* 8 typewritten pages in total, including an abstract (no more than 100 words), illustrations (no more than 4 figures and tables) and keywords
* Title page
  + Title of article (accurate, clear and concise description of the reported work, avoiding abbreviations)
* Abstract
  + Limited to 100 words
* Keywords
  + Three to ten keywords representing the main content of the article
* Introduction, Methods, and Results
  + This section should contain the body of the article, including a brief statement of the research hypothesis, the methods used, and the results found.
  + Introduction
    - Consumer trends?
    - Increasing number of organic farms?
    - How are they different?
    - IMI are of special concern on organic farms
    - Not a ton of work describing overall prevalence of IMI on organic farms (Pena-Mosca)
    - Not a ton of work speciating subclinical IMI from bedded pack farms
      * Pamela’s paper
      * Condas? Don’t give too much detail about what kind of BP
      * Pena-Mosca
    - *Given the increasing number of organic farms in the United States and the XXX continued increase in organic dairy products XXX, a need exists to further understand XXX diversity of species causing IMI on organic dairy farms XXX. The objectives of this study were to 1) characterize the prevalence of IMI caused by different microorganisms in lactating dairy cattle on small-midsize organic farms in Vermont, and 2) compare between the most commonly used type of housing for organic farms in the state (tiestall) and bedded packs.*
* Discussion
  + This section should contain a short discussion
  + How was it different than…
    - Pena-Mosca?
    - Pamela’s paper?
* Declarations
  + Ethics approval and consent to participate
    - STROBE-VET (Strengthening the Reporting of Observational Studies in Epidemiology–Veterinary Extension) statement guidelines were followed in the reporting of this study (O'Connor et al., 2016). Animal use for this project was approved by the University of Vermont Institutional Animal Care and Use Committee (IACUC; protocol #19-001).
  + Consent for publication
    - Not applicable
  + Availability of data and materials
    - The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.
  + Competing interests
    - The authors have not stated any conflicts of interest.
  + Funding
    - This project was funded by the Organic Agriculture Research and Extension Initiative (OREI) from the National Institute of Food and Agriculture (USDA-NIFA grant 2018-51300-28561). The first author, Caitlin E. Jeffrey was supported by a USDA-NIFA Predoctoral Fellowship award (grant 2022-67011-36567).
  + Authors' contributions
    - Caitlin Jeffrey conceptualized the study, acquired funding, coordinated farm recruitment and sampling, conducted on-farm sample collection, managed and curated the data, conducted the data analysis, prepared data visualizations and presentation, wrote the original and final drafts. Pamela Adkins, conducted isolate species identification by MALDI-TOF. John Barlow conceptualized the study, acquired funding, supervised the research, conducted on-farm sample collection, reviewed and edited the manuscript.
  + Acknowledgements
    - The authors thank the organic dairy producers who agreed to participate in this study, for giving us their time and allowing us to collect samples from their farms. We are grateful to the numerous University of Vermont undergraduate students who assisted with sample collection. We thank the laboratory staff at the Vermont State Agricultural and Environment Laboratory for determination of somatic cell counts from the quarter milk samples. We thank Paige Isensee, Natalie Sexton, Madyson Marrs, and Allena Radford, who provided laboratory assistance in the Adkins lab at the University of Missouri.
  + Authors' information
    - Not applicable
* References
  + All references, including URLs, must be numbered consecutively, in square brackets, in the order in which they are cited in the text. Each reference must have an individual reference number. Please avoid excessive referencing. The journal allows a maximum of 40 references for Short Reports. If automatic numbering systems are used, the reference numbers must be finalized and the bibliography must be fully formatted before submission.
* Figures, tables, and additional files
  + Figure titles (max 15 words) and legends (max 300 words) should be provided in the main manuscript, not in the graphic file.
  + Each figure should be closely cropped to minimize the amount of white space surrounding the illustration. Cropping figures improves accuracy when placing the figure in combination with other elements when the accepted manuscript is prepared for publication on our site. For more information on individual figure file formats, see our detailed instructions.
  + Individual figure files should not exceed 10 MB. If a suitable format is chosen, this file size is adequate for extremely high quality figures.
  + Table titles (max 15 words) should be included above the table, and legends (max 300 words) should be included underneath the table.
* Introduction
  + Consumer trends?
    - Global Organic Dairy Industry Report 2023: Trends, Share, Size, Growth, Opportunities and Forecasts 2022-2028 - ResearchAndMarkets.com
      * https://www.businesswire.com/news/home/20240102739435/en/Global-Organic-Dairy-Industry-Report-2023-Trends-Share-Size-Growth-Opportunities-and-Forecasts-2022-2028---ResearchAndMarkets.com
      * Global organic dairy market reached 23.9 billion in 2022, and is projected to grow 6.5% during 2023-2028
      * Governments of numerous countries, most notably India, are encouraging organic farming practices among conventional farmers by through educational campaigns, providing technical assistance, and monetary funding.
    - The global market for organic dairy reached $23.9 billion in 2022, and is projected to grow 6.5% between 2023 and 2028 (BusinessWire, 2024). The governments of numerous countries, most notably India, are encouraging organic farming practices among conventional farmers through educational campaigns, providing technical assistance, and monetary funding (BusinessWire, 2024).
  + Increasing number or IMPORTANCE of organic farms?
    - In US
      * According to the Agricultural Marketing Service (AMS), the U.S. sold 263 million pounds of organic milk products in May 2024, which is a 10.2% increase from the previous year. This includes:
      * Organic whole milk: 139 million pounds, which is a 20.2% increase from the previous year
      * 2016:
        + https://downloads.usda.library.cornell.edu/usda-esmis/files/zg64tk92g/70795b52w/4m90dz33q/OrganicProduction-09-20-2017\_correction.pdf
        + US

