

Ergonomics Research Techniques

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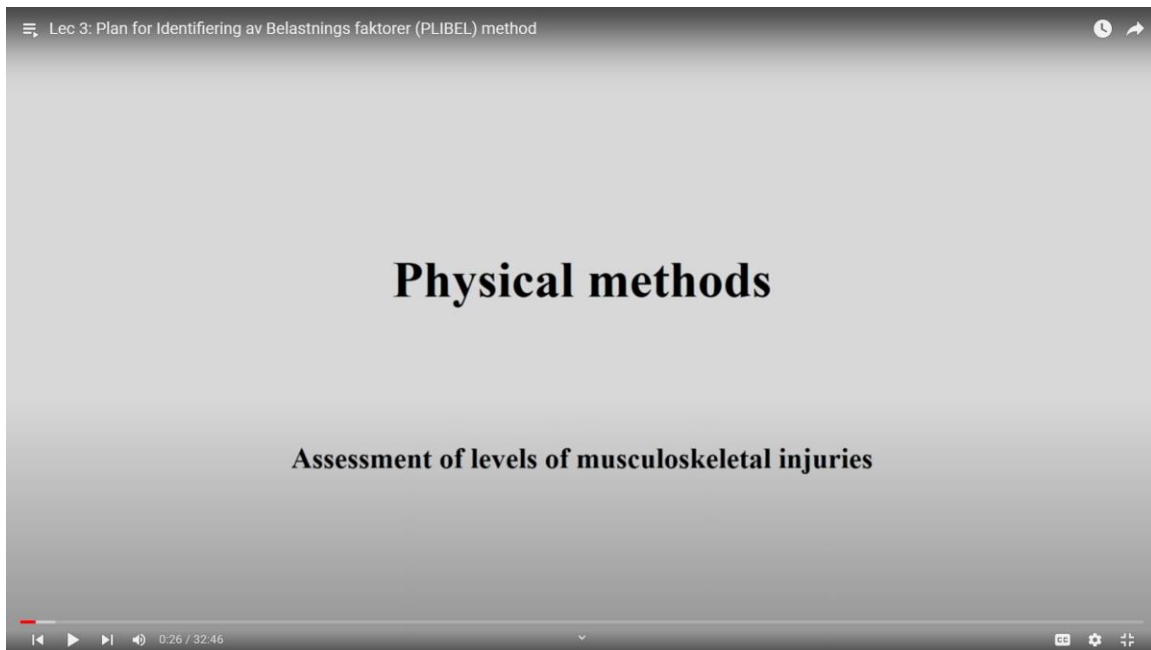
Department of Design

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Week – 01

Lecture - 03

Lec 3: Plan for Identifying av Belastnings faktorer (PLIBEL) method



Welcome back. Today, under the physical method, we will be talking about the assessment of levels of musculoskeletal injuries or the probabilities and how we assess them. So, in this particular section, what we will do will majorly understand the injuries, and we will try to understand through a checklist how we assess them.

Lec 3: Plan for Identifiering av Belastnings faktorer (PLIBEL) method

- Methods can be used to assess levels of musculoskeletal discomfort among workers-

Assessment of levels of musculoskeletal injuries

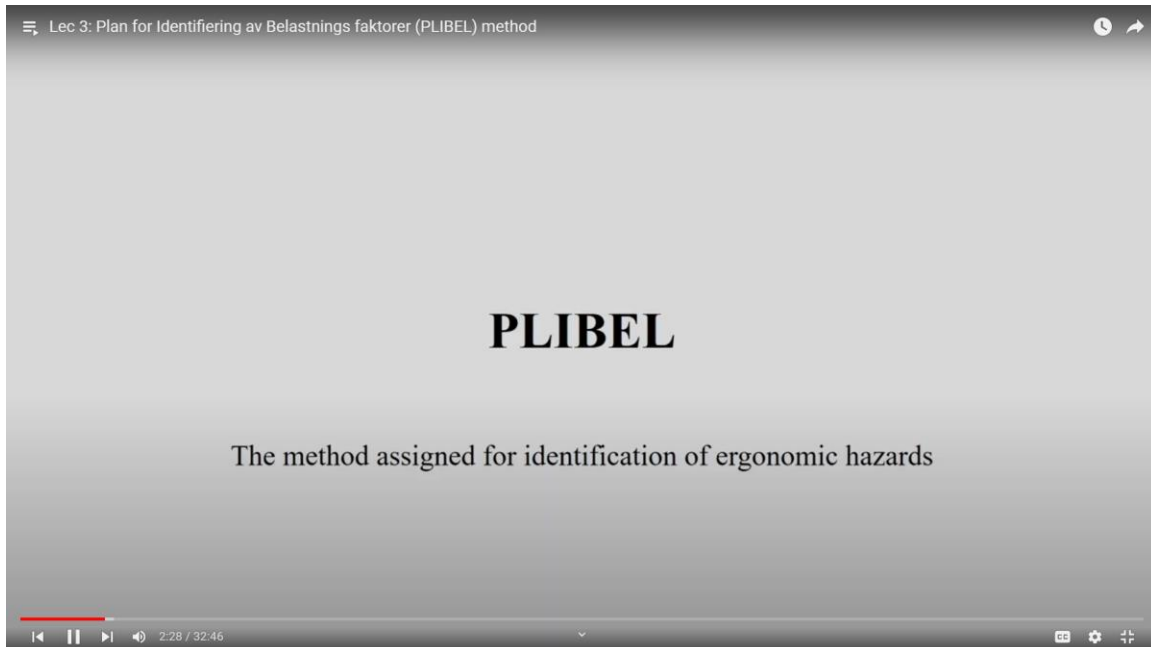
- PLIBEL
- NIOSH Discomfort Survey
- Dutch Musculoskeletal Survey (DMS)

