# Administration of Vaccines in Dairy Sheep and Goat Farms: Patterns of Vaccination, Associations with Health and Production Parameters, Predictors

**Daphne T. Lianou, Charalambia K. Michael, Efthymia Petinaki, Vasia S. Mavrogianni and George C. Fthenakis**

**Table S1.** Details of variables ($n$ = 48) collected during interview of farmers by means of a structured questionnaire and used for the assessment of patterns of vaccinations in 444 small ruminant farms during a countrywide investigation in Greece.

| |
|---|
| Management system applied in the farm (description according to EFSA classification [1]) |
| Total surface of land available to animals for grazing (acres) |
| Material of the floor of the barn (soil / other) |
| Availability of straw bedding (yes / no) |
| Type of milking mode (hand-milking / machine-milking) |
| No. of female animals in the farm (no.) |
| Breed of animals in the farm (description) |
| Average age of culling female animals (years) |
| Month of the start of the lambing / kidding season (description) |
| Total milk quantity per ewe / doe obtained during the preceding milking period (litres) |
| Total number of lambs / kids born during the preceding lambing / kidding season (no.) |
| Total number of lambs / kids sold during the preceding lambing / kidding season (no.) |
| Total number of adult animals that died during the preceding production year (no.) |
| Collaboration with a veterinarian (yes / no) |
| Age of newborns when taken away from dam (days) |
| Application of teat disinfection after milking (yes / no) |
| Use of laboratory diagnostic examinations in samples of milk (yes / no) |
| Administration of 'dry-ewe' treatment at the end of the lactation period (yes / no) |
| Duration of dry-period (months) |
| Daily number of milking sessions (no.) |
| Vaccination against brucellosis (yes / no) |
| Immunological product used for vaccination against brucellosis and vaccination regime applied (description) |
| Vaccination against chlamydial abortion (yes / no) |
| Immunological product used for vaccination against chlamydial abortion and vaccination regime applied (description) |
| Vaccination against clostridial infections (yes / no) |
| Immunological product used for vaccination against clostridial infections and vaccination regime applied (description) |
| Vaccination against contagious agalactia (yes / no) |
| Immunological product used for vaccination against contagious agalactia and vaccination regime applied (description) |
| Vaccination against contagious ecthyma (yes / no) |

Immunological product used for vaccination against contagious ecthyma and vaccination regime applied (description)

Vaccination against foot-rot (yes / no)

Immunological product used for vaccination against foot-rot and vaccination regime applied (description)

Vaccination against paratuberculosis (yes / no)

Immunological product used for vaccination against paratuberculosis and vaccination regime applied (description)

Vaccination against pneumonia (yes / no)

Immunological product used for vaccination against pneumonia and vaccination regime applied (description)

Vaccination against staphylococcal mastitis (yes / no)

Immunological product used for vaccination against staphylococcal mastitis and vaccination regime applied (description)

Vaccination against *Toxoplasma gondii* abortion (yes / no)

Immunological product used for vaccination against *T. gondii* abortion and vaccination regime applied (description)

Routine administration of antibiotics to newborns (yes / no)

Age of farmer (years)

Length of previous animal farming experience (years)

Farmer's general education (description)

Farmer's professional involvement in farming (full-time / part-time)

Daily period spent by farmer at the farm (hours)

Family tradition in farming (yes / no)

Presence of working staff in the farm (yes/no)

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[1] management system classified as intensive, semi-intensive, semi-extensive, extensive (European Food Safety Authority. Scientific opinion on the welfare risks related to the farming of sheep for wool, meat and milk production. *EFSA J.* **2014**, *12*, 3933–4060.).

**Table S2.** Details of multivariable models ($n$ = 16) employed for the evaluation for potential associations with optional vaccinations in 325 sheep flocks and 119 goat herds in Greece.

| Outcome | Variables ($n$) | | |
|---|---|---|---|
| | assessed in univariable analyses | offered to the multivariable models | required in the final models |
| Vaccination against chlamydial abortion - sheep | 16 | 9 | (a) Age of newborns when taken away from dam, (b) Daily number of milking sessions, (c) Age of farmers, (d) Presence of working staff in the farm |
| Vaccination against chlamydial abortion - goats | 16 | 7 | (a) Breed of animals in the farm, (b) Average age of culling female animals, (c) Age of newborns when taken away from dam, (d) Daily number of milking sessions, (e) Daily period spent by farmer at the farm |
| Vaccination against clostridial infections – sheep | 19 | 6 | (a) Management system applied in the farm, (b) Age of farmers, (c) Family tradition in farming |
| Vaccination against clostridial infections - goats | 19 | 4 | (a) Routine administration of antibiotics to newborns, (b) Family tradition in farming |
| Vaccination against contagious agalactia -sheep | 21 | 16 | (a) Management system applied in the farm, (b) Collaboration with a veterinarian, (c) Age of newborns when taken away from dam, (d) Use of laboratory diagnostic examinations in samples of milk, (e) Administration of 'dry-ewe' treatment at the end of the lactation period, (f) Duration of dry-period |
| Vaccination against contagious agalactia - goats | 21 | 17 | (a) Type of milking mode, (b) Breed of animals in the farm, (c) Collaboration with a veterinarian, (d) Use of laboratory diagnostic examinations in samples of milk, (e) Administration of 'dry-ewe' treatment at the end of the lactation period, (f) Daily number of milking sessions, (g) Farmer's general education, (h) Farmer's professional involvement in farming |

| | | | |
|---|---|---|---|
| Vaccination against contagious ecthyma - sheep | 15 | 6 | (a) No. of female animals in the farm, (b) Average age of culling female animals, (c) Farmer's general education, (d) Daily period spent by farmer at the farm, (e) Presence of working staff in the farm |
| Vaccination against contagious ecthyma - goats | 15 | 4 | (a) Farmer's general education, (b) Daily period spent by farmer at the farm, (c) Presence of working staff in the farm |
| Vaccination against footrot - sheep | 19 | 3 | (a) Farmer's professional involvement in farming, (b) Daily period spent by farmer at the farm |
| Vaccination against paratuberculosis - sheep | 19 | 6 | (a) Type of milking mode, (b) Average age of culling female animals, (c) Month of the start of the lambing season |
| Vaccination against paratuberculosis - goats | 19 | 6 | (a) Material of the floor of the barn, (b) No. of female animals in the farm |
| Vaccination against pneumonia - sheep | 18 | 5 | (a) Total surface of land available to animals for grazing, (b) Month of the start of the lambing season, (c) Routine administration of antibiotics to newborns, (d) Daily period spent by farmer at the farm |
| Vaccination against pneumonia - goats | 18 | 2 | (a) Presence of working staff in the farm |
| Vaccination against staphylococcal mastitis - sheep | 21 | 14 | (a) Management system applied in the farm, (b) Collaboration with a veterinarian, (c) Use of laboratory diagnostic examinations in samples of milk, (d) Administration of 'dry-ewe' treatment at the end of the lactation period, (e) Farmer's professional involvement in farming |
| Vaccination against staphylococcal mastitis - goats | 21 | 11 | (a) Type of milking mode, (b) Age of newborns when taken away from dam, (c) Daily number of milking sessions, (d) Daily period spent by farmer at the farm |

| | | | |
|---|---|---|---|
| Total number of optional vaccines administered - sheep | 19 | 14 | (a) Management system applied in the farm, (b) Collaboration with a veterinarian, (c) Age of newborns when taken away from dam, (d) Routine administration of antibiotics to newborns, (e) Daily number of milking sessions, (f) Use of laboratory diagnostic examinations in samples of milk, (g) Administration of 'dry-ewe' treatment at the end of the lactation period, (h) Age of farmers |
| Total number of optional vaccines administered - goat | 16 | 10 | (a) Type of milking mode, (b) Breed of animals in the farm, (c) Daily number of milking se-ssions, (d) Use of laboratory diagnostic examinations in samples of milk, (e) Administration of 'dry-ewe' treatment at the end of the lactation period, (f) Daily period spent by farmer at the farm |

**Table S3.** Frequency of usage of specific immunological products for optional vaccinations in 325 sheep flocks and 119 goat herds in Greece.

| **Vaccinations against chlamydial abortion** | | |
|---|---|---|
| | Farmers who provided the information | |
| Vaccine used [3] | Sheep flocks ($n$ = 101) [1] | Goat herds ($n$ = 31) |
| Enzovax | 98 (97.0%) [2] | 29 (93.5%) |
| Inmeva | 1 (1.0%) | 1 (3.2%) |
| Ovax | 2 (2.0%) | 1 (3.2%) |
| **Vaccinations against clostridial infections** | | |
| | Farmers who provided the information | |
| Vaccine used [3] | Sheep flocks ($n$ = 295) | Goat herds ($n$ = 108) |
| Anero | 6 (2.0%) | 9 (8.3%) |
| Bravoxin | 64 (21.7%) | 32 (29.6%) |
| Covexin 8A | 90 (30.5%) | 37 (34.3%) |
| Covexin 10 | 1 (0.3%) | 0 (0.0%) |
| Cubolac | 3 (1.0%) | 0 (0.0%) |
| Dialuene P | 126 (42.7%) | 32 (29.6%) |
| Panclostil | 16 (5.4%) | 9 (8.3%) |
| Toxipra | 67 (22.7%) | 29 (26.9%) |
| **Vaccinations against contagious agalactia** | | |
| | Farmers who provided the information | |
| Vaccine used [3] | Sheep flocks ($n$ = 144) | Goat herds ($n$ = 52) |
| Agalax | 120 (83.3%) | 39 (75.0%) |
| Galazel | 32 (22.2%) | 14 (26.9%) |
| **Vaccinations against contagious ecthyma** | | |
| | Farmers who provided the information | |
| | Sheep flocks ($n$ = 0) | Goat herds ($n$ = 0) |
| **Vaccinations against foot-rot** | | |
| | Farmers who provided the information | |
| Vaccine used [3] | Sheep flocks ($n$ = 4) | Goat herds ($n$ = 0) |
| Footvax | 4 (100.0%) | |
| **Vaccinations against paratuberculosis** | | |
| | Farmers who provided the information | |
| Vaccine used [3] | Sheep flocks ($n$ = 3) | Goat herds ($n$ = 26) |
| Gudair | 3 (100.0%) | 26 (100.0%) |
| **Vaccinations against pneumonia** | | |
| | Farmers who provided the information | |
| Vaccine used [3] | Sheep flocks ($n$ = 139) | Goat herds ($n$ = 39) |
| Dialuene P | 126 (90.6%) | 33 (84.6%) |
| Ovipast | 16 (11.5%) | 8 (20.5%) |

| **Vaccinations against staphylococcal mastitis** | | |
|---|---|---|
| | Farmers who provided the information | |
| Vaccine used [3] | Sheep flocks (*n* = 124) | Goat herds (*n* = 34) |
| Mastivet | 14 (11.3%) | 3 (8.8%) |
| Ovax | 21 (16.9%) | 6 (17.6%) |
| Startvac | 9 (7.3%) | 1 (2.9%) |
| Vimco | 81 (65.3%) | 25 (73.5%) |
| **Vaccinations against *T. gondii* abortion** | | |
| | Farmers who provided the information | |
| | Sheep flocks (*n* = 0) | Goat herds (*n* = 0) |

[1] number of sheep flocks or goat herds in which specific products used for vaccinations were reported.
[2] number of farms (proportion).
[3] all product names listed are ®.

