ORIGINAL ARTICLE

Canada's Pioneering Women of Vascular Surgery: A Historical Review

Abstract

The historical evolution of women's participation in the male-dominated field of surgery is an increasingly vital area of study. However, scant attention has been given to the experiences and accomplishments of female vascular surgeons, particularly within the Canadian context.

This historical review offers insights into the lives and careers of four pioneering female vascular surgeons in Canada: Dr. R. Paradis, Dr. J. Wong, Dr. P. Gaffiero, and Dr. J. Spelay. Through semi-structured interviews, a biography of each surgeon's early life, training milestones, professional challenges, and career accomplishments was created. Narrative analysis of all interviews was also completed to identify themes from subjects' collective memories and perceptions. Prominent themes included: Formative mentorship during medical training, benefiting from de-centralized fellowship selection; Limitations on practice set by family duties, Experiences of gender bias creating challenges with other healthcare professionals; and Lack of identity with the legacy of 'the first female vascular surgeon' in her respective province.

The landscape of vascular surgery training and the presence of women in the field have evolved significantly since the inception of this medical specialty in Canada. Consequently, the documentation of vascular surgery history and the progress made in achieving gender representation have taken on new-found significance. As the pioneering female vascular surgeons approach retirement and a new generation of surgeons join the field, lessons learned in the process of forging gender diversity in vascular surgery may be useful as diversity in other aspects of the field is sought.

Key words: Vascular Surgery, History of Surgery in the 20th Century, Female Surgeons, Canada, Gender Disparity, Medicine, Surgeons

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Introduction

Traditionally, surgery has been a male-dominated field of medicine. However, recent years have witnessed a growing interest in understanding the history and representation of women in surgery, driven by a shared goal of honoring and fostering continued gender diversity within the profession (Pories et al., 2019, pp. 199-201). For example, historical works in general surgery and neurosurgery have sought to unravel the identities of pioneering female surgeons, explore how they overcame professional barriers, and celebrate their accomplishments (Karekezi et al, 2021, p. E15; Motter, Brandão, and Trindade, 2023, p. 1064). These works have acknowledged the groundbreaking workplace advocacy of these women, which has often paved the way for contemporary occupational policies that benefit all members of the surgical field (Karekezi et al, 2021, p. E15; Motter, Brandão, and Trindade, 2023, p. 1066).

Within the realm of vascular surgery, notable gender gaps persist among practicing physicians (Carnevale et al, 2020, p. 1445). Experts in the field have put forth several hypotheses to explain this disparity, including inadequate mentorship opportunities and the challenge of balancing surgery with other social responsibilities (Carnevale et al, 2020, pp. 1448-1450). However, many questions still remain about the challenges and barriers to achieving gender equity in vascular surgery today. Notably, there is a significant gap in the historical literature regarding the role of women in the field of vascular surgery, especially outside of the United States.

This study aims to fill this gap by interviewing several of the first women to become Canadian vascular surgeons. The objective is to document their historical biographies and identify recurring themes in their shared experiences. Additionally, the study aims to uncover the factors that contributed to and hindered the success of these women in the field of vascular surgery.

Methods

Potential participants were identified from the registrant directory of Canada's Royal College of Physicians and Surgeons (RCPS). This directory provided information such as the date of certification, practice location, and licensing specialty. We approached participants if they were practicing or retired, who identified as female, and were chronologically the first to receive vascular surgery specialty certification from a Canadian training program[1], available from 1983 onwards (Boyd, 2021, pp. 842-844). Consenting participants

1- In Canada, Dr. Lynn Doyle was the first woman to complete a vascular surgery fellowship (University of British Columbia), and Dr. Annette M. Holmvang was the first woman to receive RCPS accreditation in vascular surgery (March 1988).

provided written agreement and approval was obtained from the University of British Columbia's Behavioural Ethics Board (certificate no. H23-00963) prior to study initiation.

The participating surgeons were interviewed using a semi-structured format, and an abbreviated interview guide can be found in Table 1. Following each interview, the content was transcribed, and participants were provided with draft transcripts to review, edit, and verify for accuracy.

Interview data served as the foundation for two key aspects of our study:

1- Historical Biographies: The first author created historical biographies of each surgeon, cross-verifying them with publicly available records to ensure accuracy.

2- Narrative Analysis: To analyze interview content about participants' experiences and perceptions, qualitative data analysis was performed. Using NVivo (v.1.7.1), inductive codes were derived by the first author and then discussed with the second author. Additionally, both authors independently analyzed transcripts by reading and re-reading the content to establish familiarity. Codes were finalized into themes through discussion and consensus between the coauthors.

