Comparative Study of Revenue Generation by Different Departments in A Hospital Using Dashboards

By

Nashit Saleha

Dissertation submitted in partial fulfillment of the requirements of the degree

MBA Hospital and Health Management

Academic year, 2018-2020

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TO WHOM IT MAY CONCERN

This is to certify that Ms. Nashit Saleha, a student of MBA (Healthcare & Hospital Management), IIHMR University, Jaipur, India, has successfully completed Dissertation Program from 14th February 2020 to 29th May 2020 at this Hospital. During the period of her Dissertation program with us she was found to be punctual and hardworking.

We wish her every success in life.

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CERTIFICATE BY SCHOLAR

This is to certify that the dissertation titled "A Comparative Study of Revenue Generation by Different Departments in a Hospital Using Dashboards" and submitted by Dr. Nashit Saleha Enrollment No. 0779 under the supervision of Dr. Piyush Kant Pandey for award of MBA in Hospital and Health of the University carried out during the period from 14/02/2020 to 29/05/2020 embodies my original work and has not formed the basis for the award of any degree, diploma associate ship, fellowship, titles in this or any other institute or other similar institution of higher learning.

Signature

ABSTRACT

INTRODUCTION

Hospitals have begun to realize the importance of dashboards in enhancing productivity. Visualization of data, facilitated by dashboards, makes it easy to comprehend and analyse. Various software can be used as effective platforms for creating dashboards. However, for the sake of ease of use and accessibility, we chose Microsoft Excel as the preferred instrument. This study deals with six departments of Regency Medical Centre, Tanzania, namely, HDU, ICU, ENT, Radiology, Laboratory and Physiotherapy. It seeks to identify which among them are the highest and lowest revenue generators. It also tries to find key revenue patterns and trends within the hospital system using dashboard as a tool. In the process, we also enumerate the strengths and weaknesses of dashboard as an instrument for revenue analysis.

METHODOLOGY

Inpatient and outpatient billing data for the month of January,2020 was obtained from Regency Medical Centre, Dar es Salaam, Tanzania. A concept map of the dynamic revenue dashboard was prepared by brainstorming sessions and focus group discussions. Data points that most appropriately reflect the hospital performance were identified. Key parameters along which revenue data should be presented were decided. Since RMC generated its monthly revenue data as excel files, it was deemed apt that the same platform be used to create the dashboard so that there is no inconsistency with the source data. It also made the dashboards easy to populate and update, hence making the model scalable. The dashboards thus generated would also be comparable since the same source data was used for all the departments. Six dynamic revenue dashboards were designed, department-wise, using suitable filters, Pivot Tables and Pivot Charts in Microsoft Excel. VBA coding was used to automate the dashboards, so that any change in the source data would be reflected on the dashboards, thereby making them interactive living documents.

RESULTS

Laboratory, Radiology and HDU were identified as the three most revenue generating departments while Physiotherapy, ICU and ENT were observed to be the three least revenue generating departments in RMC during January,2020. Several key revenue patterns and trends were observed. It was noted that diagnostic departments like Laboratory and Radiology tend to generate the most revenue. Also, a far greater footfall of patients opting for either private or public health insurance was seen as opposed to those choosing to pay by cash. It was also seen that outpatients brought in more revenue as compared to inpatients. These dashboards were found stronger than others on various fronts, namely, ease of use, scalability, comparability, affordability and accessibility. However, since they were of moderate analytical maturity, they had several limitations in that they could not be used for forecasting or to blend multiple datasets.

CONCLUSION

Dashboards were found to be a useful tool in the analysis of hospital revenue. However, recommendations were made regarding improving the analytical intensity of dashboards to carry out complex functions in the future.

ACKNOWLEDGEMENTS

This study would not have been possible without the timely guidance and help of a number of people. First and foremost, I would like to thank my mentor and guide Dr. Piyush Kant Pandey, whose valuable suggestions and recommendations gave direction to this study. I would also like to thank my industry mentor, Dr. Amish Kanabar for his trust and constant encouragement. The staff of Regency Medical Centre, Dar es Salaam, Tanzania played a crucial role in facilitating my research by being ever so cooperative and kind.