**Table S4.** Association between the total number of optional vaccinations performed in a farm and the average yearly milk production, as found in 444 small ruminant farms in Greece.

| | Number of vaccines administered | | | | | | |
|---|---|---|---|---|---|---|---|
| | 0 ($n$ = 4 [1]) | 1 ($n$ = 18) | 2 ($n$ = 57) | 3 ($n$ = 121) | 4 ($n$ = 111) | 5 ($n$ = 77) | 6 ($n$ = 47) |
| Average milk production (L) | 62.0 ± 5.5 | 112.9 ± 15.0 | 181.7 ± 10.4 | 190.0 ± 9.4 | 221.3 ± 9.0 | 219.8 ± 8.7 | 256.8 ± 13.6 |

[1] number of farms, in which respective number of vaccinations were performed.

60 **Table S5.** Results of univariable analysis for associations with optional vaccination against chlamydial abortion in 325 sheep flocks and 119 goat herds in Greece.

61 (a) Sheep flocks

| Vaccination performed ($n$ = 130) | | | | Vaccination not performed ($n$ = 195) | | | | $p$ |
|---|---|---|---|---|---|---|---|---|
| **Management system applied in the farm** | | | | | | | | |
| Intensive | Semi-intensive | Semi-extensive | Extensive | Intensive | Semi-intensive | Semi-extensive | Extensive | |
| 24 | 66 | 35 | 5 | 20 | 74 | 81 | 20 | 0.001 |
| **No. of ewes in the flock** | | | | | | | | |
| ≤ 165 ewes | 166-330 ewes | 331-500 ewes | > 500 ewes | ≤ 165 ewes | 166-330 ewes | 331-500 ewes | > 500 ewes | |
| 28 | 46 | 30 | 26 | 60 | 74 | 36 | 25 | 0.11 |
| **Breed of animals** | | | | | | | | |
| Crossbreeds | Imported breeds | Local breeds | | Crossbreeds | Imported breeds | Local breeds | | |
| 17 | 61 | 52 | | 26 | 78 | 91 | | 0.43 |
| **Milking mode in flock** | | | | | | | | |
| Machine-milking | Hand-milking | | | Machine-milking | Hand-milking | | | |
| 118 | 12 | | | 137 | 58 | | | < 0.0001 |
| **Average age of culling ewes** | | | | | | | | |
| ≤ 6.5 years | > 6.5 years | | | ≤ 6.5 years | > 6.5 years | | | |
| 104 | 26 | | | 138 | 57 | | | 0.06 |
| **Start of lambing period** | | | | | | | | |
| All year | Autumn | Winter | Spring - Summer | All year | Autumn | Winter | Spring - Summer | |
| 7 | 106 | 15 | 2 | 11 | 139 | 40 | 5 | 0.16 |
| **Collaboration with a veterinarian** | | | | | | | | |
| Yes | No | | | Yes | No | | | |
| 117 | 13 | | | 166 | 29 | | | 0.20 |
| **Age of newborns taken away from dam** | | | | | | | | |
| ≤ 40 days | 41 – 60 days | ≥ 61 days | | ≤ 40 days | 41 – 60 days | ≥ 61 days | | |
| 63 | 61 | 6 | | 54 | 111 | 30 | | < 0.0001 |
| **Number of daily milking sessions** | | | | | | | | |
| One | Two | Three | | One | Two | Three | | |
| 0 | 92 | 38 | | 1 | 172 | 22 | | 0.0002 |
| **Age of the farmer** | | | | | | | | |
| Up to 50 years | Over 50 years | | | Up to 50 years | Over 50 years | | | |
| 91 | 39 | | | 106 | 89 | | | 0.005 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Length of previous animal farming experience of the farmer** | | | | | | |
| ≤ 5 years | | > 5 years | ≤ 5 years | | > 5 years | |
| 34 | | 96 | 40 | | 155 | 0.23 |
| **Education of the farmer** | | | | | | |
| Primary education | Secondary or post-secondary education | Tertiary education | Primary education | Secondary or post-secondary education | Tertiary education | |
| 25 | 87 | 18 | 32 | 138 | 25 | 0.75 |
| **Professional involvement in farming** | | | | | | |
| Full-time | | Part-time | Full-time | | Part-time | |
| 116 | | 14 | 176 | | 19 | 0.76 |
| **Daily period at the farm** | | | | | | |
| ≤ 8 hours | | > 8 hours | ≤ 8 hours | | > 8 hours | |
| 36 | | 94 | 63 | | 132 | 0.38 |
| **Family tradition in farming** | | | | | | |
| Yes | | No | Yes | | No | |
| 112 | | 18 | 171 | | 24 | 0.69 |
| **Presence of working staff in the flock** | | | | | | |
| Yes | | No | Yes | | No | |
| 63 | | 67 | 60 | | 135 | 0.002 |

62

(b) Goat herds

| **Vaccination performed (*n* = 39)** | | | | **Vaccination not performed (*n* = 80)** | | | | *p* |
|---|---|---|---|---|---|---|---|---|
| **Management system applied in the farm** | | | | | | | | |
| Intensive | Semi-intensive | Semi-extensive | Extensive | Intensive | Semi-intensive | Semi-extensive | Extensive | |
| 2 | 12 | 21 | 4 | 7 | 17 | 40 | 16 | 0.39 |
| **No. of does in the herd** | | | | | | | | |
| ≤ 165 does | 166-330 does | 331-500 does | > 500 does | ≤ 165 does | 166-330 does | 331-500 does | > 500 does | |
| 18 | 11 | 7 | 3 | 38 | 26 | 6 | 10 | 0.34 |
| **Breed of animals** | | | | | | | | |
| Crossbreeds | Imported breeds | | Local breeds | Crossbreeds | Imported breeds | | Local breeds | |
| 7 | 21 | | 11 | 11 | 24 | | 45 | 0.013 |
| **Milking mode in herd** | | | | | | | | |
| Machine-milking | | Hand-milking | | Machine-milking | | Hand-milking | | |
| 26 | | 13 | | 40 | | 40 | | 0.09 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Average age of culling does** | | | | | | | | |
| ≤ 6.5 years | | | > 6.5 years | | ≤ 6.5 years | | > 6.5 years | |
| 26 | | | 13 | | 24 | | 56 | 0.0001 |
| **Start of kidding period** | | | | | | | | |
| All year | Autumn | Winter | Spring - Summer | All year | Autumn | Winter | Spring - Summer | |
| 3 | 23 | 12 | 1 | 5 | 40 | 32 | 3 | 0.75 |
| **Collaboration with a veterinarian** | | | | | | | | |
| Yes | | | No | | Yes | | No | |
| 36 | | | 3 | | 65 | | 15 | 0.11 |
| **Age of newborns taken away from dam** | | | | | | | | |
| ≤ 40 days | 41 – 60 days | | ≥ 61 days | ≤ 40 days | 41 – 60 days | | ≥ 61 days | |
| 15 | 12 | | 12 | 11 | 32 | | 37 | 0.009 |
| **Number of daily milking sessions** | | | | | | | | |
| One | Two | | Three | One | Two | | Three | |
| 1 | 32 | | 6 | 3 | 76 | | 1 | 0.009 |
| **Age of the farmer** | | | | | | | | |
| Up to 50 years | | | Over 50 years | | Up to 50 years | | Over 50 years | |
| 26 | | | 13 | | 47 | | 33 | 0.41 |
| **Length of previous animal farming experience of the farmer** | | | | | | | | |
| ≤ 5 years | | | > 5 years | | ≤ 5 years | | > 5 years | |
| 9 | | | 30 | | 15 | | 65 | 0.58 |
| **Education of the farmer** | | | | | | | | |
| Primary education | Secondary or post-secondary education | | Tertiary education | Primary education | Secondary or post-secondary education | | Tertiary education | |
| 4 | 30 | | 5 | 16 | 59 | | 5 | 0.24 |
| **Professional involvement in farming** | | | | | | | | |
| Full-time | | | Part-time | | Full-time | | Part-time | |
| 36 | | | 3 | | 69 | | 11 | 0.34 |
| **Daily period at the farm** | | | | | | | | |
| ≤ 8 hours | | | > 8 hours | | ≤ 8 hours | | > 8 hours | |
| 5 | | | 34 | | 23 | | 57 | 0.05 |
| **Family tradition in farming** | | | | | | | | |
| Yes | | | No | | Yes | | No | |
| 33 | | | 6 | | 70 | | 10 | 0.67 |

| | | | | | |
|---|---|---|---|---|---|
| | | | **Presence of working staff in the flock** | | |
| | Yes | No | Yes | No | |
| | 11 | 28 | 23 | 57 | 0.95 |

95 **Table S6.** Results of univariable analysis for associations with optional vaccination against clostridial infections in 325 sheep flocks and 119 goat herds in Greece.

