How TELER came about

TELER is the result of intensive and extensive co-operation over ten years between a statistician and a group of about 35 physiotherapists

The origin of TELER is a question asked in 1980 when Mr le Roux (Bunny) was teaching at Sheffield Polytechnic on a research methods course. Two of the students were paediatric physiotherapists from the Children's Unit, Kings Mill Hospital, Sutton-in-Ashfield. They had read a paper entitled Physiotherapy for the spastic child: an evaluation (Develop Med Child Neurol, 1973, 15, 146-63), which reported that "physiotherapy was not found to be of value in the treatment of spastic cerebral palsy", a finding that contradicted their treatment experiences over 10 years. Bunny asked if he could read the paper and tell them why the finding was wrong.

What he realised on reading the paper, was that the researchers did not understand statistical significance or measurement. They had made two classic mistakes: they had interpreted "not statistically significant" as "treatment was not effective", and had not defined what they had intended to measure.

According to statistical theory "not statistically significant" does not mean "treatment was not effective", it means "there is insufficient evidence for drawing a conclusion". Equally, "statistically significant" does not mean "treatment was effective", it means "there is sufficient evidence for drawing a conclusion".

So, in order to answer the question "was treatment effective?"
1. "treatment" needs to be defined before a trial begins
2. the attributes selected for measurement are identified by the definition of "treatment"
3. the method of measurement is appropriate for the selected attributes
4. "effective" is defined before a trial begins

The conclusion by the researchers that physiotherapy has no value in the treatment of spastic cerebral palsy is invalid because "physiotherapy" was not defined before the trial began, the attributes selected for measurement were not identified by the definition of "physiotherapy" and "effective" was not defined before the trial began

The basis for a valid conclusion

The basis for a valid conclusion about the effectiveness of physiotherapy is a list of the signs and symptoms to be treated. Suppose they are:
- poor balance
- difficulty shifting weight
- poor posture

Then "physiotherapy" consists of treatment to:
- improve balance
- improve ability to shift weight
- improve posture

The attributes to be measured are:
- ability to balance
- ability to shift weight
- ability to achieve symmetry in posture

The definition of "effective" within the statement "the effects of a lesion of the motor cortex has been reduced" can be defined more specifically as:

- the ability to balance has improved by 50% or more
- the ability to shift weight has improved by 50% or more
- the ability to achieve symmetry has improved by 50% or more

The definitions of "physiotherapy" available at the time did not provide a basis for defining "ability", and did not specify:

- the outcome required of physiotherapy
- how the outcome was to be achieved
- a basis for measuring the effectiveness of physiotherapy

The task of developing a definition that did so began in mid-1982 and was undertaken by three physiotherapy research interest groups.

The definition of physiotherapy was developed by Physiotherapy Research Interest Groups in Central Nottinghamshire Health Authority, North Lincolnshire Health Authority and Bassetlaw Health Authority. The definition was developed in seven stages:

1. 35 physiotherapists wrote essays giving a detailed description of everything that was done during one treatment period with one patient
2. a content analysis was done of 55 essays to identify the activities performed during treatment
3. a form was designed for recording the activities performed during treatment
4. the members of the research interest groups completed the form for 4 treatments on up to 4 patients
5. the forms completed for 67 patients and 268 treatments were analysed
6. the results were used to develop a draft definition of physiotherapy
7. members of the research interest groups developed the draft definition into an agreed definition using an adapted Delphi Method

The adapted Delphi Method required a visit to each Research Interest Group in turn to present the latest version of the definition, note agreed changes, make the changes and present the revised definition to the next Group until consensus was achieved. The definition agreed early in 1985 after 12 agreed revisions during 62 Group meetings and 6 open meetings was, and still is:

Physiotherapy intervention is the process which, following mechanical, pathological and/or psychological disorder, uses physical, managerial and communicative means in a holistic approach

- to assess and monitor the individual's response to intervention
- to promote the development, restoration, maintenance of the individual's optimal function
- to prevent mechanical, pathological, psychological disorder
- to enhance the individual's quality of life

Physical means are:

- activities such as exercise, manipulation, massage, mobilisation
- agents such as heat, light, sound, cold, electricity
- others such as acupuncture, therapeutic touch, hippotherapy

Managerial means are:

- the techniques, practices of organising and controlling the physiotherapy process, and the skilful and resourceful use of time, materials, etc

Communication means are those of:

- an education-counselling approach to impart or exchange information and ideas

The outcome required of physiotherapy is identified by this definition as "restore or maintain optimal function". Optimal function is an ability such as:

- sitting balance
- make a hot drink safely
- get out of chair
- turn a door knob
- breath unaided
- close eyelid
- put thumb to base of little finger
- catch a ball
- stand unsupported in free space
- sleep normally
- self administer medicine correctly

Mechanical, pathological or psychological disorder always produces at least a partial loss of ability.
A partial loss of the ability:

- sitting balance can be the loss of the ability to regain mid-line after moving
- make a hot drink safely can be the loss of the ability to routinely add water to the kettle
- get out of chair can be the loss of the ability to lift bottom off chair
- turn a door knob can be the loss of the ability to rotate wrist
- breath unaided can be the loss of the ability to breath unaided during the night
- open eyelid can be the loss of the ability to keep the eyelid open
- move thumb to base of little finger can be the loss of the ability to move the thumb further than the base of the middle finger
- catch a ball can be the loss of the ability to judge the flight of the ball
- stand unsupported in free space can be the loss of the ability being able to stand by holding on with one hand
- sleep normally can be the loss of the ability to find the usual sleeping position
- self administer medicine correctly can be the loss of the ability to remember the routine for medication

The outcome required of physiotherapy is achieved when a lost ability has been restored or an existing ability has been maintained. An ability does not have shape; a dimension such as length, area, volume, weight; is not amenable to measurement by conventional measuring scales for size and weight on an interval or ratio scale.
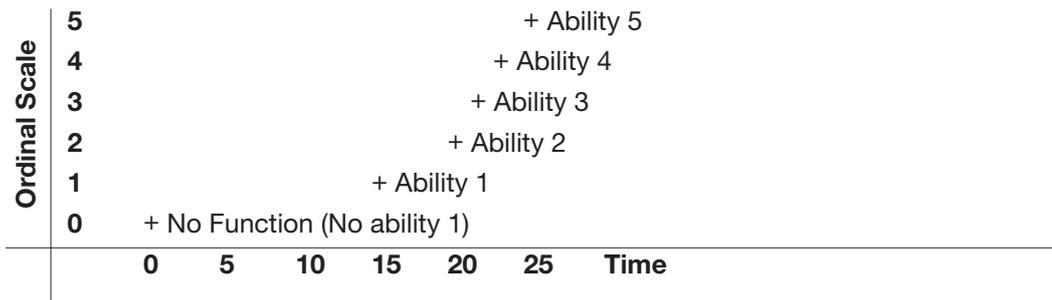
An ability is amenable to measurement by verbal description.

Measuring the effect of physiotherapy by verbal description.
A verbal description may be:

- nominal - a label on a nominal scale
- ordinal - a label on an ordinal scale
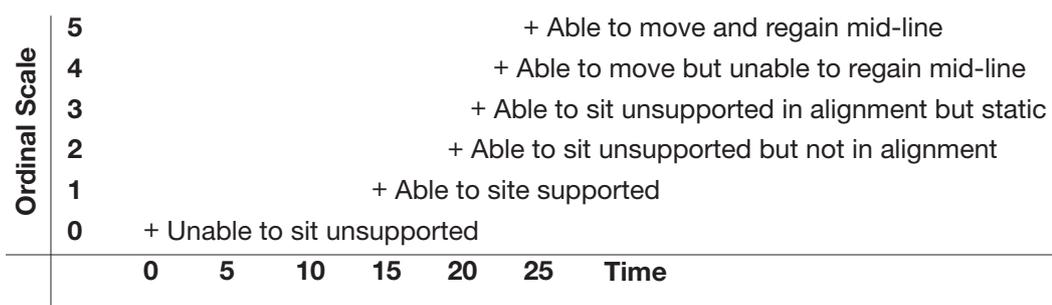- a development curve

Development curve for a Function

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     5                           + Ability 5
     4                           + Ability 4
Ordinal Scale
     3                         + Ability 3
     2                       + Ability 2
     1                     + Ability 1
     0     + No Function (No ability 1)
          0    5   10   15   20   25    Time
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Clinical knowledge identifies:

- the development curve for a function
- the hierarchy of abilities needed by a function
- the labels on the ordinal scale for measuring a function

