

Table 1: Summary Table of PDSAs

PDSA	Learning Question	Prediction	Study	Act
1	Can staff education decrease polypharmacy?	Reduction in polypharmacy. Staff generate ideas.	Reduction but not sustained. Suggestion of PRN Paracetamol.	Written information for induction. PRN Paracetamol adopted.
2	Does encouraging use of compound laxatives help?	Reduction in number of drugs and number of tablets.	30% reduction in number of tablets.	Refine laxative chart and highlight maximum doses.
3	Can education on dose strengths with guidelines help?	Reduction in number of tablets.	No change despite knowledge improving 17%.	Abandoned as ineffective and labour intensive.
4	Identify patients with polypharmacy. Checklist in notes for review.	Number of tablets reduce and start culture of polypharmacy review.	Maintained improvement during doctor swap over.	Checklist can get 'lost' in notes. To target prescription chart.
5	Compare checklist in notes, sticker on prescription and pharmacist on round.	Biggest reduction with pharmacist, then sticker then checklist.	29% reduction with Pharmacist. Sticker and checklist work better together.	Implement checklist and sticker. Pharmacist on rounds when able to.
6a	Determine patients' perception of medication burden.	Patients feel they are taking too many but it's not possible to reduce.	Results as predicted but large group excluded from survey.	Look to see if reduction is possible in these patients.
6b	Can medication review reduce number of tablets in 2 patients?	Modest reduction in number of tablets for 1 patient.	37% reduction in number of tablets for 1 patient.	Repeat for more patients who feel are on too many tablets.
6c	Can medication review reduce number of tablets in 4 patients?	$\frac{3}{4}$ will achieve reduction in number of tablets by 30%.	50% achieved reduction in number of tablets by 33-46%.	Drs and pharmacist to ask all patients if no. of tablets a problem?

PDSA Cycle 1

Aim: what are you trying to accomplish?

Reduction in polypharmacy on the pilot ward by educating staff on the problem.

Plan: what will your test be?

To introduce the project and present baseline data to the ward staff in an education session using visually appealing 'cakeometer' with 73 sweets on top, representing one patients regular daily tablet burden.

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

We will see increased drug rationalization and a reduction in polypharmacy but that this will not be sustained. Will also predict that there will be suggestions on how the problem can be tackled.

Do: what happened when you carried out your test?

Difficult to find suitable time for the presentation therefore had to be repeated several times to 'catch' all the doctors. It proved difficult to engage nursing staff with this presentation format. Staff generated a number of suggestions: 1) Highlight charts/notes of patients with more than 10 drugs for consultant/pharmacist review. 2) Target laxatives and paracetamol. 3) Further study of discharged patients on more than 10 drugs to see if rationalization possible. 4) Get patients' opinions/ perception of burden. 5) Target patients that are predicted to die in the next week and rationalize drugs. 6) Nursing staff to highlight patients on too many medicines using a sticker.

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

We saw a shift down in the number of medications and number of tablets. The consultant has already started targeting regular paracetamol and doing a trial of 'as required' paracetamol, therefore not going to be possible to look at this as a separate PDSA. As predicted we saw a loss of effect coinciding with the August doctor swap-over and annual leave of the project leads, AP and JP.

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

We have identified the need to look at counterbalance measures, particularly 'as required' medication as a proxy measure that we are not getting increased symptoms. An interim measure is to look at 'as required' controlled drug use for both wards from the controlled drugs registers. We need to re-design the data collection forms to look at all 'as required' medication use on the pilot ward. We need to data collect on Mondays in order to get this information. Sustainability needs to be looked at in form of written information perhaps in the form of posters to back up education. Polypharmacy needs to be included as an induction topic for the new doctors. Repeated education session has highlighted the need for easily accessible information on common drug strengths which will be looked at in another PDSA. JP raised idea of developing an area on the doctors' office board for information on polypharmacy.

PDSA Cycle 2**Aim:** what are you trying to accomplish?

Reduction in polypharmacy on the pilot ward by targeting laxatives which we know from our baseline data are a high frequency medication.

Plan: what will your test be?

We are going to develop a guide to choosing a laxative for hospice in-patient which is in keeping with palliative care guidelines, acceptable to our consultants and minimizes the number of tablets and volume of liquids.
AP and JP will develop the pilot guide by 8/9/14 and DR will organize four laminated copies so that they can be placed in strategic places in ward offices. AP will arrange a general teaching session on constipation for our doctors and introduce the guide.