96 (a) Sheep flocks

| Vaccination performed ($n$ = 316) | | | | Vaccination not performed ($n$ = 9) | | | | $p$ |
|---|---|---|---|---|---|---|---|---|
| **Management system applied in the farm** | | | | | | | | |
| Intensive | Semi-intensive | Semi-extensive | Extensive | Intensive | Semi-intensive | Semi-extensive | Extensive | |
| 44 | 138 | 112 | 22 | 0 | 2 | 4 | 3 | 0.016 |
| **No. of ewes in the flock** | | | | | | | | |
| ≤ 165 ewes | 166-330 ewes | 331-500 ewes | > 500 ewes | ≤ 165 ewes | 166-330 ewes | 331-500 ewes | > 500 ewes | |
| 86 | 116 | 64 | 50 | 2 | 4 | 2 | 1 | 0.95 |
| **Breed of animals** | | | | | | | | |
| Crossbreeds | Imported breeds | Local breeds | | Crossbreeds | Imported breeds | Local breeds | | |
| 41 | 138 | 137 | | 2 | 1 | 6 | | 0.15 |
| **Total land available for grazing (acres per animal)** | | | | | | | | |
| ≤ 0.50 | 0.51 – 2.00 | ≥ 2.00 | | ≤ 0.50 | 0.51 – 2.00 | ≥ 2.00 | | |
| 116 | 126 | 74 | | 2 | 4 | 3 | | 0.63 |
| **Use of straw as bedding material** | | | | | | | | |
| Yes | | No | | Yes | | No | | |
| 262 | | 54 | | 6 | | 3 | | 0.21 |
| **Milking mode in flock** | | | | | | | | |
| Machine-milking | | Hand-milking | | Machine-milking | | Hand-milking | | |
| 249 | | 67 | | 6 | | 3 | | 0.38 |
| **Average age of culling ewes** | | | | | | | | |
| ≤ 6.5 years | | > 6.5 years | | ≤ 6.5 years | | > 6.5 years | | |
| 235 | | 81 | | 7 | | 2 | | 0.82 |
| **Start of lambing period** | | | | | | | | |
| All year | Autumn | Winter | Spring - Summer | All year | Autumn | Winter | Spring - Summer | |
| 18 | 237 | 54 | 7 | 0 | 8 | 1 | 0 | 0.77 |
| **Collaboration with a veterinarian** | | | | | | | | |
| Yes | | No | | Yes | | No | | |
| 277 | | 39 | | 6 | | 3 | | 0.06 |
| **Age of newborns taken away from dam** | | | | | | | | |
| ≤ 40 days | 41 – 60 days | ≥ 61 days | | ≤ 40 days | 41 – 60 days | ≥ 61 days | | |
| 114 | 170 | 32 | | 3 | 2 | 4 | | 0.004 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Routine administration of antibiotics to newborns** | | | | | | |
| Yes | | No | Yes | | No | |
| 68 | | 248 | 2 | | 7 | 0.96 |
| **Number of daily milking sessions** | | | | | | |
| One | Two | Three | One | Two | Three | |
| 1 | 255 | 60 | 0 | 9 | 0 | 0.34 |
| **Age of the farmer** | | | | | | |
| Up to 50 years | | Over 50 years | Up to 50 years | | Over 50 years | |
| 195 | | 121 | 2 | | 7 | 0.017 |
| **Length of previous animal farming experience of the farmer** | | | | | | |
| ≤ 5 years | | > 5 years | ≤ 5 years | | > 5 years | |
| 73 | | 243 | 1 | | 8 | 0.40 |
| **Education of the farmer** | | | | | | |
| Primary education | Secondary or post-secondary education | Tertiary education | Primary education | Secondary or post-secondary education | Tertiary education | |
| 57 | 217 | 42 | 0 | 8 | 1 | 0.34 |
| **Professional involvement in farming** | | | | | | |
| Full-time | | Part-time | Full-time | | Part-time | |
| 284 | | 32 | 8 | | 1 | 0.92 |
| **Daily period at the farm** | | | | | | |
| ≤ 8 hours | | > 8 hours | ≤ 8 hours | | > 8 hours | |
| 95 | | 221 | 4 | | 5 | 0.36 |
| **Family tradition in farming** | | | | | | |
| Yes | | No | Yes | | No | |
| 277 | | 39 | 6 | | 3 | 0.06 |
| **Presence of working staff in the flock** | | | | | | |
| Yes | | No | Yes | | No | |
| 120 | | 196 | 3 | | 6 | 0.78 |

(b) Goat herds

| Vaccination performed ($n$ = 118) | | | | Vaccination not performed ($n$ = 1) | | | | $p$ |
|---|---|---|---|---|---|---|---|---|
| **Management system applied in the farm** | | | | | | | | |
| Intensive | Semi-intensive | Semi-extensive | Extensive | Intensive | Semi-intensive | Semi-extensive | Extensive | |
| 9 | 29 | 60 | 20 | 0 | 0 | 1 | 0 | 0.81 |
| **No. of does in the herd** | | | | | | | | |
| ≤ 165 does | 166-330 does | 331-500 does | > 500 does | ≤ 165 does | 166-330 does | 331-500 does | > 500 does | |
| 56 | 36 | 13 | 13 | 0 | 1 | 0 | 0 | 0.53 |
| **Breed of animals** | | | | | | | | |
| Crossbreeds | Imported breeds | Local breeds | | Crossbreeds | Imported breeds | Local breeds | | |
| 18 | 45 | 55 | | 0 | 0 | 1 | | 0.57 |
| **Total land available for grazing (acres per animal)** | | | | | | | | |
| ≤ 0.50 | 0.51 – 2.00 | ≥ 2.00 | | ≤ 0.50 | 0.51 – 2.00 | ≥ 2.00 | | |
| 17 | 31 | 70 | | 0 | 0 | 1 | | 0.37 |
| **Use of straw as bedding material** | | | | | | | | |
| Yes | | No | | Yes | | No | | |
| 75 | | 43 | | 1 | | 0 | | 0.45 |
| **Milking mode in herd** | | | | | | | | |
| Machine-milking | | Hand-milking | | Machine-milking | | Hand-milking | | |
| 65 | | 53 | | 1 | | 0 | | 0.37 |
| **Average age of culling does** | | | | | | | | |
| ≤ 6.5 years | | > 6.5 years | | ≤ 6.5 years | | > 6.5 years | | |
| 49 | | 69 | | 1 | | 0 | | 0.24 |
| **Start of kidding period** | | | | | | | | |
| All year | Autumn | Winter | Spring - Summer | All year | Autumn | Winter | Spring - Summer | |
| 8 | 62 | 44 | 4 | 0 | 1 | 0 | 0 | 0.83 |
| **Collaboration with a veterinarian** | | | | | | | | |
| Yes | | No | | Yes | | No | | |
| 100 | | 18 | | 1 | | 0 | | 0.67 |
| **Age of newborns taken away from dam** | | | | | | | | |
| ≤ 40 days | 41 – 60 days | ≥ 61 days | | ≤ 40 days | 41 – 60 days | ≥ 61 days | | |
| 25 | 44 | 49 | | 1 | 0 | 0 | | 0.16 |
| **Routine administration of antibiotics to newborns** | | | | | | | | |
| Yes | | No | | Yes | | No | | |
| 29 | | 89 | | 1 | | 0 | | 0.08 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Number of daily milking sessions** | | | | | | |
| One | Two | Three | One | Two | Three | |
| 4 | 107 | 7 | 0 | 1 | 0 | 0.95 |
| **Age of the farmer** | | | | | | |
| Up to 50 years | | Over 50 years | Up to 50 years | | Over 50 years | |
| 72 | | 46 | 1 | | 0 | 0.43 |
| **Length of previous animal farming experience of the farmer** | | | | | | |
| ≤ 5 years | | > 5 years | ≤ 5 years | | > 5 years | |
| 24 | | 94 | 0 | | 1 | 0.61 |
| **Education of the farmer** | | | | | | |
| Primary education | Secondary or post-secondary education | Tertiary education | Primary education | Secondary or post-secondary education | Tertiary education | |
| 20 | 88 | 10 | 0 | 1 | 0 | 0.84 |
| **Professional involvement in farming** | | | | | | |
| Full-time | | Part-time | Full-time | | Part-time | |
| 104 | | 14 | 1 | | 0 | 0.71 |
| **Daily period at the farm** | | | | | | |
| ≤ 8 hours | | > 8 hours | ≤ 8 hours | | > 8 hours | |
| 27 | | 91 | 1 | | 0 | 0.07 |
| **Family tradition in farming** | | | | | | |
| Yes | | No | Yes | | No | |
| 103 | | 15 | 0 | | 1 | 0.011 |
| **Presence of working staff in the flock** | | | | | | |
| Yes | | No | Yes | | No | |
| 34 | | 84 | 0 | | 1 | 0.53 |

**Table S7.** Results of univariable analysis for associations with optional vaccination against contagious agalactia in 325 sheep flocks and 119 goat herds in Greece.

(a) Sheep flocks

| Vaccination performed ($n$ = 186) | | | | Vaccination not performed ($n$ = 139) | | | | $p$ |
|---|---|---|---|---|---|---|---|---|
| **Management system applied in the farm** | | | | | | | | |
| Intensive | Semi-intensive | Semi-extensive | Extensive | Intensive | Semi-intensive | Semi-extensive | Extensive | |
| 36 | 89 | 58 | 3 | 8 | 51 | 58 | 22 | < 0.0001 |
| **No. of ewes in the flock** | | | | | | | | |
| ≤ 165 ewes | 166-330 ewes | 331-500 ewes | > 500 ewes | ≤ 165 ewes | 166-330 ewes | 331-500 ewes | > 500 ewes | |
| 45 | 72 | 38 | 31 | 43 | 48 | 28 | 20 | 0.58 |
| **Breed of animals** | | | | | | | | |
| Crossbreeds | Imported breeds | Local breeds | | Crossbreeds | Imported breeds | Local breeds | | |
| 23 | 94 | 69 | | 20 | 44 | 75 | | 0.002 |
| **Total land available for grazing (acres per animal)** | | | | | | | | |
| ≤ 0.50 | 0.51 – 2.00 | ≥ 2.00 | | ≤ 0.50 | 0.51 – 2.00 | ≥ 2.00 | | |
| 80 | 69 | 37 | | 38 | 61 | 40 | | 0.011 |
| **Milking mode in flock** | | | | | | | | |
| Machine-milking | Hand-milking | | | Machine-milking | Hand-milking | | | |
| 163 | 23 | | | 92 | 47 | | | < 0.0001 |
| **Average age of culling ewes** | | | | | | | | |
| ≤ 6.5 years | > 6.5 years | | | ≤ 6.5 years | > 6.5 years | | | |
| 146 | 40 | | | 96 | 43 | | | 0.05 |
| **Start of lambing period** | | | | | | | | |
| All year | Autumn | Winter | Spring – Summer | All year | Autumn | Winter | Spring - Summer | |
| 11 | 141 | 30 | 4 | 7 | 104 | 25 | 3 | 0.96 |
| **Collaboration with a veterinarian** | | | | | | | | |
| Yes | No | | | Yes | No | | | |
| 173 | 13 | | | 110 | 29 | | | 0.0002 |
| **Age of newborns taken away from dam** | | | | | | | | |
| ≤ 40 days | 41 – 60 days | ≥ 61 days | | ≤ 40 days | 41 – 60 days | ≥ 61 days | | |
| 79 | 97 | 10 | | 38 | 75 | 26 | | 0.0001 |
| **Number of daily milking sessions** | | | | | | | | |
| One | Two | Three | | One | Two | Three | | |
| 0 | 145 | 41 | | 1 | 119 | 19 | | 0.08 |