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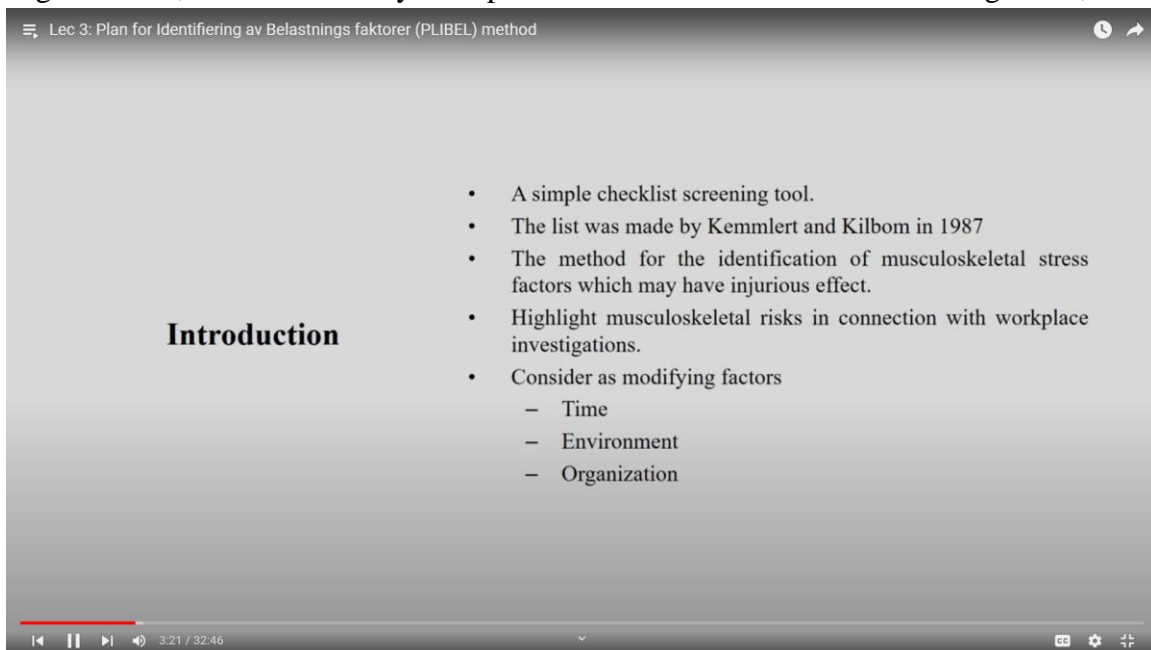
So, let us know that what are the tools we are going to learn over here. So, methods that can be used to assess the levels of musculoskeletal discomfort among the workers will try to understand that. So, from here, we will be able to get an idea of the kind of body parts and the varieties of body parts right now that have any kind of musculoskeletal discomfort that may lead to musculoskeletal disorders.

So, we will be talking about it mainly. So, there are varieties of tools. However, we will be using those tools that are commonly used. So, we will be talking about pliable, very, very easy, very old tools that are commonly used. It is a kind of checklist, ok?

So, we will understand that. We will talk about the NIOSH discomfort survey. So, it is again a very popular tool, and the Dutch Musculoskeletal Survey DMS is okay. So, in today's class, we will initially be discussing the PLIBEL technique. So, let us begin with PLIBEL.



