

Evaluation of safety culture in agriculture

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Health and safety in agriculture

- Agriculture has the worst fatal accident record of all major employment sectors
 - Over 550 fatal accidents in farming across the EU each year
 - **Fatal accident rate** for the EU15 in 2000 was 12.6 /100 000 workers
 - Rate for **accidents with more than 3 days absence** is over 6000/100 000 workers
 - Relative share of fatality burden
 - UK: 15-20% of fatalities for 1.5% of the workforce
 - Ireland: 50% of fatalities for 5% of the workforce
- Higher than average rate of self-reported illness
 - musculoskeletal disorders
 - skin diseases
 - viral and bacterial infections
 - allergies, asthma and cancer
 - hearing impairment
 - mental problems (incl. burnout and suicide)



Sources: Health & Safety Executive 2019; OSHA

Ways to address safety and health problems

- Address the consequences
 - Rapid intervention to save lives
 - Adequate medical and psychological care
- Address the causes

Influence the behavioral and environmental determinants of health and safety problems through **prevention** and **health promotion**



Making prevention effective

« Evidence based prevention »

- Analogy with Evidence Based Medicine (EBM)
 - introduced in medicine in the 1990s
 - Idea: ensure that decision making is based on scientific evidence to ensure that the health resources are used most efficiently
 - transformed the practice of medicine
- Evidence based public health

“The development, implementation, and evaluation of effective programs and policies in public health through the application of principles of scientific reasoning, including systematic use of data and information systems, and appropriate use of behavioral science theory and program planning models”



Brownson, Ross C., Elizabeth A. Baker, Terry L. Leet, and Kathleen N. Gillespie, Editors. *Evidence-Based Public Health*. New York: Oxford University Press, 2003

Building the evidence base for effective farm safety programs

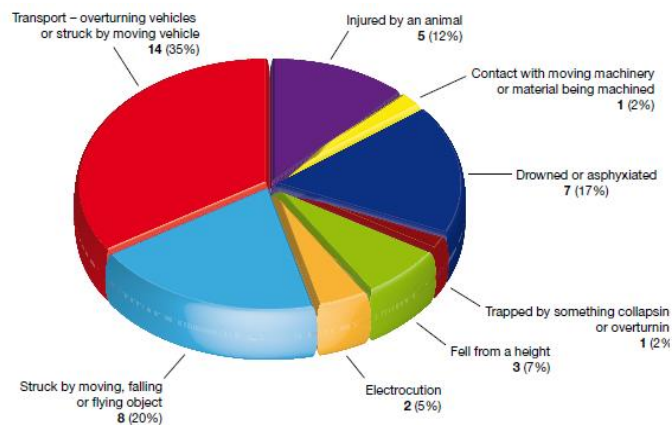


1. Identify behavioral risk factors
2. Analyse the determinants of unsafe or unhealthy behavior
3. Develop and test interventions to influence health related behavior
4. Investigate conditions for successful implementation and sustainability

1. Identify behavioral risk factors

Causes of fatalities in agriculture

Fatal injuries in farming, forestry, horticulture and associated industries, UK, 2011-12



Source: Health & Safety Executive 2013

Specific causes of fatalities

- Transport-related fatalities
 - Run over or crushed by tractors or all-terrain vehicles
 - Crushed by machinery (telehandler, forestry forwarder, trailer unit, turf harvester and cattle lorry)
- Being struck by a falling, flying or moving objects
 - Hit by trees or tree branches
 - Trapped by a grain mill, post rammer, locking ring
- Drowning or asphyxiation
 - Water, slurry fumes/gas released from a tank, grain bin
- Trampled by farm animals
- Falls from heights
 - Stairs, ladders, trees, ravines
- Electrocution
 - Contact with overhead power lines