| | | | | | |
|---|---|---|---|---|---|
| **Use of laboratory diagnostic examinations in samples of milk** | | | | | |
| Yes | | No | Yes | No | |
| 52 | | 134 | 18 | 121 | 0.001 |
| **Application of teat disinfection during milking** | | | | | |
| Yes | | No | Yes | No | |
| 33 | | 153 | 19 | 120 | 0.32 |
| **Application of 'dry-period treatment'** | | | | | |
| Yes | | No | Yes | No | |
| 40 | | 146 | 13 | 126 | 0.003 |
| **Duration of dry-period (months)** | | | | | |
| ≤ 2 | | > 2 | ≤ 2 | > 2 | |
| 77 | | 109 | 30 | 109 | 0.0002 |
| **Age of the farmer** | | | | | |
| Up to 50 years | | Over 50 years | Up to 50 years | Over 50 years | |
| 132 | | 54 | 65 | 74 | < 0.0001 |
| **Length of previous animal farming experience of the farmer** | | | | | |
| ≤ 5 years | | > 5 years | ≤ 5 years | > 5 years | |
| 52 | | 134 | 22 | 117 | 0.01 |
| **Education of the farmer** | | | | | |
| Primary education | Secondary or post-secondary education | Tertiary education | Primary education | Secondary or post-secondary education | Tertiary education | |
| 34 | 129 | 23 | 23 | 96 | 20 | 0.83 |
| **Professional involvement in farming** | | | | | |
| Full-time | | Part-time | Full-time | Part-time | |
| 164 | | 22 | 128 | 11 | 0.25 |
| **Daily period at the farm** | | | | | |
| ≤ 8 hours | | > 8 hours | ≤ 8 hours | > 8 hours | |
| 62 | | 124 | 37 | 102 | 0.19 |
| **Family tradition in farming** | | | | | |
| Yes | | No | Yes | No | |
| 156 | | 30 | 127 | 12 | 0.046 |
| **Presence of working staff in the flock** | | | | | |
| Yes | | No | Yes | No | |
| 83 | | 103 | 41 | 98 | 0.005 |

(b) Goat herds

| Vaccination performed ($n$ = 65) | | | | Vaccination not performed ($n$ = 54) | | | | $p$ |
|---|---|---|---|---|---|---|---|---|
| **Management system applied in the farm** | | | | | | | | |
| Intensive | Semi-intensive | Semi-extensive | Extensive | Intensive | Semi-intensive | Semi-extensive | Extensive | |
| 7 | 17 | 33 | 8 | 2 | 12 | 28 | 12 | 0.28 |
| **No. of does in the herd** | | | | | | | | |
| ≤ 165 ewes | 166-330 ewes | 331-500 ewes | > 500 ewes | ≤ 165 ewes | 166-330 ewes | 331-500 ewes | > 500 ewes | |
| 32 | 20 | 7 | 6 | 24 | 17 | 6 | 7 | 0.91 |
| **Breed of animals** | | | | | | | | |
| Crossbreeds | Imported breeds | Local breeds | | Crossbreeds | Imported breeds | Local breeds | | |
| 14 | 29 | 22 | | 4 | 16 | 34 | | 0.004 |
| **Total land available for grazing (acres per animal)** | | | | | | | | |
| ≤ 0.50 | 0.51 – 2.00 | ≥ 2.00 | | ≤ 0.50 | 0.51 – 2.00 | ≥ 2.00 | | |
| 12 | 14 | 39 | | 5 | 17 | 32 | | 0.24 |
| **Milking mode in herd** | | | | | | | | |
| Machine-milking | Hand-milking | | | Machine-milking | Hand-milking | | | |
| 44 | 21 | | | 22 | 32 | | | 0.003 |
| **Average age of culling does** | | | | | | | | |
| ≤ 6.5 years | > 6.5 years | | | ≤ 6.5 years | > 6.5 years | | | |
| 33 | 32 | | | 17 | 37 | | | 0.034 |
| **Start of kidding period** | | | | | | | | |
| All year | Autumn | Winter | Spring - Summer | All year | Autumn | Winter | Spring - Summer | |
| 7 | 31 | 24 | 3 | 1 | 32 | 20 | 1 | 0.18 |
| **Collaboration with a veterinarian** | | | | | | | | |
| Yes | No | | | Yes | No | | | |
| 62 | 3 | | | 40 | 14 | | | 0.0009 |
| **Age of newborns taken away from dam** | | | | | | | | |
| ≤ 40 days | 41 – 60 days | ≥ 61 days | | ≤ 40 days | 41 – 60 days | ≥ 61 days | | |
| 19 | 22 | 24 | | 7 | 22 | 25 | | 0.10 |
| **Number of daily milking sessions** | | | | | | | | |
| One | Two | Three | | One | Two | Three | | |
| 1 | 58 | 6 | | 3 | 50 | 1 | | 0.12 |
| **Use of laboratory diagnostic examinations in samples of milk** | | | | | | | | |
| Yes | No | | | Yes | No | | | |
| 22 | 43 | | | 3 | 51 | | | 0.0002 |

| | | | | | |
|---|---|---|---|---|---|
| **Application of teat disinfection during milking** | | | | | |
| Yes | | No | Yes | No | |
| 11 | | 54 | 1 | 53 | 0.007 |
| **Application of 'dry-period treatment'** | | | | | |
| Yes | | No | Yes | No | |
| 14 | | 51 | 1 | 53 | 0.001 |
| **Duration of dry-period (months)** | | | | | |
| ≤ 2 | | > 2 | ≤ 2 | > 2 | |
| 20 | | 45 | 19 | 35 | 0.61 |
| **Age of the farmer** | | | | | |
| Up to 50 years | | Over 50 years | Up to 50 years | Over 50 years | |
| 44 | | 21 | 29 | 25 | 0.12 |
| **Length of previous animal farming experience of the farmer** | | | | | |
| ≤ 5 years | | > 5 years | ≤ 5 years | > 5 years | |
| 18 | | 47 | 6 | 48 | 0.025 |
| **Education of the farmer** | | | | | |
| Primary education | Secondary or post-secondary education | Tertiary education | Primary education | Secondary or post-secondary education | Tertiary education | |
| 10 | 51 | 4 | 10 | 35 | 9 | 0.14 |
| **Professional involvement in farming** | | | | | |
| Full-time | | Part-time | Full-time | Part-time | |
| 54 | | 11 | 51 | 3 | 0.06 |
| **Daily period at the farm** | | | | | |
| ≤ 8 hours | | > 8 hours | ≤ 8 hours | > 8 hours | |
| 19 | | 46 | 9 | 45 | 0.11 |
| **Family tradition in farming** | | | | | |
| Yes | | No | Yes | No | |
| 52 | | 13 | 51 | 3 | 0.021 |
| **Presence of working staff in the flock** | | | | | |
| Yes | | No | Yes | No | |
| 22 | | 43 | 12 | 42 | 0.16 |

**Table S8.** Results of univariable analysis for associations with optional vaccination against contagious ecthyma in 325 sheep flocks and 119 goat herds in Greece.

(a) Sheep flocks

| Vaccination performed ($n$ = 3) | | | | Vaccination not performed ($n$ = 322) | | | | $p$ |
|---|---|---|---|---|---|---|---|---|
| **Management system applied in the farm** | | | | | | | | |
| Intensive | Semi-intensive | Semi-extensive | Extensive | Intensive | Semi-intensive | Semi-extensive | Extensive | |
| 1 | 1 | 1 | 0 | 43 | 139 | 115 | 25 | 0.76 |
| **No. of ewes in the flock** | | | | | | | | |
| ≤ 165 ewes | 166-330 ewes | 331-500 ewes | > 500 ewes | ≤ 165 ewes | 166-330 ewes | 331-500 ewes | > 500 ewes | |
| 0 | 1 | 0 | 2 | 88 | 119 | 66 | 49 | 0.09 |
| **Breed of animals** | | | | | | | | |
| Crossbreeds | Imported breeds | Local breeds | | Crossbreeds | Imported breeds | Local breeds | | |
| 0 | 3 | 0 | | 43 | 136 | 143 | | 0.13 |
| **Milking mode in flock** | | | | | | | | |
| Machine-milking | Hand-milking | | | Machine-milking | Hand-milking | | | |
| 3 | 0 | | | 252 | 70 | | | 0.36 |
| **Average age of culling ewes** | | | | | | | | |
| ≤ 6.5 years | > 6.5 years | | | ≤ 6.5 years | > 6.5 years | | | |
| 1 | 2 | | | 241 | 81 | | | 0.10 |
| **Start of lambing period** | | | | | | | | |
| All year | Autumn | Winter | Spring - Summer | All year | Autumn | Winter | Spring - Summer | |
| 0 | 3 | 0 | 0 | 18 | 242 | 55 | 7 | |
| **Collaboration with a veterinarian** | | | | | | | | |
| Yes | No | | | Yes | No | | | |
| 3 | 0 | | | 280 | 42 | | | 0.50 |
| **Age of newborns taken away from dam** | | | | | | | | |
| ≤ 40 days | 41 – 60 days | ≥ 61 days | | ≤ 40 days | 41 – 60 days | ≥ 61 days | | |
| 2 | 1 | 0 | | 115 | 171 | 36 | | 0.51 |
| **Age of the farmer** | | | | | | | | |
| Up to 50 years | Over 50 years | | | Up to 50 years | Over 50 years | | | |
| 2 | 1 | | | 195 | 127 | | | 0.83 |
| **Length of previous animal farming experience of the farmer** | | | | | | | | |
| ≤ 5 years | > 5 years | | | ≤ 5 years | > 5 years | | | |
| 1 | 2 | | | 73 | 249 | | | 0.66 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Education of the farmer** | | | | | | |
| Primary education | Secondary or post-secondary education | Tertiary education | Primary education | Secondary or post-secondary education | Tertiary education | |
| 2 | 1 | 0 | 55 | 224 | 43 | 0.08 |
| **Professional involvement in farming** | | | | | | |
| Full-time | | Part-time | Full-time | | Part-time | |
| 3 | | 0 | 289 | | 33 | 0.56 |
| **Daily period at the farm** | | | | | | |
| ≤ 8 hours | | > 8 hours | ≤ 8 hours | | > 8 hours | |
| 2 | | 1 | 97 | | 225 | 0.17 |
| **Family tradition in farming** | | | | | | |
| Yes | | No | Yes | | No | |
| 2 | | 1 | 281 | | 41 | 0.29 |
| **Presence of working staff in the flock** | | | | | | |
| Yes | | No | Yes | | No | |
| 3 | | 0 | 120 | | 202 | 0.026 |