Table 1: Outline of Semi-structured Interview Guide

Question	Content
1. Childhood	• What is your ancestry and hometown? • What was your family like while growing up? • What attitudes and ideas did your family have around education? Medicine?
2. Training	• When did you decide to pursue medicine and why? • What was your experience of applying to medical school? • What were your prominent memories of general surgery residency? • How did you decide to pursue a vascular surgery fellowship? What went into your interview(s), application, and school selection process?
3. Early career	• How did you first come to practice as an independent surgeon? • What factors impacted the hospital(s)/ healthcare facility/ physician group(s) you practiced with during your career? • During your career as an attending staff, what was your relationship with other healthcare professionals, attending physicians, and trainees?
4. Personal life	• What was your decision process in choosing social roles alongside surgery? Did your social and surgical roles ever conflict? If so, how? • What social supports were important to you during training and your surgical career?

Results

In spring 2023, interviews were conducted with four pioneering female surgeons who became certified through the RCPS: Dr. R. Paradis, Dr. J. Wong, Dr. P. Gaffiero, and Dr. J. Spelay. The information gleaned from these interviews, along with data from publicly available records, formed the basis for the following biographies and narrative analyses.

Dr. Rachelle L. Paradis, MD FRCSC (Vascular Fellow 1988, Ontario)

Dr. Paradis was born in 1956 and raised in Sudbury, Ontario. Her father, Laurent Paradis, worked as a miner with the International Nickel Company (INCO), while her mother,

Francoise Paradis (née Fortin), was a homemaker. Although her father financially supported the family, Dr. Paradis' mother had achieved the highest-level education among her parents. Dr. Paradis displayed an early interest in science and medicine, partly inspired by medical TV shows. She was undaunted by dissections and was the first in her family to attend university after high school.

She pursued an Honours Bachelor of Science with a major in chemistry and biology at Laurentian University from 1974 to 1978. Although she briefly contemplated a master's degree in chemistry, strong letters of recommendation from her faculty at Laurentian led her to apply to medical school. Her preference was for smaller medical schools with a Francophone community, like the University of Ottawa, which she attended from 1978 to 1982. During her medical studies, she met her future spouse, Dr. Lawrie Oliphant, and gained her first exposure to surgery during an 8-week summer scholarship program in Sudbury.

Dr. Paradis chose to pursue general surgery, in large part due to the mentoring she received from Sudbury surgeons, Dr. Gilles Helie and Dr. Claire Perreault. She and her husband matched their rank lists to attend Western University, with Dr. Paradis entering general surgery and Dr. Oliphant in internal medicine. The couple was married in their first year of residency (1983).

Training at Western University was challenging due to rigorous schedules and being among the first women in the program. Dr. Paradis worked through her research year, filling emergency department shifts in surrounding communities to supplement her income and skills. She eventually chose vascular surgery as a fellowship, which offered accelerated training. She began her vascular surgery fellowship in July 1987 and soon became pregnant with her first child. She worked until the end of her pregnancy, with no established maternity leave protocol at the time. Yet, she was pleasantly surprised when her first baby gift came from the Western University Chief of Surgery.

After giving birth to her daughter Renee in 1988, Dr. Paradis completed her fellowship and passed her oral vascular specialty exam. She joined the surgical teams at Sudbury Memorial for Cardiovascular Surgery and Laurentian Hospital for General Surgery at the behest of Dr. Paul Field. She returned to Sudbury to be closer to family and to practice clinical surgery without the obligations of an academic position.

Balancing vascular surgery with general surgery was initially challenging, but over time, she found a comfortable middle ground, with her practice primarily grounded in general surgery and establishing venous access for dialysis patients. She welcomed her second daughter, Josee, in 1990. In the ensuing years, healthcare in Northern Ontario underwent significant changes, with the amalgamation of hospitals and the establishment of the Northern Ontario School of Medicine. The medical learners offered Dr. Paradis a new challenge, as she learned to enjoy teaching through the progression of students under her tutelage.

In 2015, Dr. Paradis contributed to the development of the Quality-Based Procedures Clinical Handbook for Cancer Surgery and advocated for the prevention of the closure of Sudbury's Breast Screening and Assessment Service (BSAS, Figure 1). This advocacy garnered her national recognition field (Canadian Broadcasting Corporation, 2018). In 2023, Dr. Paradis stepped back from her surgical practice after 35 years but continues to occasionally assist in general and vascular cases.

Figure 1. Dr. Paradis was featured as a part of a coalition to save a local breast screening clinic (*Canadian Broadcasting Corporation, 2018*)

Dr. Joyce Wong, MD FRCSC (Vascular Fellow 1993, Alberta & Ontario)

Born in 1958, Dr. Joyce Wong spent her childhood in Lethbridge, Alberta. Her father, Hong, was a grocer who moved the family to Cooksville, Ontario, briefly experimenting with Chinese 'market gardening.' Dr. Wong's mother, Ellen, was a homemaker and also assisted her father at the shop. Her paternal grandmother, Sui Yung Wong, a strong traditional figure, lived with the family and had a profound impact on her childhood. Sui Yung's experiences of surviving wartime in China and escaping to Hong Kong left a lasting impression.

