave; Statistics Canada, 2023). Very little support in the literature offers insight on these occupational considerations.

Sub-Theme Pandemic Considerations. While the pandemic was difficult on so many levels, it seems that it may have had a small positive impact in some ways for some participants. Some of

the singers felt in fact that the pandemic was good time to get pregnant as the forced time off allowed the singers to spend more time with their families. The participants who had children during this period began to feel a change in occupational pressure that being mothers did not mean the end of their career. Cancellations due to COVID-19 gave singers a bit of extra time to prepare musically and vocally, one participant said she would tell herself "When the world is ready, I'll be ready, and I'll be fine." [E]

Unfortunately, the health crisis also brought negative considerations. One new mother was isolated from everyone during lockdowns. She flourishes in social situations and being cut off from friends made the postpartum period very difficult. She feels part of her depression was likely due to this situation. A large problem was also the unpredictability of the time: she felt she would make great lengths vocally and be ready to perform only to face another lockdown or cancelled contract. This see-saw of emotions and vocal response was understandably frustrating during an already precarious time of life.

Two participants became hypervigilant about getting sick. Fear of contracting COVID-19 added a great deal of stress to both of these participants. They each had two children and daycare closures added to the organizational nightmare of the time. The second participant often pulled her children out of daycare to keep everyone healthy. As could be imagined, having older children home full-time during the year postpartum in addition to stress of the pandemic added to overall fatigue.

➔ **Discussion.** These findings are in line with studies out of Belgium and Switzerland, which found that time at home was beneficial for many (Ceulemans, et al. 2020; Lambelet et al., 2021). However, it also conversely increased perinatal anxiety and depression due to lack of social connection which has been the case for many others in the general population (Buonsenso et al., 2022). Organizing an older child at home added stress, which is also in line with the research (Lambelet et al., 2021). However, the fact that performing artists were all out of work had a possible benefit to singing mothers who felt less pressure to return to work during early months of postpartum. Of course, once work restarted, singing required extra vigilance around getting sick. This is a concern specific to a singing career and was clearly experienced by a couple participants.

Sub-Theme Career. Multiple changes were experienced with respect to the occupation of singing. Cancellations, changed financial priorities, various stressors unique to singing, including reactions from people in the music industry were coded.

Cancellations Due to Baby.

Pregnancy. Four participants cancelled contracts that fell right around the birth of the baby. While disappointing, it was necessary as the contracts were too close to the time of birth. One participant had to cancel multiple contracts during pregnancy when she was advised to reduce activities. She felt the forced rest had financial and career ramifications not just for the months of rest, but also decrease work (e.g., since she was not singing auditions) for the year after.

Postpartum. Three participants cancelled opera contracts postpartum. Two of these participants canceled an opera contract postpartum because of extreme fatigue and large back-to-back contracts. One cancelled a contract six months in advance when after one month postpartum she saw that her voice was not in shape (but she felt the casting director "never forgave her"). The other cancelled a contract which required long travel, bringing a nanny, and was not financially worth the stress (for only a few performances) in addition to feeling very fatigued. She was relieved to have a break; however, she felt cancelling after having a baby was worse, optically, than cancelling for sickness and was afraid to get a bad reputation. While she feels that she was likely partly projecting this fear, she felt it was still founded in reality: she was afraid that "any other soprano without a child will be trusted to sing before the one who has already cancelled". [A]

Another participant cancelled a long opera contract when her housing plans fell through, and it was too difficult to organize other plans. One participant recalled being devastated to cancel an audition without notice after a long night without sleep. She did not feel capable emotionally or physically to do the audition. One participant had to cancel a concert for vocal health (hemorrhages). Some of the above cancellations cross-pollinate with the following category: changed financial priorities.

Changed Financial Priorities. Over half the participants turned down work during the year following childbirth. One participant weighs contracts differently now (creative interest vs. time vs. money): she would rather accept a low-paying collaborative, grassroots contract than a large-scale

low-paid contract. One has become more selective of her work, which she has found leaves room for more work to come in. She was grateful motherhood made her reorganize her priorities and time. The following points and quotes report and demonstrate more specifically how decisions were made as related to auditions and other incomes:

1. **Auditions:** Less desire and time to travel for auditions was reported by three participants. One felt that she was no longer willing to take financial risks for her career which included cutting back money spent on auditions. Another said that she used to pack her bags and go any time her agent booked her an audition, and since childbirth, she mostly chooses hometown auditions due to the complications of organizing and paying childcare and travel.
2. **Other incomes:** Two singers began teaching which helped to give stability. It allowed them more freedom to turn down contracts that were unattractive artistically, financially or geographically. One felt more confident to stay close home for the year with her babies than she thinks she would have if she didn't have the safety of teaching. One felt lucky not to be the main breadwinner, which means she felt confident to cancel if her baby was sick or turn down work that did not interest her.

Examples of quotes showing changed financial priorities:

"Singing's gotta be worth it—and my standards of 'worth it' have changed! If it's not, I'll say no." [I]

"Is this job feeding me in the way that I need to be fed? And is it worth it? You know, it just allowed me to evaluate certain work and sort of actually filter out the work that I was just doing for money or just doing for a little bit of money." [D]

Occupational Stressors or Challenges.

1. **Slower pace:** For some, it was necessary to make peace with a slightly slower singing pace because of fatigue and not wanting to be away too long from baby. One participant stated that "[t]here was a gap of two years because you throw yourself into it a little less for a year, and therefore the next year suffers a bit. So there were about two years where I still had contracts, but fewer than normal". [B]

Others had to reevaluate the pace of their career due to fatigue and admit that their back-to-back opera contracts in the early postpartum period were not possible.

2. **Stage considerations:** Professional singing comes with a special set of considerations. Costumes and staging are a part of the operatic profession for example, and as a new nursing mother, this can cause certain complications due to breast heaviness and discomfort and postpartum pain. One participant who was being asked to skip around the stage relayed having to go frequently to the washrooms to relieve her breasts of uncomfortable milk throughout the rehearsals in order to skip comfortably. Another asked for pads to be added to her costume so the milk would not run down her costume. A third participant was in pain when staging required she hug another character, and her breasts were so full of milk that it was painful. She also needed help getting up from a staging position due to discomfort in her abdomen following Caesarean-section. She quietly asked a colleague to help her. By the end of the rehearsal period, she was feeling improved, but they continued the adapted staging that they were used to anyway. She was grateful to have a colleague who would subtly and elegantly help modify her staging. A fourth participant struggled with standing positions for long periods of time while singing post-Caesarean section.
3. **Quality of time at gig:** One participant loved every moment she was singing but hated having her time wasted in rehearsals as she found it made being away from her baby harder. “Having your time wasted bothered me. Which is so bitchy to say, but like not being used properly in a rehearsal was a lot more annoying when I knew what it was taking me away from.” [G]

Reactions From Teachers, Managers, Companies and Colleagues. This theme arose from the interviews based on a question posed to the participants about how they felt people around them in the industry reacted to their motherhood. Both positive and negative experiences were recorded, either feeding into the taboo that professional singers should not have children or defying it. Having a strong team at work was positively reported by 70% of the participants: several encountered family-friendly organizations, and nurturing companies and teams led by women. While overall, the majority of singers felt well-supported, negative perceptions occupied many conversations (59 negative codes vs. 43 positive codes) and caused considerable stress for those had negative experiences.

1. **Colleagues:** No participant had any trouble with colleagues, only positive comments were shared about the conductors and singers they worked with.

> Friendly, supportive and helpful colleagues were mentioned by all, but especially about singer colleagues:
>
> "[A colleague] sent me a message. 'Are you OK? Do you need anything? Do you want me to come and take the baby?'" [E]

2. **Agents:** Three felt they had particularly helpful agents, one even signed on to a new agency while pregnant. (Agents are discussed below, under negative themes).
3. **Heads of company:** Generally, the relationships to heads of company were positive, or at least neutral. One participant mentioned two separate moments where a conductor and an artistic director stood up for her and fought to hire her despite concerns of her pregnancy and recent motherhood. Some felt ambivalent about bosses from companies, some had difficulties with them, but many felt supported:

> "I've had artistic directors literally watch, when we couldn't find babysitting, watch [name of baby] while we're rehearsing, like when she was young with a pram." [I]
>
> "I love it when people say, you know, 'your kids are welcome' or 'we are a family friendly organization, your family comes first'. Like getting that kind of affirmation from people, from colleagues and people that, you know, have the potential to hire me or not, is really lovely." [D]

4. **Changing taboo:** Mixed comments (due to both positive and negative experiences) surrounded discussions about various companies, heads of companies, agents and teachers/coaches. Three mentioned acknowledging the taboo surrounding singing and motherhood but felt times were beginning to change:

> "I think the business has changed now with Equity and you know all you know the equality and all diversity. People now know that you might come in, and if you have any kind of factor in your life, they have to accommodate, that's their job. And so it's not that that makes me

calmer, but it makes me understand that, that I have agency over how I feel going into a contract." [E]

"My worry about appearing well and to tough it out, yeah, it came more from me than from the company. I didn't feel any pressure from them." [A]

The following negative themes were found:

1. **Apprehension:** Perception of how people in the industry would react based on previous experience and the music culture caused apprehension. Fear to take time off was commonly experienced (specifically because of how it would be viewed, not for financial reasons). For 80% of the participants, fear that companies would discount them or forget them once they become mothers made taking a maternity leave seemed dangerous, and they felt trepidation to cancel if feeling unwell. Fear to cancel due to sickness was perceived to be worse after birth than prior to pregnancy.