121

(b) Goat herds

| **Vaccination performed (*n* = 1)** | | | | **Vaccination not performed (*n* = 118)** | | | | ***p*** |
|---|---|---|---|---|---|---|---|---|
| **Management system applied in the farm** | | | | | | | | |
| Intensive | Semi-intensive | Semi-extensive | Extensive | Intensive | Semi-intensive | Semi-extensive | Extensive | |
| 0 | 0 | 1 | 0 | 9 | 29 | 60 | 20 | 0.81 |
| **No. of does in the herd** | | | | | | | | |
| ≤ 165 ewes | 166-330 ewes | 331-500 ewes | > 500 ewes | ≤ 165 ewes | 166-330 ewes | 331-500 ewes | > 500 ewes | |
| 1 | 0 | 0 | 0 | 55 | 37 | 13 | 13 | 0.77 |
| **Breed of animals** | | | | | | | | |
| Crossbreeds | Imported breeds | | Local breeds | Crossbreeds | Imported breeds | | Local breeds | |
| 1 | 0 | | 0 | 17 | 45 | | 56 | 0.06 |
| **Milking mode in herd** | | | | | | | | |
| Machine-milking | | Hand-milking | | Machine-milking | | Hand-milking | | |
| 1 | | 0 | | 65 | | 53 | | 0.37 |
| **Average age of culling does** | | | | | | | | |
| ≤ 6.5 years | | > 6.5 years | | ≤ 6.5 years | | > 6.5 years | | |
| 0 | | 1 | | 50 | | 68 | | 0.39 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Start of kidding period** | | | | | | | | |
| All year | Autumn | Winter | Spring - Summer | All year | Autumn | Winter | Spring - Summer | |
| 0 | 1 | 0 | 0 | 8 | 62 | 44 | 4 | 0.83 |
| **Collaboration with a veterinarian** | | | | | | | | |
| Yes | | | No | Yes | | | No | |
| 1 | | | 0 | 100 | | | 18 | 0.67 |
| **Age of newborns taken away from dam** | | | | | | | | |
| ≤ 40 days | 41 – 60 days | | ≥ 61 days | ≤ 40 days | 41 – 60 days | | ≥ 61 days | |
| 0 | 1 | | 0 | 26 | 43 | | 49 | 0.42 |
| **Age of the farmer** | | | | | | | | |
| Up to 50 years | | | Over 50 years | Up to 50 years | | | Over 50 years | |
| 0 | | | 1 | 73 | | | 45 | 0.21 |
| **Length of previous animal farming experience of the farmer** | | | | | | | | |
| ≤ 5 years | | | > 5 years | ≤ 5 years | | | > 5 years | |
| 0 | | | 1 | 24 | | | 94 | 0.61 |
| **Education of the farmer** | | | | | | | | |
| Primary education | Secondary or post-secondary education | | Tertiary education | Primary education | Secondary or post-secondary education | | Tertiary education | |
| 1 | 0 | | 0 | 19 | 89 | | 10 | 0.08 |
| **Professional involvement in farming** | | | | | | | | |
| Full-time | | | Part-time | Full-time | | | Part-time | |
| 1 | | | 0 | 105 | | | 13 | 0.73 |
| **Daily period at the farm** | | | | | | | | |
| ≤ 8 hours | | | > 8 hours | ≤ 8 hours | | | > 8 hours | |
| 1 | | | 0 | 27 | | | 91 | 0.07 |
| **Family tradition in farming** | | | | | | | | |
| Yes | | | No | Yes | | | No | |
| 1 | | | 0 | 102 | | | 16 | 0.69 |
| **Presence of working staff in the flock** | | | | | | | | |
| Yes | | | No | Yes | | | No | |
| 1 | | | 0 | 33 | | | 85 | 0.11 |

126 **Table S9.** Results of univariable analysis for associations with optional vaccination against foot-rot in 325 sheep flocks in Greece.

| Vaccination performed ($n$ = 5) | | | | Vaccination not performed ($n$ = 320) | | | | $p$ |
|---|---|---|---|---|---|---|---|---|
| **Management system applied in the farm** | | | | | | | | |
| Intensive | Semi-intensive | Semi-extensive | Extensive | Intensive | Semi-intensive | Semi-extensive | Extensive | |
| 2 | 2 | 1 | 0 | 42 | 138 | 115 | 25 | 0.34 |
| **No. of ewes in the flock** | | | | | | | | |
| ≤ 165 ewes | 166-330 ewes | 331-500 ewes | > 500 ewes | ≤ 165 ewes | 166-330 ewes | 331-500 ewes | > 500 ewes | |
| 1 | 2 | 1 | 1 | 87 | 118 | 65 | 50 | 0.98 |
| **Breed of animals** | | | | | | | | |
| Crossbreeds | Imported breeds | Local breeds | | Crossbreeds | Imported breeds | Local breeds | | |
| 0 | 4 | 1 | | 43 | 135 | 142 | | 0.23 |
| **Total land available for grazing (acres per animal)** | | | | | | | | |
| ≤ 0.50 | 0.51 – 2.00 | ≥ 2.00 | | ≤ 0.50 | 0.51 – 2.00 | ≥ 2.00 | | |
| 3 | 1 | 1 | | 115 | 129 | 76 | | 0.24 |
| **Material of the floor of the barn** | | | | | | | | |
| Soil | Other | | | Soil | Other | | | |
| 5 | 0 | | | 285 | 35 | | | 0.43 |
| **Use of straw as bedding material** | | | | | | | | |
| Yes | No | | | Yes | No | | | |
| 4 | 1 | | | 264 | 56 | | | 0.88 |
| **Milking mode in flock** | | | | | | | | |
| Machine-milking | Hand-milking | | | Machine-milking | Hand-milking | | | |
| 5 | 0 | | | 250 | 70 | | | 0.24 |
| **Average age of culling ewes** | | | | | | | | |
| ≤ 6.5 years | > 6.5 years | | | ≤ 6.5 years | > 6.5 years | | | |
| 5 | 0 | | | 237 | 83 | | | 0.19 |
| **Start of lambing period** | | | | | | | | |
| All year | Autumn | Winter | Spring - Summer | All year | Autumn | Winter | Spring - Summer | |
| 0 | 5 | 0 | 0 | 18 | 240 | 55 | 7 | 0.65 |
| **Collaboration with a veterinarian** | | | | | | | | |
| Yes | No | | | Yes | No | | | |
| 4 | 1 | | | 279 | 41 | | | 0.63 |
| **Age of newborns taken away from dam** | | | | | | | | |
| ≤ 40 days | 41 – 60 days | ≥ 61 days | | ≤ 40 days | 41 – 60 days | ≥ 61 days | | |
| 2 | 2 | 1 | | 115 | 170 | 35 | | 0.76 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Number of daily milking sessions** | | | | | | |
| One | Two | Three | One | Two | Three | |
| 0 | 4 | 1 | 1 | 260 | 59 | 0.99 |
| **Age of the farmer** | | | | | | |
| Up to 50 years | | Over 50 years | Up to 50 years | | Over 50 years | |
| 3 | | 2 | 194 | | 126 | 0.98 |
| **Length of previous animal farming experience of the farmer** | | | | | | |
| ≤ 5 years | | > 5 years | ≤ 5 years | | > 5 years | |
| 0 | | 5 | 74 | | 246 | 0.22 |
| **Education of the farmer** | | | | | | |
| Primary education | Secondary or post-secondary education | Tertiary education | Primary education | Secondary or post-secondary education | Tertiary education | |
| 0 | 2 | 3 | 57 | 223 | 40 | 0.007 |
| **Professional involvement in farming** | | | | | | |
| Full-time | | Part-time | Full-time | | Part-time | |
| 5 | | 0 | 287 | | 33 | 0.45 |
| **Daily period at the farm** | | | | | | |
| ≤ 8 hours | | > 8 hours | ≤ 8 hours | | > 8 hours | |
| 3 | | 2 | 96 | | 224 | 0.15 |
| **Family tradition in farming** | | | | | | |
| Yes | | No | Yes | | No | |
| 4 | | 1 | 279 | | 41 | 0.63 |
| **Presence of working staff in the flock** | | | | | | |
| Yes | | No | Yes | | No | |
| 2 | | 3 | 121 | | 199 | 0.92 |

138 **Table S10.** Results of univariable analysis for associations with optional vaccination against paratuberculosis in 325 sheep flocks and 119 goat herds in Greece.

