Manual Patient Handling – MAPO

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INTRODUCTION

Scope of application. The *MPH MAPO* module makes it possible to analyze tasks that involve handling, maneuvering, lifting, transferring patients/people so as to minimize the risk of injury of healthcare workers.

It is important to emphasize that the MAPO methodology is the only methodology currently available to quantify, in a reliable and valid way, the level of risk that maneuvering patients in a hospital unit or service involves, taking into account the organizational aspects that determine the handling frequency for each worker.

When implementing this methodology, it should also be pointed out that:

- The procedure offers three variants to assess risks in inpatient wards, surgical areas (operating rooms) and outpatient services and day hospital.

- Each variant has a reduced procedure, Checklist, and an analytical method.

- The methodology includes two stages for data collection: an interview stage and an inspection stage.

Contents. On the basis of the number of workers who perform manual patient handling, the patient typology or procedures, and other conditions such as the type and number of maneuvers, training, characteristics of the assistive devices, characteristics of the facilities (bathrooms, rooms, etc.), the Mapo Index is obtained for hospitalization and the levels of ergonomic inadequacy for the different factors in both surgical areas and outpatient clinics.

Source. This procedure is based on the criteria included in:

- Technical report ISO/TR 12296 "Ergonomics -- Manual handling of people in the healthcare sector"

- BATTEVI, N., MENONI, O., MG RICCI, S. CAIROLI, 2006 MAPO index for risk assessment of patient manual handling in wards: a validation study. Ergonomics Vol. 49, No. 7, 671– 687

- MENONI, O., BATTEVI, N., CAIROLI, S. (2015). Patient handling in the Healthcare Sector. A Guide for Risk Management with MAPO Methodology (Movement and Assistance of Hospital Patients). EPM& Taylor&Francis Group.

DATA

The analysis starts by selecting *MAPO MPH* module in the *New task* window (Figure 1).

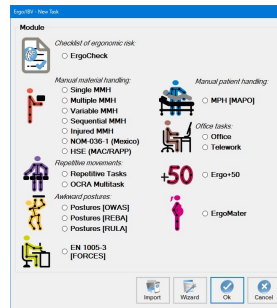This gives access to the main window of this module (Figure 2), where the module input data are shown.
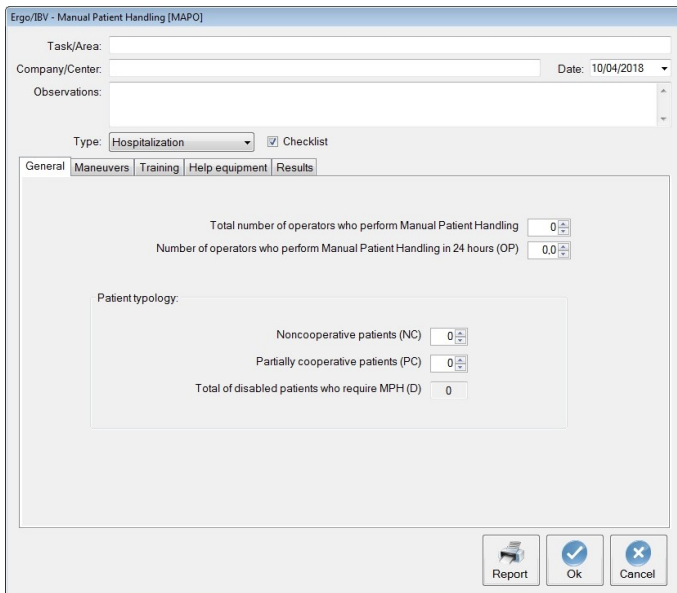

Figure 1: Access to module MAPO MPH

Figure 2. MAPO MPH – Main window (hospitalization)

Identification. The following case identification data are entered in the heading:

- **Task/Area**. A name must be assigned to the inpatient/outpatient task/area that will be analyzed.

- **Company/center**. The name of the company or working center where the task is performed must be entered.

- **Date**. The date on which the analysis is performed must be specified.

- **Observations**. Write any clarifications about the case (details of the task, company department, etc.).

- **Type**. The user must select the type of analysis to be performed:

  - **Inpatient hospitalization**
  - **Surgical area**
  - **Outpatient Services and Day Hospital**

- **Checklist**. It is the option selected by default. The objective of this procedure is to obtain, in an easy and quick way, exposure levels to manual patient handling and to detect situations that may require a more thorough assessment.

If the checklist mode is disabled/deselected, **a specific assessment** or **analytical method** will be performed, which requires more data collection, with new information tabs appearing according to the type of analysis selected.

Obtaining the necessary data has two phases. The first phase consists of an **interview** with the head of the ward or unit under analysis, during which general information is collected, as well as the type of training received, that is, the interview intends to obtain data related to the organizational aspects that characterize the area or unit being analyzed. The second stage, that is, the **inspection phase**, aims to collect information on the assistive devices and the spaces where the maneuvers are carried out, as well as to verify the information obtained in the interview phase.

Inpatient hospitalization

Inpatient wards are the areas of the medical centers where the largest number of workers perform patient maneuvers/handlings; therefore, these workers are exposed to significant biomechanical loads at the lumbar level. That is why it is essential to analyze the situation in order to prevent injuries and musculoskeletal disorders among the staff in these areas.

If the checklist mode is deselected and a more detailed (analytical) analysis is chosen, the information tabs related to wheelchairs, bathrooms, toilets and rooms are added to the existing information tabs (general, maneuvers, training, and assistive equipment).

General tab

The following data are entered in this tab:

- **Total number of operators who perform manual patient handling**. Specify, the total number of workers in the staff involved in manual patient handling.

- **Number of operators who perform manual patient handling in 24 hours (OP)**. Specify how many workers (in all three working shifts) perform manual patient handling, no matter whether they are nurses, assistants, porters, etc.

  It is an estimate of the number of workers exposed to manual patient handling (MPH) for a 24-hour period. If there are workers who are not present during the whole shift, they are also counted as a unit fraction with respect to the number of hours they perform.

- **Patient typology.** Indicate the total number of patients:

  o **Noncooperative patients (NC).** Those patients who have to be completely lifted.

  o **Partially cooperative (PC).** Patients who partially rise or move.

  From the previous data, the software calculates the total number of **disabled patients (D)** who require being handled. Disabled refers to the fact that the patient, either NC or PC, needs to be aided during the handling.