Fear of a poor reaction from the industry is illustrated in these excerpts:

"I know I felt a stress. I had people comment when they found out I was pregnant the second time, people said "again?!" It felt violent, in a way." [C]

"I made sure it didn't show too much—that I have a baby—not in the sense of hiding it, but not letting it show in my work…this care to seem fine and tough it out came mostly from myself rather than the company". [A]

"A lot of the nervousness was inside my head about how people would respond. I think we have this preconception that it's going to make us less attractive as musicians or as potential hires. I think a lot of that's in our head, especially now—I think we're really lucky because there's been a really big shift. But there are certain things—it does make things less predictable. It does make us less focused. So there are real considerations for people that are hiring us because I've thought about that before." [D]

2. **Less work/firing:** Some of the participants noticed a reduction in offers or encountered difficulties with companies during their pregnancy. Many others witnessed this with colleagues, confirming that their worries were not unfounded. Two participants had to fight to keep contracts during pregnancy with companies who wanted them to step down. Only one participant specifically said she did not experience this stress or taboo from the industry.

One participant put pressure on herself to return to work: [I felt I had to] "show I still sing, I'm not just a mom". [B]

3. **Hiding motherhood:** Two singers reported hiding their motherhood for the first months postpartum as they did not want to draw attention to the fact for fear of kickback from the singing industry. It is important to note that this was different for participants who had babies later, during the pandemic as the nature of the pandemic kept them away from public eye naturally. One of these two had her second baby during the pandemic and while she felt being on lockdown was difficult psychologically, she was relieved that she could spend months with her baby without the industry looking in. A third participant felt relieved that due to the COVID-19 pandemic, there was less need "to perform or present 'I'm still in the game' because nobody was!" [I]

This quote explains why a participant felt the need to hide her pregnancy: "I didn't talk about it, I was a mother already for some time, it was sort of like a secret. Then at some point, I was like, that's enough. But at the beginning, I admit that I was afraid to be seen completely differently…I wasn't sure that all of a sudden, because I was a mother, they wouldn't see me anymore as a young girl who can play Gilda and Juliette." [J]

4. **Agents:** Participants were divided in the reception they received from their agents. Three participants had good relationships with their agents and felt encouraged by them; three others felt unsupported by their agents. One felt that her agent only reinforced her fears of not working postpartum and while she was still pregnant, voiced multiple concerns that the participant would not recover from childbirth well enough to sing her contracts. Another

found out that her agent had actively warned companies that she was expecting and felt they should hire someone else.

> An example of a conversation with an agent:
>
> "My agent, often she stressed me out also. It's like I didn't feel a state of reassurance from her. It was causing her stress, too…She said, 'he's [head of company] very worried. You aren't experiencing any complications? Right now you're ok, but what should I tell him? You know, are you going to be ok?' It was, she was really very insistent." [F]

5. **Lack of worth:** The cost-of-living increases, but the fees do not. One participant asked for better pay for a contract, considering it would require being away from home for a while and would incur significant childcare costs. She paraphrased the answer she was given as "too bad, it's not our problem she had a baby". [H] This illustrates the lack of support some of the singers experienced. In addition to losing money on childcare or bigger apartments, fear of being disposable encouraged four participants to feel pressured to prove they were as good (or better) than before, and that they were still worth hiring. They felt it was important to be in physical and vocal shape and not ask for any special treatment (oftentimes pumping milk through breaks with no time to rest and having to run milk to a far corner of the building.

> On the taboo of having children, from two participants who received negative comments:
>
> "When you're taught by teachers of a certain generation, you're told not to have children, but it's a generation from a totally different reality. And for me, it was really important in my life. But we were told it would be impossible." [B]
>
> "I see you're not completely dedicated to your work" – "No! I want to work. But I also want children" [C]

➔ **Discussion.** It was not difficult to recruit participants who had returned to work within a year following childbirth. There are no statistics to illustrate the subjective statement, but it seems most classical singers do return to work within a year. This may be due to several factors: fear of taboo; financial needs; needing to stay in shape (like an athlete) to continue in the career (it is hard

to take an entire year off singing); or simply because of the benefits singing offer and a desire to return to work. It is most probably a combination of these.

On the positive side of the coin, rehearsing and "finding" their voice again seemed to energize some participants which is in line with research that shows how exercising and social interactions can be beneficial for postpartum wellbeing. A return to work (connecting to a social network and a supportive environment) can improve wellbeing which seems to be reflected by the positive emotional reactions of many of the participants (Schwab-Reese et al., 2016).

Despite some mentions of pressure from the industry, a few participants mentioned feeling a shift in the perception and acceptance of working singing professional mothers. Additionally, it is unsurprising that the singers who gave birth during the pandemic felt less pressure to prove they would keep singing: as singing professionals of all genders and ages were out of work, it had nothing to do with being a new mother. Perhaps now that many Canadian and other North American singers live a hybrid life between singing and a second job, the taboo of not being "fully dedicated" to singing is waning and singers feel their talent and dedication to singing is appreciated, on top of their added worth and experience as a mothers.

Chapter 5 "What I Wish I Had Known":
Applications and Resources

When I was embarking on my motherhood journey, I was lucky to be supported by my teachers, to have wonderful seasons of professional work ahead, and to have healthy pregnancies and children. The first year of motherhood with my son was one of the most fulfilling of my life to date: we traveled together as a family unit, I sang for wonderful companies with caring colleagues and my personal life was full. All parents-to-be are filled with doubt and worry over the unknown and this is no different for singers. However, the added stress about how my instrument might change, and how motherhood might affect my career was compounded by the fact that, at the time, I did not have many close friends with children, in the business. In 2013, I felt a little bit apprehensive and wished I had more resources and helpful tips as to how navigate a singing career, a body that felt unfamiliar, and motherhood.

The first section of this chapter will be drawn from the *Singing from Childbirth* study: themes from the data regarding helpful tips about postpartum health, exercise and occupational organization showed a great wealth of suggestions in the form of lived experience. The second section is derived from the background literature and resources sought out for this purpose. It is not exhaustive: rather, this section is offered as a roadmap to outside support systems or literature that might be useful.

Professional Guidance

Some singers never stop seeing voice teachers or coaches over the course of their career, others do, but when dealing with the rapid changes that come with pregnancy and postpartum singing, the majority of the participants felt that working with "outside ears" helped them embrace the period of transition and either "find" their pre-pregnancy voice and technique again, or expand upon them and adapt new sensations into their singing technique. Five worked regularly with teachers or coaches (one coached twice a week) and one took a few lessons and coachings before each contract. Data from other four was incomplete (they did not mention taking regular lessons or coachings). Establishing or continuing to consult a support group of professionals may help singers

regain confidence and is likely beneficial on a social level (seeing familiar colleagues while reacquainting with the comfort of singing). Identifying the kind of network one needs, is important. Depending on their situation, some participants wanted the familiarity and continuity of teachers or coaches they worked with regularly, others felt they needed new insights.

Many sought help from outside the singing realm, and found mental preparation coaching or speech therapy for vocal health helpful. One participant set aside a budget for psychotherapy sessions. She budgeted for one session a week: over the course of the year, she had projected that spending $5000 in exchange for being strong enough mentally and emotionally to sing her $40,000 income was a good trade-off, and in the process, would improve her overall wellbeing. In the end, she did not come close to spending this much, but giving herself the option and budget for a year of psychotherapy brought her great peace.

Vocal Health and Technique

Three themes emerged as the most helpful habits for vocal health:

1. **Sleep:** Many mentioned that the best thing they could do for their voice was to find moments to catch up on sleep. Some prioritized a nap over practicing. Others asked for time from partners or sitters/helpers to rest. Sleep was also beneficial in mitigating brain fog for two participants.
2. **Integrating new routines:** Half the participants discovered they needed longer warm-ups before singing or performing. This included physical and vocal warm-ups. Arriving earlier to the theatre or hall or allowing extra time at home for vocalizing was helpful for these participants. Additionally, five participants found it necessary to include physical stretching (see section on exercise below) to sing comfortably during pregnancy but especially in the postpartum. Two participants introduced speech-therapy exercises to their routine to reinforce vocal health and efficient phonation.
3. **Vocal technique:** Concentrating on centering the tone and on freeing the voice and musculature were mentioned often as being beneficial. A few participants mentioned using arpeggios to improve focus, range and flexibility.

4. **Semi-occluded vocal tract exercises (SOVT):** Additionally, research shows that SOVT exercises are extremely helpful for rehabilitating the voice, offering a massage effect and "to prevent malregulative glottic closure patterns" (Denizoglu & Cukurova, 2022, p. 927). These exercises (e.g., humming, lip or tongue trills, singing through a straw) partially close the vocal tract which creates a gentle back pressure that reflects back towards the larynx. SOVT exercises help balance air pressure, improve stamina, release tension, and rehabilitate tired vocal folds. They have proven to be efficient when encountering vocal dysphonia during the menstrual cycle, pregnancy and menopause (Denizoglu & Cukurova, 2022). SOVT exercises offer a very healthy point of departure when returning to singing after childbirth as a transition to full singing. The participants mentioned needing very slow, long warmups when first vocalizing and before contracts: these exercises are very beneficial for this.