2,531 farms

4,034,989,854 pounds

1,385,789,843 dollars

* + - * + VT

172

171,463,088 pounds

61,416,809 dollars

* + - * 2021
        + https://downloads.usda.library.cornell.edu/usda-esmis/files/zg64tk92g/2z10z137s/bn99bh97r/cenorg22.pdf
        + US

2,478

5,196,491,771 pounds

1,632,652,418 dollars

* + - * + VT

147

187,490,768 pounds

59,536,545 dollars

* + - In Vermont, what’s production like?
      * An average of 346,707 kg of fluid organic milk sold in Spring of 2024
      * Avg cow making 18 kg milk/day
  + How are they different?
    - management prac-tices and herd characteristics of organic dairies vary dramatically across the United States and compared with conventionally managed farms (Stiglbauer et al., 2013). The United States has experienced the growth of relatively large organic dairy farms, associated with increased profitability as herd size increases (Walsh et al., 2020). These operations typically employ different management strategies than the smaller organic dairy farms that characterized the US organic dairy industry until recently (Stiglbauer et al., 2013). Observations regarding mastitis in organic dairy herds have typically originated from smaller herds (Cicconi-Hogan et al., 2013; Levison et al., 2016) and may not extrapolate well to larger herds
    - zwald
      * mgmt. differences do exist between org and con
      * Several practices highly adopted by ORGherds (such as housing preweaned calves in an individ- ual area and the use of individual water bowls for bothmilking and dry cows)
      * Nutritional management was associated with herdtype and is a possible explanation for the higher milkyield observed in CON dairy herds. Significantly moreCON dairies fed cows a TMR, as well as a transitionration, and anionic salts to close-up cows. As expected,ORG herds used significantly less purchased feeds orfeeds obtained from off-farm sources
    - Stiglbauer 2013
      * New York, Wisconsin, and Oregon. Data from 192 organic farms (ORG), 64 conventional nongrazing farms (CON-NG), and 36 conventional grazing farms (CON-GR) were collected during farm visits and were size-matched and analyzed. The average [lactation number](https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/lactation-number) of animals on ORG and CON-GR farms was 2.6 lactations, which was greater than that on CON-NG farms (2.3 lactations). A greater percentage of first-lactation [heifers](https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/heifer) were found on conventional farms than on ORG farms. Facilities used by adult animals, including housing and milking facilities, did not differ among the [grazing systems](https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/grazing-system). Cattle on conventional farms were fed approximately twice as much grain as cattle on ORG farms and had greater milk production. Little difference was found for the average reported [somatic cell count](https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/somatic-cell-count) and standard [plate count](https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/plate-count), suggesting that milk quality is not dependent on grazing system. Milking procedures were similar across all 3 grazing systems, indicating that an industry standard now exists for milking and that milk quality problems will need to be addressed with other management problems in mind. Although some disease prevention measures were commonly utilized on ORG farms, such as keeping a closed herd and having a written record of treatments administered to the animals, the use of outside support and vaccinations were found to be less prevalent on organic farms than on conventional farms.
  + IMI are of special concern on organic farms
    - Antibiotic usage restricted
      * Organic dairies in the United States are under the auspices of the U.S. Department of Agriculture (USDA) via its National Organic Program (NOP
      * (USDA, 2024)
    - The fact that antibiotics are a key component of mastitis control and treatment on conventional farms could indicate that organically raised cows may be at increased risk of mas-titis because of restrictions on antibiotic use on organic farms
      * Ruegg, P. L. 2009. Management of mastitis on organic and conven-tional dairy farms. J. Anim. Sci. 87(Suppl. 13):43–55
      * NMC (National Mastitis Council). 2019. Mastitis Control on Organic Dairies in the United States. NMC.
    - particular challenges and solutions organic dairy producers have in controlling mastitis.
    - Antibiotics, including those used in dry cow therapy, are not allowed for use in organically produced milk
    - On organic dairies, the dairy producer is prohibited from using antibiotic dry cow therapy and teat sealants to prevent new infections that commonly occur during the early dry period. Additionally, if antibiotic therapy is used to treat an existing infection, the animal must leave the organic herd for one year. This eliminates the primary means by which dairy farmers can reduce the duration of infections during lactation and the dry period.
  + Not a ton of work describing overall prevalence of IMI on organic farms
    - Pena-Mosca
      * The objective of this study was to describe the IMI dynamics of primiparous cows on certified organic farms during early lactation. Longitudinal study enrolled 503 primiparous cows from 5 organic dairy farms around the US
      * Although the epidemiology of mastitis on organic farms has not been extensively studied, available reports suggest they have an elevated prevalence of Staphylo-coccus aureus compared with conventional dairy farms (Pol and Ruegg, 2007; Cicconi-Hogan et al., 2013). Bulk SCC has also been reported to be higher on organic compared with conventional farms (Zwald et al., 2004; Levison et al., 2016), although conflicting reports do exist (Vaarst et al., 2001; Valle et al., 2007; Stiglbauer et al., 2013).
        + Valle