Figure 3. MAPO MPH – General tab- (inpatient hospitalization)

Maneuvers tab

In this tab, the number of patient maneuvers must be specified, which are performed as:

- **Number of total liftings**
- **Number of partial liftings**

For each of them, whether the lifting is performed **manually** (with no assistive equipment) or **using assistive equipment** (aided) must be specified.

The handling tasks that are usually performed in inpatient wards are included in Figure 4.

Figure 4. MAPO MPH – Maneuvers tab- (inpatient hospitalization)

For each task, it is necessary to specify whether it is a total or partial lifting and whether it is manual or aided. The number in each box refers to the total of handlings in a workday (grouping the morning, afternoon and night shifts) performed by the total of workers.

With the handling data entered in the table, the software calculates:

- Percentage of aided total lifting operations **(%ATL)**

- Percentage of aided partial lifting operations **(%APL)**

Training tab

This tab includes the type of training (skills) and information, as well as the ability to use the assistive equipment related to the risk associated with patient maneuvers.

The type of training, duration of the training, number of workers who have received the training, time interval between the training and the verification of its effectiveness, define the concept of adequate training.

Figure 5. MAPO MPH – Training tab- (inpatient hospitalization)

The training is considered to be adequate when:

- The minimal duration of the theoretical and practical course is 6 hours.

- 75% of the workers involved in the patient maneuvers have received training.

Assistive equipment tab

This tab identifies the number of units of each device or aid used to assist during the transfers/maneuvers of disabled patients.

Figure 6 includes the equipment and minor assistive devices most frequently used.
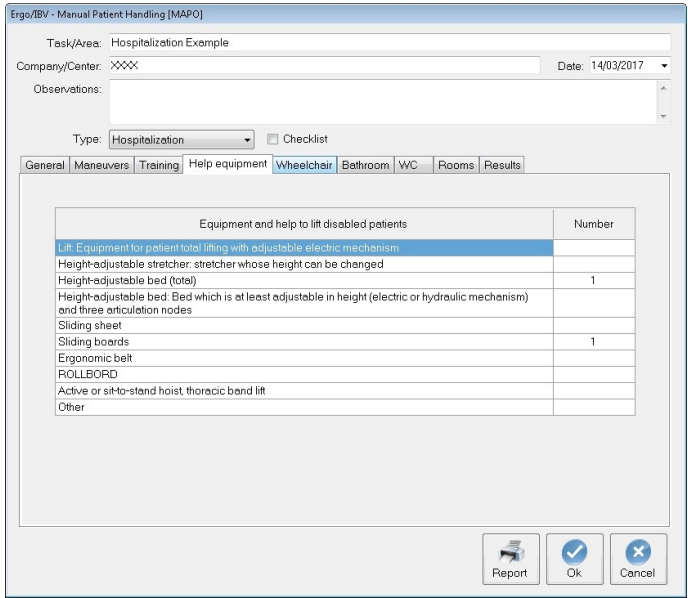
Figure 6. MAPO MPH – Assistive equipment tab- (inpatient hospitalization)

If, at the beginning of the analysis, the user chose to perform it in the **Checklist mode**, the **results** of the **risk identification** (MAPO Index and Risk Level) will be obtained after completing the previous tabs (general, maneuvers, training, and assistive devices).

Wheelchairs tab

This tab collects data from one of the devices most commonly used in the hospital setting: wheelchairs.

If, at the beginning of the analysis, the user chose to perform the analysis in the **Checklist mode**, this tab will not be available.

The data entered in this tab are as follows:

- Total number of wheelchairs available in the hospital area under study.

- For each chair, the characteristics of ergonomic inadequacy are checked as shown in Figure 7. The characteristics that appear as

(descriptive) must be specified, but they do not affect the calculation.

Figure 7. MAPO MPH – Wheelchairs tab- (inpatient hospitalization)

Bathrooms tab

If, at the beginning of the analysis, the user chose to perform the analysis in the **Checklist mode**, this tab will not be available.

The **total number of bathrooms with shower/bath** available in the area is specified in this tab.

In addition, it is necessary to specify the number of bathrooms that show the ergonomic inadequacy characteristics detailed in Figure 8.

On the basis of these data, the program calculates a total score, as well as a **mean bathroom score (MBS)**.
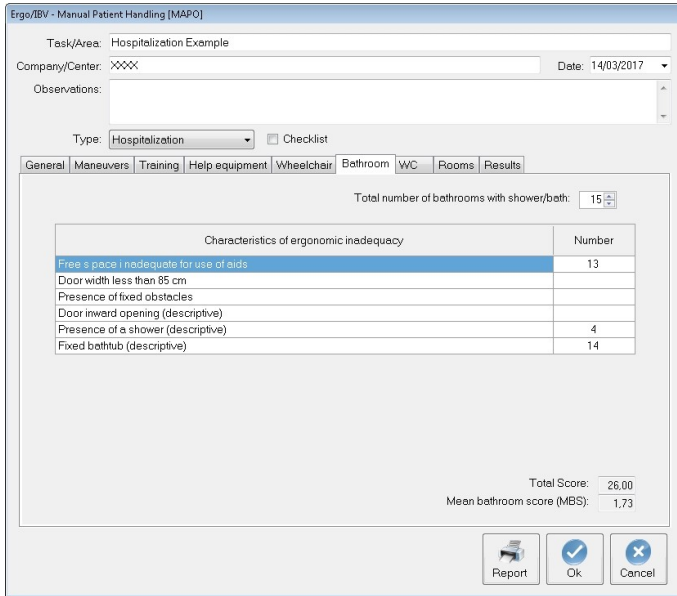
Figure 8. MAPO MPH – Bathrooms tab- (inpatient hospitalization)

WC/toilet tab

If, at the beginning of the analysis, the user chose to perform the analysis in the **Checklist mode**, this tab will not be available.

The total of bathrooms with toilet (WC) available in the area under study must be specified in this tab.

For the total of bathrooms with toilet, the characteristics of ergonomic inadequacy will be checked in the table of Figure 9. For each item, the number of bathrooms with toilet that show inadequacy will be recorded.

In addition, it is necessary to specify the number of bathrooms that show the ergonomic inadequacy characteristics detailed in Figure 8.

On the basis of these data, the software calculates a total score, as well as a **mean WC score (MSWC)**.

Figure 9. MAPO MPH –WC tab - (inpatient hospitalization)

Rooms tab

If, at the beginning of the analysis, the user chose to perform the analysis in the **Checklist mode**, this tab will not be available.

The number of rooms in the area where the analysis is performed must be specified in this tab.

In addition, several criteria or requirements of ergonomic inadequacy, which are included in Figure 10, must be checked for each room.