Growing up, Dr. Wong navigated her identity as both the 'token' person of color in her community and the child of immigrants. She balanced Westernized interests, like singing in a church choir, with traditional Chinese values at home. Dr. Wong worked in her father's store, open every single day of the year, sought out literature pertaining to her Chinese ancestry (*e.g. The Chinese Children Next Door: Buck, Pearl, Katharine Tozer*), and had to be home each night before the CTV news program ended. In common with many immigrant children, she also took on assisting her parents with language-related tasks and administrative issues (despite their English being quite good) at a young age. She would often interpret conversations, clarify instructional materials, and help draft letters for her parents who immigrated from China during the 1950's. Her father was sponsored by his uncle, after Canada repealed the Chinese Exclusion Act (1921-1949), and reopened immigration to Chinese nationals after World War II.

Experiences of overt and subtle racism further speckled Dr. Wong's childhood as a Chinese-Canadian. Although acts of racism towards children are egregious, Dr. Wong attributes these early macro- and microaggressions to her resilience in medicine. She often withstood microaggressions from patients (occasionally colleagues and faculty too) and was therefore able to navigate the care of patients with any significant bias toward her (be it gender, sex, age, etc.).

In her high school years at Lethbridge Collegiate Institute, Dr. Wong excelled in various subjects. She attended the University of Alberta for her medical education, studying biomedical sciences from 1976 to 1978 before entering medical school from 1978 to 1982. During summers, she worked to cover her rent for the school year with the Canadian

communications provider Telus and became independent personally and professionally.

At the end of medical school, Dr. Wong obtained a license for independent practice, despite an interest in surgery. She felt, at this time, discouraged from pursuing a surgical training pathway by peers and educators. As such, she pursued family practice and a 6-month GP anesthesia program at the Edmonton General from 1982 to 1984.

While locuming in family practice, Dr. Wong was accepted to the University of Calgary's general surgery program (she would later become the third woman to complete the training program). She felt she obtained her spot when she impressed the chief of surgery by recalling each step of a Bassini hernia repair in reverse with perfect accuracy. From 1985 to 1989, she worked between the Alberta Children's, Calgary General and Foothills Hospitals.

She recalls some of the most prominent challenges as a female surgical resident. These challenges included securing a locker in the women's operating change room and advocating for 'pant' scrubs for all trainees. Dr. Wong then, once again, embarked on general surgery locums from 1989 to 1991 across Calgary and in Fort McMurray

In 1991, she moved to Ottawa for a vascular surgery fellowship to meet the need for a vascular surgeon in Calgary. Due to a lack of exposure to vascular cases in Calgary, Dr. Wong completed her fellowship over two years in Ottawa, ON (Ottawa General and Ottawa Civic Hospitals) with an additional year (6 months accredited to Vascular training) spent at Queen's University Thrombosis & Hemostasis Lab to build her research experience under the guidance of Dr. Alan Giles. When she returned to Alberta in 1994, Calgary was suffering from the absence of a dedicated vascular surgeon for about three years.

Dr. Wong played a pivotal role in establishing the vascular surgery department at the University of Calgary. She presented her research at the 1995 International Society for Thrombosis and Haemostasis meeting in Jerusalem, and in 1996, testified at the widely reported Dorothy Joudrie Trial. She worked in trauma, general surgery, and vascular surgery concurrently. However, due to some personal and professional challenges, she ultimately decided to relinquish her general surgery practice in 1997.

She contributed to the creation of Calgary's first vascular high-acuity surgical step-down unit (VSCU) and served as program director from 2009 to 2015. Dr. Wong overcame challenges associated with the 'young' vascular specialty and its limited clinical support and resources.

Dr. Wong retired from clinical surgical practice in 2015 due to health issues and later retired from teaching at the University of Calgary Cumming School of Medicine in 2023. Dr. Wong is not only the first woman to become a vascular surgeon in Alberta but also the first woman of color in Canada to achieve this distinction.

At present, Dr. Wong is a lifelong learner interested in issues of equity, diversity, and wellness. She welcomed her daughter, A. Wong, in January 2011 and continues to raise her as a proud single parent (Figure 2).

Dr. Patricia Gaffiero, MD FRCSC (Vascular Fellow 1994, Quebec)

Born in Egypt in 1957, Dr. Patricia Gaffiero's family moved to Montreal, Quebec, in 1963. Growing up in a middle-class family, her father, Claude, worked as an accountant, and her mother, Thérèse, was a homemaker. From a young age, her father encouraged Dr. Gaffiero and her sister to pursue educational aspirations and achieve financial independence in their careers. Further, early exposure to medicine came from her maternal uncle,

a thoracic surgeon, who gave direction to her interest in sciences.

