PhUSE EU Connect 2018

Paper PP08

Navigating the mountains and valleys of resource demand; a road map for the future

Lucy Hoch, Early Clinical Biometrics (Programming), Early Clinical Development (ECD), IMED Biotech Unit, AstraZeneca, Cambridge, UK

ABSTRACT

In resource demand, it is often easy to see the road ahead as largely flat without the peaks and troughs that are an inevitable part of statistical programming, especially in the ever-changing landscape of an early clinical portfolio. By following this philosophy, we are often not maximizing the opportunities presented by predicting the troughs as well as the peaks in our demand; making the most of the time available for potential staff development and preparing us better for the periods of high demand as we see them on the horizon.

I will demonstrate the predictive techniques that can be used to create a map for this changing resource demand. With an adjustable and experience-based tool we can maintain our flexibility but with more foresight. As programming managers this enables us to react quicker and often proactively in our decision making; a must in the early stages of clinical development

INTRODUCTION

Effective resource planning is important within any team. Early Clinical Development (ECD) though has its own unique set of challenges. The ever-changing environment means that the need to react quickly is a must. We must be able to mobilize resource across the portfolio as stop/go criteria come into play, and studies change in scope and size. It is therefore especially important to be able to see the peaks and troughs in resource demand in advance. This allows us to make the most of the available resource for innovation/development and to mobilize contractor support as required to support decision making.

I set out with the purpose of generating visualizations of our programming demand on a month by month basis. At the same time, being aware that the use of a flat resource model was not always a true representation of how the time was being spent in our programming team, and hence not a good model for the future.

Applying a design thinking strategy to the problem which involves the “building up” of ideas, I collated experience and explored the problems faced in ensuring the correct resource is available at the correct time. The problem was then defined by carrying out a review of timesheet data within programming at AstraZeneca(AZ) along with the current picture of resource planning. This started to show factors that were inflating and deflating time across the course of each project and led me to develop a model which could map those peaks and troughs and plan resource demand more effectively.

DATA REVIEW

STUDY PEAKS AND TROUGHS

The first stage in defining the problem came from looking at our recorded time on individual projects/studies, and how that compared along the project timeline with the original flat algorithm. It was evident that sometimes we dropped below the flat algorithm at quieter times and sometimes when we had a known peak, such as a Data Safety Update Report (DSUR) or Investigator Brochure (IB) we went over that original plan. The other thing of note was the magnitude by which we went over at peak times. Therefore, simply taking an average and then increasing the flat algorithm would not be effective way to proceed and would mean missing the periods of low demand.

Figure 1 below illustrates a typical difference between the recorded time, seen in the timesheet data, for an individual (example) project versus the original flat algorithm. The light blue line shows the true time spent. If we do not plan for this fluctuation in resource demand, we may see our teams stretched to meet deadlines with a level of resource that is not reflective of our true demand.

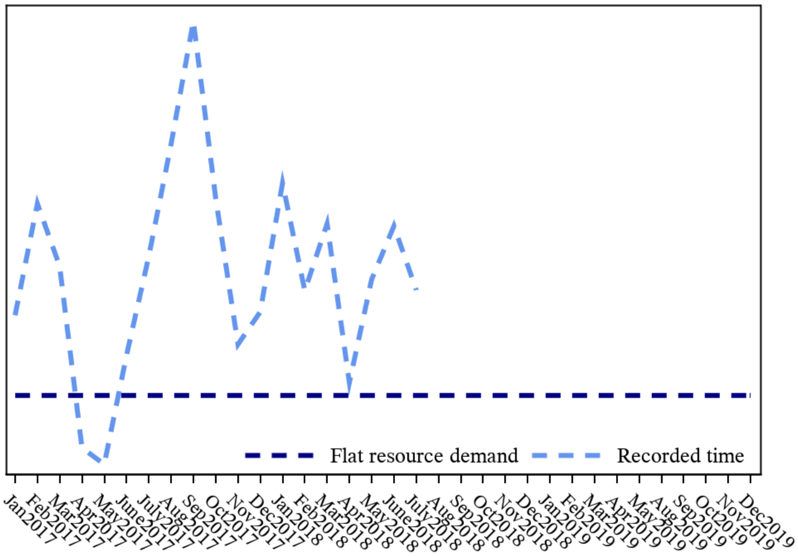


Figure 1- Recorded time from a typical project over the project conduct and the flat resource demand algorithm

As a result, I looked at whether we could model the fluctuating time line by adjusting our planned Full Time Equivalent (FTE) algorithm. As an initial test, I assumed an amount at trough that would be 80% of the original for quieter times and 120% at known 'peak' times such as CTR(Clinical Trial Report). DSUR or IB. Looking at figure 2 below, we can see we are starting to better track the time spent and are moving towards developing a model that is closer to the recorded timesheet data.