Source: Health & Safety Executive 2013

Causes of farmers' ill health

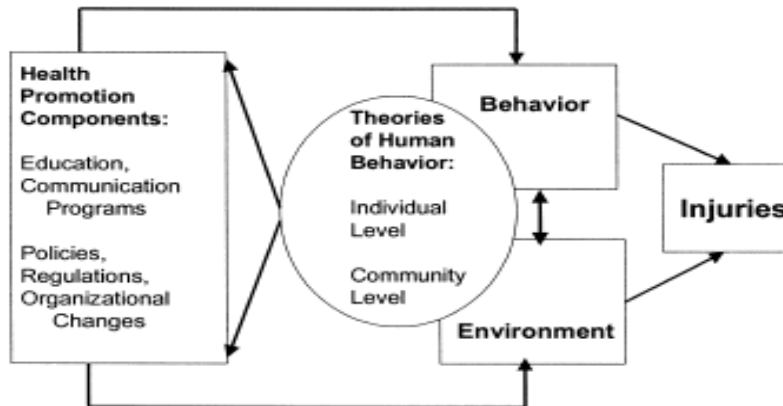
- Musculo-skeletal disorders
 - Manual handling
 - Almost 60% of workers in agriculture are exposed to painful positions at work half the time or more, the highest of any sector of industry
 - Carrying heavy loads
 - Nearly 50% of workers in agriculture carry heavy loads half the time or more
 - Repetitive movements
 - Over 50% of workers in agriculture are exposed to repetitive hand movements half the time or more
 - Vibrations
 - Cold work environments
- Skin diseases, asthma, cancer
 - Exposure to dangerous substances and biological agents
(both single short exposure & long-term accumulation of substances in the body)
- Infections
 - Exposure to parasites, viruses or bacteria
- Mental health problems
 - Stress, economic problems, low sense of control, ...



Source: Health & Safety Executive 2013

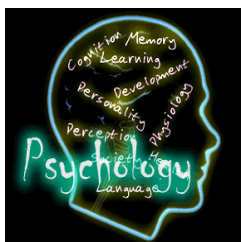
2. Analyse the determinants of unsafe/unhealthy behavior

Application of theoretical frameworks explaining risk behavior



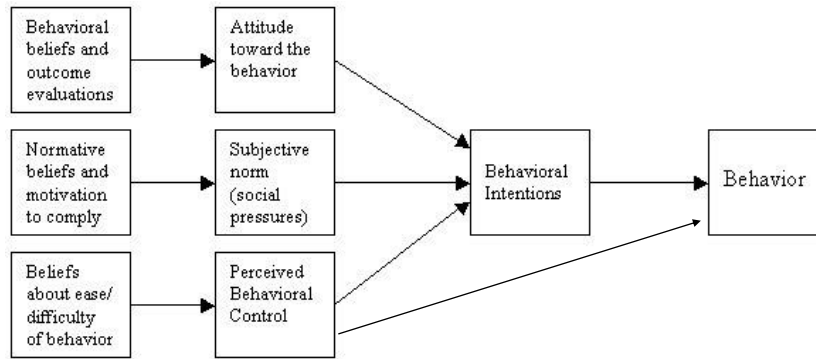
Source: Gielen & Sleet, Epidemiol Rev 2003;25:65–76

Theories of human behavior with relevance for accident prevention



- Psychological factors
 - Cognitive factors
 - lack of knowledge
 - information processing
 - inaccurate risk perceptions
 - stress
 - Motivation and attitudes
 - subjective evaluation of advantages and disadvantages of behavioral options
- Environmental factors
 - Physical environment
 - Social environment

Motivational theories of factors influencing risk behavior



Theory of Planned behavior (Ajzen, 1991)

TPB applied to farm accidents

Table 1 Beta values, t-values and p-values of attitude, subjective norm and perceived behavioural control for the prediction of intention of the entire group of respondents

	R^2	β	t	p
Machinery use	.30			
Attitude		.22	5.44	.00
Subjective norm		.41	10.32	.00
Perceived behavioral control: wagon loading		-.07	-1.84	.07
Perceived behavioral control: machinery maintenance		-.09	-2.51	.01
Perceived behavioral control: public road visibility		.07	1.79	.07
Animal handling	.35			
Attitude		.42	11.34	.00
Subjective norm		.31	8.38	.00
Perceived behavioral control: ventilate stables		.04	1.09	.28
Perceived behavioral control: stand behind animals		-.03	-.81	.42
Falling	.43			
Attitude		.33	8.63	.00
Subjective norm		.49	13.02	.00
Perceived behavioral control		.04	1.11	.27
Pesticide use	.41			
Attitude		.49	13.18	.00
Subjective norm		.25	6.56	.00
Perceived behavioral control		.04	1.05	.29