Postpartum Health

Healthcare was sought out for various issues during the postpartum year as outlined in the results. An important theme which resounded throughout many of the interviews which was that the participants often wished they had sought out this help earlier. Connections to lactation consultants can be found via birthing centers, midwives, local health centres and hospitals, or community organizations. Many cities (e.g., Montréal) provide free, weekly local clinics which offer social interaction as well as help with breastfeeding techniques. Links to support groups are found below.

One participant placed herself on a waiting list for a pelvic floor therapist while pregnant as the lists are long at the center near her home. After perineal tearing with both babies, she was grateful for this and was able to start rehabilitation as soon as she was healed enough. Additionally, there are many kinds of approaches to rehabilitation and multiple paths to recovery: this participant felt her second therapist had a gentler approach which she enjoyed more than the previous athletic approach. Becoming even more attuned with her body throughout the weeks of rehabilitation and communicating with her therapist proved to be helpful. Regular visits to chiropractors and osteopaths were also mentioned as beneficial, despite feeling like there is no time or energy to prioritize such visits. One participant felt an osteopath best helped her find vocal control through increased release in her body that she felt changed her singing for the better.

A sleep training coach was mentioned by one participant as a life-changing resource: the coach offered her help in the moments she felt the most despair and finally allowed her baby to sleep well (co-sleeping was not working for them). Others mentioned the opposite, finding co-sleeping with their babies ensured longer nights of sleep. This illustrates the most important consideration of postpartum health, as evidenced by the variety of experiences reported in this study: "*you do you*". Each family, and each child, have different needs and different priorities and will find their preferred routine. Don't be afraid to seek help when needed.

Occupational Organization

Two themes arose when discussing how to balance career and family.

1. **Childcare:** Four participants hired sitters or asked neighbours or family members to come for a couple hours a few times a week to allow time for practice or sleep. Some of these helpers looked after the baby, others assisted with tasks around the house, but the precious time it freed up for the mother aided both vocal and mental health. Other participants found they had to place practicing or coaching hours into a joint schedule or communicate their needs overtly with their partners. Whichever the method, being forced to concentrate on shorter practice times increased efficiency and this help was well worth the money spent, according to the participants.

   For contracts that were out of town, two participants searched for childcare via a Facebook group made up of mothers and parents who sing. These participants would write to the group in advance for suggestions of good sitters. This kept travel costs low (as they did not need to fly in a family member or nanny) and ensured sitters came recommended and experienced and who already understood the reality of unpredictable or unusual schedules.

2. **Communicating with companies and organizations:** Some participants had very positive communications with the people who hired them. One participant would always ask for family-friendly accommodations with a kitchen. Another would ask for her housing stipend to be given as a childcare stipend and in exchange would find accommodations with friends who had space or were out of town. Others mentioned regretting that they did not ask for

more help or support from companies and would do so in the future if it could be redone (e.g., to adapt stage directions for physical discomfort; for accessible fridges to store milk; for extra housing or childcare stipends; to bring babies backstage to nurse). Others felt too uncomfortable to ask for anything special but greatly appreciated working for companies with policies or family-friendly accommodation already in place.

Postpartum Exercise

As exercise is a large topic, for clarity and ease this section will include a hybrid of results from the study and resources from literature. Most participants felt a physical need to do exercise (of varying intensities) once they were healed from delivery, although not all were able to make time and space in their days to do so regularly. Some preferred active, more intense workouts, while others felt more gentle approaches were more helpful, all depending on personal taste and level of recovery. Almost all cited a need for stretching-based exercise to feel well. Two tended towards walking, as a "workout" was too taxing in time and energy. A few sought out professional guidance via sports centres or a performance kinetic specialist. Again, it was mentioned by some that advanced planning was helpful: some signed up for classes or researched professionals in advance, feeling that it was beneficial to have already organized and researched the possibilities before the exhaustion of motherhood set in. The following points outline the types of exercise that were considered the most beneficial in the year following childbirth or which are supported by research as being helpful. Each mother will find what works best for them.

1. **Long walks** (dog walking, nature walks, stroller walks) were very popular, both for exercise and for mental wellness. One participant mentioned she would go out for stroller walks to have a moment to herself in fresh air. Many mentioned them as being a helpful method for music-learning, also.
2. **Home exercise programs** for core strength included online programs designed specifically for maternal rehabilitation (e.g., diastasis recti, pelvic floor, Caesarean-section recovery, back pain) and Pilates-based exercise.
3. **Cardiovascular exercise** was appreciated by half the participants. Baby-mother classes were enjoyed for their added social aspect and accountability.

4. **Yoga** of any form was the most popular kind of exercise. Apart from one participant who did not enjoy yoga, and one who did not practice any regular exercise, most participants felt the stretching-breathing-strengthening combination that yoga offers was very beneficial. One practiced a Pilates-yoga blend (*PiYo)* and another practiced breathing exercises (*pranamaya*) more often, but this appreciation of yoga-based exercise reflects the benefits for postpartum mothers proposed in current research:
    a. Yoga's low-impact, mindful, centering approach complements singing in its non-taxing, strengthening quality, and thus can be practiced prior to performances (in contrast to more strenuous activities).
    b. Somatic exercise is intentional, draws attention to sensations *and* thoughts (body and mind), which helps reacquaint mothers with their bodies, while promoting positive psychology.
    c. Can be practiced in short sessions (even a few minutes of somatic work can be beneficial)
    d. Trains biofeedback/proprioceptors which is helpful for creating healthy patterns in a "new" body
    e. Sources of research and exercise:
        i. Dawn Neely's article on "Recovery for the postpartum singer: Yoga and yoga-inspired exercises for regaining abdominal strength" (2020, *Journal of Singing*, *77*/2, 191-200). A singer, teacher and registered yoga teacher, Neely's area of research is alignment and body awareness for singers. For postpartum exercise, she teaches yoga *bandhas* to slowly incorporate contracting various muscles (depending on the type of *bandha*) with mindful breathing. These exercises help restore core strength and stability, but singers must be careful to stick to short practices. Exercises like pelvic tilts and bridge poses are prescribed incrementally for early rehabilitation, gradually adding poses once abdominal strength returns. She touts the comprehensive approach of yoga: rather than isolating one muscle at a time, certain poses simultaneously engage multiple parts of the core. E.g., boat

pose engages hip flexors, the spine, and the transverse muscles (twists are also beneficial for spine, transverse and oblique muscle engagement, ideal for postpartum singing). Working incrementally and focusing on specific, small movement initially ensures safe muscular engagement for recovery. Aside from yoga, Neely also promotes keeping a flexible mindset during pregnancy, suggesting mental preparation for the fact that labour and delivery can go many ways.

ii. The dissertations of Cara Williams (2023) and Andrea Pitman Will (2013) contain wonderful suggestions and exercises for diastasis recti and pelvic floor rehabilitation and Caesarean-section recovery.

iii. *Yoga for Singing* by Judith Carman is not specifically intended for postpartum, but contains helpful ideas for incorporating singing into exercise. It also includes a section on memorization: she offers certain sequences—*asanas*—that integrate librettos or texts for improved memory.

iv. Fellow McGill doctoral candidate and singer, Sara Schabas has published "The Right Yoga for the Right Person: Applying Restorative Yoga in the Voice Studio" (2025, *Journal of Singing*, *81*/3, 265-270, available from NATS). This is a great resource (with a helpful bibliography) which includes background information, descriptive poses with images, and offers suggestions on how to apply restorative positions to singing for physiological and psychological benefits. Of special interest for postpartum singers might be the use of constructive rest for its "efficient body alignment and deep breathing through its release of the iliopsoas muscle, which connects to the diaphragm and the pelvic, thoracic and lumbar vertebrae" (p. 267).

v. Alexander Technique has been found to be helpful in pregnancy and postnatal care. The improved physical and psychological wellbeing of the mother was also shown to have positive repercussions on baby wellness (Banoofatemeh, et al., 2017). This somatic technique teaches "intentional

inhibition" from maladaptive habits, thereby releasing muscle tension (Hanefield et al., 2021).

