

## **ACTION-ORIENTED USE OF ERGONOMIC CHECKPOINTS FOR HEALTHY WORK DESIGN IN DIFFERENT SETTINGS**

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Recent experiences in the action-oriented use of ergonomic checkpoints in different work settings are reviewed. The purpose is to know what features are useful for healthy work design adjusted to each local situation. Based on the review results, common features of ergonomic checkpoints used in participatory training programs for improving workplace conditions in small enterprises, construction sites, home work and agriculture in industrially developing countries in Asia are discussed. These checkpoints generally compile practical improvement options in a broad range of technical areas, such as materials handling, workstation design, physical environment and work organization. Usually, "action checklists" comprising the tiles of the checkpoints are used together. A clear focus is placed on readily applicable low-cost options. Three common features of these various checkpoints appear to be important. First, the checkpoints represent typical good practices in multiple areas. Second, each how-to section of these checkpoints presents simple improvements reflecting basic ergonomic principles. Examples of these principles include easy reach, fewer and faster transport, elbow-level work, coded displays, isolated or screened hazards and shared teamwork. Third, the illustrated checkpoints accompanied by corresponding checklists are used as group work tools in short-term training courses. Many practical improvements achieved are displayed in websites for inter-country work improvement networks. It is suggested to promote the use of locally adjusted checkpoints in various forms of participatory action-oriented training in small-scale workplaces and in agriculture particularly in industrially developing countries.

**Key words:** ergonomic checkpoints; workplace improvements; checklists; action-oriented training; industrially developing countries.

### INTRODUCTION

As a means of improving workplace conditions from ergonomic points of view, ergonomic checkpoints compiling practical hints for work redesign are increasingly used. These checkpoints are found useful in assessing and reducing ergonomics-related risks in different work settings (ILO, 1996; Kawakami and Kogi, 2001). It is reported that the presentation of readily applicable hints for immediate improvements is particularly useful (Shahnavaz, 2000; Kogi, 2002). Different sets of ergonomic checkpoints are used for ergonomics application in small enterprises, construction sites, computer workstations, agriculture and various other workplaces (Itani et al., 2006; Kogi, 2006).

Recent experiences in the action-oriented use of ergonomic checkpoints in these different work settings are reviewed. The purpose is to know what features of the checkpoints are useful for improving workplace conditions effectively in various settings. The results are discussed by referring to the merits of various participatory approaches in ergonomics application (Vink et al., 1995; Kogi, 1998; Eklund, 2000; Zalk, 2001; Hägg, 2003; Koningsveld, 2005; Khai et al., 2005).

A particular attention is drawn to the work redesign adjusted to local situations. While many similar checkpoints are compiled in different settings, their effective use depends much on the way

the relevant hints are presented and transformed to immediate actions suitable for each local situation. In this paper, the common features of the checkpoints in this regard are discussed in relation to (a) action-oriented approaches taken, (b) types of ergonomic improvements compiled and (c) participatory steps using the checkpoints for immediate implementation. These features may be taken into account in developing similarly practical ergonomic checkpoints for various settings.

## MATERIALS

Experiences in applying ergonomic checkpoints developed for training programs for improving workplace conditions in small-scale workplaces through serial participatory steps in industrially developing countries in Asia are reviewed. These programs commonly apply participatory methods that have led to numerous improvements.

The types of ergonomic checkpoints used in these programs are listed in Table 1. Most of them are based on Work Improvement in Small Enterprises (WISE) methodology developed by the International Labour Office (Thurman et al., 1988; Batino, 1997; Hiba, 1998; ILO, 2004). They are the most typically compiled in the Ergonomic Checkpoints edited by the International Ergonomics Association (IEA) and the ILO (ILO, 1996). Serial manuals consisting of checkpoints have appeared using similar participatory training methods. Examples include checkpoints used in Work Improvement in Neighbourhood Development (WIND) training, training in small construction sites (Kawakami et al., 2003; Khai et al., 2005), Work Improvement for Safe Home (WISH) training and various other ergonomics-related training activities (Kawakami et al., 2004; Kawakami and Kogi, 2005; NIOSH, 2005). Other examples include a mental health action checklist for reducing mental

Table 1. Ergonomic checkpoints compiled for use in different work settings.

