

Optimizing implementation of interventions in agriculture for occupational upper extremity musculoskeletal disorders: Results of an expert panel

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Abstract.

BACKGROUND: Upper extremity musculoskeletal disorders (UEMSD) is reported worldwide as the second-largest occupational musculoskeletal disorder in agriculture.

OBJECTIVE: The objective of the study is to identify facilitators and barriers for employers and workers for implementing interventions to reduce work-related risk factors associated with occupational UEMSD in the agricultural sector, according to health and safety consultants.

METHODS: An expert panel was used comprising nine health and safety consultants from the Dutch agricultural sector.

RESULTS: Facilitators and barriers for employers and workers were categorized in the following themes: knowledge, skills, attitude, culture, costs, loss of income, facilitation and employability. There were no differences in facilitators and barriers between UEMSD.

CONCLUSIONS: Facilitators and barriers for implementing preventive interventions in agriculture were on organizational level, like diversity in choice of preventive devices, and personal level such as willingness if there is no work disability.

Keywords: Risk factors, work related musculoskeletal disorders, prevention, implementation

1. Introduction

Agriculture workers show high prevalence of musculoskeletal symptoms among occupational groups, with upper extremity symptoms as the most frequently occurring of all body regions [1]. Upper-extremity musculoskeletal disorders (UEMSD) are

reported worldwide as the second-largest occupational musculoskeletal disorder in agriculture after low back pain, with 1-year prevalence among farmers ranging from 4% to 72% [2]. The most prevalent UEMSD found in agriculture literature over the last 5 years is Carpal Tunnel Syndrome (CTS) with a prevalence range of 4% to 62% [3–6]. The incidence of CTS measured among French farmers was 254 per 100.000 farmers [7]. The second most prevalent UEMSD is shoulder complaints (both specific and non-specific), which showed a large variation due to the difference in definition of shoulder disorders. The prevalence varies from 1% to 44% [8–13]. The

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Box 1

Risk factors in the worksite protocol for assessing occupational CTS, epi ML and shoulder complaints [15–23]

CTS	Epi ML	Shoulder complaints
Hand force >30 N	Hand force >40 N with forearm muscles	Movements of hands above shoulder
Repetitive movements wrist/hand/fingers >2x/min	Use of hand tools \geq 1 kg	Posture of hand behind the trunk
Exposure to vibrating hand tools	Repetitive movements elbow/wrist >2x/min	Repetitive movements of the arms >2x/min
Cold environment <13°C	Use of tools >20 kg	Postures of the hand on the other side of the trunk
Bending/twisting of the wrist >30°	Exposure to vibrating hand tools	Posture of the arm >30° outward rotation
Holding hand tools or objects in precision grip or pinch- / gripping position	Elbow flexion >90 degrees	Posture of unsupported arm for >3 min
Use of computer mouse >20 h/w	Elbow in extended position	<10 min/60 min pause by repetitive movements
<10 min/60 min pause by repetitive movements	Forearm >40 degrees pronation/supination	
	<10 min/60 min pause by repetitive movements	

prevalence of epicondylitis medialis/lateralis (epi ML) is also high and showed large variations between 3% and 40% [6, 14].

The consequences of these disorders for agricultural workers are (long-term) pain, reduced ability to work, reduced income, lower quality of life, stress and depression [2]. Due to the high numbers and severe negative effects of these UEMSD, more attention should be given to prevention. To prevent occupational UEMSD among agricultural workers, interventions should aim at reducing risk factors associated with the UEMSD in order to improve work conditions. Knowledge of risk factors is available in scientific literature for occupational CTS [15–21], epi ML [20, 22, 23] and shoulder complaints [20].

In the Dutch agricultural sector, the risk factors for occupational CTS, epi ML and shoulder complaints are evaluated at the worksite by health and safety consultants using a worksite protocol based on a guidance document [24] to assess and prevent occupational diseases. A short description of the disease specific risk factors used to assess the occupational diseases is shown in Box 1. Besides diagnosing UEMSD using disease specific risk factors, the guidance aims to assist the health and safety consultant by advising interventions to reduce risk factors. The background of most of the health and safety consultants is as an occupational health nurse with additional training in industrial hygiene or safety.

