This document contain supporting documentation for:

Eriksson, H. et al. (2022). Strategies for keeping dairy cows and calves together – a cross-sectional survey study

Most analyses of the data were performed in R version 4.0.0, using RStudio version 1.3.959.

To run the R script, download R at https://www.r-project.org/, and RStudio at https://www.rstudio.com/products/rstudio/download/.

For information on how to install and load packages in R, see https://www.statmethods.net/interface/packages.html

Data was also analysed using STATA 14, which requires a licence to use. To run the STATA script, open STATA and insert the script in a do-file.

Here follows the description of variables included in the data sets. Variables where the answers were identified as either uninformative or to a large extent corrupted have been removed in the published data set. For many multiple choice questions a free-text response alternative was provided. If further themes were identified (many farms answering the same thing) when going through the free-text answers, the data was recoded. New themes are indicated by "RECODED".

VARIABLE NAME	**EXPLANATION**
no_delivery	dummy variable, 1 = farm do not deliver or use milk for dairy production, 0 = farm deliver milk for commercial purposes
id_respondant	unique identifier for farms participating in the survey
created	date-time when survey was opened
completed	date-time when survey was closed
country	country the farm is located in
date_interview	date the interview was performed
QUESTION 2	
days_suckle	the number of days calves suckle an adult lactating cow (dam or foster)
QUESTION 3	
organic_dummy	dummy variable specifying if the farm uses organic certification, 0 = no, 1 = yes
organic_label1	name of organic label used by the farm
organic_label2	if relevant, name of second organic label used by the farm
welfare_dummy	dummy variable specifying if the farm uses welfare certification, 0 = no, 1 = yes

welfare_label1	name of welfare label used by the farm
welfare_label2	if relevant, name of second welfare label used by the farm
other_dummy	dummy variable specifying if the farm uses other than organic or welfare certification, 0 = no, 1 = yes
other_label	name of other labels used by the farm

QUESTION 4-5

breed1	predominant dairy cow breed in the dairy herd
breed2	other dairy cow breed in the herd
breed3	other dairy cow breed in the herd
breed4	other dairy cow breed in the herd
cross	cross bred dairy cows used on the farm. Notes: unspecified = cross breed used on farm but not breeds not specified
pure_breed	dummy variable, 1 = farm only has dairy cows of "pure" breed, no crosses. Also used if multiple pure breeds present on farm; 0 = farm deliberately cross-breed dairy cows. Beef animals not counted, Simmental counted as dairy breed
multiple_breeds	dummy variable, 1 = farm has multiple dairy breeds (including crosses); 0 = farm only has one dairy breed, unspecified = farmer has not answered if there is more than one breed on the farm. Beef animals not counted, Simmental counted as dairy breed
other_breeds	dairy breeds not counted as predominant on the farm

QUESTION 6

cows_tot	total number of adult dairy cows (including dry cows and foster cows but not pregnant heifers)

QUESTION 7

ha_crop	crop surface in hectares
ha_perm_pasture	permanent pasture surface in hectares
ha_temp_pasture	temporary pasture surface in hectares

QUESTION 8

calves_born	number of born dairy calves during the last 12 months
heifers_weaned	number of weaned female dairy calves during the last 12 months (weaning = milk feeding is terminated on the farm of origin)
heifers_sold	number of sold female dairy calves (≤6 months of age) during the last 12 months
heifers_kept	number of female dairy calves kept for recruitment during the last 12 months:
heifers_beef	number of female dairy calves fattened during the last 12 months (or raised for fattening beef/slaughter)
own_rearing	CONSTRUCTED VARIABLE dummy variable for raising recruitment heifers on the home farm. Based on heifers_kept and free-text answers

QUESTION 9

beef_cattle	0 = no, 1 = yes

pigs	0 = no, 1 = yes
poultry	0 = no, 1 = yes
sheep	0 = no, 1 = yes
goats	0 = no, 1 = yes
horses	RECODED 0 = no, 1 = yes
bees	RECODED 0 = no, 1 = yes
turkeys	RECODED 0 = no, 1 = yes
geese	RECODED 0 = no, 1 = yes
ducks	RECODED 0 = no, 1 = yes
peacocks	RECODED 0 = no, 1 = yes
rabbits	RECODED 0 = no, 1 = yes

QUESTION 10

income_milk	proportion of household income from milk production (%), unspecified = no information given.

