In reviewing Tripod Beta analyses in the health care industry (e.g. hospitals), Ed Janssen and John Sherban, two Tripod Beta assessors, came across frequently made mistakes. Collecting information on the symptoms and diagnosing the cause are often seen as the most important barriers to prevent the end event - to minimize the harm. Once a correct diagnosis is available, the organization and patient rely on the competency of the practitioner(s) supported by the established protocols. Missing, incorrect, or incomplete information is often seen as a missing or failed barrier. From a theoretical point of view based on Tripod Beta concepts, this is wrong. This paper attempts to demonstrate some correct ways to deal with these issues by presenting a few practical examples.
Background

When analysing incidents within the health care industry (e.g. hospitals), often the focus is on preventing harm to the patient. Because of this, when using the Tripod Beta analysis methodology, the harm to the patient is usually described as the end event (and often as intermediate events as well). In such cases the object is typically (the affected body part of) the patient with more detailed information about the disease added sometimes, as the harm evolves.

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The complexity of the problem

From a theoretical point of view based on Tripod Beta concepts, such information and the subsequent diagnosis cannot be barriers to prevent or minimise the harm to a patient because these cannot by themselves stop the harm progression or energy flow. (Refer to the definition of a Tripod Beta barrier and the requirement for direct functionality.) The business processes of information gathering and diagnosis correctly belong on the Tripod Beta precondition level. Possible reasons for this confusion are:

- The analysts do not make a clear distinction in the objectives for their analysis. For example, is the objective to analyze the harm to the patient or is it to analyze the process disruption during the collection of the information required for diagnosis?
- Differences in the definitions and terminology used by different analysis methodologies, and/or with general usage of common words.

The solution

This paper attempts to demonstrate some correct ways to deal with these issues by presenting a few practical examples.

Generally speaking, there are multiple options, besides the freedom of phrasing options, to arrive at a correct Tripod Beta tree (i.e. incident model) of an incident in a health care context. For example:

1. Using a Tripod tree where the main event is described as some ‘Preventable harm to the patient’. In such a tree, the issues associated with gathering the required information, and the subsequent diagnosis based on this information (both of which could be missing, incomplete, or incorrect) can be dealt with at the Tripod precondition level.
2. Modeling the incident with two separate Tripod Beta trees. The first would be a Tripod tree where the end event describes the error(s) in the processes of gathering the required information or the diagnosis. The second could be a separate Tripod Beta tree such as that outlined as the first option mentioned above with the information from the first tree included in summarized form at the precondition level in the second tree.

3. Using a combined Tripod tree where the process disturbance is modelled in the first event (Trio), and the harm to the patient is modelled in a following event (Trio).

Examples of these approaches are provided below.

**Example 1**
A patient reports into Hospital 1. Based on examination, a tumour is diagnosed. For the required surgery, the patient is referred to a specialised Hospital 2. After the surgery, the patient is transferred to Hospital 3 for the post-treatment. All this happens within a few days. During the transfers of the patient, information about the patient is also transferred. However, part of the information which was transferred from Hospital 1 to Hospital 2 did not arrive at Hospital 3. Two years later the patient reports ill again. This illness, most probably, could have been prevented if all the information from Hospital 1 had been transferred to Hospital 3 when the patient was first transferred there.

Some possible (partial and generic) Tripod Beta trees that could be developed are shown below.

**Correct option 1: information and/or diagnosis at precondition level.**

**Correct option 2: end event being the incomplete/wrong information or diagnosis.**

However, an incorrect Tripod tree would be:

**Example 2**
A patient was treated for some illness. It is known that this illness, whether or not in combination with the treatment, can lead to a second illness. Through regular checking of the patient, this second illness can be
detected at an early stage prior to symptoms developing, such that treatment has a greater chance of success to prevent the second illness from progressing. Regular checking of this patient was interrupted (stopped) by mistake, and a few years later the patient reported with serious health problems. The second disease has progressed such that major surgery is necessary and serious permanent harm to the patient can no longer be prevented.

Correct option 1: information and/or diagnosis at precondition level.

Correct option 2: end or intermediate event with the incomplete/ wrong information/ diagnosis/ treatment.

Note how similar these two options are because both ultimately must lead to the correct barrier (i.e. timely treatment of the patient) to prevent major surgery. Critical information for learning is described in the causation path for the failed barrier - Why was the treatment not effective?

However, an incorrect Tripod tree for example 2 could be:

Note that in this case, evidence presented is that if the symptoms of disease develop to the point that the patient reports to the practitioner, then the disease has already developed beyond the point where treatment has a high chance of being effective. In some cases, patient reporting symptoms to a practitioner might also be a precondition in the two correct options above; however, in this example this information would be communicated too late to support effective treatment.