Further Suggestions From the Literature Review

1. **Hydration:** A study by Van Wyk in 2016 found that voice quality was improved by adequate hydration. As breastfeeding can cause significant dehydration, vocal fatigue and hoarseness could be mitigated by cutting caffeinated and carbonated drinks and drinking small amounts of water very regularly throughout the day are suggested by this study. While this study does not specifically measure postpartum singing, it is helpful to know that proper hydration has been proven to improve voice quality.
2. **Resources at the opera house**: Companies might be able to refer local nanny services, family-friendly accommodation suggestions, and possibly family health clinic information.
3. **Organizations and collectives**: Many groups are meeting with singing professionals and building models for companies to improve family-friendly environments. As seen in the literature regarding maternal wellness, welcoming, supportive work environments promote maternal wellbeing. The following groups are leading the way:
    a. SWAP'ra (Supporting Women and Parents in Opera) is run out of the UK and has a growing list of resources and activities for parents in the arts. They newly offer Glyndebourne and Britten-Pears retreats for UK parents facing barriers returning to professional singing careers (See Glyndebourne and Britten-Pears retreats). Sessions included coachings/masterclasses on audition repertoire with top-level industry professionals, work with a performance psychologist, and yoga. They collaborated with Oxford Lieder on a project to perform forgotten or overlooked composers and offer online mini lecture-recitals of some of these works. Moving forward, it would be inspiring to see North-American-based projects like this, where singing mothers support each other and each other's projects, and collaborate with various companies and organizations to help new parents thrive creatively and professionally. https://www.swap-ra.org

b. The USA-based Parent Artist Advocacy League for Performing Arts and Media (PAAL) describe themselves as "the National network and solutions-generator for caregivers in the performing arts and media" (New standard of care, 2021). PAAL offers parent and caregiver support and has devised a worksheet for companies who wish to better support their workers. The highlights of this worksheet are:
    i. Childcare: budgeting for stipends; offering resource lists (connecting parents to local groups/services; to other artist parents).
    ii. Space: designated space for pumping, breastfeeding and storing milk (fridge); family-friendly places to stay; flexibility of children at work/living space (quiet place for breastfeeding); lending baby items for out-of-town workers (cots, gates, high chairs, toys, baths, stroller etc.)
    iii. Scheduling: "family-friendly" scheduling; time for breastfeeding/ pumping in schedule. (This point is likely rather difficult to implement in the context of theatre/opera schedules and constraints, but it is helpful to know the discussion is being raised.

    Perhaps knowing these suggestions have been published by a performing arts advocacy group will make singers feel less alone and encourage unions and companies to reflect on the wellbeing of the whole artist, as well as the health and viability of the company. It is important for workers to feel that basic needs are being met: if a singer does not have an appropriate place to pump or breastfeed or have an accessible fridge for storing milk, they should feel confident to advocate for these needs. https://www.paaltheatre.com
c. Balancing Act Canada offers support to artists in the form of resources (e.g., financial aid, childcare information), workshops, creative therapy sessions, and support for organizations for consultations of family-friendly, care-led workplace policies. https://balancingactcanada.com/en/

Singing and Creation as a Therapy

Several studies in the last few years have measured how a mother singing to her child benefits general population maternal health and mother-infant bonding (benefitting both mother

and child). Fancourt and Perkins (2018) found that singing workshops for postpartum mothers greatly reduced depressive symptoms and promoted earlier remissions from depression. Wulff et al., 2021 also found that group singing sessions improved salivary cortisol (physiological measurements) and improved attachment and mood of postpartum mothers as reported via qualitative questionnaires. These tie in with the Perkins et al. 2020 study of the benefits of participatory music engagement on wellness which encourages confidence, provides respite and social support, and builds connections (to people, heritage).

It is unclear whether professional singers would find participatory singing groups beneficial; however, key elements of these studies could potentially help reframe singing for mothers who are struggling with emotional or psychological wellness following childbirth. Perhaps focusing attention on singing as a mode of connection first to the baby and eventually with others (e.g., either in a participatory group setting, or in rehearsals or coachings) would remove the performative aspect of singing from the equation: focusing on the sensation of sounds, meaning, and intimate communication might help singers rediscover their voice for its gift of connection. In a similar way, one participant in the *Singing after childbirth* study found that singing funerals helped rebuild her stamina, mitigated performance anxiety, and increased her joy of singing (and although she did not mention it in this way, it is possible that the giving aspect of this service activity contributed to the feeling of joy and accomplishment). Seeking out ways to connect with others, and to use the voice in a healing way rather than with a "get back into shape" attitude, might mimic the benefits of these singing workshops.

A 2025 Irish study by Cheung et al. on using individual music therapy sessions to help pregnant mothers improve anxiety and promote prenatal attachment succeeded in its goals: all participants showed improvement. Expressing emotions through music and bonding musically and physically with the baby were encouraged and the participants felt this creative outlet was applicable even outside the sessions, becoming an actionable form of positive psychology (singing to the baby in the womb, writing songs about emotions for the baby). While these suggestions might seem obvious to professional voice users, much of the stress and anxiety of a career is related to music-making, music learning and the voice: perhaps intentionally carving out time to be creative with the voice could reduce negative psychological symptoms. In a slightly different way, one participant

from *Singing after Childbirth* turned to writing as a creative way to work through anxieties and found it very helpful. In Canada, Balancing Act offers free one-one-one expressive multi-arts therapy to artists (reference above) for creative therapy.

> You know, the moral of the story is, you have to learn to know yourself, then we have to make decisions that will be good for us…we have to be able to see ourselves for real and to say, "I'm happy"… to have the honesty to look at ourselves truly, then decide what we want and express it." [E]

Even in the best conditions, the year following childbirth can be exhausting and full of emotional complexities. Health is unpredictable and so many elements are out of the control of a parent. Creating and leaning on support networks for help at home, for emotional support, for promoting healthy habits, and for an eventual return to singing is shown in the literature and through this study to be essential. While it comes with its own set of complications, singing can enhance social, physical and emotional wellbeing. Working through the many challenges they face during pregnancy and postpartum, singers can overcome these trials and reap the benefits of having refined their priorities, their habits and their technique, and enjoy the maturity and growth that motherhood brings. Reaching for lifelines or methods of coping is a sign of strength and hopefully this small chapter will encourage both singers and those who support them to seek out structures, people or activities that can help promote wellbeing during this full and complex time of life.

For a list of resources on postpartum mental health, breastfeeding support and Montréal-based health resources, please see Appendix D, List of Resources.

Chapter 6 Singing After Childbirth: Limitations and Conclusion

6.1 Limitations and Future Studies

It is important to acknowledge this study's limitations. These include implications from the COVID-19 pandemic, the inclusivity parameters of participants, sample size, researcher bias, limitations of the interview design, and the impact of a study design based on memory recall. Suggestions for future applications and studies are offered following the limitations.

One major complication of the study was that it was situated in a period that includes the worldwide COVID-19 pandemic. Discussions and analysis surrounding pregnancies and postpartum life were difficult to balance between singers who had their babies pre-pandemic, and those who gave birth during the pandemic. Some of the singers interviewed did not return to a full schedule of professional contracts in their first year postpartum due to the cancellation of public performances during the 2020-2022 seasons. Their lack of work could not be considered a factor of having recently given birth, as it was neither a conscious choice not to take contracts, nor a symptom of industry taboo: there was simply very little work to be had. Participants, as can be expected, had differing experiences during the pandemic: the psychological impact had both negative and positive implications that could not easily be removed from discussions on postpartum health. These repercussions also affected wellbeing beyond postpartum considerations which may have affected the results. Additionally, although singers were North American-born, many of them had contracts in Europe, which meant their postpartum experience was culturally and professionally different, considering that many companies in Europe continued to perform during the pandemic. Stressors cannot evenly be compared for this reason.

The original parameter of the study intended to interview singers who were one to five years postpartum. As discussed, this was to allow for a full year of postpartum data and to reasonably limit recall bias. It became clear after one or two interviews with singers who happened to have older children (born pre-pandemic) that their recent experience was vastly different from their first and that it might be interesting (and in fact, more empirically sound) to include data from their first pregnancy as well. Thus, the parameter opened to include singers who were up to seven-years

postpartum. The first-born children of these two participants were therefore included as well, for comparison.

The number of participants was limited to ten to allow for detailed, lengthy interviews. Previous research had used mainly surveys or personal one-subject case studies, and it seemed that a multiple interview design would be useful for collecting a wide-range of data. Analysis treated each interview first as a case study, then used comparative analysis across the data corpus. However, ten remains a small sample size and while themes arose, the very personal nature of postpartum experience perhaps makes the results seem more important than they would in a larger sample. Future studies using mixed method surveys and interviews, or shorter interviews discussing a smaller range of themes might be useful. It is certain that interviews are useful for discussing nuance and allow participants time to reflect upon and refine their answers; while it limited sample size, it was also a strength of the current study.

Another possible limitation is that the researcher is a Canadian singer and mother. Personal connection to some participants was to be expected, considering the small singing community, and sincere efforts and checks were made to remain impartial during analysis. The interview schedule design and analysis plan were evaluated with an advisor to eliminate bias, but it is possible that personal experience was inherent in the process. It is hoped that this only contributed to a more intimate understanding of the literature and data.

The current state of the singer (at the time of the interview) will always have a certain effect on memory recall and perception. If a singer is in a positive mindset and the career is going well, it is possible this might colour her perception of her experience more positively. Vice versa, if a singer has not continued to find joy or success in singing, or feels current stress surrounding motherhood, it is likely this will tarnish some of her memories. While this is a consideration, questions were always situated in the timeline studied for clarity of discussion. Furthermore, it is important to remember that an inclusion of participation in the study was that the singer had to have returned to singing during the year postpartum. It is likely possible that other singers (who did not have such affirming

experiences) perhaps left the business or did not choose to perform during the year postpartum and were therefore not included in the study. This is something to be considered in future studies.

Certain changes would have been more precisely reported in a systemized survey. E.g., the open-ended question "did you perceive any vocal changes during the year following childbirth" allowed for personal responses, uncoloured by options on a survey, but it is possible singers experienced more changes than were mentioned. While the interview model provoked responses that are indicative of the changes that *most* affected the participant's singing (and are therefore quite useful for understanding the experience of each singer) and allowed for nuance and discussion, a survey may have allowed for a greater quantity of data across the vocal measures.