139 (a) Sheep flocks

| Vaccination performed ($n$ = 11) | | | | Vaccination not performed ($n$ = 314) | | | | $p$ |
|---|---|---|---|---|---|---|---|---|
| **Management system applied in the farm** | | | | | | | | |
| Intensive | Semi-intensive | Semi-extensive | Extensive | Intensive | Semi-intensive | Semi-extensive | Extensive | |
| 1 | 4 | 6 | 0 | 43 | 136 | 110 | 25 | 0.51 |
| **No. of ewes in the flock** | | | | | | | | |
| ≤ 165 ewes | 166-330 ewes | 331-500 ewes | > 500 ewes | ≤ 165 ewes | 166-330 ewes | 331-500 ewes | > 500 ewes | |
| 3 | 5 | 2 | 1 | 86 | 114 | 64 | 50 | 0.90 |
| **Breed of animals** | | | | | | | | |
| Crossbreeds | Imported breeds | Local breeds | | Crossbreeds | Imported breeds | Local breeds | | |
| 0 | 5 | 6 | | 43 | 134 | 137 | | 0.40 |
| **Total land available for grazing (acres per animal)** | | | | | | | | |
| ≤ 0.50 | 0.51 – 2.00 | ≥ 2.00 | | ≤ 0.50 | 0.51 – 2.00 | ≥ 2.00 | | |
| 2 | 6 | 3 | | 116 | 124 | 74 | | 0.43 |
| **Material of the floor of the barn** | | | | | | | | |
| Soil | | Other | | Soil | | Other | | |
| 11 | | 0 | | 281 | | 33 | | 0.43 |
| **Use of straw as bedding material** | | | | | | | | |
| Yes | | No | | Yes | | No | | |
| 10 | | 1 | | 258 | | 56 | | 0.45 |
| **Milking mode in flock** | | | | | | | | |
| Machine-milking | | Hand-milking | | Machine-milking | | Hand-milking | | |
| 10 | | 1 | | 176 | | 138 | | 0.022 |
| **Average age of culling ewes** | | | | | | | | |
| ≤ 6.5 years | | > 6.5 years | | ≤ 6.5 years | | > 6.5 years | | |
| 6 | | 5 | | 236 | | 78 | | 0.12 |
| **Start of lambing period** | | | | | | | | |
| All year | Autumn | Winter | Spring - Summer | All year | Autumn | Winter | Spring - Summer | |
| 0 | 6 | 5 | 0 | 18 | 239 | 50 | 7 | 0.07 |
| **Collaboration with a veterinarian** | | | | | | | | |
| Yes | | No | | Yes | | No | | |
| 9 | | 2 | | 274 | | 40 | | 0.60 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Age of newborns taken away from dam** | | | | | | |
| ≤ 40 days | 41 – 60 days | ≥ 61 days | ≤ 40 days | 41 – 60 days | ≥ 61 days | |
| 2 | 9 | 0 | 115 | 163 | 36 | 0.13 |
| **Number of daily milking sessions** | | | | | | |
| One | Two | Three | One | Two | Three | |
| 0 | 8 | 3 | 1 | 256 | 57 | 0.74 |
| **Age of the farmer** | | | | | | |
| Up to 50 years | | Over 50 years | Up to 50 years | | Over 50 years | |
| 8 | | 3 | 189 | | 125 | 0.40 |
| **Length of previous animal farming experience of the farmer** | | | | | | |
| ≤ 5 years | | > 5 years | ≤ 5 years | | > 5 years | |
| 1 | | 10 | 73 | | 241 | 0.27 |
| **Education of the farmer** | | | | | | |
| Primary education | Secondary or post-secondary education | Tertiary education | Primary education | Secondary or post-secondary education | Tertiary education | |
| 2 | 7 | 2 | 55 | 218 | 41 | 0.88 |
| **Professional involvement in farming** | | | | | | |
| Full-time | | Part-time | Full-time | | Part-time | |
| 10 | | 1 | 282 | | 32 | 0.91 |
| **Daily period at the farm** | | | | | | |
| ≤ 8 hours | | > 8 hours | ≤ 8 hours | | > 8 hours | |
| 3 | | 8 | 96 | | 218 | 0.82 |
| **Family tradition in farming** | | | | | | |
| Yes | | No | Yes | | No | |
| 11 | | 0 | 272 | | 42 | 0.19 |
| **Presence of working staff in the flock** | | | | | | |
| Yes | | No | Yes | | No | |
| 3 | | 8 | 194 | | 120 | 0.021 |

140 (b) Goat herds

| **Vaccination performed (*n* = 31)** | | | | **Vaccination not performed (*n* = 88)** | | | | *p* |
|---|---|---|---|---|---|---|---|---|
| **Management system applied in the farm** | | | | | | | | |
| Intensive | Semi-intensive | Semi-extensive | Extensive | Intensive | Semi-intensive | Semi-extensive | Extensive | |
| 2 | 9 | 13 | 7 | 7 | 20 | 48 | 13 | 0.58 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **No. of does in the herd** | | | | | | | | |
| ≤ 165 does | 166-330 does | 331-500 does | > 500 does | ≤ 165 does | 166-330 does | 331-500 does | > 500 does | |
| 8 | 11 | 5 | 7 | 48 | 26 | 8 | 6 | 0.015 |
| **Breed of animals** | | | | | | | | |
| Crossbreeds | Imported breeds | Local breeds | | Crossbreeds | Imported breeds | Local breeds | | |
| 4 | 12 | 15 | | 14 | 33 | 41 | | 0.92 |
| **Total land available for grazing (acres per animal)** | | | | | | | | |
| ≤ 0.50 | 0.51 – 2.00 | ≥ 2.00 | | ≤ 0.50 | 0.51 – 2.00 | ≥ 2.00 | | |
| 4 | 12 | 15 | | 13 | 19 | 56 | | 0.17 |
| **Material of the floor of the barn** | | | | | | | | |
| Soil | Other | | | Soil | Other | | | |
| 25 | 6 | | | 80 | 8 | | | 0.13 |
| **Use of straw as bedding material** | | | | | | | | |
| Yes | No | | | Yes | No | | | |
| 19 | 12 | | | 57 | 31 | | | 0.73 |
| **Milking mode in herd** | | | | | | | | |
| Machine-milking | Hand-milking | | | Machine-milking | Hand-milking | | | |
| 19 | 12 | | | 47 | 41 | | | 0.45 |
| **Average age of culling does** | | | | | | | | |
| ≤ 6.5 years | > 6.5 years | | | ≤ 6.5 years | > 6.5 years | | | |
| 13 | 18 | | | 37 | 51 | | | 0.99 |
| **Start of kidding period** | | | | | | | | |
| All year | Autumn | Winter | Spring - Summer | All year | Autumn | Winter | Spring - Summer | |
| 2 | 14 | 14 | 1 | 6 | 49 | 30 | 3 | 0.74 |
| **Collaboration with a veterinarian** | | | | | | | | |
| Yes | No | | | Yes | No | | | |
| 26 | 5 | | | 62 | 26 | | | 0.14 |
| **Age of newborns taken away from dam** | | | | | | | | |
| ≤ 40 days | 41 – 60 days | ≥ 61 days | | ≤ 40 days | 41 – 60 days | ≥ 61 days | | |
| 7 | 9 | 15 | | 19 | 35 | 34 | | 0.53 |
| **Number of daily milking sessions** | | | | | | | | |
| One | Two | Three | | One | Two | Three | | |
| 0 | 31 | 0 | | 4 | 77 | 7 | | 0.12 |

| | | | | | |
|---|---|---|---|---|---|
| **Age of the farmer** | | | | | |
| Up to 50 years | Over 50 years | | Up to 50 years | Over 50 years | |
| 21 | 10 | | 52 | 36 | 0.38 |
| **Length of previous animal farming experience of the farmer** | | | | | |
| ≤ 5 years | > 5 years | | ≤ 5 years | > 5 years | |
| 5 | 26 | | 19 | 69 | 0.51 |
| **Education of the farmer** | | | | | |
| Primary education | Secondary or post-secondary education | Tertiary education | Primary education | Secondary or post-secondary education | Tertiary education |
| 4 | 24 | 3 | 16 | 65 | 7 | 0.78 |
| **Professional involvement in farming** | | | | | |
| Full-time | Part-time | | Full-time | Part-time | |
| 26 | 5 | | 79 | 9 | 0.38 |
| **Daily period at the farm** | | | | | |
| ≤ 8 hours | > 8 hours | | ≤ 8 hours | > 8 hours | |
| 5 | 26 | | 23 | 65 | 0.26 |
| **Family tradition in farming** | | | | | |
| Yes | No | | Yes | No | |
| 29 | 2 | | 74 | 14 | 0.18 |
| **Presence of working staff in the flock** | | | | | |
| Yes | No | | Yes | No | |
| 10 | 21 | | 24 | 64 | 0.60 |

**Table S11.** Results of univariable analysis for associations with optional vaccination against pneumonia in 325 sheep flocks and 119 goat herds in Greece.

(a) Sheep flocks

| Vaccination performed ($n$ = 144) | | | | Vaccination not performed ($n$ = 181) | | | | $p$ |
|---|---|---|---|---|---|---|---|---|
| **Management system applied in the farm** | | | | | | | | |
| Intensive | Semi-intensive | Semi-extensive | Extensive | Intensive | Semi-intensive | Semi-extensive | Extensive | |
| 23 | 59 | 54 | 8 | 21 | 81 | 62 | 17 | 0.37 |
| **No. of ewes in the flock** | | | | | | | | |
| ≤ 165 ewes | 166-330 ewes | 331-500 ewes | > 500 ewes | ≤ 165 ewes | 166-330 ewes | 331-500 ewes | > 500 ewes | |
| 36 | 54 | 26 | 28 | 52 | 66 | 40 | 23 | 0.33 |
| **Breed of animals** | | | | | | | | |
| Crossbreeds | Imported breeds | Local breeds | | Crossbreeds | Imported breeds | Local breeds | | |
| 19 | 64 | 61 | | 24 | 75 | 82 | | 0.85 |
| **Total land available for grazing (acres per animal)** | | | | | | | | |
| ≤ 0.50 | 0.51 – 2.00 | ≥ 2.00 | | ≤ 0.50 | 0.51 – 2.00 | ≥ 2.00 | | |
| 51 | 69 | 24 | | 67 | 61 | 53 | | 0.009 |
| **Milking mode in flock** | | | | | | | | |
| Machine-milking | | Hand-milking | | Machine-milking | | Hand-milking | | |
| 116 | | 28 | | 139 | | 42 | | 0.41 |
| **Average age of culling ewes** | | | | | | | | |
| ≤ 6.5 years | | > 6.5 years | | ≤ 6.5 years | | > 6.5 years | | |
| 112 | | 32 | | 130 | | 51 | | 0.22 |
| **Start of lambing period** | | | | | | | | |
| All year | Autumn | Winter | Spring - Summer | All year | Autumn | Winter | Spring - Summer | |
| 7 | 107 | 24 | 6 | 11 | 138 | 31 | 1 | 0.16 |
| **Collaboration with a veterinarian** | | | | | | | | |
| Yes | | No | | Yes | | No | | |
| 129 | | 15 | | 154 | | 27 | | 0.23 |
| **Age of newborns taken away from dam** | | | | | | | | |
| ≤ 40 days | 41 – 60 days | ≥ 61 days | | ≤ 40 days | 41 – 60 days | ≥ 61 days | | |
| 57 | 73 | 14 | | 60 | 99 | 22 | | 0.45 |
| **Routine administration of antibiotics to newborns** | | | | | | | | |
| Yes | | No | | Yes | | No | | |
| 41 | | 103 | | 29 | | 152 | | 0.007 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Number of daily milking sessions** | | | | | | |
| One | Two | Three | One | Two | Three | |
| 1 | 111 | 32 | 0 | 153 | 28 | 0.15 |
| **Age of the farmer** | | | | | | |
| Up to 50 years | | Over 50 years | Up to 50 years | | Over 50 years | |
| 87 | | 57 | 110 | | 71 | 0.95 |
| **Length of previous animal farming experience of the farmer** | | | | | | |
| ≤ 5 years | | > 5 years | ≤ 5 years | | > 5 years | |
| 31 | | 113 | 43 | | 138 | 0.63 |
| **Education of the farmer** | | | | | | |
| Primary education | Secondary or post-secondary education | Tertiary education | Primary education | Secondary or post-secondary education | Tertiary education | |
| 26 | 97 | 21 | 31 | 128 | 22 | 0.77 |
| **Professional involvement in farming** | | | | | | |
| Full-time | | Part-time | Full-time | | Part-time | |
| 129 | | 15 | 163 | | 18 | 0.89 |
| **Daily period at the farm** | | | | | | |
| ≤ 8 hours | | > 8 hours | ≤ 8 hours | | > 8 hours | |
| 34 | | 110 | 65 | | 116 | 0.017 |
| **Family tradition in farming** | | | | | | |
| Yes | | No | Yes | | No | |
| 125 | | 19 | 158 | | 23 | 0.90 |
| **Presence of working staff in the flock** | | | | | | |
| Yes | | No | Yes | | No | |
| 59 | | 85 | 64 | | 117 | 0.30 |