Example 3

This is an example of a similar incomplete treatment because of missing information resulting in a failed barrier, for example, a “finding by chance” on an X-ray photo which is not communicated to the medical practitioner.

Correct Option 1 - information and/or diagnosis at precondition level:
Note: In the last trio in this example, the following barrier options are also possible:

- Effective barrier(s) in the object line which minimized or prevented the patient from dying. The event would therefore be represented as a potential event; and
- Barriers in the object line that worked as designed but were not capable to prevent the severity of the event. These barriers are represented as inadequate barriers.

**Correct Option 2** - end event with the incomplete/wrong information and/or diagnosis:

According to Tripod Beta theory, passing on information is not a barrier which is able by itself to stop the energy resulting from disease 2. Only the treatment/therapy has the functionality to stop this disease progression. Passing on information is not the barrier but an enabler for the barrier. Not passing on the information is one precondition influencing the practitioner’s actions.

**Example 4**

A completely different example is a case concerning the so-called ‘double check’ - a type of independent verification. With correct phrasing the double check can be a functional barrier preventing the following event.

Because of a period of high workload expected later in the day, Nurse 1 decides to prepare medication A in advance, knowing that it will be needed later on. However, the written medication order is not available yet. The nurse makes an error and prepares medication B instead of A. (This medication B is prepared fully according to the protocol for medication B but is marked in error as A).

Nurse 2 is not present/available for an independent double check at this time. At some later time, Nurse 2 does check this medication but not properly in accordance with the protocol (without intermediate contact with Nurse 1 and without reference to the written medication order that is still not available), and signs off for its correctness.

Thereafter, this wrong medication B is also wrongly administered to the patient (epidural catheter instead of through intravenous delivery) with the medical practitioner present. Medication A should be administered via epidural catheter while medication B should be administered intravenously.
**Option 1: Correct version but a lot of room for improvement**

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Need to prepare medication A
  Preparation on the basis of a written medication order
  Preparation on the basis of a verbal medication order
  Double check in conformance with the protocol (e.g. read back order with written medication order)

Wrong medication is ready (B in stead of A)
  Do not dispense without double checking the combination: patient/medication/medication order
  Connections of intravenous medication and epidural catheter do not match

Patient receives wrong medication (B instead of A)
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**Option 2: A much better version**

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Need to administer medication to patient
  Nurse wants to prepare medication A for later delivery to a patient
  Medication A prepared according to a written medication order
  Medication A prepared according to a verbal medication order with read back confirmation
  Independent verification (double check) that medication A was prepared in conformance with the order and preparation protocol

Wrong medication (B instead of A) administered to the patient in the wrong manner (as A instead of B)
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**Example 5**

At some date (xx+3)-20yy, Mrs. A, in the presence of her husband, reports to her practitioner because of abdominal pain. Mr. A speaks the local language with the practitioner; however, Mrs. A hardly speaks this language at all. Mr. A tells the practitioner that the pain has already existed for about five years with varying intensity. According to Mr. A, his wife had keyhole surgery about 15 years ago to remove gallstones and leaving the gallbladder in place. This surgery was done in Hospital D but this fact is not known by the practitioner.

The differential diagnosis is constipation and cholecystitis. Based on this information the GP orders an ultrasound examination on date (xx+4)-20yy. The observation of Radiologist 1 is that although the gallbladder is hard to identify; in that area, a large concrement is visible. Radiologist 1 concludes that this is probably a large stone inside the gallbladder.

Based on this information, the GP refers Mrs. A to Surgeon 1.

On date (xx+11)-20yy, Mrs. A reports, together with her husband, at the outpatient clinic where Surgeon 1 works. He checks the
reports from two ultrasound (US) exams. The first was done about one year prior, upon which Radiologist 2 indicated that a gallbladder without concrements is visible, and the second US from date (xx+4)-20yy. Surgeon 1 also sees the scars of the operation from about 15 years ago. Since it would be strange that a laparoscopic keyhole surgery was performed, and that only the stones were removed while leaving the gallbladder in place, Surgeon 1 asks the outpatient clinic assistant to call Hospital D to obtain the information from that operation. The Secretary of the surgeons in Hospital D indicates she found no data on that gallbladder surgery, and found no operation report either. On this basis, Surgeon 1 moves the planning of a laparoscopic operation forward to speed up the process, since Mrs. A was in a lot of pain. The surgery was scheduled and on date (xx+18)-20yy Mrs. A reports for the laparoscopic surgery. During the surgery, Surgeon 1 sees that the gallbladder has in fact been removed (he sees the associated clips). Immediately after this surgery, he asks again for information from Hospital D. This time they send him a surgery report from about 15 years ago. It states that the gallbladder has indeed been removed.

Example of a correct although limited Trio focused on receiving all the correct information needed for diagnosis and treatment.