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

We predict that this will cause a reduction in the mean no of tabs by 20% (16 to 13) but will have less of an effect on no of drugs, probably less than 10%.

Do: what happened when you carried out your test?

Education session carried out and guide introduced but due to 'polypostery' the guide has been put on the desktop of the computer as well as on the doctors offices' noticeboard.

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

Looking at the run chart on the pilot ward we found a 30% reduction in number of tablets 2 weeks later but the number of medications were static and no major difference in number of mls of liquid medication.

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

Targeting laxatives is a very useful strategy and although on desktop of computer it may be worthwhile having copy with the ward 'conversion charts'. Some refinements to the current chart need to be made to make it more visually appealing and to highlight stopping constipating drugs where possible. It also needs to highlight the maximum doses as knowledge of this is poor and we are not always maximizing the laxative selected.

PDSA Cycle 3

Aim: what are you trying to accomplish?

Reduction in polypharmacy on the pilot ward by improving knowledge on dose strengths. Knowledge of dose strengths has been highlighted by the prescribing doctors as needing improvement at an education session.

Plan: what will your test be?

Knowledge has been measured by a pre-intervention anonymous survey which gave an average score of 10/30. Education sessions in form of a game (8/10/2014 and 10/10/2014) on dose sizes of common drugs used at the hospice and a colourful, laminated 'common dose size' poster developed to back up the education session to be kept with the 'conversion charts' on the ward. We plan to measure effectiveness of the education with a repeat anonymous survey in a few weeks' time.

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

Predict that knowledge of dose sizes will improve and hopefully will be sustained by the written resources. We hope to see a decrease in the number of tablets <10% but should not cause any decrease in no of drugs. We predict that the post intervention survey will improve knowledge.

Do: what happened when you carried out your test?

The education was well received. On the pilot ward, the number of drugs did not alter however the number of tablets increased on the run chart (but within limits on the U chart). However number of mls of liquid medication did decrease (probably because less macrogols being prescribed). Post-education survey showed that the average score was 15/30.

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

The education was effective by an improvement in the average score but it's not possible to tell if every individual improved as the survey was anonymous. It may be with different education the knowledge could be improved further. However this intervention did not produce any reduction in the number of tablets.

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

As improved knowledge of dose strengths didn't achieve our aim and was labour intensive we should abandon the education on drug strengths. It may be helpful to keep on the checklist for the pharmacist to highlight where better choice of dose strengths could help reduce the medication burden.

PDSA Cycle 4**Aim:** what are you trying to accomplish?

Reducing polypharmacy on pilot ward by highlighting patients with major polypharmacy that require a medication review.

Plan: what will your test be?

Need to highlight the patients with more than 10 drugs or more than 20 tablets which can be done with the weekly point prevalence data collection. On the following Monday the patients need to be highlighted for the consultant ward round to apply the polypharmacy checklist

- 1) trial of 'as required' paracetamol?
- 2) rationalize laxatives?
- 3) consider dose strengths available
- 4) other suggestions e.g. potentially inappropriate medicines?)

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

Predict that this will reduce medication and number of tablets for these patients with major polypharmacy but the overall reduction at the ward level will be smaller (5%). However by applying this checklist and observing how the consultant does this, will mean the process will become more routine and will be applied by all prescribing staff for all patients and could be the way for the adoption of culture change.

Do: what happened when you carried out your test?

We are finding that there are approximately two patients a week for major polypharmacy review therefore the workload is not too onerous. Decision made not to keep re-stickering the same patient unless there is something new to consider. We also needed to highlight in the ward book which patients need reviewing.

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

Use of the checklist has helped sustain our improvement and coped with the changeover of junior doctors on the ward. However we are finding that the checklist stickers are getting 'lost' in the notes particularly when there is a lot of documentation in the notes over the weekend prior to the consultant ward round.

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

We will adopt the checklist sticker for the notes with some format changes to make it stand out more. In that the checklist can get 'lost' in the notes we are going to test the use of an alert sticker on the prescription chart.

PDSA Cycle 5

Aim: what are you trying to accomplish?

Reducing polypharmacy on pilot ward by highlighting patients with major polypharmacy that require a medication review.

Plan: what will your test be?