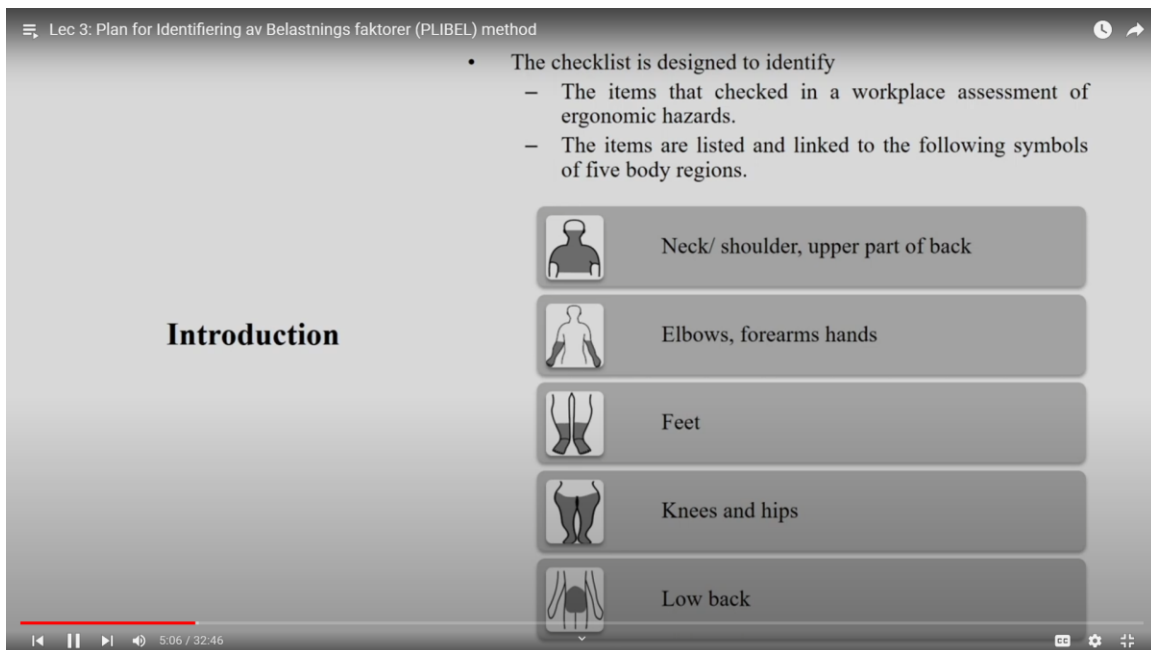
So, this particular method is assigned for identification of the ergonomics hazard and we will, from this particular checklist we will, try to understand if your infected body region is something like, you know, maybe shoulder or maybe neck or maybe lower back or leg somewhere what are the varieties of probable reasons are there and then it will help us to get a direction that to identify what are the causal factors of it. So, it is a very initial tool, an initial method which we will implement at the very beginning of our study. So, let us begin. So, it is a very simple checklist. It is a screening tool, ok.



So, it is a screening tool. You will not get any kind of indexing over here. Only through screening will you understand the varieties of body parts that are having problems and the probable causal factors associated with them in the workplace or workstation. So, the list

made this is a checklist. So, if this particular list is made by, you know, in 1987, of course, this particular group of people like, you know, Kemlert and Kilbohm are continuously working on this field, and there a lot of further developments also happened.

So, the method for the identification of musculoskeletal stress factors that may have injurious effects that we will try to get from this particular checklist. This will further highlight the musculoskeletal risks in connection with workplace investigation. So, as I mentioned, we will also get an idea what are the causal issues available in that particular region. So, we will be considering the modifying factor, that is the time, environment, and organization. So, these are the modifying factors that will be there which we will take into consideration.



Lec 3: Plan for Identifiering av Belastnings faktorer (PLIBEL) method

- The checklist is designed to identify
 - The items that checked in a workplace assessment of ergonomic hazards.
 - The items are listed and linked to the following symbols of five body regions.

Introduction

- Neck/ shoulder, upper part of back
- Elbows, forearms hands
- Feet
- Knees and hips
- Low back

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So, if we look at it, we will definitely show you the total checklist. So, here I would like to mention these are the five body parts: neck, shoulder, upper back, and upper part of your back. So, this whole region, neck, shoulder, and upper from back side upper part of your back is one region; elbows, the forearm of both hands is one another region, both feet another region, knees, and hips. So, that is another part. So, the lower, upper, and lower back will have another region.

So, these things are directly taken from the actual tool. So, the items that are checked in the workplace assessment of ergonomics hazards are the body regions that we are going to check through this particular tool. So, let us know a little more about this particular technique or particular tool. So, the list of items consists of questions concerning awkward posture and tiresome work movement, so if something is happening, it is very tiring.

Lec 3: Plan for Identifying av Belastnings faktorer (PLIBEL) method

Introduction

- The list of items consist of questions concerning the awkward postures, tiresome work movements, poor design of tool or workplace and stressful environmental or organizational conditions.
- To use the PLIBEL, the injured body region are located at first.
- After that, the white fields on the left side table of the form are checked according to the question and the injured body region of the individual worker.
- When a question is irrelevant to a certain body region, and/ or if documentation has not been found in literature
 - Represented by a gray field in the checklist
 - Need not to be answered.

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So, we will come to know about that as well, poor design of tools or workplace and stressful environment or organizational conditions. To use this PLIBEL technique, the injured body regions need to be located first. So, you have to have a body map from where we need to understand the injured area or discomfort of the person and where the person is finding discomfort. So, after that, the white field. So, we will show you the checklist, and then you will understand what that white field is.

The white field on the left-hand side of the table of the form is checked according to the questions and injured body region of the individual worker that I am going to show you in the actual checklist. So, when a question is irrelevant to a certain body region and if documentation has not been found in the literature, then represented by a gray area or gray field in this particular checklist, you will see the checklist that only you can understand, and you need not answer for that particular gray area. So, on the whole checklist, there are some white areas and some gray areas. So, for gray areas already, it has already been evaluated that those need not be answered. Only the white portion needs to be answered. So, I will show you the checklist.