156

(b) Goat herds

| **Vaccination performed (*n* = 39)** | | | | **Vaccination not performed (*n* = 80)** | | | | *p* |
|---|---|---|---|---|---|---|---|---|
| **Management system applied in the farm** | | | | | | | | |
| Intensive | Semi-intensive | Semi-extensive | Extensive | Intensive | Semi-intensive | Semi-extensive | Extensive | |
| 4 | 8 | 21 | 6 | 5 | 21 | 40 | 14 | 0.78 |
| **No. of does in the herd** | | | | | | | | |
| ≤ 165 does | 166-330 does | 331-500 does | > 500 does | ≤ 165 does | 166-330 does | 331-500 does | > 500 does | |
| 17 | 13 | 8 | 1 | 39 | 24 | 5 | 12 | 0.032 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Breed of animals** | | | | | | |
| Crossbreeds | Imported breeds | Local breeds | Crossbreeds | Imported breeds | Local breeds | |
| 5 | 17 | 17 | 13 | 28 | 39 | 0.65 |
| **Total land available for grazing (acres per animal)** | | | | | | |
| ≤ 0.50 | 0.51 – 2.00 | ≥ 2.00 | ≤ 0.50 | 0.51 – 2.00 | ≥ 2.00 | |
| 7 | 9 | 23 | 10 | 22 | 48 | 0.69 |
| **Milking mode in herd** | | | | | | |
| Machine-milking | | Hand-milking | Machine-milking | | Hand-milking | |
| 22 | | 17 | 44 | | 36 | 0.88 |
| **Average age of culling does** | | | | | | |
| ≤ 6.5 years | | > 6.5 years | ≤ 6.5 years | | > 6.5 years | |
| 16 | | 23 | 34 | | 46 | 0.88 |
| **Start of kidding period** | | | | | | |
| All year | Autumn | Winter | Spring - Summer | All year | Autumn | Winter | Spring - Summer | |
| 3 | 20 | 14 | 2 | 5 | 43 | 30 | 2 | 0.88 |
| **Collaboration with a veterinarian** | | | | | | |
| Yes | | No | Yes | | No | |
| 33 | | 6 | 68 | | 12 | 0.96 |
| **Age of newborns taken away from dam** | | | | | | |
| ≤ 40 days | 41 – 60 days | ≥ 61 days | ≤ 40 days | 41 – 60 days | ≥ 61 days | |
| 7 | 15 | 17 | 19 | 29 | 32 | 0.77 |
| **Routine administration of antibiotics to newborns** | | | | | | |
| Yes | | No | Yes | | No | |
| 8 | | 31 | 22 | | 58 | 0.41 |
| **Number of daily milking sessions** | | | | | | |
| One | Two | Three | One | Two | Three | |
| 2 | 34 | 3 | 2 | 74 | 4 | 0.62 |
| **Age of the farmer** | | | | | | |
| Up to 50 years | | Over 50 years | Up to 50 years | | Over 50 years | |
| 23 | | 16 | 50 | | 30 | 0.71 |
| **Length of previous animal farming experience of the farmer** | | | | | | |
| ≤ 5 years | | > 5 years | ≤ 5 years | | > 5 years | |
| 6 | | 33 | 18 | | 52 | 0.21 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Education of the farmer** | | | | | | |
| Primary education | Secondary or post-secondary education | Tertiary education | Primary education | Secondary or post-secondary education | Tertiary education | |
| 5 | 32 | 2 | 15 | 57 | 8 | 0.43 |
| **Professional involvement in farming** | | | | | | |
| Full-time | | Part-time | Full-time | | Part-time | |
| 34 | | 5 | 71 | | 9 | 0.80 |
| **Daily period at the farm** | | | | | | |
| ≤ 8 hours | | > 8 hours | ≤ 8 hours | | > 8 hours | |
| 7 | | 32 | 21 | | 59 | 0.32 |
| **Family tradition in farming** | | | | | | |
| Yes | | No | Yes | | No | |
| 36 | | 3 | 67 | | 13 | 0.21 |
| **Presence of working staff in the flock** | | | | | | |
| Yes | | No | Yes | | No | |
| 15 | | 24 | 19 | | 61 | 0.10 |

**Table S12.** Results of univariable analysis for associations with optional vaccination against staphylococcal mastitis in 325 sheep flocks and 119 goat herds in Greece.

(a) Sheep flocks

| Vaccination performed ($n$ = 126) | | | | Vaccination not performed ($n$ = 199) | | | | $p$ |
|---|---|---|---|---|---|---|---|---|
| **Management system applied in the farm** | | | | | | | | |
| Intensive | Semi-intensive | Semi-extensive | Extensive | Intensive | Semi-intensive | Semi-extensive | Extensive | |
| 20 | 66 | 36 | 4 | 24 | 74 | 80 | 21 | 0.004 |
| **No. of ewes in the flock** | | | | | | | | |
| ≤ 165 ewes | 166-330 ewes | 331-500 ewes | > 500 ewes | ≤ 165 ewes | 166-330 ewes | 331-500 ewes | > 500 ewes | |
| 39 | 48 | 24 | 15 | 49 | 72 | 42 | 36 | 0.35 |
| **Breed of animals** | | | | | | | | |
| Crossbreeds | Imported breeds | Local breeds | | Crossbreeds | Imported breeds | Local breeds | | |
| 15 | 66 | 45 | | 28 | 73 | 98 | | 0.019 |
| **Total land available for grazing (acres per animal)** | | | | | | | | |
| ≤ 0.50 | 0.51 – 2.00 | ≥ 2.00 | | ≤ 0.50 | 0.51 – 2.00 | ≥ 2.00 | | |
| 52 | 50 | 24 | | 66 | 80 | 53 | | 0.19 |
| **Milking mode in flock** | | | | | | | | |
| Machine-milking | | Hand-milking | | Machine-milking | | Hand-milking | | |
| 109 | | 17 | | 146 | | 53 | | 0.005 |
| **Average age of culling ewes** | | | | | | | | |
| ≤ 6.5 years | | > 6.5 years | | ≤ 6.5 years | | > 6.5 years | | |
| 100 | | 26 | | 142 | | 57 | | 0.11 |
| **Start of lambing period** | | | | | | | | |
| All year | Autumn | Winter | Spring - Summer | All year | Autumn | Winter | Spring - Summer | |
| 6 | 102 | 14 | 4 | 12 | 143 | 41 | 3 | 0.10 |
| **Collaboration with a veterinarian** | | | | | | | | |
| Yes | | No | | Yes | | No | | |
| 119 | | 7 | | 164 | | 35 | | 0.009 |
| **Age of newborns taken away from dam** | | | | | | | | |
| ≤ 40 days | 41 – 60 days | ≥ 61 days | | ≤ 40 days | 41 – 60 days | ≥ 61 days | | |
| 51 | 68 | 7 | | 66 | 104 | 29 | | 0.033 |
| **Number of daily milking sessions** | | | | | | | | |
| One | Two | Three | | One | Two | Three | | |
| 0 | 95 | 31 | | 1 | 169 | 29 | | 0.06 |

| | | | | | |
|---|---|---|---|---|---|
| **Use of laboratory diagnostic examinations in samples of milk** | | | | | |
| Yes | | No | Yes | No | |
| 39 | | 87 | 31 | 168 | 0.001 |
| **Application of teat disinfection during milking** | | | | | |
| Yes | | No | Yes | No | |
| 27 | | 99 | 25 | 174 | 0.033 |
| **Application of 'dry-period treatment'** | | | | | |
| Yes | | No | Yes | No | |
| 30 | | 96 | 23 | 176 | 0.004 |
| **Duration of dry-period (months)** | | | | | |
| ≤ 2 | | > 2 | ≤ 2 | > 2 | |
| 48 | | 78 | 59 | 140 | 0.11 |
| **Age of the farmer** | | | | | |
| Up to 50 years | | Over 50 years | Up to 50 years | Over 50 years | |
| 85 | | 41 | 112 | 87 | 0.044 |
| **Length of previous animal farming experience of the farmer** | | | | | |
| ≤ 5 years | | > 5 years | ≤ 5 years | > 5 years | |
| 37 | | 89 | 37 | 162 | 0.024 |
| **Education of the farmer** | | | | | |
| Primary education | Secondary or post-secondary education | Tertiary education | Primary education | Secondary or post-secondary education | Tertiary education | |
| 25 | 83 | 18 | 32 | 142 | 25 | 0.57 |
| **Professional involvement in farming** | | | | | |
| Full-time | | Part-time | Full-time | Part-time | |
| 109 | | 17 | 183 | 16 | 0.11 |
| **Daily period at the farm** | | | | | |
| ≤ 8 hours | | > 8 hours | ≤ 8 hours | > 8 hours | |
| 38 | | 88 | 61 | 138 | 0.92 |
| **Family tradition in farming** | | | | | |
| Yes | | No | Yes | No | |
| 110 | | 16 | 173 | 26 | 0.92 |
| **Presence of working staff in the flock** | | | | | |
| Yes | | No | Yes | No | |
| 52 | | 74 | 71 | 128 | 0.31 |