Types of checkpoints	Main target workplaces	References
- WISE manual for a better place to work	Small and medium-sized enterprises	Thurman et al., 1988; ILO, 2004
- IEA/ILO Ergonomic checkpoints	Small industrial workplaces	ILO, 1996
- WIND training in agriculture	Small-scale farms	Kawakami et al., 2003
- Training in construction	Small construction sites	ILO et al., 2004
- WISH training for home work	Home-based workplaces	Kawakami and Kogi, 2005
- Practical hints for workplaces	Workplaces in a developing country	NIOSH (Malaysia), 2005
- Mental health action checklist	Stressful workplaces	Kogi et al., 2004
- ISO/TS 20646	Workplaces with muscle load	Itani et al., 2006
- Workplace checklists	Various workplaces	Khai et al., 2005

stress at work and ISO/TS 20646 for reducing muscle load (Kogi et al., 2004; Itani et al., 2006).

The processes of developing these ergonomic checkpoints are examined by examining the common features of the checkpoints that are effectively applied in these different settings. Attention is drawn to the link between the checkpoints and good practices in multiple areas, the focus on basic ergonomic principles applicable at low cost and the use of the checkpoints as group work tools.

## RESULTS AND DISCUSSION

The development of the reviewed checkpoints has been closely related to the participatory action-oriented training for small-scale workplaces particularly in industrially developing countries. The application of ergonomics within training methods for these workplaces has been emphasized especially since the International Symposium on Ergonomics in Developing Countries held in Jakarta

in 1985 (ILO, 1985). WISE training activities subsequently undertaken in a number of countries in Asia and other developing regions have led to the publications of “Higher Productivity and a Better Place to Work” (Thurman et al., 1988) and “Ergonomic Checkpoints” (ILO, 1996). WISE and related participatory training programs have stimulated the development and use of similarly compiled checkpoints for agriculture, construction sites, home workplaces and various other training programs (Kawakami et al., 2005; Khai et al., 2005). A more recent development is the use of selected checkpoints for reducing muscular load or work stress (Kogi, 2004; Itani et al., 2006). The close relation between participatory programs and these checkpoints is noteworthy.

The checkpoints reviewed generally compile practical improvement options in a broad range of technical areas, such as materials handling, workstation design, physical environment and work organization. This is obviously associated with the broad workplace problems. Prevalent problems relate to injury risks, heavy materials handling, repetitive work operations, constrained postures, environmental effects as well as stressful work organization and poor communication.

It is of particular interest that the checkpoints as well as the checklists used as a participatory tool used together with them usually cover a broad range of problem areas. The reviewed checkpoints incorporated in these checklists have common structures as indicated in Table 2.

Table 2. Common structures of the checkpoints incorporated in the checklists of the typical participatory programs.

WISE checklist (44 items)	WIND checklist (42 items)	Construction site checklist (45 items)	ISO/TS 20646 checklist (25 items)
For small enterprises	For farmers	For small sites	For muscular load
Materials handling (8) Machine safety (6) Workstations (8) Lighting (5) Control of hazard sources (6) Premises (4) Welfare facilities (4) Work organization (3)	Materials handling (8) Workstations (7) Machine safety (5) Work environment and control of hazards (9) Welfare facilities (8) Work organization (5)	Materials handling (7) Work at height (7) Work postures (5) Machine safety (5) Physical environment (7) Welfare facilities (5) Emergency preparedness (3) Work organization (3) Safety organization (3)	Handling work (6) Workstations (9) Work organization (2) Heat and lighting (2) Design process (1) Resting facilities (1) Work time (2)

Two distinct aspects in this broad coverage of technical areas by each set of checkpoints may be mentioned. First, each set comprises practical improvement actions confirmed through good practices in small-scale workplaces. Since these local good practices are aimed at reducing safety and health risks in multiple problem areas, the checkpoints necessarily include improvement actions in these multiple areas. This explains why the main technical areas covered by the different checklists shown in Table 2 are strikingly similar. Second, a clear focus common to all the reviewed checkpoints is on simple, low-cost improvements applicable in small-scale workplaces. This focus is obviously related to the practical nature of the good practices referred to. It is important that many low-cost solutions exist in all the areas covered and in all the small-scale sectors.

Three common features of these various checkpoints appear to be important. The first important feature is that the design process of ergonomic checkpoints is based on good practices. This is consistent with the participatory training steps as in the case of WISE programs. The typical design steps relying on local good practices are shown in Figure 1 in relation to corresponding WISE steps. Both kinds of these steps reflect on-going good practices and guide people to follow them.