On the basis of these data, the total score of the rooms and the **mean rooms score (MRS)** are automatically calculated.

Figure 10. MAPO MPH – Rooms tab- (inpatient hospitalization)

Results tab

Once the data have been entered in the previous tabs, the program calculates and shows in the same window the values obtained for each risk factor considered by the methodology.

Figure 11. MAPO MPH – Results tab- (inpatient hospitalization)

The factors considered are as follows:

- **LF (lifting devices factor)**. The value of the lifting devices factor is provided, which is related to the presence of noncooperative patients. This value is obtained from the sufficiency and adequacy data found in the methodology tables. For instance, the case in Figure 11 shows that LF has a value of 4.00, which indicates absence or inadequacy and insufficiency of devices that meet the requirements of the room where the analysis is performed. This value is obtained from the following table considered by the methodology:

LF VALUE	Interpretation
4	Absent or inadequate (%ATL ≤90) and insufficient (equipment available for patient total lifting)
2	Insufficient or inadequate
0.5	Adequate (%LTA≥90) and sufficient

- **TF (training factor)**. It provides the value of the training factor and the corresponding level of ergonomic inadequacy. Both the value and the level are tabulated and obtained by checking the characteristics specified in the training tab. For example, the case in Figure 11 shows that TF has a value of 2.00, which means that none of the conditions related to time, workers and training materials have been performed or met. The TF value and the level of ergonomic inadequacy are obtained from the following table.

TF VALUE	Ergonomic Inadequacy	Interpretation
0.75	Negligible	Training through an adequate course, which should have been taken no more than two years before the risk assessment, for at least 75% of the workers in the ward.
0.75	Negligible	If the training was performed more than two years ago for at least 75% of the workers of the ward and its efficiency has been verified.

1	Medium	Training through an adequate course, which should have been taken no more than two years before the risk assessment, for between 50% and 75% of the workers in the ward.
1	Medium	Information/training in the use of equipment was provided or brochures were distributed to 90% of the workers. Its effectiveness was verified.
2	High	No training was performed or none of the conditions are met.

- **AF (minor aids factor)**. The value of the minor aids factor is offered. This value is obtained from the data of sufficiency and adequacy of the minor aids that were entered in the Assistive equipment tab.

AF VALUE	Interpretation
1	Absent or inadequate (%APL ≤90) and insufficient (absence of ergonomic sliding sheet or board, rollbord or belt).
0.5	Adequate (%APL ≥90) and sufficient

- **WF (wheelchair factor)**. The value of the wheelchair factor is provided. If "Checklist" was chosen in the general screen, then the value for this factor will be WF=1.5, an average value considered by the authors. If the complete assessment is performed, the WF factor will be calculated from the MSWh and from the wheelchairs sufficiency value, directly obtained by the program from the data entered in the relevant tab. On the basis of the MSWh data (mean wheelchair score) and the sufficiency data (presence of a number of chairs ≥50% of the D patients), the WF is obtained by means of the following table:

	Low		Medium		High	
MSWh	0.00-1.33		1.34-2.66		2.67-4.0	
Sufficiency	No	Yes	No	Yes	No	Yes
Value WF	1	0.75	1.5	1.12	2	1.5

- **EF (environmental factor)**. The value of the environmental factor is also provided. If "Checklist" was selected in the general screen, the value for this factor will be EF=1.25, a constant value considered by the authors.

  If a complete assessment is performed, the factor (EF) is calculated from the mean scores of the bathrooms (MBS), WC (MSCW) and rooms (MSR). The program calculates the mean environment score (MSEnv), a data required to calculate de environmental factor (EF), included in the following table:

	Low	Medium	High
EF: mean environment score	0-5.8	5.9-11.6	11.7-17.5
EF value	0.75	1.25	1.5

MAPO Index and risk level. With the value of all the factors considered above, the software calculates the MAPO Index, which is associated with a risk level.

The MAPO Index is calculated by applying the following formula:

> **MAPO INDEX = (NC/Op x LF + PC/Op x AF) x WF x EF x TF**

Three risk levels are considered with their respective color codes, whose interpretation is as follows:

- o **Negligible Risk** (green), (MAPO Index <=1.5). Negligible risk. No intervention is required.

- o **Medium Risk** (yellow), (1.5< MAPO Index <=5). Moderate risk. Medium/long-term intervention is required.

- o **High Risk** (red), (MAPO Index >5). Unacceptable risk. Short-term intervention is required.

For instance, a **MAPO Index of 24.17** corresponds with a HIGH risk level. The MAPO Index indicates the probability of lumbar pain occurrence among workers who perform manual patient handling.

With regard to the interpretation of the level of ergonomic inadequacy, there are also 3 levels with an associated color code, whose interpretation is summarized in the following table:

INTERPRETATION OF THE LEVEL OF ERGONOMIC INADEQUACY	
Negligible	The risk factor is within adequate ergonomic levels.
Medium	The risk factor is partially adequate or can be improved.
High	The risk factor is completely inadequate. Intervention is required to improve it.

Surgical Area

The process to calculate the risk for patient handling in operating rooms follows the same model as the one explained for inpatient wards.

In surgical areas, the type and number of daily operations determine the handling activity and, therefore, the biomechanical load at the lumbar level of the workers exposed.

The type of maneuvers that are carried out in these areas pose a high biomechanical risk because, due to the effects of the anesthesia, the patient lifting is usually total.

The main difference lies in the fact that **it is not possible to calculate a risk level** in surgical areas and, therefore, the result is an estimate of the exposure level.

If the user deselects the Checklist mode and chooses to perform a more detailed (analytical) analysis, the information tabs related to stretchers and operating rooms are added to the existing information tabs (general, maneuvers and training).

General tab

The following data are entered in this tab:

- **Total number of operators who perform manual patient handling**. Specify, the total number of workers in the staff involved in manual patient handling.

- **Number of operators who perform manual patient handling in 24 hours (OP).** Specify how many workers (in the three working shifts) perform patient handling, no matter whether they are nurses, assistants, porters, etc.

  It is an estimate of the number of workers exposed to manual patient handling (MPH) for a 24-hour period, just as in the case of inpatient hospitalization.

- **Type of procedure.** Specify the total number of procedures:

  - **With general anesthesia (GA).** Those patients who have to be completely lifted.

  - **With local anesthesia (LA).** Patients who rise or move partially.