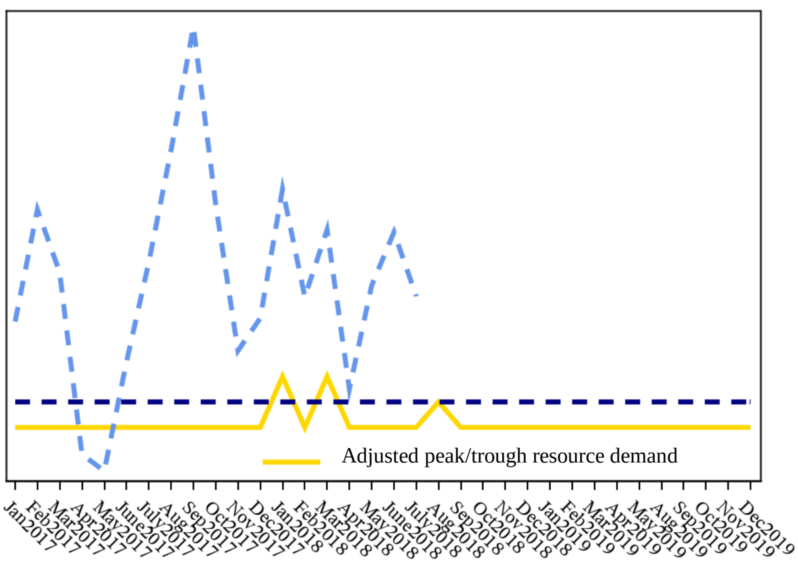
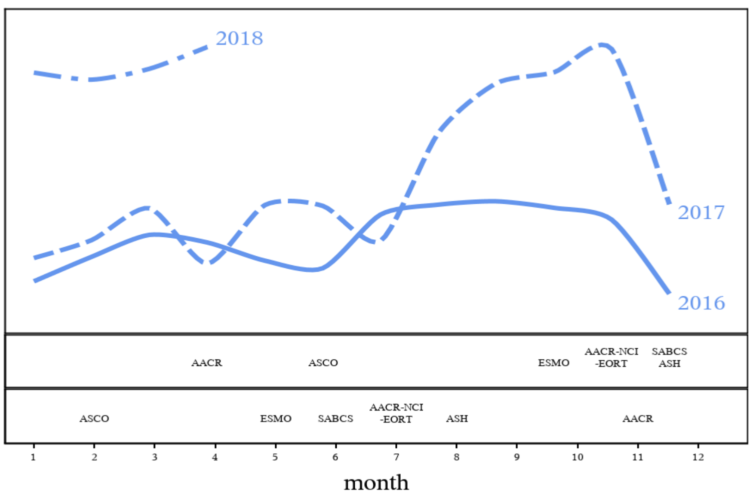


Figure 2- Initial peak and trough model alongside the recorded time from a typical project and the flat resource demand algorithm

Although this is a step towards an improved algorithm, there are still peaks that are not mapped by the model seen here. Therefore, the explanation is only partial, and it is necessary to look at other reasons for the increase in resource demand.

PORTFOLIO PEAKS

Since the model (accounting for known project peaks) did not fully correlate with the recorded time, I moved on to consider other events that might be responsible for the increases in recorded time. ECD as stated, is an environment and landscape that is constantly changing, not just in terms of increases in the portfolio, but changes in study scope. Programmers are often asked to create visualizations for decision making, and this can be laborious, so this may be in part responsible for the higher resource demand. It is often difficult to predict these ad hoc tasks. However, the visualizations are often associated with presentations at conferences. These are predictable, in terms of annual deadlines and present the opportunity to look at the increase in time spent (e.g. for abstracts, paper and poster submissions).



Line graph represents actual time sheet data

Figure 3 Recorded time across the year shown alongside conference submission deadlines

The results of this review are presented in here in figure 3. The bottom sections show the timing of conference deadlines both for paper/poster submission (middle) and abstracts (bottom

I concluded that the time spent on a given project did generally increase in line with conference paper/poster submission deadlines. Although the magnitude of such increases in resource demand is hard to determine, owing to confounding affects or known peaks, we can clearly see an increase. This information was therefore included in the improved algorithm, applying an estimate of FTE to represent the magnitude of the increase. The resulting predictor is shown by the grey line graph in figure 4 below. We can see this clearly maps some of the peaks, and to some extent also maps ones missed by the study/project peak and trough model (see figure 2).

