Taking a ‘One Welfare’ approach to dairy farmer well-being: A qualitative exploration of dairy farmer well-being within the context of animal care and technology.

by

Arielle Le Heiget

A Thesis submitted to the Faculty of Graduate Studies of

The University of Manitoba

in partial fulfilment of the requirements for the degree of

MASTER OF SCIENCE

Department of Animal Science

University of Manitoba

Winnipeg

ABSTRACT

Le Heiget, Arielle. M.Sc., The University of Manitoba, March 2025. Taking a 'One Welfare' approach to dairy farmer well-being: A qualitative exploration of dairy farmer well-being within the context of animal care and technology. Major Professor; Dr. Meagan T.M. King.

Farmers from all commodity groups encounter different stressors; livestock farmers especially grapple with choices that muddle ethical, emotional, and economical boundaries. Canadian farmers experience higher levels of anxiety, depression, perceived stress, and are at an elevated risk of burnout in comparison to the general population, and animal-care related occupations also experience higher levels of psychological distress. Agriculture is rooted in culture and tradition, and being a 'good farmer' is frequently part of one's identity (Burton, 2004). In animal agriculture, on-farm technology is promoted to enhance farmer well-being, animal welfare, and/or environmental sustainability. As such, technology has advantages but the fundamental changes it brings to the farmer-cow dynamic cannot be ignored. The objective of this study was to explore dairy farmer well-being in the context of (1) animal health and welfare, and (2) on-farm technology. I conducted semi-structured interviews to address these objectives and conducted a thematic analysis for each. I found that the emotional and physical act of caring for livestock, as well as the connection to their animals, may play a role in dairy farmer well-being, serving as both a risk and reward. It was evident that technology can be of benefit when used as a tool, if appropriate for the farmer and the specific on-farm context. In both research chapters of the thesis, external pressures were an added source of stress for farmers which underscores that many stressors are out of their control, particularly when it comes to feed sovereignty and weather, uncertainty, economic volatility and labour shortages, and structural inequity.

ACKNOWLEDGEMENTS

This thesis received funding from Mitacs and Dairy Farmers of Ontario. To all of the farmers who were part of my thesis, thank you for sharing your story with me. My appreciation and gratitude for everyone who supported this project extends far beyond one page. I would like to express my appreciation to my advisor, Dr. Meagan King, you have taught me the power of curiosity and confidence and empowered me throughout this journey. I am honoured to be your first graduate student to conduct qualitative work, and could not imagine a better advisor to learn and grow with. I sincerely appreciate your intentional approach to collaborating with farmers and cannot wait to hear more about your future work. Thank you for your steadfast support, encouragement, and for being a person I can look up to. To my committee – Drs. Andria Jones, Briana Hagen, Jolene Kinley, and Kees Plaizier, thank you for encouraging me, providing insight that allowed me to grow, and pushing me to prioritize self-care. Andria and Bri, thank you for guiding me, your dedication to farmers is inspiring. Jolene, you taught me to give myself grace, I cannot thank you enough.

Mike, Glen, Eric, and Marilyn, thank you for trusting and teaching me how to work with livestock – my most treasured memories are from the corrals. Johnson women, past and present, thank you for passing down the traits of strong-willed, determined women – and thank you to the men who tolerate us. Mom, I am grateful that you shared your love and connection to the farm with me, and for showing me what resilience looks like. Dad, thank you for sharing your passion for animals with me, and inspiring me to be a voice for the voiceless. Granny and Grandpa, thank you for your tireless support, and never doubting me. Matthew, thank you for fueling my interest in social justice from a young age, and inspiring me to advocate. Marshall, thank you for consistently pushing me, and propelling me to grow throughout my life. Brynn, through life's

darkest moments, we are together – thank you for bringing light. To Pat, thank you for your support through countless nights of, “just a few more minutes.” This thesis was a labour of love and loss, and your unwavering stability provided me with the safe space I needed to survive the darkness, and thrive when the light returned. You were there for me through it all, and I will forever be grateful to have the privilege of building our life together.

DEDICATION

I dedicate this thesis to Bernie, Christian, Ethan, and to the countless others who were unable to access rural mental health resources when they needed it most, and to their loved ones left behind.

CONTRIBUTION OF AUTHORS

Arielle Le Heiget: Conceptualization, Methodology, Data Collection, Data Analysis, Writing (original draft), and Writing (review and editing). **Meagan King:** Conceptualization, Methodology, Data Collection, Data Analysis, Writing (original draft), Writing (review and editing), and Supervision. **Andria Jones and Briana Hagen:** Conceptualization, Methodology, Data Analysis, and Writing (review and editing). **Jolene Kinley:** Conceptualization, Methodology, and Writing (review and editing). **Halimatou Tambadou and Breanna Zwick:** Conceptualization, Methodology, and Data Collection. **Kees Plaizier:** Conceptualization, Methodology, and Writing (review and editing). **Valli Fraser-Celin:** Methodology, and Data Analysis.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF APPENDICES

1 Chapter 1 | Literature Review & Research Objectives

1.1 Introduction

The animal agriculture sector thrives on interdependencies; humans depend on animals for food production and the animals within these production systems depend on humans to care for them. Care and connection exist within the farmer-animal relationship (Edwards-Callaway et al., 2022; Schuppli et al., 2023; Buddle et al., 2021), which contribute to livestock farmer well-being (Chapman & Deplazes-Zemp, 2023). Research suggests that animal welfare and farmer well-being are related (Hansen & Østerås, 2019; King et al., 2021). There is an increasing amount of technology being utilized on dairy farms across the world with automated milking systems (AMS) at the forefront (Baur & Iles, 2023; Butler et al., 2012; Cogato et al., 2020; Finstad et al., 2021; Jacobs & Siegford, 2012; John et al., 2016; Kaarlenkaski, 2023; Karttunen et al., 2016; King & DeVries, 2018; Lage et al., 2024; Neethirajan & Kemp, 2021; Schillings et al., 2021) which offers potential benefits such as increased efficiency (Baur & Iles, 2023; Cogato et al., 2021; Finstad et al., 2021; Holloway et al., 2014; Jacobs & Siegford, 2012; John et al., 2015; Neethirajan & Kemp, 2021; von Keyserlingk et al., 2024), improved animal welfare (Butler et al., 2012; Cogato et al., 2021; Finstad et al., 2021; Jacobs & Siegford, 2012; King & DeVries, 2018; Neethirajan & Kemp, 2021; Tse et al., 2017), and enhanced environmental sustainability (Cogato et al., 2021; Neethirajan & Kemp, 2021). However, studies have demonstrated that AMS may have positive and/or negative impacts on farmer health and well-being (Borchers & Bewley, 2015; Hansen et al., 2020; Hansen & Stræte, 2020; Lunner-Kolstrup et al., 2018; Tse et al., 2018; von Keyserlingk et al., 2024).

Technology may change the farmers role on the farm (Butler et al., 2012; Lunner-Kolstrup et al., 2018; von Keyserlingk et al., 2024), consequently altering the farmer-cow relationship

(Finstad et al., 2021; Holloway & Bear, 2017; Peralta & Haefs, 2023; von Keyserlingk et al., 2024), which could challenge existing beliefs around what caring for animals entails (Holloway et al., 2014; Vigors et al., 2023; von Keyserlingk et al., 2024). The 'good farmer' identity coined by Burton (2004) goes beyond production and economically-focused definitions, where one's identity as a farmer may be intertwined within cultural and symbolic systems that exist within their social community, possibly holding history for those with generations of farmers in their family, and at the community level offering a symbol of status. Altering the systems and processes that identities are rooted in may result in acts of resistance, as this may threaten a farmer's identity (Burton, 2004). Building upon this work, Vigors et al. (2023) conducted a qualitative study with livestock farmers in Scotland and found that participants considered providing good animal welfare to be integral to the 'good farmer' identity. To many farmers, there is pride and responsibility involved in caring for their animals, where safeguarding animal welfare is seen as a moral or ethical obligation (Croyle et al., 2019; Enticott & Vanclay, 2011; Marshall et al., 2023; von Keyserlingk et al., 2024).

There is growing concern from the general public about farm animal welfare (Alonso et al., 2020; Burton et al., 2012; Mahon et al., 2023; Muhammad et al., 2022; Sirovica & von Keyserlingk, 2023; Ventura et al., 2015; Ventura et al., 2016; Ventura et al., 2021), holding potential for livestock farmers to feel targeted or criticized (Ceccato et al., 2021; Ceccato et al., 2022; Schuppli et al., 2023; Vigors et al., 2023). Multiple constructs of animal welfare exist (Muhammad et al., 2022), perhaps this relates to the differences in how farmers and the general public describe animal welfare (Sirovica & von Keyserlingk, 2023; Ventura et al., 2015; Ventura et al., 2016), neither of which description may be optimal from the stance of the animal (von Keyserlingk & Weary, 2017). Policy may aim to improve animal welfare, but barriers to

implementation remain (Belage et al., 2019; Roche et al., 2019; Marshall et al., 2023), perhaps some disconnect exists between farmers and policy-makers, as well. When farmers are involved in the process of finding solutions or developing recommendations, there may be a higher likelihood that they will implement that recommendation (Kröbel et al., 2021; Ritter et al., 2019), however, animal welfare research may at times take an evaluative view of farmers (Vigors et al., 2023). As suggested by Ventura et al. (2015), with regards to animal welfare in the dairy industry, there is a need for more effective and meaningful engagement, perhaps through a multi-stakeholder network. Lastly, there is a perceived disconnect between farmers and society in Canada (Letourneau & Davidson, 2022; Thompson et al., 2023b) which impacts "farm credibility" of mental health clinicians (Hagen et al., 2022). Although agricultural communities can provide a strong sense or support, the perceived lack or misunderstanding from society there may lead to experiences of cultural loneliness (Wheeler et al., 2023).

Research surrounding empathy of livestock farmers and/or farm workers towards the animals in their care show mixed findings (Burton et al., 2012; Campler et al., 2018; Albernaz-Gonçalves et al., 2021; Kielland et al., 2010; Schuppli et al., 2023; Spooner et al., 2014; Román-Muñiz et al., 2021). In human caregiving professions, empathy plays a role in the development of compassion fatigue (Figley, 1995), and is associated with burnout (Wilkinson et al., 2017) and secondary traumatic stress (STS) (Shi et al., 2022). Existing research regarding compassion fatigue in human caregiving professions is well-documented, however, there is a growing body of work that suggests animal care professions are may be at risk for occupational stress and compassion fatigue (LaFollette et al., 2020; Polachek and Wallace, 2018; Rohlf, 2018; Monaghan et al., 2020). Literature has started to draw connections between livestock farmers and/or farm workers and compassion fatigue (Campler et al., 2018; Denis-Robichaud et al.,

2023; Edwards-Callaway et al., 2022; Wagner et al., 2020; Mullins et al., 2017) or the 'caring-killing paradox' (Román-Muñiz et al., 2021; Wagner et al., 2020). Further, compassion fatigue risk has been identified in veterinarians and government staff involved in mass culling of livestock (Park et al., 2020). Nonetheless, there remains a lack of evidence to make the conclusion that livestock farmers and/or farm workers may experience compassion fatigue, however, there is an established concern for the mental health of farmers in Canada (Hagen et al., 2021; Jones-Bitton et al., 2019, 2020). Thus, further work exploring livestock farmer well-being is necessary to ensure that farmers are adequately supported.

The following review will discuss current literature pertaining to livestock farmer well-being in the context of animal care and technology use. A discussion regarding the well-being of farmers in Canada will provide the context for the following section which provides a detailed overview of farm animal welfare, and the role technology may play from a 'One Welfare' perspective. Drawing these sections together, a discourse regarding the complexity of caring for livestock will be provided.

1.2 Well-being of farmers in Canada

1.2.1 Defining well-being

Well-being has been approached from two different lines of sight: eudaimonia or hedonia (Deci & Ryan, 2008; Lambert et al., 2015; Thorsteinsen & Vittersø, 2020; Dodge et al., 2012; Ryff, 2014). Eudaimonic perspectives take from the philosophy of Aristotle, where a key element of a life well-lived is through the betterment of oneself offers direction to life, and allows one to achieve their true potential (Thorsteinsen & Vittersø, 2020; Ryff, 1989; Ryff, 2014; Lambert et al., 2015). Hedonia relates to life satisfaction, positive feelings such as

happiness, and minimizing negative feelings (Dodge et al., 2012; Mead et al., 2021; Thorsteinsen & Vittersø, 2020; Lambert et al., 2015). These two concepts have been described as eudaimonia and hedonia ((Ryff, 1989; Thorsteinsen & Vittersø, 2020; Lambert et al., 2015). A eudaimonic view looks at psychological well-being which involves autonomy, environmental mastery, personal growth, positive relationships, purpose in life, and self-acceptance, whereas a hedonic approach looks at subjective well-being which is described by happiness or life satisfaction (Ryff, 2014; Lambert et al., 2015). While subjective and psychological well-being can be considered to stand alone, they each relate to the construct of well-being (Thorsteinsen & Vittersø, 2020). However, each theory is lacking as emphasizing feeling or functioning consequently results in compromise of the other (Lambert et al., 2015).

1.2.2 Perceptions of rural and farming communities

A deficit perspective, whereby emphasis is placed on what populations in rural areas are lacking rather than what they have (Ahmadu et al., 2021; Bourke et al., 2010; Bourke et al., 2013; Crumb et al., 2022; Malatzky & Bourke, 2016; Malatzky & Couch, 2023), reinforcing the idea that problems lie within rural areas (Bourke et al., 2010; Bourke et al., 2013; Crumb et al., 2022). The deficit perspective is often seen in rural health as it can be utilized for the benefit of the community by drawing attention to negative elements for political gain; however, this often comes at a cost of ignoring positive elements (Simpson & McDonald, 2017). The dominant narrative suggests that rural communities are lower and undereducated social strata than urban communities, and that they are naïve, lack sophistication, adhere to traditional norms, and struggle with poverty (Malatzky & Bourke, 2016). Framing such as this has been identified in Canada (Ahmadu et al., 2021; Corbett, 2014; Edwards & McKinnon, 1987; Herron et al., 2025; Kitchen et al., 2012), the United States (Crumb et al., 2022; Cirell & Sweet, 2020; Larson &

Dearmont, 2002; McNamee et al., 2025; Strover et al., 2020), and Australia (Bourke et al., 2010; Bourke et al., 2013). Such narratives have led to the development of the phrase ‘rural place stigma’ in reference to the systemic inequities that deficit perspectives perpetuate toward rural communities (Malatzky & Couch, 2023).

Deficit-based thinking has been used to depict a myriad of challenges; health (Ahmadu et al., 2021; Bourke et al., 2010; Bourke et al., 2013; Kitchen et al., 2012), education (Cirell & Sweet, 2020; Corbett, 2014; Crumb et al., 2022; Edwards & McKinnon, 1987; McNamee et al., 2025;), child welfare (Larson & Dearmont, 2002), internet and technology (Strover et al., 2020), and area-based socio-economic inequality (Fu et al., 2015). In comparison to urban populations, rural populations are described as having lower incomes (Corbett, 2014; Bourke et al., 2010; Bourke et al., 2013; Crumb et al., 2022; Malatzky & Bourke, 2016; Malatzky & Couch, 2023; McNamee et al., 2025; Strover et al., 2020) and poor socioeconomic conditions (Caxaj, 2016), a lower level of education (Bourke et al., 2013; Corbett, 2014; Crumb et al., 2022; Malatzky & Bourke, 2016; Malatzky & Couch, 2023; McNamee et al., 2025), challenges with technology (Caxaj, 2016; Strover et al., 2020), live less healthy lifestyles (Bourke et al., 2010), reduced health outcomes (Ahmadu et al., 2021; Caxaj, 2016; Kitchen et al., 2011; Malatzky & Bourke, 2016; Malatzky & Couch, 2023), less job opportunities (Herron et al., 2020; Malatzky & Couch, 2023; McNamee et al., 2025) resulting in higher rates of unemployment (Bourke et al., 2013), Further, this framing has been seen within the context of child welfare, where farming children are thought to have limitations that impact development such as a lack of social interaction, and involvement in activities (Larson & Dearmont, 2002).

A review by Asheber et al. (2024) of the Canadian healthcare system and public health policies, within both federal and provincial contexts, reported a theme of stigma towards

individuals with disabilities and those living in marginalized communities, such as rural areas. Rural communities experience challenges unique to urban communities such as limited health services (Allan et al., 2019; Banack et al., 2023; Bourke et al., 2010; Caxaj, 2016; Crumb et al., 2022), lack of resources (Larson & Dearmont, 2002), and poor internet connectivity (Strover et al., 2020). Fu et al. (2017) conducted a comparative review of papers from 1975 to 2014 in Aotearoa/New Zealand, Canada, and the United Kingdom describing deprivation indices, of which aim to measure geographic socio-economic inequality, they posit that these measures are created from an ethnocentric viewpoint and call for more critical analyses in socio-economic inequality work. There are ways in which rural communities are indeed at a disadvantage, which involves comparison of social groups where imbalances of power and status exist, however, it is preferable to avoid framing as deficiencies, and to instead approach these as differences (Edwards & McKinnon, 1987). In particular, misrepresentation and/or lack of understanding of the culture within farming communities from the general public can lead to individuals feeling detached or isolated from society which is referred to as 'cultural loneliness' (Wheeler et al., 2023).

Although reports have illustrated reduced health outcomes in rural areas compared urban counterparts, the resilience and strengths of rural communities have also been noted. There is a stronger sense of belonging in rural communities which has been linked to better mental health outcomes (Kitchen et al., 2012). There may be a more robust social capital in rural areas (Bourke et al., 2010). This is relevant to research in Canada that has highlighted the role of community in health promotion (Caxaj, 2016; Ahmadu et al., 2021; Herron & Skinner, 2012). For example, community-led groups such as 'Men's sheds' which have shown to benefit mental health outcomes, but these are not specific to men from rural communities (Banack et al. 2023).

The resilience of rural people has been suggested by Caxaj (2016). Qualitative research in Canada has contextualized resilience of older adults in rural communities in the face of adverse events, such as the COVID-19 pandemic, highlighting the contributors to well-being such as resource accessibility and availability (Herron et al., 2022) and social connection (Herron et al., 2025). A benefit of living in rural communities may be the accessibility to outdoor environments, as these environments are often used by individuals in rural communities as a means of coping by promoting positive states of affect in Canada (Admadu et al., 2021; Herron et al., 2025).

Dairy farmers may be perceived by the general public positively (e.g., hard working, passionate, integral to the rural community, part of the 'rural idyll') or negatively (e.g., intensive production systems, reduced level of animal welfare as farm size increases, economically-driven) (Ventura et al., 2016; Mahon et al., 2023). A survey conducted by Wolf et al. (2016) in the United States showed the tendency for respondents in the general public to support the statement, "dairy farmers face a trade-off between profitability and animal welfare." Farmers within animal agriculture are facing increasing pressures from the public regarding the care and treatment of livestock (Sirovica & von Keyserlingk, 2024; Alonso et al., 2020). Studies have shown that consumers perceive organic production systems to be more positive in comparison to conventional for human health and/or for the welfare of livestock (Alonso et al., 2020). Farmers and agricultural advisors may emphasize biological functioning whereas the general consumer may focus more on naturalness and affective states within regards to animal welfare (Cardoso et al., 2019). In a study by Ventura et al. (2016), citizens were surveyed regarding their perceptions of animal welfare on dairy farms before and after visiting a 500-head dairy farm which illustrated mixed results, whereby participants may have felt more satisfied in regard to their

existing concerns of animal welfare following the visit, while possibly bringing other concerns of significance to their attention.

1.2.3 Culture and identity in farming

Farming is not merely a job but a lifestyle; it is a socio-cultural (Vanclay, 2004) and relational activity (Darnhofer et al., 2016). Farming is generally part of the identity of an individual; being a 'good farmer' can hold significant meaning and status in the agricultural community (Burton, 2004). A relational viewpoint considers farming as contextual, built on relationships that are fluid, and influenced by the social and physical environment (Darnhofer et al., 2016). Farming culture often upholds traditional masculine norms that associate strength with self-reliance and providing for one's family (Hammersley et al., 2023; Holton et al., 2023; Roy et al., 2017). These ideals can be seen in farmers striving to continue the family farm, which can bring feelings of pride (Carmicheal et al., 2023) and pressure (Thompson et al., 2023b), as there may be a strong sense of obligation (Hammersley et al., 2023; Kuehne, 2013) and emotional attachment to the family farm (Hu & Gill, 2021). Selling the family farm is often perceived as a failure (Bryant & Garnham, 2018; Kuehne, 2013; Polain et al., 2011) while also posing a threat to their identity as a farmer (Burton, 2004). The loss of occupational identity may also bring the risk of social isolation from severing the connections that tied them to the farming community (Kuehne, 2013; Nye et al., 2023). Related to the focus on this thesis, mental health stigma could also be related to the cultural norms described in farming communities such as stoicism, independence, and masculine stereotypes (Berry et al., 2011; Hagen et al., 2021, 2022; Vayro et al., 2020). These cultural norms in farming are reported as barriers to help-seeking in Canadian farming communities (Hagen et al., 2022; Pavloff et al., 2023). Farmers are often interdependent, which can be both a facilitator and a barrier to help-seeking. Community members may help

support them, which helps with community connectedness; however, this connectedness may evoke fears related to anonymity (Cole & Bondy, 2020; Collins et al., 2017; Hagen et al., 2022).

1.2.4 Stressors in farming

It is well-documented that farming is a high stress occupation (Bondy & Cole, 2019; Deary et al., 1997; Hagen et al., 2021; Henning-Smith et al., 2021; Jones et al., 2024; Liang et al., 2021; Thompson et al., 2023a; Thompson et al., 2023b; Truchot & Andela, 2018; Walker & Walker, 1987; Walker & Walker, 1988; Yazd et al., 2019), characterized by a unique set of stressors (Gregoire, 2002; Hammersley et al., 2023; Jones-Bitton et al., 2019; Keeney et al., 2022; Walker & Walker, 1987). Episodic (e.g., yield loss) and chronic stressors (e.g., perceived lack of control) are both experienced by farmers (Thompson et al., 2023b). Further, many stressors in farming are ubiquitous, including: climate change (Thompson et al., 2023b; Yazd et al., 2019), unpredictability (Deary et al., 1997; Gregoire, 2002; Thompson et al., 2023b; Truchot & Andela, 2018; Yazd et al., 2019), regulatory pressures and bureaucracy (Booth & Lloyd, 1999; Deary et al., 1997; Gregoire, 2002; Thompson et al., 2023b; Truchot & Andela, 2018; Yazd et al., 2019), financial stress (Deary et al., 1997; Hagen et al., 2021; Gregoire, 2002; Sprung, 2021; Thompson et al., 2023b; Truchot & Andela, 2018; Yazd et al., 2019), time pressure and/or workload (Deary et al., 1997; Gregoire, 2002; Thompson et al., 2023b; Truchot & Andela, 2018; Yazd et al., 2019), geographical and/or social isolation (Deary et al., 1997; Gregoire, 2002; Thompson et al., 2023b; Truchot & Andela, 2018; Yazd et al., 2019), pest and/or disease challenges (Deary et al., 1997; Gregoire, 2002; Kallioniemi et al., 2016; Yazd et al., 2019), work-family conflict (Sprung, 2021; Yazd et al., 2019), criticism in the media (Booth & Lloyd, 1999; Thompson et al., 2023b; Yazd et al., 2019), future uncertainty (Kallioniemi et al., 2016; Thompson et al., 2023b; Yazd et al., 2019), and succession planning (Thompson et al., 2023b; Truchot & Andela, 2018).

Difficulty balancing the demands from work and family domains has been associated with stress scores for men and women on farms (Walker & Walker, 1987). Further, personal economic stress can have direct impacts (family distress) and can have indirect impacts (work-family conflict in farming couples) (Sprung, 2022). Living and working with family can make it difficult to disconnect from the farm (Thompson et al., 2023b) and the demanding nature of farming may leave farmers feeling that they cannot take a break (Proctor & Hopkins, 2023; Thompson et al., 2023b; Wheeler et al., 2023). Despite working with family, farmers can experience 'social loneliness', which is the perceived lack of connections, as well as 'emotional loneliness' which is more related to the perceived lack of depth in relationships (Wheeler et al., 2023).

1.2.5 Mental health outcomes of farmers

Farming populations in Canada have demonstrated higher than normative levels of perceived stress (Hagen et al., 2021; Jones-Bitton et al., 2020; Thompson et al., 2022) and self-reported stress (Walker & Walker, 1988). Farmers have been reported to experience high levels of occupational stress in England (Booth & Lloyd, 1999) and the United Kingdom (UK) (Deary et al., 1997). In the UK, farming couples may have elevated psychological morbidity in comparison to non-farming couples (Hounsome et al., 2011). Researchers have also reported that farmers may experience heightened levels of anxiety and depression in England (Booth & Lloyd, 1999) and Canada (Jones-Bitton et al., 2020; Thompson et al., 2022). Depression has also been noted in farmers and farmworkers in the United States (Keeney et al., 2022); however, the paper did not mention how these levels compare to norms. Hawes et al. (2019) suggested that there may be a positive association between poor sleep quality and depressive symptoms for American farmers. Further, there have been reports of increased suicidal ideation, as well as suicide rates of farmers

in Canada (Thompson et al., 2023a), Australia (Arnautovska et al., 2014; Vayro et al., 2020; Vayro et al., 2021), Ireland (Hammersley et al., 2022), the United States (Hawes et al., 2019; Henning-Smith et al., 2021; Keeney et al., 2022; Liang et al., 2021), the UK (Gregoire, 2002; Hounsome et al., 2006; Hounsome et al., 2011).

Burnout involves three components: low professional efficacy, high exhaustion, and high cynicism (Thompson et al., 2022; Jones-Bitton et al., 2019). Jones-Bitton et al. (2019) found that 12% of Canadian farmers met the criteria for burnout and 44% met the criteria for at least one of the following: low professional efficacy, high exhaustion, or high cynicism. When comparing samples of farming populations from surveys conducted in 2016 and 2021, Thompson et al. (2022) found that there was a reduced mean professional efficacy in 2021; although there was little difference in total burnout scores, their results suggested that participants were headed towards burnout. In comparison to scale norms, Canadian farmers have demonstrated lower resilience scores (Jones-Bitton et al., 2020; Thompson et al., 2022). Hagen et al. (2021) observed an inverse relationship between resilience and perceived stress in Canadian farmers, as well as positive relationships between perceived stress scores and the following factors: financial stress, identifying as a woman, farming pigs, and feeling as though family and/or industry support is lacking, as well as an interaction between anxiety and depression scores, which illustrated an additive effect.

Numerous researchers have also identified sex and gender differences of mental health outcomes; the following statements use the exact terminology used in each study. Being a woman has been positively associated with perceived stress of farmers in Canada (Hagen et al., 2021). Higher stress has been reported with females involved in farming in Canada (Jones-Bitton et al., 2020; Walker & Walker, 1988), England (Booth & Lloyd, 1999), and the UK (Deary et al.,

1997). Female farmers have demonstrated higher anxiety scores than males in Canada (Jones-Bitton et al., 2020). Depression scores have been reported to be higher in female farmers in the United States (Hawes et al., 2019) and Canada (Jones-Bitton et al., 2020). Suicide rates are reported to be higher in young farming men than women in Australia (Arnautovska et al., 2014). Women farmers have also reported to utilize more coping mechanisms, both positive and negative, in Canada (Thompson et al., 2023a). Resilience has also been shown to be lower amongst female farmers in Canada (Jones-Bitton et al., 2020)

1.2.6 Qualitative mental health research with farmers

The quantitative evidence is well-documented and is of great benefit to monitor populations and inform future research. However, it should be noted that qualitative methods may be better suited to capture the nuances that exist under the subject of farmer mental health. Hagen et al.'s (2019) review of existing literature regarding mental health in farming populations illustrates that a disproportionate number of studies used quantitative methods (72.1%) in comparison to qualitative methods (14.4%) and mixed methods (7.0%). For example, participating farmers in a mixed methods study by Thompson et al. (2023a) in Canada revealed the overwhelming nature of their experiences with stressors in farming, oftentimes with stressors having an additive effect, while also being complex and interconnected. For some farmers, increased stress and/or mental health challenges may result in personal consequences such as a lack of motivation, implications on physical health such as sleep, avoidant coping strategies (e.g., self-medicating), isolating themselves from others, and suicidal ideation (Jones et al., 2024). When considered in conjunction, a quantitative approach allows for breadth, while qualitative research allows for a more in-depth understanding of farmer mental health.

Purpose and meaning have been described to aid in farmers resilience (Hagen et al., 2021). Darnhofer et al., (2016) identified two approaches to how farm resilience dynamics are described: biophysical (e.g., farm type, agroecosystems) and social actors (e.g., agency, power relations); however, the authors suggest an approach that is built upon a relational framework, acknowledging and integrating both social and biophysical elements. Hammersley et al. (2023) highlighted how agricultural policy may be perceived to threaten the 'good farmer' identity and entrenched masculinities of farming men in Ireland. The resilient nature of farmers may stem from these traditional masculinities (Bryant & Garnham, 2018). Although, women in farming may experience stress related to challenges specific to working in a traditionally male-dominated industry (Hagen et al., 2021; Wheeler et al., 2022) and may be less inclined to become involved in the industry or events (Hagen et al., 2022).

In a study with small-scale farmers in Ontario, Bondy & Cole (2019) described how participants experience an increasing amount of paperwork required and also perceive limited support from government for young farmers, as well as small farms, including those of which may incorporate practices that promote ecological resilience, specifically mentioning that the existing system is perceived by some to support larger farm operations. Although agricultural communities tend to be closely connected, which can have positive aspects such as social support, farmers may also experience fear of judgement that comes with community connectedness (Hagen et al., 2021). In an Australian case study, Bryant & Garnham (2014) described situations where winegrape producers perceived themselves and/or are perceived by the community as blameworthy, or not blameworthy, for the lack of viability of their farm depending on the context and conditions that may or may not be within their control. Briefly, the term 'moral economy' describes the economic conditions of which relate to social aspects built

upon ethics and standards (Bryant & Garnham, 2014). Circumstances hold potential to influence farmer well-being (Bryant & Garnham, 2018). They also drew attention to the relationships between corporations, states, and farmers, and described the moral and political economies that exist within the context of farmer distress, whereby the economic system has a fundamental set of ethics that guide social relations, known as the moral economy.

The advantages of conducting both qualitative and quantitative research can also be observed when studying financial stress. Canadian farmers may feel constant financial stress on the farm, this may be experienced with routine tasks such as veterinary costs with livestock farming, or with the stress of decision making as the result may compromise financial viability of the farm (Hagen et al., 2021). Participating farmers in a study by Jones et al. (2024) in Canada described how excess stress and/or mental health challenges can result in reduced personal productivity (e.g., less efficient at tasks), reduced animal welfare (e.g., less patience with animals), financial implications (e.g., reduced value of milk as a result of quality concerns and animal welfare), and some farmers shared that they contemplated ending their farming career. Financial crises and uncertainty have been highlighted in 13/14 (93%) and 8/14 (57%) of qualitative studies regarding farmer suicide, respectively, spanning Australia, India, Canada, the US, and the UK (Purc-Stephenson et al., 2023). These findings are alarming and illustrate a need for further depth in understanding to prevent irreversible outcomes.

1.2.7 Research gaps

Current literature regarding farmers has breadth through quantitative research, however there is significantly less qualitative research and thus a lack of depth (Hagen et al., 2019), which may provide more context behind results as suggested by Purc-Stephenson et al. (2023) regarding farmer suicide. Further, there has been an emphasis on negative mental health outcomes such as

stress, suicide, and depression, rather than positive outcomes such as resilience and life satisfaction in the existing literature on farming populations (Hagen et al., 2019). This emphasis on negative outcomes perpetuates the deficit perspective (Simpson & McDonald, 2017). Future understanding of farmer mental health and well-being may benefit from taking a qualitative or mixed methods approach to ensure the breadth and depth of knowledge.

Farmers experience many of the same stressors, but they also experience different stressors. As farmers compare themselves to larger farms, other generations, other commodity groups (e.g., supply managed and non-supply managed), and even to non-farmers, this comparison may leave them envious of others, which results in stress (Thompson et al., 2023b). Thus, it would be beneficial for future work to take a commodity-specific approach to gain a deeper understanding.

1.3 The relationships between humans, animals, and their environment

There has been interest surrounding the relationships between humans, animals, and the environment for centuries (Capua & Cattoli, 2018; Pettan-Brewer et al., 2024; Zinsstag et al., 2011). The link between human and animal disease and the environment was illustrated in the 1700s by Vicq d'Azyr in France (Capua & Cattoli, 2018). In the mid-late 1700s, the first veterinary school was formed in Lyon by Claude Bourgelat (Capua & Cattoli, 2018; Zinsstag et al., 2011). Rudolph Virchow made advancements in comparative medicine, specifically with models of disease in humans and animals, these concepts were brought back to North America by William Osler (Capua & Cattoli, 2018; Zinsstag et al., 2011). In the 20th century Calvin Schwabe defined 'One Medicine' as the way in which humans and animals formed a tight-knit relationship where they relied on each other for food, purpose, and health (Zinsstag et al., 2011). This term later evolved into 'One Health' in the early 21st century as there was realization that

‘One Medicine’ overshadowed factors beyond that of medical, such as societal and environmental influences (Zinsstag et al., 2011).

Interestingly, a similar realization took place over the past decade. The term ‘One Welfare’ has been developed recently to help address aspects such as psycho-social-economic elements which may be overlooked by the ‘One Health’ approach as a result of the emphasis on clinical aspects (Pinillos et al., 2016) such as disease (Pinillos, 2018). However, humans who are described to be healthy may still experience a reduced level of well-being (Pinillos, 2018). The concept of health’ can be considered as just one of the many factors that contribute to the overall welfare of human and non-human animals (Broom & Johnson, 2019). However, there are many strong initiatives built upon the ‘One Health’ approach and thus, the intention of ‘One Welfare’ is to complement rather than replace the current framework (Pinillos, 2018).

The ‘One Welfare’ approach recognizes the interconnections between animal welfare, human well-being, and the social and physical environment (Pinillos, 2018). Some of the key outcomes that a ‘One Welfare’ has potential to improve include enhancing farm productivity through recognizing the link between farmer well-being and animal welfare, as well as the positive influence of enhancing animal welfare on food safety, food security, and sustainability (Pinillos et al., 2016). Emphasizing only one component of ‘One Welfare’ could negatively influence another dimension (Pinillos, 2018). Consider the 1960s’ movement to enhance production efficiency to feed the population, when modernization and the ‘green revolution’ with technological advancements in agriculture began (van der Ploeg, 2023). Alongside the increased cost, capital investment, and requirement for extension services was the promise of enhanced production efficiency with technology (van der Ploeg, 2023), which was incentivizing for farmers who had to reduce the cost of production for the farm to survive (Rotz et al., 2019).

Consequently, modernization contributed to a reduced number of lower-level jobs, which lead to increased marginalization of labourers who were less technologically inclined (Rotz et al., 2019).

Researchers have described how the role of farmers may be altered with incorporation of technology (Butler et al., 2012; Lunner-Kolstrup et al., 2018; von Keyserlingk et al., 2024). As mentioned previously, many farmers feel pride when managing their animals and farms; the 'good farmer' identity (Burton, 2004) could be threatened by factors such as the negative influence of increased regulations on farmer autonomy (Ida et al., 2023), public pressures economic and environmental challenges (Schuppli et al., 2023). The effects of climate change pose threat to the livestock sector, as feed is challenging to produce as a result of weather events such as droughts and flooding, which holds implications to production, environmental sustainability, and economic viability (Cordeiro et al., 2022; Godde et al., 2021; Tourangeau et al., 2019).

Technology may also pose risk to the 'good farmer' identity, as the farmer-cow relationship may change (Finstad et al., 2021; Holloway & Bear, 2017; Peralta & Haefs, 2023; von Keyserlingk et al., 2024), and caring for animals through technology may not align with how farmers view animal care (Holloway et al., 2014; Vigors et al., 2023; von Keyserlingk et al., 2024). As noted by Ritter et al. (2020), there may be topics farmers discuss in focus groups that are seemingly unrelated to animal welfare, but interconnections may exist, which aligns with the 'One Welfare' framework (Pinillos, 2018). The following section will discuss the narratives surrounding animal welfare and provide more detailed context about economic, research and policy, and consumer perception discourses. As noted by Ritter et al. (2020), there may be topics farmers discuss in focus groups that are seemingly unrelated to animal welfare, but interconnections may exist, which aligns with the 'One Welfare' framework (Pinillos, 2018).