On the basis of the previous data, the program calculates the total **number of procedures requiring handling (NS)**.
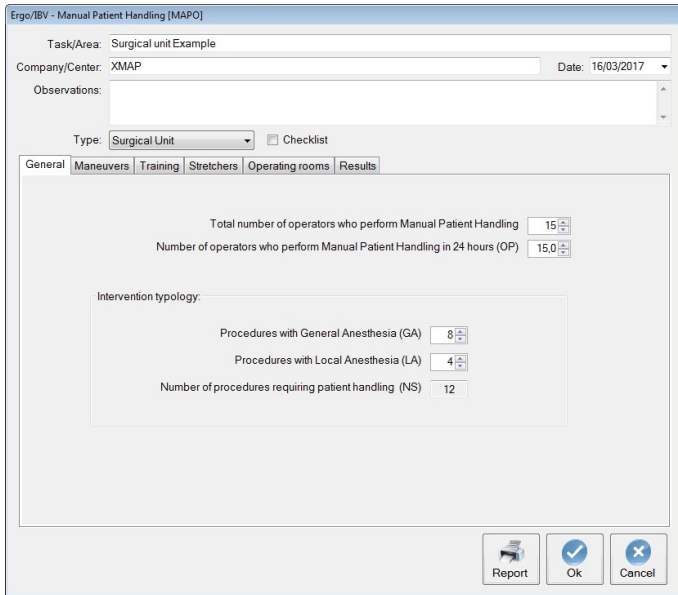

Figure 12. MAPO MPH – General tab- (surgical area)

Maneuvers tab

In this tab, the patient maneuvers and their number are specified, which are performed as:

- **Number of liftings in procedures with general anesthesia**

- **Number of liftings in procedures with local anesthesia**

For each of them, whether the lifting is performed **manually** (with no assistive devices) or **using assistive equipment** (aided) must be specified.

The handling tasks that are usually performed in the surgical areas are included in Figure 13.

Figure 13. MAPO MPH – Maneuvers tab- (surgical area)

For each procedure, the type of anesthesia used and whether the handling is manual or aided must be specified.

With the handling data entered in the table, the program calculates the **percentage of aided lifts (AMPER).**

Training tab

This tab includes the type of training (skills) and information, as well as the ability to use the assistive equipment related to the risk associated with patient maneuvers.

The type of training, duration of the training, number of workers who have received the training, time interval between the training and the verification of its effectiveness, define the concept of appropriate training.
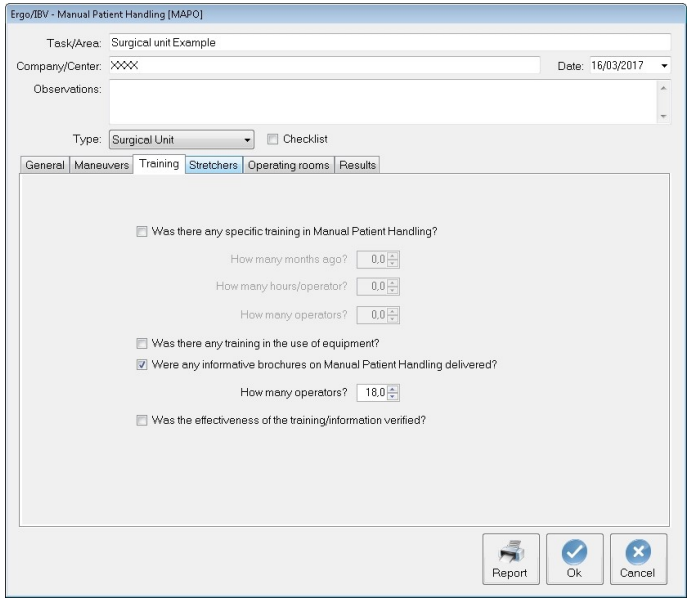
Figure 14. MAPO MPH – Training tab- (surgical area)

The training is considered to be adequate when:

- The minimal duration of the theoretical and practical course is 6 hours.

- 75% of the workers involved in the patient maneuvers have received training.

If, at the beginning of the analysis, the user chose to perform the analysis in the **Checklist mode**, after completing the previous tabs (general, maneuvers, and training), the **results** of the level of ergonomic adequacy of the lifting devices factor (LF) and the training factor (TF) will be obtained.

Stretchers tab

This tab collects data from one of the devices most commonly used in the surgical setting: stretchers.
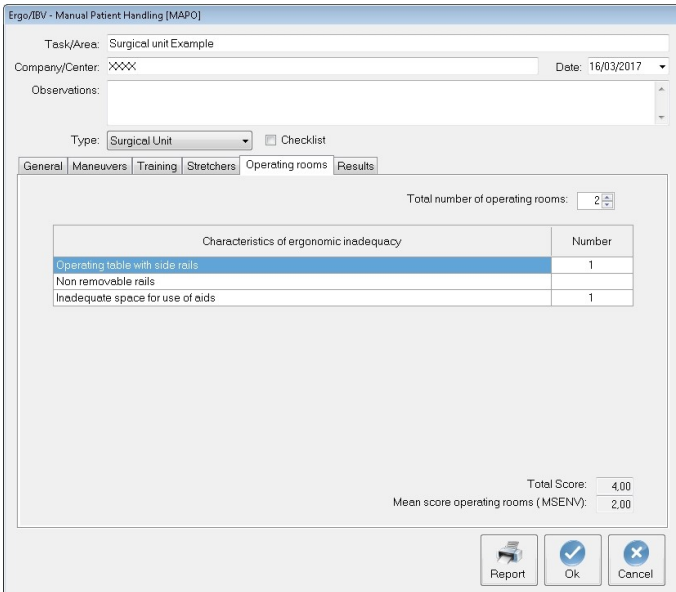
If, at the beginning of the analysis, the user chose to perform the analysis in the **Checklist mode**, this tab will not be available.

The data that must be entered are as follows:

- The total number of stretchers present in the surgical area under study.

- For each stretcher, the characteristics of ergonomic inadequacy shown in Figure 7 are checked. The characteristics that are shown as (descriptive) must be specified, but they do not affect the calculation.

Once these data have been entered, the program automatically calculates a total score and a **mean score for stretcher (MSSTR)**, value required to calculate the level of ergonomic inadequacy of the stretchers factor.

Figure 15. MAPO MPH– Stretchers tab- (surgical area)

Operating rooms tab

This tab analyzes the conditions of ergonomic inadequacy in the operating rooms regarding the furniture, with particular attention to the operating table.

If, at the beginning of the analysis, the user chose to perform the analysis in the Checklist mode, this tab will not be available.

The data that must be entered in this tab are as follows:

- Total number of operating rooms in the surgical area under study.