Last but far from the least, I would like to thank my parents for their constant support and my sisters, Salma and Amna for all their help.

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LIST OF SYMBOLS AND ABBREVIATIONS

SYMBOL / ABBREVIATION	MEANING
RMC	Regency Medical Centre
HDU	High Dependency Unit
ICU	Intensive Care Unit
ENT	Ear Nose Throat
RAG	Red Amber Green
HIS	Hospital Information System
VBA	Visual Basic for Applications
HIV	Human Immunodeficiency Virus
TB	Tuberculosis
IT	Information Technology
OPD	Outpatient Department
IPD	Inpatient Department
IBM	International Business Machines

INTRODUCTION

As the healthcare industry is undergoing a significant shift from a 'fee-for-service' model to a 'value based' model, hospitals are beginning to devise new and innovative tools and techniques to streamline and optimize allocation of resources and facilitate cost benefit analysis. Dashboards have emerged as novel and effective platforms that enable visualization of data and ease the process of analysis. These analyses can further inform key strategic decisions regarding resource allocation, staffing and material management, while simultaneously being an important milestone in the direction of digitization. Moreover, a revenue dashboard may serve as an indispensable link between the administration, the IT department, billing department, the OPD and the wards.

Hospitals capture a large amount of data in carrying out their daily functions of patient care. Analysing this data can provide useful insights into the patterns and trends of hospital revenue generation. All this information often goes untapped when supply related decisions are taken. This study aims to remedy this disconnect between various areas of the hospital system and endeavours to bridge the gap between demand and supply by means of a revenue dashboard.

Dashboard is defined as 'a user interface or web page that gives a current summary, usually in graphic easy-to-read form, of key information relating to progress and performance, especially of a business.' Depending on analytical intensity and maturity, dashboards can be progressively graded as

- static dashboards,
- interactive dashboards,
- interactive drillable dashboards and
- interactive drillable dashboards that blend datasets.

Furthermore, hospital dashboards are broadly classified into four categories, depending on who they are designed for-

- healthcare organization dashboards that reflect hospital performance to the administration,
- patient perception dashboards that capture patient experience,
- clinician dashboards intended for the clinical staff and
- donation dashboards for fundraising and attracting charity.

Different healthcare visualization software can be used for the purpose of designing a dashboard, such as

- Tableau,
- Qlik,
- Micro strategy,
- IBM,
- Microsoft Excel and
- SAP business objects.

Keeping in mind ease of access, this study chose to work with Microsoft Excel. A dynamic interactive drillable healthcare organization dashboard was designed for Regency Medical Centre, Dar es Salaam, Tanzania. Six departments of the 56 bedded hospital, were chosen for the same

- ICU

- HDU
- ENT
- Laboratory
- Radiology
- Physiotherapy

The dashboard presented key revenue datapoints for January,2020 and reflected the outliers in terms of performance, on the top. It was done with the objective of capturing and analysing revenue related data for the purposes of real time monitoring and comparative assessment to provide insights into hospital revenue patterns and trends.

LITERATURE REVIEW

STUDY	AUTHOR	JOURNAL (YEAR)	KEY FINDINGS
Using Dashboard for Lean Revenue Cycle Management	Jihong Zeng, John Zhang	Published Online (September 2013)	Visual dashboards are important tools to transform metadata into insightful information. They can be used to implement lean management for hospital revenue cycle to reduce waste and enhance productivity. QlikView software is much more suited to the graphic user interface when compared with traditional IBM dashboards, that require conscious thinking.
Utilization of Dashboard Technology in Academic Radiology Departments: Results of a National Survey	Bahar Mansoori MD Ronald D. Novak PhD, MPA, MPH Carlos J. Sivit MD Pablo R. Ros MD, MPH, PhD	Journal of the American College of Radiology (April 2013)	Less than two-third of the responding Academic Radiology Departments used dashboard and half had been using it for two years or more. The information given by various institutional dashboards varies greatly because a host of different factors are used in each to quantify productivity, revenue and other parameters.
The Creation of a Pediatric Hospital Medicine Dashboard: Performance Assessment for Improvement	Lindsay Anne Fox, Kathleen E. Walsh, Elisabeth G Schainker	Hospital Pediatrics (July 2016)	Dashboards are extremely useful platforms which can also be used to share data across institutions in order to identify trends and establish industry benchmarks. Although they require a substantial investment in terms of resources, their potential to improve

