



**ACI** NSW Agency  
for Clinical  
Innovation

# A PRODUCTIVITY INDEX FOR NSW OPERATING THEATRES

AN OVERVIEW AND WORKED EXAMPLES

A handout  
prepared by the  
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Economics &  
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Efficient Operating  
Theatre on a  
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## OPERATING THEATRE PRODUCTIVITY INDEX

### Overview

Productivity is defined as the quantity of **outputs** produced per unit of **input**. A Productivity Index (PI) is a metric used in other industries to compare the relative productivity of an entity over time, or compared with other entities producing similar products. Productivity in operating theatres is complex and multifactorial. Compared with other industries, defining and measuring efficiency and productivity in the health sector is complicated by the varied characteristics of health services.

During the development of the Operating Theatre Efficiency Guidelines, there was an expressed desire to develop a standardised method of assessing productivity in NSW Operating Theatres. A Productivity Index should allow operating theatre managers to compare the productivity of surgical sessions:

- Over time
- Across surgical procedures, specialties, surgeons, operating theatres, hospitals, peer groups, and Local Health Districts (LHDs)

A literature search has revealed there has been limited work undertaken in developing PIs for operating theatres. To test the approach in NSW, the first stage of development concentrates on **elective in operating theatre** productivity only. This approach may be refined and expanded over time, as appropriate, to incorporate more factors that are demonstrated to be materially important in affecting productivity.

The key things to know about a Productivity Index are that:-

- It is only really useful when used as a **relative** concept  
A Productivity Index result by itself is not particularly useful information. Its value as a management tool is when it is used to **compare** productivity over time or against common entities.
- It is **not** the same as efficiency  
A better PI result compared over time or to other entities, does not automatically imply you are being more efficient. However, a PI is an important marker and piece of information that can lead to better management of resources and together with other markers of efficiency, lead to improved overall efficiency.
- It is **one** of the metrics in the Efficiency Toolkit  
The PI is a management flag. Whether a PI is above or below the comparator, the key question to ask is **WHY am I different?** The results of the PI, together with information from the other metrics in the OT Efficiency Guidelines will create a more complete picture of what is being produced in operating theatres and how it is being produced. This will allow operating theatre staff to identify and focus in on the area that needs adjustment.

## What is the Operating Theatre Productivity Index?

Algebraically, the Operating Theatre Productivity Index (**OTPI**) can be expressed as:

$$\text{OTPI}_t = \text{Output}_t / (\text{L}_t + \text{C}_t)$$

Where:

**OTPI<sub>t</sub>** = Operating Theatre Productivity Index

**Output** = sum of NWAUs

**L** = sum of the costs of the mix of labour hours used

**C** = sum of costs not associated with labour used

**t** = time period

It is expressed as the number of surgical NWAUs (output) produced per \$1,000 of surgery resources (input). Each of the variables in the formula is measured as follows:

### Output

- Surgical DRGs converted to NWAUs

### Input

- Labour mix (medical, nursing) used in surgery (\$)
- Operating theatre costs (\$)

### Exclusions:

- Emergency Surgery
- Operating Theatre utilisation (time) as this is a separate metric in the Guidelines
- Pre-surgical work up and post operating theatre components
- Quality of surgery

### Output: A word about NWAUs.

NSW Health operates in an Activity Based Funding environment. An NWAU is a National Weighted Activity Unit and while it forms the basis for payment in NSW (in 2014/15 the price is \$4,583 per NWAU) we are using NWAUs to count activity (output). An NWAU is calculated for each surgical DRG<sup>1</sup> separation and it weights that activity to reflect the relative consumption of resources required to undertake that activity. In this way, it reflects the relative complexity of the patient – the higher the NWAU weight, the greater the resources required for that activity, the more complex the patient.

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<sup>1</sup> DRG is a Diagnosis Related Group and is the standardised description of admitted inpatient activity in NSW hospitals

An NWAU is used to count the activity and weight that activity for the complexity of the patients.