Van den Broucke & Colemont (unpublished)

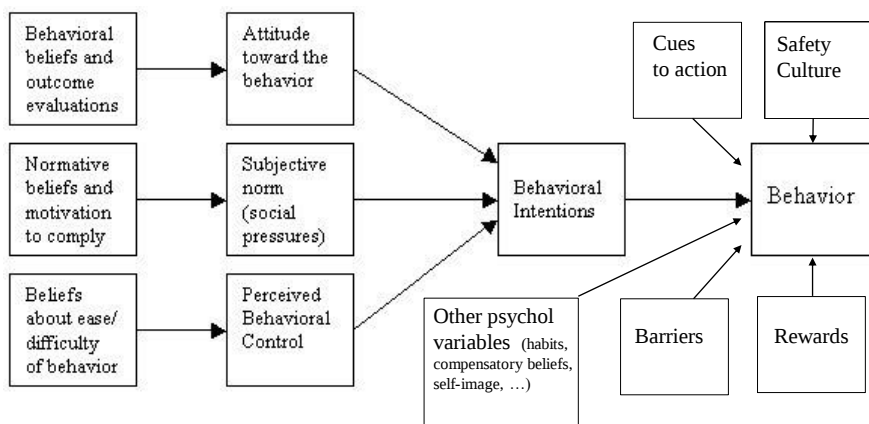
TPB applied to farmers' health problems

Table 4 Beta values, t-values and p-values of attitude, subjective norm and perceived behavioural control for the prediction of intention for occupational disease

	R^2	β	t	p
DISEASE				
Machinery use	.20			
Attitude		.15	1.20	.23
Subjective norm		.39	3.10	.00
Perceived behavioral control: wagon loading		-.22	-1.89	.06
Perceived behavioral control: machinery maintenance		.00	.03	.98
Perceived behavioral control: public road visibility		.08	.65	.52
Pesticide use	.23			
Attitude		.51	4.23	.00
Subjective norm		.03	.26	.80
Perceived behavioral control		-.04	-.34	.73
NO DISEASE				
Machinery use	.30			
Attitude		.23	5.16	.00
Subjective norm		.40	9.18	.00
Perceived behavioral control: wagon loading		-.03	-.78	.43
Perceived behavioral control: machinery maintenance		-.11	-2.76	.01
Perceived behavioral control: public road visibility		.06	1.42	.16
Pesticide use	.43			
Attitude		.47	11.55	.00
Subjective norm		.30	7.38	.00
Perceived behavioral control		.05	1.25	.21

Van den Broucke & Colemont (unpublished)

Adding the influence of environmental factors



“Safety culture”

- Definitions of safety culture
 - “The way in which safety is managed in a workplace. It is the combination of beliefs, perceptions and attitudes of employees toward the safety of workers and the overall safety of the work environment. Cultivating a safety culture is a key aspect in maintaining workplace safety.”
 - “A positive safety culture is the culture of a workplace in which all the employees think of safety as an important thing and behave in a way that prioritizes their own safety as well as the safety of those around them. This includes using proper personal equipment, following the safety laws and just generally being conscious of safety and safe practices at all times.”