In a similar vein, participants were asked about a wide variety of subjects. If they did not mention experiencing something that others did, it is possible to deduce that there were no remarkable circumstances in that particular area of discussion; nevertheless, it is also possible that an experience was forgotten or was glossed over in discussion. Interviews were lengthy, offered ample time for discussion, and always closed with a prompt for the participant to open the discussion up to anything they feel is important, or if there were any subjects regarding singing in the year following childbirth that had not been discussed. It is likely that no other extraordinary experiences or major issues were left unturned, but assumptions cannot be made.

Research surrounding maternal wellbeing in most disciplines (psychology, medicine, voice science) is truly still in its infancy, as is research on motherhood among professional singers. Current literature, this study included, has rested on qualitative data mostly carried out by doctoral students who are singers. For example, voice science has not yet paired with medicine to run comprehensive analyses of hormonal fluctuations to better understand the myriad of variables which may affect, positively or negatively, the classical voice during postpartum. Unions and organizations are attempting to improve conditions which support the return of mothers to their livelihood, and slowly, new generations of singers are shedding the perceived taboos and choosing to parent *and* sing. The

PERMA[2] model of wellbeing, and maternal psychology frameworks which celebrate the flourishing of a population are welcome examples of how adaptive aspects can be studied, widening the framework from traditional risk factor analysis. This dissertation could be used as a springboard for future wellness-based research. In addition, subsequent research could and should include more diverse populations as much as possible. Perhaps narrowing geographical locations would also offer a different viewpoint of the data, although the international nature of classical singing makes this difficult.

6.2 Conclusions:

Becoming a mother should not mean the end of a career, nor should singing stifle the joys of parenting. Both a professional singing career and motherhood are complex in their own rights, and the individual nature of how each singer experiences a return to their career after childbirth negates the need to attempt too many generalizations. However, the lack of transparency or knowledge sharing surrounding this time of life in the singing industry tends to create unnecessary fear and apprehension. Singers should not have to resort to asking colleagues they barely know about their personal experiences, or turn online to "mom's groups" with information that may or may not be vetted (although, thankfully, these online forums do offer connection across countries for colleagues to share experiences). As research is helping singers and pedagogues sing more healthily during the menstrual cycle, it is the hope of this current paper to offer a compilation of literature and shared experience that will shape future studies and offer insights to those considering or experiencing *matrescence*.

After outlining the background concepts (based on a literature review of each subject) which led to the *Singing After Childbirth* study, an interview schedule was designed to fill in the knowledge gap. Questions specifically queried for both positive and negative perceptions of the physiological, psychological and occupational changes professional singers experienced after childbirth. Ten

[2] PERMA is a framework for measuring wellbeing consisting of five elements: positive emotions, engagement, relationships, meaning and accomplishment (Seligman, 2018). It has been applied to studies on musicians' wellbeing (Ascenso et al., 2016) and would offer a strong model for future studies on singing postpartum through a positive psychology approach.

singers were interviewed in late 2023 and the results are presented and discussed in Chapter four of this present dissertation. Key findings include a rediscovery or new understanding of the embodiment of voice in the body (important after the vast physiological changes of pregnancy and postpartum) which particularly influenced breath management and vocal support; temporary and permanent voice quality changes (mainly gained strength in lower registers and rounder vocal colour); the many implications of fatigue and breastfeeding (fatigue being the most difficult factor to overcome vocally and psychologically; breastfeeding was a challenge for many, enjoyed by others for proximity and ease); a changed perspective on singing after becoming a mother solidified a desire to sing and a healthier approach to the career; the negative effect of travel on vocal and emotional health; prevalence of complications with childcare in an unpredictable career; and the complicated perception of reactions from the industry regarding motherhood and singing. From the interviews, recommendations and helpful tips were garnered and presented in Chapter 5 for reference and support, along with lists of helpful resources.

Highlighting the challenges North American singers have recently experienced and how they overcame these difficulties to continue developing successful careers will hopefully offer accompaniment to many and help future singers prepare in advance for the healthiest experience possible, personally and professionally. More affirmatively, celebrating the thriving growth these singers experienced over the course of one year establishes an important foundation for further studies in performing science in line with recent wellbeing models. The participants of this study showed they represent their artform well: they are resilient, they embrace change in periods of transition, and they find beauty in themselves, their art, their families, and the stories they have to tell.

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Appendix A

Hormones and the Body: The Basics

This appendix serves as a rudimentary overview of how hormones work and is not meant to be exhaustive.

What are Hormones?

The word *hormone* is taken from the Greek word *hormao*, which means "I excite, or arouse" (Nussey & Whitehead, 2001).

> Hormones are part of the endocrine system. Along with the nervous system, the endocrine system regulates all aspects of body function, including co-ordination, homeostasis (internal balance), glandular secretion, growth and development, physical appearance, behaviour, metabolism, digestion, body fluids, moods and emotions, hunger pains, circadian rhythm (sleep cycle), and immune response (Nussey & Whitehead, 2001). Hormones are chemical molecules secreted in bursts by endocrinal glands and cells scattered throughout the body. They travel as messengers through the body via the bloodstream and communicate with tissues and organs. Hormones often have a chain-reaction effect whereby one type of hormone is released, in turn causing another to be secreted or to stop being secreted. Different kinds of hormones have different jobs to do, and act on specific glands or cells (Primal Pictures, n.d.-a). (Woodley, 2022, p. 1).

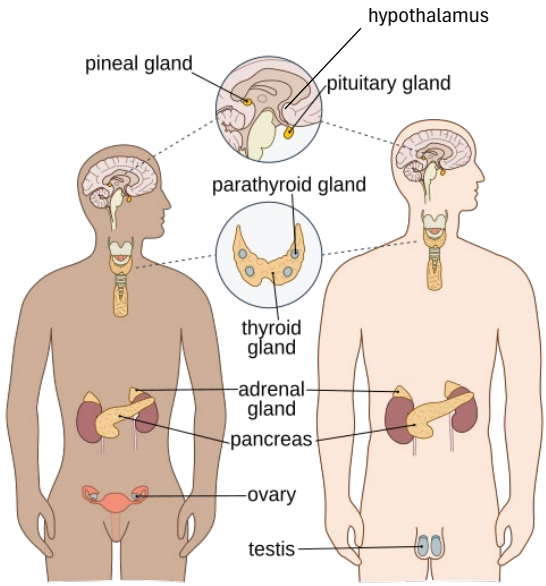
How Does the Body Maintain Internal Balance?

The Endocrine System. The body needs to maintain an internal balance (*homeostasis*) between its organs, tissues, muscles, and nerves to function properly. The endocrine system is the project manager of homeostasis, coordinating communication between the body's systems via hormones (Plexico & Sandage 2018, 47). Hormones are the carrier pigeons that bring information to and from cells and organs (Primal Pictures, n.d.-a). They are released by groups of cells called

endocrinal glands, of which there are many in the body: adrenal glands, hypothalamus, ovaries, pancreas, parathyroid, pineal gland, pituitary gland, testes, thymus and thyroid (see Figure A.1).

Figure A.1

Endocrine System Glands



https://commons.wikimedia.org/wiki/File:1801_The_Endocrine_System.jpg by OpenStax

Each endocrine gland has an individual mission to release a specific hormone. In turn, each hormone has a distinct task and will act only on their particular target cell: they will not take effect on any other type of receptor than their match (if they do, pathological endocrinal disorders may develop) (Kleine & Rossmanith, 2016, 12).

The following table A.1 offers an overview of the endocrinal glands and their responsibilities to give a larger picture of the entirety of the endocrinal system beyond the reproductive system.

Table A.1

Glands and Hormones Key Facts

Endocrine Gland	Examples of hormones (not exhaustive)	General job
Hypothalamus	Gonadotropin-releasing hormone (GnRH), growth hormone-releasing hormone (GHRH), dopamine	Body temperature, appetite, thirst, weight, mood, sleep
Pituitary gland	Growth hormone (GH), gonadotropins (FSH; LH), anti-diuretic hormone (ADH), Prolactin, Oxytocin	Growth, reproduction, lactation, "control centre" for other glands, ovulation
Pineal gland	Melatonin	Sleep cycles
Parathyroid	Parathyroid hormone	Regulates calcium
Thyroid	Thyroxine, calcitonin	Heartrate, metabolic rate, promotes balanced growth
Adrenal glands	Androgens, cortisol, adrenaline	Stress response; body odour, pubic hair; regulates blood pressure, heartrate and; raises blood sugar level, etc.
Pancreas	Insulin, glucagon	Blood glucose (sugar) levels
Ovaries	Estrogen, testosterone, progesterone	Organ development, bone health, pregnancy, breast development
Testes	Testosterone	Sperm production, secondary sexual characteristics

Stimulation

What causes a hormone to be released? There are three ways that endocrine glands are stimulated to release a hormone (Primal Pictures, n.d.-c):

a) **Hormonal** (stimulation by hormone)