QUESTION 11

housing	factor variable for housing system used for the dairy cows; levels: freestall = cubicle housing, loosehouse = free walking system without cubicles, outside = cows housed outdoors during all seasons, tiestall = tiestall housing, mixed = more than one housing system used for adult cows
mixed_description	closer description of mixed, as these housing systems were variable

QUESTION 12

ms	dummy for using any form of milking system, including manual milking for delivery; 1 = yes, 0 = no
ams_ms	automatic milking; 0 = no, 1 = yes
rotary_ms	rotary milking; 0 = no, 1 = yes
fishbone_ms	fishbone parlour; 0 = no, 1 = yes
tandem_ms	tandem parlour; 0 = no, 1 = yes
parallell_ms	RECODED parallel parlour; 0 = no, 1 = yes
butterfly_ms	RECODED butterfly parlour; 0 = no, 1 = yes
tie_pipe_ms	tie-stall pipeline; 0 = no, 1 = yes
bucket_ms	RECODED bucket milking; 0 = no, 1 = yes
hand_ms	RECODED manual milking for commercial purposes; 0 = no, 1 = yes
other_ms	other milking system; 0 = no, 1 = yes
other_ms_description	description of milking systems described as other

QUESTION 13

rearing	factor variable for type of calf rearing practice on the farm; mother = calves reared together with the dam, foster = calves reared together with foster cows, mix = farm uses both mother and foster cows for calf rearing, mother_bulk = calves first dam reared, then

	manually fed bulk milk, bulk_foster = calves first manually fed bulk milk, then reared together with foster cows
other_rearing_ description	Free-text comments on calf rearing practice
QUESTION 14	
milking_suckled_cows	dummy variable for milking suckled cows; 1 = yes, 0 = no, other = various responses
other_suckling	description of practices used when stating “Other” on "Are suckled cows milked?"; most often because dams are milked while foster cows are not
nbr_milkings_suckled	the number of times per day that suckled cows are milked
QUESTION 16	
season_calving	dummy variable for seasonal calving; 1 = yes, 0 = no, other = farmer left free-text answers
season_description	farmers' comments on seasonal calving practices
QUESTION 18	
pasture_type	type of pasture that the dairy cows are kept on; production_pasture = production pasture, exercise = exercise paddock, no_pasture = no-grazing system, mix = multiple practices, other = very unusual pasture practices
QUESTION 19	
qt_TFR	proportion of pasture in the total feed ration (TFR) during the grazing season; 0 = no pasture, 1 = 1-25%, 2 = 26-50%, 3 = 51-75%, 4 = 76-100%
QUESTION 20	
early_foster_NA	dummy variable for NOT using early lactation foster cow; 1 = yes, 0 = no
early_foster_SCC	dummy variable for using early lactation foster cows to female calves due to high somatic cell count; 1 = yes, 0 = no
early_foster_noSCC	RECODED dummy variable for using early lactation foster cows to female calves due to excellent udder health; 1 = yes, 0 = no;
early_foster_lowmilk	dummy variable for using early lactation foster cows to female calves due to low milk production; 1 = yes, 0 = no
early_foster_hard	dummy variable for using early lactation foster cows to female calves due to the cow being difficult to milk; 1 = yes, 0 = no
early_foster_nice	RECODED dummy variable for using early lactation foster cows to female calves because they are known to be nice to the calves; 1 = yes, 0 = no
early_foster_dim	RECODED dummy variable for using early lactation foster cows to female calves due to the lactation stage; 1 = yes, 0 = no. Note: often cows in low DIM were used for older calves

early_foster_lame	RECODED dummy variable for using early lactation foster cows to female calves due to lameness; 1 = yes, 0 = no
early_foster_cull	RECODED dummy variable for using early lactation foster cows to female calves because the cow is selected for slaughter; 1 = yes, 0 = no
early_foster_other	dummy variable for using early lactation foster cows to female calves due to (uncommon) reasons not mentioned above; 1 = yes, 0 = no
early_foster_other_description	description of other reasons for choosing early lactation foster cows, full original comment retained (also for recoded reasons)