The pharmacist will identify and highlight polypharmacy patients after the weekly pill count on a Friday. A factorial design comparing checklist in notes, sticker on medicine chart and pharmacist on ward round in combination or alone will be carried out. The sticker on the medicine chart will reduce the no. of lines to prescribe on by one (less draconian than the other suggestion of gluing two pages together which would reduce by eight, but rejected due to it being desperately unpopular with the doctors and also we know that transcribing charts is a source of error). The sticker on the medicine chart is unlikely to get lost in the notes if there are a lot of entries over weekend and more likely to be seen by consultant on the ward round. The pharmacist will design a sticker to fit on medicine chart and as soon as these are printed, to start this cycle. The pharmacist will assign consecutive polypharmacy patients to the groups and in order to strengthen the data, multiple patients were assigned to each combination of factors.

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

We expect that pharmacist being on the ward round will reduce polypharmacy to the greatest extent. We feel the sticker on the medicine chart will be better than the checklist in the notes but that the two together being better than either alone. We are hoping that these will help the sustainability of the project and will stop the rise in polypharmacy rather than reduce the number further.

Do: what happened when you carried out your test?

Data collection took several weeks. Assigning consecutive patients to the groups could not be done in order as planned as the pharmacist was not always available to attend the ward round.

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

If a pharmacist attended the ward round there was an average reduction of 29% of the regular tablets/ capsules, without a pharmacist the average reduction was 15%. If no intervention (i.e. no pharmacist, no sticker, and no checklist) was made there was an average reduction of 5%.

	(-) sticker		(+) sticker	
	(-) checklist	(+) checklist	(-) checklist	(+) checklist
(-) pharmacist	-5% (n=4)	-13% (n=4)	-17% (n=4)	-25% (n=4)
(+) pharmacist	-6% (n=2)	-57% (n=1)	-41% (n=2)	-10% (n=1)

Where n = the number of patients

The effect of sticker and checklist

	(-) sticker	(+) sticker
(-) checklist	-6%	- 29%
(+) checklist	-35%	- 18 %

The effect of sticker and pharmacist

	(-) sticker	(+) sticker
(-) pharmacist	-9%	-21%
(+) pharmacist	-32%	-26%

The effect of checklist and pharmacist

	(-) checklist	(+) checklist
(-) pharmacist	-11%	-19%
(+) pharmacist	-24%	-34%

Study: continued

(-) sticker	(+) sticker
-20%	-23%
(-) checklist	(+) checklist
-17%	-26%
(-) pharmacist	(+) pharmacist
-15%	-29%

If these results are plotted on a response plot it demonstrates a possible interaction between the checklist and sticker. The plot demonstrates that the use of either a sticker or checklist can increase the reduction in number of tablets. However when the results included the presence of a pharmacist we were unable to demonstrate that the combination of a sticker and checklist gave the best outcome.

The presence of a pharmacist on the ward round and the use of the checklist appeared to be independent to each other. You would expect this as the pharmacist would prompt review whether there was a checklist there or not. However it was felt the presence of the checklist and /or sticker created a ward round opportunity to focus on review of medication.

The results where a pharmacist was not present showed an average reduction in the number of tablets of 5% when neither a sticker nor checklist was used. A reduction of 13% was seen for checklist alone, 17% for sticker alone and 25% when a combination of sticker and checklist were used together. When these results are plotted on a response plot the lines are parallel which indicates that the effect from using a sticker or checklist does not interact but they both have an important effect on reduction of average number of tablets.

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

The presence of a pharmacist on the ward round was shown to produce a good effect but the pharmacist is a limited and costly resource and it is not possible for them to be on all ward rounds. Therefore the use of both a sticker and / or a checklist were both shown to produce a good effect it was decided to implement the use of a sticker and a checklist for all patients identified as having polypharmacy.

A process measure needs to be undertaken to check that the sticker and / or checklist are being signed by the prescriber as being considered and acted upon where appropriate.

PDSA Cycle 6a

Aim: what are you trying to accomplish?

Obtain all hospice in-patients' perspective of medication burden and in particular find out what they feel about the number of tablets that they are taking.

Plan: what will your test be?

- 1) Initially pharmacist to ask 2 patients whether they are happy with the number of tablets that they take?
- 2) Design a simple patient survey form asking about their opinion on (a) the number of tablets they take and (b) how well their symptoms are controlled on that day? Also an option to ask for a medication review by the doctor. Survey will be reviewed by a current in-patient to check that it is understandable and not too onerous.
- 3) All in-patients on one day in the hospice will be given the survey. The medical and nursing staff will be asked to identify patients that they deem too unwell or confused to answer and these will be excluded. The survey will be distributed, assisted with and collected by a doctor who doesn't work on the ward.