Lec 3: Plan for Identifiering av Belastnings faktorer (PLIBEL) method

Introduction

- A workplace assessment using the PLIBEL starts with a preliminary observation and introductory interview with the employee.
- The tasks that are conducted for most of the working hours, are chosen for this assessment.
- Also the tasks that the worker and/ or observer looks upon as particularly stressful to the musculoskeletal system are assessed.
- Thus several PLIBEL forms may have to be filled in for each employee.

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So, workplace assessment using the pliable starts with a preliminary observation and introductory interview with the employee. So, it is not that you go and start taking the observation. First, you have to interact with the employee. So here I will give you one more. I already discussed it in some other classes that whenever we are taking you know feedback, questionnaire, or some you know relevant information from the operator, you have to keep that in mind you have to have their consent to do or to conduct this study that is the ethical requirement. So, every institution will normally have their ethical board institutional ethical board before you start any kind of human study even if it is questionnaire even it is not an invasive procedure you still need to declare what you are going to do with that information and how you are going to use it for your academic and research purpose.

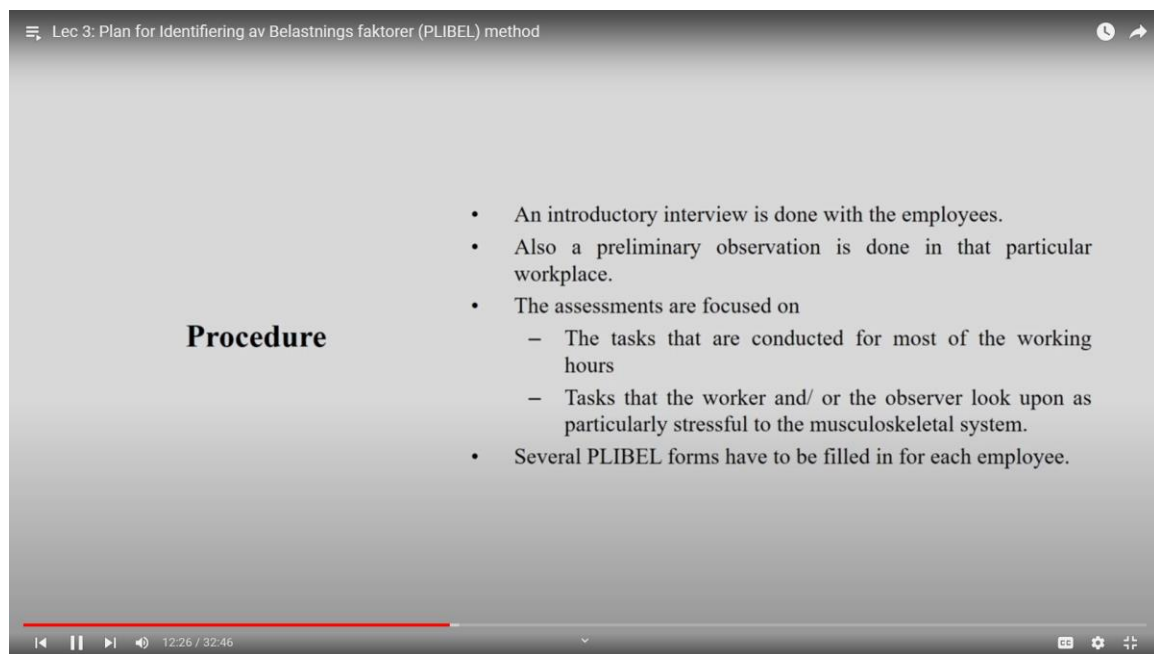
Individual information should not be public, which you also need to declare. Once you write that declaration form then you should get consent from the participant that is the procedure you should follow. So, in this case also, before you start the experiment, you should get the signed informed consent from each participant. So the tasks that are conducted for most of the working hours suppose they are working from starting from 8 o'clock in the morning. So okay, and they are, you know, finishing it maybe in the afternoon.

So, during these 8 hours, you have to study. So, based on the study objective, you will decide when and how you are going to collect the information and collect the data. The task that the worker and the observer look upon is particularly stressful to the musculoskeletal system that you are going to assess. So here, the opinions of the stakeholders are very, very important. Here, the stakeholders are the operators or the

workers who are working in that particular situation.

So, stakeholder's information and input are very important in this particular technique. Thus, several pliable forms you need to fill for each employee. So typically, for an employee, there are five tasks or seven tasks or seven jobs, which is difficult, and they reported yes, this is this. Then, you have to have 5 or 6, depending on the number of indications you have to complete for that single individual worker. So, there will definitely be 10 employees, and each employee must indicate that some employees have 5 jobs, some employees have 4 jobs, or maybe 1 or 2, okay?