The following section will discuss the narratives surrounding animal welfare and provide more detailed context about economic, research and policy, and consumer perception discourses.

1.3.1 Economics

While there is pressure on farmers to incorporate practices that increase environmental sustainability (Carmichael et al., 2023) and animal welfare (Barkema et al., 2015), there are also economic constraints that influence their decision-making power (Rotz et al., 2019). For example, there are economic barriers to implementing practices such as: pain management (Moggy et al., 2017), lameness (Knauss et al., 2022), and to reduce antimicrobial use (Cobo-Angel et al., 2021). There are numerous factors that dairy farmers use to justify outdoor access, or lack thereof, such as environment, animal welfare, finances, infrastructure, and management (Smid et al., 2021). Ultimately, farmers are individuals, each with their own unique set of values and context that influence farm animal welfare (Vigors et al., 2023).

Some farmers may consider certain factors prior to purchase, such as herd size (Gargiulo et al., 2018), benefit-to-cost ratio, initial investment, and usability (Bianchi et al., 2022; Borchers & Bewley, 2015), alignment with personal beliefs and values, ability to test the technology before purchase, and observations of how the implementation goes for others (Stone, 2020). Findings from Rotz et al. (2019) draw attention to the fact that farmers must be able to afford to implement technology to reap the expected benefits, which creates an exclusionary dynamic of increased marginalization for farmers and labourers who are either unable to afford the investment cost, or lack the skills needed to utilize the technology.

1.3.2 Regulations & requirements

There may also be real and perceived disconnects between policy-makers and farmers. Recommended practices are typically identified by groups of stakeholders including farmers, commodity groups, government specialists, veterinarians, and academics. However, studies in Canada with dairy farmers have highlighted negative perceptions of some recommended practices (Marshall et al., 2023; Roche et al., 2019) and oversight from government or industry (Wilson et al., 2024), as well as notable frustration from dairy farmers towards "one size fits all" approaches (Knauss et al., 2022) that lack consideration of farm-specific context (Ida et al., 2023; Marshall et al., 2023). A study with Canadian dairy farmers and veterinarians by Wilson et al. (2024) suggests that tailored recommendations, such as considering farm-specific context may be of value to improving calf care. Farmers value autonomy (Ida et al., 2023; Schuppli et al., 2023), which can be negatively influenced by regulations as autonomy involves independence, self-congruence, and power to self-govern (Stock & Forney, 2014). Although, these findings may suggest that some farmers may not feel represented or supported by existing groups and processes, which has been described by small-scale farmers in Canada (Bondy & Cole, 2019). Further, implementation of recommended practices may come with a monetary cost while also requiring additional time, both of which have been identified as a perceived barrier by dairy farmers in Canada within the context of milking practices (Belage et al., 2019), Johne's disease control (Roche et al., 2019), lameness (Knauss et al., 2022), reduce antimicrobial use (Ida et al., 2023), and cull cow management (Marshall et al., 2023).

Two separate review articles have criticized the evaluative approach towards farmers beliefs, attitudes, and/or perceptions within research relating to animal welfare (Vigors et al., 2023) and climate change (Soubry et al., 2020). This reinforces the idea that there is a 'right' way of farming, but the relational nature in the reality of farming is local and rooted in uncertainty,

which opposes traditional scientific ways of valuing objectivity and universality (van der Ploeg, 2023). Oftentimes, traditional science creates knowledge within the scientific community and then shares the knowledge with the public (Vanclay, 2004). This is increasingly problematic as research can influence policy development (Muhammad et al., 2022; Vigors et al., 2023), and regulations have been noted as a factor that may influence farmer mental health (Yazd et al., 2019). Research that involves farmers in the solution, may have a positive impact when it comes to implementation (Kröbel et al., 2021). A study in Alberta by Ritter et al. (2019) investigated the satisfaction and preparedness of dairy farmers to implement recommendations from veterinarians following a herd health visit on-farm; their findings suggest that an approach where farmers are more involved may increase their preparedness to implement recommendations from the veterinarian.

1.3.3 Consumer perceptions

An idyllic painting of rural and agricultural communities is often seen as problematic as this informs consumers' expectations and it does not always align with existing animal production systems which may be more intensive than the traditional tranquil image of rural life (Mahon et al., 2023). Ventura et al. (2016) conducted surveys with lay consumers in Canada regarding perceptions and concerns about dairy cattle welfare before and after a farm visit; the findings illustrate that the farm visit helped to put some concerns at ease while also solidifying and giving rise to other concerns, for example, pasture access. This may be related to why farm animal welfare is a particularly contentious subject in terms of public trust and the support farmers feel from society (Alonso et al., 2020; Burton et al., 2012; Mahon et al., 2023; Muhammad et al., 2022; Sirovica & von Keyserlingk, 2023; Ventura et al., 2015; Ventura et al., 2016). For example, livestock farmers in Sweden fear victimization due to animal rights activism (Ceccato

et al., 2021), and some report that they have been targeted by crime for being a livestock farmer (Ceccato et al., 2022). There may be differences in how animal welfare is perceived; consumers and the general public generally emphasize naturalness and the feelings of animals whereas farmers and veterinarians may focus on animal health and production (Sirovica & von Keyserlingk, 2023). Although consumers may not be willing to pay for welfare-friendly products, they may relate farm animal welfare to product quality, environmental sustainability, human health benefits, tradition, safety and hygiene (Alonso et al., 2020).

According to Muhammad et al. (2022), animal welfare in agriculture can be seen as a social construct with five main narratives: (1) 'farming as a business,' which is observed in the commodification of animals; (2) the 'religion-based' narrative where humans have a moral obligation to animals; (3) the animal welfare research and policy-based narrative, which is rooted in animal sentience and the promotion of enhanced welfare; (4) the 'higher welfare' narrative in which animal products may be priced at a premium due to different production systems used to enhance welfare; and (5) animal rights/power-based, which draws on multiple forms of knowledge to argue against animal commodification using emotionally-charged tactics. Further, an individuals' reaction towards media regarding agriculture has been found to be less negative for those familiar with agriculture (Mahon et al., 2023). With that in mind, animal rights organizations use emotionally charged tactics to raise awareness of perceived welfare concerns in animal agriculture (Jarvis et al., 2019). The utilization of a "blame mentality" that is used in anti-meat narratives can threaten the moral character of those who eat meat, which leads to defensive behaviour of meat-eating consumers (Shulman et al., 2021). This may hold potential to negatively impact farmers, for example, Ceccato et al. (2022) described the occupational hazards

that Swedish livestock farmers can encounter such as being the target of crime from animal activists, which can evoke feelings of fear surrounding safety on the farm.

Consumer perceptions of on-farm technology are unclear; there is some indication of concern towards a more technology-driven animal production system, but at the same time consumers acknowledge the potential benefits to animal health and welfare and environmental sustainability (Kleen & Guatteo, 2023). A perceived lack of support by consumers can be a source of frustration for dairy farmers as they feel their ability to care for their animals is being questioned (Schuppli et al., 2023). Considering these findings, it is no surprise that farmers perceive a disconnect between themselves and society in Canada (Letourneau & Davidson, 2022; Thompson et al., 2023b), the US (Proctor & Hopkins, 2023), the UK (Nye et al., 2023), and Australia (Polain et al., 2011; Vayro et al., 2021). There are multiple narratives related to animal welfare (Muhammad et al., 2022). The increased social and environmental sustainability may be of value but there is a monetary cost to implementation which may limit adaptive capacity of farmers (Barkema et al., 2015; Carmichael et al., 2023; de Boon et al., 2024).

Given the increasing concern from the general public in terms of animal welfare, some nations have developed policy in response to this (Alonso et al., 2020; Balzani & Hanlon, 2020), perhaps this relates to some farmers describing the need to be seen positively by consumers (Vigors et al., 2023). There has been suggestion that policy attends to the general public, while often requiring a financial investment from farmers (Vanclay, 2004). As scientific research often aids in policy development (Balzani & Hanlon, 2020), where institutional knowledge tends to favor objectivity (Darnhofer, 2020). It is important to consider the importance of social, cultural, and/or historical factors that may influence understandings of animal welfare (Alonso et al., 2020; Balzani & Hanlon, 2020), of which may not be captured by using traditional scientific

methods alone; this may be problematic as traditional science may neglect the socio-cultural and relational aspects of farming (Soubry et al., 2020; Vanclay, 2004; Vigors et al., 2023), oftentimes prioritizing quantitative methods (Soubry et al., 2020; Vigors et al., 2023). Taking such an approach may risk failing to capture the nuances that lie within farming, as practices are not always based on scientific ways of knowing, but frequently incorporate cultural and social elements (Vanclay, 2004). Although, acknowledging farmers points of view does not guarantee that farmers interests will be addressed, and thus more work may be needed to involve farmers in order to find solutions to the specific challenges they may face (Gray et al., 1997). Future research may consider the value in farmers experience (Soubry et al., 2020) which could offer insight for solutions (Kröbel et al., 2021; Vanclay, 2004) while also helping to ensure transfer from theoretical to practical application (Muhammad et al., 2022; Kröbel et al., 2021).

1.4 The emotional cost of caring for livestock

Caring for livestock, both the action and the emotion, have been described in research with farmers (Albernaz-Gonçalves et al., 2021; Buddle et al., 2021; Denis-Robichaud et al., 2023; Mills et al., 2023; Schuppli et al., 2023; Wagner et al., 2020; Chapman & Deplazes-Zemp, 2022; Wilson et al., 2021; MacKay, 2023) and/or farm workers (Campler et al., 2019; Edwards-Callaway et al., 2022; Mullins et al., 2017; Simpson et al., 2020). Research has also described empathy (Román-Muñiz et al., 2021; Kielland et al., 2010; Simpson et al., 2020; Campler et al., 2018; Schuppli et al., 2023; Rault et al., 2017), compassion (Edwards-Callaway et al., 2022), and sympathy (Albernaz-Gonçalves et al., 2021) of livestock farmers and/or farm workers towards animals under their care. Qualitative studies with livestock farmers and/or farm workers have described the importance of empathy when working with animals (Burton et al., 2012; Spooner et al., 2014). Previous literature describes cross-species empathy from the standpoint of

evolution, whereby the mechanism is protective, particularly within regards to pain (Kielland et al., 2010). Rault et al. (2017) conducted a study on attitudes towards euthanasia with swine caretakers and identified the components of empathy to include: (1) the caretakers emotional response or "empathy affect"; and (2) the perceived impact on the animal or "empathy attribution".

In the medical sense, empathy can be described as the capacity of an individual to appreciate the feelings of others and feel the spectrum of emotions that come with experiences throughout life (Harrison, 2021). Empathy is central to compassion and distress; compassion can be described as empathetic concern whereas personal distress is described as empathetic distress (Harrison, 2021). There is a heightened risk of stress-related conditions for individuals who work in animal caretaking roles (Andrukonis & Protopopova, 2020; Monaghan et al., 2020). Livestock farmers encounter emotional, ethical, and economic challenges in raising animals (MacKay, 2023). Research with livestock farmers and/or farm workers have described guilt (Denis-Robichaud et al., 2023; Edwards-Callaway et al., 2022), and feelings of failure (Wagner et al., 2020; Mullins et al., 2017; Román-Muñiz et al., 2021) in regard to euthanasia. Burton et al. (2012) and Gray (1998) posit that there is an intuitive sense or empathy in the disposition of those who work with livestock where the idea of being a farmer is 'bred into' an individual. The following section will discuss the emotional cost of caring for production animals from the farmer's viewpoint.

1.4.1 Empathy and Stress

Many different, related concepts may be of relevance within consideration to the role of empathy and stress on caregivers. Although some of these concepts have been used more so in human caregiving professions, there may also be parallels in animal caregiving professions.

Briefly, there are distinct conceptual differences between vicarious trauma, secondary traumatic stress, and compassion fatigue: vicarious trauma is characterized by a shift in outlook over time which is usually related to repeated experiences with trauma, and involves concerns of safety, trust, esteem, intimacy, and control; secondary traumatic stress does not need to occur more than once to manifest, and shares similarities with post-traumatic stress disorder such as intrusion (e.g., flashbacks, reminders that could lead to a reaction of a psychological or physiological nature, nightmares), avoidance of cognitive and/or physical reminders, negative impacts on mood and cognitive function (e.g., feeling detached, negative affect, forgetfulness), and increased arousal and reactivity (e.g., easily irritated, hypervigilance, difficulties in focusing, impacts on sleep); compassion fatigue is also a condition that develops over time, shares characteristics of professional burnout which is further implicated by secondary traumatic stress and vicarious trauma, and can manifest as a lack or absence of empathy towards others which is seen in their reactions to others (Holland et al., 2022, p. 3-6). Figley (1995, p. 8) described secondary traumatic stress as "the natural consequent behaviors and emotions resulting from knowing about a traumatizing event experienced or suffered by a person" and discussed the terms compassion fatigue, secondary traumatic stress, and secondary traumatic stress disorder interchangeably. Burnout is when individuals experience chronic stress from the interpersonal demands of their occupation resulting in exhaustion, cynicism, and reduced professional efficacy (Maslach et al., 2001; Schaufeli et al., 2009; Holland et al., 2022, p. 3).

There are associations between occupational stress and professional burnout, whereas compassion fatigue, vicarious trauma, and secondary traumatic stress (STS) have been associated specifically with empathic stress within human and animal caregiving professions (Holland et al., 2022, p. 1-12). Two key elements of compassion fatigue are exposure to trauma and empathy,

specifically in human caregiving professions (Figley, 1995). In human healthcare, empathy was found to be negatively associated with burnout which may have implications on quality of care (Wilkinson et al., 2017), meaning that those who are at higher risk of burnout are less likely to show empathy as they may be tired, cynical, and less confident in their skills. Research with oncology nurses has identified a positive correlation between empathy and STS which is positively influenced by grief (Shi et al., 2022). Existing research regarding compassion fatigue in human caregiving professions is well-documented, however, there is a growing body of work that suggests animal care professions (e.g., veterinarians, animal health technologists, laboratory research technicians, paid staff and volunteers at animal shelters) are also at risk for occupational stress (Andrukonis & Protopopova, 2020; LaFollette et al., 2020; Polachek and Wallace, 2018; Rohlf, 2018; Monaghan et al., 2020; Scotney et al., 2015). These occupations may also be vulnerable to experiencing compassion fatigue, although this is difficult to discern due to inconsistent terminology (Monaghan et al., 2020; Rohlf et al., 2018; Scotney et al., 2015). Interchangeable use of the terms compassion fatigue, occupational stress, secondary trauma, vicarious trauma (Scotney et al., 2015; Rohlf et al., 2018). Further, findings from Polachek & Wallace (2018) suggest that there are marked differences between the concepts of compassion satisfaction and compassion fatigue.

While there is not enough evidence to make the conclusion that livestock farmers and/or farm workers experience compassion fatigue, several researchers have investigated concepts of empathy, sympathy, and stress associated with caring for and/or culling livestock. An association may exist between empathy and attitudes toward livestock which has been reported with swine farm workers (Campler et al., 2018; Rault et al., 2017) and dairy farmers (Kielland et al., 2010). All participating dairy caretakers in a study by Román-Muñiz et al. (2021) demonstrated

empathy toward livestock. Empathy and animal welfare were briefly noted by Schuppli et al. (2023) in a qualitative study with dairy farmers in Canada. In contrast, a study conducted in Brazil by Albernaz-Gonçalves et al. (2021) reported that farmers also showed a lack of empathy towards pain management and stereotypic behaviors of animals, however, sympathy from farmers towards pigs during potentially painful procedures to animals. Researchers have started to note connections between livestock farmers and/or farm workers and compassion fatigue (Campler et al., 2018; Denis-Robichaud et al., 2023; Edwards-Callaway et al., 2022; Wagner et al., 2020; Mullins et al., 2017; Simpson et al., 2020) and/or the 'caring-killing paradox' (Román-Muñiz et al., 2021; Wagner et al., 2020). Findings from a study in South Korea with veterinarians and government staff involved in mass culling of livestock during disease events such as avian influenza and foot and mouth disease, approximately 74.5% of participants had scores that were over the threshold for post-traumatic stress disorder (Park et al., 2020). However, there still remains a lack of evidence to draw the conclusion that livestock farmers and/or farm workers may experience compassion fatigue.

1.4.2 Farmer-animal relationship

The farmer-animal relationship is influenced by the species, purpose, herd/flock size, time on the farm, and the characteristics of the interactions between farmers and their animals such as frequency, intensity, and intimacy (Bock et al., 2007). This description resonated with Balzani & Hanlon (2020) who found that farm animal welfare is influenced by the farmer's views, external factors, and internal factors such as the farmer-animal relationship, empathy, and experience. The empathy that farmers have for their animals is also associated with animal welfare (Kielland et al., 2010). Livestock farmers describe a sense of gratification in relation to raising animals (Crimes & Enticott, 2019). A qualitative study by Chapman & Deplazes-Zemp (2023) explored

the relational values of livestock farmers in Sweden and found two sets of relational values: (1) eudaimonic elements where caring for animals was perceived to have a positive influence on farmer well-being, and (2) respect for the animals in their care, which included a humane death. In a study by Saraceni et al. (2022) dairy farmers suggest that other dairy farmers who do not value animal welfare over economic factors may not prioritize pain mitigation when disbudding or dehorning due to the cost of medication. These findings illustrate the aspect of financial well-being of farmers and the way it may implicate decision-making on their farm. Caretaker well-being and farm animal welfare are illustrated to be symbiotic; the welfare of one is dependent on the welfare of the other (Kauppinen et al., 2010).

1.4.3 Moral obligation

To farmers, maintaining good animal welfare is a moral obligation that comes with caring for animals (Croyle et al., 2019; Enticott & Vanclay, 2011; Marshall et al., 2023). The sense of obligation to their animals can be a source of satisfaction for farmers as they are doing what is deemed necessary to be a 'good farmer' (Burton, 2004) in the context of animal welfare (Vigors et al., 2023). Animal welfare is a priority for dairy farmers (Marshall et al., 2023), they take pride in providing a high level of animal care (Croyle et al., 2019), which is perceived as their responsibility (Cobo-Angel et al., 2021; Schuppli et al., 2023). As such, autonomy is an important value for farmers (Ida et al., 2023; Schuppli et al., 2023); some dairy farmers have expressed concern that increased legislation on antimicrobial use may reduce their autonomy and threaten animal welfare on their farm (Cobo-Angel et al., 2021; Ida et al., 2023).

There are also other factors that influence the farmers decision making process of administering antimicrobial treatment such as how old an animal is, symptoms, severity, and lived experience of the farmer (Cobo-Angel et al., 2021). These animal-level factors have been

described as “common sense” by beef farmers when discussing what influences use of pain management (Moggy et al., 2017). Utilization of pain mitigation may be motivated by a sense of relatability to their livestock; dairy farmers may equate disbudding or dehorning to a dental procedure (Saraceni et al., 2022), and beef farmers may compare branding to burning themselves (Moggy et al., 2017).

1.4.4 Tough decisions

The responsibility to alleviate animal suffering through euthanasia, when necessary, may come with risk of compassion fatigue or moral stress (Wagner et al., 2020). Veterinarians’ ethical boundaries of “good” killing may be challenged in companion animal medicine by emphasizing emotional aspects, and in farm animal medicine by focusing on cost (Bubeck, 2023). In a quantitative study in Canada, Denis-Robichaud et al. (2023) found that dairy farmers experience complex emotions relating to euthanasia, and that there is limited utilization of decision trees and veterinary consultations during the euthanasia decision-making process; however, the reasoning behind this needs further investigation.

A sense of guilt has also been described by participating dairy farmers in a study by Wilson et al. (2021) regarding calf care. Euthanasia can leave farmers feeling as though they failed the animal, while they may also experience moral stress, and additional symptoms consistent with compassion fatigue (Wagner et al., 2020). The welfare of the animal plays a large role in a farmer’s decision to euthanize (Wagner et al., 2020), and farmers deeply care for their animals, which can make these decisions emotionally challenging (Edwards-Callaway et al., 2022; Schuppli et al., 2023). Similarly, livestock farmers experience moral stress with animal disease and death (Thompson et al., 2023b). The complex emotions regarding euthanasia (Denis-Robichaud et al., 2023; Wilson et al., 2021) and moral stress experienced by livestock farmers

(Thompson et al., 2023b) may relate to emotional attachment between farmers and their animals (Schuppli et al., 2023).

1.4.5 Coping mechanisms

Some farmers may experience with cognitive dissonance and must cope with the malignment between the farmer-animal bond and the utilitarian purpose of livestock (Balzani & Hanlon, 2020). For example, farmers may struggle with raising animals for production while also forming a connection with the animals. Further, economic influences, practicality, tradition, or best interest of the animal are often reasons used to help cope with the moral stress of practices that may be seen as negative for the animal, this form of coping is referred to as rationalization (Taylor & Fraser, 2019). There could perhaps be a reduced level of empathy in farmers with coping mechanisms such as normalization or becoming desensitized over time to stereotypic behaviours in their herd, for example with sows sitting like dogs or tail biting in piglets (Albernaz-Gonçalves et al., 2021). Furthermore, researchers who have investigated the reasons for "barn blindness" or discrepancies in lameness identification from researchers have reported that producers often see a cow's gait slowly change over time and become "a new normal" for her, which is perhaps another form of normalization (Croyle et al., 2019; Knauss et al., 2022). These findings are of interest to the well-being of livestock farmers as compassion fatigue manifests as a lack of empathy (Holland et al., 2022).

Farmers in Canada have described consideration of suicide, or suicidal ideation as a means to cope (Jones et al., 2024; Roy et al., 2017). Avoidant coping strategies such as substance use has also been reported from farmers in Canada (Jones et al., 2024; Roy et al., 2017; Thompson et al., 2022), the United States (Henning-Smith et al., 2021). However, farmers may also use positive coping strategies of a cognitive basis such as taking a long-term outlook, positive reframing,

being solution-focused rather than problem-focused, turning to faith, and maintaining optimism (Roy et al., 2017; Thompson et al., 2022). In the United States, farmers have shared coping strategies such as self-care techniques, and support seeking (Henning-Smith et al., 2021; Keeney et al., 2022). Setting clear boundaries may also be used to cope, positively impacting resilience (Hagen et al., 2022). Some farmers who participated in a study by Thompson et al. (2023b) shared one of their coping mechanisms was to spend time with their animals. The passion farmers have to farm may also be a way of coping with stress (Bondy & Cole, 2019; Roy et al., 2017)

1.4.6 Farmer-animal-technology relationships

There is a growing amount of technology employed to enhance animal welfare and environmental sustainability in livestock production systems (Bianchi et al., 2022; Neethirajan & Kemp, 2021; Schillings et al., 2021). Often increased production efficiency is thought to be an advantage of AMS (Baur & Iles, 2023; Finstad et al., 2021; Holloway et al., 2014; von Keyserlingk et al., 2024) and precision livestock technologies (Bianchi et al., 2022; Neethirajan & Kemp, 2021) which is a possibility as shown in research studies (Cogato et al., 2021), although there may be farm-level factors that influence efficiency (Jacobs & Siegford, 2012; John et al., 2015). Increased production efficiency can also enhance environmental sustainability (Neethirajan & Kemp, 2021; Schillings et al., 2021). Additionally, there is potential to enhance animal welfare with AMS (Butler et al., 2012; Cogato et al., 2021; Finstad et al., 2021; Jacobs & Siegford, 2012; King & DeVries, 2018; Tse et al., 2017), as farmers have reported easier detection of cow health concerns with AMS compared to CMS (Tse et al., 2017) which is achievable from collecting cow-level data, holding potential for early detection of health disorders (King & DeVries, 2018). However, the benefits AMS offers are dependent on

management (Butler et al., 2012; Jacobs & Siegford, 2012; John et al., 2015; Karttunen et al., 2016; King & DeVries, 2018; Lage et al., 2024) and utilization of technology by farmers (Finstad et al., 2021; King & DeVries, 2018; Schillings et al., 2021; von Keyserlingk et al., 2024).

Farmers who have changed from CMS to AMS experience a higher mental workload (Butler et al., 2012; Lunner-Kolstrup et al., 2018), alarm stress (Lundström & Lindblom, 2021; Lunner-Kolstrup et al., 2018) or frustration (Finstad et al., 2021), feeling like they are on call (Butler et al., 2012), and information overload (Butler et al., 2012; Finstad et al., 2021; Lundström & Lindblom, 2021; Lunner-Kolstrup et al., 2018; Tse et al., 2017). The everyday tasks of dairy farmers undergoes significant alteration when shifting from CMS to AMS, with less physical labor and more flexibility to their day-to-day schedule (Butler et al., 2012; Finstad et al., 2021; Lunner-Kolstrup et al., 2018; Tse et al., 2018; von Keyserlingk et al., 2024). There is evidence to suggest that there are associations between farmer well-being and animal welfare on farms with AMS. Farmers using a manual feed system had higher stress, anxiety, depression, and lower resilience in comparison to those using an automated feed system (King et al., 2021). A positive association has been identified between animal welfare and farmers with high occupational wellbeing, and low stress, additionally, determination to continue farming and level of optimism are indirectly related to farm expansion, both of which were positively linked to animal welfare (Hansen & Østerås, 2019). Findings from Norway by Hansen & Stræte (2020) reported a higher level of job satisfaction with farmers using AMS than those using CMS.

The utilization of technology has resulted in a decreased amount of time that must be spent interacting with livestock, which poses a threat to the farmer-animal relationship (Peralta & Haefs, 2023). The domestication triangle' was coined by Finstad et al. (2021) suggesting that

farmers, cows, and technology take part in a relational learning process leading to co-evolution of their triangular relationship. Technology changes the farmer's role in livestock farming and the previously established farmer-cow relationship (Holloway & Bear, 2017; von Keyserlingk et al., 2024). Farm animal welfare and technology are contextual in nature, as farmers must be able to utilize the technology appropriately (Schillings et al., 2021). Reducing the number of farmer-cow interactions could come with a risk to cow welfare if the farmer-animal relationship is a positive contributor, such as helping to reduce fear associated with handling or visual identification of health disorders (Weary & von Keyserlingk, 2023). Marketing differs across AMS brands, where some focus on animal welfare and others on technology, but similarly discuss efficiency (Finstad et al., 2021). Although, the promotion of AMS as a form of liberation for both cows and farmers has received criticism (Baur & Iles, 2023; Holloway et al., 2014). Baur & Iles (2023) suggest such messaging infers suggests there is a lack of desire to be on the farm, whereas Holloway et al. (2014) problematizes the assumption that AMS offers cows freedom and autonomy.

1.4.7 Research gaps

Current research has often been focused on a specific topic within animal welfare, such as antimicrobial use (Cobo-Angel et al., 2021; Ida et al., 2023), pain mitigation (Moggy et al., 2017; Saraceni et al., 2022), lameness (Knauss et al., 2022), or cull cow management (Marshall et al., 2023). However, this may not build an understanding of the entire decision-making process that producers mentally juggle when it comes to animal care. Further research is needed to explore the experience of Canadian livestock farmers within the broader context of animal welfare more holistically.

This review has illustrated the cultural, socio-political, and economic influences that may facilitate or impede farmer well-being which is associated with farm animal welfare. Considering the reviewed literature, there are likely concerns in regards to livestock farmer mental health which have not yet been discussed in detail in the Canadian context. Farmers play a key role within agricultural systems, thus, there is potential to impact food security which has public health implications. Therefore, the animal agriculture sector must work together to foster meaningful, transformative change to better support farmers and their animals.

1.5 Methodology

There is a growing body of literature using qualitative methods in the dairy industry; however, only a limited number of these adequately discuss the philosophical underpinnings of the methodology used (Ritter et al., 2023). The existing quantitative research in farm animal welfare tends to assess farmer attitudes and perceptions towards recommended practices, which fails to capture the nuance that lies within farmers experiences (Vigors et al., 2023). Consequently, there appears to be a lack of literature within dairy science that centres the farmer experience of farm animal welfare. To help bridge this gap, this thesis uses qualitative methods rooted in a constructivist paradigm to explore dairy farmer well-being in the context of animal health and welfare (Chapter 2) and technology (Chapter 3).

1.5.1 Constructivist paradigm

The ontological standpoint within constructivism believes there is more than one experience of reality (Spencer et al., 2014) and that how an individual perceives reality is subjective (Fleuret, 2018). Constructivist epistemology holds that knowledge is co-created between the researcher and the participant, emphasizing the importance of the researcher's role throughout the research process (Spencer et al., 2014).

With the co-creation of knowledge, researcher reflexivity is integral to qualitative approaches as one must reflect on how their past experiences, social position, and values may influence data generation (Creswell & Creswell, 2018). As individuals and their perspectives are fluid, reflexivity is a continual process (Braun & Clarke, 2022a). Steps to ensure reflexivity include a research journal (e.g., memo-ing), which helped to intentionally reflect and question how the researcher's position, and experience may be influencing their interpretation through the research process (Braun & Clarke, 2022a). Validity strategies were used such as reflexivity, peer debriefing, thick description of findings, and member checking (Creswell & Creswell, 2018, p. 198-202). The lead author maintained a research journal throughout the research process which helped with reflexivity by providing insight to how her experiences may have influenced interpretation. Debriefing took place throughout the research process, most often between ALH and MK. A detailed description of findings was sent to participants whom gave consent, allowing for member checking, participants provided positive feedback and confirmed the findings. Lastly, themes are described with a rich, thick description which aims to enhance readers understanding of each theme and the experiences associated (Creswell & Creswell, 2018, p. 198-202). This information was then used to reflect introspectively, ensuring to acknowledge how the researcher may be actively influencing the interpretation. Similarly, the author's positionality statement can be found further on in this chapter in an effort to encourage transparency. The main authors' research team also aided in the reflexive process as they offered support, meaningful feedback, and discourse throughout.

1.5.2 Thematic analysis

The approach taken to analysis was originally thematic analysis (TA) informed by the six steps by Braun & Clarke (2006). Upon further reading, it became clear that TA is more of an

umbrella of approaches (Braun et al., 2019) and thus, refinement had to take place. Blending types of TA holds the potential to undermine elements of each method; however, it is acceptable as long as there is logical reasoning and justification behind the choice to blend methods (Braun & Clarke, 2021). The reason to use elements of codebook TA was due to flexibility in regards to timeline and research experience with thematic analysis. Characteristics of reflexive TA enhanced the research as it provided researchers with the capacity to preserve the nuance of each farmers' experience within the context of animal health and welfare, and technology; it offered a more iterative coding process in terms of code development; and it allowed for emphasis and value on a deeper reflexive process that offered a complementary effect to knowledge generation due to the researchers' agricultural experience (Braun & Clarke, 2022b). Thus, the approach I used was developed by Braun & Clarke (2006) and was informed by reflexive (Braun & Clarke, 2022b) and codebook TA (King & Brooks, 2018).

Firstly, the researcher increased data familiarization (Braun & Clarke, 2006, 2022b; King & Brooks, 2018). The second step was to conduct initial coding (Braun & Clarke, 2006), each qualitative research team member using three transcripts to establish a preliminary codebook which was used to help guide coding (King & Brooks, 2018). For the third step, all transcripts were coded by the lead author, then VFC conducted secondary coding to enhance the analysis in a collaborative approach (Braun & Clarke, 2022b). Code generation continued throughout the coding process as more semantic and latent codes were noted (Braun & Clarke, 2022b). These codes were added to the codebook and left highlighted to ensure that previous transcripts were returned to, so that these new codes were considered as well. After all data were reviewed, initial theme development was conducted (Braun & Clarke, 2022b), whereby themes were created to form a basis, allowing for adaptation for themes to evolve as coding continued. Then themes

were reviewed and refined to ensure the coded data aligned (Braun & Clarke, 2022b). Finally, researchers developed a thorough definition of each theme and situated themes in relation to other themes in a thematic map and reported the final analysis in detail (Braun & Clarke, 2022b).

1.5.3 Positionality statement

Arielle Le Heiget is a White, cisgender, straight woman in her mid-twenties living with a disability in rural Manitoba with her husband, dog, and cat. She was raised in a middle-class neighbourhood in Winnipeg, Manitoba but her love for animal agriculture is rooted in southern Saskatchewan where her great, great grandfather established the family farm in 1909. She completed a Bachelor of Science in Agriculture with specialization in Animal Systems in 2022 and then began her Master of Science in Animal Science at the University of Manitoba. She has worked with various species and has had first-hand experience of the traumatic stress associated with disease outbreaks in animal agriculture. Losing loved ones to their battles with mental health, and the effects of stigma in rural communities played an important role in her story.

1.5.3.1 Reflexivity statement – in my own voice

I grew up in a household where religion and politics were common conversations at the table, with representation of Christian, Catholic, Buddhist, Atheist religions, as well as every major political party. Our house was dominated by feminists, it goes without saying that the power and privilege upheld by existing systems was frequently problematized. This upbringing taught me that respect and moral values always take precedence. I also developed a thick skin, and an ability to have tough conversations.

I was very young when I first learned that I would never meet my second cousin. As we left the farm, my family would always stop at the century-old church and take a moment to

acknowledge and honor those who are no longer with us. I was in my teenage years when I learned that it was suicide, early twenties when I realized the stigma remained, and history repeated during my graduate studies. The churchyard visits continue to this day and often end in tears, the generational trauma bringing resilience, and the deep-rooted meaning that lies within the land and the connections I have to it. These experiences made the topic of stigma, suicide, and mental health-related loss an indescribably emotional and extremely difficult element of this research.

I was six years old when I was diagnosed with Type 1 Diabetes. I was forced to grow up quickly and I learned how to cope with the lack of control I had and the chronic stress that my diagnosis brought. I am fully reliant on technology as a lifeline. During my graduate studies, I was at the mercy of the technology manufacturer to fast-track a replacement to me – on a farmyard in rural Manitoba. This experience allowed me to draw connections to the challenges in rural healthcare systems, as well as the challenges dairy farmers face with the technology that they rely upon to milk their cows. Although the purpose is very different, similarities exist.

Furthermore, I conducted one of the first qualitative studies in a department that favours quantitative research with animals – about *mental health* with *farmers, as a woman*. It has been challenging to be the first student to learn and use qualitative methods in this specific environment. As it was new for me, it was also necessary to sit in the discomfort, and I am slowly learning to lean into curiosity. I believe these experiences can be seen throughout my writing, especially through discourse surrounding traditional ways of knowing and valuing farmer experience.

1.6 Thesis Rationale

The proposed research project aimed to provide insight into dairy farmer well-being in the context of animal health and welfare, and technology.