An endocrine gland synthesizes and releases one hormone which in turn activates a second gland to release their own hormone (a hormonal chain-reaction). This is illustrated in the reproductive cycle: the hypothalamus (an almond-sized region at the top of the brainstem), instigates the cycle

by sending gonadotropic-releasing hormone (GnRH) to the anterior pituitary gland which in turn releases follicle stimulating hormone (FSH); FSH then travels to the ovaries where it stimulates the growth of ovarian follicles which in turn produce estrogen (Primal Pictures, n.d.-b).

b) **Humoral** (stimulation via elements in the blood)

Some endocrinal glands have the job of monitoring chemical composition of the blood. If there is an imbalance, the endocrinal gland will secrete hormones to restore balance. For example, the pancreas oversees regulating levels of glucose in the blood to maintain homeostasis. In the case of hyperglycemia, elevated levels of glucose in the bloodstream signal the pancreas to release insulin which in turns restores a normal blood glucose level, thus maintaining homeostasis (Primal Pictures, n.d.-e).

c) **Neural** (stimulation by the nervous system)

Neural stimulation happens when endocrine glands are stimulated by a nerve fiber and in turn secrete their hormone(s). The body's reaction to stress illustrates this: at the first sign of stress, the hypothalamus sends nerve impulses to the pituitary gland in the sympathetic nervous system which stimulates the adrenal medulla to release epinephrine (adrenalin) and norepinephrine. The rise of these hormones creates the body's "fight or flight" reaction. Symptoms include sweating, increased heartrate, elevated blood pressure (Primal Pictures, n.d.-d).

How do hormones take action?

There are three different processes, or signaling, by which hormones can take action: a) endocrine b) paracrine c) autocrine.

a) **Endocrine**: *"Deployed Troops"*

Endocrine signaling is when a hormone travels via the circulatory system (bloodstream) to act on a target cell or organ. These hormones could be thought of as *deployed troops*: when called upon, each type of troop is tasked with an order and travels through the bloodstream to their place of battle (e.g., FSH travelling from the pituitary gland to the ovaries). Some need extra protection and have special "vehicles" for this travel (see the arrow below), but most do not. Because many weaken along

the way (enzymatic degradation), hormones are released in short bursts, or pulses, to release enough troops, or hormones, to be effective. This deployment requires the organized effort of many cells to pulse out many hormones (Kleine & Rossmanith, 2016, 12).

➔ As mentioned in the analogy of hormones as troops, certain kinds of hormones travel differently through the bloodstream. There are two types of hormones, lipid-soluble and water-soluble. Lipid-soluble hormones cannot dissolve in water and therefore must bind to transport proteins to travel through the blood. These proteins act as "special vehicles" and help increase the hormones' solubility, allowing them to diffuse through the lipid bilayer of a cell's plasma membrane and go directly into their target cell (one smooth action). Sex steroid hormones estrogen and progesterone are examples of lipid-soluble hormones. Contrarily, water-soluble hormones cannot pass through the lipid bilayer of a target cell's plasma membrane. They must bind to the receptors on the plasma membrane (cell surface) and use chain-link reactions to affect their action: the hormone is a *first messenger* which, once bound to the plasma membrane receptor on their target cell, must stimulate a *second messenger*, to create the chain reactions within the cell. Peptide hormone oxytocin (responsible for lowering blood pressure and reducing levels of stress and anxiety, released at higher levels during breastfeeding) is an example of a water-soluble hormone (The physiological basis of breastfeeding, 2009).

b) **Paracrine**: *"Homebodies"*

Paracrine stimulating happens between neighbouring endocrine glands. Hormones are released from one organ and act locally on a nearby cell with very little distance to travel. The hypothalamus and pituitary glands, for example, are neighbouring: when the hypothalamus releases gonadotropin releasing hormone (GnRH), the hormone only travels a distance of 2-3 cm to the pituitary gland which in turn releases FSH and Luteinizing hormone (LH). Because they do not have far to travel, paracrine signaling hormones tend to have short biological half-lives (the time it takes for half of the concentrations of hormone to degrade; Kleine & Rossmanith, 2016, 12).

c) **Autocrine:** *"Self-sufficient"*

A cell produces a hormone which turns around and acts on that very same cell (Primal Pictures, n.d.-a). An example of this is the placenta, a temporary organ which grows from the foetus during pregnancy. During pregnancy, the placenta produces progesterone which in turn acts upon the placenta in a variety of ways (e.g., encouraging a thick lining of the uterus) to help maintain pregnancy (Kumar & Magon, 2012).

How do Hormones Know When to Quit (or Not)?

To maintain balance (homeostasis), the body needs a sign to either continue or stop sending a hormone. This is achieved using a messaging system of checks and balances called *negative* and *positive feedback loops*. A negative feedback loop works much like a thermostat: when the temperature of a room is below the desired level (e.g., 18 degrees Celsius), the heat is turned on and keeps running until 18 degrees is reached and maintained, at which point, the negative feedback loop tells the thermostat that it can stop producing heat (Parkes, 2020).

In the case of a positive feedback loop, a hormone is released which in turn causes further release of the same hormone. E.g., Childbirth: to help the body prepare for labour, oxytocin is released which causes uterine contractions. These contractions in turn trigger more oxytocin to be released, which perpetuates the cycle and thus promotes a successful birth. Similarly, during breastfeeding, oxytocin is released to stimulate the release of breastmilk. The more milk ejected, the more oxytocin is stimulated, creating a positive feedback loop. Once nursing diminishes or subsides (weaning) and the production of milk decreases, oxytocin will stop being produced in the body (Parks, 2020).

Appendix B

Basic Breathing Physiology

Taken in part from "Through the lens of physiology:
breathing and the use of imagery in vocal pedagogy (Part 1)" (Woodley, 2021)

The respiratory apparatus is made up of structures, organs, and muscles in a unit called the pulmonary-chest wall which is comprised of the pulmonary apparatus and chest wall (Hixon, 2006). The chest wall itself is divided in two parts: rib cage wall (which houses the pulmonary apparatus; anchored to the spine and sternum and given flexibility by costosternal and costovertebral joints) and abdominal wall (which houses the contents of the abdomen). These two sections move independently throughout the breath cycle. The rib cage wall and abdominal wall are separated by the diaphragm, an elastic muscle which attaches around the internal circumference of the body. (Hixon, 2006).

Inside the rib cage wall is the **pulmonary apparatus** which is comprised of the lungs and a myriad of pulmonary airways. Lungs are spongy, elastic, balloon-like structures, filled with alveoli (tiny bags of air, responsible for the exchange of oxygen to carbon dioxide).

Fundamentally, respiratory function allows the body to maintain homeostasis by balancing the level of gases in arterial blood. Oxygen is brought into the alveoli, diffused to the blood and sent throughout the body via the bloodstream before being absorbed by tissues. Oxygen, along with glucose, are converted via cellular respiration into energy, and this breakdown of sugars creates carbon dioxide (Patel et al., 2022). The carbon dioxide byproduct then returns through the bloodstream to the alveoli. Excess carbon dioxide is released through exhalation, and the cycle of ventilation begins again.

The lungs themselves are not muscles, they cannot control air coming in and out: air exchange occurs because of the inspiratory and expiratory muscle contractions of the pulmonary-chest wall unit (Watson, 2009, 104). The lungs are covered by two thin membranes called pleura. A layer of fluid attaches them to the lungs, to each other, and to the chest wall. These pleurae are what permit

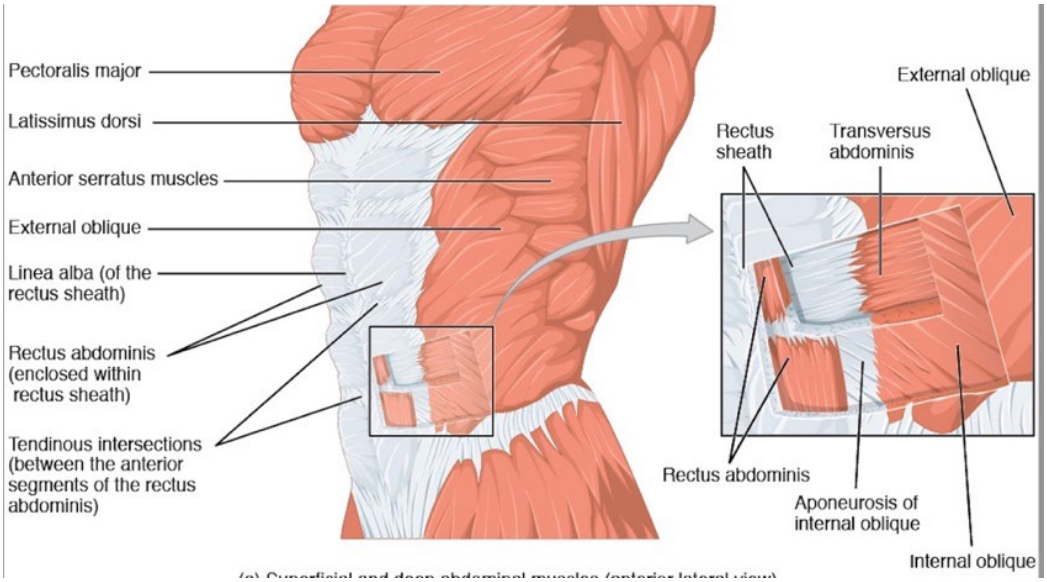
the lungs to expand with the chest wall during inhalation because of changes in *intrapleural pressure* (Watson, 2009).