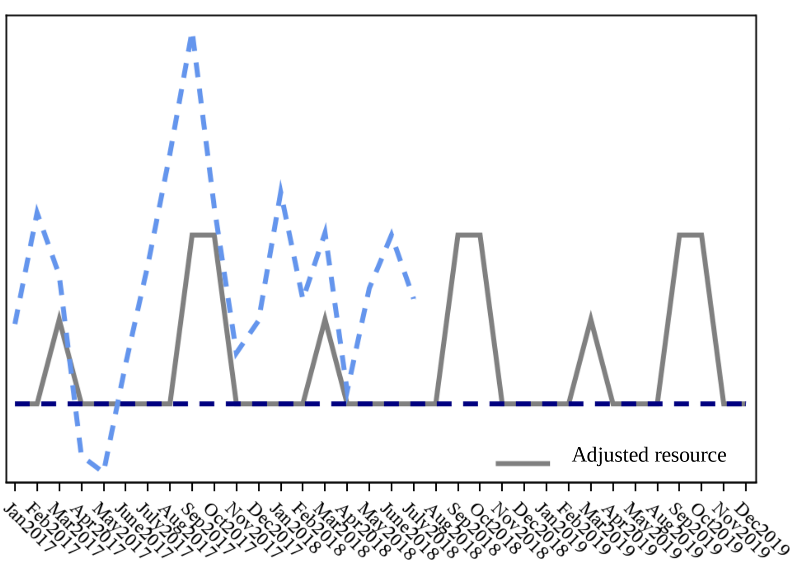


Figure 4 Model adjusted for increase in time for conference submissions alongside recorded time sheet data and the flat resource algorithm

OVERALL MODEL BUILDING

The review of recorded time data provided two explanations for the peaks and troughs seen in recorded timesheet data. Over time, I suspect other explanations will also come to light which will allow us to build more granularity into the model. This current specification of the problem however, already allows us to see the project resource flow on a month by month basis, within and across projects. Building a model around this understanding for resource planning allows for effective resource sharing from one project to another where peaks are not aligned. Where peaks do align, we can use this knowledge to plan for contract programmer time.

MAPPING PEAKS

Combining the peaks from the two intermediary models into an overall model provided us with a predictor of fluctuating FTE within studies/projects.

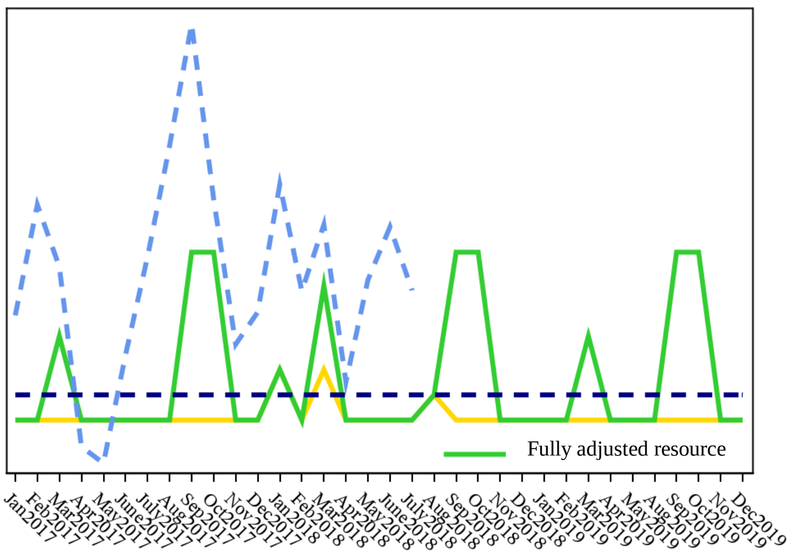


Figure 5 Fully adjusted model combining all previous assumptions alongside recorded time sheet data and the flat resource algorithm

The green line seen here in figure 5, represents the overall result created, a result of combining the different aspects of our knowledge of the peaks and troughs

Once this model is deployed across the AZ portfolio we could then see more realistically, and on a month by month basis where resource is available to be used elsewhere or moved to a project with high resource demand. Available resource, forecast ahead of time could also be used on innovation, development and exploratory work.

The graphs in Figure 6, below show overall demand across the portfolio. The left-hand graph shows the demand landscape before the peak and trough model, and the right-hand graph includes the predictions of the new model. The yellow highlighted areas present a good visual representation of changes in resource demand.