lower level of acute mastitis in organic [dairy herds](https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/dairy-herds) relative to conventional. When controlling for production level — milk yield being lower in organic herds — no difference between the two groups remained.

* + - * + Levinson 2016

observational study were (1) to determine the producer-reported IRCM and predominant pathogen types on conventional and organic dairy farms in Southern Ontario, Canada, and (2) to evaluate the association of both mean overall IRCM and pathogen-specific IRCM with management system, housing type, and pasture access

conventional (n=41) and organic management (n=18) systems

The most frequently isolated mastitis pathogens were coagulase-negative staphylococci, Bacillus spp., Streptococcus spp., Staphylococcus aureus, and Escherichia coli. The IRCM was higher on conventional farms than organic (23.7 vs. 13.2 cases per 100 cow-years) and was not associated with housing type (loose or tie-stall), pasture access, or herd-average milk yield. Bulk tank somatic cell count tended to be lower on conventional farms than organic (222,000 vs. 272,000 cells/mL). Pathogen-specific IRCM attributed to Staph. aureus, Bacillus spp., and E. coli was greater on conventional than organic farms, but was not associated with housing or any other factors. In conclusion, organic management was associated with reduced overall and pathogen-specific IRCM

* + - * + Zwald

HigherSCC values were reported for proportionally more ORGherds compared with SCC values reported by CONherds

* + - * + Cicconi-Hogan, K. M., M. Gamroth, R. Richert, P. L. Ruegg, K. E. Stiglbauer, and Y. H. Schukken. 2013. Risk factors associated with bulk tank standard plate count, bulk tank coliform count, and the presence of Staphylococcus aureus on organic and convention-al dairy farms in the United States.

Bulk tank

Org had more bulk tanks that were SA poisitive, but fewer herds had a high CC

* + - * + Pol and ruegg (subclin, quarter-level)

The prevalence of all mastitis pathogens, except coliforms, was greater for ORG farms compared with CON farms

Of the total mastitis pathogens isolated (n = 1,197 for CON vs. n = 1,306 for ORG), significant differences (P < 0.01) in the proportion of pathogens based on farm type were observed for CNS (38% CON and 30% ORG), Strep. agalactiae (2% CON and 4% ORG), Strep. spp. (18% CON and 15% ORG), coliforms (6% CON and <1% ORG), and other pathogens (27% CON and 40% ORG). No significant differences were found in the proportion of Staph. aureus isolated based on herd type (8.5% of isolates).