QUESTION 21

late_foster_NA	dummy variable for NOT using late lactation foster cow; 1 = yes, 0 = no
late_foster_SCC	dummy variable for using late lactation foster cows to female calves due to high somatic cell count; 1 = yes, 0 = no
late_foster_milk	dummy variable for using late lactation foster cows to female calves due to low milk production; 1 = yes, 0 = no
late_foster_hard	dummy variable for using late lactation foster cows to female calves due to the cow being difficult to milk; 1 = yes, 0 = no
late_foster_nice	RECODED dummy variable for using late lactation foster cows to female calves because they were known to be nice to the calves; 1 = yes, 0 = no
late_foster_dim	RECODED dummy variable for using late lactation foster cows to female calves due to the lactation stage; 1 = yes, 0 = no. Note: most often either low-producing cows in high DIM, or very high producing animals
late_foster_lame	RECODED dummy variable for using late lactation foster cows to female calves due to lameness; 1 = yes, 0 = no
late_foster_cull	RECODED dummy variable for using late lactation foster cows to female calves because the cow is selected for slaughter; 1 = yes, 0 = no
late_foster_other	dummy variable for using late lactation foster cows to female calves due to (uncommon) reasons not mentioned above; 1 = yes, 0 = no
late_foster_other_description	description of other reasons for choosing late lactation foster cows, full original comment retained (also for recoded reasons)

QUESTION 22

cow_moo	dummy variable for observing vocalization responses for several days after separation among the cows; 1 = yes, 0 = no
cow_moo_24h	RECODED dummy variable for observing vocalization responses the day after separation among the cows; 1 = yes, 0 = no
cow_distress	RECODED dummy variable for observing agitation among the cows after separation; 1 = yes, 0 = no
no_milk	dummy variable for observing impaired milk let down among the cows for several days after separation; 1 = yes, 0 = no

no_milk_24	RECODED dummy variable for observing impaired milk let down among the cows the day after separation; 1 = yes, 0 = no
cow_no_feed	dummy variable for observing reduced feed intake for several days after separation among the cows; 1 = yes, 0 = no
calf_moo	dummy variable for observing vocalization responses for several days after separation among the calves; 1 = yes, 0 = no
calf_moo_24h	RECODED dummy variable for observing vocalization responses the day after separation among the calves; 1 = yes, 0 = no
calf_distress	RECODED dummy variable for observing agitation among the calves after separation; 1 = yes, 0 = no
calf_weight	dummy variable for observing weight loss among the calves after separation; 1 = yes, 0 = no
calf_breakout	RECODED dummy variable for calves breaking out of their new holding pen after they have been separated from the adult cows; 1 = yes, 0 = no
no_signs	dummy variable for NOT observing any problems after separation; 1 = yes, 0 = no
separation_other	dummy variable for observing other problems at separation, than those listed above; 1 = yes, 0 = no
separation_other_ description	description of other reasons for problems at weaning, full original comment retained (also for recoded reasons)