So for each, depending on their input and the stakeholder's information, you have to fill out individual pliable forms. You cannot mix them if it is not required. It is not possible, and it will hamper your data collection. So, depending on the employee and the job that is being identified, you have to fill out the pliable form for that particular worker. So, this is very important to mention and follow during data collection. Also, we can say this is an introductory interview that needs to be done with the employees because if the employee or the operator does not understand what is the requirements of this PLIBEL checklist, they will not be able to contribute.



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Procedure

- An introductory interview is done with the employees.
- Also a preliminary observation is done in that particular workplace.
- The assessments are focused on
 - The tasks that are conducted for most of the working hours
 - Tasks that the worker and/ or the observer look upon as particularly stressful to the musculoskeletal system.
- Several PLIBEL forms have to be filled in for each employee.

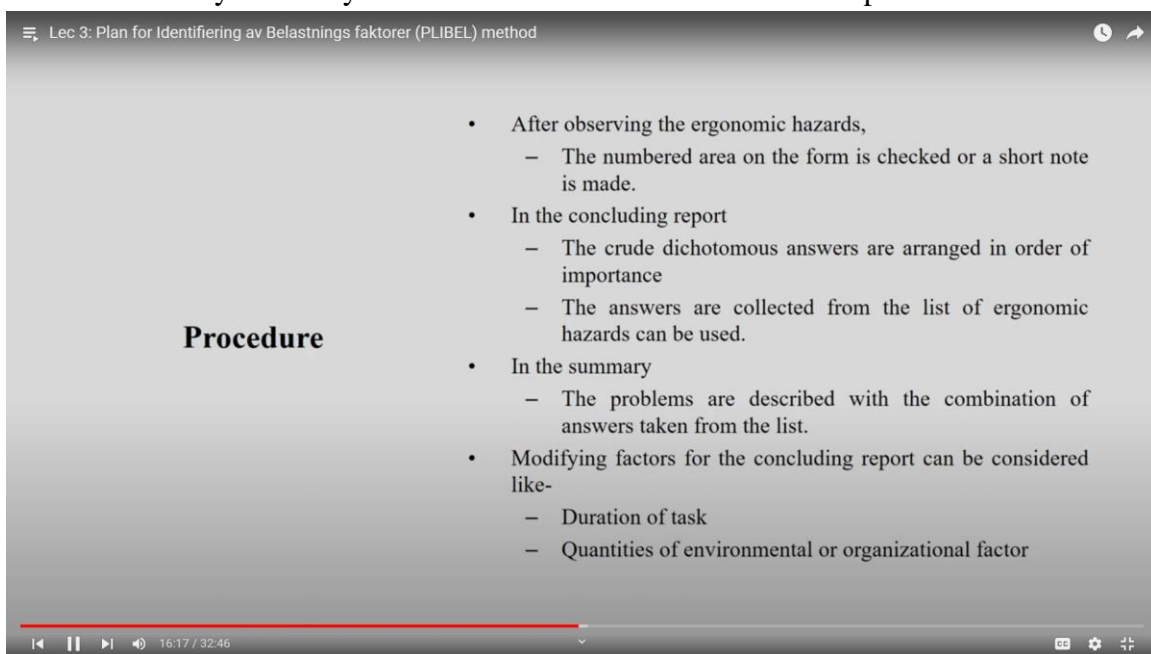
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So, an initial interview needs to be done to understand that what are the major exposed body parts. The preliminary observation needs to be done in that particular workplace. It is not that you come back to another place and take the interview. It is always suggested that you conduct the interview at the same place where the work is being carried out. Now, there may be a question: Some workplaces are really dangerous, and you may need a different kind of safety gear while working.

So those cases are based on the scenario; based on the situation, you have to make a decision. Now, these decisions are always based on your experience. So it is advised that you know you get help in those cases from your expert person who is available over there. So it is always suggested that you conduct the interviews at the same workplace. However, if there are some safety issues or hazardous issues are there, and you really cannot enter those restricted areas or something in that case based on the scenario based on the context, you make the decision.

Of course, that decision should be associated with your study's aim and objective. So the assessment, whatever we are going to do through PLIBLE, is focused on two major things. What are these? The tasks that are conducted during most working hours need to be there. It is not that once in a while, that task is being carried out, and you are doing the assessment for it. Or maybe it is one on a whole day shift.

No, no, not for those cases. Only if the task is being carried out or conducted by the workers during most of the working hours do those tasks need to be selected. The second is the task that the worker and the observer look upon as particularly stressful to the musculoskeletal system. Then, only you choose the task. So, initial observation and initial interview are very, very important and impacting factors of this particular checklist, and they will actually give you some impact on the result of the PLIBLE. So, these two considerations need to be considered. First, which task you are conducting for most of the hours of your working hour task from the preliminary observation, if you find that some task which is creating which is you are creating is stressful to the musculoskeletal system, then only you choose that particular task.



Procedure

- After observing the ergonomic hazards,
 - The numbered area on the form is checked or a short note is made.
- In the concluding report
 - The crude dichotomous answers are arranged in order of importance
 - The answers are collected from the list of ergonomic hazards can be used.
- In the summary
 - The problems are described with the combination of answers taken from the list.
- Modifying factors for the concluding report can be considered like-
 - Duration of task
 - Quantities of environmental or organizational factor

Of course, as I mentioned earlier several pliable forms have to be filled for each employee

that I mentioned earlier as well. Now, if we come to the observe like the procedure, this is like this particular slide is explaining that. So, let us understand it. So, the major bullet points are the major steps, and sub-bullets are also there.