For this first stage, the OTPI can be calculated down to hospital level. The OTPI of a hospital can be compared:-

- Over time
- With other hospitals in the LHD
- With peer hospitals
- To the average of all hospitals across NSW

### **Data sources to calculate the OTPI**

The NSW ABM portal provides information to LHDs on activity and costs of their health services by financial year. The following variables in the OTPI are available through the AMB portal:

#### **Output**

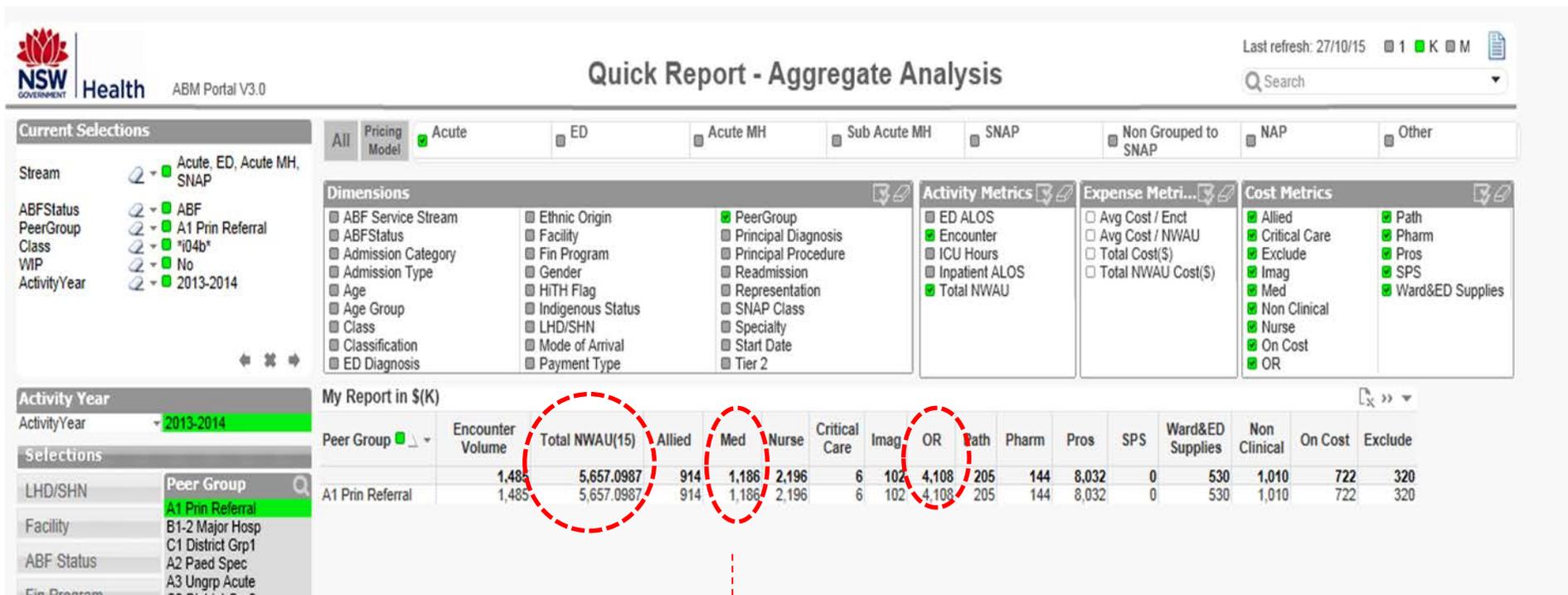
- Surgical NWAU at a DRG level at hospital, LHD, Peer group and NSW and over time

#### **Input**

- **Labour costs** – Med cost bucket and OR cost bucket (screenshot example below). Nursing, surgeon, anaesthetists costs are picked up across these two costs buckets. The Med cost bucket also includes doctors' hours in the ward post-surgery and is therefore discounted to exclude that component. The nursing bucket reflects ward nursing costs.
- **Non labour surgical costs** – OR cost bucket

The costs in the ABM portal are being provided by the LHDs to the ABM team. While these costs may not be perfect at this point, with greater use and understanding of the OTPI, it is expected that over time data being fed into these costs buckets will become more refined and accurate.

