**PDSA Cycle [1]**

**Aim:** what are you trying to accomplish?

1) To establish the first design for the new fluid chart.

* The chart included an ‘indications column,’ a ‘cautions box,’ and a management column titled ‘after this bag.’ These were additions to previous chart in Trust.
* The cautions box was located at the top of chart in red to clearly highlight co-morbidities to prescribers. Tick boxes next to ‘heart failure,’ ‘renal failure,’ ‘liver failure,’ ‘other- specify’ (with space next to it for free text) and ‘none,’ were listed in the box for ease.
* An indications column at the beginning of the chart was introduced to encourage consideration over why fluids were being given. In this first design, the box was left blank for free text
* An ‘after this bag,’ column was added towards the end of the chart with three options for prescribers to circle; ‘review patient,’ ‘continue fluids,’ or ‘stop fluids.’

2) To establish if the new design helped align NBT fluid prescription with NICE recommendations.

3) To establish where the chart could be improved upon to further improve fluid prescribing.

**Plan:** what will your test be?

The new fluid prescription chart was introduced to the surgical assessment unit and four medical wards. The old chart was temporarily removed so that the new chart would be used. The head of nursing, and subsequently all nursing staff, were informed on the day of roll out and any questions or queries were answered before their use. This was accompanied by a brief teaching session to the relevant doctors on the ward and posters being displayed on the wards to highlight the new chart. After a two-week period, data was collected on documentation of indication, co-morbidities and fluid management plans.

**Prediction:** what do you think will happen as a result of your test?

It was expected that these measures would improve documentation, and subsequent communication of indication for fluids, co-morbidities and fluid management plans. It was predicted that this would improve safety of fluid prescription at NBT, and would logically reduce fluid error associated mortality and morbidity.

**Do:** what happened when you carried out your test?

The following results were recorded:

* Indication was stated in 96% of the time on the chart and 58% in corresponding notes
* One of three options for ‘after this bag,’ was circled 87% of the time
* Comorbidities were documented 65% of the time with 93% accuracy.

**Study:** how did the results of your test compare with predictions?

As predicted there was an improvement in documentation of indication, comorbidities and fluid management plans. The improvement was outstanding, considering pilot study results gave the following data:

* + An indication was found in only 26% of notes
  + It took an average of 4.6 minutes to find co-morbidities in notes, easy access did not exist
  + Further management plans were rarely documented

**Act:** how will you change your previous test in light of what you have learned?

As this was only the first cycle, our next efforts were to see if documentation of these three measures could be maximized even further. We had not anticipated such dramatic change during our first cycle, but drew a lot of positivity from it. We were clearly on the right track.

**PDSA Cycle [2]**

**Aim:** what are you trying to accomplish?

To make further amendments to the fluid chart design to improve the data/safe prescription

**Plan:** what will your test be?

We introduced the second version of the fluid prescription chart onto the same wards. Informal feedback from nursing staff and other members of the team were collected and taken into consideration during this process.

It was suggested that leaving the indications column as free text was too open, and tick box options would improve use of this space. NICE suggest there are 3 broad indications for fluid prescription in their guidelines- resuscitation, routine maintenance, and replacement. Therefore, we included these as options in the indications column in chart 2.

We discussed how the cautions box could be improved. It was suggested that listing heart, liver, and renal failure was too broad to be accurate, despite including ‘other-specify,’ and ‘none.’ We therefore added ‘specify,’ to follow on from the failures in the hope that this would give people more freedom to complete the chart how they saw fit.

This chart was accompanied by a formal presentation at the monthly foundation year 1 trust teaching, and a further poster campaign that was extended to all clinical areas.

**Prediction:** what do you think will happen as a result of your test?

Having incorporated changes reflecting feedback from interested parties we expected our next set of data to show improvement in documentation.

**Do:** what happened when you carried out your test?

The following results were observed:

* Indication was documented less on the chart, with reduction from 96 to 77% of the time, but was documented more frequently in notes, rising from 59 to 71%. This suggested that prescribers preferred free text, and perhaps documented more frequently in notes to clarify exact indication that they did not feel fit well with one of the three broad categories.
* ‘After this bag,’ was filled out 68% of the time compared to 87% of the time with the first chart, despite no change in design. We speculated that this may have been subject to a new group of juniors using the charts, as they were released during change of jobs.
* The comorbidities box was completed 50% of the time, compared to 65% in the first chart, although accuracy improved from 93% to 96%. We wondered if the ‘specify,’ next to each failure induced concern over accuracy, and therefore lead to a reduction in documentation as prescibers became unsure how to specify. We also reflected that ‘specify,’ meant it would take longer for prescribers to write a prescription, and perhaps the additional effort required reduced documentation.

**Study:** how did the results of your test compare with predictions?

Contrary to our predictions, the changes to the chart reduced documentation over all in all three measures.

**Act:** how will you change your previous test in light of what you have learned?

We analysed our results and feed-back and set out to re-design our chart to once again improve our data and safety of fluid prescription at NBT.

**PDSA Cycle [3]**

**Aim:** what are you trying to accomplish?

To finalise a sustainable fluid prescription chart that would maximize documentation of our measures and align fluid prescription with NICE guidelines.

**Plan:** what will your test be?

We reverted back to free text in the indications column, educated junior doctors about the importance of specifying after the failures in the comorbidities box, for example, after ‘renal failure,’ to write ‘acute on chronic,’ or ‘chronic’ or ‘new renal failure.’ We explained, they could be even more specific and document type I- V renal failure, depending on time and knowledge of patient. However, mainly we emphasized that it was better to tick one of the failures if applicable than not at all, leaving ‘specify,’ empty if uncertain. It came to our attention that circling one of the three options for what to do after the fluid finished, could look ambiguous, and therefore we changed it to a tick box system. We also changed the wording of the ‘continue fluids,’ option to ‘give next prescribed bag,’ to stop prescribers from writing up several bags of fluids without review.

This chart was accompanied by all of the essential advertising and education as the previous charts, but in addition, we took the chart to all the required hospital committees to gain approval for its use trust wide.

**Prediction:** what do you think will happen as a result of your test?

We expected our results to revert back to those following the introduction of the first design.

**Do:** what happened when you carried out your test?

There was improvement in documentation of 2/3 measures with chart 3.

* + An indication was given in 72% of cases compared to 77% with chart 2,
  + Co-morbidities were documented on 64% of charts with 93% accuracy, compared to 50% with 96% accuracy in chart 2,
  + Further management was documented in 100% of cases compared to 68% with chart 2.

**Study:** how did the results of your test compare with predictions?

Overall there was an improvement in our measures with chart 3 compared to chart 2, in line with our prediction. There was a slight decrease in the number of cases where an indication was given, but seeing as the design for the indications column was exactly the same as in chart 1 where an inidication was recorded in 96%, this should perhaps be interpreted as a range that can be expected with that design.

**Act:** how will you change your previous test in light of what you have learned?

As chart 3 made use of all feedback and data accumulated, we decided to make no further changes and to use this deisgn layout as a prototype escalation Trust wide.