So let us go one by one. So, after observing the ergonomics hazard, what are you going to do with that? So what do you have to do? You have to number the area on the form that is checked, or a short note needs to be made. So once you look at the form, you will understand that. So, what are the areas that need to be worked on or need to be checked further? You have to tick them. Either you tick them, or you keep a short note. Then, in the concluding report, the crude dichotomous answers are arranged in order of importance, and the answers are collected from the list of ergonomics hazards that can also be used.

In summary, what are you going to do? The problems are described in the combination of the answers taken from the list and in the modifying sector. So you have first the observation, then the conclusion, then you have to write the summary, and there is one more option where you can modify it. So modifying factors for concluding the report can also be considered or is influenced by the duration of the task. Of course, if the duration of a task is longer, it has more impact and the quantities of environmental or organizational factors. So, the duration of the task and organizational and environmental factors can also be used as modifying factors.

Lec 3: Plan for Identifying av Belastnings faktorer (PLIBEL) method

Kemlerik, K. and Kilbom, A. (1986) National Board of Occupational Safety and Health Research Department, Work Physiology Unit, 17184 Solna, Sweden

neck/shoulders, upper part of back	elbows, forearms, hands	feet	knees and hips	low back	
1.	1.	1.	1.	1.	1. Is the walking surface uneven, sloping, slippery, or nonresistant?
2.	2.	2.	2.	2.	2. Is the space too limited for work movements or work materials?
3.	3.	3.	3.	3.	3. Are tools and equipment unsuitably designed for the worker or the task?
4.	4.	4.	4.	4.	4. Is the working height incorrectly adjusted?
5.	5.	5.	5.	5.	5. Is the working chair poorly designed or incorrectly adjusted?
6.	6.	6.	6.	6.	6. If the work is performed while standing, is there no possibility to sit and rest?
7.	7.	7.	7.	7.	7. Is fatiguing foot-pedal work performed?
8.	8.	8.	8.	8.	8. Is fatiguing leg work performed, e.g.: a) repeated stepping up on stool, step, etc.? b) repeated jumps, prolonged squatting, or kneeling? c) one leg being used more often in supporting the body?
9.	9.	9.	9.	9.	9. Is repeated or sustained work performed when the back is: a) mildly flexed forward? b) severely flexed forward? c) bent sideways or mildly twisted? d) severely twisted?
10.	10.	10.	10.	10.	10. Is repeated or sustained work performed when the neck is: a) flexed forward? b) bent sideways or mildly twisted? c) severely twisted? d) extended backward?
11.	11.	11.	11.	11.	11. Are loads lifted manually? Notice factors of importance as: a) periods of repetitive lifting e) handling beyond forearm length b) weight of load f) handling below knee height c) awkward grasping of load g) handling above shoulder height d) awkward location of load at onset or end of lifting
12.	12.	12.	12.	12.	12. Is repeated, sustained, or uncomfortable carrying, pushing, or pulling of loads performed?
13.	13.	13.	13.	13.	13. Is sustained work performed when one arm reaches forward or to the side without support?
14.	14.	14.	14.	14.	14. Is there repetition of: a) similar work movements? b) similar work movements beyond comfortable reaching distance?
15.	15.	15.	15.	15.	15. Is repeated or sustained manual work performed? Notice factors of importance as: a) weight of working materials or tools b) awkward grasping of working materials or tools
16.	16.	16.	16.	16.	16. Are there high demands on visual capacity? a) weight of working materials or tools b) awkward grasping of working materials or tools
17.	17.	17.	17.	17.	17. Is repeated work, with forearm and hand, performed with: a) twisting movements? b) weight of working materials or tools c) uncomfortable hand positions?

Method of application:

- * Find the injured body region.
- * Follow white fields to the right.
- * Do the work tasks contain any of the factors described?
- * If so, tick where appropriate.

Also take these factors into consideration:

- a) the possibility to take breaks and pauses
- b) the possibility to choose order and type of work tasks or pace of work
- c) if the job is performed under time demands or psychological stress
- d) if the work can have unusual or unexpected situations
- e) presence of cold, heat, draught, noise, or troublesome visual conditions
- f) presence of jerks, shakes, or vibrations

Table 1. PLIBEL Form (Handbook of Human Factors and Ergonomics Methods; Neville Anthony Stanton, Alan Hedge)

So, let us start with the understanding of what this checklist looks like. This is the whole checklist. This particular checklist has been adopted for this particular presentation from this particular author; it is a textbook from here we adopted this particular figure. However, this table is also available in the original publication of this particular tool.

Now, let us understand it. So we discussed these figures. So the first figure talks about the neck, shoulder, and upper part of your back, elbow, forearm, and hands. That is the second then the feet and knees, knees and hips, this part, and the lower back. So these are the major five regions. So here is a very important thing, so these are some grey areas. First, let us understand the grey areas in this form.