1.6.1 Thesis objectives

1. To explore dairy farmer well-being in the context of animal health and welfare.

2. To explore dairy farmer well-being in the context of technology.

1.7 References

Ahmadu, M., Herron, R.V., Allan, J.A., & Waddell, C.M. (2021). Identifying places that foster mental health and well-being among rural men. Health & Place, 71, 102673. https://doi.org/10.1016/j.healthplace.2021.102673

Albernaz-Gonçalves, R., Olmos, G., & Hötzel, M. J. (2021). My pigs are ok, why change? – animal welfare accounts of pig farmers. Animal, 15(3), 100154. https://doi.org/10.1016/j.animal.2020.100154

Allan, J.A., Waddell, C.M., Herron, R.V., & Roger, K. (2019). Are rural Prairie masculinites hegemonic masculinities? NORMA, 14(1), 35-49, https://doi.org/10.1080/18902138.2018.1519092

Alonso, M.E., González-Montaña, J.R., & Lomillos, J.M. (2020). Consumers' concerns and perceptions of farm animal welfare. Animals, 10, 385. https://doi.org/10.3390/ani10030385

Arnautovska, U., McPhedran, S., & De Leo, D. (2014). A regional approach to understanding farmer suicide rates in Queensland. Social Psychiatry and Psychiatric Epidemiology, 49, 593-599. https://doi.org/10.1007/s00127-013-0777-9

Asheber, H., Minhas, R., Hatolkar, V., Jaiswal, A., & Wittich, W. (2024). Sensory health and universal health coverage in Canada—an environmental scan. Healthcare, 12, 2475. https://doi.org/10.3390/healthcare12232475

Balzani, A., & Hanlon, A. (2020). Factors that influence farmers' views on farm animal welfare: A semi-systematic review and thematic analysis. Animals, 10(9), 1–25. https://doi.org/10.3390/ani10091524

Banack, C., Whitfield, K.Y., & Isley, S. (2023). Men's sheds and mental health in rural communities: exploring the benefits of a community-level program. Canadian Journal of Community Mental Health, 42(4). https://doi.org/10.7870/cjcmh-2023-026

Baur, P. & Iles, A. (2023). Inserting machines, displacing people: how automation imaginaries for agriculture promise 'liberation' from the industrialized farm. Agriculture and Human Values, 40, 815-833. https://doi.org/10.1007/s10460-023-10435-5

Barkema, H. W., von Keyserlingk, M. A. G., Kastelic, J. P., Lam, T. J. G. M., Luby, C., Roy, J. P., LeBlanc, S. J., Keefe, G. P., & Kelton, D. F. (2015). Invited review: Changes in the dairy industry affecting dairy cattle health and welfare. Journal of Dairy Science, 98(11), 7426–7445. https://doi.org/10.3168/jds.2015-9377

Belage, E., Croyle, S. L., Jones-Bitton, A., Dufour, S., & Kelton, D. F. (2019). A qualitative study of Ontario dairy farmer attitudes and perceptions toward implementing recommended milking practices. Journal of Dairy Science, 102(10), 9548-9557. https://doi.org/10.3168/jds.2018-15677

Berry, H. L., Hogan, A., Owen, J., Rickwood, D., & Fragar, L. (2011). Climate change and farmers' mental health: Risks and responses. Asia-Pacific Journal of Public Health, 23(2 Suppl), 119S-32. https://doi.org/10.1177/1010539510392556

Bianchi, M.C., Bava, L., Sandrucci, A., Tangorra, F.M., Tamburini, A., Gislon, G., & Zucali, M. (2022). Diffusion of precision livestock farming technologies in dairy cattle farms. Animal, 16, 100650. https://doi.org/10.1016/j.animal.2022.100650

Bock, B. B., Van Huik, M. M., Prutzer, M., Kling Eveillard, F., & Dockes, A. (2007). Farmers' relationship with different animals: the importance of getting close to the animals. Case studies of French, Swedish and Dutch cattle, pig and poultry farmers. International Journal of Sociology of Agriculture and Food, 15(3), 108-125.

Bondy, M. & Cole, D.C. (2019). Change as a double-edged sword: Ecological farmers' stressors and responses to changes in farming in Grey County, Ontario. The Journal of Rural and Community Development, 14(4), 114-131.

Borchers, M.R., & Bewley, J. M. (2015). An assessment of producer precision dairy farming technology use, prepurchase considerations, and usefulness. Journal of Dairy Science, 98(6), 4198-4205. http://doi.org/10.3168/jds.2014-8963

Booth, N.J. & Lloyd, K. (1999). Stress in farmers. International Journal of Social Psychiatry, 46(1), 67-73.

Bourke, L., Humphreys, J.S., Wakerman, J., & Taylor, J. (2010). From 'problem-describing' to 'problem-solving': Challenging the 'deficit' view of remote and rural health. Australian Journal of Rural Health, 18, 205-209. https://doi.org/10.1111/j.1440-1584.2010.01155.x

Bourke, L., Taylor, J., Humphreys, J.S., & Wakerman, J. (2013). "Rural health is subjective, everyone sees it differently": Understandings of rural health among Australian stakeholders. Health & Place, 24, 65-72. http://doi.org/10.1016/j.healthplace.2013.08.005

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. Qualitative Research in Psychology, 3(2), 77–101. https://doi.org/10.1191/1478088706qp063oa

Braun, V., & Clarke, V. (2021). One size fits all? What counts as quality practice in (reflexive) thematic analysis? Qualitative Research in Psychology, 18(3), 328–352. https://doi.org/10.1080/14780887.2020.1769238

Braun, V., & Clarke, V. (2022a). Conceptual and design thinking for thematic analysis. Qualitative Psychology, 9(1), 3–26. https://doi.org/10.1037/qup0000196

Braun, V., & Clarke, V. (2022b). Thematic Analysis: A Practical Guide. SAGE.

Broom, D. M., & Johnson, K. G. (2019). One Welfare, One Health, One Stress: Humans and other animals. In Stress and Animal Welfare, 2nd ed., 1–13. https://doi.org/https://doi.org/10.1007/978-3-030-32153-6

Bryant, L., & Garnham, B. (2014). Economies, ethics and emotions: Farmer distress within the moral economy of agribusiness. Journal of Rural Studies, 34, 304-312. http://doi.org/10.1016/j.jrurstud.2014.03.006

Bryant, L., & Garnham, B. (2018). Farming exit and ascriptions of blame: The ordinary ethics of farming communities. Journal of Rural Studies, 62, 62–67. https://doi.org/10.1016/j.jrurstud.2018.07.004

Bubeck, M. J. (2023). Justifying euthanasia: A qualitative study of veterinarians' ethical boundary work of "good" killing. Animals, 13(15). https://doi.org/10.3390/ani13152515

Buddle, E. A., Bray, H. J., & Ankeny, R.A. (2021). "Of course we care!": A qualitative exploration of Australian livestock producers' understandings of farm animal welfare issues. Journal of Rural Studies, 83, 50-59. https://doi.org/10.1016/j.jrurstud.2021.02.024

Burton, R. J. F. (2004). Seeing through the "good farmer's" eyes: Towards developing an understanding of the social symbolic value of "productivist" behaviour. Sociologia Ruralis, 44(2), 195–215. https://doi.org/10.1111/j.1467-9523.2004.00270.x

Burton, R. J. F., Peoples, S., & Cooper, M. H. (2012). Building "cowshed cultures": A cultural perspective on the promotion of stockmanship and animal welfare on dairy farms. Journal of Rural Studies, 28(2), 174–187. https://doi.org/10.1016/j.jrurstud.2011.12.003

Butler, D., Holloway, L., & Bear, C. (2012). The impact of technological change in dairy farming: robotic milking systems and the changing role of the stockperson.

Campler, M. R., Pairis-Garcia, M. D., Rault, J-L., Coleman, G., & Arruda, A.G. (2018). Caretaker attitudes toward swine euthanasia. Translational Animal Science, 2, 254-262. https://doi.org/10.1093/tas/txy015

Capua, I., & Cattoli, G. (2018). One health (r)evolution: Learning from the past to build a new future. Viruses, 10(12). https://doi.org/10.3390/v10120725

Cardoso, C.S., von Keyserlingk, M.A.G., & Hötzel, M.J. (2019). Views of dairy farmers, agricultural advisors, and lay citizens on the ideal dairy farm. Journal of Dairy Science, 102, 1811-1821. https://doi.org/10.3168/jds.2018-14688

Carmichael, J., Cran, A., Hrvatin, F., & Matthews, J. (2023). "We are stewards and caretakers of the land, not exploiters of resources": A qualitative study exploring Canadian farmers' perceptions of environmental sustainability in agriculture. PLoS ONE, 18(8 August). https://doi.org/10.1371/journal.pone.0290114

Caxaj, C.S. (2016). A review of mental health approaches for rural communities: Complexities and opportunities in the Canadian context. Canadian Journal of Community Mental Health, 35(1). https://doi.org/10.7870/cjcmh-2015-023

Ceccato, V., Lundqvist, P., Abraham, J., Göransson, E., & Svennefelt, C. A. (2021). The nature of fear among farmers working with animal production. International Criminology, 1, 193-207. https://doi.org/10.1007/s43576-021-00024-z

Ceccato, V., Lundqvist, P., Abraham, J., Göransson, E., & Svennefelt, C. A. (2022). Farmers, victimization, and animal rights activism in Sweden. Professional Geographer, 74(2), 350–363. https://doi.org/10.1080/00330124.2021.2004899

Chapman, M., & Deplazes-Zemp, A. (2023). 'I owe it to the animals': The bidirectionality of Swiss alpine farmers' relational values. People and Nature, 5(1), 147–161. https://doi.org/10.1002/pan3.10415

Cirell, A.M. & Sweet, J.D. (2020). A posthumanist unsmoothing of narrative smoothing. Qualitative Inquiry, 26(10), 1184-1195. https://doi.org/10.1177/1077800420939206

Cobo-Angel, C., LeBlanc, S. J., Roche, S. M., & Ritter, C. (2021). A focus group study of Canadian dairy farmers' attitudes and social referents on antimicrobial use and antimicrobial resistance. Frontiers in Veterinary Science, 8. https://doi.org/10.3389/fvets.2021.645221

Cogato, A., Brščić, M., Guo, H., Marinello, F., & Pezzuolo, A. (2021). Challenges and tendencies of automatic milking systems (AMS): A 20-years systematic review of literature and patents. Animals, 11, 356. https://doi.org/10.3390/ani11020356

Cole, D. C., & Bondy, M. C. (2020). Meeting farmers where they are–rural clinicians' views on farmers' mental health. Journal of Agromedicine, 25(1), 126–134. https://doi.org/10.1080/1059924X.2019.1659201

Collins, J., Ward, B. M., Snow, P., Kippen, S., & Judd, F. (2017). Compositional, contextual, and collective community factors in mental health and well-being in Australian rural communities. Qualitative Health Research, 27(5), 677–687. https://doi.org/10.1177/1049732315625195

Corbett, M. (2014). We have never been urban: Modernization, small schools, and resilient rurality in Atlantic Canada. The Journal of Rural and Community Development, 9(3), 186–202.

Cordeiro, M.R.C., Mengistu, G.F., Pogue, S.J., Legesse, G., Gunte, K.E., Taylor, A.M., Ominski, K.H., Beauchemin, K.A., McGeough, E.J., Faramarzi, M., & McAllister, T.A. (2022). Assessing feed security for beef production within livestock-intensive regions. Agricultural Systems, 196, 103348. https://doi.org/10.1016/j.agsy.2021.103348

Creswell, J. W., & Creswell, J. D. (2018). Research design: Qualitative, quantitative, and mixed methods approaches, 5th ed. SAGE.

Crimes, D., & Enticott, G. (2019). Assessing the social and psychological impacts of endemic animal disease amongst farmers. Frontiers in Veterinary Science, 6. https://doi.org/10.3389/fvets.2019.00342

Croyle, S. L., Belage, E., Khosa, D. K., LeBlanc, S. J., Haley, D. B., & Kelton, D. F. (2019). Dairy farmers' expectations and receptivity regarding animal welfare advice: A focus group study. Journal of Dairy Science, 102(8), 7385–7397. https://doi.org/10.3168/jds.2018-15821

Crumb, L., Chambers, C., Azano, A., Hands, A., Cuthrell, K., & Avent, M. (2022). Rural cultural wealth: dismantling deficit ideologies of rurality. Journal for Multicultural Education, 17(2), 125-138. https://doi.org/10.1108/JME-06-2022-0076

Darnhofer, I., Lamine, C., Strauss, A., & Navarrete, M. (2016). The resilience of family farms: Towards a relational approach. Journal of Rural Studies, 44, 111–122. https://doi.org/10.1016/j.jrurstud.2016.01.013

Darnhofer, I. (2020). Farming from a process-relational perspective: Making openings for change visible. Sociologia Ruralis, 60(2), 505-528. https://doi.org/10.1111/soru.12294

de Boon, A., Sandström, C., & Rose, D. C. (2024). To adapt or not to adapt, that is the question. Examining farmers' perceived adaptive capacity and willingness to adapt to sustainability transitions. Journal of Rural Studies, 105. https://doi.org/10.1016/j.jrurstud.2023.103171

Deary, I.J., Willock, J., & Mcgregor, M. (1997). Stress in farming. Stress medicine, 13, 131-136.

Deci, E. L., & Ryan, R. M. (2008). Hedonia, eudaimonia, and well-being: An introduction. Journal of Happiness Studies, 9(1), 1–11. https://doi.org/10.1007/s10902-006-9018-1

Denis-Robichaud, J., Rousseau, M., Denicourt, M., Villettaz-Robichaud, M., Lamothe, A. M., & DesCôteaux, L. (2023). Methods used by Canadian dairy farmers for on-farm euthanasia and the emotions associated with the decision and the practice of euthanasia. Journal of Dairy Science, 106(2), 1301–1314. https://doi.org/10.3168/jds.2022-21986

Dodge, R., Daly, A.P., Huyton, J., & Sanders, L.D. (2012). The challenge of defining wellbeing. International Journal of Wellbeing, 2(3), 222-235. https://doi.org/10.5502/ijw.v2i3.4

Edwards-Callaway, L., Simpson, H., Román-Muñiz, N., Cramer, C., Mijares, S., Stallones, L., Rivera-Gonzalez, J., & Aberle, J. (2022). Preliminary Exploration of weekly peer group discussions as a strategy for coping with feelings associated with euthanasia in dairy caretakers. International Journal of Environmental Research and Public Health, 19(4), 2177. https://doi.org/10.3390/ijerph19042177

Edwards, J. & McKinnon, M. (1987). The continuing appeal of disadvantage as deficit: A Canadian study in a rural context. Canadian Journal of Education, 12(2), 330-349.

Enticott, G., & Vanclay, F. (2011). Scripts, animal health and biosecurity: The moral accountability of farmers' talk about animal health risks. Health, Risk and Society, 13(4), 293–309. https://doi.org/10.1080/13698575.2011.575456

Figley, C. R. (1995). Compassion Fatigue as Secondary Traumatic Stress Disorder: An Overview. In C. R. Figley (Ed.), Compassion fatigue: Coping with secondary traumatic stress disorder in those who treat the traumatized (pp. 1–20). Routledge.

Finstad, T., Aune, M., & Egseth, K. A. (2021). The domestication triangle: How humans, animals and technology shape each other – The case of automated milking systems. Journal of Rural Studies, 84, 211–220. https://doi.org/10.1016/j.jrurstud.2021.03.006

Fleuret, S. (2018). Social Constructivism (In a socially constructed health geography?). In 1st (Ed.), Routledge Handbook of Health Geography. Routledge. https://doi.org/10.4324/9781315104584

Fu, M., Exeter, D.J., & Anderson, A. (2015). “So, is that your ‘relative’ or mine?” A political-ecological critique of census-based area deprivation indices. Social Science & Medicine, 142, 27-36. http://doi.org/10.1016/j.socscimed.2015.07.036

Gargiulo, J. I., Eastwood, C. R., Garcia, S. C., & Lyons, N. A. (2018). Dairy farmers with larger herd sizes adopt more precision dairy technologies. Journal of Dairy Science, 101(6), 5466–5473. https://doi.org/10.3168/jds.2017-13324

Gray, J. (1998). Family farms in the Scottish borders: A practical definition by hill sheep farmers. Journal of Rural Studies, 14(3), 341-356.

Gray, I., Dunn, T., & Phillips, E. (1997). Power, interests and the extension of sustainable agriculture. Sociologia Ruralis, 37, 97-113. https://doi.org/10.1111/1467-9523.00038

Gregoire, A. (2002). The mental health of farmers. Occupational Medicine, 52(8), 471-476.

Godde, C.M., Mason-D’Croz, D., Mayberry, D.E., Thornton, P.K., & Herrero, M. (2021). Impacts of climate change on the livestock food supply chain; a review of the evidence. Global Food Security, 28, 100488. https://doi.org/10.1016/j.gfs.2020.100488

Hagen, B. N. M., Albright, A., Sargeant, J., Winder, C. B., Harper, S. L., O’Sullivan, T. L., & Jones-Bitton, A. (2019). Research trends in farmers’ mental health: A scoping review of mental health outcomes and interventions among farming populations worldwide. PLoS ONE, 14(12). https://doi.org/10.1371/journal.pone.0225661

Hagen, B. N. M., Sawatzky, A., Harper, S. L., O’sullivan, T. L., & Jones-Bitton, A. (2021). What impacts perceived stress among Canadian farmers? A mixed-methods analysis.

International Journal of Environmental Research and Public Health, 18(14). https://doi.org/10.3390/ijerph18147366

Hagen, B. N. M., Sawatzky, A., Harper, S. L., O'Sullivan, T. L., & Jones-Bitton, A. (2022). "Farmers aren't into the emotions and things, right?": A qualitative exploration of motivations and barriers for mental health help-seeking among Canadian farmers. Journal of Agromedicine, 27(2), 113–123. https://doi.org/10.1080/1059924X.2021.1893884

Hammersley, C., Meredith, D., Richardson, N., Carroll, P., & McNamara, J. (2023). Mental health, societal expectations and changes to the governance of farming: Reshaping what it means to be a 'man' and 'good farmer' in rural Ireland. Sociologia Ruralis, 63(S1), 57–81. https://doi.org/10.1111/soru.12411

Hansen, B. G. (2015). Robotic milking-farmer experiences and adoption rate in Jæren, Norway. Journal of Rural Studies, 41, 109–117. https://doi.org/10.1016/j.jrurstud.2015.08.004

Hansen, B. G., & Østerås, O. (2019). Farmer welfare and animal welfare – exploring the relationship between farmer's occupational well-being and stress, farm expansion and animal welfare. Preventive Veterinary Medicine, 170, 104741. https://doi.org/10.1016/j.prevetmed.2019.104741

Hansen, B. G., & Stræte, E. P. (2020). Dairy farmers' job satisfaction and the influence of automatic milking systems. NJAS – Wageningen Journal of Life Sciences, 92, 100328. https://doi.org/10.1016/j.njas.2020.100328

Harrison, K. (2021). Compassion fatigue: Understanding empathy. Veterinary Clinics of North America - Small Animal Practice, 51(5), 1041–1051. https://doi.org/10.1016/j.cvsm.2021.04.020

Hawes, N. J., Wiggins, A. T., Reed, D. B., & Hardin-Fanning, F. (2019). Poor sleep quality is associated with obesity and depression in farmers. Public Health Nursing, 36, 270-275. https://doi.org/10.1111/phn.12587

Henning-Smith, C., Alberth, A., Bjornestad, A., Becot, F., & Inwood, S. (2021). Farmer mental health in the US Midwest: Key informant perspectives. Journal of Agromedicine, 27(1), 15-24. https://doi.org/10.1080/1059924X.2021.1893881

Herron, R.V., Ahmadu, M., Allan, J.A., Waddell, C.M., & Roger, K. (2020). "Talk about it:" changing masculinities and mental health in rural places? Social Science & Medicine, 258, 113099. https://doi.org/10.1016/j.socscimed.2020.113099

Herron, R.V, Lawrence, B.C., Newall, N.E.G., Ramsey, D., Waddell-Henowitch, C.M., & Dauphinais, J. (2022). Rural older adults' resilience in the context of COVID-19. Social Science & Medicine, 306, 115153. https://doi.org/10.1016/j.socscimed.2022.115153

Herron, R.V., Lawrence, B.C., Newall, N.E.G., & Ramsey, D. (2025). Older adults' resilience in rural places: Explaining the role of place, time, and social connection during COVID-19. Journal of Rural Studies, 114, 103579. https://doi.org/10.1016/j.jrurstud.2025.103579

Herron, R.V. & Skinner, M.W. (2012). Farmwomen's emotional geographies of care: a view from rural Ontario. Gender, Place and Culture, 19(2), 232-248. http://doi.org/10.1080/0966369X.2011.572432

Holland, M. L., Brock, S. E., Oren, T., & van Eckhardt, M. (2022). Burnout and trauma related employment stress. Springer Nature Switzerland AG. https://doi.org/10.1007/978-3-030-83492-0_1

Holloway, L., & Bear, C. (2017). Bovine and human becomings in histories of dairy technologies: robotic milking systems and remaking animal and human subjectivity. BJHS Themes, 2, 215–234. https://doi.org/10.1017/bjt.2017.2

Holloway, L., Bear, C., & Wilkinson, K. (2014). Re-capturing bovine life: Robot-cow relationships, freedom and control in dairy farming. Journal of Rural Studies, 33, 131–140. https://doi.org/10.1016/j.jrurstud.2013.01.006

Holton, M., Riley, M., & Kallis, G. (2023). Towards the geographies of loneliness: interpreting the spaces of loneliness in farming contexts. Social and Cultural Geography, 24(10), 1752–1770. https://doi.org/10.1080/14649365.2022.2104360

Hounsome, B., Edwards, R. T., & Edwards-Jones, G. (2006). A note on the effect of farmer mental health on adoption: The case of agri-environment schemes. Agricultural Systems, 91, 229-241. https://doi.org/10.1016/j.agsy.2006.09.001

Hounsome, B., Edwards, R. T., Hounsome, N., & Edwards-Jones, G. (2011). Psychological morbidity of farmers and non-farming population: Results from a UK survey. Community Mental Health Journal, 48, 503-510. https://doi.org/10.1007/s10597-011-9415-8

Hu, R., & Gill, N. (2021). The family farming culture of dairy farmers: A case-study of the Illawarra Region, New South Wales. Sociologia Ruralis, 61(2), 398–421. https://doi.org/10.1111/soru.12329

Ida, J. A., Wilson, W. M., Nydam, D. V., Gerlach, S. C., Kastelic, J. P., Russell, E. R., McCubbin, K. D., Adams, C. L., & Barkema, H. W. (2023). Contextualized understandings of dairy farmers' perspectives on antimicrobial use and regulation in Alberta, Canada. Journal of Dairy Science, 106(1), 547–564. https://doi.org/10.3168/jds.2021-21521

Jacobs, J. A. & Siegford, M. (2012). Invited review: The impact of automatic milking systems on dairy cow management, behavior, health, and welfare. Journal of Dairy Science, 95(5), 2227-2247. http://doi.org/10.3168/jds.2011-4943

Jarvis, L. C., Goodrick, E., & Hudson, B. A. (2019). Where the heart functions best: Reactive–affective conflict and the disruptive work of animal rights organizations. Academy of Management Journal, 62(5), 1358–1387. https://doi.org/10.5465/amj.2017.0342

John, A. J., Clark, C. E. F., Freeman, M. J., Kerrisk, K. L., Garcia, S. C., & Halachmi, I. (2016). Review: Milking robot utilization, a successful precision livestock farming evolution. Animal, 10(9), 1484-1492. https://doi.org/10.1017/S1751731116000495

Jones, A. Q., Sawatzky, A., Thompson, R., & Hagen, B. N. M. (2024). Poor mental health negatively impacts farmers personally, interpersonally, cognitively, and professionally. FACETS, 9, 1–16. https://doi.org/10.1139/facets-2023-0230

Jones-Bitton, A., Hagen, B., Fleming, S. J., & Hoy, S. (2019). Farmer burnout in Canada. International Journal of Environmental Research and Public Health, 16(24). https://doi.org/10.3390/ijerph16245074

Jones-Bitton, A., Best, C., MacTavish, J., Fleming, S., & Hoy, S. (2020). Stress, anxiety, depression, and resilience in Canadian farmers. Social Psychiatry and Psychiatric Epidemiology, 55(2), 229–236. https://doi.org/10.1007/s00127-019-01738-2

Kaarlenkaski, T. (2023). Cows and humans as technology users: Multispecies agency and gender in automated milking systems in Finland. Technology and Culture, 64(4), 1093-1119. https://doi.org/10.1353/tech.2023.a910996

Kallioniemi, M. K., Simola, A., Kaseva, J., & Kymäläinen, H. (2016). Stress and burnout among Finnish dairy farmers. Journal of Agromedicine, 21(3), 259-268. https://doi.org/10.1080/1059924X.2016.1178611

Karttunen, J. P., Rautiainen, R. H., & Lunner-Kolstrup, C. (2016). Occupational health and safety of Finnish dairy farmers using automatic milking systems. Frontiers in Public Health, 4, 147. https://doi.org/10.3389/fpubh.2016.00147

Kauppinen, T., Vainio, A., Valros, A., Rita, H., & Vesala, K. (2010). Improving animal welfare: qualitative and quantitative methodology in the study of farmers' attitudes. Animal Welfare, 19(4), 523–536. https://doi.org/10.1017/S0962728600001998

Keeney, A. J., Quandt, A., Meng, Y., Flores, L. Jr., Flores, D., Garratt, R., Hernandez, P., & Villaseñor, M. (2022). "We all have a job to do in this world, it's up to us": Farmworker and

farmer mental health in a rural US-Mexico Border region. Journal of Agromedicine, 28(3), 365-377. https://doi.org/10.1080/1059924X.2022.2154298

Kielland, C., Skjerve, E., Østerås, O., & Zanella, A. J. (2010). Dairy farmer attitudes and empathy toward animals are associated with animal welfare indicators. Journal of Dairy Science, 93(7), 2998–3006. https://doi.org/10.3168/jds.2009-2899

King, M. T. M., & DeVries, T. (2018). Graduate student literature review: Detecting health disorders using data from automatic milking systems and associated technologies. Journal of Dairy Science, 101, 8605-8614. https://doi.org/10.3168/jds.2018-14521

King, M., Matson, R., & DeVries, T. (2021). Connecting farmer mental health with cow health and welfare on dairy farms using robotic milking systems. Animal Welfare, 30(1), 25–38. https://doi.org/10.7120/09627286.30.1.025

King, N., & Brooks, J. M. (2018). Doing template analysis: A guide to the main components and procedures. In Template analysis for business and management students. SAGE Publications Ltd. https://doi.org/10.4135/9781473983304

Kitchen, P., Williams, A., & Chowhan, J. (2012). Sense of community belonging and health in Canada: A regional analysis. Social Indicators Research, 107(1), 103-126. https://doi.org/10.1007/sl 1205-01 1-9830-9

Kleen, J. L., & Guatteo, R. (2023). Precision livestock farming: What does it contain and what are the perspectives? Animals, 13(5). https://doi.org/10.3390/ani13050779

Knauss, M., Adams, C. L., & Orsel, K. (2022). Producer perceptions toward prevention and control of lameness in dairy cows in Alberta Canada: A thematic analysis. Frontiers in Veterinary Science, 9. https://doi.org/10.3389/fvets.2022.812710

Kröbel, R., Stephens, E. C., Gorzelak, M. A., Thivierge, M-N., Akhter, F., Nyiraneza, J., Singer, S. D., Geddes, C. M., Glenn, A. J., Devillers, N., Alemu, A. W., St. Luce, M., & Giardetti, D. (2021). Making farming more sustainable by helping farmers to decide rather than telling them what to do. Environmental Research Letters, 16, 055033. https://doi.org/10.1088/1748-9326/abef30

Kuehne, G. (2013). My decision to sell the family farm. Agriculture and Human Values, 30(2), 203–213. https://doi.org/10.1007/s10460-012-9393-7

LaFollette, M. R., Riley, M. C., Cloutier, S., Brady, C. M., O'Haire, M. E., & Gaskill, B. N. (2020). Laboratory animal welfare meets human welfare: A cross-sectional study of professional quality of life, including compassion fatigue in laboratory animal personnel. Frontiers in Veterinary Science, 7. https://doi.org/10.3389/fvets.2020.00114

Lage, C. F. de A., Marques, T. C., Bruno, D. R., Endres, M. I., Ferreira, F., Pires, A. P. A., Leão, K., & de Lima, F. S. (2024). Farmers' perceptions on implementing automatic milking systems in large USA dairies: Decision-making process, management practices, labor, and herd performance. Animals, 14(2). https://doi.org/10.3390/ani14020218

Lambert, L., Passmore, H. A., & Holder, M. D. (2015). Foundational frameworks of positive psychology: Mapping well-being orientations. Canadian Psychology, 56(3), 311–321. https://doi.org/10.1037/cap0000033

Larson, N.C. & Dearmont, M. (2002). Strengths of farming communities in fostering resilience in children. Child Welfare, 81(5), 821-835.

Letourneau, A. M., & Davidson, D. (2022). Farmer identities: facilitating stability and change in agricultural system transitions. Environmental Sociology, 8(4), 459–470. https://doi.org/10.1080/23251042.2022.2064207

Liang, Y., Wang, K., Janssen, B., Casteel, C., Nonnenmann, M., & Rohlman, D. S. (2021). Examination of symptoms of depression among cooperative dairy farmers. International Journal of Environmental Research and Public Health, 18, 3657. https://doi.org/10.3390/ijerph18073657

Lundström, C., & Lindblom, J. (2021). Care in dairy farming with automatic milking systems, identified using an activity theory lens. Journal of Rural Studies, 87, 386–403. https://doi.org/10.1016/j.jrurstud.2021.09.006

Lunner-Kolstrup, C., Hörndahl, T., & Karttunen, J. P. (2018). Farm operators' experiences of advanced technology and automation in Swedish agriculture: a pilot study. Journal of Agromedicine, 23(3), 215–226. https://doi.org/10.1080/1059924X.2018.1458670

MacKay, C. (2023). A necessary evil? Examining the complexities of care and commodification. Environment and Planning E: Nature and Space, 6(3), 1725–1744. https://doi.org/10.1177/25148486221132227

Mahon, N., Holloway, L., Clark, B., & Proctor, A. (2023). The application of a sentiment analysis approach to explore public understandings of animal agriculture. Journal of Rural Studies, 103. https://doi.org/10.1016/j.jrurstud.2023.103127

Malatzky, C. A. R., & Couch, D. L. (2023). The power in rural place stigma. Journal of Bioethical Inquiry, 20(2), 237–248. https://doi.org/10.1007/s11673-023-10260-9

Malatzky, C., & Bourke, L. (2016). Re-producing rural health: Challenging dominant discourses and the manifestation of power. Journal of Rural Studies, 45, 157–164. https://doi.org/10.1016/j.jrurstud.2016.03.005

Marshall, J., Haley, D. B., Kelton, D., Miltenburg, C., Roche, S., & Duffield, T. (2023). A focus group study exploring dairy farmers' perspectives of cull cow management in Ontario, Canada. Frontiers in Veterinary Science, 10. https://doi.org/10.3389/fvets.2023.1189668

Maslach, C., Schaufeli, Wilmar. B., & Leiter, Michael. P. (2001). Job burnout. Annual Review of Psychology, 52, 397–422.

McNamee, T.C., Ardoin, S., Cooper, N.D., & Sansone, V.A. (2025). "Because I'm from a rural background": An examination of rural students in higher education through a critical, non-deficit framework. The Journal of Higher Education, 1-31. https://doi.org/10.1080/00221546.2025.2455333

Mead, J., Fisher, Z., & Kemp, A. H. (2021). Moving beyond disciplinary silos towards a transdisciplinary model of wellbeing: An invited review. Frontiers in Psychology, 12, 642093. https://doi.org/10.3389/fpsyg.2021.642093

Mills, K. E., Payne, P. R., Saunders, K., Zobel, G. (2023). ''If you were a cow, what would you want?" Findings from participatory workshops with dairy farmers. Animal, 100779. https://doi.org/10.1016/j.animal.2023.100779

Moggy, M. A., Pajor, E. A., Thurston, W. E., Parker, S., Greter, A. M., Schwartzkopf-Genswein, K. S., Campbell, J. R., & Windeyer, M. C. (2017). Management practices associated with pain in cattle on western Canadian cow-calf operations: A mixed methods study. Journal of Animal Science, 95(2), 958–969. https://doi.org/10.2527/jas2016.0949

Monaghan, H., Rohlf, V., Scotney, R., & Bennett, P. (2020). Compassion fatigue in people who care for animals: An investigation of risk and protective factors. Traumatology. https://doi.org/10.1037/trm0000246

Muhammad, M., Stokes, J. E., Morgans, L., & Manning, L. (2022). The social construction of narratives and arguments in animal welfare discourse and debate. Animals, 12(19). https://doi.org/10.3390/ani12192582

Mullins, C. R., Pairis-Garcia, M. D., George, K. A., Anthony, R., Johnson, A. K., Coleman, G. J., Rault, J. L., & Millman, S. T. (2017). Determination of swine euthanasia criteria and analysis of barriers to euthanasia in the United States using expert opinion. Animal Welfare, 26(4), 449–459. https://doi.org/10.7120/09627286.26.4.449

Neethirajan, S., & Kemp, B. (2021). Digital livestock farming. Sensing and Bio-Sensing Research, 32, 100408. https://doi.org/10.1016/j.sbsr.2021.100408

Nye, C., Winter, M., & Lobley, M. (2023). Farmers supporting farmers: Livestock auctions as spaces to reconstruct occupational community and counter mental health issues. Journal of Agromedicine, 28(3), 401–414. https://doi.org/10.1080/1059924X.2023.2176959

Park, H., Chun, M. S., & Joo, Y. (2020). Traumatic stress of frontline workers in culling livestock animals in South Korea. Animals, 10, 1920. https://doi.org/10.3390/ani10101920

Pavloff, M., McCutcheon, J. M., Beck, C. D., Laventure, S., Farthing, P., Duff, E., Wasko, K., Szafron, M., Disiewich, K., Entz, F., Heuchert, B., Weinheimer, A., Labrecque, M. E., Labrecque, C. S., Little, K., & Lustig, J. (2023). Cultivating perceptions of farm culture: Perspectives from the Canadian prairies. Journal of Rural Mental Health. https://doi.org/10.1037/rmh0000243

Peralta, J. M., & Haefs, T. (2023). Human-animal interactions in an agricultural and production setting. In The Routledge International Handbook of Human-Animal Interactions and Anthrozoology, 613–625. Routledge. https://doi.org/10.4324/9781032153346-42

Pettan-Brewer, C., Penn, G., Biondo, A. W., Jaenisch, T., Grützmacher, K., & Kahn, L. H. (2024). Who coined the term “One Health”? Cooperation amid the siloization. One Health, 18, 100678. https://doi.org/10.1016/j.onehlt.2024.100678

Pinillos, R. G., Appleby, M., Manteca, X., Scott-Park, F., Smith, C., & Velarde, A. (2016). One Welfare – a platform for improving human and animal welfare. Veterinary Record, 179(16), 412-413. https://doi.org/10.1136/vr.i5470

Pinillos, R. G. (2018). The path to developing a One Welfare framework. In One Welfare: A Framework to Improve Animal Welfare and Human Welfare, 1–15. CABI.

Polachek, A. J., & Wallace, J. E. (2018). The paradox of compassionate work: A mixed-methods study of satisfying and fatiguing experiences of animal health care providers. Anxiety, Stress, & Coping, 31(2), 228-243. https://doi.org/10.1080/10615806.2017.1392224

Polain, J. D., Berry, H. L., & Hoskin, J. O. (2011). Rapid change, climate adversity and the next “big dry”: Older farmers’ mental health. Australian Journal of Rural Health, 19(5), 239–243. https://doi.org/10.1111/j.1440-1584.2011.01219.x

Proctor, C., & Hopkins, N. (2023). Stressors and coping strategies in rural farmers: A qualitative study. Journal of Agromedicine, 28(3), 415–424. https://doi.org/10.1080/1059924X.2023.2173691

Purc-Stephenson, R., Doctor, J., & Keehn, J. E. (2023). Understanding the factors contributing to farmer suicide: A meta-synthesis of qualitative research. Rural and Remote Health, 23(3). https://doi.org/10.22605/RRH8189

Rault, J.-L., Holyoake, T., & Coleman, G. (2017). Stockperson attitudes toward pig euthanasia. Journal of Animal Science, 95, 949-957. https://doi.org/10.2527/jas2016.0922

Ritter, C., Adams, C. L., Kelton, D. F., & Barkema, H. W. (2019). Factors associated with dairy farmers’ satisfaction and preparedness to adopt recommendations after veterinary herd health visits. Journal of Dairy Science, 102(5), 4280–4293. https://doi.org/10.3168/jds.2018-15825

Ritter, C., Mills, K. E., Weary, D. M., & von Keyserlingk, M. A. G. (2020). Perspectives of western Canadian dairy farmers on the future of farming. Journal of Dairy Science, 103(11), 10273–10282. https://doi.org/10.3168/jds.2020-18430

Ritter, C., Koralesky, K.E., Saraceni, J., Roche, S., Vaarst, M., & Kelton, D. (2023). Invited review: Qualitative research in dairy science – a narrative review. Journal of Dairy Science, 106(9), 5880-5895. https://doi.org/10.3168/jds.2022-23125

Roche, S. M., Kelton, D. F., Meehan, M., Von Massow, M., & Jones-Bitton, A. (2019). Exploring dairy producer and veterinarian perceptions of barriers and motivators to adopting on-farm management practices for Johne's disease control in Ontario, Canada. Journal of Dairy Science, 102, 4476-4488. https://doi.org/10.3168/jds.2018-15944

Rohlf, V. I. (2018). Interventions for occupational stress and compassion fatigue in animal care professionals – a systematic review. Traumatology, 24(3), 186-192. https://doi.org/10.1037/trm0000144

Román-Muñiz, I. N., Cramer, M. C., Edwards-Callaway, L. N., Stallones, L., Kim, E., Thompson, S., Simpson, H., & Mijares, S. (2021). Dairy caretaker perspectives on performing euthanasia as an essential component of their job. Animals, 11, 289. https://doi.org/10.3390/ani11020289

Rotz, S., Gravely, E., Mosby, I., Duncan, E., Finnis, E., Horgan, M., LeBlanc, J., Martin, R., Neufeld, H. T., Nixon, A., Pant, L., Shalla, V., & Fraser, E. (2019). Automated pastures and the digital divide: How agricultural technologies are shaping labour and rural communities. Journal of Rural Studies, 68, 112–122. https://doi.org/10.1016/j.jrurstud.2019.01.023

Roy, P., Tremblay, G., Robertson, S., & Houle, J. (2017). "Do it all by myself": A salutogenic approach of masculine health practice among farming men coping with stress.