Figure 2. Dr. Wong (*Photograph courtesy of Dr. Wong*)

Dr. Gaffiero completed her Bachelors of Science at McGill University from 1976 to 1979. After an unsuccessful first application to medical school, she pursued a Master's degree in physiology at the Université de Montréal in 1979 under the guidance of Dr. Michel Bergeron, a nephrologist involved in academic research. Her graduate lab work, along with her fascination for surgical dissections, sparked her interest in surgery.

In 1981, she completed her Master's degree and was subsequently accepted into the Université de Montréal medical program. Throughout her medical studies, she continued her research in her graduate lab and graduated with her medical doctorate in 1986 (Figure 3).

Figure 3. Dr. Gaffeiro's graduation photo from the Université de Montréal (*Photograph courtesy of Dr. Gaffeiro*)

In the summer of 1982, after her first year of medical school, Dr. Gaffiero married Dr. Yves Beaudry, a fellow medical student. Their understanding of the challenges in the medical field, despite pursuing different specialties, strengthened their bond. Once mar-

ried, Dr. Gaffiero was determined to continue her training in Montreal and build her family.

During her general surgery residency, Dr. Gaffiero discovered her passion for vascular surgery. Her excellence and engagement during her vascular surgery rotation contrasted with other aspects of general surgery. The prospect of an 18-month vascular surgery fellowship over three years, compared to the standard for cardiac surgery, was appealing as well.

Throughout her medical career, Dr. Gaffiero felt the benefit of looking up to the female general surgery residents who had come before her. Upon transitioning to vascular surgery, she occasionally noted that she was often the only female vascular surgeon in the room but never made the connection that she may have been the first female vascular surgeon in the province of QC. She adapted throughout her career to be 'one of the boys' among co-residents and colleagues, forming lifelong close relationships

During her vascular fellowship, Dr. Gaffiero was excited to be specializing but encountered several obstacles to settling into the program. Although accepted into the fellowship in 1993, she deferred the start date to the following year because she had become pregnant with her daughter, Pascale, requiring medical bedrest during her second trimester. This leave was unpaid but did provide Dr. Gaffiero with a renewed perspective on work-life boundaries and the demands of surgical training. Being a mother during those fellowship years was challenging for Dr. Gaffiero. As she spent long hours in the hospital, she felt a sense of guilt for not being present enough for her daughter, which made any discussions of motherhood in the workplace very uncomfortable at that time.

Before her official start date, she met with the attending faculty to ensure she was provided two days off every two weeks across her fellowship as protected family time. Attendings were critical of this request at first, but Dr. Gaffiero paved the way for the program to adopt these standards for all future fellows.

In September of 1994, at the end of her fellowship, Dr. Gaffiero opted to write both her final written and oral exams in English as a demonstration of her bilingualism and to circumvent being examined by the staff that she knew personally. She was successful in each portion of the exam and became certified by the Royal College on March 17th, 1995.

Beyond fellowship, Dr. Gaffiero was set on obtaining a solely vascular position and submitted her CV to various surgical positions. Her family continued to call the city of Montreal home as her spouse worked as an interventional cardiologist at the General Hospital. At first, Dr. Gaffiero was offered only dual positions in general and vascular surgery. However, she patiently located a sole vascular surgery position in Joliette, QC. She practiced for approximately a year and a half before becoming pregnant with her second child, her son Simon. Once again, this pregnancy required an extended and unpaid leave for medical bedrest, which Dr. Gaffiero embraced as an opportunity to locate work closer to Montreal.

In the spring of 1996, she received an offer to join a new vascular surgery practice in Saint-Jérôme, Quebec, where she could work alongside a respected colleague. Over the next 24 years, the practice grew in reputation, welcomed numerous referrals, and recruited additional vascular surgeons. Towards the end of her career, Dr. Gaffiero incorporated endovascular procedures into her skillset. She retired from her surgical practice in April 2022 and now enjoys spending more time with her family.

Dr. Jodi L. Spelay, MD FRCSC (Vascular Fellow 1998, Manitoba and Saskatchewan)

Born and raised in the small town of Yorkton, Saskatchewan, Dr. J. Spelay had a tomboy childhood. She and her three brothers (Blaine, Brent, & Darrell) were often outdoors playing street hockey and other games until dark. Her parents both had careers outside the home, with her mother, Mildred Spelay (née Shumay), working as a travel agent for G&J Luggage and Travel Aids, and her father, Steve, serving as a shop foreman for International Harvester.

Dr. Spelay considered a career in nursing up until grade nine when her father underwent a coronary artery bypass graft, which sparked in her an intense interest in surgery. She worked hard to familiarize herself with the interworking's of surgery through first book learning and then hands-on skills, although the focus of what surgical specialty she wanted to pursue changed during her training.