Figure 1: Screenshot of the ABM Portal



As the surgeons' theatre related costs are included in the 'Med' bucket, this bucket is discounted to reflect remove the inpatient ward costs.

## How can I use the OTPI? Some Worked Examples

3 examples of how the OTPI can be used are provided. All these examples look at the Productivity Index for one principal referral hospital (Hospital A) for one DRG (104B – Knee replacement W/O Catastrophic or Severe CC ).

Key points:

- The comparator is always set to a value of 1
- An OTPI of **less than 1** indicates **lower productivity** than the comparator
- An OTPI of **greater than 1** indicates **higher productivity** than the comparator

### 1. Year on Year Operating Theatre Productivity Index

In 2012/13 Hospital A had 169 separations for DRG 104B producing a total of 665 NWAUs. The OT resources used to produce those NWAUS was \$729,000. The OTPI for 2012/13 is calculated as:-

$$= 665/\$729$$

$$= \mathbf{0.91}.$$

This means that in 2012/13 Hospital A produced 0.91 NWAUs for every \$1,000 spent in the operating theatre. This piece of information by itself means very little, but we can compare it to the previous year's PI to establish how the hospital is performing relative to its productivity last year.

In 2013/14 Hospital A had 163 separations for DRG 104B producing a total of 643 NWAUs. The OT resources used to produce those NWAUS was \$781,000. The OTPI for 2013/14 was:-

$$= 643/\$781$$

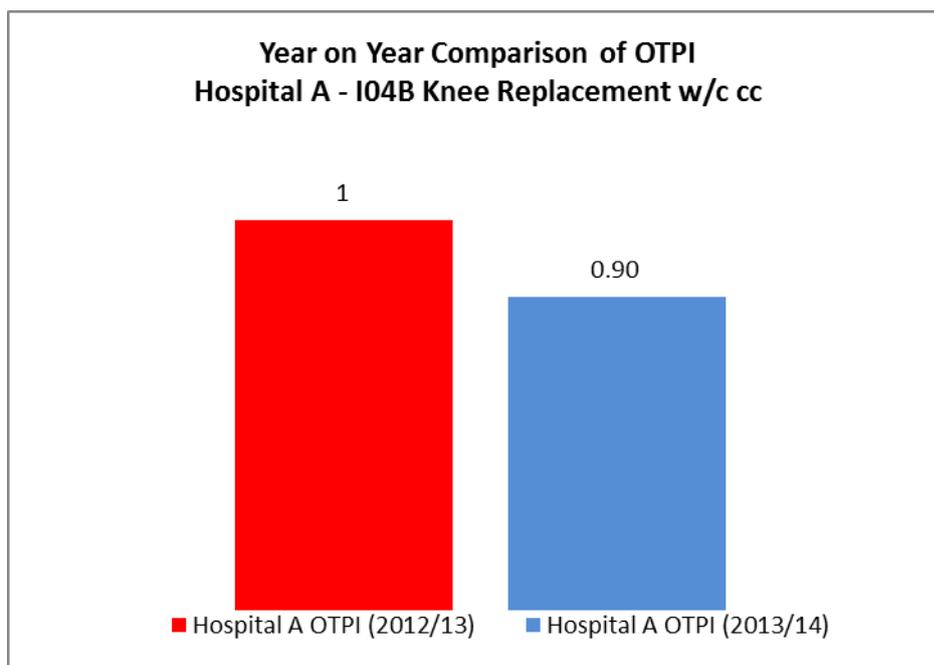
$$= \mathbf{0.82}$$

It is the **change** in the OTPI over time that is of interest, therefore to calculate the change the latest data for the hospital is divided by the previous year's OTPI. To make comparison easy, the OTPI 2012/13 for Hospital A is set as the Base Year of comparison (0.91/0.91 = 1). To calculate the Year on Year OT Productivity Index, the latest PI for the hospital is divided by the previous year's as we are measuring the change in PI over the years. That is:-

$$= \mathbf{0.82/0.91}$$

$$= \mathbf{0.9}$$

**Graph 1: Year on OTPI - Hospital A**



This means that in 2013/14, Hospital A produced **10% less** NWAUs for every \$1,000 spent on surgery knee replacements (without catastrophic or severe CC).