- For each operating room, the characteristics of ergonomic inadequacy included in Figure 16 are checked.

Once these data have been entered, the program automatically calculates a total score and a **mean score for the operating rooms (MSENV),** a value required to calculate the level of ergonomic inadequacy of the environment factor.

Figure 16. MAPO MPH – Operating rooms tab- (surgical area)

Results tab

Once the data have been entered in the previous tabs, the program calculates and shows in the same window the levels of ergonomic inadequacy (negligible, medium, high) for each risk factor considered by the methodology, as well as the level of risk for the lifting devices factor (LF).
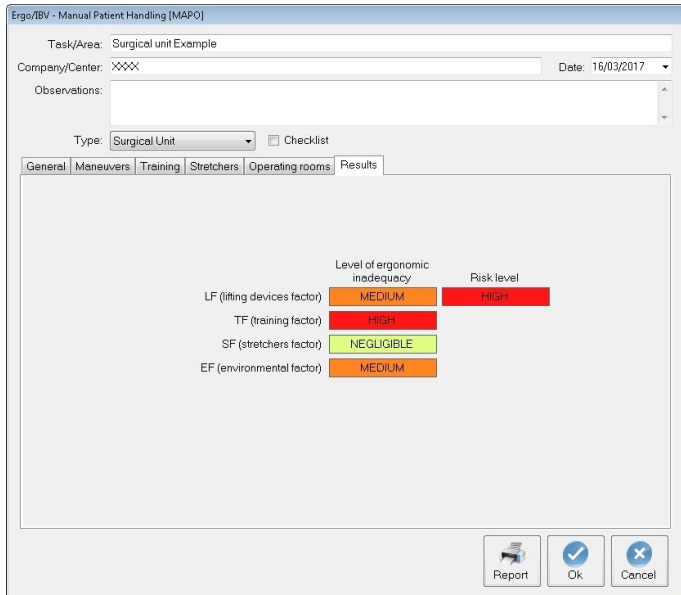
Figure 17. MAPO MPH – Results tab- (surgical area)

The factors considered are as follows:

- **LF (lifting devices factor)**. The level of ergonomic inadequacy of the lifting devices factor is provided. This level is related to the percentage of maneuvers carried out using assistive devices (AMPER), a value that is obtained in the maneuvers tab.

  The AMPER value and its relation to the ergonomic inadequacy of LF is obtained from the following table. For example, in this case the AMPER value obtained in the maneuvers tab is 60.00, which corresponds with a medium inadequacy of the lifting devices factor, as shown in Figure 17.

AMPER VALUE	Interpretation (ergonomic inadequacy of LF)
<50%	**HIGH** (assistive devices are rarely used)
≥50% and <90%	**MEDIUM** (assistive devices are partially used)
≥90%	**NEGLIGIBLE** (assistive devices are adequately used)

- **Risk level for the lifting devices factor.** The level of ergonomic risk is provided for the lifting devices factor. The risk level is related to the presence of patients requiring handling and the AMPER values calculated in the maneuvers tab. The level of risk is obtained from the following table:

RISK LEVEL	Interpretation
NEGLIGIBLE	Presence of NS and AMPER ≥90%
HIGH	Presence of NS and AMPER <90%

- **TF (training factor).** The level of ergonomic inadequacy for the training factor is offered. The level is tabulated and obtained by checking the characteristics specified in the training tab.

Ergonomic inadequacy	Interpretation
Negligible	Training through an adequate course, taken no more than two years before the risk assessment for at least 75% of the workers in the ward.
Negligible	If the training was performed more than two years ago, for at least 75% of the workers in the ward and its efficacy was verified.
Medium	Training through an adequate course, taken no more than two years before the risk assessment for between 50% and 75% of the workers of the ward.
Medium	Information/training in the use of the devices was

	provided or brochures were distributed to 90% of the workers, and its effectiveness was verified.
High	No training was performed or none of the conditions are met.

Type of Training	Adequate	Partially adequate	Completely inadequate
Ergonomic Inadequacy for TF	Negligible	Medium	High

- **SF (stretchers factor)**. The level of ergonomic inadequacy of the stretchers factor is provided. This level is obtained from the MSSTR value (calculated in the stretchers tab), and then obtaining the inadequacy value by means of this table:

MSSTR	0.00-2.00	2.01-4.00	4.01-6.00
Ergonomic Inadequacy for SF	Negligible	Medium	High

For example, a MSSTR value of 2.00 obtained in the stretchers tab indicates that the level of ergonomic inadequacy of the stretchers factor is negligible.

EF (environmental factor). The level of ergonomic inadequacy is provided for the environmental factor. This level is obtained from the MSENV value calculated in the operating room tab and by means of the following table:

MSENV	0.00-1.50	1.51-3.00	3.01-4.50
Ergonomic Inadequacy for EF	Negligible	Medium	High

For example, a MSENV value of 2.00 obtained on the operating rooms tab indicates that the level of ergonomic inadequacy of the environment factor is medium.

Regarding the interpretation of the level of ergonomic inadequacy, the 3 levels are also associated with their color codes, and the interpretation is summarized in the following table:

INTERPRETATION OF THE LEVEL OF ERGONOMIC INADEQUACY	
Negligible	The risk factor is within adequate ergonomic levels.
Medium	The risk factor is partially adequate or can be improved.
High	The risk factor is completely inadequate. Intervention is required to improve it.

Outpatient Services or Day Hospital

The process to calculate the risk for patient handling in outpatient clinics follows the same model as the one explained for surgical areas.

In recent years, the advances in medical treatments have increased the importance of outpatient departments and clinics in the treatment of patients, since many procedures that required inpatient hospitalization, nowadays can be performed on an outpatient basis. Due to this fact, outpatient services face the increasing presence and handling of disabled patients, which, together with a very limited number of workers, significantly increases the risk of manual handling in these areas.

In addition, the fact that these areas do not normally involve night work, there is a misconceived tendency to relocate older workers or workers with any pathology, which considerably increases the likelihood of injury.

As in the surgical areas, **it is not possible to calculate a risk level** in outpatient clinics, the result is an estimate of the exposure level.

If the Checklist mode is deselected and the user chooses to perform a more detailed (analytical) analysis, the information tabs related to stretchers, wheelchairs, examination rooms and rooms (outpatient clinics) are added to the existing information tabs (general, maneuvers and training).

General tab

In this tab, the following data are introduced:

- **Total number of operators who perform manual patient handling**. Specify, the total number of workers in the staff involved in manual patient handling.