Advice of health and safety consultants to reduce UEMSDs is based on a workplace visit, but the implementation of MSD interventions remains difficult [25]. Successful implementation of these interventions in agriculture could be hampered by economic,

technical or practical reasons [26]. Furthermore, barriers for implementing MSD interventions are an over-reliance on training and not taking into account the organizational understanding of the problem and how to solve this [25]. Facilitators for implementation are improvement in communication, more training about ergonomic concerns and the availability of interventions [26]. In most interventions or preventive advices, little attention is paid to the implementation in daily practice to reduce risk factors. In this study, we question how prevention of UEMSDs could be improved by gathering more knowledge about the implementation of interventions in the agricultural sector. Therefore, the corresponding research question is: What facilitators and barriers are there for employers and workers for implementing interventions to reduce work-related risk factors associated with occupational UEMSD (CTS, epi ML and (non-) specific shoulder complaints) in agriculture, according to health and safety consultants?

2. Materials and methods

An expert panel was used as a qualitative research method aimed at identifying facilitators and barriers for employers and workers for implementing interventions to reduce work-related risk factors associated with CTS, epi ML and shoulder complaints in the Dutch agriculture. The facilitators and barriers were asked to the health and safety consultants since they can use these facilitators and barriers to inform and convince the employer and worker to implement the interventions. The coding of the expert panel was

based on a content analysis [27]. The COnsolidated criteria for REporting Qualitative research (COREQ) checklist was used to report this qualitative research [28].

2.1. Participants

All health and safety consultants who worked for the Dutch agriculture ($n = 14$) were purposefully recruited by e-mail. The health and safety consultants worked for a health and safety institute for all agricultural companies. All health and safety consultants have their own geographic region and agricultural companies throughout the Netherlands. The expert panel was part of a larger study to improve the assessment and prevention of occupational diseases. Both focus group leaders (LB, HM) were known to the health and safety consultants.

2.2. Procedure

The expert panel was guided by the first author, the second author deputized and took notes. A meeting took place with occupational physicians and health and safety consultants of the agriculture branch on 5 July 2016 in a congress center. This meeting was devoted to information exchange and discussion sessions of health topics within agriculture. The health and safety consultants were sent the questions of the expert panel one week in advance. At the start of the expert panel, the first author explained the aim. All participants were also given an information letter and asked to complete an informed consent. During the expert panel four research questions were discussed. Each question took around 15 minutes. Both authors took additional notes during the meeting which were used to provide a summary at the end of each question, to invite the health and safety consultants to add or rephrase some wordings. An audio recording of the meeting was made.

2.3. Expert panel

The four initial questions during the expert panel were:

- (1) What are facilitators for implementing preventive interventions for employers?
- (2) What are facilitators for implementing preventive interventions for workers?
- (3) What are barriers for implementing preventive interventions for employers?

- (4) What are barriers for implementing preventive interventions for workers?

The questions were displayed using a projector. These questions were used to start a discussion, followed by questions about the background and meaning of the answers.

2.4. Data analysis

The audio recording was transcribed verbatim and structured using MAXQDA 12. The transcript was not returned to the participants. The transcription was first read by the first and then the second author to independently derive all possible facilitators or barriers from the data. The identified parts were then classified as a facilitator or barrier factor for employer or worker. Consensus of the factors was reached during further meetings, including with the third author. Next, the factors were classified into thematic categories. Finally, a consensus of the factors and themes was achieved during several meetings of all three authors. The quotes were translated from Dutch to English and vice versa by two different professional translators, of a Dutch translation agency, who were native speakers of the language to which they translated.

3. Results

Characteristics of the study population are shown in Table 1. In total, nine out of 14 health and safety consultants in the Dutch agricultural sector participated in the expert panel. Five health and safety consultants were absent due to vacation or a sabbatical. The four females and five males who attended had a mean age of 52 years (range = 41–61) and a mean length of working experience in the branch organization of 17 years (range = 2–25 years). The facilitators and barriers for implementation of interventions for employers were categorized in seven themes as shown in Table 2. The facilitators and barriers for implementation of intervention for

Table 1
Characteristics of study population (sex, age and working experience)

	Health and safety consultants
Male (n)	5
Female (n)	4
Average age (years) [range]	52 [41–61]
Average no. of years' working experience in the branch organization [range]	17 [2–25]