At the outset of medical school Dr. Spelay pursued plastic surgery, spending her fourth year at the Mayo Clinic of Rochester, Minnesota, under the renowned plastic surgeon, Dr. J. Woods (Post-Bulletin, 2019). This experience, while valuable, left her disheartened by the number of patients who were turned away for life-altering surgeries, particularly those without insurance. It was during a night on-call with Dr. Brian Ulmer, where she witnessed a patient saved from a ruptured aneurysm, that she found her true calling in vascular surgery. Dr. Spelay was captivated by the quick decision-making processes and critical life-saving skills that vascular surgery demanded.

Dr. Spelay attended two years of pre-medical undergraduate studies (1986-1988), medical school (1988-1992), a rotating internship (1993), and a general surgery residency, all under the educational masthead of the University of Saskatchewan. This receipt of education wholly within the city of Saskatoon left Dr. Spelay feeling strongly tied to the region once she became a full-fledged surgeon. She knew that no matter what her future practice looked like she would likely stay within the local region, where she still had close relationships with family and medical classmates. Even so, she had to balance a desire to pursue vascular surgery; a surgical specialty for which no fellowship exists to this day in Saskatchewan.

A compromise occurred for Dr. Spelay when the opportunity arose to train in neighbouring Manitoba with the pioneer of vascular surgery, Dr. Downs. Two of Dr. Spelay's vascular surgery partners had trained at the University of Manitoba previously and assured her that a job would be available in Saskatoon upon completion of her fellowship. Despite the hassle and politics associated, including being asked if she planned to have children during her fellowship interview, Dr. Spelay rose to the challenge and made the move to Winnipeg with her husband in the summer of 1998.

Due to the evolution of in-situ grafting in vascular surgery, Dr. Spelay had the opportunity to pursue this evolving skill while in fellowship. Along with fellow learners and faculty from the University of Manitoba, she attended Education courses at Vanderbilt University, Nashville, TN to gain the necessary experience to bring these skills back to the Canadian prairies.

Dr. Spelay returned to Saskatoon and embarked on a dual practice in general and vascular surgery at St. Paul's Hospital on July 3rd, 2000 field (Figure 4). Her early career was marked by various roles beyond her clinical responsibilities. She chaired the Medical Equipment Committee from 2000 to 2005 and was honored with the Clinical Faculty

Appreciation Award from the University of Saskatchewan in 2004. She also played a significant role in the Canadian Society for Vascular Surgery and served as the program chair for the 2007 annual meeting. Additionally, she contributed to the creation of the 2008 Clinical Practice Guidelines for the Prevention and Management of Diabetes Foot Complications (Saskatchewan Ministry of Health, 2008, p. 4) as part of a working group. At professional events, she was easily recognizable in her distinctive attire, consisting of a blue suit, feminine blouse, and high heels. She was committed to ensuring the representation of women in her field and consistently secured a seat at the front of each room.

Dr. Spelay held a dual specialty practice until she focused on open and Endovascular Surgery in 2014. She continues, at the time of this publication, to provide vascular surgical services with the Surgical Associates of Saskatoon (still using some of the surgical techniques taught to her by Dr. Brian Ulmer) and is a clinical associate in the Department of Vascular Surgery at the University of Saskatchewan (Figure 5).

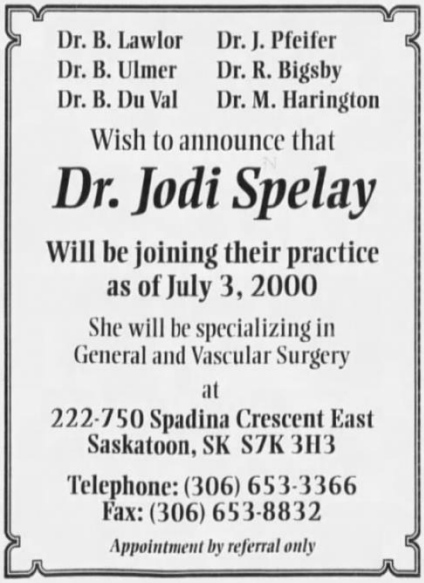
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Figure 4. A Newspaper announcement welcoming Dr. Spelay back to Saskatoon after fellowship (*The Star-Pheonix, 2000, p. 2*)

Narrative Analysis

Thematic analysis of the interview transcripts revealed a total of nine key themes that encompassed major milestones in the lives and medical training of the four female vascular surgeons (Table 2). These themes were as follows:

1- Humble Beginnings and Strong Sense of Self: The surgeons' early life experiences were marked by humble beginnings, growing up in families where financial resources were limited. However, their strong sense of self, coupled with a clear vision of their future as surgeons, set them on a path to success. This unwavering self-belief was a driving force that propelled them forward, even in the face of adversity.