American Journal of Men's Health, 11(5), 1536–1546. https://doi.org/10.1177/1557988315619677

Ryff, C.D. (1989). Happiness is everything, or is it? Explorations on the meaning of psychological well-being. Journal of Personality and Social Psychology, 57(6), 1069-1081.

Ryff, C.D. (2014). Psychological well-being revisited: advances in the science and practice of eudaimonia. Psychotherapy and Psychosomatics, 83, 10-28. https://doi.org/10.1159/000353263

Saraceni, J., Renaud, D. L., Nelson, E., Van Os, J. M. C., Miltenburg, C., & Winder, C. B. (2022). Ontario dairy producers' perceived barriers and motivations to the use of pain control for disbudding and dehorning calves: A qualitative study. Animals, 12(8). https://doi.org/10.3390/ani12080973

Schaufeli, W. B., Leiter, M. P., & Maslach, C. (2009). Burnout: 35 years of research and practice. Career Development International, 14(3), 204–220. https://doi.org/10.1108/13620430910966406

Schillings, J., Bennett, R., & Rose, D. C. (2021). Exploring the potential of precision livestock farming technologies to help address farm animal welfare. Frontiers in Animal Science, 2. https://doi.org/10.3389/fanim.2021.639678

Schuppli, C. A., Spooner, J. M., & von Keyserlingk, M. A. G. (2023). Canadian dairy farmer views about animal welfare. Animal Welfare, 32, e38. https://doi.org/10.1017/awf.2023.32

Scotney, R.L., McLaughlin, D., & Keates, H.L. (2015). A systematic review of the effects of euthanasia and occupational stress in personnel working with animals in animal shelters, veterinary clinics, and biomedical research facilities. Journal of American Veterinary Medical Association, 247(10), 1121-1130. https://doi.org/10.2460/javma.247.10.1121

Shi, H., Shan, B., Zheng, J., Zhang, Y., Zhang, J., & Hu, X. (2022). Grief as a mediator of the relationship between empathy and compassion fatigue. Psycho-Oncology, 31(5), 840–847. https://doi.org/10.1002/pon.5875

Shulman, D., Shnitzer-Akuka, M., & Reifen-Tagar, M. (2021). The cost of attributing moral blame: Defensiveness and resistance to change when raising awareness to animal suffering in factory farming. PLoS ONE, 16. https://doi.org/10.1371/journal.pone.0254375

Soubry, B., Sherren, K., & Thornton, T. F. (2020). Are we taking farmers seriously? A review of the literature on farmer perceptions and climate change, 2007–2018. Journal of Rural Studies, 74, 210–222. https://doi.org/10.1016/j.jrurstud.2019.09.005

Simpson, H., Edwards-Callaway, L. N., Cramer, M. C., Roman-Muniz, I. N., Stallones, L., Thompson, S., Ennis, S., Kim, E., & Pairis-Garcia, M. (2020). Preliminary study exploring caretaker perspectives of euthanasia on swine operations. Animals, 10, 2296. https://doi.org/10.3390/ani10122296

Simpson, C., & McDonald, F. (2017). Rethinking Rural Health Ethics. In Weisstub & Cooley (Eds.), International Library of Ethics, Law, and the New Medicine, 72. Springer International Publishing AG. https://doi.org/10.1007/978-3-319-60811-2

Sirovica, L. V., & Keyserlingk, M. A. G. von. (2023). Public perceptions of farm animal welfare. In The Routledge International Handbook of Human-Animal Interactions and Anthrozoology, 644–657. Routledge. https://doi.org/10.4324/9781032153346-44

Smid, A. M. C., Inberg, P. H. J., de Jong, S., Sinclair, S., von Keyserlingk, M. A. G., Weary, D. M., & Barkema, H. W. (2021). Perspectives of Western Canadian dairy farmers on providing outdoor access for dairy cows. Journal of Dairy Science, 104(9), 10158–10170. https://doi.org/10.3168/jds.2021-20342

Soubry, B., Sherren, K., & Thornton, T. F. (2020). Are we taking farmers seriously? A review of the literature on farmer perceptions and climate change, 2007–2018. Journal of Rural Studies, 74, 210–222. https://doi.org/10.1016/j.jrurstud.2019.09.005

Spencer, R., Pryce, J.M., & Walsh, J. (2014). Philosophical approaches to qualitative research. In Patricia Leavy (Ed.), The Oxford Handbook of Qualitative Research, Oxford Library of Psychology, Oxford Academic. https://doi.org/10.1093/oxfordhb/9780199811755.013.027

Spooner, J. M., Schuppli, C. A., & Fraser, D. (2014). Attitudes of Canadian pig producers toward animal welfare. Journal of Agricultural & Environmental Ethics, 27, 569-589. https://doi.org/10.1007/s10806-013-9477-4

Sprung, J.M. (2022). Economic stress, family distress, and work-family conflict among farm couples. Journal of Agromedicine, 27(2), 154-168. https://doi.org/10.1080/1059924X.2021.1944417

Stock, P. V., & Forney, J. (2014). Farmer autonomy and the farming self. Journal of Rural Studies, 36, 160–171. https://doi.org/10.1016/j.jrurstud.2014.07.004

Stone, A. E. (2020). Symposium review: The most important factors affecting adoption of precision dairy monitoring technologies. In Journal of Dairy Science, 103(6), 5740–5745. https://doi.org/10.3168/jds.2019-17148

Strover, S., Whitacre, B., Rhinesmith, C., & Schrubbe, A. (2020). The digital inclusion role of rural libraries: social inequalities through space and place. Media, Culture, & Society, 42(2), 242-259. https://doi.org/10.1177/0163443719853504

Taylor, N., & Fraser, H. (2019). Number 2 Article 10 2019 Dairy farmers' conceptions of cruelty and kindness. Animal Studies Journal, 8(2), 133-153. https://doi.org/10.14453/asj.v8i2.10

Thompson, R., Hagen, B.N.M., Lumley, M.N., Winder, C. B., Gohar, B., & Jones-Bitton, A. (2022). Mental health and substance use of farmers in Canada during COVID-19. International Journal of Environmental Research and Public Health, 19, 13566. https://doi.org/10.3390/ijerph192013566

Thompson, R., Hagen, B.N.M., & Jones-Bitton, A. (2023a). Tractors, talk, mindset, mantras, detachment, and distraction: A mixed-methods investigation of coping strategies used by farmers in Canada. Sustainability, 15, 8566. https://doi.org/10.3390/su15118566

Thompson, R., Hagen, B. N. M., Lumley, M. N., Winder, C. B., Gohar, B., & Jones-Bitton, A. (2023b). "An incredible amount of stress before you even put a shovel in the ground": A mixed methods analysis of farming stressors in Canada. Sustainability, 15(8). https://doi.org/10.3390/su15086336

Thorsteinsen, K., & Vittersø, J. (2020). Now you see it, now you don't: Solid and subtle differences between hedonic and eudaimonic Wellbeing. Journal of Positive Psychology, 15(4), 519–530. https://doi.org/10.1080/17439760.2019.1639794

Tourangeau, W., Sherren, K., & Kent, C. (2019). Of climate and weather: Examining Canadian farm and livestock organization discourses from 2010 to 2015. Weather, Climate, and Society, 11, 95 – 111. https://doi.org/10.1175/WCAS-D-18-0028.1

Truchot, D. & Andela, M. (2018). Burnout and hopelessness among farmers: The Farmers Stressors Inventory. Social Psychiatry and Psychiatric Epidemiology, 53, 859-867. https://doi.org/10.1007/s00127-018-1528-8

Tse, C., Barkema, H. W., DeVries, T. J., Rushen, J., & Pajor, E. A. (2017). Effect of transitioning to automatic milking systems on producers' perceptions of farm management and cow health in the Canadian dairy industry. Journal of Dairy Science, 100(3), 2404–2414. https://doi.org/10.3168/jds.2016-11521

Tse, C., Barkema, H. W., DeVries, T. J., Rushen, J., Vasseur, E., & Pajor, E. A. (2018). Producer experience with transitioning to automatic milking: Cow training, challenges, and effect on quality of life. Journal of Dairy Science, 101(10), 9599–9607. https://doi.org/10.3168/jds.2018-14662

van der Ploeg, J. D. (2023). The sociology of farming: Concepts and methods.

Vanclay, F. (2004). Social principles for agricultural extension to assist in the promotion of natural resource management. Australian Journal of Experimental Agriculture, 44(3), 213–222. https://doi.org/10.1071/EA02139

Vayro, C., Brownlow, C., Ireland, M., & March, S. (2020). 'Farming is not just an occupation [but] a whole lifestyle': A qualitative examination of lifestyle and cultural factors affecting mental health help-seeking in Australian farmers. Sociologia Ruralis, 60(1), 151–173. https://doi.org/10.1111/soru.12274

Vayro, C., Brownlow, C., Ireland, M., & March, S. (2021). "Don't … break down on Tuesday because the mental health services are only in town on thursday": A qualitative study of service provision related barriers to, and facilitators of farmers' mental health help-seeking. Administration and Policy in Mental Health and Mental Health Services Research, 48(3), 514–527. https://doi.org/10.1007/s10488-020-01085-4

Ventura, B. A., von Keyserlingk, M. A. G., & Weary, D. M. (2015). Animal welfare concerns and values of stakeholders within the dairy industry. Journal of Agricultural and Environmental Ethics, 28, 109–126. https://doi.org/10.1007/s10806-014-9523-x

Ventura, B.A., von Keyserlingk, M.A.G., Wittman, H., & Weary, D.M. (2016). What difference does a visit make? Changes in animal welfare perceptions after interested citizens tour a dairy farm. PLoS ONE, 11(5), e0154733. https://doi:10.1371/journal.pone.0154733

Ventura, G., Lorenzi, V., Mazza, F., Clemente, G.A., Iacomino, C., Bertocchi, L., & Fusi, F. (2021). Best farming practices for the welfare of dairy cows, heifers and calves. Animals, 11, 2645. https://doi.org/10.3390/ani11092645

Vigors, B., Wemelsfelder, F., & Lawrence, A. B. (2023). What symbolises a "good farmer" when it comes to farm animal welfare? Journal of Rural Studies, 98, 159–170. https://doi.org/10.1016/j.jrurstud.2023.01.009

von keyserlingk, M. A. G., & Weary, D. M. (2017). A 100-Year Review: Animal welfare in the Journal of Dairy Science—The first 100 years. Journal of Dairy Science, 100, 10432-10444. https://doi.org/10.3168/jds.2017-13298

von Keyserlingk, M. A. G., Mills, K. E., & Weary, D. M. (2024). Attitudes of western Canadian dairy farmers toward technology. Journal of Dairy Science, 107(2), 933–943. https://doi.org/10.3168/jds.2023-23279

Wagner, B. K., Cramer, M. C., Fowler, H. N., Varnell, H. L., Dietsch, A. M., Proudfoot, K. L., Shearer, J., Correa, M., & Pairis-Garcia, M. D. (2020). Determination of dairy cattle euthanasia criteria and analysis of barriers to humane euthanasia in the United States: Dairy producer surveys and focus groups. Animals, 10(5). https://doi.org/10.3390/ani10050770

Walker, L. S., & Walker, J. L. (1987). Stressors and symptoms predictive of distress in farmers. Family relations, 36(4), 374-378. https://doi.org/10.2307/584486

Walker, J.L., & Walker, L.J.S. (1988). Self-reported stress symptoms in farmers. Journal of Clinical Psychology, 44(1), 10-16.

Weary, D. M., & von Keyserlingk, M. A. G. (2023). Review: Using animal welfare to frame discussion on dairy farm technology. Animal, 17, 100836. https://doi.org/10.1016/j.animal.2023.100836

Wheeler, R., Lobley, M., McCann, J., & Phillimore, A. (2023). 'It's a lonely old world': Developing a multidimensional understanding of loneliness in farming. Sociologia Ruralis, 63(S1), 11–36. https://doi.org/10.1111/soru.12399

Wilkinson, H., Whittington, R., Perry, L., & Eames, C. (2017). Examining the relationship between burnout and empathy in healthcare professionals: A systematic review. Burnout Research, 6, 18–29. https://doi.org/10.1016/j.burn.2017.06.003

Wilson, D. J., Pempek, J. A., Roche, S. M., Creutzinger, K. C., Locke, S. R., Habing, G., Proudfoot, K. L., George, K. A., & Renaud, D. (2021). A focus group study of Ontario dairy producer perspectives on neonatal care of male and female calves. Journal of Dairy Science, 104, 6080-6095. https://doi.org/10.3168/jds.2020-19507

Wolf, C.A., Tonsor, G.T., McKendree, G.S., Thomson, D.U., & Swanson, J.C. (2016). Public and farmer perceptions of dairy cattle welfare in the United States. Journal of Dairy Science, 99, 5892-5903. http://dx.doi.org/10.3168/jds.2015-10619

Yazd, S. D., Wheeler, S. A., & Zuo, A. (2019). Key risk factors affecting farmers' mental health: A systematic review. In International Journal of Environmental Research and Public Health, 16(23). https://doi.org/10.3390/ijerph16234849

2 CHAPTER 2 | *"My heart says keep trying, my head says otherwise":* A qualitative study of dairy farmer well-being and the responsibility to care for livestock

2.1 Abstract

As society faces challenges related to food security and sustainability, the relationship between farmer well-being and animal welfare is critical to consider. Livestock farmers may face decisions that blur ethical, emotional, and economical components. Caring for livestock entangles two occupational categories associated with an increased prevalence of psychological distress: farming and animal care-related careers, where farming pertains to agriculture generally to include crop and livestock sectors, and animal care professions include veterinarians, animal health technologist, animal shelter staff, laboratory animal staff, volunteer animal caretakers, and/or trainers. Growing public concern regarding farm animal welfare has led to the development of policy and/or recommended practices to address concerns. As barriers to implementation exist, solutions may be more successful by enhancing farmer engagement throughout development, perhaps by acknowledging farmers lived experience and integrating this within scientific knowledge. Using a 'One Welfare' approach, the objective of this study was to explore dairy farmer well-being in the context of animal health and welfare. Semi-structured interviews were conducted from June to October 2023 with 30 dairy farmers in Ontario and Western Canada. The interview guide included topics such as: technology, well-being, stress, relationships and labour, and health resources. Collaborative coding and thematic analysis were conducted by 2 authors with inductive and deductive methods. Through thematic analysis, 5 main themes were generated from thematic analysis: 1) positive aspects of caring for cows; 2)

farmer-cow interdependency; 3) pressure and responsibility to care for cows; 4) the costs of caring for cows; and 5) threats to quality and provision of care. The results describe how caring for cows may be both a risk and reward to the well-being of dairy farmers, and may provide insight to future strategies to enhance sustainability by promoting dairy farmer well-being and animal welfare in a more holistic approach.

2.2 Introduction

While caring for dairy cattle is a desire and necessity for production, economic, and ethical reasons, some livestock farmers deeply care about their animals (Schuppli et al., 2023), which provides eudaimonic benefits to farmer well-being (Chapman & Deplazes-Zemp, 2023; Crimes & Enticott, 2019), such as pride (Croyle et al., 2019) and satisfaction (Vigors et al., 2023). Research has also suggested there may be concern for compassion fatigue with livestock farmers and/or farm workers (Campler et al., 2018; Denis-Robichaud et al., 2023; Edwards-Callaway et al., 2022; Wagner et al., 2020; Mullins et al., 2017; Simpson et al., 2020) and have highlighted the 'caring-killing paradox' (Román-Muñiz et al., 2021; Wagner et al., 2020). There is research surrounding the risk of occupational stress and compassion fatigue in animal care professions (e.g., veterinarians, animal health technicians, animal shelter staff and/or volunteers) (Andrukonis & Protopopova, 2020; LaFollette et al., 2020; Polachek and Wallace, 2018; Rohlf, 2018; Monaghan et al., 2020). Unsurprisingly, on-farm euthanasia of dairy cattle can be an emotional experience for caretakers (Denis-Robichaud et al., 2023; Edwards-Callaway et al., 2022; Wagner et al., 2020). Culling may be influenced by animal welfare and finances as described by a study with dairy farmers in Canada (Marshall et al., 2023) and the United States (Wagner et al., 2020).

In human caregiving professions there can be a ‘cost to caring’ (Figley, 1995, p. 1), in medicine, empathy is central to compassion (empathic concern) and personal (or empathic) distress (Harrison, 2021). As the empathy that farmers and/or farm workers have for their animals is also associated with animal welfare (Campler et al., 2018; Kielland et al., 2010; Rault et al., 2017), there may be interest into exploring the potential risk for compassion fatigue (CF) as empathy and exposure to trauma are two key elements of CF within human caregiving professions (Figley, 1995). Briefly, trauma can be summarized as the result that occurs if a stress response does not successfully alleviate an individual’s stress level and return to previously established levels (Figley, 1995, p. 28). CF may be viewed as a blend of burnout and secondary traumatic stress (STS) (Holland et al., 2022, p. 2; Monaghan et al., 2020) and can manifest as a lack of empathy towards others, notably through interactions with others, whereas STS can develop into a condition similar to post-traumatic stress disorder (Holland et al., 2022).

Over the past decade, there has been an increase in literature regarding farmer mental health. Farmers experience a myriad of stressors, which can be both episodic (e.g., machinery breakdown or yield loss) and chronic stressors (e.g., lack of control) (Thompson et al., 2023b). A survey of Canadian farmers by Jones-Bitton et al. (2020) found higher levels of perceived stress, anxiety and depression, and lower levels of resilience compared to the general population. Hagen et al. (2021) found that higher perceived stress scores in Canadian farmers were associated with the following factors: financial stress, identifying as a woman, farming pigs, and feeling as though family and/or industry support is lacking.

These findings resonate with the complexities within livestock farming where emotional, ethical, and economical challenges take place (MacKay, 2023); maintaining a high level of animal welfare is perceived as a moral obligation (Croyle et al., 2019; Enticott & Vanclay, 2011;

Marshall et al., 2023), as such, livestock farmers may experience moral stress (Thompson et al., 2023b; Wagner et al., 2020). Chronic stress from interpersonal demands related to work may lead to exhaustion, cynicism, and reduced professional efficacy, collectively constituting the syndrome of burnout (Maslach et al., 2001; Schaufeli et al., 2009). Researchers have shown an increased prevalence of burnout amongst Canadian veterinarians (Jones-Bitton et al., 2023), and, in comparison to global norms, farmers have demonstrated elevated scores for two of three components of burnout, exhaustion and cynicism (Jones-Bitton et al., 2019).

There is growing concern from the public regarding farm animal health and welfare (Alonso et al., 2020; Buddle et al., 2021; Burton et al., 2012; Mahon et al., 2023; Muhammad et al., 2022; Schuppli et al., 2023; Sirovica & von Keyserlingk, 2023; Spooner et al., 2014; Ventura et al., 2015; Ventura et al., 2016). Consequently, livestock farmers have described a perceived disconnect between consumers and farming in Australia (Buddle et al., 2021), Brazil (Albernaz-Gonçalves et al., 2021; Cardoso et al., 2018), and Canada (Schuppli et al., 2023). Some farmers may feel that their livelihood is threatened by consumers, as identified from research in Australia (Buddle et al., 2021), Brazil (Albernaz-Gonçalves et al., 2021), England and Wales (Enticott & Vanclay, 2011). Reports from Sweden have described livestock farmers being targeted by crime, specifically due to their involvement in animal agriculture (Ceccato et al., 2021; Ceccato et al., 2022). Furthermore, farming communities may experience cultural loneliness and social isolation which has consequences for well-being (Wheeler et al., 2023), and could be of concern with increased scrutiny of animal agriculture.

Nevertheless, public concern has led to policy development in some nations (Alonso et al., 2020; Balzani & Hanlon, 2020; Burton et al., 2012; Sirovica & von Keyserlingk, 2023; Spooner et al., 2014). Such recommendations often require farmers to make a financial investment for

implementation (Vanclay, 2004), as evidenced by qualitative studies with dairy farmers in Canada that report time and cost as perceived barriers to implementation of recommended milking practices (Belage et al., 2019), Johne's disease control (Roche et al., 2019), lameness (Knauss et al., 2022), antimicrobial use (Ida et al., 2023), pain mitigation for disbudding and dehorning (Saraceni et al., 2022), and cull cow management (Marshall et al., 2023). Some dairy farmers may perceive recommendations negatively (Marshall et al., 2023; Roche et al., 2019; Saraceni et al., 2022; Shock et al., 2020) and this may lead to frustration, especially if there is not consideration of farm-specific context (Ida et al., 2023; Marshall et al., 2023) as evidenced in "one size fits all" approaches (Knauss et al., 2022). One of the reasons for this may be due to the socio-cultural and relational aspects of farming, often rooted in local history (Darnhofer et al., 2016; Darnhofer et al., 2020; Soubry et al., 2020; Vanclay, 2004) which may impact one's understanding of animal welfare (Alonso et al., 2020; Balzani & Hanlon, 2020; Vigors et al., 2023).

Briefly, the 'good farmer' identity was first described by Burton (2004) how an individuals' identity as a farmer is entangled within systems that hold cultural and symbolic value within their social community, which extends beyond definitions that centre around production and economical aspects of farming. While animal welfare research may attempt to 'prescribe' recommendations for farmers and their farms (Vigors et al., 2023), being a 'good farmer' or 'good stockperson' (Burton et al., 2012) may involve aspects of animal welfare (Burton et al., 2012; Enticott & Vanclay, 2011; Vigors et al., 2023). Thus, those who develop recommendations must not assume implementation will occur solely based on what experts believe makes "logical sense" (Ida et al., 2023). Additional challenges in regards to animal welfare recommendations exist, as livestock farmers may not always be sufficiently included in related public debates – if

at all (Schuppli et al., 2023; Spooner et al., 2014). As a result, there have been calls to enhance engagement specifically within the context of animal welfare research and/or related policy, between farmers, institutions (e.g. government, research), and the general public in Australia (Buddle et al., 2021; Enticott & Vanclay, 2011), Canada (Ida et al., 2023; Spooner et al., 2014; Schuppli et al., 2023), New Zealand (Burton et al., 2012), and Scotland (Vigors et al., 2023).

Balzani & Hanlon (2020) reviewed the past three decades of literature regarding farmers views of animal welfare and found only 15% of studies approached the topic generally (e.g., farmers perceptions and attitude toward animal welfare). Embracing farmers lived experience could offer benefits (Soubry et al., 2020), as their insight could help ensure feasibility of solutions extends beyond theoretical application (Muhammad et al., 2022; Kröbel et al., 2021; Vanclay, 2004). Findings from Ritter et al. (2019) with dairy farmers in Alberta suggest that taking an approach with more farmer involvement during herd health may hold potential to increase preparedness to implement recommendations from the veterinarian. Although it could be argued that these recommendations are the duty of professionals in veterinary and/or animal welfare science, it is also reasonable to consider the value in deepening current understanding of animal welfare through the farmer lens, and the potential benefits that a collaborative approach may offer.

The ‘One Welfare’ approach is central to this study, which recognizes the interconnections between humans, animals, and the environment, particularly by acknowledging the psycho-social-economic elements that may not be within the scope of a ‘One Health’ approach (Pinillos et al., 2016; Pinillos et al., 2018). Health is only one of several factors that contributes to the overall welfare of humans and animals (Broom & Johnson, 2019); a person may be deemed healthy, although their well-being could still be suffering (Pinillos, 2018). An example of a

relevant outcome that the 'One Welfare' framework holds potential to improve is farm productivity, through recognition of the relationship between farmer well-being and animal welfare (Pinillos et al., 2016). Thus, the objective of this study was to explore dairy farmer well-being in the context of animal health and welfare.

2.3 Materials and Methods

2.3.1 Ethical considerations

This study protocol was approved by the University of Manitoba Research Ethics Board (REB # HE2023-0014). Before the interview, all participants provided informed consent, both written and verbal. To be included in the study, informed consent and consent of audio recording was required, which participants were able to revoke before the given deadline. Participants were able to withdraw their interview consent until the data de-identification deadline approximately 8 to 12 months later. Upon the deadline, all potentially identifying data were removed from interview transcripts. Participants were offered an honorarium of $20 in the form of a gift card.

2.3.2 Epistemology and Positionality

This study was conducted from a constructivist paradigm with a phenomenological approach (Creswell & Creswell, 2018). The lead author (ALH) has a combination of practical and academic knowledge in animal agriculture working with various species in commercial and research settings. In reflecting on the research, ALH believes this was an asset to the research as the ability to see the farm from both viewpoints, allowing her to gain respect from participating farmers and build rapport with them. She has first-hand experience of the challenges that come with caring for animals, from calving and processing cattle to mass culling during disease outbreaks. ALH deeply resonated with this research, as she has also lost loved ones to battles

with mental health. While these experiences allowed her to relate to participating farmers' experiences, they also came with personal challenges that forced her to grow such as coping with frequent reminders of her own trauma.

ALH previously completed courses in Psychology as electives for a Bachelor of Science in Animal Systems and has lived experience with mental health from a personal and community stance. At the beginning of her graduate studies, ALH completed a course on qualitative methodologies in Community Health Sciences, as the majority of her previous research experience took positivist approaches. With awareness that qualitative methodologies would be her new to her, ALH delved into the theoretical underpinnings and leaned on authors with extensive qualitative research experience to enhance her understanding. This experience has given ALH a deep appreciation, not only for qualitative research, but for the complexity of individual experience.

2.3.3 Recruitment

Recruitment was conducted through a network of organizations and individuals involved in the Canadian Dairy industry as part of a larger project. The recruitment material was distributed by the network via social media and email. Prospective farmers completed a screening survey which was then used to purposively sample to ensure a variety of perspectives. Qualitative researchers have conducted semi-structured interviews with individual livestock farmers regarding animal health and welfare with sample size ranging; in Canadian studies, researchers have interviewed 22 (MacKay, 2023), 29 (Saraceni et al., 2022), 20 (Spooner et al., 2014), and 22 participants (Schuppli et al., 2023). In Scotland and Switzerland, respectively, researchers have interviewed 26 (Vigors et al., 2023), and 32 farmers (Chapman & Deplazes-Zemp, 2022). Qualitative research with dairy farmers regarding technology in Norway, Canada, and the United

Kingdom, respectively, have interviewed 19 (Hansen, 2015), 11 (von Keyserlingk et al., 2024) and 20 farmers (Holloway & Bear, 2017). Based on these previous studies, a sample size of 30 was estimated to be sufficient to meet the objectives of this study while also being achievable within the existing constraints (e.g., time to interview and code transcripts within a MSc program). Saturation is a concept that is not without challenges within qualitative research, as described in detail by Braun & Clarke (2021). However, my study was conducted within a field dominated by positivist research. Thus, the sample size was re-evaluated throughout data collection to ensure data saturation was achieved, as defined in some qualitative research, once there are no new insights that come out of further data collection (Creswell & Creswell, 2018, p. 186). In total, 31 dairy farmers across Western Canada and Ontario participated, 1 interview was removed due to ethical concerns (e.g., inappropriate participant behaviour towards researchers), thus 30 interviews were included in the analysis. Participant demographics can be found in

Table 1.

2.3.4 Interviews and interview guide

A network of individuals and organizations involved in the Canadian Dairy industry helped to create a semi-structured interview guide (Appendix A), which was used by the lead author (ALH) to explore dairy farmer emotional well-being in the context of animal health and welfare. Interviews took place between June 2023 and October 2023 by the lead author (ALH). Participating farmers were asked to choose an interview location with the option of virtual (phone, Zoom, Microsoft Teams) or in-person at their farm, whichever was the most comfortable for them. The majority of participating farmers chose the virtual option (n = 28) instead of the in-person option (n=2). The interviews were an average of 78 minutes ranging from 44 to 143 mins. The interview guide used consisted of 5 topics, 2 of which will be discussed within this paper:

well-being, and animal health (Appendix A: Semi-structured interview guide). The following sections will outline each topic in detail.

2.3.4.1 Well-being questions

To ensure a consistent understanding across interviews, participating farmers were provided with the definition of well-being used in this study prior to discussing questions. Specifically, we defined as an individual's overall feeling and functioning which can fluctuate based on experiences one has (Huppert & So, 2013). When I would begin discussing well-being, I first asked: how would you describe the well-being of farmers, generally? Then, what kind of challenges may farmers face, as opposed to the general population? How do you think the sources of stress differ between livestock and crop farmers? This allowed for dialogue and establishing trust with farmers before asking about their individual well-being. After these questions, I asked questions that were more specific to the individual (e.g., how would you describe your physical and emotional well-being? What aspects of dairy farming do you find fulfilling? How do you feel when things are going well on your farm? What aspects of dairy farming do you find stressful? How do you feel when things aren't going so well on your farm? Please tell me about any of your worries you have related to your well-being. When, if at all, do you find yourself worrying about your livestock or your farm? Can you describe a time as a farmer when you experienced excessive stress?)

2.3.4.2 Animal health questions

To learn more about participating farmers experience with animal health and welfare, I asked questions about health challenges (e.g., how do you feel when/if a cow is experiencing health issues?), and asked them about hypothetical outcomes (e.g., how do you feel if the cow gets better? How do you feel when things get worse?). Additionally, I asked about treatment

decisions (e.g., please tell me about the decision-making process associated with treatment plans for animals), emotional well-being (e.g. ,how do you feel during this time/process?), and coping with animal health challenges (e.g., how do you cope during this time?). Participating farmers were also asked about culling and euthanasia (e.g. how are culling decisions made? How are euthanasia decisions made? Would you describe the feelings after euthanasia or culling differently, or similarly? Please tell me more about that.)

2.3.5 Analysis

Validity strategies were used such as reflexivity, peer debriefing, thick description of findings, and member checking (Creswell & Creswell, 2018, p. 198-202). The first author maintained a research journal throughout the research process which helped with reflexivity by providing insight to how her experiences may have influenced interpretation. Debriefing took place throughout the research process, most often between ALH and MK. A detailed description of findings was sent to participants who gave consent, allowing for member checking, participants provided positive feedback and confirmed the findings. Lastly, themes are described with a rich, thick description which aims to enhance readers understanding of each theme and the experiences associated (Creswell & Creswell, 2018, p. 198-202).

Data analysis was informed by reflexive and codebook thematic analysis (Braun & Clarke, 2022a). Analysis of data involved the following stages, which are indicated in one or both reflexive TA and codebook TA. Firstly, the researcher increased data familiarization (Braun & Clarke, 2006) by listening to the interview audio recordings and reading transcripts. The research team (ALH, AJ, BH, MK, VFC) then came together to collaborate and engage in an initial coding process to establish a preliminary codebook (King & Brooks, 2018). Next, the codebook was used to help guide analysis, as the codes were organized into categories to provide structure

to the analysis (King & Brooks, 2018). ALH conducted primary coding of the transcripts and VFC conducted secondary coding of the dataset to enhance rigor (King & Brooks, 2018). It should be noted, the reasoning for multiple coders was not to reach a consensus but offered advantages in terms of reflexivity as there may be multiple ways to interpret an excerpt of data.

Code generation continued throughout the coding process as more semantic and latent codes were noted (Braun & Clarke, 2021a) and as such, these codes were added to the codebook and left highlighted to ensure that previous transcripts were returned to so that these new codes were considered, as well. After all data were reviewed, theme development took place as informed by Braun & Clarke (2021a), followed by revision of themes to ensure the coded data fits and refined if needed (Braun & Clarke, 2006, 2021a). Finally, a definition of each theme was created and then the final analysis reported each theme within the context of other themes (Braun & Clarke, 2006).

2.3.6 A note on language

The participants in this study most often referred to themselves as "farmers," and their livestock using the term "cows" which often encompassed calves and heifers, as well. We will proceed to refer to use the same terminology throughout the remainder of this paper to preserve participants' voices.

2.4 Results

Overall, 5 main themes were generated from thematic analysis: 1) positive aspects of caring for cows; 2) farmer-cow interdependency; 3) pressure and responsibility to cows; 4) the costs of caring for cows; and 5) threats to quality and provision of care. Theme 1, compassion for cows, is a single theme intertwined within themes 2-4 which is illustrated in **Error! Reference source**

not found.. A summary of themes can be found in Table 2. Themes will be discussed in detail in the following section.

2.4.1 Positive aspects of caring for cows

Several participating farmers expressed they "love the cows" and have a "passion" for working with cows, which may positively contribute to their well-being. One participant said, "…when you work with your cows every day, then they become part of you, right?" Frequently, participating farmers shared sentiments such as, "[they're] not just doing it for a paycheck" and consistently mentioned they "want the best for them [cows]." This was not only discussed in terms of biological functioning, but in terms of behaviour and agency, as one participant said they "want cows to go be cows, do what they want to do." One participating farmer mentioned, "I love taking care of the animals and seeing them from, you know, birth all the way through is, is really cool." These sentiments highlight positive influences of intrinsic rewards on emotional well-being such as a sense of satisfaction related to caring for their cows.

There was not necessarily a specific aspect that participating farmers described when asked about fulfilment, rather many described the "little things" and some emphasized how important it was to "soak those in and appreciate them." Not only could this possibly be used as a means to cope, but it also relates to the care that participating farmers held for their animals, and to the next theme of how participating farmers' emotional well-being may relate to caretaking. One participating farmer shared, "…when you're back in the barn even on cold winter days milking cows, it's just nice to be around a barn, warm with animals, so." Another participating farmer described:

"To see a new calf born, to see it grow up, to see—see the sun come up in the morning, I really love that sunrise. To get good production out of a cow, to— I don't know— to see— the— see the barley come up in the spring. Just to live out in— in the open."

2.4.2 Farmer-cow interdependency

There appeared to be a bidirectional relationship between participating farmers and cows depending on one another. Participating farmers described how their cows depend on farmers to care for them, and farmers depend on cows for their income, while their cows may also impact farmers emotional well-being. One participating farmer shared:

"…it's [dairy farming] our income, right. But we also really, really care about these animals, right? We're not just out to, like milk them for all they're worth literally and figuratively."

2.4.2.1 Influence on farmers' emotional well-being "…for my mental health, or my well-being, I enjoy seeing healthy cows."

Cow health and welfare was described by some participating farmers to depend on the farmer's well-being, as one participant explained, "…when [they're] struggling, it's harder to manage the farm which definitely can have an impact on the cattle." Several participants shared how their emotional well-being depends on their cows' health and welfare, one participating farmer mentioned, "we have less sick cows, less lame cows. So it's just less stress." Some participants described the reward "to see cows do well" while there was also reassurance and validation for the farmer when they are able to "save" them. One participant explained:

"When they start feeling better then there's a little extra pep in your step, I guess. Makes you feel, not just that you've got a cow feeling better, which is usually a good feeling anyway but then you've got your favourite cow is now feeling better, too."

In some cases, it is "worth the extra time and energy and love and whatever else to help this cow come ahead." There are also cases where the exhaustion could be detrimental to participating farmers' well-being, as one participating farmer explained, "if we see either no improvement or she's definitely going down, then we make an end to it [by euthanasia] because you're running yourself ragged otherwise." Some participating farmers described how "it [euthanasia] can be a relief, because [they] see the animal is suffering and [they'll] see her not making progress and [they're] spending and wasting a lot of time."

Caring, as described in the previous section, appeared to be a pivotal element of farmer-cow interdependency. There may be risks and rewards associated with caring and/or caretaking, the risks associated with caring will be further discussed in 2.4.4.

2.4.2.2 Influence of animal health and welfare on financial well-being

Similar sentiments were shared by several participants relating to financial well-being, as one participating farmer described being "stretched very thin right now" in reference to the state of the economy, however, veterinary costs were "the one bill that [they] have no issue paying every month." Another participating farmer shared, "our philosophy is to do the best for the cows and know they'll pay the bills."