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

We predict that the patients will feel that they are taking too many tablets but will feel they have to take them to try and control their symptoms. We will probably see 30% of patients being excluded as being unable to answer and also 20% may decline to fill the survey in.

Do: what happened when you carried out your test?

- 1) When pharmacist asked one patient was happy and felt symptoms much better and one patient felt he was on too many.
- 2) Survey required many revisions tending towards more simple with free text option.
- 3) There were 17 patients on the ward and 9(53%) were deemed too unwell to complete the survey. 7(41%) patients filled it in. Only 12% of those asked, declined to fill it in but the majority filled it in with assistance (86%).
- 4 patients wished to take less but were ok with taking the tablets. (Two said symptoms ok **most** of time, two said symptoms ok **some** of the time).
- 3 would like to take less. (All said symptoms ok **some** of the time).

With regards to option of medication review 3 said nothing more could be done as already had been reduced and 1 patient was worried that reducing would affect symptom control.

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

Much larger group excluded than predicted and this may be due to overprotective effect of staff which is well recognized in palliative care research. Fewer patients declined to fill in than anticipated. Findings were as expected but patients felt that their medicines had been reduced as much as possible which could be that the polypharmacy project was up and running and it was the case, or that patients didn't realize that further reductions may have been possible.

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

Need to look at whether patients who express they are on too many tablets whether any further reduction is possible if they have a medication review? To repeat the cycle and then feedback to prescribers on the ward if patients feel they are on too many tablets.

PDSA Cycle 6b**Aim:** what are you trying to accomplish?

Obtain hospice in-patients' perspective of medication burden and to look at those patients who feel they are on too many tablets as to whether a medication review can reduce the number of tablets?

Plan: what will your test be?

Medical Student (KC) on a 4 week PEP placement at the hospice will undertake more detailed patient survey. Patients will fill in survey with her, as this was the preferred option for patients on previous PDSA cycle. Initially she will select two patients who say that they are on too many tablets and present to the doctors in charge of their care to see if there is scope to reduce the number.

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

Predict that some reduction in the number of tablets (at least two) will be possible in at least one of the patients.

Do: what happened when you carried out your test?

One patient deteriorated and died before any reduction could be made. The other patient had the number of tablets reduced by three (37% reduction).

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

Results were as expected and the reduction was in a patient that hadn't polypharmacy by our numerical definition. That a patient died before reduction was made highlights the difficulties that are experienced with palliative care research and highlights the importance of this work on polypharmacy as we know that even a week before death, patients are taking (on average) 11 regular tablets a day.

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

Repeat the cycle using 4 patients who express that they are on too many tablets.

PDSA Cycle 6c**Aim:** what are you trying to accomplish?

Obtain hospice in-patients' perspective of medication burden and to look at those patients who feel they are on too many tablets as to whether a medication review can reduce the number of tablets?

Plan: what will your test be?

KC will select four patients who say that they are on too many tablets and present to the doctors in charge of their care to see if there is scope to reduce the number.

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

Predict that a patient will die before medication review but that the other three patients will reduce the number of tablets by 30%.

Do: what happened when you carried out your test?

One patient died before reduction could be made. 1 patient had medication changed but did not reduce overall no. of tabs. Other 2 patients had number reduced by 2 tablets (33% reduction) and 6 tablets (46% reduction).

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

Clearly 50% patients benefitted from the medication review and again were patients that did not have polypharmacy by our definition. Of those that benefitted, 33- 46% reduction was impressive.

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

Ideally it would be good to ask all patients on the wards and see if makes any difference to overall weekly pill count but as we ran out of time for the student and survey are time consuming this hasn't been possible. It would also have been helpful to look at before and after satisfaction with symptom control to check it didn't have a negative impact.

We need to incorporate asking patients 'whether the number of tablets is a problem?' routinely as they don't bring it up unless specifically asked. This will potentially benefit all patients not just those with major polypharmacy. This can be done on admission by the doctor and a prompt needs to be added to the admission documentation. We also need to add a prompt to the pharmacy medicine reconciliation paperwork done by pharmacist and technician and then bring to the ward doctors attention by use of the polypharmacy checklist/ sticker.