Safeopedia (2018)

- Characteristics of organisations with a positive safety culture
 - communications founded on mutual trust
 - shared perceptions of the importance of safety
 - confidence in the efficacy of preventive measures

3. Develop and test interventions to influence behavior



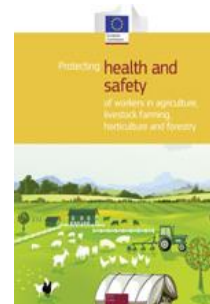
Existing campaigns and programs to prevent harm to workers in agriculture



- 'Think safety Farm safely' campaign (Ireland)
 - “Better to lose a minute in life than to lose your life in one minute.”
- 'Make the promise' campaign and Farm Safety and Health Awareness Days (UK)
- PreventAgri (Belgium)
 - comprises awareness raising, training, research and intervention
- Safety Certificates by Social Insurance Institution for Farmers (Austria)
 - award for farmers who pay attention to safety
 - subject to strict criteria
 - e.g., a general standard of health and safety practice, safe work organisation, protective equipment, tidy working area, safe vehicles, safe buildings, ...

Internet based campaigns

- Video clips of real farmers sharing real accident experience on Survivor Stories
- Farm self-assessment software
 - helps farmers carry out a risk assessment of their farms and apply good health and safety practices
 - raises the levels of health and safety awareness
 - step-by-step route into learning about what farmers need to do to protect their health and safety and to comply with the law, without being overwhelmed.
 - simplifies the process of risk assessment and is intended to help farmers



Source: Griffin, P (2013) Safety and Health in Agriculture
 "Farming - a hazardous occupation - how to improve health & safety?"

Do prevention campaigns work?



“ We hope farmers will find [the self-assessment tool] useful to help improve awareness of health and safety and so reduce the risk of costly accidents on their farms ”

- Roger Nourish, HSE's Agriculture and Food Sector

The evidence on effectiveness

Meta-analyses of effectiveness studies

- De Roo & Rautiainen (2000)
 - 25 farm safety education programs
 - Most reported positive changes following the interventions, but limitations in the design of evaluations make the results of many studies invalid
- Burke et al (2006)
 - 95 quasi-experimental studies (n=20991) on worker safety
 - Comparison between least engaging (lecture, pamphlets, videos), moderately engaging (programd instruction, feedback interventions), and most engaging (training in behavioral modeling, hands-on training)
 - ***Training involving behavioral modeling, a substantial amount of practice, and dialogue is generally more effective than other methods of safety and health training.***
- Coman (in progress)
 - 39 programs aimed at enhancing safety and health literacy among farmers
 - ***programs based on behavioral models tend to be more effective***

De Roo & Rautiainen, Am J Prev Med 18(4): 51-62
Burke et al (2006) Am J Public Health; 96(2): 315-324

Only a small number of programs are based on behavioral models

Reference	Risk	Behavior Determinant	Results/Comments	Reference	Risk	Behavior Determinant	Results/Comments
Elmore and Arcury (2001) ^[4]	Pesticide exposure	Individual's beliefs, susceptibility to risk, barriers to action	Belief to be susceptible to short-term consequences, not long-term. Perceived barriers: high work pressure and need for employment. Study limits: qualitative design, generalization to larger population.	Malenga et al. (2002) ^[4]	Farm hazards in children	Measurement of pre-contemplation, action, and maintenance stages	Action/maintenance stage: enhanced strategy = 49.5%, standard strategy = 37%, difference = 12.5%, 95% CI (3.4, 21.7); p = 0.002.
DeBarr et al. 1995 ^[6]	Youth tractor safety	Behavioral intentions (BI), attitudes (Att), subjective norms (SN), behavioral norms (BN)	Att and BI r = 0.60, SN and BI r = 0.65, BN and BI r = 0.61. R ² combined model (Att, SN) = 0.48, R ² combined model (Att, SN, BN) = 0.53.	Tangsc (2004)	Farm safety in general	Knowledge	
Lee et al. (1997) ^[4]	Farm risk exposure among children	Behavioral intentions (BI), attitudes (Att), subjective norms (SN), perceived behavioral control (PBC)	R ² combined model (Att, SN, PBC) = 0.67 to 0.79. Att (β = 0.50 to β = 0.60), SN (β = 0.24 to β = 0.26), PBC (β = 0.09 to β = 0.16). Limitation: behavior is not included.	Malenga (1995)	Sun exposure	Knowledge	Knowledge not associated with behavior (use of sun protection).
Pereira (2001) ^[6]	Respiratory protection	Behavioral intentions (BI), attitudes (Att), subjective norms (SN), perceived behavioral control (PBC)	Att and BI r = 0.42, SN and BI r = 0.37, PBC and BI r = 0.06, BI and self-reported behavior r = 0.53. R ² combined model (Att, SN, PBC) = 0.28.	Perry and Layde (2003)	Pesticide safety	Knowledge, beliefs, intentions, peer safety norms	Increased safety knowledge, intentions, and cancer risk perceptions have effect on behavior (contribution of individual determinant on behavior not given).
Kidd et al. (2003) ^[4]	Injury prevention in adolescents	Measurement of contemplation and action stages	Contemplation: F(1732) = 197.4; p < 0.0001. Action: F(1730) = 106.1; p < 0.0001. LS means post-intervention contemplation score: 3.3 for treatment and 2.3 for control. LS means post-intervention action score: 2.8 for treatment and 2 for control. Both significant at p < 0.0001. 86% of students made behavior changes towards safety.	Avory and Cogon (1994)	Personal protective equipment (PPE)	Attitude	
				Hwang et al. (2000)	PPE, machinery, safety in general	Individual's perception	
				Westaby and Le (2003)	Agricultural injuries in youth	Safety consciousness, dangerous risk taking, safety knowledge	Participating in safety activities and safety consciousness: r = 0.54, participating in safety activities and dangerous risk taking: r = 0.07.
				Murphy (1981) ^[4]		Attitudes	No effect on injury occurrence.
				Turell and McGuffing (1997)	Rinsing practices	Attitudes and perceptions	
				Mitchell et al. (2002)	Farming in general	Perception of personal risk, perceived susceptibility	