- **Number of operators who perform manual patient handling in 24 hours (OP)**.Specify how many workers (in all three working shifts) perform manual patient handling, no matter whether they are nurses, assistants, porters, etc.

  It is an estimate of the number of workers exposed to manual patient handling (MPH) for a 24-hour period just as with inpatient hospitalization and surgical areas.

- **Type of patient.** Specify the total number of patients:

  o **Noncooperative (NC).** Those patients who have to be completely lifted.

o **Partially cooperative (PC).** Patients who rise or move partially.

With the above data, the program calculates the **total number of disabled patients (D)** who need to be handled. Disabled refers to the fact that the patient, either NC or PC, needs to be aided during the handling, and is calculated with respect to the average number of patients who access the service daily.

Figure 18. MAPO – General tab- (outpatient services)

Maneuvers tab

In this tab, the number of patient maneuvers must be specified, which are performed as:

- **Number of total liftings**

- **Number of partial liftings**

For each of them, whether the lifting is performed **manually** (with no assistive equipment) or **using assistive equipment** (aided) must be specified.

The handling tasks that are usually performed in outpatient clinics are included in Figure 19.

Figure 19. MAPO MPH – Maneuvers tab- (outpatient services)

For each task, it is necessary to specify whether it is a total or partial lifting and whether it is manual or aided. The number entered in each box refers to the total handlings in a workday performed by the total of workers.

With the handling data entered in the table, the software calculates:

- Percentage of aided total lifts **(%TL ATLPER)**.

- Percentage of aided partial lifts **(%PL APLPER)**.

Training tab

This tab includes the type of training (skills) and information, as well as the ability to use the assistive equipment related to the risk associated with patient maneuvers.

The type of training, duration of the training, number of workers who have received training, time interval between the training and the verification of its effectiveness, define the concept of adequate training.

Figure 20. MAPO MPH – Training tab- (outpatientservices)

The training is considered to be appropriate when:

- The minimal duration of the theoretical and practical course is 6 hours.

- 75% of the workers involved in the patient maneuvers have received training.

If, at the beginning of the analysis, the user chose to perform the analysis in the **Checklist mode**, after completing the previous tabs (general, maneuvers, and training), the **results** of the level of ergonomic adequacy of the lifting devices factor both for the total lifts (TLF) and the partial lifts (PLF), and of the training factor (TF).
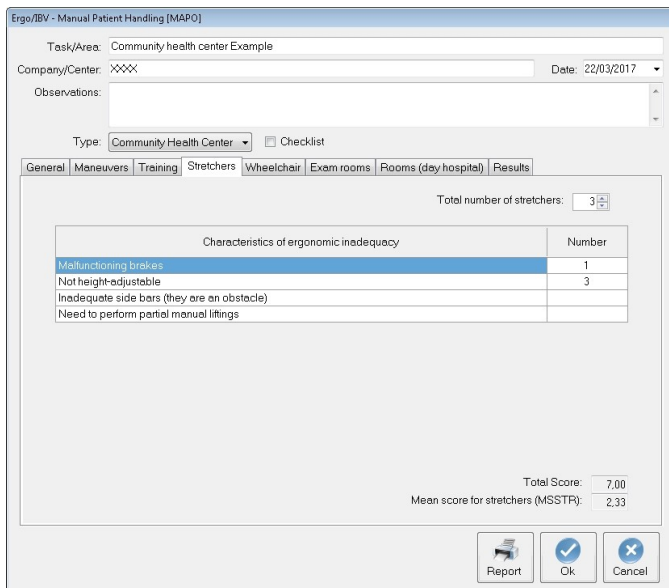
Stretchers tab

This tab collects data from one of the devices most commonly used in outpatient clinics and departments: stretchers.

If, at the beginning of the analysis, the user chose to perform the analysis in the **Checklist mode**, this tab will not be available.

The data that must be entered in this tab are as follows:

- The total number of stretchers present in the outpatient area under study.

- For each stretcher, the characteristics of ergonomic inadequacy shown in Figure 7 are checked. The characteristics that are shown as (descriptive) must be specified, but they do not affect the calculation.

Figure 21. MAPO MPH – Stretchers tab- (outpatientservices)

Once these data have been entered, the program automatically calculates a total score and a **mean score for stretchers (MSSTR)**, a value required to calculate the level of ergonomic inadequacy of the stretchers factor.

Wheelchairs tab

This tab collects data from other of the devices most commonly used in an outpatient setting: wheelchairs.

If, at the beginning of the analysis, the user chose to perform the analysis in the **Checklist mode**, this tab will not be available.

The data that must be entered in this tab are as follows:

- Total number of the wheelchairs in the outpatient area under study.

- For each chair, the characteristics of ergonomic inadequacy shown in Figure 7 are checked. The characteristics that are shown as (descriptive) must be specified, but they do not affect the calculation.

Once these data have been entered, the program automatically calculates a total score and a **mean wheelchair score (WSWh)**, a value required to establish the level of ergonomic inadequacy.

Figure 22. MAPO MPH – Wheelchairs tab - (outpatientservices)

Examination rooms Tab

Examination rooms are one of the areas of outpatient clinics where manual patient handling is performed.

If, at the beginning of the analysis, the user chose to perform the analysis in the **Checklist mode**, this tab will not be available.

The data that must be entered in this tab are as follows:

- Total number of examination rooms present in the outpatient area under study.

- For each examination room, the characteristics of ergonomic inadequacy shown in Figure 7 are checked.
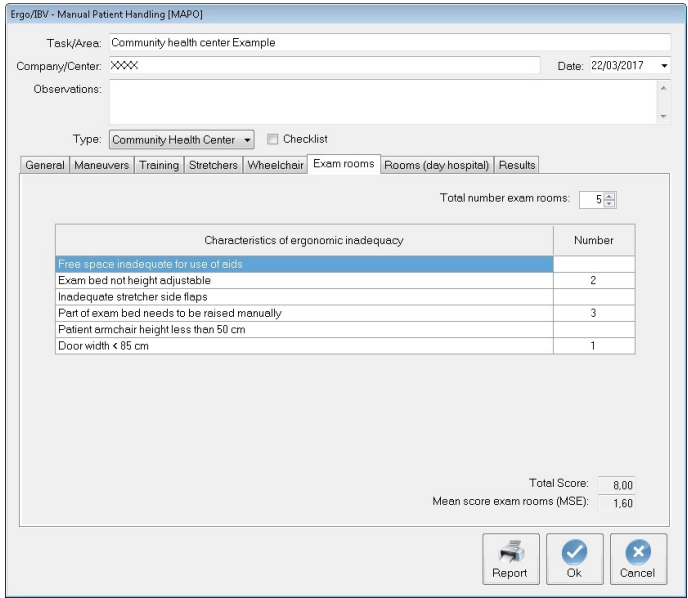
Figure 23. MAPO MPH – Examination rooms- (outpatient servives

Rooms tab (outpatient clinic/day hospital)

If, at the beginning of the analysis, the user chose to perform the analysis in the **Checklist mode**, this tab will not be available.