Table 2

Employers' facilitators and barriers for implementation of preventive interventions according to health and safety consultants (quote number, see Table 4)

Themes	Facilitators (+) and barriers (–) for employers according to health and safety consultants
1. Knowledge	+ : Higher educational level / (more) education of the worker + : Worker is aware of work ability (1) + : Worker is aware of risk factors
2. Skills	+ : Ensure/maintain high professional competence of workers – : Inadequate competences and skills of employers (2)
3. Attitude	+ : Employer has open attitude to implementing preventive interventions + : Continued attention of employer for preventive interventions + : High employer-worker involvement + : Urgent need for employer to implement preventive interventions (i.e. otherwise worker would have to leave the organization) – : Incorrect assumptions of the employer regarding job changes (3) – : Employer reluctant to use technical aids – : Less attention paid by employers to temporary workers – : Lack of time of the employer – : Denial that complaints are work-related
4. Culture	+ : Employer shows understanding towards workers – : High production standard – : Hierarchical culture among workers (4)
5. Costs	+ : Perception of achieving lower costs by reducing absenteeism – : High costs for employers by workplace adjustments – : High costs for employers by job changes (5)
6. Facilitation	+ : More preventive interventions available for the employer in the sector + : Diversity in choice of preventive devices for upper extremities for the employer + : Worker has time to get used to new technical aids (6)
7. Employability	+ : Workers' employability being threatened (7)

Table 3

Workers' facilitators and barriers for implementation of preventive interventions according to health and safety consultant of workers (quote number, see Table 4)

Themes	Facilitators (+) and barriers (–) for workers according to health and safety consultants
1. Knowledge	+ : Knowledge transfer to workers on paper (8) + : Multimodal knowledge transfer to worker + : Awareness of symptoms by worker – : Little knowledge of risk factors in private life by worker – : Little knowledge of physical capacity in private life by worker
2. Skills	+ : Identifying stressful postures experienced by the worker + : Coupling identification of stressful postures experienced by the worker with 'advice on the job'(9)
3. Attitude	+ : Worker feels urgency to implement preventive actions (i.e. otherwise worker has to leave the company) – : Worker has no time to get used to new technical aids – : Employer fails to listen to workers' ideas of preventive interventions – : Little willingness of the employer if there is no work disability (10) – : Worker is not open to change – : Little willingness of the worker if there is currently no work disability.
4. Culture	– : No time to get used to new methods for worker due to high production demands. – : Worker's reluctance to use technical aids from a sense of bravado (peer pressure) (11) – : Workers who work alone not allowing themselves a break – : Absence of employer at workplace
5. Income	+ : Worker knows the financial consequence of work disability (12)
6. Facilitation	+ : Diversity in choice of preventive resources available to the employer for UEMSD (13)

workers were categorized in six themes as shown in Table 3.

3.1. Facilitators and barriers – employers

The facilitators and barriers for employers as reported by the health and safety consultants were

categorized in seven themes: knowledge, skills, attitude, culture, costs, facilitation and employability, see Table 2.

Regarding knowledge, reported facilitators for employers were: a higher education level of workers, worker is aware of work ability (quote 1, Table 4) and worker is aware of risk factors. On the theme

Table 4

Quotes of health and safety consultants in the focus group regarding facilitators and barriers for employers and workers for implementation of preventive interventions