^[4] Health Belief Model.

^[6] Theory of Reasoned Action.

^[4] Theory of Planned Behavior.

^[4] Translational Model.

Van den Broucke & Colemont (2005) *Journal of Agricultural Safety and Health*, 12(3): 227–238



Sacurima COST Action

(Safety Culture and Risk Management in Agriculture)

- Understand the determinants of safety behavior in agriculture
 - Individual determinants (knowledge, attitudes, perceived risks, perceived norms, “safety literacy”)
 - Contextual/environmental determinants (safety culture)
- Produce an innovative tool to measure
 - Knowledge, attitudes, perceived risks, norms and behaviors among farmers regarding safety, health and risk management and to measure safety culture on farms
 - Safety culture
- Measure determinants of safe behavior among farmers, and use it for benchmarking national performance



Draft Survey Tool to Measure Agricultural Safety Culture and Risk behavior

- **Background information** (age, gender, type of farm, ...) (8 items)
- **Injury history** (3 items)
- **Safety practices** (falls prevention, machinery handling, pesticides and chemicals handling, animal handling) (17 items)
- **Attitudes, norms perceived behavioral control, and intentions** (35 items)
- **Safety culture in the farmer community** (5 items)
- **Obstacles to safety behavior** (tiredness, stress, workload, weather conditions, ...) (7 items)



SACURIMA Survey Tool

Part 2: Injury history

9. Have you personally been involved in an accident on the farm you working in the last 10 years?
☐ No ☐ Yes.....Accidents
10. Has anyone else been involved in an accident on the farm you work in the last 10 years?
☐ No ☐ Yes.....Accidents
11. Of all the accidents that have occurred on your farm, how severe was the most serious accident?
☐ Injury requiring 0-3 days off work ☐ Injury requiring 4 or more days off work ☐ Fatal injury

Part 3: Your safety practices

For each of the following working practices, please tick the box that best represents your view:

- | | 1
Never | 2
Rarely | 3
Some-
times | 4
Most of
the time | 5
Always |
|---|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| Falls prevention | | | | | |
| 12. I make sure the floors of my farm are always dry | ☐ | ☐ | ☐ | ☐ | ☐ |
| 13. I clean dirty floors immediately | ☐ | ☐ | ☐ | ☐ | ☐ |
| 14. I store my tools carefully | ☐ | ☐ | ☐ | ☐ | ☐ |
| 15. When I have to carry a heavy load, I check in advance for obstacles | ☐ | ☐ | ☐ | ☐ | ☐ |