Diaphragm: The diaphragm divides the torso vertically in half, attaching at the bottom of the sternum in the front, the lowest six ribs and cartilages in the side, as well as the first three or four lumbar vertebrae in the spine. In its resting position, the diaphragm is in the shape of a dome, tenting internally upwards like a parachute (Watson, 2009). When the muscle contracts, it lowers into a flattened inverted pie pan form.

Abdominal wall: The abdominal wall is formed by muscles positioned around the front, sides and back of the torso. The posterior abdominal wall is composed of the three back muscles (latissiumus dorsi, lateral iliocostal lumborum and quadratus lumborum; Hixon, 2006). The anterolateral abdominal wall consists of four abdominal muscles (rectus abdominis, external and internal oblique muscles and transversus abdominis) which run along the sides and front of the abdomen (see Figure A-2).

Figure A-2

Muscles of the Abdominal Wall



Betts et al., 2013. https://openstax.org/books/anatomy-and-physiology/pages/1-introduction

Connected to the rib cage wall in the back, they provide "postural support to the respiratory apparatus" by bracing and stiffening the abdominal wall (Hixon, 2006, p. 31). Upon contraction, they pull the abdominal wall inward; and all but the transversus abdominis pull down on the lower ribs upon contraction (Hixon, 2006).

Quiet Breathing

A system of pressures coordinates this gas exchange for quiet (tidal) breathing. A pressure is "a force distributed over an area" (Hixon, 2006, 47). There are different types of pressures which work together to allow for respiration. *Alveolar pressure* is the lung's internal pressure. When parts of the respiratory apparatus compress or expand due to muscle contraction, the elastic properties of the respiratory system, and gravity, alveolar pressure changes.

Inspiration: When the body needs oxygen, the diaphragm contracts downwards and the external intercostal muscles expand the chest wall (rib cage; Hixon, 2006). Specifically, the diaphragm contracting causes the lowest six ribs to rise, which effects two changes in the rib cage wall: it simultaneously produces a larger circumference and creates a longer thorax by vertically lowering its base. When the external intercostal muscles are activated during inhalation, the ribs lift upward and forward or up and out to the sides. In addition, the sternocleidomastoid and scalene muscles aid in expanding the thoracic wall: even in tidal respiration, the scalene muscles lift the first two ribs, and the sternocleidomastoid muscles lift the sternum, clavicle, and upper ribs (Watson, 2009). These simultaneous motions allow the ribcage wall to expand (Hixon 2006). When the space increases (lungs expanding), pleural pressure and alveolar pressures drop as the air molecules have more room, creating a negative pressure. If the glottis is open, air rushes into the lungs until the outside atmospheric pressure and inside lung pressure are the same (Watson, 2009, 104).

Expiration. When the body needs to get rid of the carbon dioxide build-up, the diaphragm and other inspiratory muscles relax, and the passive recoil engages (the elastic recoil of the respiratory system and gravity; Watson, 2009). The internal intercostal muscles contract which draws the rib cage down and in, decreasing the size of the thorax (Primal Pictures, n.d.-g).

Thus, during quiet breathing, breathing is occurring without our attention, for the sole purpose of balancing gas levels in the body. This tidal respiration or quiet breathing happens while we're sitting or lying passively (not speaking or moving).

Q: Why do we talk about "breathing from the belly"?
A: The abdomen itself is filled with water-like content, fixed in volume and therefore unable to be compressed. This gives the abdominal wall indirect contact with the lungs (Hixon 2006). When the diaphragm contracts, it displaces the volume-fixed abdominal contents which creates a bulge in the lower abdominal wall, manifesting to the naked eye as the abdomen expanding (Leanderson & Sundberg, 1988).

Q: How does the abdominal wall help or hinder breathing?
A: An important factor in optimizing the passive movements of the diaphragm is posture, for which the abdominal wall is mainly responsible (Watson, 2009). If standing erect and centered, the diaphragm is freer to move, and the consequential opening and closing of the rib cage wall, and displacement of abdominal contents are more effective, aiding the vital capacity of the lungs (Watson, 2009).

Breathing for Singing

When muscles are engaged with effort (muscle activation) for deep inspiration or expiration, it is typically outside the scope of a tidal or resting breath, for example, in speaking loudly or long phrases or singing. When the body prepares to speak or sing, as compared to quiet breathing, there is one extra movement which happens: in the moment of transition between inhalation and exhalation, a small movement called "prephonatory posturing" expands the chest wall further due to a small contraction of the abdominal muscles (Watson, 2009). This does not necessarily bring in more air, it optimizes the chest wall and onsets the support mechanism. The inspiratory muscles (external intercostal muscles and diaphragm) simultaneously relax, liberating the natural elastic force, which, along with the contraction of the internal intercostals, return the ribs with downward rotation to their pre-inspiratory position, the positive muscular pressure helping to expel the air (Watson, 2009, 115).

Because singing often requires an even longer expiratory phrase than when speaking, singers must slow the expiration rate. Although the mechanics of how to accomplish that are not consistently agreed upon in the vocal pedagogy world, from a physiological point of view, “braking” is the preferred theory. Both Watson and Hixon, respected vocal scientists who have studied breathing and the voice for decades, agree on this. Because the mouth is open during singing, resisting the elastic recoil is also important for keeping breath pressure constant (Watson, 2009, 108). To do this, the inspiratory external intercostal muscles of the rib cage stay active while expiration begins which slow the descent of the ribs and places a brake on the expiration, slowing the flow of air (Watson, 2009). For the first half of a singing line at high lung volume, a singer can produce efficient pressure with only relaxation pressure and the braking technique: subglottal pressure is high because of high lung volume. The principle of braking can be defined as a way of moderating airflow throughout a long phrase and therefore, as a form of breath support. Watson defines support as the “regulation of air pressure and the velocity of airflow in the respiratory system during expiratory episodes underlying singing…generated by a dynamic interaction between expiratory and inspiratory muscles” (2009, p. 114).

Later in the phrase, when air volume reaches its resting state (at functional residual capacity), relaxation pressure is no longer sufficient for singing (Watson, 2009). Additional pressure is needed to maintain the necessary level of subglottal pressure for singing. The expiratory abdominal muscles and internal intercostals are activated to compress air within the chest. The lower external oblique, internal oblique and transversus abdominis muscles are activated most for this extra expiratory force, allowing the rib cage to remain in its optimized, raised position (Hixon, 2006).

Appendix C

Singing After Childbirth Materials

Interview Schedule April 2023

PART ONE: Background Questions (by Microsoft forms in advance of the interview)

Name: Participant # (for the researcher):

Age:

Gender identity/pronouns (not for data collection, only for thesis dissemination purposes):

Occupation(s):

How many children do you have and what are their current ages:

For how many years were you singing professionally before your first pregnancy:

How long after (each) childbirth did you begin performing professionally again:

a) Does the COVID-19 pandemic play a factor in your answer?

On average, does over 50% of your income comes from singing contracts (if you prefer, you can give pre-COVID statistics as well as current numbers):

On average, what percentage of your income comes from other music-related activities?

On average, what percentage of your singing contracts are in a city away from home:

Did you breast/chestfeed your child(ren)? If so, for how long:

PART TWO: Interview Questions

(Definition of *Postpartum* – the year following the birth of your child)

When answering the following questions, please feel free to highlight if you have had multiple children, and whether these changes varied depending on the child.

Some of these questions may trigger difficult memories or feelings. Please remember that you may, at any point, decline to answer and that request will be respected.

I will include a few resources at the end of the interview, and by email, should you like some help with any emotions or difficulties that may arise.

Pregnancy – How was your experience? Last gig was at _____ weeks before giving birth?

In the year following the birth of your child (the postpartum period), what were the perceived changes:

Physiological

Did you experience any changes, positive or negative, in breathing while singing?

a) Ease of breathing from a physical standpoint (physical awareness of breathing)

b) ability to sing long phrases

c) breath management/technique changes

Did you experience back/neck/shoulder pain?

a) Describe the changes

b) in your opinion, what were these pains caused by?

c) has anything helped (exercise, medication, etc.)?

Did you/are you breast/chestfeeding? (Follow-up to background form)

a) were you physically and emotionally comfortable feeding your baby?

b) if so, for how long?

c) was this beneficial to you?

d) did this cause you any physical or emotional pain or difficulty?

e) what were the occupational implications of breast/chestfeeding?

Were you given time to nurse? Did you pump milk also?

How do you think your colleagues, or the companies perceived your feeding schedule/methods?

Did you exercise while pregnant?

How often/consistently?

Did you exercise during the year postpartum?

How often/consistently?

Did you experience pelvic floor issues?

a) did you seek out/were you prescribed pelvic floor rehabilitation?

b) if not, did you do your own exercises for the pelvic floor?

c) do you think these exercises affected your singing, for either better or worse?

- if you did pelvic floor rehabilitation or your own exercises, did it change your singing technique and if so, how?

Psychological

Did you have any professional contracts for which you had to leave your child at home to travel?

a) Freedom vs separation

- did being away on your own to work give you positive emotions (a sense of freedom and autonomy); or did it cause you negative emotions (guilt, panic, stress)?