Quotes

- (1) #5: 'We've already spent 5 years in a row on a toolbox, so that's going from in-depth to even more in-depth. For a long time it concentrated on the load or burden itself, but last year the focus on the capacity of the individual was taken into account.'
- (2) #1: 'And now you see indeed that managers are often workers who have moved up through the ranks. And they don't have the capacity or skills at all to promote this [working preventively].'
- (3) #1: 'I keep coming back to the fact that if the employer thinks 'that's bound to cost me more social insurance or contractual pay' then there's an end to it [it is already based on an assumption].'
- (4) #5: 'A sort of pecking order to put it bluntly, that one person is better than the other, so people are attached to their position. And then they don't want to rotate work at all themselves.'
- (5) #9: In the greenhouse horticulture we once had the problem that when you did task rotation, that when people got more tasks they went up into a higher salary scale.'
- (6) #9: 'What I often see is that companies that really take the time [to implement new tools] say, we'll try it out for a week first to see if it suits us.'
- (7) #1: 'It has everything to do with the employability of the staff. Once that is at stake, that's a good facilitating factor for employers, but also for managers for introducing a preventive intervention.'
- (8) #6: 'We're really getting into the digital age with all kinds of wonderful flashy and great things, but let's not forget the power of print, the piece of paper, the folder and the flyer which are really important for reaching certain groups who are particularly visually oriented.'
- (9) #5: 'Once for example I went around with a worker in the greenhouse horticulture, just 'on the job' and then you can say, 'Hey I see that you do this. Why don't you try doing it like that?'
- (10) #5: 'When you come to do a workplace visit and sick leave is already an issue, and even if it is a preventive workplace analysis where someone might go on sick leave, then I think the willingness to act is entirely different.'
- (11) #2: 'What can also be a barrier is that they don't want to use a certain [technical] aid because they think it makes them a bit of a sissy to use it.'
- (12) #7: 'What I also see as a facilitating factor is when workers have a general idea of what the consequences are, also financially, of being unable to work.'
- (13) #5: 'So the knowledge that there are quite a lot of possible solutions for the upper extremities [regarding preventive interventions] compared to the knee.'
-

of skills, health and safety consultants reported that employers are more willing to implement preventive interventions for workers with high professional competences who are at risk of work disability. A barrier for implementation was the inadequate competencies and skills of employers (quote 2, Table 4).

In relation to employer's attitude, the reported facilitators were: open attitude for implementation, continued attention for preventive interventions, high employer-worker involvement and urgent need for employer to implement preventive intervention (i.e. otherwise worker would have to leave the organization). Barriers mentioned in this theme were incorrect assumptions of the employer regarding job changes (quote 3, Table 4), not wanting to use technical aids, less attention paid by employers to temporary workers, lack of time and denial that complaints are work-related. Regarding culture, employer's understanding towards workers is reported as a facilitator for preventive actions. The barriers were a high production standard and hierarchical culture among workers (quote 4, Table 4).

In relation to costs, the facilitator for implementation reported was the perception of achieving lower costs by reducing absenteeism. The barriers mentioned were: high costs for employers to implement

workplace adjustments and job changes (quote 5, Table 4).

On the theme of facilitation, there were three facilitators, 1) availability of preventive interventions for the employer in the sector, 2) diversity in choice of preventive devices for upper extremities for the employers and 3) time for the worker to get used to new technical aids (quote 6, Table 4).

Regarding the theme of employability, workers' employability being threatened was reported as a facilitator for implementation (quote 7, Table 4).

3.2. *Facilitators and barriers – workers*

The facilitators and barriers for workers as reported by the health and safety consultants were categorized in six main themes: knowledge, skills, attitude, culture, income, facilitation, see Table 3. Regarding the theme of knowledge, the facilitators mentioned were: knowledge transfer for workers on paper (quote 8, Table 4), multimodal knowledge transfer for workers (i.e. listening, writing and giving each other tips) and awareness of symptoms. The barriers were: little knowledge of risk factors and little knowledge of physical capacity in private life by the worker.

On the theme of skills, the two facilitators were identifying stressful postures experienced by workers and coupling this with ‘advice on the job’ (quote 9, Table 4).

Regarding the attitude of the worker there was one facilitator and five barriers. The reported facilitator was that the worker feels urgency to implement preventive actions (i.e. otherwise worker has to leave the company). The reported barriers for implementation were: worker has no time to get used to new technical aids, employer fails to listen to workers’ ideas of preventive interventions, little willingness of the employer and worker if there is currently no work disability (quote 10, Table 4) and worker is not open to change.

On the theme of culture, four barriers were reported and no facilitators. The barriers were: no time to get used to new methods for the worker due to high production standards, worker’s reluctance to use technical aids from a sense of bravado (peer pressure, quote 11, Table 4), workers who work alone not allowing themselves a break and absence of employer at workplace.

Regarding income: it was mentioned as a facilitator when workers knew the financial consequences of work disability (quote 12, Table 4). Regarding facilitation, it is a facilitator for the worker when there is diversity in choice of preventive resources available to the employer for UEMSD (quote 13, Table 4).