Cow health and welfare were frequently described by participants to directly influence production which reflects that "there's a business component to this, you know, but there's also

an animal care component to it." Several participants described the compounding effect if cows are not provided sufficient care, as one participating farmer explained:

"…your animals, your business units, if they're not well taken care of, they're not happy if they're not healthy. You're just going down a dark spiral hole. That's… yeah, you're not saving money by doing that."

Some participating farmers also discussed the influence of quality and consistency of feed on health and production, as one said, "cows are so fine tuned." Another participant explained how they "have to feed [the cows], give [the cows] the right conditions, and that's when [cows] produce." There was also pressure to "make the best feed quality" due to the influence on "production for the whole entire year." These factors could hold direct influence on financial success of the farm, and thus, the financial well-being of the farmer.

2.4.3 Pressure and responsibility to care for cows

Consistently, participating farmers mentioned the "responsibility" or "moral obligation" to their animals and the pressure of having "lives depending on [them]." Participating farmers often discussed "doing what's right for the cows." One participating farmer provided the following analogy:

"…there is hundreds, if not 1000s, of living beings, that completely and 100% depend on you, it's a lot, and it can really— yeah, it can be draining, you know, knowing that you-- it's like, it's like running an orphanage, it, you know, you've got all these mouths to feed, and they need to be cared for."

2.4.3.1 Constant and unpredictable - "…we have livestock, so our mind is always occupied with that."

The "constant" nature of caring for livestock was often mentioned. Another participating farmer explained, "there's so many things that you have to continuously think about when you raise livestock." Some were able to get away from the farm, but that sense of responsibility and worry remains because "…even if you do leave, you're stressing about your cows." Several participating farmers described that they were "basically on call all the time," as things can change instantaneously. As one participating farmer explained:

"…a calf was born and a mom lays on top of it, like you know, you have a moment that things are fantastic and the next hour something disastrous happens."

2.4.3.2 Cows take priority – "we're always talking about animals, not, well…not really talking about ourselves."

Many participating farmers tended to "prioritize [the cows'] care over [their] own, all the time." To begin their day, most participating farmers would wake up early, care for their animals, and then have breakfast. For example, one participating farmer mentioned, "I get up at 3:45AM. And then I go milk. I milk the cows. I treat all the cows. So usually, I'm inside for breakfast at 7:30AM." Another participating farmer shared, "…you structure your entire life around when you're harvesting or when you're going to have a calving bump."

A few participating farmers described "sacrifices" in their personal lives to provide care to their cows "that maybe other people don't see, or even your kids don't understand, right?" One participating farmer mentioned they "don't go very far in the evening" because they want to be near the farm, in the event of an emergency. Another participating farmer shared, "…the reality is, it could, if there's a calving and help is needed at eight at night, I mean, my son, myself, my

brother, like, one or two of us just have to leave whatever were at and go to it." This has potential to impact work-life balance and relationships, ultimately posing concern to participating farmers' emotional and social well-being.

Several participating farmers discussed both acute and chronic, physical and mental health challenges. One participating farmer shared "…you probably push yourself, and don't let yourself heal all the way either because you know that the work has to get done, right?" Another participating farmer explained:

"That's where we place all our energy, is caring about them [cows]. Rightly or wrongly. So, I don't feel worried about them. Like, I always feel like they're gonna get what they need. But then, the consequence of that, is that oftentimes, people's wives or kids or whatever, are not getting what they need."

When cow health and welfare were compromised, participating farmers' emotional well-being suffered. Oftentimes participating farmers would "push stuff down and bottle it up," and one participating farmer shared, "I felt like I had to be strong for like everybody. And I just… there was no room for me to crash." Another participant shared the experience of their neighbour:

"…he was so stressed out and mentally, just drained every day, like, he's the kind of guy that would stay up, you know, all night watching sick cows or sick calves. And it's just, […] to know that there was no other option for him than to just give up. […] It's so heartbreaking."

2.4.4 The costs of caring for cows

2.4.4.1 Worries and stress – "…livestock is stress year-round."

Cow health and welfare depends on a "whole bunch of things" which was evident as nearly every participating farmer described worries related to their cows, many of which participating farmers "don't have influence over, that we simply have to accept." Another participating farmer explained, "there's so many things that you have to continuously think about when you raise livestock." Some described worries pertaining to the domino-effect of incomplete tasks, as one participating farmer explained, "if I don't do this thing, then these 40 things are going to happen, and ultimately, then I am not going to have the money that I need to support my family, or my animal is gonna die." Some participants were able to get away from the farm, but that sense of responsibility and worry remains because "…even if you do leave, you're stressing about your cows." One participating farmer described the inability to take a break when caring for livestock and shared that "every day we walk out and we look at that [dairy farming], and we realize that stress." Another participating farmer shared, "… if we didn't make the best quality feed then I worry about how it might impact them. Things like… if I see diarrhea in our barn, always stresses me out because I'm like, you know, is that feed related? Or is that sickness going around? What's happening?"

One participating farmer explained:

"every part of dairy farming at times can be stressful— whether it's pregnancy rates, retained placentas, twisted stomachs, poor milk production, loose manure. Every – I think every aspect of dairy farming can be stressful, you just have to determine what level of stress you're going to allow that to add to your life and so, you kind of— I think you kind of try to mitigate some of the things that cause stress and put them on the back burner. And, and the major ones I

think can be extremely stressful such as the pneumonia case or the Salmonella Dublin, they've become extremely stressful. So, probably disease is one of the –disease or sickness- is probably one of the biggest ones.."

A few participating farmers shared their experiences with extreme weather through their farming career such as drought, atmospheric rivers, and hailstorms. Extreme weather can have a lasting impact, as one participating farmer mentioned, "I still think about— not often, not nearly as often as I did initially, but it's, it doesn't go away. It probably never will." Another participating farmer shared that their "big boogeyman is drought," as a result of their experience during the 1980's and explained:

*"In theory, I don't even have to go haying this year. That's because I learnt in those years from an old neighbour. He bailed hay, and he built it [hay shed]. He never had to buy hay through the 80s. He had it. People all said he was nuts, 'well, why would you build a hay shed and fill it with hay? You'll never use it.' He was ready for what was to come. And, that, that stays with you. *voice shaking*"*

2.4.4.2 Guilt & grief – "It's a feeling of failure in one way… of not being able to, you know, do more for the animals"

With both individual animal disease and disease outbreak contexts, many participating farmers describing the "feeling of failure" if they were unable to "save them." Several participating farmers shared that losing animals made them feel like they "let her down" and "didn't do my job." One participating farmer said, "I just feel like I've let her down." Another participating farmer said "…losing cows and postpartum problems, that makes you feel pretty garbage as a caregiver." Numerous participating farmers mentioned that loss after unsuccessful

intervention was “discouraging, demoralizing” and made them feel “depressed,” “upset,” or “emotional.” One participating farmer explained:

“I've worked at farms where they had lots of cows that you wonder, why are they even here? And that just puts more stress on you. Because you're dealing with those poor animals. Because you see these sick animals, or you see these animals that have chronic illness, or chronic issues. And you're like, why are they here? Because they just make you more depressed. Or make you feel like, well, you failed them. And yeah, it does. You do have that, where you feel like you failed them.”

2.4.4.3 Internal conflict – “you see that animal as a living thing, and you also see it as that as the lost revenue”

The decision to treat or euthanize an animal blurred ethical and emotional aspects for some participating farmers, caring may “cause you some stress, some anxiety because you want to, to make it better.” In reference to euthanasia decisions, one participating farmer said, “my heart says, ‘keep trying’, my head says otherwise.” Several participating farmers discussed current recommendations as very “cut and dry,” especially as “it's a difficult decision always to make, like if you simply go by the guidelines.” One participating farmer explained, “they [the guidelines] will tell you we should probably put them down sooner. But I always want to give them that chance.” The regulations they discussed often take a binary approach to situations that are arguably contextual, the tension surrounding this will be further described in 2.4.5.3.

There is also the boundary between ethical and economical was frequently mentioned by participating farmers. One participating farmer described, “you see the animals suffering and you'll see her not making progress and you're spending and wasting a lot of time.” In contrast, some participating farmers placed emphasis on ethical dimensions and described situations

where caring for animals meant that euthanasia would be the “responsible choice” to relieve the “animal’s suffering.” Numerous participating farmers mentioned, “if they're in pain, and there's absolutely nothing you can do, you have no choice” other than euthanasia. Another participating farmer explained, “I'm doing the best I can do to care for this animal, and sometimes that means putting them down.” While some participating farmers acknowledged it was “probably the hardest part of the job is to say, you know, I need to end that suffering right now.”

Participating farmers were asked about their experiences with culling and/or euthanasia, but often they would discuss these outcomes separately. Euthanasia was often described to be in “their [the cows] best interest.” There appeared to be nuance within regards to culling. One participant shared they “just hope that it [the cow] goes to a good home.” Another participant described how they coped with culling for slaughter, sharing that “an animal you've had for a long time, you kind of just have to let go.” Another participant shared: “…they're going to greener pastures, maybe, in my mind. But they’re actually going to the slaughterhouse. It's abstract, loading on the trailer, sending them to auction, maybe they don’t end up at the packing house.” One participating farmer also shared the emotional impact: “a lot of my cows are very friendly, so, like they lead – so I'm leading them onto a trailer [to go to slaughter] so that's hard, there's usually tears.” Culling cows was often influenced by economic considerations regarding performance and the amount of quota the participating farmer had available, as one participating farmer explained:

“I have too much milk, like so I have more than—I produce more than what my quota holding is. And so I have to sell cows and then to figure out which cows to sell. I think that's like right now, at this period, like probably my most stressful time because you're— you're picking

between, you know, which –which animal you want to keep and which you see the most potential in, but then you're still selling."

2.4.5 Threats to quality and provision of care

2.4.5.1 Disease – "you try your best to keep them healthy. And then shit hits the fan one day and you've got weeks where it's just sickness."

Some participants described the unpredictability of "stressful illness" and disease outbreaks because "sometimes it hits, sometimes it doesn't." When referring to a disease outbreak, a participating farmer mentioned that, "I guess it definitely affects you physically, mentally, emotionally, in all ways." One participating farmer shared, "…we had a bug in there last fall and the cows, it just kicked the snot out of them, it took them forever to recover and you never know when something like that can happen."

Disease outbreaks could take a toll on participating farmers' well-being as it can be "stressful" while "trying to figure it out, you end up treating calves, treating cows." One participating farmer mentioned "that kind of stuff, you take home at night," and another felt "extremely depressed." A participating farmer mentioned that "scours is hard on any farmer" because "sometimes it just hits too hard, too fast." When there is "nothing you can do," some participating farmers described feeling as though they "hit that mental brick wall." One participating farmer shared:

"…it's extremely tough because when it goes through that rampant, and you wonder what you've done wrong, how you can— how you can even see a light at the other side when you've got so many treated cows."

2.4.5.2 Feed sovereignty - “you got to feed the cows, but like, you can barely grow a first cut.”

Many participating farmers grew their own crops to feed their animals, but due to environmental factors, such as changing weather patterns, one participant said that “it's [farming] getting harder every year.” The difficulties with growing crops for feed contributed to “worries about having enough feed,” especially if the “weather doesn’t cooperate.” This was described to contribute to financial stress because “there's only so much feed you can buy” and “feed prices are extremely expensive.” Some participating farmers described not having control over the cost of feed, as one farmer mentioned they have to feed their animals, but they “can’t go from name brand to no name to save some money.” This financial and ethical stress may compound due to the “domino effect” of feed shortages, as one participating farmer explained:

“Our crops get hail, we don't have feed to feed our cows that have to milk and make money and grow babies and do all those things, right.”

2.4.5.3 Sociopolitical influences

Most participating farmers shared a wide variety of “pressures from government, there's pressure from consumers, there's even pressure from like, neighbours.” Frequently, participating farmers discussed regulatory pressures. One participating farmer shared: “there's just more and more paperwork. They [producer organization] say it's to add value, but it doesn't go to the consumer. The consumer has no clue I do workbooks and crap.” The “disconnect” from institutions and dissatisfaction with new regulations was often noted by participants. For example, one participant mentioned “somebody in an office in Toronto thinks that this should be a new rule, which for 90% of the farmers or 98% of the farmers make no sense at all.” Ultimately, the “new rules” that participating farmers “have to abide by” may result in a

perceived loss of autonomy, as some participating farmers mentioned they “don’t have a choice.” Some participants directly related this to their emotional well-being, as one participating farmer mentioned: “applying for government grants is a ridiculously intense process that has caused so many tears and so many headaches.”

Some participants drew attention to perceived power struggles, which were related to various institutions or systems such as provincial dairy boards, the quota system, proAction, and government. As one participating farmer shared: “…if you piss them [the milk inspector] off, they have the power […] So, as a farmer, you […] had to adopt the policy, like be quiet and, and comply.” One participating farmer experienced stress in relation to a government warning that the “water for our cattle and stuff can be shut off” due to “very low water flows in our watershed through the summertime” which is a result of “trying to protect […] the salmon.” One participating farmer brought to light how the existing penalty system for herds with high somatic cell counts could be detrimental to emotional and financial well-being:

“So, you put a $15/hectoliter penalty on this guy, and it'll go up to 25. So, the guy’s in a hole. And instead of bringing him a ladder to get out of the hole, we just dug 10 feet deeper, and all looked in and said, "So, how's it going now? Can you get out yet?”

Although policy must exist to protect animal health and welfare, but there may be issues with the current system as one participating farmer shared: “I think it's kind of a joke that we have all these rules, but like, I know of a farm up the road from me that probably shouldn't pass and always does.” Another participating farmer mentioned, “…you can bullshit your way through a lot of it [the proAction requirements].” One participating farmer connected organizations to emotional well-being and explained:

"...part of why people struggle with mental health is because they're not heard. And when the politicians and when the large organizations, farm organizations included, are more worried about the political standing with the politicians than what the grassroots people are telling them, I think that will remain a barrier."

Several participating farmers mentioned "the feeling from the general public about farmers is something that really eats away at a farmer, as well." One participating farmer explained further, "farmers want to do good and try our best for animals and stuff, sometimes I feel like, it's like you're looked down upon." This also may impact help-seeking, as another participating farmer explained:

"Farmers are so scared to talk to anybody just because they're going to be judged. They're going to be judged with a perspective that doesn't give them grace for doing what they do."

Several participating farmers had been personally "targeted" by animal activist groups and numerous participants knew of others who had been. A few participants described a sense of "intrusion" or "invasion." Numerous participants described fear surrounding animal activism, one participant had "a constant worry that somebody comes onto this yard" and another participant shared that it "scares the shit out of me." There was one affected participant who described "feeling like you had been attacked by them personally." This was described by another participating farmer, as an activist group was planning to target a farm nearby, the participating farmer worried that the group was going to "invade or come onto our property and like wanting to hurt us or like, let our cows out, or steal things from us, or Lord knows what else." One participating farmer mentioned that "I don't want them [animal activists] to know that I exist" and another said, "you're always on edge, too. You don't know who you can trust or not."

2.5 Discussion

The objective of this study was to explore dairy farmer well-being in the context of animal health and welfare. These findings can provide insight to help guide future efforts to better support farmer well-being and farm animal welfare holistically using the One Welfare framework. The themes generated in this study illustrate a relationship between farmers, their animals, and their farm. This complex relationship may involve economic and ethical considerations, external influences, and emotional elements such as caring.

2.5.1 Caring for dairy cattle

The care, connection, and concern that participating farmers had for their animals, and the way it influences their emotional, physical, social, and financial well-being was a key finding of this study. Empathy, the root of compassion, relates to compassion and personal distress for individuals in human caring professions (Harrison, 2021). Although we cannot assume participating farmers were describing empathy, the emotional aspects of caring for animals was evident with all participants. The salient piece being that caring for animals, may be both a risk and reward for dairy farmer well-being. Other studies have described associations between animal welfare and empathy of farmers and/or farmworkers (Campler et al., 2018; Kielland et al., 2010; Rault et al., 2017) which is of particular relevance to our findings.

The rewarding aspects of dairy farming in terms of emotional and/or financial well-being align with qualitative research with livestock farmers in Canada (Schuppli et al., 2023) and Switzerland (Chapman & Deplazes-Zemp, 2023), as well as mixed methods research in New Zealand (Crimes & Enticott, 2019). Chapman & Deplazes-Zemp (2023) conducted a study in Switzerland with farmers, participants described ‘relational’ (e.g., farmer-cow) or context-specific values, which had both intrinsic and instrumental elements; intrinsic elements included

the farmer-animal relationship, and respect and care for their animals, while instrumental elements involved the positive influences on farmer well-being such as the emotional reward of working with their animals, as well as the economic reward. Findings from a study with Canadian dairy farmers by Schuppli et al. (2023) described various aspects of animal welfare, and the identity of being a dairy farmer. A study in New Zealand by Crimes & Enticott (2019) with dairy and beef farmers highlighted the positive influence that the farmer-animal relationship and satisfaction from their work had on farmer well-being.

2.5.2 Risks and rewards related to caring for, and depending on, dairy cattle

Prioritizing animal health and welfare by caring for their animals was both a risk and reward to participating farmers emotional, physical, social, and/or financial well-being. Our study contributes added context to findings by Jones-Bitton et al. (2019) reporting elevated scores in 2 of 3 components of burnout in Canadian farmers. Participants here would prioritize the health of their animals over their own well-being during animal health challenges which included individual animal illness, disease outbreaks, flooding, stray voltage, and water quality issues. It is reasonable to consider that, when farmers place their animals' needs above their own, they may be at risk of developing occupational stress conditions which may lead well-being to suffer.

We asked participants about a hypothetical situation they might face such as a cow with a non-infectious illness. There can be two outcomes at the cow-level; the cow improves or worsens. For the farmer themselves, numerous participants reported their emotional well-being being positively influenced through a sense of gratification, but the cow may have also improved as a result of the farmer prioritizing the cow's health while compromising their own emotional, physical, and social well-being. Moreover, there must be consideration to the cost of treatment and the economic implications for the farm. Although, there are positive impacts such as the

sense of gratification when farmers could help their animals, the potential implications to physical, emotional, social, and financial well-being must be considered.

Our findings align with current literature that describes the perceived moral obligation to ensure high standards of animal welfare (Cobo-Angel et al., 2021; Croyle et al., 2019; Schuppli et al., 2023). Similarly, researchers have shown that farm animal veterinarians experience moral challenges (Dürnburger, 2020). While we recognize this is still a great challenge for the veterinary community, many farmers do not have the opportunity to shut off "farm mode" as they provide direct care to their own animals, rather than providing care to clients' animals. The ability to disengage or detach from occupational stressors can contribute to compassion fatigue resilience and buffer against compassion fatigue in human caregiving professions (Ludick & Figley, 2017).

The guilt described in the current study by participating farmers "feeling like a failure" in the event of an unsuccessful intervention resulting in death or euthanasia aligns with findings reported in the US, both in dairy producers (Wagner et al., 2020) and swine caretakers (Mullins et al., 2017). This also relates to moral stress, described briefly in a qualitative study of farmers in Canada, specifically surrounding animal disease and loss (Thompson et al., 2023b). A survey of dairy farmers in Canada by Denis-Robichaud et al. (2023) found that half of the participants reported that the individual who performs euthanasia on-farm has discomfort and/or anxiety surrounding it. A review by Scotney et al. (2015) consistently found animal care professionals were at risk of trauma exposure due to occupational demands which can have deleterious effects on an individual's well-being. Having to perform euthanasia, or even being exposed to euthanasia, can put animal shelter and laboratory staff at a greater risk of burnout and compassion fatigue, termed 'The Caring-Killing Paradox' (Andrukonis & Protopopova, 2020;

LaFollette et al., 2020). However, the literature exploring animal care professionals often fails to include livestock farmers. Some studies have explored farmers' attitudes and perceptions regarding euthanasia, but farmers do more than euthanize their animals, they also care for them. Poor mental health and high stress pose a risk to animal welfare, productivity, financial consequences, and may culminate in farm attrition (Jones et al., 2024). To our knowledge, this study is one of, if not, the first study in Canada to highlight both the risks and rewards that come with caring for livestock from the lived experience of dairy farmers.

2.5.3 Threats to the quality of care for dairy cattle

Three key threats to the quality and provision of care were highlighted: feed sovereignty, disease, and sociopolitical influences. Thompson et al. (2023b) conducted a mixed method analysis of farming stressors in Canada and articulated how the context of stressors is an important consideration; an episodic stressor can be a tipping point for farmers as they face one chronic stressor, a lack of control. As such, the compounding effect of stressors illustrated in our study is of concern. If a farmer does not produce enough crop yield to feed their animals, they will need to purchase feed – now, consideration must be given to the contextual nature of environmental challenges. A crop failure as a result of drought has potential to also affect the surrounding area which may result in more farmers in need of purchasing feed, feed shortages, and an increased cost of feed. Reduced feed quality and/or quantity can also threaten a farmer's perceived moral obligation, possibly leading to moral stress. Similarly, disease can impact an entire herd, leaving the farmer to cope with the emotional and financial implications.

Participating farmers in our study mentioned regulatory pressures and frustrations with public perceptions which is consistent with other interviews with Canadian farmers (Thompson et al., 2023b). Dairy farmers in Canada value autonomy (Ida et al., 2023; Schuppli et al., 2023)

while an increasing number of regulations can hold implications for farmers' autonomy (Stock & Forney, 2014). The 'good farmer' identity (Burton, 2004) has been further described in qualitative research with livestock farmers, with findings illustrating how animal welfare may influence the 'good farmer' identity in Scotland (Vigors et al., 2023), Australia (Enticott & Vanclay, 2011), and the 'good stockperson' in New Zealand (Burton et al., 2012). These studies further highlight the need to consider the impact of sociopolitical factors such as regulations on farmers, which is in alignment with our findings. A review by Balzani & Hanlon (2020) regarding farmers views on animal welfare highlights the need for more farmer involvement during policy development, as well as more education for consumers about animal care on farms. Our study only scraped the surface in further understanding the influence that existing power structures (government, producer organizations, academia) may have on farmers in relation to animal care. More work is needed for a comprehensive understanding; however, there appears to be room for improvement to communication, and current policies to ensure farmers are adequately considered.

2.6 Strengths and limitations

Strengths of this study include the participation of men and women from provinces across Ontario and Western Canada, spanning a broad age range. Participants represented both tie stall and free stall housing systems, and conventional and robotic milking systems. Limitations include conducting interviews in English only, not including Quebec or Atlantic Canada, not collecting ethnicity data to determine degree of representation, and there was no representation from individuals who identify as 2SLGBTQIA+. We know there is a higher proportion of tie-stall barns in Quebec and Ontario than in Western Canada, as well as more smaller farms in Quebec and Atlantic Canada (Statistics Canada, 2023). It is quite possible that if more

participants were involved from Quebec and the Atlantic region, there may be a greater emphasis on other aspects of well-being such as physical (e.g., demanding physical labour with tie stall systems) and/or financial well-being (lack of scale to spread out costs). Further, the lack of representation from ethnic groups and individuals who identify as 2SLGBTQIA+ is regrettable, as incorporating diverse perspectives may bring different topics to light and offer further insight.

An additional limitation was that our interview guide initially asked about euthanasia and culling together but evolved to ask these questions separately to better understand farmers experience and the influence on their emotional well-being; from additional conversations with producers after interviews were conducted, it may be the culling decisions are even more difficult because they are even more complex and there is extra time to mull over the decision. Due to the qualitative nature of this study, these findings cannot infer temporality of association nor extrapolate to a wider population, however, the results may provide insights into dairy farmer well-being in the context of animal health and welfare.

2.7 Conclusion

This study begins to fill a gap in the farmer mental health literature: caring for livestock. Caring for livestock has an intricate role within animal agriculture, and the well-being of dairy farmers. Our results suggest that caring for their animals may play an integral role in dairy farmer emotional, physical, social, and financial well-being. Participating farmers described care for their animals which ultimately may be a risk and reward to their well-being. Further, participating farmers are facing compounding stressors – unpredictable weather impacting feed sovereignty and the looming threat of disease transmission while also navigating a system where power structures may exist. At both the farmer and cow level, it may be that care is at the heart of supporting future sustainability of the dairy industry.

Table 1. Demographic variables of participants (n=30)

	Variable	n	%
Province	Ontario	13	43.3
	Manitoba	4	13.3
	Saskatchewan	2	6.67
	Alberta	4	13.3
	British Columbia	7	23.3
Age	18-34	10	33.3
	35-44	12	40.0
	45+	8	26.7
Milking system	Conventional	19	63.3
	Robot	11	36.7
Housing type	Tie stall	8	26.7
	Free stall	22	73.3
Gender	Man	18	60.0
	Woman	12	40.0

Table 2. Themes and sub-themes generated through thematic analysis of dairy farmer well-being in the context of animal health and welfare.

Main Themes	**Sub-themes**
1. Positive aspects of caring for cows	Gratitude Satisfaction
2. Farmer-cow interdependency	Emotional well-being Financial well-being
3. Pressure and responsibility to care for cows	Constant & unpredictable Cows take priority
4. The costs of caring for cows	Worries & stress Guilt & grief Internal conflict
5. Threats to quality and provision of care	Disease Feed sovereignty Sociopolitical influences

2.8 References

Albernaz-Gonçalves, R., Olmos, G., & Hötzel, M. J. (2021). My pigs are ok, why change? – animal welfare accounts of pig farmers. Animal, 15(3), 100154. https://doi.org/10.1016/j.animal.2020.100154

Alonso, M.E., González-Montaña, J.R., & Lomillos, J.M. (2020). Consumers' concerns and perceptions of farm animal welfare. Animals, 10, 385. https://doi.org/10.3390/ani10030385

Andrukonis, A., & Protopopova, A. (2020). Occupational Health of Animal Shelter Employees by Live Release Rate, Shelter Type, and Euthanasia-Related Decision. Anthrozoos, 33(1), 119–131. https://doi.org/10.1080/08927936.2020.1694316

Balzani, A., & Hanlon, A. (2020). Factors that influence farmers' views on farm animal welfare: A semi-systematic review and thematic analysis. Animals, 10(9), 1–25. https://doi.org/10.3390/ani10091524

Belage, E., Croyle, S. L., Jones-Bitton, A., Dufour, S., & Kelton, D. F. (2019). A qualitative study of Ontario dairy farmer attitudes and perceptions toward implementing recommended milking practices. Journal of Dairy Science, 102(10), 9548-9557. https://doi.org/10.3168/jds.2018-15677

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. Qualitative Research in Psychology, 3(2), 77–101. https://doi.org/10.1191/1478088706qp063oa

Braun, V., & Clarke, V. (2021). One size fits all? What counts as quality practice in (reflexive) thematic analysis? Qualitative Research in Psychology, 18(3), 328–352. https://doi.org/10.1080/14780887.2020.1769238

Braun, V., & Clarke, V. (2022a). Conceptual and design thinking for thematic analysis. Qualitative Psychology, 9(1), 3–26. https://doi.org/10.1037/qup0000196

Braun, V., & Clarke, V. (2022b). Thematic Analysis: A Practical Guide. SAGE.

Broom, D. M., & Johnson, K. G. (2019). One Welfare, One Health, One Stress: Humans and other animals. In Stress and Animal Welfare, 2nd ed., 1–13. https://doi.org/https://doi.org/10.1007/978-3-030-32153-6

Buddle, E. A., Bray, H. J., & Ankeny, R.A. (2021). "Of course we care!": A qualitative exploration of Australian livestock producers' understandings of farm animal welfare issues. Journal of Rural Studies, 83, 50-59. https://doi.org/10.1016/j.jrurstud.2021.02.024

Burton, R. J. F. (2004). Seeing through the "good farmer's" eyes: Towards developing an understanding of the social symbolic value of "productivist" behaviour. Sociologia Ruralis, 44(2), 195–215. https://doi.org/10.1111/j.1467-9523.2004.00270.x

Burton, R. J. F., Peoples, S., & Cooper, M. H. (2012). Building "cowshed cultures": A cultural perspective on the promotion of stockmanship and animal welfare on dairy farms. Journal of Rural Studies, 28(2), 174–187. https://doi.org/10.1016/j.jrurstud.2011.12.003

Campler, M. R., Pairis-Garcia, M. D., Rault, J-L., Coleman, G., & Arruda, A.G. (2018). Caretaker attitudes toward swine euthanasia. Translational Animal Science, 2, 254-262. https://doi.org/10.1093/tas/txy015

Cardoso, C.S., von Keyserlingk, M.A.G., & Hötzel, M.J. (2019). Views of dairy farmers, agricultural advisors, and lay citizens on the ideal dairy farm. Journal of Dairy Science, 102, 1811-1821. https://doi.org/10.3168/jds.2018-14688

Ceccato, V., Lundqvist, P., Abraham, J., Göransson, E., & Svennefelt, C. A. (2021). The nature of fear among farmers working with animal production. International Criminology, 1, 193-207. https://doi.org/10.1007/s43576-021-00024-z

Ceccato, V., Lundqvist, P., Abraham, J., Göransson, E., & Svennefelt, C. A. (2022). Farmers, victimization, and animal rights activism in Sweden. Professional Geographer, 74(2), 350–363. https://doi.org/10.1080/00330124.2021.2004899

Chapman, M., & Deplazes-Zemp, A. (2023). 'I owe it to the animals': The bidirectionality of Swiss alpine farmers' relational values. People and Nature, 5(1), 147–161. https://doi.org/10.1002/pan3.10415

Cobo-Angel, C., LeBlanc, S. J., Roche, S. M., & Ritter, C. (2021). A focus group study of Canadian dairy farmers' attitudes and social referents on antimicrobial use and antimicrobial resistance. Frontiers in Veterinary Science, 8. https://doi.org/10.3389/fvets.2021.645221

Creswell, J. W., & Creswell, J. D. (2018). Research design: Qualitative, quantitative, and mixed methods approaches, 5th ed. SAGE.

Crimes, D., & Enticott, G. (2019). Assessing the social and psychological impacts of endemic animal disease amongst farmers. Frontiers in Veterinary Science, 6. https://doi.org/10.3389/fvets.2019.00342

Croyle, S. L., Belage, E., Khosa, D. K., LeBlanc, S. J., Haley, D. B., & Kelton, D. F. (2019). Dairy farmers' expectations and receptivity regarding animal welfare advice: A focus group study. Journal of Dairy Science, 102(8), 7385–7397. https://doi.org/10.3168/jds.2018-15821

Darnhofer, I., Lamine, C., Strauss, A., & Navarrete, M. (2016). The resilience of family farms: Towards a relational approach. Journal of Rural Studies, 44, 111–122. https://doi.org/10.1016/j.jrurstud.2016.01.013

Darnhofer, I. (2020). Farming from a process-relational perspective: Making openings for change visible. Sociologia Ruralis, 60(2), 505-528. https://doi.org/10.1111/soru.12294

Denis-Robichaud, J., Rousseau, M., Denicourt, M., Villettaz-Robichaud, M., Lamothe, A. M., & DesCôteaux, L. (2023). Methods used by Canadian dairy farmers for on-farm euthanasia and the emotions associated with the decision and the practice of euthanasia. Journal of Dairy Science, 106(2), 1301–1314. https://doi.org/10.3168/jds.2022-21986

Dürnberger, C. (2020). Am I actually a veterinarian or an economist? Understanding the moral challenges for farm veterinarians in Germany on the basis of a qualitative online survey. Research in Veterinary Science, 133, 246–250. https://doi.org/10.1016/j.rvsc.2020.09.029

Edwards-Callaway, L., Simpson, H., Román-Muñiz, N., Cramer, C., Mijares, S., Stallones, L., Rivera-Gonzalez, J., & Aberle, J. (2022). Preliminary Exploration of weekly peer group discussions as a strategy for coping with feelings associated with euthanasia in dairy caretakers. International Journal of Environmental Research and Public Health, 19(4), 2177. https://doi.org/10.3390/ijerph19042177

Enticott, G., & Vanclay, F. (2011). Scripts, animal health and biosecurity: The moral accountability of farmers' talk about animal health risks. Health, Risk and Society, 13(4), 293–309. https://doi.org/10.1080/13698575.2011.575456

Figley, C. R. (1995). Compassion Fatigue as Secondary Traumatic Stress Disorder: An Overview. In C. R. Figley (Ed.), Compassion fatigue: Coping with secondary traumatic stress disorder in those who treat the traumatized (pp. 1–20). Routledge.

Hansen, B. G. (2015). Robotic milking-farmer experiences and adoption rate in Jæren, Norway. Journal of Rural Studies, 41, 109–117. https://doi.org/10.1016/j.jrurstud.2015.08.004

Harrison, K. (2021). Compassion fatigue: Understanding empathy. Veterinary Clinics of North America – Small Animal Practice, 51(5), 1041–1051. https://doi.org/10.1016/j.cvsm.2021.04.020

Holland, M. L., Brock, S. E., Oren, T., & van Eckhardt, M. (2022). Burnout and trauma related employment stress. Springer Nature Switzerland AG. https://doi.org/10.1007/978-3-030-83492-0_1

Huppert, F. A., & So, T. T. C. (2013). Flourishing across Europe: Application of a new conceptual framework for defining well-being. Social Indicators Research, 110(3), 837–861. https://doi.org/10.1007/s11205-011-9966-7

Ida, J. A., Wilson, W. M., Nydam, D. V., Gerlach, S. C., Kastelic, J. P., Russell, E. R., McCubbin, K. D., Adams, C. L., & Barkema, H. W. (2023). Contextualized understandings of dairy farmers' perspectives on antimicrobial use and regulation in Alberta, Canada. Journal of Dairy Science, 106(1), 547–564. https://doi.org/10.3168/jds.2021-21521

Jones, A. Q., Sawatzky, A., Thompson, R., & Hagen, B. N. M. (2024). Poor mental health negatively impacts farmers personally, interpersonally, cognitively, and professionally. FACETS, 9, 1–16. https://doi.org/10.1139/facets-2023-0230

Jones-Bitton, A., Hagen, B., Fleming, S. J., & Hoy, S. (2019). Farmer burnout in Canada. International Journal of Environmental Research and Public Health, 16(24). https://doi.org/10.3390/ijerph16245074

Jones-Bitton, A., Gillis, D., Peterson, M., & McKee, H. (2023). Latent burnout profiles of veterinarians in Canada: Findings from a cross-sectional study. Veterinary Record, 192(2). https://doi.org/10.1002/vetr.2281

Kielland, C., Skjerve, E., Østerås, O., & Zanella, A. J. (2010). Dairy farmer attitudes and empathy toward animals are associated with animal welfare indicators. Journal of Dairy Science, 93(7), 2998–3006. https://doi.org/10.3168/jds.2009-2899

King, N., & Brooks, J. M. (2018). Doing template analysis: A guide to the main components and procedures. In Template analysis for business and management students. SAGE Publications Ltd. https://doi.org/10.4135/9781473983304

Knauss, M., Adams, C. L., & Orsel, K. (2022). Producer perceptions toward prevention and control of lameness in dairy cows in Alberta Canada: A thematic analysis. Frontiers in Veterinary Science, 9. https://doi.org/10.3389/fvets.2022.812710

Kröbel, R., Stephens, E. C., Gorzelak, M. A., Thivierge, M-N., Akhter, F., Nyiraneza, J., Singer, S. D., Geddes, C. M., Glenn, A. J., Devillers, N., Alemu, A. W., St. Luce, M., & Giardetti, D. (2021). Making farming more sustainable by helping farmers to decide rather than

telling them what to do. Environmental Research Letters, 16, 055033. https://doi.org/10.1088/1748-9326/abef30

LaFollette, M. R., Riley, M. C., Cloutier, S., Brady, C. M., O'Haire, M. E., & Gaskill, B. N. (2020). Laboratory animal welfare meets human welfare: A cross-sectional study of professional quality of life, including compassion fatigue in laboratory animal personnel. Frontiers in Veterinary Science, 7. https://doi.org/10.3389/fvets.2020.00114

Larue, B., Singbo, A., & Pouliot, S. (2017). Production rigidity, input lumpiness, efficiency, and the technological hurdle of Quebec dairy farms. Canadian Journal of Agricultural Economics, 65(4), 613–641. https://doi.org/10.1111/cjag.12156

Ludick, M., & Figley, C. R. (2017). Toward a mechanism for secondary trauma induction and reduction: Reimagining a theory of secondary traumatic stress. Traumatology, 23(1), 112–123. https://doi.org/10.1037/trm0000096

MacKay, C. (2023). A necessary evil? Examining the complexities of care and commodification. Environment and Planning E: Nature and Space, 6(3), 1725–1744. https://doi.org/10.1177/25148486221132227

Mahon, N., Holloway, L., Clark, B., & Proctor, A. (2023). The application of a sentiment analysis approach to explore public understandings of animal agriculture. Journal of Rural Studies, 103. https://doi.org/10.1016/j.jrurstud.2023.103127

Marshall, J., Haley, D. B., Kelton, D., Miltenburg, C., Roche, S., & Duffield, T. (2023). A focus group study exploring dairy farmers' perspectives of cull cow management in Ontario, Canada. Frontiers in Veterinary Science, 10. https://doi.org/10.3389/fvets.2023.1189668

Maslach, C., Schaufeli, Wilmar. B., & Leiter, Michael. P. (2001). Job burnout. Annual Review of Psychology, 52, 397–422.