Did your desire to sing increase or decrease in the postpartum period of singing?

a) what inspired you the most?

b) were you able to follow these desires (increase or decrease)?

c) if not, why?

Did you experience stress related to singing during this year postpartum?

a) If so, what do you think was the source of this stress?

e.g., Your own fears/frustrations? Physical/emotional? Stress felt by external pressures?

b) did it change while practicing and/or performing?

c) Rate your experience of stress from most to least stressful

not singing

while practicing

during performance

Occupation

What was your practice schedule like at home?

Was this easy or difficult to implement?

What helped you prepare for your contracts?

Did you experience difficult discussions with your teacher/agent/companies/colleagues regarding a return to singing postpartum? No need to name the person or company specifically.

a) if so, what were the issues raised?

b) do you feel these issues or discussions were unfounded or unnecessary and if so, why?

If there were contracts where you left your child at home to travel:

b) What were the arrangements (or did they vary from contract to contract)?

- what were the factors that went into your decision? (Distance away, length of time away, fee/financial considerations)?

- did you have a partner who travelled with you and/or a partner who stayed home with child(ren)?

c) did the company you worked for give any assistance with arrangements?

- did they offer a list of babysitters? Did they offer suitable accommodation? Were the hours suitable to having your child(ren) with you? Did you find the company open and amenable to you bringing your child(ren)?

Last question: are there any other further points or comments you wish to make that has not been discussed?

McGill
Schulich School of Music
École de musique Schulich

Participant Consent Form

Researcher:
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Supervisor:
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Title of Project:
Singing after childbirth: Physiological, psychological, and occupational changes for professional classical singers

Sponsor(s): *Social Sciences and Humanities Research Council (SSHRC)* Canada Graduate Scholarships—Doctoral Program

Purpose of the Study:

As part of my DMus thesis at McGill University, I am conducting a qualitative study on the personal experiences of professional singers in the year following childbirth. I plan to interview 10-15 professional singers who have given birth in the last one to five years and I would like to invite you to participate.

A literature review of singing after childbirth confirmed a deficiency of research in this field. I endeavor to better understand the nuanced and detailed experience of singers during this time of life. This study seeks to fill the literature gap on this specific period in a professional singing career by offering qualitative research from working singers who have recently returned to their career postpartum. Both positive and negative experiences related to these questions will be explored.

The study focuses on the physiological, psychological, and occupational changes experienced by professional classical singers in the postpartum period. Questions on perceived changes will be organized as following:

- Physiological changes - including changes to the musculature, breathing apparatus and physical sensations required for singing
- Psychological changes – including emotional and mental health considerations
- Occupational changes - including the perception of how reactions of agents, companies, and colleagues affected the postpartum experience as well as financial implications and travel considerations.

Study Procedures*:*

The interview will take between 60 and 90 minutes, which will allow time for the structured questions, as

well as informal follow-up discussions. The goal is to understand your detailed personal experiences.

I will be conducting the study from Montreal, Québec, Canada. Interviews will be held online via the McGill University Teams platform. These online interviews will be recorded for analyzing purposes using the Teams platform video record. Confidentiality is extremely important: only the researcher and the academic advisor will have access to the video recordings which will be stored in McGill's password-protected Microsoft OneDrive folder. Data (including transcripts from the interviews and any email correspondence) will be stored for a minimum of seven years and subsequently erased. Your participation in this study will remain confidential and you will not be named in any publications.

Voluntary Participation:
Your name will not be published anywhere. You may also decline to answer any question you do not wish to answer. Consent can be withdrawn at any time during the interview process. No identifying details will be published. If an interviewee withdraws their consent at any point during the study up until publication, their data, including transcripts, videos, emails, and background form will be erased from the advisors' password-protected McGill Microsoft OneDrive. Your comfort and consent are very important considering the delicate and personal subject matter and will be fully respected.

Potential Risks:
Considering the possibly sensitive subject matter, and the fact that these questions may raise recent emotional reactions, the annex to this consent form contains links to support groups and information that may be helpful. Interview questions will be asked in a gentle, non-biased manner; however, should difficult or distressing emotions be raised, these links are available for support.

Potential Benefits:
Participating in the study will have no direct benefit for you; however, this study could offer important insight to future singers preparing and negotiating their experience singing postpartum. Identifying what changes to anticipate would allow for a more specific postpartum training regime and facilitate a swifter, more confident return to a singing career. Currently, this knowledge is almost exclusively anecdotal: resources are significantly lacking for expectant singers as well as the teachers and professionals supporting them. The research could benefit all singers who are expecting or have recently experienced childbirth as well as the agents, conductors, teachers, and others supporting them.

Compensation:
This study does not involve compensation.

Confidentiality:
As the interview will be video recorded, your participation is not anonymous. However, no identifiable data will be used publicly. The analysis will use anonymous labels and the key will be saved in a password-protected file in McGill's Microsoft OneDrive. Only myself and my academic advisor will have access to the data. Videos and all materials will be destroyed after seven years. Your participation is therefore confidential.

Dissemination of Results:

The results of the study will be published in my DMus thesis paper. They may also be used in future publications or presentations, all respecting the confidentiality and anonymity of the participants.

Questions:

If you have any questions or wish to discuss the study further before giving your consent, please contact me at Jacqueline.woodley@mail.mcgill.ca or 514-566-3629 or my research advisor, Isabelle Cossette :

isabelle.cossette1@mcgill.ca.

If you have any ethical concerns or complaints about your participation in this study, and want to speak with someone not on the research team, please contact the Associate Director, Research Ethics at 514-398-6831 or lynda.mcneil@mcgill.ca citing REB file number 22-12-063.

Please sign below if you have read the above information and consent to participate in this study. Agreeing to participate in this study does not waive any of your rights or release the researchers from their responsibilities. To ensure the study is being conducted properly, authorized individuals, such as a member of the Research Ethics Board, may have access to your information. A copy of this consent form will be given to you and the researcher will keep a copy.

Participant's Name: (please print) _____

Participant's Signature: _____ Date: _____

McGill University
Research Ethics Board Office
www.mcgill.ca/research/research/compliance/human

CERTIFICATE OF ETHICS APPROVAL

REB File Number:	22-12-063
Project Title:	Singing after childbirth: Physiological, psychological, and occupational changes for professional classical singers
Student Principal Investigator:	Jacqueline Woodley
Department:	Music (Schulich School of)
Supervisor Name:	Prof. Isabelle Cossette
Sponsor/Funding Agency (if applicable):	SSHRC

Research Team (if applicable):

Name	Affiliation

Approval Period:

FROM	TO
25-Jul-2023	24-Jul-2024

The *REB-2* reviewed and approved this project by Delegated review in accordance with the requirements of the McGill University Policy on the Ethical Conduct of Research Involving Human Participants and the Tri-Council Policy Statement: Ethical Conduct For Research Involving Humans.

* Approval is granted only for the research and purposes described.
* The PI must inform the REB if there is a termination or interruption of their affiliation with the University. The McGill REB approval is no longer valid once the PI is no longer a student or employee.
* An **Amendment** form must be used to submit any proposed modifications to the approved research. Modifications to the approved research must be reviewed and approved by the REB before they can be implemented. Changes to funding or adding new funding to a previously unfunded study must be submitted as an Amendment.
* A **Continuing Review** form must be submitted before the above expiry date. Research cannot be conducted without a current ethics approval. Submit 2-3 weeks ahead of the expiry date.
A total of 5 renewals are permitted after which time a new application will need to be submitted.
* A **Termination** form must be submitted to inform the REB when a project has been completed or terminated.
* A **Reportable New Information** form must be submitted to report any unanticipated issues that may increase the risk level to participants or that may have other ethical implications or to report any protocol deviations that did not receive prior REB approval.
* The REB must be promptly notified of any new information that may affect the welfare or consent of participants.
* The REB must be notified of any suspension or cancellation imposed by a funding agency or regulatory body that is related to this study.
* The REB must be notified of any findings that may have ethical implications or may affect the decision of the REB.

Appendix D:

List of Resources

Mental health

Mind.org.uk - Postnatal depression and perinatal mental health page

- Definitions, symptom recognition, tips
- Contact information is based mainly in UK, with helpful links to global online sources

AMI Quebec

- Many links for postpartum health and support
- Illness and mental health support for loved ones

Life with a baby

- Formerly the **Canadian Perinatal Mental Health** collaborative (Parental mental health, hormonal health)
- Canada-wide chapters of parents dedicated to wellbeing, a branch of the LWAB foundation for maternal mental health

Postpartum Support International (Canadian site)

Canadian Mental Health Association

Breastfeeding

La Lèche league

Allaitement Québec

- Online chatting or telephone support (418-704-3575)
- Clinics with registered lactation consultants
- List of free meetings
- "Marrainage d'allaitement": personal meetings with a volunteer who checks in with you at appointed times to follow-up and act as a support system for those who need it.

Montréal-based postpartum health resources

La source en soi

- Activities, exercise classes
- Workshops for parents
- Birth accompaniment
- Therapies

Clinique Pelvi-santé

- Perinatal care (e.g., pelvic rehabilitation, acupuncture)
- Blog

Other resources

Alexander Technique Canada

Dr. Dawn Neely on yoga and singing: YouTube