2- Formative Mentorship and Acceptance of Surgical Culture: Mentorship played a critical role during their medical training, especially during their general surgery residencies. These mentors, often faculty members or senior residents, served as guides, offering invaluable support and guidance. Their influence was pivotal in shaping the participants'

surgical careers. The recognition and adaptation of surgical culture were also essential in medical training. Participants were eager to understand the "rules" of the operating room as trainees. They learned to always come prepared and often tolerated the social traditions of the surgical department to succeed and avoid humiliation.

Figure 5. Dr. Spelay in clinic (*Photograph courtesy of Dr. Spelay*)

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3- Decentralized Fellowship Selection and Value in a Group Practice Setting: The decentralized approach to selecting vascular surgery fellowships offered predictability and flexibility, allowing participants to secure positions that aligned with their family circumstances and training timeframes. Working in a group practice setting provided benefits such as reduced call responsibilities and increased opportunities for continuing education. For those without the support of a group practice, covering vascular calls proved to be challenging.

4- Challenges Related to Family Duties and Gender Bias: Balancing family responsibilities, particularly during pregnancy and maternity leave, was a common challenge faced by the participants. Unpaid maternity and caregiver leave limited their ability to fully commit to their careers, and in return, demands of call often interfered with family duties. The participants also encountered gender bias, particularly with certain professional groups such as nursing and cardiac surgery. Challenges with nurses often arose during training, with issues in other surgical disciplines encountered more frequently during independent practice. These biases were met with strategies like setting boundaries,

professionalism, and clear communication.

5- Lack of Identity as 'First Female Vascular Surgeon': None of the participants identified as the "First Female Vascular Surgeon" in their respective provinces. Instead, they acknowledged the pioneering work of other women in different surgical specialties and considered themselves followers, continuing the legacy of breaking barriers. This lack of a unique identity at the provincial level was a common theme among the participants.

Table 2: Results of narrative analysis

Theme	Details	Examples
Humble beginnings	• All participants were from low- and middle-class backgrounds. • No immediate family members in the field of medicine.	• From homes marked by 'hard work' and 'saving money.' • "She [my mother] then became a homemaker and managed our household on a limited budget and provided for all my older brother and I ever needed. Including saving for my education."
Strong sense of self in early life	• Embraced unique personal characteristics, unwavering sense of identity and interests. • Clear vision of self as a future surgeon.	• "I knew from the get-go that I wanted to go into surgery." • "A lot of my colleagues, even in grade school knew I was going to go into something medical" • "I actually had to walk my own path. I was my own drummer." • "Thought I could do almost anything that I wanted to." • "Made myself known as a med student during my [surgical] rotations". • "I knew I was going to do this pretty much from the day I started."
Formative mentorship during medical training	• Mentors were identified by most participants, especially during general surgery residency. • Often, mentors were faculty or an attending. Yet, senior residents acting as mentors or role models were almost always women. • Mentors varied greatly in surgical discipline (i.e., Plastics, thoracic, general) and all participant mentors demonstrated attributes of stakeholder-ship.	• "I really loved surgery. I had some very good surgical mentors during my general surgery" and they, "encouraged me to go into surgery" • "They dragged me around everywhere to see emergency cases, as a first assist"
Acceptance of surgical culture	• Keen to understand the 'rules' of the operating room as • trainees. • Learned to always come prepared to the operating room to compete and/or avoid humiliation. • Took on or tolerated the social traditions of the surgical department.	I didn't want to be known as the girl who quit again" • Nothing smaller than size 6 glozes on internship, needed 5.5 and a brusque attending brought in two small demo gloves, "thinking he was funny" • "I always took my place in the front" and "You can't be a mouse, or you will be crushed." • Tried to be "One of the boys" • "There was stuff the guys liked to do and I learned to go along" • "I have learned my whole life to show up at things and smile politely." • "If you can't stand the heat, get out of the kitchen". • Co-resident events often revolved around drinking; "never champagne, always beer". • "You've got the learn to roll with the sense of humour. It doesn't mean that you are a doormat"