Monaghan, H., Rohlf, V., Scotney, R., & Bennett, P. (2020). Compassion fatigue in people who care for animals: An investigation of risk and protective factors. Traumatology. https://doi.org/10.1037/trm0000246

Muhammad, M., Stokes, J. E., Morgans, L., & Manning, L. (2022). The social construction of narratives and arguments in animal welfare discourse and debate. Animals, 12(19). https://doi.org/10.3390/ani12192582

Mullins, C. R., Pairis-Garcia, M. D., George, K. A., Anthony, R., Johnson, A. K., Coleman, G. J., Rault, J. L., & Millman, S. T. (2017). Determination of swine euthanasia criteria and analysis of barriers to euthanasia in the United States using expert opinion. Animal Welfare, 26(4), 449–459. https://doi.org/10.7120/09627286.26.4.449

Pinillos, R. G., Appleby, M., Manteca, X., Scott-Park, F., Smith, C., & Velarde, A. (2016). One Welfare – a platform for improving human and animal welfare. Veterinary Record, 179(16), 412-413. https://doi.org/10.1136/vr.i5470

Pinillos, R. G. (2018). The path to developing a One Welfare framework. In One Welfare: A Framework to Improve Animal Welfare and Human Welfare, 1–15. CABI.

Rault, J.-L., Holyoake, T., & Coleman, G. (2017). Stockperson attitudes toward pig euthanasia. Journal of Animal Science, 95, 949-957. https://doi.org/10.2527/jas2016.0922

Ritter, C., Adams, C. L., Kelton, D. F., & Barkema, H. W. (2019). Factors associated with dairy farmers' satisfaction and preparedness to adopt recommendations after veterinary herd health visits. Journal of Dairy Science, 102(5), 4280–4293. https://doi.org/10.3168/jds.2018-15825

Roche, S. M., Kelton, D. F., Meehan, M., Von Massow, M., & Jones-Bitton, A. (2019). Exploring dairy producer and veterinarian perceptions of barriers and motivators to adopting on-farm management practices for Johne's disease control in Ontario, Canada. Journal of Dairy Science, 102, 4476-4488. https://doi.org/10.3168/jds.2018-15944

Rohlf, V. I. (2018). Interventions for occupational stress and compassion fatigue in animal care professionals – a systematic review. Traumatology, 24(3), 186-192. https://doi.org/10.1037/trm0000144

Román-Muñiz, I. N., Cramer, M. C., Edwards-Callaway, L. N., Stallones, L., Kim, E., Thompson, S., Simpson, H., & Mijares, S. (2021). Dairy caretaker perspectives on performing euthanasia as an essential component of their job. Animals, 11, 289. https://doi.org/10.3390/ani11020289

Saraceni, J., Renaud, D. L., Nelson, E., Van Os, J. M. C., Miltenburg, C., & Winder, C. B. (2022). Ontario dairy producers' perceived barriers and motivations to the use of pain control for disbudding and dehorning calves: A qualitative study. Animals, 12(8). https://doi.org/10.3390/ani12080973

Schaufeli, W. B., Leiter, M. P., & Maslach, C. (2009). Burnout: 35 years of research and practice. Career Development International, 14(3), 204–220. https://doi.org/10.1108/13620430910966406

Schuppli, C. A., Spooner, J. M., & von Keyserlingk, M. A. G. (2023). Canadian dairy farmer views about animal welfare. Animal Welfare, 32, e38. https://doi.org/10.1017/awf.2023.32

Scotney, R. L., McLaughlin, D., & Keates, H. L. (2015). A systematic review of the effects of euthanasia and occupational stress in personnel working with animals in animal shelters, veterinary clinics, and biomedical research facilities. Journal of the American Veterinary Medical Association, 247(10), 1121-1130. https://doi.org/10.2460/javma.247.10.1121

Shock, D. A., Coe, J. B., LeBlanc, S. J., Leslie, K. E., Renaud, D., Roche, S., Hand, K., Godkin, M. A., & Kelton, D. F. (2020). Characterizing the attitudes and motivations of Ontario dairy producers toward udder health. Journal of Dairy Science, 103(5), 4618–4632. https://doi.org/10.3168/jds.2019-16621

Simpson, H., Edwards-Callaway, L. N., Cramer, M. C., Roman-Muniz, I. N., Stallones, L., Thompson, S., Ennis, S., Kim, E., & Pairis-Garcia, M. (2020). Preliminary study exploring caretaker perspectives of euthanasia on swine operations. Animals, 10, 2296. https://doi.org/10.3390/ani10122296

Sirovica, L. V., & Keyserlingk, M. A. G. von. (2023). Public perceptions of farm animal welfare. In The Routledge International Handbook of Human-Animal Interactions and Anthrozoology, 644–657. Routledge. https://doi.org/10.4324/9781032153346-44

Spooner, J. M., Schuppli, C. A., & Fraser, D. (2014). Attitudes of Canadian pig producers toward animal welfare. Journal of Agricultural & Environmental Ethics, 27, 569-589. https://doi.org/10.1007/s10806-013-9477-4

Statistics Canada. (2023). Dairy barns by type. . Accessed 17 March 2025.

Stock, P. V., & Forney, J. (2014). Farmer autonomy and the farming self. Journal of Rural Studies, 36, 160–171. https://doi.org/10.1016/j.jrurstud.2014.07.004

Thompson, R., Hagen, B.N.M., & Jones-Bitton, A. (2023a). Tractors, talk, mindset, mantras, detachment, and distraction: A mixed-methods investigation of coping strategies used by farmers in Canada. Sustainability, 15, 8566. https://doi.org/10.3390/su15118566

Thompson, R., Hagen, B. N. M., Lumley, M. N., Winder, C. B., Gohar, B., & Jones-Bitton, A. (2023b). "An incredible amount of stress before you even put a shovel in the ground": A mixed methods analysis of farming stressors in Canada. Sustainability, 15(8). https://doi.org/10.3390/su15086336

Vanclay, F. (2004). Social principles for agricultural extension to assist in the promotion of natural resource management. Australian Journal of Experimental Agriculture, 44(3), 213–222. https://doi.org/10.1071/EA02139

Ventura, B. A., von Keyserlingk, M. A. G., & Weary, D. M. (2015). Animal welfare concerns and values of stakeholders within the dairy industry. Journal of Agricultural and Environmental Ethics, 28, 109–126. https://doi.org/10.1007/s10806-014-9523-x

Ventura, B.A., von Keyserlingk, M.A.G., Wittman, H., & Weary, D.M. (2016). What difference does a visit make? Changes in animal welfare perceptions after interested citizens tour a dairy farm. PloS ONE, 11(5), e0154733. https://doi.org/10.1371/journal.pone.0154733

Vigors, B., Wemelsfelder, F., & Lawrence, A. B. (2023). What symbolises a "good farmer" when it comes to farm animal welfare? Journal of Rural Studies, 98, 159–170. https://doi.org/10.1016/j.jrurstud.2023.01.009

Wagner, B. K., Cramer, M. C., Fowler, H. N., Varnell, H. L., Dietsch, A. M., Proudfoot, K. L., Shearer, J., Correa, M., & Pairis-Garcia, M. D. (2020). Determination of dairy cattle euthanasia criteria and analysis of barriers to humane euthanasia in the United States: Dairy producer surveys and focus groups. Animals, 10(5). https://doi.org/10.3390/ani10050770

Wheeler, R., Lobley, M., McCann, J., & Phillimore, A. (2023). 'It's a lonely old world': Developing a multidimensional understanding of loneliness in farming. Sociologia Ruralis, 63(S1), 11–36. https://doi.org/10.1111/soru.12399

3 CHAPTER 3 | Efficiency as a *"double-edged sword"*: A qualitative study of dairy farmer well-being in the context of on-farm technology

3.1 Abstract

The use of technology on-farm continues to increase as animal welfare and sustainability are of growing concern to the general public. Dairy farmers are also intrigued by the benefits technology has to offer, from cow-level benefits to better work-life balance and enhancing the well-being of farmers. However, there may also be negative aspects of technology. The farmer-cow relationship becomes the farmer-cow-technology relationship, and the influence of this change is highly dependent on the farmer and their farm. The objective of this study was to explore dairy farmer well-being in the context of technology. Semi-structured interviews were conducted with 30 dairy farmers in Ontario and Western Canada using an interview guide from June to October 2023. Collaborative coding and thematic analysis were conducted by 2 authors with inductive and deductive methods. Through thematic analysis, 3 main themes were identified: 1) benefits for cows; 2) no two farms or farmers are identical; and 3) pressures "pushing everybody toward robots". These findings provide more context to farmers lived experience with technology, offering insights as to how we can better support farmers.

3.2 Introduction

The benefits technology offers to farmer well-being have been quantitatively demonstrated to include lower stress, anxiety, depression, and higher resilience (King et al., 2021), increased job satisfaction (Hansen & Stræte, 2020), reduced physical labor, more flexibility to their day-to-day schedule (Butler et al., 2012; Finstad et al., 2021; Lunner-Kolstrup et al., 2018; Tse et al., 2018;

von Keyserlingk et al., 2024). However, there are also negative aspects that may lead well-being to suffer; dairy farmers who have shifted from conventional milking systems (CMS) to automated milking systems (AMS) have reported stress and/or frustration from alarms (Finstad et al., 2021; Lundström & Lindblom, 2021; Lunner-Kolstrup et al., 2018), increased mental workload (Butler et al., 2012; Lunner-Kolstrup et al., 2018), feeling like they are on call (Butler et al., 2012), and information overload (Butler et al., 2012; Finstad et al., 2021; Lundström & Lindblom, 2021; Lunner-Kolstrup et al., 2018; Tse et al., 2017).

Utilization of technology to enhance animal welfare and environmental sustainability in livestock production systems continues to grow (Neethirajan & Kemp, 2021; Schillings et al., 2021). Technology such as automated milking systems (AMS) may help enhance production efficiency (Baur & Iles, 2023; Finstad et al., 2021; Holloway et al., 2014; von Keyserlingk et al., 2024) and animal welfare (Butler et al., 2012; Cogato et al., 2021; Finstad et al., 2021; Jacobs & Siegford, 2012; King & DeVries, 2018; Tse et al., 2017) through easier detection of cow health concerns compared to conventional milking systems (CMS) (Tse et al., 2017). Although management (Bianchi et al., 2022; Butler et al., 2012; Jacobs & Siegford, 2012; John et al., 2015; Karttunen et al., 2016; King & DeVries, 2018; Lage et al., 2024) and the utilization of technology (Finstad et al., 2021; King & DeVries, 2018; Schillings et al., 2021; von Keyserlingk et al., 2024) are important factors that may be required to reap the benefits.

The pre-purchase considerations must be acknowledged in this discussion, including the benefit-to-cost ratio, initial investment, and usability, these findings are consistent across studies conducted with dairy farmers located in Italy (Bianchi et al., 2022) and in the United States (Borchers & Bewley, 2015). Oftentimes, there is relatively little representation of farmers who have not implemented technology. This creates a gap in understanding where farmers and on-

farm technology meet, which is the crux of implementing technology. There is also limited consideration in the literature of dairy farmers' experience with on-farm technology and how this may influence their well-being.

The 'One Welfare' approach integrates animal welfare, human well-being, and the social and physical environment (Pinillos, 2018). Awarding more attention to one dimension (e.g., human well-being) may impact another dimension (e.g., animal welfare or environment) (Pinillos, 2018). This was observed during the 'green revolution' when technology began to be marketed to help increase production efficiency, but this shift required a capital investment and more technical support by extension services (van der Ploeg, 2023). Farmers who needed to increase efficiency to avoid farm attrition were incentivized by the promise of technology (Rotz et al., 2019). To date, scientific literature has emphasized the potential benefits to animals rather than approaching on-farm technology with a holistic approach.

The socio-cultural and relational aspects of farming cannot be ignored, as the effects of power and policy have played a role in the devaluation of farming, resulting in a shift away from sustenance farming to farming for economic gain (van der Ploeg, 2023). The influx of pressure to enhance efficiencies portrays capitalistic ideals where it is difficult for sustenance farming to coexist (Bronson et al., 2019). The 'good farmer' identity holds significant meaning to one's identity and status in the agricultural community (Burton, 2004). The touting of technology as a solution for animal welfare, the environment, and/or farmer well-being is concerning as this idealization of technology shares similarities to the 'green revolution' which preceded a historically significant marginalization of farmers and skilled labourers who were no longer valued to the same extent post-technology.

For example, dairy farmers' role on the farm is significantly different with AMS than CMS (Butler et al., 2012; Lunner-Kolstrup et al., 2018). The evolving relationship between farmers, cows, and technology was coined by Finstad et al. (2021) as 'the domestication triangle'. It is necessary for farmers to be able to use the technology as a tool at their disposal to benefit farm animal welfare, which requires a certain level of knowledge and understanding of technology (Schillings et al., 2021). Technology has potential to alter the farmer-cow relationship, and the farmers' lifestyle (Holloway & Bear, 2017; Schillings et al., 2021; von Keyserlingk et al., 2024) as there is less time spent interacting with livestock (Peralta & Haefs, 2023; Schillings et al., 2021). In the event that farmer-cow interactions are a positive contributor to cow welfare, there may be a risk if the frequency of interactions are reduced (Weary & von Keyserlingk, 2023). However, if the majority of interactions are neutral to negative, it may be best to leave cows be.

After shifting to AMS, participants in a study by Tse et al. (2018) in Canada perceived positive influences on their work-life balance, workload, and farm and herd management. Approximately 68% of farmers altered how they approached herd health by utilizing the information offered by AMS reports, while 82% reported detection of health concerns to be easier with AMS (Tse et al. 2017). For farmers using AMS, farmers using a conventional feeding system had increased levels of stress, anxiety, depression, and lower resilience compared with those who also had an automated feeding system (King et al., 2021). There has also been a positive relationship identified between animal welfare and farmers with high occupational well-being and low stress, as well as a positive association between farm expansion and animal welfare (Hansen & Østerås, 2019).

The factors that affect a farmer's decision to adopt technology have been reported to include: herd size, investment cost, benefit-to-cost ratio, alignment with personal beliefs and values, ease

of use, ability to test out the technology before purchase, and observations of how the implementation goes for others (Bianchi et al., 2022; Borchers & Bewley, 2015; Gargiulo et al., 2018; Stone, 2020). In order to consider adopting technology, a farmer must be able to afford to invest in implementation to reap the benefits of technology, but this creates marginalization of farmers and labourers for whom investment is not financially feasible, or if they do not possess the skills necessary to utilize technology (Rotz et al., 2019).

Farmers face regulatory stress (Thompson et al., 2023; Truchot & Andela, 2018; Yazd et al., 2019) while also experiencing pressure to ensure they are using practices that favor environmental sustainability (Balasundram et al., 2023; Carmichael et al., 2023) and animal welfare (Barkema et al., 2015). But, again, affordability constrains their decisions (Rotz et al., 2019). Unsurprisingly, farmers in Canada have been found to experience constant financial stress on the farm which is linked to a variety of other factors (Hagen et al., 2021). There is also frustration from farmers towards 'one-size fits all' approaches that fail to consider the context on-farm (Knauss et al., 2021). It appears as though this has been the dominant discourse in relation to on-farm technology in the dairy industry.

This study utilized the 'One Welfare' framework, which recognizes the interconnections between humans, animals, and the environment (Pinillos et al., 2016; Pinillos et al., 2018). A 'One Welfare' framework may hold potential for improving farm productivity, for example, by recognizing the link between farmer well-being and animal welfare (Pinillos et al., 2016). Therefore, the objective of this study was to explore dairy farmer well-being in the context of technology.

3.3 Materials and Methods

3.3.1 Ethical considerations

This study protocol was approved by the University of Manitoba Research Ethics Board (REB # HE2023-0014).). All participants provided informed consent before the interview in written and verbal format. To be included in the study, informed consent and consent of audio recording was required, which participants were able to revoke before the given deadline. Participants were able to withdraw their interview consent until the data de-identification deadline approximately 8 to 12 months later. Upon the deadline, all potentially identifying data were removed from interview transcripts. Participants were offered an honorarium of $50 in the form of a gift card.

3.3.2 Recruitment

Recruitment was conducted through a network of organizations and individuals involved in the Canadian dairy industry as part of a larger project. The recruitment material was distributed by the network via social media and email. Prospective farmers completed a screening survey which was then used to purposively sample to ensure a variety of perspectives. Qualitative researchers have conducted semi-structured interviews with individual livestock farmers regarding animal health and welfare with sample size ranging; in Canadian studies, researchers have interviewed 22 (MacKay, 2023), 29 (Saraceni et al., 2022), 20 (Spooner et al., 2014), and 22 participants (Schuppli et al., 2023). In Scotland and Switzerland, respectively, researchers have interviewed 26 (Vigors et al., 2023), 32 farmers (Chapman & Deplazes-Zemp, 2022). Qualitative research with dairy farmers regarding technology in Norway, Canada, and the United Kingdom, respectively, have interviewed 19 (Hansen, 2015), 11 (von Keyserlingk et al., 2024) and 20 farmers (Holloway & Bear, 2017). Based on these previous studies, a sample size of 30

was estimated to be sufficient and achievable within the constraints (e.g. time and duration of MSc program). The concept of saturation in qualitative research has been problematized in detail by Braun & Clarke (2021), however, this study was conducted in a field dominated by positivist research. As a result, the sample size was re-evaluated throughout data collection to ensure data saturation, which is defined in some qualitative research, to be achieved once there are no new insights that come out of further data collection (Creswell & Creswell, 2018, p. 186). In total, 31 dairy farmers across Western Canada and Ontario participated, 1 interview was removed due to ethical concerns (e.g. inappropriate participant behaviour towards researchers), Participant demographics can be found in

Table 1.

3.3.3 Epistemology and Positionality

This study was conducted from a constructivist paradigm with a phenomenological approach (Creswell & Creswell, 2018). The lead author (ALH) has a combination of practical and academic knowledge in animal agriculture working with various species in commercial and research settings. In reflecting on the research, ALH believes this was an asset as the ability to see the farm from both viewpoints, from researcher and farm worker, and allowed her to gain respect and build rapport with farmers. She has first-hand experience of the blood, sweat, and tears that come with caring for animals, from calving and processing cattle to mass culling of pigs during disease outbreaks. ALH has utilized a variety of on-farm technologies which was invaluable in her research as it offered her added context to the challenges farmers faced with technology. Further, the sense of dependency on technology is something that ALH is well-versed in, as she relies on an insulin pump everyday to manage Type 1 Diabetes. Although there is a marked difference between an insulin pump as a life-saving device and on-farm technology

as part of one's livelihood, there are similarities that she noted throughout this research, namely when farmers depend on an AMS to milk cows.

ALH previously completed courses in Psychology as electives for a Bachelor of Science in Animal Systems and has lived experience with mental health from a personal and community stance. At the beginning of her graduate studies, ALH completed a course on qualitative methodologies in Community Health Sciences, as the majority of her previous research experience has taken positivist approaches. With awareness that qualitative methodologies would be new to her, ALH delved into the theoretical underpinnings and leaned on authors with extensive qualitative research experience to enhance her understanding. This experience has given ALH a deep appreciation, not only for qualitative research, but for the complexity of individual experience.

3.3.4 Interviews and Interview Guide

A network of individuals and organizations involved in the Canadian dairy industry helped to create a semi-structured interview guide (Appendix A), which was used by the lead author (ALH) to explore dairy farmer well-being within the context of technology. Interviews took place between June 2023 and October 2023 by the lead author (ALH). Participating farmers were asked to choose an interview location with the option of virtual (phone, Zoom, Microsoft Teams) or in-person at their farm, whichever was the most comfortable for them. The majority of participating farmers chose the virtual option (n = 28) instead of the in-person option (n=2). The interviews were an average of 78 minutes ranging from 44 to 143 min.

The interview guide used consisted of 5 topics, 1 of which will be discussed within this paper: technology. Before asking questions about technology, I shared the definition used in this

study, “any type of technology on the farm such as computers in the office, AMS, automated feed mixing or delivery systems, automated calf feeders, rumination monitors, pedometers, or any other technology.” Questions included: “please tell me about the technology that you use on your farm. How has that technology positively influenced your life? How has that technology negatively influenced your life? What kind of barriers are there to implementing technology on your farm?”

3.3.5 Analysis

Validity strategies were used such as reflexivity, peer debriefing, thick description of findings, and member checking (Creswell & Creswell, 2018, p. 198-202). The lead author maintained a research journal throughout the research process which helped with reflexivity by providing insight to how her experiences may have influenced interpretation. Debriefing took place throughout the research process, most often between ALH and MK. A detailed description of findings was sent to participants whom gave consent, allowing for member checking, participants provided positive feedback and confirmed the findings. Lastly, themes are described with a rich, thick description which aims to enhance readers understanding of each theme and the experiences associated (Creswell & Creswell, 2018, p. 198-202).

Data analysis was informed by reflexive and codebook thematic analysis (TA) (Braun & Clarke, 2022a). Analysis of data involved the following stages, which are indicated in one or both reflexive TA and codebook TA. Firstly, the researcher increased data familiarization (Braun & Clarke, 2006) by listening to audio recordings and reading transcripts, while simultaneously correcting any errors in transcripts generated using Otter.ai. The research team (ALH, AJ, BH, MK, VFC) then came together to collaborate and engage in an initial coding process to establish a preliminary codebook (King & Brooks, 2018). Next, the codebook was used to help guide

analysis, as the codes were organized into categories to provide structure to the analysis (King & Brooks, 2018). ALH conducted primary coding of the transcripts and VFC conducted secondary coding of the dataset to enhance rigor (King & Brooks, 2018). It should be noted, the reasoning for multiple coders was not to reach a consensus but rather, it offered advantages in terms of reflexivity as there may be multiple ways to interpret an excerpt of data (Braun & Clarke, 2021).

Code generation continued throughout the coding process as more semantic and latent codes were noted (Braun & Clarke, 2021) and, as such, these codes were added to the codebook and left highlighted to ensure that previous transcripts were returned to such that these new codes were considered as well. After all data were reviewed, theme development took place (Braun & Clarke, 2021) and was followed by revision of themes to ensure the coded data fit as well as any refinement needed (Braun & Clarke, 2006, 2021). Finally, a definition of each theme was created and the final analysis reported each theme within the context of other themes (Braun & Clarke, 2006).

3.3.6 A note on language

The participating dairy producers in this study most often referred to themselves as "farmers," and their livestock using the term "cows" which often encompassed calves and heifers, as well. Additionally, farmers often refer to AMS as "robots". We will proceed to refer to use the same terminology throughout the remainder of this paper to preserve farmers' voices.

3.4 Results

Overall, three main themes were identified through thematic analysis: 1) benefits for cows; 2) no two farms or farmers are identical; and 3) pressures "pushing everybody towards robots".

Themes are summarized in **Error! Reference source not found.**, and illustrated in **Error! Reference source not found.**. The following sections outline each theme in detail.

3.4.1 Benefits for cows

Participating farmers were eager to share the cow-level benefits that technology offers. There were three subthemes identified in relation to the benefits for cows: a) cow agency; b) consistency; and c) detection of health concerns.

3.4.1.1 Cow agency – "do what she needs to do."

Many participants described how free stall and bedded pack barns that utilize AMS allow cows to "go wherever they want, within the confines of their pen." There was a shared sense of value in cows being "completely autonomous" as one participating farmer mentioned, "I like the idea of the cows being able to be milked when they want to." Another participating farmer said, "the cows do what they want to, not what we are forcing them to do." This may indirectly offer benefit to farmer well-being which was noted in the way that participants spoke positively about the agency of their cows, with some participants mentioning "allowing autonomy for the animals is beneficial to them" as the cows "just seem happy and content."

There were related benefits that a few participating farmers shared, such as "heat detection is much easier because cows are free to express themselves." This may positively impact farmer well-being with the potential for reduced time spent on heat detection. Not only does this sentiment relate to cow agency, but it also offered benefits for the participating farmers in terms of work-life balance which will be discussed in 3.4.2.1

3.4.1.2 Consistency – "you're not relying on human error or having human error."

Several participants mentioned the ability for cows to have "some consistency" in how they are milked either with automatic takeoffs or with automated milking systems. One participant provided an example, "the robot never stayed out till 3 in the morning at the family wedding and came by to milk at 6AM." A few participants described stress regarding labour, which was often drawn together as a reason to incorporate technology:

"Like automatic takeoff means that anybody... like most people can milk... like, because you don't have to monitor the cows to see how close to done they are, like the milker goes out and takes it off when they're done right."

Another participant explained:

"Well, the robots milk the cows the same way every day, right? With people it was always well, this one would milk this way, and then, like I had one employee, she would just talk too much."

Participants also discussed automated feed systems. Participating farmers explained how automated feed mixers held benefits as they "eliminated variability in the feed." With automated feed systems, some participants also mentioned the reduced need for labour. One participant estimated "it [automated feeding system] saves about an hour a day of just standing there pressing buttons." Participating farmers discussed having an automated feed cart in a tie stall barn which "goes around the barn and drops off X amount of kilograms in front of each cow." In that situation, the technology was providing that farmer with the re-assurance that their cows are fed with precision which may help to ease financial stress. Another participating farmer explained:

"...records every weight that goes into the mixer wagon, and then sends it to like our phones, to make sure that all of the quantity of feed is right and the ration is right. From a budget perspective, it ensures that we are feeding them the right thing every day, and you're not, you know, dumping a whole bunch of extra grain or something in for fun."

3.4.1.3 Detection of cow health concerns – "you're getting it before it bakes into the [cow's] system."

Technology provides much more data at the cow-level than CMS. This was described by several participants to have the potential to help "with cows, as far as their health concerns." One participant shared that the technology they installed "…improved udder health, somatic cell counts, and mastitis rates." Another participant explained how they utilized technology to help monitor cow health:

"*…the technology allows us to do that [track cow health] really easily, just to see, because it follows them like through their ear tags, like their movement, like how much they're eating, their temperature, like all that stuff."*

Another participant mentioned, "…we have a lot of technology to help us monitor that so we can see if an animal is kind of going downhill before she physically starts to look like it."

3.4.2 No two farms or farmers are identical

There was a variety of experiences and/or opinions about on-farm technology shared by participating farmers in this study. Within this theme, binary patterns of participating farmer preferences appeared which led to development of sub-themes including: a) daily structure versus flexibility; b) management of cow health using technology versus hands-on; c) milking cows as "pleasurable" versus "mundane." There were different comfort levels of participating

farmers regarding implementation of technology; some were early adopters and some would wait and see how the technology performed for others which is discussed in sub-theme d) adoption of technology. There were also sub-themes relating to the participating farmers values such as: e) wanting to disconnect from the farm to various degrees; f) utility of the technology to that individual; and g) dependency on technology, suppliers, and providers. The following section will discuss each sub-theme in detail.

3.4.2.1 Structured vs. flexible lifestyle - "we can look at how things are going on our phones or whatever, like you've never truly disconnected from it."

Participating farmers with both CMS and AMS incorporated technology, from automated feed mixers and feeding systems to rumination and activity monitors, which potentially "helps the overall day to day tasks to become a lot more easy." Work-life balance was described as being challenging for some with CMS, as one participant explained: "…dairy specifically requires the farmer to be in the barn milking cows at specific times, every single day, you cannot leave the farm when you have to milk cows, you can't." But, some participating farmers appreciated this because "your day was kind of choreographed for you." Although AMS can "reduce workload," it does not necessarily translate to the workload becoming "less, but [instead] more flexible." Because milking becomes automated, chores related to milking for "eight hours a day [are] now gone, due to the robots." This means it is "no big deal if they do their chores an hour later," however, some may prefer CMS due to the loss of a daily schedule because "it's not like you have an endpoint." One participant mentioned, "the best thing about a milking parlor is when you're done milking, you're done."

Most participating farmers without AMS described their hope to incorporate them in the future to "reduce labor" and "increase work life balance." However, a few participating farmers

appreciated that they had CMS because “when you're done milking, you're done.” Participating farmers with AMS discussed how the addition of technology could give them “the freedom to be able to monitor things from afar” but it also “draws you back into your farm, probably more than you should be.” Numerous participants discussed challenges with AMS and well-being, such as the “unpredictability” of alarms and the “potential to be woken up all night.” One participant mentioned, “you get the times that the robot is going to call you three times a night and other times it's going to leave you alone for three months.” This led to some participants to describe feeling like they “never get to really turn it off.” The consequences to well-being were problematized by one participant:

“For cows, robots are ideal. The one thing they never tell you as a farmer, when you invest in this system is ‘say goodbye to the concept of day and night’. A robot works 24 hours a day. It has no concept of day and night. But you are a biological being. You do.”

3.4.2.2 Technology vs. hands-on – “sometimes the naked human eye is the best computer you have.”

Technology was described as having the potential to be “good” and “helpful for the cows,” although some participants believed there are also circumstances where “nothing really beats, you know, your own two eyes.” Specifically, AMS provided participating farmers with “more data than any animal scientists could ever dream of having” and can “tell you everything you need to know, and then some.” There are certainly advantages to obtaining cow-level data, as previously described in theme 1. Participating farmers mentioned that technology may be limited to detection of animal health challenges “on a piece of paper but not in person.” Some participating farmers described that they would “pay attention to details, but through technology, not necessarily. It's just through hard work and information.” One participant explained,

"But all the little intangibles, like the health recognition, things that are missed, heats that are missed in animals… not spending—you know, spending 10 minutes in your breeding age heifer pen is extremely valuable time, but walking by with a quick glance over your shoulder saying I've done my heat detection. That's so –sometimes trying to stress the importance of observing and listening is sometimes lost on the next generation that, okay, there's value in heat detection, there's value in walking through your barn. You can't always be just out with a camera and a device, you need to be among your animals."

3.4.2.3 Milking cows - "pleasurable" vs. "mundane"

Some participants mentioned how milking cows in a parlor and/or tie stall may lead physical well-being to suffer as it can be "very labour intensive" and "wearing on your body" from the "reaching motion" which "puts strain on your back" to "crouching to milk cows twice a day." Oftentimes, the physical toll was mentioned to be "part of the reason we're going to be putting in robots." For some participating farmers, AMS removes the "the mundane part of milking cows" which means "you wouldn't have to milk cows." However, for others who "love milking," AMS could take away parts of a farmer's job that they find enjoyable from "the actual milking of the cow because the jar is getting fuller," or the "daily contact" of "going to the barn every day and seeing the cows." With implementation of AMS, participating farmers were required to "change their whole management style to adapt to that technology" which meant they may lose the "pleasurable" task of milking. Consequently, for some participating farmers who enjoyed milking cows and are less technology-adept, "not all technologies will create a stress-free environment," and there appears to be potential for well-being to be affected.

3.4.2.4 Utility of technology – "helpful" vs. "hindrance"

Technology changes dairy farming by using "a different mentality," as one participant mentioned the barriers to utilizing technology were "just in our minds." Participating farmers shared the importance of accepting that "there is going to be a learning curve" and to "embrace" and "trust" that the technology will be "helpful as opposed to a hindrance." However, new technology can be "a little bit daunting," especially if the farmer does not find it "intuitive." Some participants shared that the time and effort required to learn the system properly was "not worth it" because ultimately the technology must be "manageable by the people who employ it." For some participants "switching to technology is really tough," there must be consideration towards the individuals' capacity to utilize technology as "you have to be a little more computer savvy." A few participating farmers mentioned that they may not want to "push ahead and tackle" the "overwhelming scope" of AMS, especially when utilization of technology is a "weak spot" for primary or secondary decision makers on multi-generational family farms. For example, one participant shared:

"…my dad is not good with computers or anything like that. So, it's um, it like, any time we adopt this technology, usually means that, like I'm taking on whatever labour is associated with that. Which is, which is fine, I don't, that's not a complaint, but it is a part of the calculus, I guess, in that."

3.4.3 Pressures "pushing everybody towards robots"

Participating farmers described many factors that are "pushing everybody towards robots" and other technologies. While participating farmers would often discuss AMS specifically, there was also discussion of other on-farm technology such as automated feed systems, manure robots, and calf feeders. The sub-themes include: a) future uncertainty; b) labour and financial

considerations; c) efficiency as a “double-edged sword”; and d) power structures. Each of these sub-themes seemed to have potential to influence emotional well-being, whether directly or indirectly.

3.4.3.1 Future uncertainty – “You don't want to be on this 40-year never never plan. You don't want to be treading water financially”

Participating farmers mentioned technology provided the ability for “adaptation” on a farm, “if you want it [technology] to [be incorporated on the farm].” The rapid acceleration and improvements were often a source of hesitancy for participants without AMS because “in 10 years, that technology, technology is worth nothing, and it's so much better.” Some participating farmers described themselves as “not early adopters” of technology due to the financial reasons, but also because this allowed the technology to be “a little bit more tried and tested.” Several participating farmers mentioned that they “prefer to let somebody else figure it out first” and work “some of the kinks out.”

There were worries before implementing technology such as “how it's going to work and how, if it's going to be the right way to go.” This uncertainty was also noted by a few participating farmers who had implemented technology, as one participating farmer mentioned, “it's great technology – when it works.” One participating farmer who had implemented AMS mentioned, “Has it [AMS] been the right step? Most days, yes. Some days, no.” Succession planning was also mentioned by some participating farmers, as one participant shared “it's hard to agree on what to do,” especially while concerns about “certainty of the future” are present. Another participating farmer explained, “one son wants to farm but he cannot do it by himself. The other one thinks he loves the farm, but you're a bit in a holding pattern, and will you expand? Will you keep it like that?” One participating farmer mentioned that they “should build

robots [for their barn], because that's the way of the future and you're not going to be able to get staff forever."

3.4.3.2 Labour & financial considerations – "if I had a blank cheque, we'd have all the fun toys, right?"

Shifting milking systems is usually "quite a financial consideration," which brought hesitation to invest in technology because "there's no sense spending a bunch of money on something that ends up not really being that useful." Some participants mentioned that "going robotic meant building a whole new barn." For many participants, implementing new technology was "cost prohibitive" as investing in more technology was "not in the budget." One participant explained,

"…at the end of the day, I have to pay bills, I have to pay staff, I have to do a lot of shit I got to pay for. Its return on investment, to—to bring in technology and there's technology that exists that would be great for us, but it's not economically feasible."

With technology, several participating farmers described how "there are considerable maintenance costs for robots, and they ain't cheap." Another participant explained, "you can't just take it apart and change the lightbulbs. You have to change the entire box, which is like two grand." One participant shared, "I had the feed pusher for 10 years. I've spent the same amount on maintenance on it as I did when I bought it."

The quality of labour is also a challenge because, as one participating farmer mentioned, "there is great people, and there is not so great people, and there is everything in between." Employee challenges were a "headache" and for some participants such challenges would "push us towards robots." Before shifting to AMS, one participant shared, "we were just having

employee nightmares. And so my stress from employees went from above my head down to my toes.” Finding labour is challenging, as there are more hybrid and remote options for working nowadays, but “there's not a virtual option for milking cows.” In reference to taking time off, one participating farmer said, “the most stressful part [of taking the break] is finding someone to— to do the milking,” another shared, “when you're short of help, then it just seems like the farm becomes more of a burden.”

For numerous participants, using AMS was a means to alleviate pressure that developed as a result of the “turnover rates” and “reliability” of hired labour being a challenge for dairy farmers due to “the hours” and how “labour intensive” the tasks are. Several participating farmers discussed labour as an influence in their decision to implement AMS, they were having “labour issues” as hiring because finding local help is “impossible” and “their monetary expectations were quite high.” Participating farmers also mentioned that “more and more farms are going robotic ‘cause they just can't find help.”