Machinery handling

16. Do you work with machines on your farm? ☐ Yes ☐ No (-> go to question 21)

- | | 1
Never | 2
Rarely | 3
Some-
times | 4
Most of
the time | 5
Always |
|--|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| 17. Before I use a new machine, I read the manual carefully | ☐ | ☐ | ☐ | ☐ | ☐ |
| 18. Before using tractors and machinery I check that they are in good working order (e.g., brakes, lights, PTOs, etc.) | ☐ | ☐ | ☐ | ☐ | ☐ |
| 19. I work with machinery without a PTO or proper guarding | ☐ | ☐ | ☐ | ☐ | ☐ |
| 20. I wear safety gear when necessary (e.g., goggles, ear defenders, high-vis jacket, etc.) | ☐ | ☐ | ☐ | ☐ | ☐ |

Chemicals and pesticides handling

21. Do you work with chemicals and/or pesticides on your farm?
☐ Yes ☐ No (-> go to question 27)
- | | 1
Never | 2
Rarely | 3
Some-
times | 4
Most of
the time | 5
Always |
|---|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| 22. I read the instructions through before I start working with chemicals or pesticides | ☐ | ☐ | ☐ | ☐ | ☐ |
| 23. I store chemicals and pesticides in a separate storage room | ☐ | ☐ | ☐ | ☐ | ☐ |
| 24. I have an inventory of all pesticides on the farm | ☐ | ☐ | ☐ | ☐ | ☐ |

Part 4: Your and others' views with regard to safety behaviour

Machinery handling

40. Do you work with machines on your farm? ☐ Yes ☐ No (-> go to question 49)

- | | 1
strongly
disagree | 2 | 3
indifferent | 4
agree | 5
strongly
agree |
|---|---------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| 41. I find it important to read the manual carefully before using a machine for the first time | ☐ | ☐ | ☐ | ☐ | ☐ |
| 42. I find it dangerous to work with machinery without proper protection or guarding | ☐ | ☐ | ☐ | ☐ | ☐ |
| 43. Other farmers would disapprove if I would use machinery without proper protection or guarding | ☐ | ☐ | ☐ | ☐ | ☐ |
| 44. Most farmers check if no one is standing in the way before they drive away | ☐ | ☐ | ☐ | ☐ | ☐ |
| 45. I can decide for myself whether I take precautionary measures when working with machinery | ☐ | ☐ | ☐ | ☐ | ☐ |
| 46. Whether I maintain my machines well depends on the circumstances, not on myself | ☐ | ☐ | ☐ | ☐ | ☐ |
| 47. I intend to read the manual before using a new machine in the future | ☐ | ☐ | ☐ | ☐ | ☐ |
| 48. I intend to take precautionary measures when working with machinery in the future | ☐ | ☐ | ☐ | ☐ | ☐ |

Animal handling

49. Do you have animals on your farm? ☐ Yes ☐ No (-> go to question 59)

- | | 1
strongly
disagree | 2 | 3
indifferent | 4
agree | 5
strongly
agree |
|--|---------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| 50. I find it important not to stand behind animals | ☐ | ☐ | ☐ | ☐ | ☐ |
| 51. I find it obvious to approach aggressive animals with caution | ☐ | ☐ | ☐ | ☐ | ☐ |
| 52. It is important to look for signals of restlessness in animals | ☐ | ☐ | ☐ | ☐ | ☐ |
| 53. Other farmers do not let themselves be entrapped by an animal | ☐ | ☐ | ☐ | ☐ | ☐ |
| 54. Other farmers think that one should be extra careful with animals | ☐ | ☐ | ☐ | ☐ | ☐ |
| 55. I can decide myself whether or not I need to stand behind my animals | ☐ | ☐ | ☐ | ☐ | ☐ |
| 56. It is impossible for me to ventilate my stables | ☐ | ☐ | ☐ | ☐ | ☐ |
| 57. I intend to approach animals with caution in the future | ☐ | ☐ | ☐ | ☐ | ☐ |
| 58. I will try to keep my stables well ventilated | ☐ | ☐ | ☐ | ☐ | ☐ |