**WHY is the OTPI different Year on Year?**

**Look at inputs**

- Staffing mix  
Has there been a change in staffing mix that has resulted in an increase in costs? For example, increased use of locums, recruiting additional staff.  
Was there an award increase that was applied that year?
- Costing system  
Are costs being allocated correctly to the right cost buckets?  
Was there a change in the way the costs were allocated in that year?

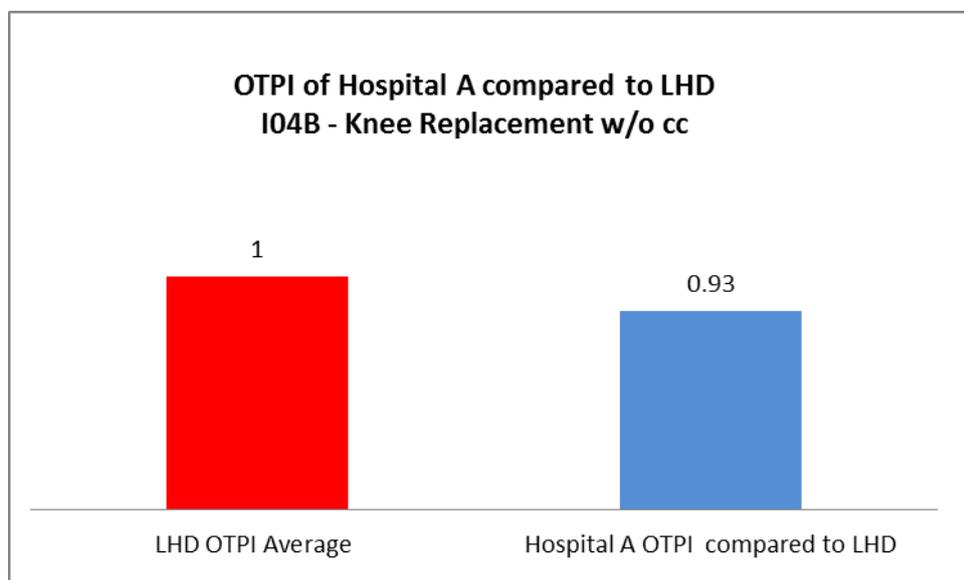
**Look at outputs**

- Coding  
Are we actually coding and recording all our activity accurately, was there a change?
- Review other operating theatre utilisation efficiency metrics  
Examine other metrics that affect throughput and output of the operating theatres - OT utilisation, anaesthetic care time, first case on time start, day of surgery cancellation, turnover time, underrun and overrun times.
- LHD/Hospital operational and strategic policy decisions  
Were there changes in policy directives during the year that affected throughput such as a focus on reducing readmissions to the operating theatre or reducing a waiting list for targeted specialties?

## 2. Hospital to LHD Operating Theatre Productivity Index

This second example compares the productivity of Hospital A for uncomplicated knee replacement surgery to the average of productivity for the same surgery across all the hospitals in its LHD.

**Graph 2: Hospital A to LHD OTPI**



To derive this graph, the basis of comparison is the OTPI for the LHD for 2013/14 which is 0.89, which, as per the previous example, is set at 1. The process to calculate the Hospital to LHD OTPI for Hospital A is:

$$=0.82/0.89$$

$$= \mathbf{0.93}$$

This means that in 2013/14, Hospital A produced 7% less knee replacement NWAUs for every \$1,000 spent in the operating theatre compared to the LHD average.