3.4.3.3 Efficiency as a “double-edged sword”

Efficiency can have a dual-purpose, one participating farmer explained they decided to “make some changes to make the farm not only more efficient in the way it worked, but financially more efficient and less risky.” Some participating farmers mentioned that they are “technically not making any more income but it's on the cost side” where they can “reduce labor” costs, and fill “quota with less cows.” Some participating farmers noted that the advantages of technology in regard to efficiency “are all truthful statements,” while also noting the pressure to enhance efficiency. One participating farmer mentioned, “either grow and get efficient, or you're gonna have to get out” and further explained, “it’d be nice if we all could make a living milking

30 cows, but those days are gone." The emphasis on efficiency also could hold potential for negative impacts on well-being, as another participating farmer explained:

"Everybody's rah rah rah robots, robots, robots. Oh, we're gonna be so efficient. This and that and you'll never have to work anymore. Yeah, but every form of refuge has its price. Physically, what is the long term effect of wiping out day and night?"

The idealization of efficiency was also questioned, as one participating farmer shared:

"…it can allow you to work a lot longer, but in the negative it can allow you to work a lot longer. That's kind of a double-edged sword there. But it's— it makes—it increases efficiencies to a great degree and I think that's one thing that as a farmer, we really have to watch is how efficient we are with things. And it's one way to allow us to become more efficient."

3.4.3.4 Power relations – "we need to change our whole system, or we need to sell."

Power can be described as "capacity to effect outcomes" (de Boon et al., 2022), such outcomes can be affected by factors at the individual level, however, they are also deeply entrenched within institutional and social structures (Gray et al., 2002). This study highlighted power relations within the dairy industry, specifically in regards to adoption/non-adoption of on-farm technology.

Participating farmers with older systems often described limitations, such as technology and equipment companies "don't even make anything better anymore" for tie stall systems. However, the lack of technical support was not exclusive to tie stalls. CMS systems were frequently described by participants as "old fashioned," and "aging technology." For participating farmers with CMS, this meant that "you're forced to upgrade, eventually, otherwise you will be obsolete"

which was a sentiment shared across most participants with CMS. Although, several participants explained that technology can be “too expensive to justify” due to “cost benefit,” or herd “size” because AMS may be “geared more towards like the 80 plus cow herd.” To qualify for a loan, farmers need to hold a certain amount of quota. Farmers need to buy more quota to increase production but a few participating farmers mentioned that “it's not easy to buy quota,” and oftentimes “nobody would lend us the money.” This then resulted in constrained options for farms wanting or needing to purchase more quota, even if the “barn isn’t made to fill” the increased amount of quota.

One participating farmer explained:

“…we've been buying quota for 13 years on this farm, because we are always trying to grow, we're trying to get big enough that we can fund building a barn. And so basically, all the loaning companies said you have to own 60 kgs of quota. But because we're only milking 40 cows, they [their parents] only owned 38 [kilograms of quota]. When my husband came home, so we've been buying since he came home. So now we own 59.6 [kilograms of quota].”

Participating farmers often discussed breakdowns with technology on their farm and how “those are the days I realize how much I depend on it.” Dependency on technology was also a deterring factor, one participating farmer explained, “you don't have auto steer on a lot of stuff because it works for a while and then it doesn't work and then you spend time fixing it and it still doesn't work.” Technology breakdowns were mentioned by some participating farmers as “a big problem” for farmer well-being, as well as cow health and welfare. This was explained with a detailed experience from one participant:

"We had an issue this past year where even the [robot dealer] techs couldn't figure out what was wrong with one of our robots. So that was probably the worst case scenario for everybody's mental health because it was so discouraging that it took about three weeks to find the problem. And they had so many techs on it. So you felt really helpless like, 'I can't fix this robot and if the techs can't fix the robot, are we left with we need to buy a new $250,000 machine because it's not being fixed?' Like the last day before they found the problem, there was a discussion on like, 'do we call the bank and see if we can afford to buy a new robot?' And like, that was probably worst case scenario, right? If it's, if it's really hard to fix or complicated to fix, like you are helpless, you can fix the main, the main problems, but it's not as easy as a fix as, you know, you had one broken milker in the other barn, well the rest of your cows are still going to get milked. But here, it was, it was hard on the cows too, they weren't getting milked not often enough, they had mastitis, all kinds of issues, we weren't filling our quota. Like it was really a bad, a bad couple of months. So, like that was worst case scenario."

This also draws attention to further discourse regarding power dynamics and technical support from technology companies, as the technology is often highly specialized, thus issues arise then the farmer is dependent on the manufacturer to determine a solution. Some participating farmers mentioned, "the people that have sold you the product aren't sure exactly what it [the alarm code] means." Another participating farmer shared that the technical support was "kind of banging their head against the wall trying to figure out what was wrong. This resulted in some participating farmers experiencing "frustration of repeat visits for the same fix" because the technical support team are "supposed to be the people who can fix, and it's not fixed." One participating farmer shared that a support technician "was at our farm for 48 hours straight." However, some participating farmers mentioned that "the tech support is really great"

with AMS, they will “walk you through it on the phone, as opposed to being like, ‘yep, I'm gonna jump in my van, and you're gonna pay for a service call.”

Barn hygiene can be compromised as “it gets so dirty so fast when the scrapers are out.” If the automated feed system breaks down, “when it doesn't work, it actually creates more work for us.” Breakdowns can also be “frustrating” as one participating farmer mentioned, “the manure robot made us pull out our hairs every once in a while.” This dependency could pigeon-hole participating farmers, as one participating farmer mentioned, “you just can’t wait to get it fixed because you want it back to how it was.” Not only does this illustrate the negative aspects of technology breakdowns on cow health and welfare, but it also underscores how this connects to participating farmers’ emotional well-being.

3.5 Discussion

The findings of this study met the objective which was to explore dairy farmer well-being in the context of technology, while also demonstrating that it may be important to consider technology within a ‘One Welfare’ framework to ensure recognition of socioeconomic factors. To our knowledge, this study is the first in Western Canada and Ontario to use qualitative methods to explore farmer well-being in the context of technology. The following discussion will begin by discussing relevant literature to benefits for cows (theme 1), then proceed to farmer-specific preferences (theme 2), throughout the discussion I will intertwine the pressures “pushing everyone to robots” (theme 3).

This study illustrates that although there are potential benefits for cows, participating farmers and their cows may not always reap the benefits as the outcomes of technology are contingent on the specific context for each farmer and their farm. These findings are in alignment with other

qualitative research conducted with dairy farmers in Canada (von Keyserlingk et al., 2024), Finland (Kaarlenkaski, 2023), Norway (Hansen, 2015), Sweden (Lundström & Lindblom, 2021), and the United Kingdom (Holloway et al., 2014; Holloway & Bear, 2017). Our findings are also consistent with previous quantitative research in Australia (Wildridge et al., 2019), Canada (King et al., 2016; Tse et al., 2018), the United States (Lage et al., 2024). Lundström & Lindblom (2021) suggest that, in Sweden, AMS can be used as a management tool for the farmer, however, if AMS is not used alongside interaction and observation of cows then the success level will be reduced.

Participating farmers described three distinct benefits that technology could offer for their cows: cow agency, consistency, and detection of cow health concerns. Technology can positively impact cow health and/or welfare, this has been well-documented within regards to AMS (Butler et al., 2012; Svennersten-Sjaunja & Pettersson, 2008; Tse et al., 2018). Negative impacts may also be observed which may depend on farm management (Svennersten-Sjaunja & Pettersson, 2008). For example, cow welfare challenges with AMS may be similar to CMS, including lameness prevalence which negatively impacts milk yield (King et al., 2016) and behaviour (King et al., 2017). As cows transition from CMS to AMS, welfare may be impacted as evidenced by physiological responses (e.g. increased heart rate) and behavioural changes (Svennersten-Sjaunja & Pettersson, 2008), as well as impacts on udder health such as increased bulk milk somatic cell count (van den Borne et al., 2021) and mastitis (Tse et al., 2017). Over time, scientific advancements and farm management (e.g. better understanding of equipment and perhaps more knowledge of potential issues to watch for) may have helped to reduce the impacts on cow health and welfare as evidenced by recent observation of lower bulk milk somatic cell counts (van den Borne et al., 2021).

Many participating farmers shared the benefits AMS offered in terms of cow agency, for example, cows can choose when they want to be milked. Other studies with dairy farmers shared similar sentiments to our findings surrounding cow agency in the United Kingdom (Holloway et al., 2014; Holloway & Bear, 2017). The narrative regarding cow welfare and/or agency may stem from AMS manufacturers as the comments reflect existing AMS marketing strategies (Baur & Iles, 2023; Butler et al., 2012; Finstad et al., 2021; Holloway et al., 2014; Holloway & Bear, 2017; Kaarlenkaski, 2023). Although there are potential benefits that agency offers to cow welfare, it is also worth considering that the findings of our study may, at least partially, suggest a successful marketing strategy utilized by AMS manufacturers.

Researchers have also described consistency of AMS in Europe (Svennersten-Sjaunja & Pettersson, 2008), and dairy farmers in Finland have discussed consistency and the positive experience that cows know what to expect with AMS, which may differ with human labour (Kaarlenkaski, 2023). Nevertheless, it is worth noting the current socioeconomic backdrop that could perhaps relate to consistency. There was pressure to increase efficiency noted by many participating farmers in this study which may also be connected to labour and economic influences as more efficient systems are more economically viable. Participating farmers in our study described the uncertainty of finding labour in the future as a reason that technology would be necessary, aligning with findings of von Keyserlingk et al. (2024). The reduced need for labour has been highlighted in the decision to implement AMS in the United States (Lage et al., 2024), Norway (Hansen, 2015), and Canada (Gargiulo et al., 2018; Stone, 2020).

As such, technology is boasted to enhance efficiency and thus, investment is needed for implementation which makes it necessary to discuss the economic climate of dairy in Canada. Trade has been a contentious subject recently as the dairy industry has been subject to loss of the

domestic milk market after Canada signed three separate agreements: the Comprehensive and Economic Trade Agreement (CETA) in 2016, the Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP) in 2018, and the North American Free Trade Agreement (NAFTA) which resulted in the United States-Mexico-Canada Agreement (USMCA) in 2020 (McLachlan & van Kooten, 2022). Although, supply management also holds benefits for farmers such as reduced price volatility (Doyon, 2011), there is also a seemingly impossible situation: farmers need more quota, but this may not be easy or affordable to acquire depending on provincial quota allocations, and farmers need to hold a certain amount of quota to qualify for a loan from lenders, unless however, the farm is already large enough that there is no need to purchase quota to secure funding.

Furthermore, price ceilings for quote were introduced in Quebec and Ontario between 2007-2009 to mitigate the limitations that new farmers were experiencing with the increasing quota prices (Larue et al., 2017; Vyn & Rude, 2020), however, limitations in obtaining quota may make it difficult to expand while increasing profitability (Larue et al., 2017). Doyon (2011) postulated that limitations in quota increases would limit farmers from implementing strategies to enhance efficiencies such as technology, my study supports this prediction. Considering this, it is not surprising that farms in Western Canada tend to be larger, and more technologically advanced than those in Eastern Canada (Larue et al., 2017). Not only does this illustrate friction between financial institutions and milk boards, but it also shows the challenges that small- to medium-sized farms face when it comes to making investments in technology and/or growing their operation. This structural imbalance must be addressed to provide opportunities in order for dairy farms of all sizes to be able to achieve long-term sustainability.

The participating farmers in our study described the advantages in detection of cow health concerns that technology offers, particularly with AMS. Dairy farmers have described similar benefits in studies conducted in the United Kingdom (Holloway et al., 2014; Holloway & Bear, 2017). Research has also reported the potential positive impacts that AMS may have for cow health through cow-level data in reviews (Cogato et al., 2021; Jacobs & Siegford, 2012), and studies in Norway (Finstad et al., 2021), the United States (Borchers & Bewley, 2015). Further, an association has been identified between dairy farmer well-being and the utilization of information from AMS for management in Norway (Hansen et al., 2020).

The changes that technology has on a farmer's daily routine can promote their well-being, as farmers have less labour-intensive chores and more flexibility allowing for work-life balance, however, this is not always the case. Some participating farmers shared that they struggled with the adaptation to more chores related to interpretation or utilization of the technology, and they appreciated the structure that twice daily milking provides. These experiences hold potential to impact job satisfaction, thus, resulting in consequences to farmer well-being. In review papers, it has been noted that farmers may experience being overwhelmed due to the sheer volume of information from AMS (King & DeVries et al., 2018) and/or precision livestock technologies (Hostiou et al., 2017). Other studies have also reported that dairy farmers experience information overload with AMS which poses implications to farmer well-being in Canada (Tse et al., 2018), Norway (Hansen et al., 2020), Sweden (Lunner-Kolstrup et al., 2018), and the United States (Borchers & Bewley, 2015). A study conducted by Karttunen et al. (2016) with dairy farmers in Finland reported those with AMS experienced mental stress which was attributed to a variety of reasons such as the constant nature of AMS management and alarms. Further consideration should be given to the aspects of dairy farming that the farmer values prior to advising a shift

from CMS to AMS. For example, some may enjoy milking while others may find it physically taxing. By considering these values, there may be ability to draw attention to aspects of everyday life that contribute positively to well-being, perhaps supporting farmers to make a more informed decision which may also help to mitigate negative outcomes on farmer well-being.

The differences in participating farmers' experiences with technology could be due to multiple reasons, perhaps relating to their understanding of technology which could be, at least partially, influenced by technical support and the support and guidance received upon implementation. An individual may also have more hesitation and a more negative view of technology if they have experienced issues with the technology and associated supports. Numerous participating farmers described frustration related to challenges with the technology with respect to either lack of technical support, or inability for the technical support team to find a solution within a reasonable time frame. This resulted in significant stress for participating farmers, and in some cases, their animals. These findings contribute added context to a study by Hansen et al. (2020) with Norwegian dairy farmers using AMS whereby researchers identified a positive association between farmer well-being, and training and extension services for AMS. Technology suppliers must be equipped to support farmers with installation, and more extension efforts may help farmers to reap the benefits that the technology offers (Hansen et al., 2020; von Keyserlingk et al., 2024). The results of this current study further stress the importance of technical support teams but also call for more onus on technology manufacturers to ensure readily accessible, available, and adequate support systems to find solutions when problems occur.

As mentioned by a few participating farmers with AMS, there may be consequences to cow health and welfare in the event of technology breakdowns such as mastitis due to a reduced

frequency of milking. If AMS malfunctions and this leads to abnormal milkings, there is risk to udder health and milk quality (Svennersten-Sjaunja & Pettersson, 2008). Further, a negative association has been identified between the number of cows per AMS units and the daily milking frequency of cows (King et al., 2016), which also holds implications for milk production and cow comfort in a multi-AMS barn if even one AMS unit is down. Although there were only a few participants in our study who shared a specific experience related to technology breakdowns, it may be of interest to further explore this specifically, and the potential impact on cow welfare and farmer well-being in future studies.

For promotion of technology to farmers as a tool to benefit animal welfare, which can indirectly benefit consumer trust, there must be acknowledgement of the invaluable knowledge that comes with farmers lived experience. Through the implementation of technology, the farmer-cow relationship may undergo changes (von Keyserlingk et al., 2024; Weary & von Keyserlingk, 2023), resulting in a newly formed "human-animal-technology relationship" as described by Holloway et al. (2014). Our findings also align with the discourse from Holloway & Bear (2017) in which they posit the implementation of AMS does not simply enhance the life of farmer and cows but changes the lifestyle of each, while also complicating the farmer-cow relationship. Baur & Iles (2023) suggest that the current on-farm technology narrative proposes that farmers are not needed on the farm, inferring that there is not a desire from farmers to be on the farm. This narrative may devalue the farmer's skillset and possibly threaten aspects of their identity. Here it is important to consider the relational and sociocultural nature of farming, as part of the 'good farmer' identity (Burton, 2004) for livestock farmers relates to providing care for animals and what farmers envision animal welfare to be (Burton et al., 2012; Vigors et al., 2023). I posit that management of cow health by technology may not always fall within the

‘good farmer’ (Burton, 2004) ideals when it comes to animal welfare, as evidenced by sentiments from some participating farmers in this study because they feel the technology can distance them from their animals. Although, farmers and cows who have only operated within a system where technology is incorporated may have a different experience. As incorporation of technology continues, it may be of interest for future research to explore how this relationship exists in such a system, and perhaps how the ‘good farmer’ identity may be re-defined.

If provision of animal care is a fundamental part of a farmer’s identity, the pivot from hands-on to technology and data-driven decisions is a salient change. This change can come at the cost of losing a core piece of one’s occupational identity by working less with the cows and more with technology. In terms of work-life balance, this change can cost farmers their structured routine, or it may offer the benefit of a more flexible schedule. There may also be loss of tasks that previously offered joy such as the satisfaction of seeing the milk fill up the jar, or the interactions with cows, however, this may be alternately viewed as a ‘benefit’ because there is less demanding labour. The value of learned experience and stockmanship skills that farmers earned and refined to better identify and detect cow health concerns may be lost, as they are replaced by the ‘benefit’ technology can offer to aid in early detection and data-driven health decisions without interacting with the cows. Ultimately, the benefits that technology has to offer can only be fully realized if farmers can and want to use it.

3.6 Strengths and limitations

Strengths of this study include the participation of men and women from provinces across Ontario and Western Canada, spanning a broad age range. Participants represented both tie stall and free stall housing systems, and conventional and robotic milking systems. Limitations include conducting interviews in English only, not including Quebec or Atlantic Canada, not

collecting ethnicity data to determine degree of representation, and there was no representation from individuals who identify as 2SLGBTQIA+. Dairy farms in Western Canada tend to be larger in comparison to Eastern Canada (Larue et al., 2017), which may be related to the price ceilings on quota (Doyon, 2011). In Western Canada, there are a higher proportion of automated milking systems than in Ontario, Quebec, and Eastern Canada (Statistics Canada, 2023). Although we interviewed several participants from Ontario, it is quite possible that if more participants were involved from Quebec or Eastern Canada, there may be an emphasis on other aspects of well-being such as physical (e.g. from milking in tie-stalls or parlours) and/or more discussion on financial well-being, particularly in relation to sociopolitical context (e.g. quota system) and financial constraints to implement technology. Further, the lack of representation from ethnic groups and individuals who identify as 2SLGBTQIA+ is regrettable, as incorporating diverse perspectives may bring different topics to light and offer further insight.

An additional limitation may be a lack of probing about machinery breakdown. In hindsight, it may have been better to ask participants about challenges with technology rather than about the negative aspects. When asked about negative aspects, specific experiences may not have come to mind and thus reframing the question may have been beneficial (e.g. “please tell me about a challenge you’ve experienced with technology.” Due to the qualitative nature of this study, these findings cannot infer temporality of association nor extrapolate to a wider population, however, the results may provide insights into dairy farmer well-being in the context of technology.

3.7 Conclusion

This study provides a comprehensive, in-depth exploration of on-farm technology through the lens of dairy farmers. On-farm technology may influence cows and farmers in positive and

negative ways, and this may be dependent on the farmer and their farm. As such, on-farm technology should not be promoted as a catch-all, but instead, a tool for those who would like to incorporate it on their farm. Consideration must also be given to the pressures prompting the shift to incorporate more on-farm technology such as efficiency, labour and economic reasons, future uncertainty, and power structures. Where technical support systems fail to address challenges appropriately, there may be risk of undue stress on farmers and their animals. There may be a lack of support related to on-farm technology for dairy farms in Canada, which should be made up of farmers, extension specialists, and on-farm technology manufacturers. The findings of this study may provide insight to future strategies to safeguard cow welfare and farmer well-being to enhance the sustainability of the dairy industry.

Table 3. Demographic variables of participants (n=30)

	Variable	n	%
Province	Ontario	13	43.3
	Manitoba	4	13.3
	Saskatchewan	2	6.67
	Alberta	4	13.3
	British Columbia	7	23.3
Age	18-34	10	33.3
	35-44	12	40.0
	45+	8	26.7
Milking system	Conventional	19	63.3
	Robot	11	36.7
Housing type	Tie stall	8	26.7
	Free stall	22	73.3
Gender	Man	18	60.0
	Woman	12	40.0

Table 4. Themes and sub-themes generated through thematic analysis of dairy farmer well-being in the context of on-farm technology.

Main Themes	**Sub-themes**
1. Benefits for cows	Cow agency Consistency Detection of cow health concerns
2. Farmer-specific preferences	Structured vs. flexible lifestyle Technology vs. hands-on management of cow health Utility of technology – “Helpful” vs. “hindrance” Milking cows – “pleasurable” vs. “mundane”
3. External influences	Future uncertainty Labour & financial considerations Efficiency as a “double-edged sword” Power relations

3.8 References

Baur, P. & Iles, A. (2023). Inserting machines, displacing people: how automation imaginaries for agriculture promise 'liberation' from the industrialized farm. Agriculture and Human Values, 40, 815-833. https://doi.org/10.1007/s10460-023-10435-5

Barkema, H. W., von Keyserlingk, M. A. G., Kastelic, J. P., Lam, T. J. G. M., Luby, C., Roy, J. P., LeBlanc, S. J., Keefe, G. P., & Kelton, D. F. (2015). Invited review: Changes in the dairy industry affecting dairy cattle health and welfare. Journal of Dairy Science, 98(11), 7426–7445. https://doi.org/10.3168/jds.2015-9377

Bianchi, M.C., Bava, L., Sandrucci, A., Tangorra, F.M., Tamburini, A., Gislon, G., & Zucali, M. (2022). Diffusion of precision livestock farming technologies in dairy cattle farms. Animal, 16, 100650. https://doi.org/10.1016/j.animal.2022.100650

Borchers, M.R., & Bewley, J. M. (2015). An assessment of producer precision dairy farming technology use, prepurchase considerations, and usefulness. Journal of Dairy Science, 98(6), 4198-4205. http://doi.org/10.3168/jds.2014-8963

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. Qualitative Research in Psychology, 3(2), 77–101. https://doi.org/10.1191/1478088706qp063oa

Braun, V., & Clarke, V. (2021). One size fits all? What counts as quality practice in (reflexive) thematic analysis? Qualitative Research in Psychology, 18(3), 328–352. https://doi.org/10.1080/14780887.2020.1769238

Braun, V., & Clarke, V. (2022a). Conceptual and design thinking for thematic analysis. Qualitative Psychology, 9(1), 3–26. https://doi.org/10.1037/qup0000196

Braun, V., & Clarke, V. (2022b). Thematic Analysis: A Practical Guide. SAGE.

Bronson, K., Knezevic, I., & Clement, C. (2019). The Canadian family farm, in literature and in practice. Journal of Rural Studies, 66, 104–111. https://doi.org/10.1016/j.jrurstud.2019.01.003

Broom, D. M., & Johnson, K. G. (2019). One Welfare, One Health, One Stress: Humans and other animals. In Stress and Animal Welfare, 2nd ed., 1–13. https://doi.org/https://doi.org/10.1007/978-3-030-32153-6

Burton, R. J. F. (2004). Seeing through the "good farmer's" eyes: Towards developing an understanding of the social symbolic value of "productivist" behaviour. Sociologia Ruralis, 44(2), 195–215. https://doi.org/10.1111/j.1467-9523.2004.00270.x

Burton, R. J. F., Peoples, S., & Cooper, M. H. (2012). Building "cowshed cultures": A cultural perspective on the promotion of stockmanship and animal welfare on dairy farms. Journal of Rural Studies, 28(2), 174–187. https://doi.org/10.1016/j.jrurstud.2011.12.003

Butler, D., Holloway, L., & Bear, C. (2012). The impact of technological change in dairy farming: robotic milking systems and the changing role of the stockperson.

Cardoso, C.S., von Keyserlingk, M.A.G., & Hötzel, M.J. (2019). Views of dairy farmers, agricultural advisors, and lay citizens on the ideal dairy farm. Journal of Dairy Science, 102, 1811-1821. https://doi.org/10.3168/jds.2018-14688

Carmichael, J., Cran, A., Hrvatin, F., & Matthews, J. (2023). "We are stewards and caretakers of the land, not exploiters of resources": A qualitative study exploring Canadian

farmers' perceptions of environmental sustainability in agriculture. PLoS ONE, 18(8 August). https://doi.org/10.1371/journal.pone.0290114

Chapman, M., & Deplazes-Zemp, A. (2023). 'I owe it to the animals': The bidirectionality of Swiss alpine farmers' relational values. People and Nature, 5(1), 147–161. https://doi.org/10.1002/pan3.10415

Cogato, A., Brščić, M., Guo, H., Marinello, F., & Pezzuolo, A. (2021). Challenges and tendencies of automatic milking systems (AMS): A 20-years systematic review of literature and patents. Animals, 11, 356. https://doi.org/10.3390/ani11020356

Creswell, J. W., & Creswell, J. D. (2018). Research design: Qualitative, quantitative, and mixed methods approaches, 5th ed. SAGE.

de Boon, A., Sandström, C., & Rose, D.C. (2022). Governing agricultural innovation: A comprehensive framework to underpin sustainable transitions. Journal of Rural Studies, 89, 407 – 422. https://doi.org/10.1016/j.jrurstud.2021.07.019

Doyon, M. (2011). Canada's Dairy Supply Management: Comprehensive Review and Outlook for the Future. https://www.researchgate.net/publication/228829951

Finstad, T., Aune, M., & Egseth, K. A. (2021). The domestication triangle: How humans, animals and technology shape each other – The case of automated milking systems. Journal of Rural Studies, 84, 211–220. https://doi.org/10.1016/j.jrurstud.2021.03.006

Gargiulo, J. I., Eastwood, C. R., Garcia, S. C., & Lyons, N. A. (2018). Dairy farmers with larger herd sizes adopt more precision dairy technologies. Journal of Dairy Science, 101(6), 5466–5473. https://doi.org/10.3168/jds.2017-13324

Gray, I., Dunn, T., & Phillips, E. (2002). Power, interests and the extension of sustainable agriculture. Sociologia Ruralis, 37, 97-113. https://doi.org/10.1111/1467-9523.00038

Hagen, B. N. M., Sawatzky, A., Harper, S. L., O'sullivan, T. L., & Jones-Bitton, A. (2021). What impacts perceived stress among Canadian farmers? A mixed-methods analysis. International Journal of Environmental Research and Public Health, 18(14). https://doi.org/10.3390/ijerph18147366

Hansen, B. G. (2015). Robotic milking-farmer experiences and adoption rate in Jæren, Norway. Journal of Rural Studies, 41, 109–117. https://doi.org/10.1016/j.jrurstud.2015.08.004

Hansen, B. G., & Østerås, O. (2019). Farmer welfare and animal welfare – exploring the relationship between farmer's occupational well-being and stress, farm expansion and animal welfare. Preventive Veterinary Medicine, 170, 104741. https://doi.org/10.1016/j.prevetmed.2019.104741

Hansen, B. G., & Stræte, E. P. (2020). Dairy farmers' job satisfaction and the influence of automatic milking systems. NJAS – Wageningen Journal of Life Sciences, 92, 100328. https://doi.org/10.1016/j.njas.2020.100328

Holloway, L., & Bear, C. (2017). Bovine and human becomings in histories of dairy technologies: robotic milking systems and remaking animal and human subjectivity. BJHS Themes, 2, 215–234. https://doi.org/10.1017/bjt.2017.2

Holloway, L., Bear, C., & Wilkinson, K. (2014). Re-capturing bovine life: Robot-cow relationships, freedom and control in dairy farming. Journal of Rural Studies, 33, 131–140. https://doi.org/10.1016/j.jrurstud.2013.01.006

Hostiou, N., Fagon, J., Chauvat, S., Turlot, A., Kling-Eveillard, F., Boivin, X., & Allain, C. (2017). Impact of precision livestock farming on work and human-animal interactions on dairy farms. A review. Biotechnology, Agronomy and Society and Environment, 21(4). https://doi.org/10.25518/1780-4507.13706

Jacobs, J. A. & Siegford, M. (2012). Invited review: The impact of automatic milking systems on dairy cow management, behavior, health, and welfare. Journal of Dairy Science, 95(5), 2227-2247. http://doi.org/10.3168/jds.2011-4943

John, A. J., Clark, C. E. F., Freeman, M. J., Kerrisk, K. L., Garcia, S. C., & Halachmi, I. (2016). Review: Milking robot utilization, a successful precision livestock farming evolution. Animal, 10(9), 1484-1492. https://doi.org/10.1017/S1751731116000495

Kaarlenkaski, T. (2023). Cows and humans as technology users: Multispecies agency and gender in automated milking systems in Finland. Technology and Culture, 64(4), 1093-1119. https://doi.org/10.1353/tech.2023.a910996

Karttunen, J. P., Rautiainen, R. H., & Lunner-Kolstrup, C. (2016). Occupational health and safety of Finnish dairy farmers using automatic milking systems. Frontiers in Public Health, 4, 147. https://doi.org/10.3389/fpubh.2016.00147

King, M. T. M., & DeVries, T. (2018). Graduate student literature review: Detecting health disorders using data from automatic milking systems and associated technologies. Journal of Dairy Science, 101, 8605-8614. https://doi.org/10.3168/jds.2018-14521

King, M. T. M., Pajor, E. A., LeBlanc, S. J., & DeVries, T. J. (2016). Associations of herd-level housing, management, and lameness prevalence with productivity and cow behavior in herds with automated milking systems. Journal of Dairy Science, 99, 9069-9079. http://doi.org/10.3168/jds.2016-11329

King, M. T. M., LeBlanc, S. J., Pajor, E. A., & DeVries, T. J. (2017). Cow-level associations of lameness, behavior, and milk yield of cows milked in automated systems. Journal of Dairy Science, 100, 4818-4828. https://doi.org/10.3168/jds.2016-12281

King, M., Matson, R., & DeVries, T. (2021). Connecting farmer mental health with cow health and welfare on dairy farms using robotic milking systems. Animal Welfare, 30(1), 25–38. https://doi.org/10.7120/09627286.30.1.025

King, N., & Brooks, J. M. (2018). Doing template analysis: A guide to the main components and procedures. In Template analysis for business and management students. SAGE Publications Ltd. https://doi.org/10.4135/9781473983304

Knauss, M., Adams, C. L., & Orsel, K. (2022). Producer perceptions toward prevention and control of lameness in dairy cows in Alberta Canada: A thematic analysis. Frontiers in Veterinary Science, 9. https://doi.org/10.3389/fvets.2022.812710

Kröbel, R., Stephens, E. C., Gorzelak, M. A., Thivierge, M-N., Akhter, F., Nyiraneza, J., Singer, S. D., Geddes, C. M., Glenn, A. J., Devillers, N., Alemu, A. W., St. Luce, M., &

Giardetti, D. (2021). Making farming more sustainable by helping farmers to decide rather than telling them what to do. Environmental Research Letters, 16, 055033. https://doi.org/10.1088/1748-9326/abef30

Lage, C. F. de A., Marques, T. C., Bruno, D. R., Endres, M. I., Ferreira, F., Pires, A. P. A., Leão, K., & de Lima, F. S. (2024). Farmers' perceptions on implementing automatic milking systems in large USA dairies: Decision-making process, management practices, labor, and herd performance. Animals, 14(2). https://doi.org/10.3390/ani14020218

Larue, B., Singbo, A., & Pouliot, S. (2017). Production rigidity, input lumpiness, efficiency, and the technological hurdle of Quebec dairy farms. Canadian Journal of Agricultural Economics, 65(4), 613–641. https://doi.org/10.1111/cjag.12156

Lundström, C., & Lindblom, J. (2021). Care in dairy farming with automatic milking systems, identified using an activity theory lens. Journal of Rural Studies, 87, 386–403. https://doi.org/10.1016/j.jrurstud.2021.09.006

Lunner-Kolstrup, C., Hörndahl, T., & Karttunen, J. P. (2018). Farm operators' experiences of advanced technology and automation in Swedish agriculture: a pilot study. Journal of Agromedicine, 23(3), 215–226. https://doi.org/10.1080/1059924X.2018.1458670

MacKay, C. (2023). A necessary evil? Examining the complexities of care and commodification. Environment and Planning E: Nature and Space, 6(3), 1725–1744. https://doi.org/10.1177/25148486221132227

McLachlan, B.A., & van Kooten, G.C. (2022). Reforming Canada's dairy supply management scheme and the consequences for international trade. Canadian Journal of Agricultural Economics, 70(1), 21 – 39. https://doi.org/10.1111/cjag.12305

Neethirajan, S., & Kemp, B. (2021). Digital livestock farming. Sensing and Bio-Sensing Research, 32, 100408. https://doi.org/10.1016/j.sbsr.2021.100408

Peralta, J. M., & Haefs, T. (2023). Human-animal interactions in an agricultural and production setting. In The Routledge International Handbook of Human-Animal Interactions and Anthrozoology, 613–625. Routledge. https://doi.org/10.4324/9781032153346-42

Pinillos, R. G., Appleby, M., Manteca, X., Scott-Park, F., Smith, C., & Velarde, A. (2016). One Welfare – a platform for improving human and animal welfare. Veterinary Record, 179(16), 412-413. https://doi.org/10.1136/vr.i5470

Pinillos, R. G. (2018). The path to developing a One Welfare framework. In One Welfare: A Framework to Improve Animal Welfare and Human Welfare, 1–15. CABI.

Rotz, S., Gravely, E., Mosby, I., Duncan, E., Finnis, E., Horgan, M., LeBlanc, J., Martin, R., Neufeld, H. T., Nixon, A., Pant, L., Shalla, V., & Fraser, E. (2019). Automated pastures and the digital divide: How agricultural technologies are shaping labour and rural communities. Journal of Rural Studies, 68, 112–122. https://doi.org/10.1016/j.jrurstud.2019.01.023

Saraceni, J., Renaud, D. L., Nelson, E., Van Os, J. M. C., Miltenburg, C., & Winder, C. B. (2022). Ontario dairy producers' perceived barriers and motivations to the use of pain control for disbudding and dehorning calves: A qualitative study. Animals, 12(8). https://doi.org/10.3390/ani12080973

Schillings, J., Bennett, R., & Rose, D. C. (2021). Exploring the potential of precision livestock farming technologies to help address farm animal welfare. Frontiers in Animal Science, 2. https://doi.org/10.3389/fanim.2021.639678

Schuppli, C. A., Spooner, J. M., & von Keyserlingk, M. A. G. (2023). Canadian dairy farmer views about animal welfare. Animal Welfare, 32, e38. https://doi.org/10.1017/awf.2023.32

Spooner, J. M., Schuppli, C. A., & Fraser, D. (2014). Attitudes of Canadian pig producers toward animal welfare. Journal of Agricultural & Environmental Ethics, 27, 569-589. https://doi.org/10.1007/s10806-013-9477-4

Statistics Canada. (2023). Dairy barns by type. . Accessed 16 March 2025.

Stone, A. E. (2020). Symposium review: The most important factors affecting adoption of precision dairy monitoring technologies. In Journal of Dairy Science, 103(6), 5740–5745. https://doi.org/10.3168/jds.2019-17148

Thompson, R., Hagen, B. N. M., Lumley, M. N., Winder, C. B., Gohar, B., & Jones-Bitton, A. (2023). “An incredible amount of stress before you even put a shovel in the ground”: A mixed methods analysis of farming stressors in Canada. Sustainability, 15(8). https://doi.org/10.3390/su15086336

Truchot, D., & Andela, M. (2018). Burnout and hopelessness among farmers: The Farmers Stressors Inventory. Social Psychiatry and Psychiatric Epidemiology, 53(8), 859–867. https://doi.org/10.1007/s00127-018-1528-8

Tse, C., Barkema, H. W., DeVries, T. J., Rushen, J., & Pajor, E. A. (2017). Effect of transitioning to automatic milking systems on producers' perceptions of farm management and cow health in the Canadian dairy industry. Journal of Dairy Science, 100(3), 2404–2414. https://doi.org/10.3168/jds.2016-11521

Tse, C., Barkema, H. W., DeVries, T. J., Rushen, J., Vasseur, E., & Pajor, E. A. (2018). Producer experience with transitioning to automatic milking: Cow training, challenges, and effect on quality of life. Journal of Dairy Science, 101(10), 9599–9607. https://doi.org/10.3168/jds.2018-14662

van der Ploeg, J. D. (2023). The sociology of farming: Concepts and methods.