More IMI were present in ORG herds compared with CON herds. Milk samples obtained from ORG herds yielded significantly more bacteria compared with samples originating from CON herds. All isolates, except coliforms, were more prevalent in ORG herds compared with CON herds (Table 2). Intramammary pathogens that can be easily controlled using antimicrobial therapy (i.e., Strep. agalactiae) were more prevalent in ORG herds. The prevalence of Strep. agalactiae was almost 3 times higher in ORG than in CON herds. Prevention of Strep. agalactiae infections should be a priority on organic farms

* + - * In contrast, the incidence of clinical masti-tis on organic dairy farms has been reported to be lower than conventional farms (Hamilton et al., 2006; Valle et al., 2007; Richert et al., 2013). Additionally, no dif-ferences have been found in the incidence of subclinical mastitis (Hardeng and Edge, 2001) or individual SCC (Mullen et al., 2013) on organic versus conventional farms. Such reports suggest differences in mastitis epidemiology between conventional and organic dairy farms
        + Hardeng and edge

Conventional herds were matched on size and region, and from these, three herds were randomly selected for each organic herd. This resulted in a study group of 31 organic and 93 conventional herds

Odds ratios for organic compared with conventional herds were as follows: mastitis, 0.38

There was no marked difference in milk somatic cell count (SCC - monthly, cow-level) between organic and conventional herds

The overall geometric mean SCC was slightly higher in the organic than the conventional herds; the difference between the two means (Table 1) was found to be significant (P = 0.016). However, when this analysis was done separately for each lactation (Table 2), it was found that organic cows had lower mean SCC in first and second lactations, this difference being significant in the second lactation (P = 0.007). Above sixth lactation, the mean SCC was significantly higher in the organic group (P = 0.0015).

the proportion of high SCC was used as an objective measure of subclinical mastitis. No marked difference was found between organic and conventional herds

* + - * + mullen

compare milk quality on organic and conventional dairies in North Carolina during the warm summer months of the year. Data were compared from 7 organically and 7 conventionally managed herds in North Carolina

The proportion of cows with subclinical mastitis did not differ between conventional (20.8%) and organic (23.3%) herds. No significant difference was observed between herd management types in the proportion of cows without microbiological growth in milk samples. Also, no significant differences were observed between organic and conventional herds for cow-level prevalence of [*Staphylococcus aureus*](https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/staphylococcus-aureus), coagulase-negative *Staphylococcus* spp., [*Streptococcus*](https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/streptococcus) spp., or [*Corynebacterium*](https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/corynebacterium) spp. Two of the organic herds had a notably higher prevalence of *Corynebacterium* spp. and higher SCS. Coliforms were found in 5 of 7 conventional herds and in only 1 of 7 organic herds. Mean SCS did not differ between conventional (3.3 ± 0.2) and organic (3.5 ± 0.2) herds.

* + - * + Hamilton

Treatment of mastitis was found to be similar to what is practised in conventional herds. Homeopathic remedies were not widely used in the treatment of clinical mastitis.The calves in most of these organic herds suckled their dams for only a few days, which were not considered to substantially affect the udder health. The main management factor that was different from conventional herds was the feeding strategy, where organic herds used a larger share of forage. The organic herds were found to have a lower incidence of swededn; clinical mastitis, teat injuries, and a lower proportion of cows with a high somatic cell count (as indicated by the UDS, Udder Disease Score) compared to conventional herds. The spectrum of udder pathogenic bacteria was similar to that found in other Swedish studies

* + - * + Richert

Dairy herds (n=292) were enrolled across 3 states (New York, Oregon, Wisconsin) with CON herds matched to ORG herds based on location and herd size.

 An increased rate of farmer-identified and recorded cases of clinical mastitis was associated with use of CON management

* Although ranked 19th for overall production, dairy farming is an incredibly important part of Vermont’s agricultural production; dairy comprised 65% of the state’s total farm sales, the highest in the US for 2023 (Progressive Dairy, 2024). In 2021, at the time of the last USDA Certified Organic Survey, Vermont (US) had 147 organic dairy farms, which made over 85 million kg of fluid milk, worth over 59 million dollars (USDA, 2022).