QUESTION 23

wean_stepwise	dummy variable for stepwise separation; 1 = yes, 0 = no
wean_med	dummy variable for medical treatment at separation; 1 = yes, 0 = no
wean_feed	dummy variable for providing attractive feed to cows and calves at separation, to deviate attention; 1 = yes, 0 = no
wean_no_problem	dummy variable for NOT observing any problems that need intervention at separation; 1 = yes, 0 = no
wean_alt_trt	RECODED dummy variable for homeopathic/herbal remedy treatment at separation; 1 = yes, 0 = no
wean_noseflaps	RECODED dummy variable for using nose flaps on the calves before separation; 1 = yes, 0 = no
wean_away	RECODED dummy variable for removing visual, and preferably auditory contact at separation; 1 = yes, 0 = no
wean_nothing	RECODED dummy variable for NOT performing any special interventions at separation; 1 = yes, 0 = no
wean_other	dummy variable for performing any other intervention at separation, than those listed above; 1 = yes, 0 = no
wean_other_ description	description of other interventions at separation, full original comment retained (also for recoded interventions)

QUESTION 24

udder_care	dummy variable for using any special measures to care for the udders, particularly for foster cows; 1 = yes, 0 = no
trt_udder_care	free-text option to describe special measures for udder care

QUESTION 25

pct_ge8	proportion of all calves (heifers and bulls) that have cow contact for more than 7 days (%)

QUESTION 26

foster_nbr_calves	number of calves per foster cow on average. Note: NA = foster cows not used, 0 = calf kept with the dam, but farmer had noticed that calves also suckle other cows

QUESTION 27

foster_start_day	age in days when the calf is moved to the foster cow. Note: 999 = days in age when transferred to foster cows not provided

QUESTION 28

col_suck	dummy variable for letting the calves obtain colostrum through suckling; 1 = yes, 0 = no
col_drench	dummy variable for giving colostrum with drencher; 1 = yes, 0 = no
col_bucket	dummy variable for giving colostrum with bucket; 1 = yes, 0 = no
col_bottle	RECODED dummy variable for giving colostrum with bottle; 1 = yes, 0 = no
col_description	description of ways to provide colostrum than those listed above, full original comment retained (also for recoded interventions)

QUESTION 29

own_rearing	dummy variable for rearing recruitment heifers at the home farm; 1 = yes, 0 = no

QUESTION 30

pct_female_suckle	proportion of female calves that are allowed to suckle (%)
pct_male_suckle	proportion of male calves that are allowed to suckle (%)

QUESTION 31

description_rearing	open text description on how a female calf is kept, the majority of the day, from birth to weaning

QUESTION 32

calf_forage_wk	age in weeks when the calves get access to forage
calf_no_forage	dummy variable for NOT giving forage to the calves; 1 = yes, 0 = no

QUESTION 33

calf_concentrate_wk	age in weeks when the calves get access to concentrate
calf_no_concentrate	dummy variable for NOT giving concentrate to the calves; 1 = yes, 0 = no

QUESTION 34

female_suckle_d	age in days when female calves on average stop suckling. Notes: this not always mean that they stop consuming milk

QUESTION 35

female_extra	dummy variable for giving additional milk with bucket to female calves; 1 = yes, 0 = no
female_extra_l	the amount of additional milk that are given in liters
female_extra_l_ description	free-text descriptions of reasons to provide additional milk

QUESTION 36

female_contact	factor variable for contact allowance for female calves, levels: permanent = full day contact, restricted = always time-restricted access, mix = part of life permanent and part of life restricted, both = some calves permanent access, some restricted access, NA = one farm that let the bulls calves suckle but not the heifer calves
female_contact_ description	free-text description of contact allowance for female calves

QUESTION 37

female_nbr_contact1	number of times per day the female calves were kept with the adult animals during the beginning of the milk period
female_nbr_contact2	if relevant, the number of times per day the female calves were kept with the adult animals after the beginning of the milk period. Notes: most common to initially have contact two times per day, and decrease to one time per day when approaching weaning. farms that did not change daily contact occasions = NA
female_nbr_contact3	if relevant, the number of times per day the female calves were kept with the adult animals in the end of the milk period. Notes: some farms let the calves suckle every other day after the once per day period.