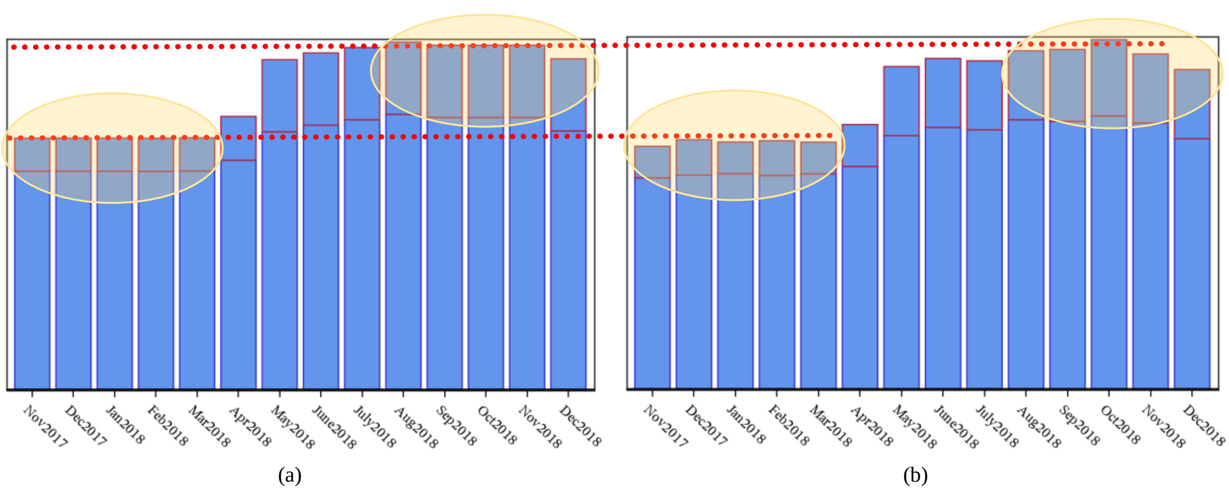


Figure 6 Demand seen before peak and trough model addition (a) and after (b)

ANALYTICS AND PREDICTORS

The peaks and trough analysis and subsequent model development helped us understand the fluctuations in resource demand within our known portfolio and projects. However, to fully plan we required some projections of future demand. To ensure we could see beyond the existing portfolio, I used analytics, resulting from a review and analysis of the past portfolio to help me predict how much resource might be required to deliver the future ECD portfolio.

Those analytics formed the basis of a group of parameters. I looked at the distribution of the FSIs(First Subject In) dates across the year and the increasing portfolio in ECD, and incorporated some assumptions regarding model (vendor) selection. This was combined with measurements of attrition, slippage, and project advancement to generate a series of 'dummy' predicted studies/projects to create a prediction model.

I compared what was expected in a given year, and what we currently had planned during that same year to see what should be projected. I then used the number of 'dummy' studies/projects to generate a sequence of random FSIs, using the SAS® code below

```
data RandInt;
do i = 1 to &no_fsi_f;
   fsi = rand("Integer", &start_point., &end_point.);
   output;
end;
```

Within each dummy study, I went on to assign details such as phase, complexity, project advancement and model.

```
proc sql OUTOBS= 4;
  create table RE as
    select random_dates.*, "R" as Repeat_project
      from random_dates
        order by RANUNI(0);
quit;
```

The graph below shows an illustration of our portfolio demand, including the peaks and troughs analysis, but before accounting for the future projections

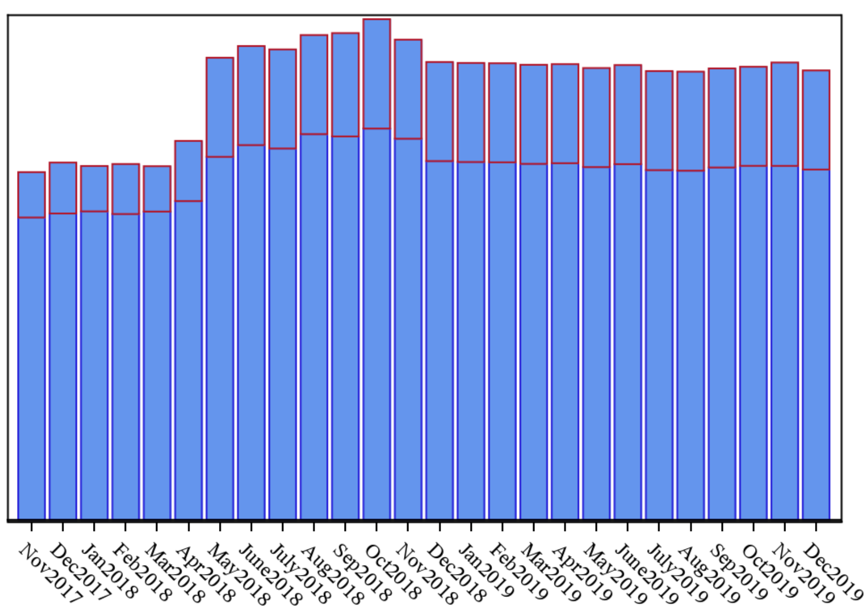


Figure 7 An illustration of overall portfolio demand without projections

Figure 8 shows our demand including future projections (seen in light blue). The projections are divided into project level role and study level role, so you see them as two sections. This gives us a perfect opportunity to plan for an increase in team size and justify headcount to senior management.