Vigors, B., Wemelsfelder, F., & Lawrence, A. B. (2023). What symbolises a "good farmer" when it comes to farm animal welfare? Journal of Rural Studies, 98, 159–170. https://doi.org/10.1016/j.jrurstud.2023.01.009

von Keyserlingk, M. A. G., Mills, K. E., & Weary, D. M. (2024). Attitudes of western Canadian dairy farmers toward technology. Journal of Dairy Science, 107(2), 933–943. https://doi.org/10.3168/jds.2023-23279

Vyn, R. J., & Rude, J. (2020). The influence of supply management on farmland values in Ontario. Applied Economic Perspectives and Policy, 42(4), 815–834. https://doi.org/10.1093/aepp/ppz006

Weary, D. M., & von Keyserlingk, M. A. G. (2023). Review: Using animal welfare to frame discussion on dairy farm technology. Animal, 17, 100836. https://doi.org/10.1016/j.animal.2023.100836

Yazd, S. D., Wheeler, S. A., & Zuo, A. (2019). Key risk factors affecting farmers' mental health: A systematic review. In International Journal of Environmental Research and Public Health, 16(23). https://doi.org/10.3390/ijerph16234849

4 CHAPTER 4 | General Discussion and Future Directions

4.1 Discussion of Research Findings

This research project involved one study with two separate analyses, situated within a larger project investigating dairy farmer well-being. A network of organizations and individuals, including farmers, veterinarians, clinicians, academics, and dairy producer organizations (Dairy Farmers of Ontario, Dairy Farmers of Manitoba, SaskMilk, Alberta Milk, BC Dairy, and Lactanet) helped to recruit participants and helped to develop the interview guide. This thesis aimed to provide insight into dairy farmer well-being in the context of animal health and welfare, and technology by utilizing qualitative methods to better understand the lived experience and perceptions of dairy farmers.

This thesis began with a literature review (Chapter 1) of how well-being is defined as a construct influenced by a multitude of factors, before moving into the current literature surrounding mental health and well-being in rural and farming communities, and animal care professions. From there, I discussed perceptions of rural and farming communities, culture and identity in farming, leading into stressors and farmer mental health in Canada. I then described the 'One Welfare' framework, and the challenges that come with emphasizing one dimension (e.g., animals) over the other dimensions (e.g., humans or the environment), with examples such as the green revolution. Within this section, I touched on how livestock farmers and animal agriculture are affected by multiple narratives, economics, structural inequity, and consumer perceptions. I then delved into the subject of empathy in caring professions, how it pertains to stress, the farmer-animal relationship, moral obligations, tough decisions such as euthanasia, coping mechanisms, and the challenges that may be experienced when technology is inserted

into the farmer-animal-technology relationship. I also provided a brief overview of the methodology used within this thesis.

I conducted semi-structured interviews and then used thematic analysis to explore dairy farmer well-being in the context of animal health and welfare (Chapter 2) and technology (Chapter 3). In Chapter 2, there were 5 themes identified: 1) positive aspects of caring for cows; 2) farmer-cow interdependency; 3) pressure and responsibility to cows; 4) the costs of caring for cows; and 5) threats to quality and provision of care. The findings revealed the profound impact that caring may have on an individuals' well-being, specifically as a dairy farmer. Participating farmers shared how they "love" the cows and appreciated the "little things" about farming and working with livestock.

Individuals are driven to caring professions by compassion, which can be both a risk and protective factor to one's emotional well-being (Ludick & Figley, 2017). It seems to be evident from our results that participating dairy farmers may also fall into the caring profession as illustrated by the impact of caring for cows on well-being, as I will explain further. A relationship was observed between participating farmers and cows; cows depend on farmers to care for them, and farmers' emotional and financial well-being depends on how their cows are doing. An inherent pressure and responsibility to care for their cows undoubtedly affected participating farmer emotional well-being as they mentioned having "lives depending on you," while also holding potential consequences to participating farmers financial well-being as dairy farming is still a "business." Being responsible for livestock brought worries and stress that were seemingly inescapable, which may be detrimental to participating farmers' work-life balance and their social and emotional well-being, as they feel they are always "on call." Not only were there consequences to emotional well-being but also to their physical well-being, as participating

farmers said they would prioritize their cows over themselves and/or their family. The costs of caring livestock were wide-ranging, from worries and stress, guilt and grief, and the internal conflict when ethical, economical, and emotional factors collide during decision-making processes. As livestock farmers face increasing pressure from consumers regarding animal welfare (Alonso et al., 2020; Burton et al., 2012; Mahon et al., 2023; Muhammad et al., 2022; Sirovica & von Keyserlingk, 2023; Ventura et al., 2015; Ventura et al., 2016), farmers may perceive a threat to the 'good farmer' from public pressures (Schuppli et al., 2023) and resultant regulations (Ida et al., 2023). Due to these additional factors, it may be possible that the consequences of caring for animals differ for livestock farmers in comparison to other animal care professionals such as veterinarians, laboratory animal staff, and animal shelter staff.

I have demonstrated how caring may positively and negatively affect participating farmers well-being as they care for their livestock. Researchers have described the emotional toll of euthanasia on farmers and/or farmworkers (Denis-Robichaud et al., 2023; Wagner et al., 2020; Edwards-Callaway et al., 2022). My findings align and contribute additional context illustrating that farmer emotional well-being may be affected by more than euthanasia. Culling decisions can also be challenging as it can be more difficult to accept whereas with euthanasia, numerous participating farmers shared how they were able to rationalize that, in some situations, euthanasia was the best choice for the animal to alleviate suffering. For example, most participating farmers described that when a euthanasia decision was made, it was for the cows "best interest." Whereas for some participants, culling decisions were emotionally challenging because of the connection to their cows from knowing their cows "by name" and the "personalities" of them. I have also highlighted that more research indeed is necessary to further understand livestock farmer well-being beyond euthanasia as there appears to be a complex relationship based on these findings.

In Chapter 2, I demonstrated how participating dairy farmers experience pressure and responsibility to care for their animals, this relates to moral responsibility which aligns with current research (Croyle et al., 2019; Marshall et al., 2023; Schuppli et al., 2023; Ida et al., 2023). I also have illustrated an inability to disconnect from the farm, which is consistent with existing literature (Walker & Walker, 1987; Thompson et al., 2023; Proctor & Hopkins, 2023; Wheeler et al., 2023). It is important to consider the findings of moral responsibility and work-life balance in conjunction because there may be a relationship between them that could highlight areas where coping strategies may be helpful. For example, some participants felt a "moral obligation" to their animals, overextending themselves to care for their animals. This has potential to result in detrimental impacts to the well-being of the farmer, but it is also likely to impact family members and loved ones, as well.

Findings by Thompson et al. (2023) regarding episodic and chronic stressors in farming are particularly relevant here, as I have illustrated the constant worries and stress participating dairy farmers face, which may very well be a chronic stressor for livestock farmers, more broadly. These findings contribute additional context to the influence of stressors present for livestock farmers. Factors such as disease outbreaks, feed sovereignty, and sociopolitical influences appeared to threaten participating farmers quality and provision of care. Perhaps more succinctly, it could be said that this poses risk to their autonomy which aligns with findings in other research studies with dairy farmers in Canada (Ida et al., 2023; Schuppli et al., 2023). The 'good farmer' identity (Burton, 2004) is related to providing a high level of animal welfare (Burton et al., 2012; Vigors et al., 2023), whereas the threats to quality and provision of care for livestock that I have outlined may also implicate farmer identity which poses risk for social isolation and cultural loneliness (Wheeler et al., 2023) and thus, well-being.

One of the salient findings from Chapter 2 relates to the sociopolitical influences described by participating farmers. It is my understanding that a shared goal between industry, government, consumers, and farmers is to promote animal welfare and enhance sustainability. Based on my findings, there may be a need for more collaborative engagement to take place between farmers, industry, government, and consumers. By involving farmers in development of strategies (e.g., recommendations, requirements), there may be potential to increase success and effectiveness of proposed strategies which has been noted previously (Kröbel et al., 2021; Ritter et al., 2019). While respect should be non-negotiable throughout meaningful engagement, it appears that, according to some participating farmers in my study, there could be some circumstances where respect may have been fractured or at least perceived to be (e.g., "be quiet […] and comply" with policy, or "instead of bringing him a ladder to get out of the hole, we just dug 10 feet deeper"). As one farmer described in Chapter 2:

"*"...part of why people struggle with mental health is because they're not heard. And when the politicians and when the large organizations, farm organizations included, are more worried about the political standing with the politicians than what the grassroots people are telling them, I think that will remain a barrier."*

Although this may be challenging to address, it is worthwhile repairing as a lack of mutual respect and trust could be burdensome to collaboration. There may be areas for improvement to existing supports, these findings can help foster positive change to support systems to safeguard animal welfare and farmer well-being.

The main themes generated through thematic analysis in Chapter 3 include: 1) benefits for cows; 2) no two farms or farmers are identical; and 3) pressures "pushing everybody towards

robots". These findings show the emphasis placed on cow-level benefits that technology offers such as cow agency, consistency, and detection of cow health concerns. However, I also illustrate the importance of considering the specific context prior to employing new technology. Farmers are individuals with their own set of beliefs, preferences, strengths, and weaknesses. This was clear in four different ways: lifestyle preferences (structured vs. flexible), management of cow health (using technology vs. hands-on), views about milking cows (pleasurable vs. mundane), and utility of technology (helpful vs. hindrance). There are external pressures such as future uncertainty, labour and financial considerations, efficiency as a "double-edged sword", and power structures. These influences make it difficult *to avoid* incorporating technology, while also making it difficult *to* incorporate technology.

In retrospect, the findings of Chapter 2 contributed more depth to the analysis and findings of Chapter 3, as participating farmers would begin by describing how technology offered benefits to cows. For livestock farmers, their identity of being a 'good farmer' (Burton, 2004) involves taking care of and safeguarding the welfare of their livestock, however that may look in their eyes (Vigors et al., 2023). When asked about technology, participating farmers would first speak of the benefits for cows and would follow up with the positive impacts on their own well-being. This underscores the fact that participating farmers, more often than not, put their animals before themselves, and possibly their families. Considering that participating farmers also described feelings of guilt when they were unable to help their animals, I posit that when farmers place cows as their first priority, this may serve as a coping mechanism in an effort to mitigate such outcomes. Unfortunately, this approach is unlikely to mitigate animal health challenges because there are numerous factors outside of the farmer's control. Regardless of the external threats to cow health and welfare, I posit that farmers oftentimes feel more justified in

caring for their cows than for themselves, which ultimately can place well-being of the farmer at risk. A study by Hagen et al. (2020) reported that individuals in farming communities may be more inclined to help others facing mental health challenges after participating in tailored mental health literacy training. Perhaps, it may be beneficial to increase extension efforts to farming communities regarding the relationship between animal welfare and farmer well-being, to illustrate that if farmer well-being is compromised there are potential consequences to animal welfare and vice versa.

When caring for living things, sickness and death are unavoidable, but there are also positive aspects of dairy farming. I have depicted the rewarding aspects of dairy farming such as the farmer-cow relationship and the satisfaction that participating farmers experience when they can help animals recover. In some ways, technology can also be a risk, because it can distance farmers from their animals, perhaps threatening the 'good farmer' identity (Burton, 2004). Further, there is risk with current narratives surrounding technology use stating that farmers do not *want* to be in the barn (Baur & Ile, 2023) which may de-value farmers' intentions and skillsets, which highlights how important it is to consider farmers' experiences and to conduct more research like this thesis. Data-driven decision-making can theoretically work, but farmers have to be willing and able to shift their approach to farming for this to work in a practical sense. The increase in on-farm technology may be perceived to compromise aspects of farming that are a fundamental piece of a farmer's identity. It is clear that 'one-size-fits-all' approaches do not work, unfortunately, the approach taken to animal welfare research favours this method (Vigors et al., 2023). These findings build upon existing literature regarding alteration of the farmer-cow relationship through implementation of technology (Holloway et al., 2014; von Keyserlingk et al., 2024; Weary & von Keyserlingk, 2023).

In Chapter 2, I also illustrated how participating farmers described a sense of inadequacy from the perspective of consumers. This finding relates to research that has described criticism towards livestock farmers (Ceccato et al., 2022, 2021; Schuppli et al., 2023; Ida et al., 2023), and farmers not feeling understood (Cobo-Angel et al., 2021) or appreciated (Ida et al., 2023; Letourneau & Davidson, 2022) by consumers. In some cases, they also felt like they had a target on their back which aligns with findings from Sweden where livestock farmers felt they were targeted by crime for being a livestock farmer (Ceccato et al., 2022) and experience fear from the worry that they will be victims of animal activism (Ceccato et al., 2021). The hostility present here relates to cultural loneliness and social isolation (Wheeler et al., 2023) which has implications physical, emotional, and social well-being (Mead et al., 2021; Kemp et al., 2017; Kemp & Fisher, 2022). Future research may help to understand what strategies may be most appropriate to help find common ground and address feelings of hostility and lack of safety.

I also demonstrated how disease and feed sovereignty threaten the provision of animal care in Chapter 2. My findings regarding disease are consistent with existing literature as livestock disease is a risk factor to farmer mental health (Yazd et al., 2019), likely due to the stress of preventing disease, and the devasting impacts of disease outbreaks (Thompson et al., 2023; McAloon et al., 2017). Current research has illustrated the challenges livestock farmers face in regards to feed quality and availability (Cordeiro et al., 2022; Tourangeau et al., 2019; Godde et al., 2021), however, my findings surrounding feed sovereignty contribute additional context as to how this may have an additional impact on participating dairy farmers well-being. For example, difficulties producing feed may require a farmer to purchase feed, which is likely to be costly in the event of a local shortage thus, contributing financial stress, and ultimately, threatening a farmers' capacity to care for their livestock. Although Berry et al. (2011) discussed

how climate change may hold implications for the well-being of farmers in general, I have highlighted how this may be more nuanced for livestock farmers. It may be challenging, however, it could be beneficial to develop an action plan that can provide additional support for livestock farmers in the face of adverse weather events, such as drought and flooding.

There are similarities related to structural inequity in both Chapter 2 and 3, as each draw on power structures and sociopolitical factors. In Chapter 2, I described the perceived threats to provision of animal care, whereas in Chapter 3 I highlighted the external pressures pushing farmers to incorporate technology. Support from the general public for livestock farmers, and perhaps animal agriculture as a whole, appears to be lacking, based on the findings of our study, as well as existing literature (Alonso et al., 2020; Burton et al., 2012; Mahon et al., 2023; Muhammad et al., 2022; Sirovica & von Keyserlingk, 2023; Ventura et al., 2015; Ventura et al., 2016). However, it also seems that some participating farmers did not feel they have sufficient support from the organizations within the dairy industry that exist to support them, particularly within regards to regulations and requirements. Increasing regulatory and administrative requirements were a source of frustration in my study, which is consistent with current literature about dairy farmers in Canada (Knauss et al., 2022; Ida et al., 2023; Marshall et al., 2023) and farmers generally (Thompson et al., 2023; Truchot & Andela, 2018; Yazd et al., 2019). Although there may be benefits to consumer trust, the environment, or animal welfare, it is crucial to consider the monetary cost and practicality of implementing new practices.

In this thesis, I described pressures and conflicting demands that participating farmers were facing. There is a perceived a disconnect between farmers and the general public (Thompson et al., 2023; Letourneau & Davidson, 2022) which is consistent with my findings. These conflicting demands and increasing pressures may place farmer well-being at risk, whether that is

financially, socially, emotionally, or physically. My findings illustrate that these challenges continue to exist, while additionally contributing context to how and why these challenges may influence farmer well-being.

My findings suggest that several participating farmers felt they were not adequately considered, consulted, or represented in processes from policy to research. These results build on research that has demonstrated a need to consider the influence of sociopolitical factors on farmers (Vigors et al., 2023) and to ensure farmers are involved in policy development (Balzani & Hanlon, 2020). As Gray et al. (1997) explained succinctly, "merely giving farmers' perspectives recognition by offering them participation in research and extension will not ensure their interests are addressed." It is crucial to work together and find solutions and new ways to mitigate challenges. There is no 'one-size fits all' when it comes to enhancing farmer well-being, environmental sustainability, or animal welfare. Before widespread promotion of on-farm technology and new regulatory schemes, it is crucial to careful consider the impact and practical application to avoid marginalization of farmers where implementation is not feasible, such as not having the money or skills to utilize technology (Rotz et al., 2019). The implementation of required or recommended practices may not be as effective or successful if farmers are not considered throughout development (Kröbel et al., 2021; Ritter et al., 2019). The consequences that may result from inadequate support systems for farmers have potential to be wide-reaching – food security, animal health and welfare, the well-being of individual farmers and their families, well-being of rural communities, and so much more.

In summary, participating farmers demonstrated a great deal of care for their animals. While there are rewards such as fulfilment and gratification, there are also risks such as worries and stress, guilt and grief, and internal conflict, which may influence dairy farmer emotional,

physical, social, and financial well-being. Providing a high-level of animal care is perceived as a moral obligation; this often resulted in participating farmers prioritizing animals over themselves which is further compounded by the domino effect of stressors such as feed sovereignty, disease, consumer and regulatory pressures that threaten the participating farmer's capacity to provide care to their animals. There are a number of advantages and disadvantages to on-farm technology, which are highly contextual to each farm and farmer, and the external pressures that they may face.

4.2 Study Strengths and Limitations

This thesis contributes added context to dairy farmer well-being in relation to animal health and welfare, and technology. The findings of this study provide insight to further understanding the lived experience of dairy farmers. These results can be utilized to provide further insight into the context that quantitative studies fail to capture. This study included participants across age groups, with men and women from across Ontario and Western Canada. There was representation of both tie stall and free stall housing systems, and conventional and robot milking systems. Previous research with farmer mental health has taken a broad strokes approach to include all commodity groups, which provided the framework and rationale for further research, such as this, to deepen current understanding of commodity specific challenges in regards to well-being. Lastly, this study has provided necessary evidence to conduct more work with livestock farmers to explore their experience caring for livestock.

A limitation of this study is that the results are not generalizable due to the qualitative nature of this study. A further limitation was a lack of representation from diverse populations, not collecting ethnicity data to determine representation within the study, conducting interviews in English only, and lack of inclusion of farmers in Eastern Canada.

4.3 Future Directions

4.3.1 Investigate compassion fatigue risk in livestock farmers

Although my research is not generalizable to the entire population of dairy farmers in Western Canada and Ontario, it provides valuable insight to suggest that participating dairy farmers may experience challenges related to caring for livestock. I have illustrated the positive and negative effects that caring for livestock may have on farmer well-being. Existing literature often approaches specific challenges such as euthanasia, but it is of interest to broaden the scope to include positive and negative aspects to better understand the influence of caring for livestock on well-being. Future work could offer more insight into the potential for compassion fatigue and the role of compassion in other commodities involved in animal agriculture. More research is necessary to elucidate the potential risk and protective factors, and the occurrence of compassion fatigue in livestock farmers.

4.3.2 Implement a 'not about us, without us' mentality with industry-wide changes

I have highlighted how regulations, requirements, and power dynamics may negatively affect participating farmers well-being. It is reasonable to consider that there is likely to be more changes coming with the revision of Codes from the National Farm Animal Care Council (2024). While advancing animal welfare is of significant importance, there is a need to ensure adequate farmer representation in these processes, especially in regard to policy development that directly affects their livelihood. For example, if tie stall systems are to be phased out, it is crucial to involve farmers who currently utilize tie stall systems on their farm in policy planning and development.

I recommend future research to better elucidate the influence of policy and power on farmer well-being. There are also steps that the dairy industry can take now to minimize further stress

on farmers, and more than likely, their animals. More efforts could be directed towards community-based approaches that foster meaningful engagement. For example, informal sessions with farmers and industry to connect and better understand unique farm-level challenges. This could help build trust and respect, which will likely be necessary for future collaboration. It should be noted that a lack of involvement and/or consideration of farmers throughout policy development may be due to a variety of factors such as time, resources, willingness to participate, lack of understanding of the success of community-based approaches. However, as an industry, there may be benefit in increased engagement between farmers, government, milk boards, researchers.

4.3.3 Establish support systems for on-farm technology

I have illustrated that some farmers who participated in this study perceive a lack of support to plan for or incorporate on-farm technology. There are significant consequences to animal welfare and farmer well-being when there are issues with technology which need to be adequately addressed within a timely fashion. It would be of benefit for the dairy industry and technology manufacturers to work together and invest in establishing a network of industry experts to be willing and able to support and solve issues when they arise with on-farm technology. As it is reasonable to consider that there may be a lack of resources available, a virtual network could also be developed to help in these situations.

4.3.4 Collaborating with farmers to inform initiatives

As farmer well-being and cow welfare are fundamentally intertwined, one of the best ways to ensure care for cow welfare is to support farmer well-being. Oftentimes, participants in this study would place cow welfare ahead of their own, therefore being an ally in efforts to support cow welfare. Appreciating different perspectives (e.g., lived experience) alongside scientific research

may strengthen initiatives. By working together with farmers to develop strategies to enhance cow welfare, there is potential to build trust and respect, and facilitate meaningful collaboration.

4.4 Conclusion

Caring for livestock underpins dairy farming, perhaps livestock farming as a whole. Dairy farmers may experience both the risks and rewards involved with caring for animals, but they also face a great deal of threats to the provision of care to their cows. On-farm technology has the potential to benefit farmer well-being, but it must be considered as part of the solution rather than the entire solution. Rather, it is a tool for farmers to utilize if they desire. There is also an ever-increasing pressure to become more efficient and promote animal welfare. The farmer-cow relationship is important to many farmers, incorporating technology can alter this relationship in positive and negative ways, while it also alters a fundamental piece of what makes a dairy farmer who they are. The findings of this thesis reveal numerous ways in which farmers' social, emotional, physical, and financial well-being can be influenced by animal health and welfare, and technology.

4.5 References

Alonso, M.E., González-Montaña, J.R., & Lomillos, J.M. (2020). Consumers' concerns and perceptions of farm animal welfare. Animals, 10, 385. https://doi.org/10.3390/ani10030385

Balzani, A., & Hanlon, A. (2020). Factors that influence farmers' views on farm animal welfare: A semi-systematic review and thematic analysis. Animals, 10(9), 1–25). https://doi.org/10.3390/ani10091524

Baur, P. & Iles, A. (2023). Inserting machines, displacing people: how automation imaginaries for agriculture promise 'liberation' from the industrialized farm. Agriculture and Human Values, 40, 815-833. https://doi.org/10.1007/s10460-023-10435-5

Berry, H. L., Hogan, A., Owen, J., Rickwood, D., & Fragar, L. (2011). Climate change and farmers' mental health: Risks and responses. Asia-Pacific Journal of Public Health, 23(2 Suppl), 119S-32. https://doi.org/10.1177/1010539510392556

Burton, R. J. F. (2004). Seeing through the "good farmer's" eyes: Towards developing an understanding of the social symbolic value of "productivist" behaviour. Sociologia Ruralis, 44(2), 195–215. https://doi.org/10.1111/j.1467-9523.2004.00270.x

Burton, R. J. F., Peoples, S., & Cooper, M. H. (2012). Building "cowshed cultures": A cultural perspective on the promotion of stockmanship and animal welfare on dairy farms. Journal of Rural Studies, 28(2), 174–187. https://doi.org/10.1016/j.jrurstud.2011.12.003

Ceccato, V., Lundqvist, P., Abraham, J., Göransson, E., & Svennefelt, C. A. (2021). The nature of fear among farmers working with animal production. International Criminology, 1, 193-207. https://doi.org/10.1007/s43576-021-00024-z

Ceccato, V., Lundqvist, P., Abraham, J., Göransson, E., & Svennefelt, C. A. (2022). Farmers, victimization, and animal rights activism in Sweden. Professional Geographer, 74(2), 350–363. https://doi.org/10.1080/00330124.2021.2004899

Cobo-Angel, C., LeBlanc, S. J., Roche, S. M., & Ritter, C. (2021). A focus group study of Canadian dairy farmers' attitudes and social referents on antimicrobial use and antimicrobial resistance. Frontiers in Veterinary Science, 8. https://doi.org/10.3389/fvets.2021.645221

Cordeiro, M.R.C., Mengistu, G.F., Pogue, S.J., Legesse, G., Gunte, K.E., Taylor, A.M., Ominski, K.H., Beauchemin, K.A., McGeough, E.J., Faramarzi, M., & McAllister, T.A. (2022). Assessing feed security for beef production within livestock-intensive regions. Agricultural Systems, 196, 103348. https://doi.org/10.1016/j.agsy.2021.103348

Croyle, S. L., Belage, E., Khosa, D. K., LeBlanc, S. J., Haley, D. B., & Kelton, D. F. (2019). Dairy farmers' expectations and receptivity regarding animal welfare advice: A focus group study. Journal of Dairy Science, 102(8), 7385–7397. https://doi.org/10.3168/jds.2018-15821

Denis-Robichaud, J., Rousseau, M., Denicourt, M., Villettaz-Robichaud, M., Lamothe, A. M., & DesCôteaux, L. (2023). Methods used by Canadian dairy farmers for on-farm euthanasia and the emotions associated with the decision and the practice of euthanasia. Journal of Dairy Science, 106(2), 1301–1314. https://doi.org/10.3168/jds.2022-21986

Edwards-Callaway, L., Simpson, H., Román-Muñiz, N., Cramer, C., Mijares, S., Stallones, L., Rivera-Gonzalez, J., & Aberle, J. (2022). Preliminary Exploration of weekly peer group discussions as a strategy for coping with feelings associated with euthanasia in dairy caretakers.

International Journal of Environmental Research and Public Health, 19(4), 2177. https://doi.org/10.3390/ijerph19042177

Godde, C.M., Mason-D'Croz, D., Mayberry, D.E., Thornton, P.K., & Herrero, M. (2021). Impacts of climate change on the livestock food supply chain; a review of the evidence. Global Food Security, 28, 100488. https://doi.org/10.1016/j.gfs.2020.100488

Hagen, B. N. M., Harper, S. L., O'Sullivan, T. L., & Jones-Bitton, A. (2020). Tailored mental health literacy training improves mental health knowledge and confidence among Canadian farmers. International Journal of Environmental Research and Public Health, 17, 3807. https://doi.org/10.3390/ijerph17113807

Ida, J. A., Wilson, W. M., Nydam, D. V., Gerlach, S. C., Kastelic, J. P., Russell, E. R., McCubbin, K. D., Adams, C. L., & Barkema, H. W. (2023). Contextualized understandings of dairy farmers' perspectives on antimicrobial use and regulation in Alberta, Canada. Journal of Dairy Science, 106(1), 547–564. https://doi.org/10.3168/jds.2021-21521

Kemp, A. H., Arias, J. A., & Fisher, Z. (2017). Social ties, health and wellbeing: A literature review and model. In A. Ibáñez et al. (Ed.), Neuroscience and Social Science, 397–427. Springer International Publishing. https://doi.org/10.1007/978-3-319-68421-5_17

Kemp, A. H., & Fisher, Z. (2022). Wellbeing, whole health and societal transformation: Theoretical insights and practical applications. Global Advances in Health and Medicine, 11, 1-16. https://doi.org/10.1177/21649561211073077

Kielland, C., Skjerve, E., Østerås, O., & Zanella, A. J. (2010). Dairy farmer attitudes and empathy toward animals are associated with animal welfare indicators. Journal of Dairy Science, 93(7), 2998–3006. https://doi.org/10.3168/jds.2009-2899

Knauss, M., Adams, C. L., & Orsel, K. (2022). Producer perceptions toward prevention and control of lameness in dairy cows in Alberta Canada: A thematic analysis. Frontiers in Veterinary Science, 9. https://doi.org/10.3389/fvets.2022.812710

Kröbel, R., Stephens, E. C., Gorzelak, M. A., Thivierge, M-N., Akhter, F., Nyiraneza, J., Singer, S. D., Geddes, C. M., Glenn, A. J., Devillers, N., Alemu, A. W., St. Luce, M., & Giardetti, D. (2021). Making farming more sustainable by helping farmers to decide rather than telling them what to do. Environmental Research Letters, 16, 055033. https://doi.org/10.1088/1748-9326/abef30

Letourneau, A. M., & Davidson, D. (2022). Farmer identities: facilitating stability and change in agricultural system transitions. Environmental Sociology, 8(4), 459–470. https://doi.org/10.1080/23251042.2022.2064207

Ludick, M., & Figley, C. R. (2017). Toward a mechanism for secondary trauma induction and reduction: Reimagining a theory of secondary traumatic stress. Traumatology, 23(1), 112–123. https://doi.org/10.1037/trm0000096

Mahon, N., Holloway, L., Clark, B., & Proctor, A. (2023). The application of a sentiment analysis approach to explore public understandings of animal agriculture. Journal of Rural Studies, 103. https://doi.org/10.1016/j.jrurstud.2023.103127

McAloon, C.G., Macken-Walsh, Á., Moran, L., Whyte, P., More, S.J., O'Grady, L., & Doherty, M.L. (2017). Johne's disease in the eyes of Irish cattle farmers: A qualitative narrative research approach to understanding implications for disease management. Preventive Veterinary Medicine, 141, 7-13. http://dx.doi.org/10.1016/j.prevetmed.2017.04.001

Muhammad, M., Stokes, J. E., Morgans, L., & Manning, L. (2022). The social construction of narratives and arguments in animal welfare discourse and debate. Animals, 12(19). https://doi.org/10.3390/ani12192582

Proctor, C., & Hopkins, N. (2023). Stressors and coping strategies in rural farmers: A qualitative study. Journal of Agromedicine, 28(3), 415–424. https://doi.org/10.1080/1059924X.2023.2173691

Ritter, C., Adams, C. L., Kelton, D. F., & Barkema, H. W. (2019). Factors associated with dairy farmers' satisfaction and preparedness to adopt recommendations after veterinary herd health visits. Journal of Dairy Science, 102(5), 4280–4293. https://doi.org/10.3168/jds.2018-15825

Rotz, S., Gravely, E., Mosby, I., Duncan, E., Finnis, E., Horgan, M., LeBlanc, J., Martin, R., Neufeld, H. T., Nixon, A., Pant, L., Shalla, V., & Fraser, E. (2019). Automated pastures and the digital divide: How agricultural technologies are shaping labour and rural communities. Journal of Rural Studies, 68, 112–122. https://doi.org/10.1016/j.jrurstud.2019.01.023

Schuppli, C. A., Spooner, J. M., & von Keyserlingk, M. A. G. (2023). Canadian dairy farmer views about animal welfare. Animal Welfare, 32, e38. https://doi.org/10.1017/awf.2023.32

Sirovica, L. V., & Keyserlingk, M. A. G. von. (2023). Public perceptions of farm animal welfare. In The Routledge International Handbook of Human-Animal Interactions and Anthrozoology, 644–657. Routledge. https://doi.org/10.4324/9781032153346-44

Statistics Canada. (2023). Dairy barns by type. . Accessed 16 March 2025.

Thompson, R., Hagen, B. N. M., Lumley, M. N., Winder, C. B., Gohar, B., & Jones-Bitton, A. (2023). "An incredible amount of stress before you even put a shovel in the ground": A mixed methods analysis of farming stressors in Canada. Sustainability, 15(8). https://doi.org/10.3390/su15086336

Tourangeau, W., Sherren, K., & Kent, C. (2019). Of climate and weather: Examining Canadian farm and livestock organization discourses from 2010 to 2015. Weather, Climate, and Society, 11, 95 – 111. https://doi.org/10.1175/WCAS-D-18-0028.1

Truchot, D., & Andela, M. (2018). Burnout and hopelessness among farmers: The Farmers Stressors Inventory. Social Psychiatry and Psychiatric Epidemiology, 53(8), 859–867. https://doi.org/10.1007/s00127-018-1528-8

Ventura, B. A., von Keyserlingk, M. A. G., & Weary, D. M. (2015). Animal welfare concerns and values of stakeholders within the dairy industry. Journal of Agricultural and Environmental Ethics, 28, 109–126. https://doi.org/10.1007/s10806-014-9523-x

Ventura, B.A., von Keyserlingk, M.A.G., Wittman, H., & Weary, D.M. (2016). What difference does a visit make? Changes in animal welfare perceptions after interested citizens tour a dairy farm. PLoS ONE, 11(5), e0154733. https://doi:10.1371/journal.pone.0154733

Vigors, B., Wemelsfelder, F., & Lawrence, A. B. (2023). What symbolises a “good farmer” when it comes to farm animal welfare? Journal of Rural Studies, 98, 159–170. https://doi.org/10.1016/j.jrurstud.2023.01.009

von Keyserlingk, M. A. G., Mills, K. E., & Weary, D. M. (2024). Attitudes of western Canadian dairy farmers toward technology. Journal of Dairy Science, 107(2), 933–943. https://doi.org/10.3168/jds.2023-23279

Wagner, B. K., Cramer, M. C., Fowler, H. N., Varnell, H. L., Dietsch, A. M., Proudfoot, K. L., Shearer, J., Correa, M., & Pairis-Garcia, M. D. (2020). Determination of dairy cattle euthanasia criteria and analysis of barriers to humane euthanasia in the United States: Dairy producer surveys and focus groups. Animals, 10(5). https://doi.org/10.3390/ani10050770

Walker, L. S., & Walker, J. L. (1987). Stressors and symptoms predictive of distress in farmers. Family relations, 36(4), 374-378. https://doi.org/10.2307/584486

Weary, D. M., & von Keyserlingk, M. A. G. (2023). Review: Using animal welfare to frame discussion on dairy farm technology. Animal, 17, 100836. https://doi.org/10.1016/j.animal.2023.100836

Wheeler, R., Lobley, M., McCann, J., & Phillimore, A. (2023). ‘It’s a lonely old world’: Developing a multidimensional understanding of loneliness in farming. Sociologia Ruralis, 63(S1), 11–36. https://doi.org/10.1111/soru.12399

Yazd, S. D., Wheeler, S. A., & Zuo, A. (2019). Key risk factors affecting farmers’ mental health: A systematic review. In International Journal of Environmental Research and Public Health, 16(23). https://doi.org/10.3390/ijerph16234849

APPENDICES

Appendix A: Semi-structured interview guide

INTRODUCTION

- Please tell me a bit about your farm, and how you began farming.
    - Probes: influencing factors, major life events
- For what reasons did you choose to participate in this study?
- Please tell me about an average day on the farm for you.

TECHNOLOGY

- Please tell me about the technology that you use on your farm.
    - Probes: positive influences? Negative influences?
- What kind of barriers are there to implementing technology on your farm?

WELL-BEING

- How would you describe your well-being?
    - Probes: physical, emotional/mental, social, sleep
- Please tell me about the aspects of dairy farming that influence your well-being.
    - Probes: positive/negative influences. Fulfilling/challenging aspects
- Can you think of a time when you or someone on the farm experienced any physical or occupational injuries?
- Please tell me about any worries you have related to your health and well-being.
    - Probes: mental, physical
- When, if at all, do you find yourself worrying about your animals?

- Probes: Your farm? Please describe some of the worries.

- Can you describe a time as a producer when you experienced excessive stress?

STRESS

- What aspects of dairy farming do you find stressful?
- How do you think that the sources of stresses differ between livestock farmers and crop farmers?
- How do you feel when things are going well on your farm?
- How do you feel when things aren't going so well on your farm?
- Please tell me about the decision-making process associated with treatment plans for animals.
    - Probes: How do you feel during this process? How do you cope during/after this?
- How are culling and/or euthanasia decisions made on your farm?
    - Probes: How do you feel following the decision-making process? How do you cope during/after this?
- As a livestock farmer, what worries do you find yourself having regarding animal activists/protesters and/or trespassers on your farm?
    - Probes: Have you ever been targeted by individuals belonging to these groups, or know of someone who has?

RELATIONSHIPS & LABOUR

- How would you describe your work-life balance?

    - Probes: Family time, ability to enjoy time outside of work
- Who do you turn to for support when things aren't going well?
    - Probes: emotional support, informational support, helping hand
- Some studies have highlighted different types of labour based on gender. How do you think gender impacts people's roles on your farm?
    - Probes: Can you think of an example of how gender might play a role on your farm?
- What kind of challenges have you experienced with labour on the farm?

HEALTH RESOURCES & COPING

- How would you describe the mental well-being of farmers, in general?
- What kind of challenges may farmers face, as opposed to someone in the general population?
- Has your experience with clinicians (such as doctors, counsellors, or therapists) provided you with the feeling that your challenges are understood?
    - Probes: Please tell me about an experience where you felt/did not feel understood?
- What type of changes could help improve the mental health resources available for dairy, or livestock farmers?