QUESTION 38

female_contact_when	factor variable for when cow-calf contact occurred, levels: before = female calves has access before milking, after = access after milking, permanent = female calves are permanently with adult cows, both = calf access specified as both before and after milking, while specifying restricted access, during = calf access specified as during milking, halfday = access to adult cows between milkings, for half of the day, mix = either access before milking for part of life, and access after milking at other times or some other combination of the other strategies, NA = female calves have contact with adult cows but does not suckle, no_milking = cows used for suckling is not milked
female_when_description	free-text comments for when cow-calf contact occured

QUESTION 41

female_wean_wk	average weaning age in weeks for female calves

QUESTION 42

suckled_milk_test	factor variable describing if suckled cows are included in performance testing or milk recording; levels: yes = all cows included, no = no cows included, some = a proportion of suckled cows are included, no_recording = farm is not enrolled in milk recording, no_answer = no answer provided

QUESTION 44

cow_fertility	factor variable describing the farmers perception of fertility for suckled cows, compared to cows that had their calf removed shortly after birth, levels: better = suckled cows have better fertility, worse = suckled cows have worse fertility, same = no difference, dont_know = farmer is unsure about the effect, no_answer = no answer provided
cow_udder_health	factor variable describing the farmers perception of udder health for suckled cows, compared to cows that had their calf removed shortly after birth, levels: better = suckled cows have better udder health, worse = suckled cows have worse udder health, same = no difference, dont_know = farmer is unsure about the effect, no_answer = no answer provided

QUESTION 45

calf_health	factor variable describing the farmers perception of general calf health for calves allowed to suckle, compared to calves removed from adult cows shortly after birth, levels: better = calves allowed to suckle have better general health, worse = calves allowed to suckle have worse general health, same = no difference, dont_know = farmer is unsure about the effect, no_answer = no answer provided
calf_gain	factor variable describing the farmers perception of weight gain in calves allowed to suckle, compared to calves removed from adult cows shortly after birth, levels: higher = calves allowed to suckle grow faster, lower = calves allowed to suckle grow slower, same = no difference, dont_know = farmer is unsure about the effect, no_answer = no answer provided
calf_diarrhoea	factor variable describing the farmers perception of diarrhea among calves allowed to suckle, compared to calves removed from adult cows shortly after birth, levels: higher = calves allowed to suckle more frequently have diarrhea, lower = calves allowed to suckle less frequently have diarrhea, same = no difference, dont_know = farmer is unsure about the effect, no_answer = no answer provided
calf_cough	factor variable describing the farmers perception of respiratory

	disease among calves allowed to suckle, compared to calves removed from adult cows shortly after birth, levels: higher = calves allowed to suckle more frequently have respiratory disease, lower = calves allowed to suckle less frequently have respiratory disease, same = no difference, dont_know = farmer is unsure about the effect, no_answer = no answer provided
QUESTION 46	
ab_12mo	dummy variable for using antibiotics for treatment of calves during the last 12 months; 1 = yes, 0 = no, no_answer = no answer provided
QUESTION 47	
deworm_3y	dummy variable for using any kind of anthelmintic treatment of calves during the last 3 years; 1 = yes, 0 = no, no_answer = no answer provided
deworm_convent	dummy variable for using medical anthelmintic treatment of calves during the last 3 years; 1 = yes, 0 = no
deworm_hpt	dummy variable for using homeopathic anthelmintic treatment of calves during the last 3 years; 1 = yes, 0 = no
deworm_alt	dummy variable for using other alternative treatment (e.g. fytotherapy, herbal medicine) of calves during the last 3 years; 1 = yes, 0 = no
deworm_alt_description	free-text description of alternative medicine (e.g. fytotherapy, herbal medicine)
QUESTION 48	
calf_annual_death	the average number of calves (0-3 months of age) that die annually in the herd, stillbirths not included
calf_annual_death_ description	free-text comments to annual calf mortality
calf_death_rate	CONSTRUCTED VARIABLE = calf_annual_death /calves_born. Notes: if either the number of born calves, or number of calves dying was not reported, the value was set to 999
QUESTION 49	
start_year	the year the farm started with cow-calf contact. Notes: 1900 indicates that the farm has used cow-calf contact for several generations
QUESTION 50	
more_time	factor variable for perceiving cow-calf contact as more time consuming than conventional systems, levels: yes = CCC more time consuming, no = CCC not more time consuming, same = RECODED free-text answers shows that farmer think CCC takes as much time as conventional calf rearing, don't know = RECODED farmer has no opinion, unspecified = RECODED no answer provided