### WHY is Hospital A different to the LHD average?

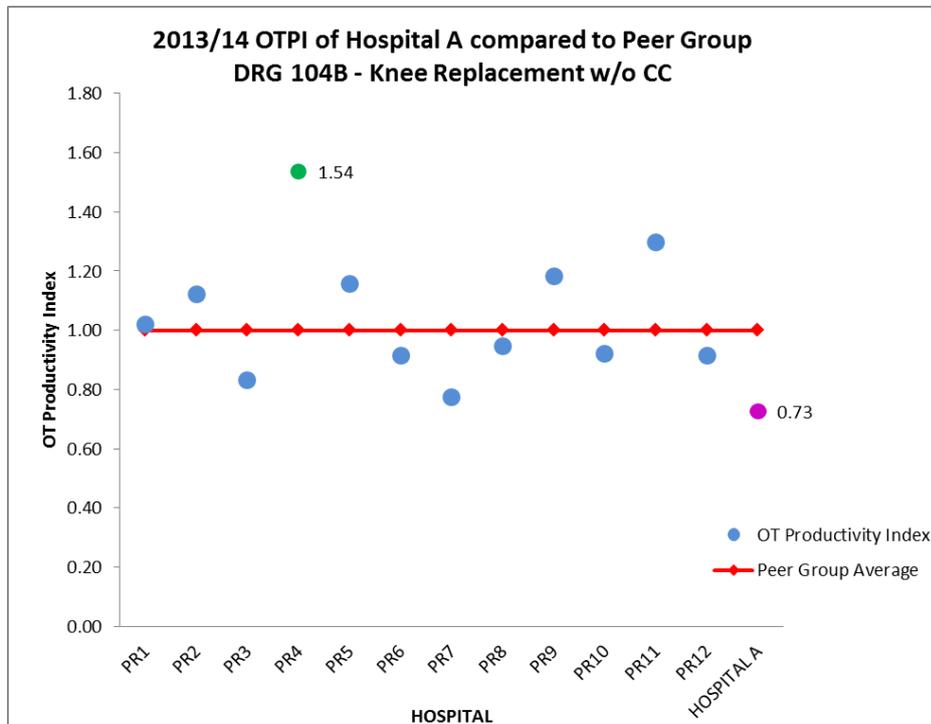
- Examine issues in previous example  
Are costing being allocated appropriately across the LHD?  
Is activity being recorded appropriately?  
Is the surgical staffing mix different to other hospitals in the LHD?
- Look at PI of other hospitals within an LHD and talk to those performing better

**This information can assist an LHD to decide where best to allocate different types of surgery within an LHD.**

### 3. Hospital to Peer Group Operating Theatre Productivity Index

Another useful way of examining the OTPI is to look at the OTPI of a hospital for a DRG compared to the OTPI of peer hospitals.

**Graph 3: Hospital A to Peer Group OPTI**



The basis of comparison in this example is the Peer group average OTPI which is 1.13. As with the other examples, this is set at 1 for ease of comparison. The process to calculate the Hospital to Peer Group OTPI for Hospital A is:

$$= 0.82/1.13$$

$$= \mathbf{0.73}$$

This means that in 2013/14, Hospital A produced 27% less knee replacements NWAUs for every \$1,000 spent compared to the Peer Group average.

#### **WHY is Hospital A so different to the Peer Group Average?**

- Go to Hospital PR4 as the “best” performer to see what they are doing to be more productive than their peers.
- Are their costs better managed or is their throughput more effective?
- What is their staffing mix like?
- How do they allocate their operating theatre costs?
- What OT efficiency strategies do they have in place to get more patients through?

## HOW can I improve productivity?

Productivity can be improved by adjusting the level of inputs or outputs or both at the same time at different rates. For example you can focus on strategies that:

- Increase throughput using the same resources
- Increase throughput at a greater rate than increasing resources
- Reduce resources but maintain the same throughput
- Reduce resources and increase throughput

Some examples of approaches you can use:

- Implementing the OT efficiency guidelines
- Improved costing systems
  - OT standard costs template
- Improved coding of activity
  - OT Efficiency Data dictionary
- Clinical redesign processes
- Improvements in technology

The OTPI will help you to better understand your business of undertaking surgery. It is **one** of the metrics you can use to create the picture of how your operating theatre works. There are readily available levers you can start to use to make adjustments and the metrics suggested in the Efficiency Guidelines will help you monitor the effects of your changes in practice.

## What Next?

**The next piece of work is to link data (surginet/surgical data with admitted patient data collection) so that OTPIs can be prepared and compared at an operating theatre and surgeon level. The ACI is keen to work with self-nominated pilot sites to develop this next stage of analysis.**

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