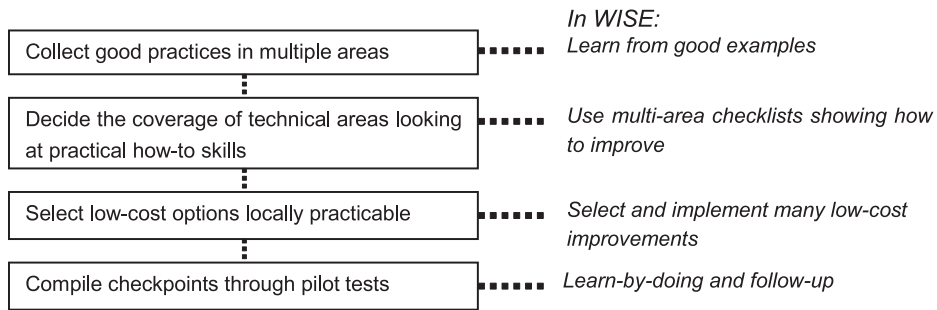


Fig. 1. Design steps of ergonomic checkpoints based on good practices and corresponding WISE training steps.

The composition of each checkpoint thus compiled has a common, unique format. Usually, each checkpoint is presented in about one printed page, describing the targeted action. In the page, easy-to-understand information is given about why this action is beneficial and how it is implemented. In the “how” section, practicable low-cost options are presented with some supplementary hints. Usually, this one-page information is followed by a few illustrations showing real improvements.

An abbreviated example of a checkpoint page is shown in Figure 2. Here, for the improvement action of adjusting work at elbow height, WHY, HOW and SOME MORE HINTS are described. The HOW part gives practicable options. The attached illustrations give low-cost examples of these options.

The titles of these checkpoints correspond to improvement actions and they can be directly used in “action checklists” listing selected improvement actions for each work setting. This makes it easy to formulate checklists used in different settings.

The second common feature of the reviewed checkpoints is that their how-to sections present ways of making simple improvements reflecting basic ergonomic principles. This helps users make immediate improvements that have real impacts. Typical such principles are listed in Table 3.


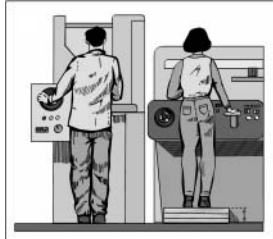
<p>&lt;Adjust work height at elbow level&gt;</p> <p><u>WHY</u> Most work operations are efficiently done around elbow level. Too high work surface leads to painful shoulders and arms, and too low work surface causes low back pains.</p> <p><u>HOW</u></p> <ul style="list-style-type: none"> <li>- Use adjustable tables.</li> <li>- Use foot platforms for smaller workers and work-item stands for tall workers.</li> <li>- Use a tilting work stand.</li> </ul> <p><u>SOME MORE HINTS</u> The same work table may be used for both standing and sitting workers with the help of foot rests or fixtures.</p> <p><u>POINTS TO REMEMBER</u> Apply the elbow rule for reducing upper limb and low back disorders</p>	 <p>Fig. 1. Work operations are best performed around elbow level.</p>  <p>Fig. 2. Use foot platforms for smaller workers.</p>
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Fig. 2. A checkpoint describing low-cost options based on good practices.

Table 3. Basic ergonomic principles incorporated in the reviewed checkpoints in the six main technical areas.

Technical areas	Basic ergonomic principles in checkpoints	Examples of low-cost actions
Materials handling	<ul style="list-style-type: none"> <li>- Organized storage</li> <li>- Use of mobile devices for transport</li> <li>- Use of mechanical lifting devices</li> </ul>	<ul style="list-style-type: none"> <li>Multi-shelves, home for each tool</li> <li>Carts and hand-trucks, mobile racks</li> <li>Lifters, rollers and conveyors</li> </ul>
Workstation design	<ul style="list-style-type: none"> <li>- Easy reach to materials, tools and controls</li> <li>- Elbow-height work</li> <li>- Use of fixtures with both hands free</li> <li>- Easy-to-distinguish displays and controls</li> </ul>	<ul style="list-style-type: none"> <li>Containers and racks in easy reach</li> <li>Adjustable tables, platforms/stands</li> <li>Jigs, fixtures, suspended tools</li> <li>Easy-to-read labels, colour codes</li> </ul>
Machine safety	<ul style="list-style-type: none"> <li>- Proper guards and safety devices</li> <li>- Feeding/ejection with no hands in danger</li> </ul>	<ul style="list-style-type: none"> <li>Guards at moving parts, interlocking</li> <li>Feeding devices, two-hand controls</li> </ul>
Physical environment	<ul style="list-style-type: none"> <li>- Combined use of day light and lamps</li> <li>- Thermal comfort with proper ventilation</li> <li>- Isolation or screening of hazard sources</li> <li>- Personal protection conducive to workers</li> </ul>	<ul style="list-style-type: none"> <li>Skylights, general and local lights,</li> <li>Heat barriers, push-pull ventilation</li> <li>Isolating noise, dust, hazard sources</li> <li>Well-fit equipment in designated sites</li> </ul>
Welfare facilities	<ul style="list-style-type: none"> <li>- Hygienic drinking and sanitary facilities</li> <li>- Refreshing resting facilities</li> </ul>	<ul style="list-style-type: none"> <li>Drinking water, toilets, wash facilities</li> <li>Resting corners, changing rooms</li> </ul>
Work organization	<ul style="list-style-type: none"> <li>- Self-paced, autonomous teamwork</li> </ul>	<ul style="list-style-type: none"> <li>Buffer stocks, teamwork, job rotation</li> </ul>