Benefit from de-centralized fellowship selection	• All participants felt they benefited from local fellowship selection processes. • Able to directly arrange a spot for themselves or through a colleague. • National selection system felt to have been too unpredictable for family circumstances or training timeframes.	• "I didn't want to leave the city because of husband's training" • "The person who was eventually going to be my husband… we ranked the same [fellowships] 1, 2, and 3"
Limitations on practice set by family duties	• Pregnancy was challenging and medical conditions were encountered for all participants with children (i.e. medical bedrest, pre-eclampsia). • Unpaid maternity, childcare, and caregiver leaves of absence were the norm. • All participants felt limited geographically to communities where their families were already established. • However, all participants with spouses reported them to be supportive and instrumental to their daily work. Private supports, like nannies, were typically hired.	• "No paid time off for pregnancy." • "I had to take some time off because I developed preeclampsia mostly related to the stress of a particular surgeon staff" • "Surgery can be fairly onerous, especially when you're doing a lot of ruptured aneurysms at 7 to 8 months pregnant" • "I had family…that I wanted to come home for, and I promised them I would return".
Gender bias creating challenges with other healthcare professionals	• Gender bias felt strongly among some professional groups, like nursing and cardiac surgery. • Challenges resolved by setting boundaries, being professional, and clarifying expectations. • Challenges with nurses were encountered more frequently during training (issues with other surgical disciplines were experienced more often during independent practice).	• "Throughout all my training, nurses were your worst enemy." • "The men [surgeons' got fondled over and the women got ignored [by nursing]" • Nurse discharged a surgeon's patient without notifying them. • "Cardiac treated us like a poor cousin and wouldn't let us go" • "Took less seriously than male colleagues". • "One resident used to joke out the side of this mouth, you learned to not take offence, but he used to say you guys should be barefoot and pregnant."
Value in a group practice setting	• Working in a group practice was expressed as beneficial by all participants. • Experienced less call and more continuing education opportunities noted while practicing in a surgical group. • If no group practice, other surgical specialties are not willing to cover vascular calls.	• "I was assumed to drop everything and deal with the vascular surgeries while they did their open-heart surgeries" • "He had his way of doing things and it was different from how I was taught"

Lack of identity with 'First female vascular surgeon' at provincial level	• No participant identified with a legacy of 'First Female Vascular Surgeon' in her respective province. • Many saw themselves as a 'follower' of other women who were ahead of them in general and other surgical specialties.	• One surgeon noted she was often the oldest female surgeon in the room, but never linked herself with being 'the first female' in vascular. • "Always been a square peg in a round hole my entire life"

Discussion

This article presents the biographies and narrative analysis of four female vascular surgeons' remarkable journeys into the field of vascular surgery and the challenges they encountered throughout their careers. The identified themes reveal common experiences and shared hurdles that ultimately led to their success in a traditionally male-dominated specialty. Four of these themes, Acceptance of Surgical Culture, Limitation on Practice Set by Family Duties, Gender Bias Creating Challenges with Other Healthcare Professionals, and Lack of Identity with the 'First Female Vascular Surgeon', represent major barriers in participants' careers. Surgeons ultimately had to overcome these barriers to succeed and secure their position in the speciality.

Historical research, like this study, offers an important forum to record and preserve the distinct narratives of pioneering individuals. In presenting a series of biographical works and a narrative analysis of the first women to become vascular surgeons in Canada, we hope future generations of surgeons will utilize this text as a point of reference for the ongoing development of diversity and representation in the field. For female-identifying trainees, especially those hoping to enter a male-dominated surgical specialty, these narratives may assist in the meaning-making of experiences and professional growth (Yardley et al., 2020, pp. 837-840).

Of the nine themes identified during narrative analysis, a wide array of ideas has been put forth for application. Particularly, the themes of Formative mentorship in medical training and Gender Bias Creating Challenges with Other Healthcare Professionals resonate with contemporary research. Improving mentorship opportunities, which have been often limited for women, and reducing institutional mistreatment among female-identifying trainees through policy and leadership buy-in have both been associated with diversified recruitment to the specialty (Dageforde, Kibbe and Jackson, 2013, p. 263; Dorsey et al., 2021, p. 9). Implementation of such initiatives should be considered a priority for vascular training programs especially, as the proportion of female medical students and female cardiovascular patients continues to grow (Arya, Franco-Mesa, and Erben, 2022, pp. 6-8; Dageforde, Kibbe and Jackson, 2013, p. 266). For example, as per the Canadian RCPS directory, three female trainees completed their specialty certification in vascular surgery between 2022-2023.

While this study acknowledges the limitations of a small number of participants and a narrow geographical scope, the authors are confident that thematic saturation was achieved. The unique context and richness of historical interviews have uncovered several areas warranting further investigation.

One area of interest is understanding why participants felt that nurses tended to discriminate against female residents and how this issue can be effectively addressed. Additionally, questions arise as to whether female trainees need to adapt more consciously to the surgical culture than their male counterparts, whether they feel compelled to be better prepared to avoid humiliation, and whether they have to outperform their male colleagues, double standard and/or higher expected standards for women surgeons (Arya, Franco-Mesa and Erben, 2022, pp. 5-9). Addressing these questions and making sustainable changes to attract more females to the field are vital steps in achieving greater gender diversity.

Despite the progress made, there is still a long way to go, as evidenced by the fact that only three Canadian female vascular surgeons completed fellowship in comparison to 15 males. This underscores the need for ongoing efforts to break down barriers and create a more inclusive and equitable environment for aspiring female vascular surgeons.