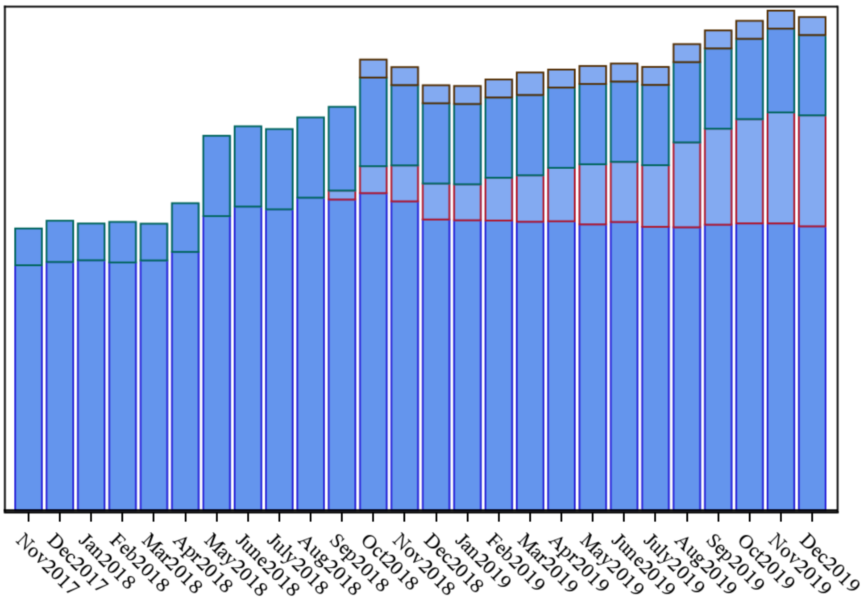


Figure 8 An illustration of overall portfolio demand with projections

CONCLUSION

Resource planning requires foresight, and a scientific approach, to fully see our resource demands now and in the future. I applied a design thinking strategy to help bring some creative thinking to resource planning. The process involved defining the problem, and implementing some strategies, to create a tool that will help us to react quicker as resource managers in programming.

In this paper, I have outlined the modelling and prediction techniques used to help visualize resource demand more effectively in a fast moving and dynamic environment, where a flexible approach is required and expected. I modelled naturally fluctuating resource demand by using data review and an understanding of project challenges, and built a model around it. At the next stage, data analytics allowed use of specific knowledge to manage the process of prediction, outputting results visually that were actionable. In the future, evidence-based decision making will be even easier as more data is gathered and fed back into the system. In the meantime, by having a system that is parameter driven we can run simulations to assess the impact of scenarios as they are presented.

As data is fed back into the system, Artificial Intelligence (AI) and Machine Learning (ML) can be used to ensure the systems themselves can react, making the predictions even more accurate and realistic. We could move from a manual system of data discovery/exploration, human interaction and data visualizations into machine learning, automation and interactive, complex querying. Such innovation is ongoing and as we move through the process we hope the result will be a true automation of the resourcing planning process.

ACKNOWLEDGMENTS

I should like to thank the Biometrics and Capacity teams in ECD at AstraZeneca, specifically Yvonne Jangvik (Team Leader, Programming) and Alison Dobson (Director, Clinical Trial Data Science) for their support during the preparation of the resource tool process

RECOMMENDED READING

Report around design thinking
https://churchill.imgix.net/files/pdfs/IDEO_HBR_DT_08.pdf
AI and ML and the possibilities within Big Data
https://ico.org.uk/media/for-organisations/documents/2013559/big-data-ai-ml-and-data-protection.pdf
AI and ML in BI
https://www.zdnet.com/article/how-machine-learning-and-artificial-intelligence-will-transform-business-intelligence-and-analytics/

CONTACT INFORMATION

Your comments and questions are valued and encouraged. Contact the author at:

Lucy Hoch
AstraZeneca
Da Vinci Building,
Cambridge Road
Melbourn Science Park,
Royston SG8 6EE
07885 451070
Lucy.Hoch@astrazeneca.com