more_time_comment	free-text comment to more_time

QUESTION 51

driver_natural	dummy variable for perceiving naturalness of the system as an important driver for cow-calf contact; 1 = yes, 0 = no
driver_lesstime	dummy variable for perceiving reduced work load as an important driver for cow-calf contact; 1 = yes, 0 = no
driver_calfhealth	dummy variable for improved calf health as an important driver for cow-calf contact; 1 = yes, 0 = no
driver_calfgrowth	RECODED dummy variable for improved calf growth as an important driver for cow-calf contact; 1 = yes, 0 = no
driver_cowhealth	dummy variable for improved cow health as an important driver for cow-calf contact; 1 = yes, 0 = no
driver_consumer	dummy variable for consumer demands as an important driver for cow-calf contact; 1 = yes, 0 = no
driver_welfare	RECODED dummy variable for improved animal welfare as an important driver for cow-calf contact; 1 = yes, 0 = no
driver_happy	RECODED dummy variable increased work satisfaction as an important driver for cow-calf contact; 1 = yes, 0 = no
driver_profit	RECODED dummy variable for profit as an important driver for cow-calf contact; 1 = yes, 0 = no
driver_certification	RECODED dummy variable for meeting certification criteria as an important driver for cow-calf contact; 1 = yes, 0 = no
driver_other	other (uncommon) factors mentioned by farmers as important drivers for cow-calf contact; other = other reasons than those mentioned above important driver for cow-calf contact
description_driver_other	free-text comment to driver_other. Full original comments retained (also for recoded drivers)

QUESTION 52

barrier_nothink	dummy variable for not thinking about any barriers before implementing cow-calf contact; 1 = yes, 0 = no
barrier_dontknow	dummy variable for perceiving lack of knowledge as a barrier for implementing cow-calf contact; 1 = yes, 0 = no
barrier_complicated	dummy variable for perceiving the complexity of the system as a barrier for implementing cow-calf contact; 1 = yes, 0 = no
barrier_notallowed	dummy variable for perceiving prohibition as a barrier for implementing cow-calf contact; 1 = yes, 0 = no
barrier_moretime	dummy variable for perceiving increased work load as a barrier for implementing cow-calf contact; 1 = yes, 0 = no
barrier_separation	dummy variable for perceiving separation distress among the animals as a barrier for implementing cow-calf contact; 1 = yes, 0 = no
barrier_testing	dummy variable for perceiving performance testing as a barrier for implementing cow-calf contact; 1 = yes, 0 = no

barrier_barn	RECODED dummy variable for perceiving the current barn construction as a barrier for implementing cow-calf contact; 1 = yes, 0 = no
barrier_none	RECODED dummy variable for not perceiving any barriers for implementing cow-calf contact; 1 = yes, 0 = no
barrier_noanswer	RECODED dummy variable for not responding to the question about barriers for implementing cow-calf contact; 1 = yes, 0 = no
barrier_other	dummy variable for perceiving other (uncommon) factors as barriers for implementing cow-calf contact; 1 = yes, 0 = no
barrier_other_description	free-text comment to barrier_other. Full original comments retained (also for recoded barriers)

QUESTION 53

want_change	factor variable for wanting to modify something in the present cow-calf rearing strategy, levels: 1 = yes, 0 = no, maybe = RECODED thinking about maybe implementing an alternative practice in the future
change_description	free-text comment to want_change. Full original comments retained (also for recoded responsed)

QUESTION 55

final_comment	free-text responses to final comments or other important aspects