So wherever these grey areas are, you need not worry about it. Only your concerns are these white areas. See, you have numbering. So these are the white areas that you need to answer.

Now, here is the list of factors. So, we have a total of 17 factors. For each body part, for each portion or modified portion, you can have all the combinations of these 17 factors. So, I will give an example of the first portion. Suppose you can understand that the first question is not required for you to get information because it is a grey area. What it says is the walking surface is uneven, sloping, slippery, or non-resilient.

So what does this mean? Of course, if that is the question, your upper back, neck, and shoulder is nowhere connected. So you need not to answer for it. The second question asks if this space is too limited for work movement or work maintenance. Of course, in that case, your neck, shoulder, and upper back are connected. Suppose you are in a confined zone you have little or a lot of restriction in the body movement where you can have an answer yes or no.

So, all are dichotomous. So, either yes or no. So only yes, no situation. So, for this particular portion, you can have answers; you can read these questions in detail thoroughly before you go for the interview. Also, this particular figure helps you understand where you should get an answer and where you should not get an answer. So, all grey areas you need not that have been decided or priorly identified that are not relevant to this kind of question. Whereas the only white areas need to be answered and need to be answered only from these questions, not from anywhere else.

So if you look at the first segment, you need to answer only question number 2, 3, 4, 5, then there is a long gap like you know 6, 7, 8 you need not to answer. Whereas again, you will be answering for 9 ABCD, 10 ABCD, and 11 ABCDEFG all the portions, then 14, 15, and 16. Again, 17 is not required for the first part. Why let us read 17? 17 is saying it is repressed work; whatever the work they are doing with the forearm and hand is performed with twisting movement or an uncomfortable hand position. So, of course, that is not going to affect your neck, shoulder, and upper back. So that is quite irrelevant for the first part of your body.

So this way, what do you need to do? You need to get an answer for yes, no, yes, no, all dichotomous answers. So, this is the checklist. This is the PLIBLE checklist. How do you use it? Suppose you have the data. So you have the data, you have filled for one employee, you have five jobs or five tasks you have identified, and for each task, you have one one pliable worksheet.

You have filled out the worksheet. Now, what are you going to do with this? What is the kind of interpretation we will have? Now you have one employee, you have maybe another 50 employees. For each employee, such a task will be connected somewhere. Then, you need to see how many of these factors are responsible for causing the problem. Then, you will get an understanding of the major causal factors that have those problems, such as percentage, so you can calculate. Also, you can go for any other analytical statistics where dichotomous variables are used.

That is also possible. So, you need to check what your objective is and how you analyze this particular data. So here is the very important thing: you will get some direction that if there is a problem or discomfort in this particular body part, these are the probable causal factors. It is not a confirmatory test. It is not confirmed.

It is only going to give you a direction. So once you get the direction, you have to investigate more. Once you investigate more, you will probably get the confirmatory result. Yes, this is the causal factor, and then only you can modify it and get better results. So this is the checklist, and you understand how you are going to use this particular checklist.

It is a very primitive tool. However, it is a very effective tool. Now, let us understand the advantages of this particular tool. It is a general assessment method. So learning is very easy.

Lec 3: Plan for Identifiering av Belastnings faktorer (PLIBEL) method

Advantages

- It is a general assessment method.
- It observes a part, or whole, of the body and summarizes the actual identification of ergonomic hazards in a few sentences.
- Simple and designed for primary checking.
- An initial investigative method for workplace observer to identify ergonomic hazards.
- It can be supplemented by other measurements, for instance weight and time, or questions/ observation from other studies.

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I understand that you understood this particular tool at this time. If you have a printout of this particular checklist, you can easily start collecting data. It is a very easy technique. So, it observed the part, the whole, or the body and summarized the actual identification of ergonomics hazards in a few sentences. So you have some, so these are all detailed sentences, right?

So everywhere. So you can really understand where the hazards are. It is simple and designed for primary checking, as I mentioned earlier. An initial investigative method for workplace observers is to identify ergonomic hazards. It can be supplemented by other measurements, such as weight and time, questions, and observations from other studies. Of course the organizational factors need to be considered if you need to go for more detail, time of exposure.

You can add these as per your requirement. So it is a very easy technique. But there are some disadvantages. So, it is not intended for any specific occupational task, not any specific occupations or body regions.

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Disadvantages

- Not intended for any specific occupations or tasks.
- Many other methods are intended for a specific occupation or body region.
- They can record more detailed answers.

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So, in this case, it is very generic, very general. So, you may not have a specific indication. And they can also record more detailed answers. Here, it is not a detailed answer. Only you understand whether risk factors are there or not.

And that, too, is the participatory response. So subjective responses. So here, you need to be very careful about how you consider those results. So, if you are an expert in collecting such information, collecting such, using such a tool, you will get very good results. However, if the person is not an expert in that particular field may have some kind of wrong information as well. So experiencing it is very important.