(b) Goat herds

| Vaccination performed ($n$ = 34) | | | | Vaccination not performed ($n$ = 85) | | | | $p$ |
|---|---|---|---|---|---|---|---|---|
| **Management system applied in the farm** | | | | | | | | |
| Intensive | Semi-intensive | Semi-extensive | Extensive | Intensive | Semi-intensive | Semi-extensive | Extensive | |
| 2 | 13 | 19 | 0 | 7 | 16 | 42 | 20 | 0.007 |
| **No. of does in the herd** | | | | | | | | |
| ≤ 165 ewes | 166-330 ewes | 331-500 ewes | > 500 ewes | ≤ 165 ewes | 166-330 ewes | 331-500 ewes | > 500 ewes | |
| 17 | 11 | 5 | 1 | 39 | 26 | 8 | 12 | 0.32 |
| **Breed of animals** | | | | | | | | |
| Crossbreeds | Imported breeds | Local breeds | | Crossbreeds | Imported breeds | Local breeds | | |
| 6 | 17 | 11 | | 12 | 28 | 45 | | 0.12 |
| **Total land available for grazing (acres per animal)** | | | | | | | | |
| ≤ 0.50 | 0.51 – 2.00 | ≥ 2.00 | | ≤ 0.50 | 0.51 – 2.00 | ≥ 2.00 | | |
| 5 | 8 | 21 | | 12 | 23 | 50 | | 0.92 |
| **Milking mode in herd** | | | | | | | | |
| Machine-milking | | Hand-milking | | Machine-milking | | Hand-milking | | |
| 27 | | 7 | | 39 | | 46 | | 0.0009 |
| **Average age of culling does** | | | | | | | | |
| ≤ 6.5 years | | > 6.5 years | | ≤ 6.5 years | | > 6.5 years | | |
| 18 | | 16 | | 32 | | 53 | | 0.13 |
| **Start of kidding period** | | | | | | | | |
| All year | Autumn | Winter | Spring - Summer | All year | Autumn | Winter | Spring - Summer | |
| 3 | 20 | 10 | 1 | 5 | 43 | 34 | 3 | 0.71 |
| **Collaboration with a veterinarian** | | | | | | | | |
| Yes | | No | | Yes | | No | | |
| 31 | | 3 | | 70 | | 15 | | 0.22 |
| **Age of newborns taken away from dam** | | | | | | | | |
| ≤ 40 days | 41 – 60 days | ≥ 61 days | | ≤ 40 days | 41 – 60 days | ≥ 61 days | | |
| 12 | 14 | 8 | | 14 | 30 | 41 | | 0.021 |
| **Number of daily milking sessions** | | | | | | | | |
| One | Two | Three | | One | Two | Three | | |
| 0 | 29 | 5 | | 4 | 79 | 2 | | 0.018 |
| **Use of laboratory diagnostic examinations in samples of milk** | | | | | | | | |
| Yes | | No | | Yes | | No | | |
| 24 | | 10 | | 70 | | 15 | | 0.15 |

| | | | | |
|---|---|---|---|---|
| **Application of teat disinfection during milking** | | | | |
| Yes | No | Yes | No | |
| 7 | 27 | 5 | 80 | 0.017 |
| **Application of 'dry-period treatment'** | | | | |
| Yes | No | Yes | No | |
| 8 | 26 | 7 | 78 | 0.023 |
| **Duration of dry-period (months)** | | | | |
| ≤ 2 | > 2 | ≤ 2 | > 2 | |
| 11 | 23 | 28 | 57 | 0.95 |
| **Age of the farmer** | | | | |
| Up to 50 years | Over 50 years | Up to 50 years | Over 50 years | |
| 23 | 11 | 50 | 35 | 0.37 |
| **Length of previous animal farming experience of the farmer** | | | | |
| ≤ 5 years | > 5 years | ≤ 5 years | > 5 years | |
| 7 | 27 | 17 | 68 | 0.94 |
| **Education of the farmer** | | | | |
| Primary education | Secondary or post-secondary education | Tertiary education | Primary education | Secondary or post-secondary education | Tertiary education | |
| 4 | 27 | 3 | 16 | 62 | 7 | 0.65 |
| **Professional involvement in farming** | | | | |
| Full-time | Part-time | Full-time | Part-time | |
| 30 | 4 | 75 | 10 | 1.00 |
| **Daily period at the farm** | | | | |
| ≤ 8 hours | > 8 hours | ≤ 8 hours | > 8 hours | |
| 5 | 29 | 23 | 62 | 0.15 |
| **Family tradition in farming** | | | | |
| Yes | No | Yes | No | |
| 29 | 5 | 74 | 11 | 0.80 |
| **Presence of working staff in the flock** | | | | |
| Yes | No | Yes | No | |
| 13 | 21 | 21 | 64 | 0.14 |

183 **Table S13.** Results of univariable analysis for associations with total number of optional vaccinations in 325 sheep flocks and 119 goat herds in Greece.

184 (a) Sheep flocks

| | | | | *p* |
|---|---|---|---|---|
| **Management system applied in the farm** | | | | |
| Intensive | Semi-intensive | Semi-extensive | Extensive | |
| 3.43 ± 0.17 | 3.04 ± 0.10 | 2.62 ± 0.12 | 1.72 ± 0.26 | < 0.0001 |
| **No. of ewes in the flock** | | | | |
| $r$ = 0.055 | | | | 0.16 |
| **Total land available for grazing (acres per animal)** | | | | |
| $r$ = –0.097 | | | | 0.04 |
| **Milking mode in flock** | | | | |
| Machine-milking | | | Hand-milking | |
| 3.04 ± 0.08 | | | 2.14 ± 0.15 | < 0.0001 |
| **Average age of culling ewes** | | | | |
| $r$ = –0.162 | | | | 0.002 |
| **Start of lambing period** | | | | |
| All year | Autumn | Winter | Spring - Summer | |
| 2.72 ± 0.29 | 2.90 ± 0.08 | 2.58 ± 0.19 | 3.28 ± 0.42 | 0.32 |
| **Collaboration with a veterinarian** | | | | |
| Yes | | | No | |
| 2.94 ± 0.08 | | | 2.17 ± 0.19 | 0.0004 |
| **Age of newborns taken away from dam** | | | | |
| $r$ = –0.281 | | | | < 0.0001 |
| **Routine administration of antibiotics to newborns** | | | | |
| Yes | | | No | |
| 3.33 ± 0.14 | | | 2.71 ± 0.08 | 0.0005 |
| **Number of daily milking sessions** | | | | |
| $r$ = –0.214 | | | | < 0.0001 |
| **Use of laboratory diagnostic examinations in samples of milk** | | | | |
| Yes | | | No | |
| 3.43 ± 0.16 | | | 2.68 ± 0.08 | < 0.0001 |
| **Application of 'dry-period treatment'** | | | | |
| Yes | | | No | |
| 3.33 ± 0.18 | | | 2.71 ± 0.08 | 0.0005 |

| | | | |
|---|---|---|---|
| **Duration of dry-period (months)** | | | |
| *r* = –0.176 | | | 0.007 |
| **Age of the farmer** | | | |
| *r* = –0.250 | | | 0.007 |
| **Education of the farmer** | | | |
| Primary education | Secondary or post-secondary education | Tertiary education | |
| 3.02 ± 0.08 | 2.77 ± 0.07 | 2.98 ± 0.22 | 0.36 |
| **Professional involvement in farming** | | | |
| Full-time | | Part-time | |
| 2.82 ± 0.16 | | 3.06 ± 0.21 | 0.32 |
| **Daily period at the farm** | | | |
| *r* = –0.002 | | | 0.49 |
| **Family tradition in farming** | | | |
| Yes | | No | |
| 2.83 ± 0.08 | | 2.95 ± 0.22 | 0.57 |
| **Presence of working staff in the flock** | | | |
| Yes | | No | |
| 3.13 ± 0.11 | | 2.67 ± 0.09 | 0.002 |

185

(b) Goat herds

| | | | |
|---|---|---|---|
| | | | ***p*** |
| **No. of does in the herd** | | | |
| *r* = 0.090 | | | 0.49 |
| **Breed of animals** | | | |
| Crossbreeds | Imported breeds | Local breeds | |
| 3.11 ± 0.29 | 3.13 ± 0.20 | 2.36 ± 0.18 | 0.008 |
| **Material of the floor of the barn** | | | |
| Soil | | Other | |
| 2.76 ± 0.13 | | 2.80 ± 0.39 | 0.93 |
| **Milking mode in flock** | | | |
| Machine-milking | | Hand-milking | |
| 3.09 ± 0.16 | | 2.36 ± 0.18 | 0.003 |
| **Average age of culling ewes** | | | |
| *r* = 0.199 | | | 0.015 |

| | | | |
|---|---|---|---|
| **Collaboration with a veterinarian** | | | |
| Yes | | No | |
| 2.87 ± 0.14 | | 2.17 ± 0.23 | 0.043 |
| **Age of newborns taken away from dam** | | | |
| | $r$ = –0.174 | | 0.029 |
| **Routine administration of antibiotics to newborns** | | | |
| Yes | | No | |
| 2.80 ± 0.23 | | 2.75 ± 0.15 | 0.87 |
| **Number of daily milking sessions** | | | |
| | $r$ = 0.219 | | 0.008 |
| **Use of laboratory diagnostic examinations in samples of milk** | | | |
| Yes | | No | |
| 3.48 ± 0.27 | | 2.57 ± 0.14 | 0.003 |
| **Application of 'dry-period treatment'** | | | |
| Yes | | No | |
| 3.67 ± 0.30 | | 2.63 ± 0.26 | 0.006 |
| **Education of the farmer** | | | |
| Primary education | Secondary or post-secondary education | Tertiary education | |
| 2.40 ± 0.32 | 2.84 ± 0.34 | 2.80 ± 0.44 | 0.42 |
| **Professional involvement in farming** | | | |
| Full-time | | Part-time | |
| 2.73 ± 0.14 | | 3.00 ± 0.30 | 0.49 |
| **Daily period at the farm** | | | |
| | $r$ = 0.093 | | 0.16 |
| **Family tradition in farming** | | | |
| Yes | | No | |
| 2.77 ± 0.13 | | 2.75 ± 0.13 | 0.96 |
| **Presence of working staff in the flock** | | | |
| Yes | | No | |
| 3.12 ± 0.25 | | 2.62 ± 0.14 | 0.07 |