It is important these basic principles cover multiple technical areas indicated. Examples of these principles include fewer and faster handling of materials, easy reach and elbow-level work, coded displays, isolated or screened hazards and shared teamwork.

The third common feature of the checkpoints is that they are used directly as part of action-oriented training tools. In the reviewed programs, checklists presenting typical low-cost options among the compiled checkpoints as well as manuals describing the details of benefits and how-to information of the checkpoints are used together with information on good examples locally achieved. As the action checklists present the available options in the action form, such as “use push-arts and mobile racks”, they can facilitate the users’ attention to prompt action with a clear focus on practical improvements. Usually, as a set of group work tools, an action checklist, a manual comprising checkpoints and local good examples are used in a combined manner. The users are thus guided to apply basic ergonomic principles in the form of low-cost improvements learned through local good practices.

This combined use of group work tools referring to the compiled checkpoints can effectively support the planning and implementation of priority improvements by local people in each work setting. Checklist results can lead to proposals of practicable options similar to local good practices. Through subsequent group work making full use of information in the checkpoints manual and good examples, people can agree on priority options reflecting ergonomic principles. It should be noted that this participatory process is encouraged by trainers experienced in the use of these tools.

These common features of the checkpoints and the practical nature of their use as group work tools may explain the reasons why they are effective in encouraging locally adjusted implementation of appropriate improvements. Three main reasons are summarized in Figure 3. These are the close link between the checklists and local good practices, the application of appropriate options with the help of the checkpoints and the follow-up and encouragement by trainers trained in the use of the tools. The steps taken in applying the group work tools correspond to the Plan-Do-Check-Act cycle of risk management. We may suggest that the group work steps using these tools represent a small PDCA cycle concentrating on the application of basic ergonomic principles.

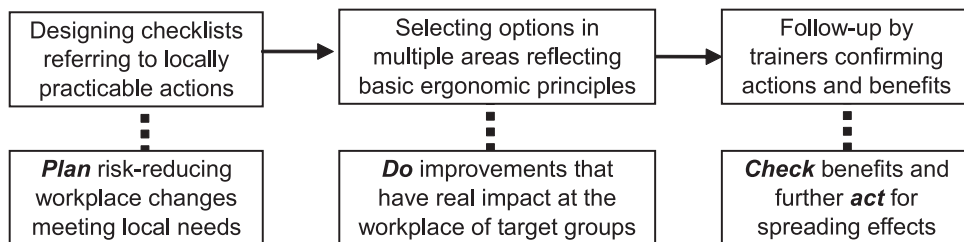


Fig. 3. Reasons for the effectiveness of the checkpoints in encouraging participatory steps for applying ergonomic principles. The steps represent the Plan-Do-Check-Act cycle of workplace risk reduction.

The group work tools are utilized in short-term training courses that have led to numerous improvements in all the work settings. Many such improvements are displayed in websites for inter-country work improvement networks, including many achieved in Southeast Asia. It is encouraging that websites showing low-cost improvements achieved in occupational safety and health programs in industrially developing countries are increasing (such as <http://www.win-asia.org/>; <http://www.wingtoshc.org/>; <http://agri-osh.org/english/>). These good examples are now used as part of training tools in each target group. The discussed features of the tools are found useful for spreading the effective use of ergonomic checkpoints in the locally adjusted manner in different countries..

## CONCLUSIONS

The effective use of ergonomic checkpoints in different work settings is facilitated by compiling ergonomic checkpoints describing practicable improvement actions based on local good practices. It is found helpful to mention the benefits of each particular action and locally available options that reflect basic ergonomic principles. The checkpoints can be used directly as action-oriented training tools in combination with action checklists listing typical low-cost options and information materials showing local good practices. It is suggested to promote the use of locally adjusted checkpoints in various forms of participatory action-oriented training particularly in small-scale workplaces and in agriculture in industrially developing countries.

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