In this tab, the number of outpatient rooms present in the area where the analysis is performed must be specified.

Additionally, for each room, it is necessary to check a series of criteria or requirements of ergonomic inadequacy included in Figure 24.

On the basis of these data, the total rooms score and the **mean rooms score (MSR)** are automatically calculated.

Figure 24. MAPO MPH – Rooms (day hospital) tab- (outpatient care)

Results tab

Once the data have been entered in the previous tabs, the program calculates and shows in the same window the levels of ergonomic inadequacy (negligible, medium, high) for each risk factor considered by the methodology, as well as the level of risk for the total and partial lifting devices factor.
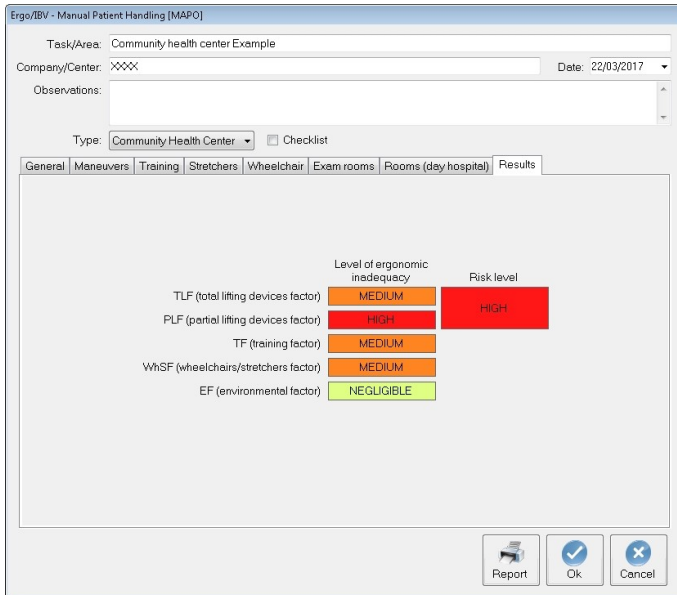
Figure 25. MAPO MPH – Results tab- (outpatient care)

The factors considered are:

- **TLF (total lifting devices factor)**. The level of ergonomic inadequacy of the lifting devices factor is provided for total patient lifting, which is related to the percentage of aided total lifts (%TL) ATLPER, a value that is obtained in the maneuvers tab.

  The (%TL) ATLPER value and its relation to the ergonomic inadequacy of TLF is obtained from the following table. For instance, in this case, the (%TL) ATLPER value obtained in the maneuvers tab is 53.33, which corresponds with a medium inadequacy of the lifting devices factor, as shown in Figure 25.

(%TL) ATLPER VALUE	Interpretation (ergonomic inadequacy for TLF)
<50%	**HIGH** (assistive devices are rarely used)
≥50% y <90%	**MEDIUM** (assistive devices are partially used)
≥90%	**NEGLIGIBLE** (assistive devices are adequately used)

- **PLF (partial lifting devices factor)**. The level of ergonomic inadequacy of the lifting devices factor is provided for partial patient lifting, which is related to the percentage of aided partial lifts (%PL) APLPER, a value that is obtained in the maneuvers tab.

  The (%PL) APLPER value and its relation to the ergonomic inadequacy of PLF is obtained from the following table. For instance, in this case, the (%PL) APLPER value obtained in the maneuvers tab is 16.67, which corresponds with a high inadequacy of the lifting devices factor.

(%PL) APLPER VALUE	Interpretation (ergonomic inadequacy for PLF)
<90%	**HIGH** (assistive devices are rarely used)
≥90%	**NEGLIGIBLE** (assistive devices are adequately used)

- **Risk level for the total and partial lifting devices factor.** The level of ergonomic risk for the lifting devices factor is provided. The risk level is related to the presence of patients who need to be handled as well as the (%TL) ATLPER and (%PL) APLPER values calculated in the maneuvers tab. The risk level is obtained from the following table:

RISK LEVEL	Interpretation
NEGLIGIBLE	Presence of patients who need to be handled and (%TL) ATLPER and (%PL) APLPER ≥90%

MEDIUM	Presence of patients who need to be handled and (%PL) APLPER <90%, and eventually (%TL) ATLPER ≥90%
HIGH	Presence of patients who need to be handled and (%TL) ATLPER <90%

- **TF (training factor).** The level of ergonomic inadequacy for the training factor is provided. The level is obtained by checking the characteristics specified in the training tab.

Ergonomic Inadequacy	Interpretation
Negligible	Training through an adequate course, which should have been taken no more than two years before the risk assessment, for at least 75% of the workers of the ward.
Negligible	If the training took place more than two years ago, for at least 75% of the workers of the ward and its efficacy was verified.
Medium	Training through an adequate course, taken no more than two years before the risk assessment for between 50% and 75% of the workers of the ward.
Medium	Information/training in the use of the devices was provided or brochures were distributed to 90% of the workers, and its effectiveness was verified.
High	No training was performed or none of the conditions are met.

Type of Training	Adequate	Partially adequate	Completely inadequate
Ergonomic Inadequacy for TF	Negligible	Medium	High

- **SF (stretchers/wheelchairs factor)**. The level of ergonomic inadequacy of the stretchers/wheelchairs factor is provided. This level is obtained from the MSSTR value (calculated in the stretchers tab) and the MSWh value (calculated in the wheelchairs tab), and then obtaining the inadequacy value by means of the following table:

MSSTR + MSWh	0.00-3.33	3.34-6.66	6.67-10.00
Ergonomic Inadequacy for SF	Negligible	Medium	High

For example, a **MSSTR** value of 2.33 and a **MSWh** value of 3.45 obtained in the stretchers and wheelchairs tab respectively, indicates that the SF level of ergonomic inadequacy (stretchers/wheelchairs) is Medium.

EF (environmental factor). The level of ergonomic inadequacy for the environmental factor is provided. This level is obtained from the MSE value obtained in the consultation rooms tab and the MSR value in the rooms tab. With both data and using the table below, the level of ergonomic inadequacy for EF is obtained.