4. Discussion

4.1. *Main findings*

Important facilitators and barriers for implementation of preventive interventions for employers and workers according to health and safety consultants were found in the theme of attitude. An open attitude and continued attention to preventive interventions enhance the opportunity for implementation of preventive interventions for UEMSD. Incorrect assumption of the employer regarding job changes and little willingness by the employer if there is no work disability are two important barriers regarding attitude which reduce the chance of preventive interventions being implemented. Other reported factors were in the theme of knowledge, of which (little) knowledge/awareness of risk factors and physical capacity are named as facilitator and barrier. Factors in the theme of skills are important to minimize work-related risk factors by removing the barrier

of inadequate competences and skills of employers and support the facilitator of addressing stressful posture experienced by the workers with ‘advice on the job’. On the theme of culture there were mainly barriers, and for facilitation, only facilitators for implementation were reported by the health and safety consultants. Another finding is that there were no differences reported in facilitators and barriers between CTS, epi ML and shoulder complaints according to the health and safety consultants.

4.2. *Comparison with other studies*

To optimize the implementation of preventive measures, it is important that tools for risk management promote the participation of workers [29]. The participation of workers can be improved through intervening in the barriers of attitude reported in the expert panel, i.e.: worker is not open to change and little willingness of the worker if there is no work disability. The participation of workers also seems important in improving sustainable employability, since a passive attitude was considered as a barrier for sustainable employability in the construction industry [30]. Another important factor for implementing preventive measures for the employer is the acquisition of more knowledge about the risk factors, since the employer plays an important role in generating these risk factors [29]. This is in line with the barrier reported in the focus group, inadequate competences and skills of employers. The competences and skills of the employer could be improved, because with more knowledge of work-related risk factors it can be expected that the employer will get more insight into which interventions should be implemented.

A positive organizational climate and participatory ergonomics training improved the implementation of new working methods in the floor-laying trade [31]. This focus group promotes observing and addressing stressful postures experienced by the worker with ‘advice on the job’ which is also a participatory ergonomics training that supports the implementation of interventions. Within the process of implementing effective ergonomic intervention in agriculture, the whole team, but especially the worker, is important to implement preventive interventions [26].

4.3. *Methodological considerations*

A methodological consideration of the study is that facilitators and barriers for employers and workers are reported by the health and safety consultants

instead of by the employers and workers themselves. Due to the large experience of health and safety consultants in agriculture, the result gives a good overview of the facilitators and barriers in this sector. However, no information about facilitators and barriers from individual companies was retrieved.

4.4. Implications for practice and research

Interviews with employers and workers can highlight facilitators and barriers from individual companies and these could increase insight in reported facilitators and barriers reported by the health and safety consultants. Future research could examine to what extent facilitators and barriers for implementation, as reported by the health and safety consultant, also apply to employers and workers. According to the health and safety consultants there were no differences in facilitators and barriers between interventions aimed to reduce risk factors for CTS, epi ML and shoulder complaints. Therefore, it is expected that these facilitators and barriers could also be helpful for the implementation of interventions in other MSDs and economic sectors outside agriculture.

For optimizing risk management there could be a more active participation of workers, supervisors and occupational health and safety personnel [29]. The collaboration between occupational health and safety personnel, workers and supervisors could help to improve the implementation of interventions [29]. However, in many agricultural companies there is no occupational health personnel or service. Therefore, the health and safety consultants could facilitate training and technical assistance in these companies to support the implementation process.

The reported facilitators and barriers can give health and safety consultants insight to optimize their knowledge of prevention strategies. In this way, the branch organization can improve the quality of their advice and their training and technical assistance for a better implementation of interventions for UEMSD in agriculture. Advice and training of the health and safety consultants should pay attention to multiple factors for employer and worker to support the implementation of interventions, of which knowledge, attitude and culture seem promising factors due to the diversity in reported facilitators and barriers. In conclusion, facilitators and barriers for employers and workers for implementing interventions to reduce work-related risk factors associated with CTS,

epi ML and specific and non-specific shoulder complaints in agriculture according to health and safety consultants were mainly on an organizational and personal level for the employer and worker and covered the themes of: knowledge, skills, attitude, culture, costs, income, facilitation and employability.

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Conflict of interest

There are no conflicts of interests to disclose.

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