SACURIMA Survey Tool

Part 5: The safety norms in your farmer community

The following statements refer to the safety norms held by the community of farmers that you belong to or can refer to. For each of the following practices, please tick the box that best represents your view:

	1 strongly disagree	2 disagree	3 indifferent	4 agree	5 strongly agree
The farmers in my community ...					
70. Talk about safety issues	☐	☐	☐	☐	☐
71. Discusses with us how to improve safety	☐	☐	☐	☐	☐
72. Give higher priority to safety than to the on-time completion of tasks	☐	☐	☐	☐	☐
73. Invest in safety training for farmers and workers	☐	☐	☐	☐	☐
74. Use programs to improve farmer health and wellness (e.g., diet, exercise)	☐	☐	☐	☐	☐

Part 6: Obstacles to safety behavior

For each of the following issues, please indicate to what extent they may prevent you from behaving safely on your farm:

	1 no influence	2 small influence	3 some influence	4 strong influence	5 very strong influence
75. General tiredness	☐	☐	☐	☐	☐
76. Stress	☐	☐	☐	☐	☐
77. Unavailability of suitable tools or equipment	☐	☐	☐	☐	☐
78. Not enough time to prepare for the job	☐	☐	☐	☐	☐
79. Financial constraints	☐	☐	☐	☐	☐
80. Workload	☐	☐	☐	☐	☐
81. Weather conditions	☐	☐	☐	☐	☐

Survey to Measure Agricultural Safety Culture and Risk behavior

• Objective

collect comparative data on the safety practices and its main determinants among agricultural workers in the countries that participate in COST Action SACURIMA

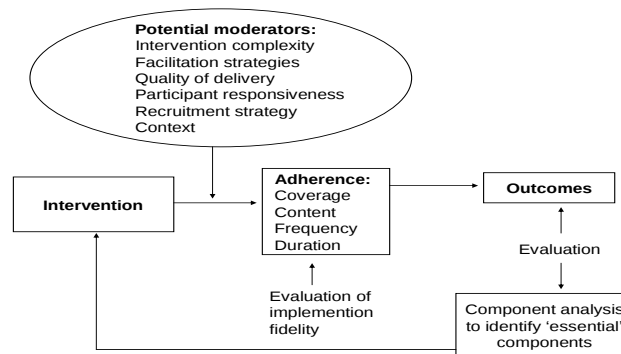
• Method

- Data collection method to be decided by each participating country
 - face-to-face interviews preferred
 - telephone-based interviews or self-report (handed out paper versions or online survey) can be considered
- Convenience sampling procedure
- Translation of the survey questionnaire in each country's language(s)
- Minimum sample size is 200 farmers per country

4. Investigate conditions for successful implementation of prevention programs

Importance of **implementation fidelity**

- Degree to which an intervention is delivered **as planned**
- Investigate potential **moderators** of the implementation



(adopted from Hasson et al., 2010, originally from Carroll et al., 2007)

Conclusions

- Farming is a hazardous and increasingly stressful occupation
- The specificity of agriculture and the risks facing farmers and their families are often missed or neglected in general health and safety
- Farm safety campaigns should be based on a sound understanding of the risk or health-damaging behavior
 - documented impact of specific behavioral factors
 - role of **determinants** of risk behavior using psychological models
- Understanding of behavioral determinants is a sound basis to develop preventive interventions
 - interventions should target the determinants of unsafe/unhealthy behavior
 - effectiveness of preventive interventions can be measured by looking at change in behavioral determinants
 - conditions for successful implementation and sustainability need to be considered
- The European COST Action SACURIMA can contribute to enhancing farm safety
 - measure determinants of unsafe behavior among farmers
 - benchmark national performance and identify priorities
 - evaluate interventions and policies to enhance safe behavior by farmers

“An ounce of prevention is worth a pound of cure”

- Benjamin Franklin



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