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Standard & Regulation

- An ergonomic screening tool, for the assessment of ergonomic conditions at workplace has been suggested as a feasible instrument by other researchers.
- It is valuable to have a systemic assessment method when doing follow-ups and when analyzing how intervention after the onset of occupational musculoskeletal injuries could be made more effective.
- PLIBEL follows the standard and regulations of the day, and although it is a self-explanatory, subjective assessment method, registering only at a dichotomous level.
- It requires a solid understanding of ergonomics.
- To use the method skilfully, a certain degree of practice is firmly recommended.

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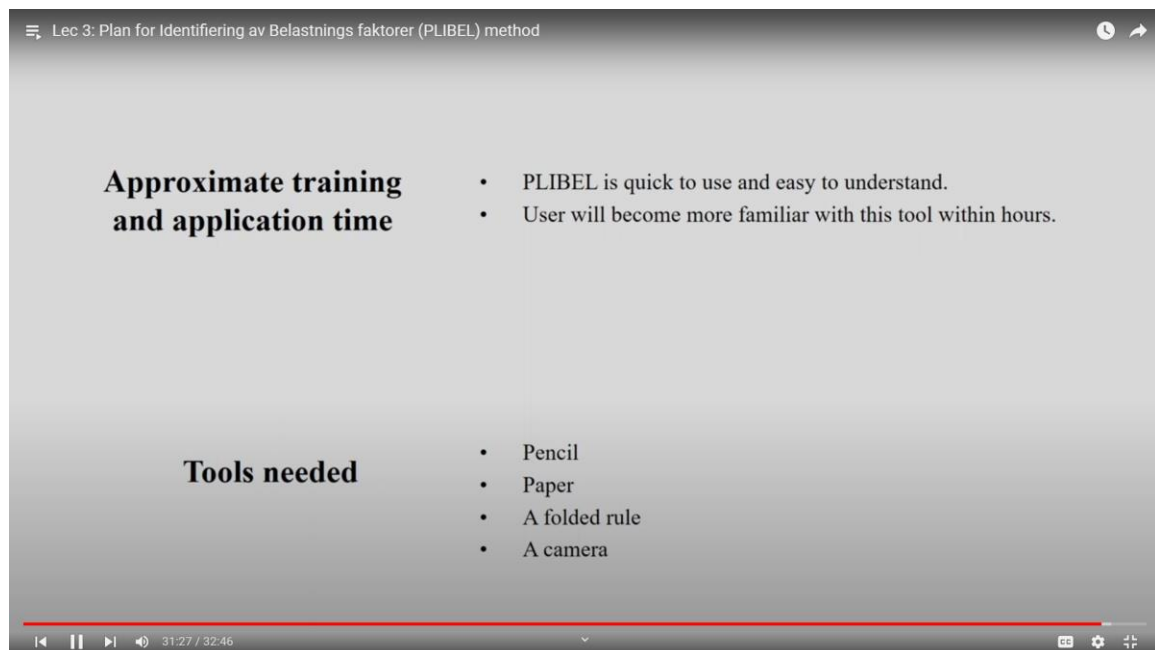
So we need to follow some standards and regulations. So, an ergonomic screening tool

for the assessment of ergonomics conditions at the workplace has been suggested as a feasible instrument by many other researchers for this particular tool. It is valuable to have a systemic assessment method when doing follow-ups and when analyzing how interventions after the onset of occupational musculoskeletal injuries could be made more effective. So you have before data, you have after data, and you can really compare it. That is that.

So if the number of yeses is very high, most of the questions are on that side. So, of course, it is not all similar. Still, if you have more difficulties, your number of yeses is more. So then you can compare, and you can really have a good understanding of the impact of that particular intervention. Also, Pliable follows the standards and regulations of that day, although it is a self-explanatory subjective assessment method registered only at the dichotomous level.

So you have no difficulties. It requires a solid understanding of ergonomics. This is very important. It is not that anybody and everybody can use it. You need to know the basic fundamentals of ergonomics.

And if you know that, you will not be able to use it. To use this particular method, some kind of skill and a certain degree of practice are required. So before you go for actual data collection, for many other tools, also, I always suggest that you go for some pilot data. So, pilot test. So if you do that successfully, of course, you are ready to collect a bigger chunk of data.



Lec 3: Plan for Identifiering av Belastnings faktorer (PLIBEL) method

Approximate training and application time

- PLIBEL is quick to use and easy to understand.
- User will become more familiar with this tool within hours.

Tools needed

- Pencil
- Paper
- A folded rule
- A camera

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So you can increase your sample size. So training already we discussed. For tools, what do you need? You need only a pencil, paper, folded ruler, and a camera to capture that

particular task. Otherwise, you will not be able to collect the correct information. This will be because number of data is very high. So later in the laboratory, when you come for your analysis, that may create confusion or difficulties.

So that is all for this pliable technique. I suggest you take a printout. It is easily available. The original paper is also available on the internet. So please collect the original publication. You get the datasheet, and you may practice it by yourself; if you find any difficulties, we can definitely discuss it in the discussion forum. Thank you.