MSE+MSR	0.00-2.50	2.51-5.00	5.01-7.50
Ergonomic Inadequacy for EF	Negligible	Medium	High

For example, a MSE value of 1.60 and a MSR value of 0.65, obtained in the consultation rooms and the outpatient rooms tab respectively, indicates that the level of ergonomic inadequacy of the environmental factor is negligible.

With regard to the interpretation of the level of ergonomic inadequacy, the 3 levels are also associated with color codes. The interpretation is summarized in the following table:

INTERPRETATION OF THE LEVEL OF ERGONOMIC INADEQUACY	
Negligible	The risk factor is within adequate ergonomic levels.
Medium	The risk factor is partially adequate or can be improved.
High	The risk factor is completely inadequate. Intervention is required to improve it.

REPORT

Clicking the *Report* button in the main window of this module provides a report of the task which contains the following sections:

- **Identification**. It includes general data; date, name of the task/area and of the company/center, and the evaluator observations. If a photograph was added to the task, it will also appear in this section.

  In addition, this section includes the type of analysis (inpatient hospitalization, surgical area or outpatient care) and whether it is a checklist.

Figure 26. MAPO MPH – Report -Identification- (inpatient hospitalization)

- **Risk factors**. This section of the report shows essentially the same information as the results tab.

  Depending on the type of analysis (inpatient hospitalization, surgical area or outpatient services, the information shown in this section varies.

  For inpatient hospitalization, the values of each risk factor are shown (Figure 27). If the analysis belongs to a surgical or outpatient services, this section shows the levels of ergonomic inadequacy for

each factor considered by the methodology in each case (Figure 28 and Figure 29), respectively.

In addition, this section also includes the legend to interpret the level of MAPO risk or the levels of ergonomic inadequacy according to the case analyzed.
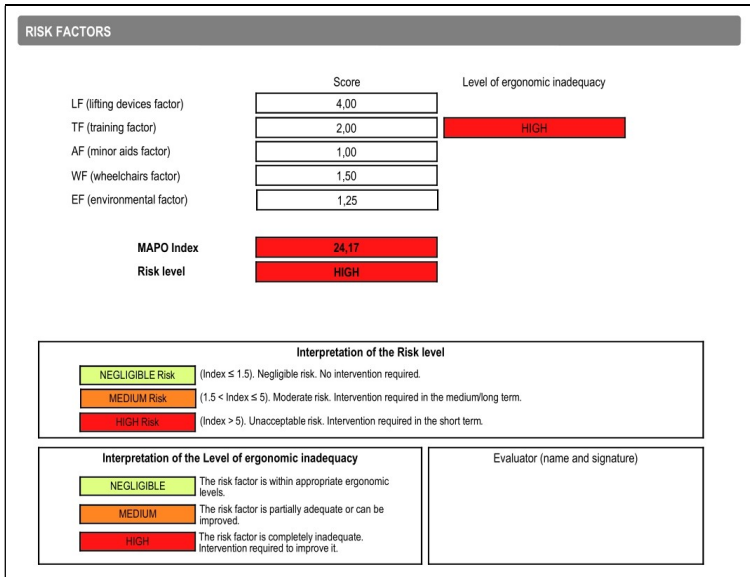

Figure 27. MAPO MPH – Report – risk factors - (inpatient hospitalization)

RISK FACTORS

	Level of ergonomic inadequacy	Risk level
LF (lifting devices factor)	MEDIUM	HIGH
TF (training factor)	HIGH	
SF (stretchers factor)	NEGLIGIBLE	
EF (environmental factor)	MEDIUM	

Interpretation of the Risk level

NEGLIGIBLE Risk	Negligible risk. The percentage of aided lifts is higher than 90%
HIGH Risk	Unacceptable risk. The percentage of aided lifts is lower than 90%

Interpretation of the Level of ergonomic inadequacy

		Evaluator (name and signature)
NEGLIGIBLE	The risk factor is within appropriate ergonomic levels.	
MEDIUM	The risk factor is partially adequate or can be improved.	
HIGH	The risk factor is completely inadequate. Intervention required to improve it.	

Figure 28. MAPO MPH – Report – risk factors - (surgical area)

RISK FACTORS

	Level of ergonomic inadequacy	Risk level
TLF (total lifting devices factor)	MEDIUM	HIGH
PLF (partial lifting devices factor)	HIGH	
TF (training factor)	MEDIUM	
WhSF (wheelchairs/stretchers factor)	MEDIUM	
EF (environmental factor)	NEGLIGIBLE	

Interpretation of the Risk level

NEGLIGIBLE Risk	Negligible risk. The percentage of aided lifts is higher than 90%
MEDIUM Risk	Moderate risk. The percentage of total aided lifts is higher than 90%, but the number of partial aided lifts is less than 90%
HIGH Risk	Unacceptable risk. The percentage of total aided lifts is lower than 90%

Interpretation of the Level of ergonomic inadequacy

		Evaluator (name and signature)
NEGLIGIBLE	The risk factor is within appropriate ergonomic levels.	
MEDIUM	The risk factor is partially adequate or can be improved.	
HIGH	The risk factor is completely inadequate. Intervention required to improve it.	

Figure 29. MAPO MPH – Report – risk factors - (outpatients services)

- **Information of the area analyzed** (Figure 30). This section provides the information of the different tabs that were completed in the case under analysis. For each tab considered by the methodology, a summary table with the data entered is provided.

HELP EQUIPMENT

Equipment and help to lift disabled patients	Number
Lift: Equipment for patient total lifting with adjustable electric mechanism	-
Height-adjustable stretcher: stretcher whose height can be changed	-
Height-adjustable bed (total)	1
Height-adjustable bed: Bed which is at least adjustable in height (electric or hydraulic mechanism) and three articulation nodes	-
Sliding sheet	-
Sliding boards	1
Ergonomic belt	-
ROLLBORD	-
Active or sit-to-stand hoist, thoracic band lift	-
Other	-

WHEELCHAIRS

Total number of wheelchairs:	11

Characteristics of ergonomic inadequacy	Number
Malfunctioning brakes	9
Non-removable or folding armrest	11
Inadequate backrest H > 90 cm; Incl > 100°	9
Maximum inadequate width > 70 cm	9
Non-removable or non-folding footrest (descriptive)	9
Poor maintenance (descriptive)	9
Total Score:	38,00
Mean wheelchair score (MSWh):	3,45

Figure 30. MAPO MPH – Report - (inpatient hospitalization)