***Discussion notes***

* + Not a ton of work describing overall prevalence of subclinical IMI on organic farms
    - Mullen
      * 2 farms had notably high corynebacterium prevalence
    - Pol and ruegg
      * What were their proportions like- anything interesting?
    - Pena-Mosca
      * The objective of this study was to describe the IMI dynamics of primiparous cows on certified organic farms during early lactation. Longitudinal study enrolled 503 primiparous cows from 5 organic dairy farms around the US
      * Although the epidemiology of mastitis on organic farms has not been extensively studied,
      * 3/5 very large farms 1500+
      * At post partum sample 2, 404 samples
        + S aureus, prev of 13.6%
        + NASM overall, prev of 31.4%
        + Chrom, prev of 22.5%
        + Haem 0.7; rare but identfied
        + Hominis rare but identfied
        + sciuri rare but identified
        + strep dys 4.2
        + strep ub 0.5
        + coryne 3.7
        + they had high proportion of bacillus at 6.9, higher e coli 1.2
  + Not a ton of work speciating subclinical IMI from bedded pack farms
    - Pamela’s paper
      * The purpose of this prospective observational study was to determine whether dairy cattle housing types were associated with staphylococcal and mammaliicoccal populations found on teat skin, bedding, and in **bulk tank milk**. Twenty herds (n = 10 sand-bedded freestall herds; n = 10 compost-bedded pack herds) were enrolled.
        + Freestalls

Staphylococcus capitis

Staphylococcus cohnii

Staphylococcus gallinarum

Staphylococcus hominis

Staphylococcus hyicus

Staphylococcus succinus

* + - * + CBP

Staph. succinus

* + - Check 40 herd notes for quarter-level
      * Fávero, S., Portilho, F.V.R., Oliveira, A.C.R., Langoni, H., Pantoja, J.C.F., 2015. Factors associated with mastitis epidemiologic indexes, animal hygiene, and bulk milk bacterial concentrations in dairy herds housed on compost bedding. Livestock Science 181, 220–230
        + Coryne most frequent subclinical mast on 2/3 farms

CNS also very common

* + - * Eckelkamp, E.A., Taraba, J.L., Akers, K.A., Harmon, R.J., Bewley, J.M., 2016. Sand bedded freestall and compost bedded pack effects on cow hygiene, locomotion, and mastitis indicators. Livestock Science 190, 48–57
        + Neither the incidence of clinical mastitis nor The distribution of udder pathogen isolates (% of total isolates) causing clinical mastitis were not different between CBP and SFB; for e. coli, env strep, then CNS, then SA
      * Freu, G.; Garcia, B.L.N.; Tomazi, T.; Di Leo, G.S.; Gheller, L.S.; Bronzo, V.; Moroni, P.; Dos Santos, M.V. Association between Mastitis Occurrence in Dairy Cows and Bedding Characteristics of Compost-Bedded Pack Barns. Pathogens 2023, 12, 583
        + Clinical and subclinical mastitis
        + Clinical – e coli and env strep most common clinical mast
        + Subclinical – staph chromogenes, strep ag, and staph aureus

Just like current study, chrom absolutely dominant; 24.9% of total samples, ag was 5.4 and aureus 4.1

* + BP systems have a number of advantages for producers considering updating their facilities, including a smaller initial investment when compared to a new FS or TS barn (Barberg et al., 2007a; Janni et al., 2007; Black et al., 2013), although the cost year-over-year for bedding is substantial (Shane et al., 2010). Bedded packs are designed for cow comfort (Barberg et al., 2007b; Bewley et al., 2012), and prevalence of lameness, foot, and leg injuries in these systems has been found to be less than TS and FS barns (Barberg et al., 2007b; Lobeck et al., 2011; Burgstaller et al., 2016). Lastly, manure management and environmental stewardship is a top concern for both dairy producers and the general public (Holly et al., 2018). Anecdotally, the BP producers enrolled in the study were pleased with their systems of manure management, viewing their used bedding material and manure as a valuable soil amendment and an integral part of their nutrient management plan. Bedded pack systems decrease the amount of liquid manure waste when compared to conventional barns, and the used bedding with manure is more easily composted before use as a soil amendment. As aged pack material is drier before it is spread on fields, it poses less of a risk for run-off into waterways, increases soil infiltration of nutrients, and creates flexibility around timing of manure application to fields (Rushmann, 2023). Bedded packs may be a good housing option for small, pasture-based farms in the Northeastern U.S. when properly managed on farms with excellent milking hygiene practices already in place.