It is important to note that this study specifically focuses on the first women in vascular surgery rather than encompassing the collective specialty of cardiac, vascular, and thoracic surgery (CVT). Female trainees had entered CVT at earlier dates in Canadian history. Our selection of vascular-specific trainees was intended to be mindful that CVT largely paved the way for modern-day cardiac surgery. However, we acknowledge the intertwined nature of these surgical subspecialties during this unique period in Canadian history (Noly et al, 2017, p. 998). Additionally, it should be noted that during the period of interest (the 1980s to 1990s), the training structure required all surgical residents to complete general surgery training before progressing to a specialized fellowship like vascular surgery (Boyd, 2021, p. 842; Noly et al, 2017, p. 999). Modern-day surgical trainees in Canada can progress directly into a vascular residency from medical school.

Conclusion

This publication, as an acknowledgment of the contributions made by the first female vascular surgeons, represents a sincere endeavor to honour their legacies and shed light on the barriers to gender diversity within surgical disciplines. Despite the barriers and biases imposed on them, all surgeons featured in this historical review have progressed vascular surgery as a discipline through publications, mentorship, and decades of practice. Likewise, the women featured in this review have made a lasting impact on their community, not just through their surgical practices but through their families, philanthropy, and advocacy work.

Additional research on gender representation in the field of vascular surgery will help determine the strength and generalizability of narrative analysis results.

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Authors' Contribution

Crystal McLeod conceptualized study design, collected data, conducted initial analysis, drafted the manuscript, and coordinated with other authors to finalize this publication. Carolyn Coles independently verified first author data analysis and assisted with the first

manuscript draft. Authors Rebecca Kenny, Alexa Mordhorst, and Julia Wimmers-Klick contributed to the final manuscript by asisting with ethics approval, offering feedback on data analysis and revisions to text. All authors read and approved the final version of the work.

Conflict of Interest

None.

References

Arya, S., Franco-Mesa, C. and Erben, Y., 2022. An analysis of gender disparities amongst United States medical students, general surgery residents, vascular surgery trainees, and the vascular surgery workforce. *Journal of Vascular Surgery*, 75(1), pp. 5-9.

Boyd, A. J., 2021. Vascular surgery in Canada: Challenges in the great white north. European *Journal of Vascular and Endovascular Surgery*, 62(6), pp. 842-844.

Canadian Broadcasting Corporation, 2018. Assessment of HSN breast clinic: Hospital did not meet some requirements for breast cancer patients. CBC News, [Online] 25 October. Available at: https://www.cbc.ca/news/canada/sudbury/hsn-breast-clinic-assessment-1.4876985 [Accessed 4 November 2023]

Carnevale, M., et al., 2020. Gender disparities in academic vascular surgeons. *Journal of Vascular Surgery*, 72(4), pp. 1445-1450.

Dageforde, L. A., Kibbe, M. and Jackson, G. P., 2013. Recruiting women to vascular surgery and other surgical specialties. *Journal of Vascular Surgery*, 57, pp. 262-267.

Dorsey, C., Ross, E., Appah-Sampong, A., Vela, M. and Saunders, M., 2021. Update on workforce diversity in vascular surgery. *Journal of Vascular Surgery*, 74(1), pp. 5-11.

Karekezi, C., et al., 2021. History of African women in neurosurgery. Journal of Neurosurgery, 50(3), p. E15.

Motter, S. B., Brandão, G. R. and Trindade, B. O., 2023. Beyond medicine: Eloísa Díaz, the first woman surgeon graduate in Latin America. *Journal of the American College of Surgeons*, 236(5), pp. 1064-1067.

Noly, P., et al., 2017. Cardiac surgery training in Canada: Current state and future perspectives. *The Journal of Thoracic and Cardiovascular Surgery*, 154(3), pp. 998-1005.

Pories, S.E., et al., 2019. Leadership in American surgery: Women are rising to the top. Annals of Surgery, 269(2), pp. 199-205.

Post-Bulletin, 2019. John Woods – Rochester. Obituaries, [Online] 28 December. Available at: https://www.postbulletin.com/obituaries/john-woods-rochester [Accessed 4 November, 2023]

Saskatchewan Ministry of Health, 2008. Clinical practice guidelines for the prevention and management of diabetes foot complications. Ehealthsask, [Online] 6 February. Available at: https://www.ehealthsask.ca/services/resources/Resources/diabetes-clinical-guidelines.pdf [Accessed 4 November 2023]

The Star-Pheonix, 2000. General. The Star-Pheonix Saskatoon, [Online] 1 July. Available at: https://www.newspapers.com/image/511197510/?match=1&terms=Dr.%20Spelay [Accessed 4 November 2023]

Yardley, S., et al., 2020. 'What do we do, doctor?' Transitions of identity and responsibility: A narrative analysis. *Advances in Health Sciences Education*, 25, pp. 825–843.