Development curve for the Function *Sitting Balance*

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     5                     + Able to move and regain mid-line
     4                     + Able to move but unable to regain mid-line
Ordinal Scale
     3                   + Able to sit unsupported in alignment but static
     2                 + Able to sit unsupported but not in alignment
     1               + Able to site supported
     0     + Unable to sit unsupported
          0    5   10   15   20   25    Time
```

When the variable time is ignored, the development curve for the function *Sitting Balance* becomes:

Hierarchy of abilities for the function Sitting Balance

5 Able to move and regain mid-line

4 Able to move but unable to regain mid-line

3 Able to sit unsupported in alignment but static

2 Able to sit unsupported but not in alignment

1 Able to site supported

0 Unable to sit unsupported

Which becomes:

Sitting Balance

0 Unable to sit unsupported

1 Able to site supported

2 Able to sit unsupported but not in alignment

3 Able to sit unsupported in alignment but static

4 Able to move but unable to regain mid-line

5 Able to move and regain mid-line

Every function consists of a different hierarchy of abilities and requires a different measuring scale which did not exist already, so the Research Interest Groups undertook the task of producing a selection called TELER indicators.

The TELER indicator satisfies the requirements of the Theory of Measuring Scales, Stevens, S S (1946), On the theory of measuring scales, Science, 103, pages 667-80, and Senders, Virginia L (1958), Measurement and Statistics OUP, New York, pages 50-70.

The TELER indicator gives valid ordinal measurements when:
- each numeral (code) on its scale denotes a clinically significant ability
- the definition of each ability is singular
- the difference between two numerals (codes) on its scale denotes a clinically significant difference
- the definition of each clinically significant difference is singular

An ability is clinically significant when:
- clinical knowledge explains why it is needed by the patient

An ability is singular when it has:
- one and only one meaning
- a unique meaning

A difference is clinically significant when:
- clinical knowledge explains why the two abilities are different
- clinical knowledge explains how the difference occurred

A difference is singular when it has:
- one and only one meaning
- a unique meaning

The Research Interest Groups found that calibrating the TELER indicator for a problem was more difficult than they had expected. They had considerable difficulty mastering the concept of singularity and the concept of clinical significance. This is illustrated with the first versions of two of the very early indicators produced:
- putting on/off limb
- walking distance

The first version of the indicator for putting on/off limb is:

Putting on/off limb
1. Applied by assistant
2. Helped on & taken off alone
3. On & off alone - difficult
4. On & off alone easily
5. On & off in standing

Consider the definition of Code 3 - it is not singular and for a particular patient has one of three meanings:
- putting on the limb is difficult
- taking off the limb is difficult
- putting on and taking off the limb is difficult

If Code 3 means "putting on the limb is difficult", it will have one or more of the following meanings:
- placing the covering on the stump is difficult
- placing the bedding on the stump is difficult
- positioning the stump on the limb is difficult
- holding the limb in position while fastening the straps is difficult
- using the fasteners on the straps is difficult
- adjusting the pressure on the stump is difficult

If Code 3 means "taking off the limb is difficult", it will have one or more of the following meanings:
- holding the limb in position while undoing the straps is difficult
- using the fasteners on the straps is difficult
- removing the bedding from the stump is difficult
- removing the covering from the stump is difficult
- checking for signs of pressure sores developing is difficult.

Code 3 does not have a unique meaning, therefore is not a valid measurement.

A later version of the indicator is:
Putting on and taking off artificial limb
1. Patient can take off limb with assistance
2. Patient can take off limb without assistance
3. Patient can partially put on limb but needs assistance to complete putting it on, and can take it off without assistance
4. Patient can put limb on and can take it off but the limb needs further adjustment from an assistant when on
5. Patient can put limb on and take it off Independently

The first version of the indicator for walking distance is:
Walking distance
1. 10 metres
2 . 20 metres
3 . 40 metres
4 . 100 metres
5 . More

There was no evidence that any of the distances was clinically significant or served the needs of the patient.

A later version of the indicator is:
Walking distance
1. Walks about department with frequent rests due to pain
2. Walks about department with no pain
3. Walks to dining room, pain necessitates rest half way
4. Walks to dining room, ache at end
5. Walks to dining room, pain free

This indicator does not measure the patient's achievement on the walk back - another indicator is needed to do that.

Indicators were developed using the modified Delphi Method and testing them on patients. The agreed definition for an indicator often did not accurately reflect the changes seen in patients and was too insensitive to measure accurately the changes patients had experienced and the effects of physiotherapy on a patient.

This situation continued until it was realised that indicators were being developed for signs and symptoms instead of the problems the patient was experiencing or the loss of abilities the patient had suffered.

The situation was resolved by introducing a three-stage procedure for identifying the problem list for a patient:

Stage 1: Record diagnosis
Stage 2: Record clinical signs and symptoms
Stage 3: Record clinical or managerial problems

For example:

Diagnosis	Clinical signs & symptoms	Clinical &/or managerial problems*
Stroke - left	Loss of mobility	Poor sitting balance
	Depression	Unable to wash self
	Painful shoulder	Disturbed sleep
* Each clinical and /or managerial problem is the title of a TELER Indicator		

TELER indicator codes recorded in sequence show the clinically significant changes experienced by a patient and the effects of treatment on the patient.

The Groups wrote their patient notes in the form of Patient Orientated Medical Records which did not allow for the sequential recording of TELER indicator codes, required an additional page to allow for, the sequential recording of TELER indicator codes

The TELER form

The Groups undertook the task of designing a form for recording TELER indicators by obtaining an agreed design using the adapted Delphi Method and testing the agreed design on patients.

With this procedure
- Design 1 became Design 2
- Design 2 became Design 3
- Design 3 became Design 4
- Design 4 became Design 4A

The testing of Design 4A demonstrated that the content of the design was not specific enough to show the effect of treatment. It was decided that each function associated with a clinical condition should have a separate form. Design 4A became Design 5 with each function denoting a version of Design 5. Testing showed the content of Design 5 for a specific function provided enough information to show the effect of treatment. The number of different forms required made the design impractical. It was decided the design of the form should be less specific but should reflect the definition of physiotherapy.

Consequently,
- Design 5 became Design 6
- Design 6 became Design 7

Four versions of Design 7 all showed the design had achieved the aim of the effect of treatment. The Groups decided the form should be incorporated into the design of Problem Orientated Medical Records, and Design 7 became Design 8.

Six versions of Design 8 all showed the design required too much writing most of it unnecessary. Refinement of Design 8 produced Design 9 - the basic TELER form for therapy.

In 1992 the three Research Groups started using TELER routinely on their patients.