			performance makes them worth it.
STUDY	**AUTHOR**	**JOURNAL (YEAR)**	**KEY FINDINGS**
A Map for Clinical Laboratories Management Indicators in the Intelligent Dashboard	Zahra Azadmanjir, Mashallah Torabi, Reza Safdari, Maryam Bayat, and Fatemeh Golmahi	Acta Inform Med (August 2015)	Identifying key indicators is an important first step in the development of a dashboard. However, designing a dashboard is an incremental process and these things may keep evolving with time. Nevertheless, it helps spot patterns to help in setting of protocols.
A Management Dashboard to Boost Operating Theatre Utilisation, Productivity and Profitability	Dr Sohaib Rufai, Mr Peter Cronbach, Mr Philip Alexander, Mr Stephen Lash	International Journal of Surgery (2015)	A RAG (Red, Amber, Green) rated dashboard was designed using Microsoft Excel to retrospectively analyse theatre utilization for ophthalmic surgeries during a three-month period. It was found to have a positive impact on the productivity and profitability of the theatre as a result.
On Adoption and Use of Hospital Information System in Developing Countries Experiences of Health Care Personnel and Hospital Management in Tanzania	Johanna Peltola	Published online (December 2019)	Tanzania faces myriad public health problems, from high maternal and child mortality rates to an enormous infectious disease burden (malaria, HIV, TB). These are further exacerbated by poverty, illiteracy and inadequate infrastructure. While technological interventions like HIS may not solve all these issues, they can help in effective allocation of resources and

			contribute in better management.
STUDY	**AUTHORS**	**JOURNAL (YEAR)**	**KEY FINDINGS**
A Productivity Dashboard for Hospitals: An Empirical Study	Miguel Pestana, Rúben Pereira and Sérgio Moro	Published online (September 2018)	The stakeholders interviewed stated that the necessary conditions were present for successful implementation of hospital dashboards. These dashboards were found to be assets in improving the performance of hospitals. Visual graphics and colour were found to add value to the dashboard and make it more engaging.

Table 13.1 Review of Lierature

METHODOLOGY

- **KEY RESEARCH QUESTIONS-**The study attempts to answer three key questions.

1. What were the highest and lowest revenue generating departments of RMC for January,2020?
2. What key patterns and trends were observed in the hospital's financial performance?
3. What strengths and shortcomings of dashboard as a tool for revenue analysis, were found in the course of this study?

- **RESEARCH DESIGN-** It was an observational descriptive study.

- **STUDY SETTING-** This study was set in Regency Medical Centre, Dar es Salaam, Tanzania.

- **RESEARCH PROCEDURE-** Inpatient and outpatient billing data for the month of January,2020 was obtained from Regency Medical Centre, Dar es Salaam, Tanzania. A concept map of the dynamic revenue dashboard was prepared by brainstorming sessions and focus group discussions. Six departments of the hospital, namely, ICU, HDU, ENT, Physiotherapy, Radiology and Laboratory were chosen. Data points that most appropriately reflect the hospital performance were identified. Key parameters along which revenue data should be presented were decided. Since RMC generated its monthly revenue data as excel files, it was deemed apt that the same platform be used to create the dashboard so that there is no inconsistency with the source data. It also made the dashboards easy to populate and update, hence making the model scalable. The dashboards thus generated would also be comparable since the same source data was used for all the departments. Visual Basic programming was used to automate the dashboard.

- **SAMPLE SIZE-** During the month of January, RMC witnessed a total footfall of 66,451 patients (both inpatients as well as outpatients). This was the sample size for our study.

- **SAMPLING METHOD-** Convenience sampling method was used. All inpatients and outpatients in RMC during January,2020 were included in the study. All patients referred from other healthcare organizations or those who were not registered with RMC were excluded from the study.

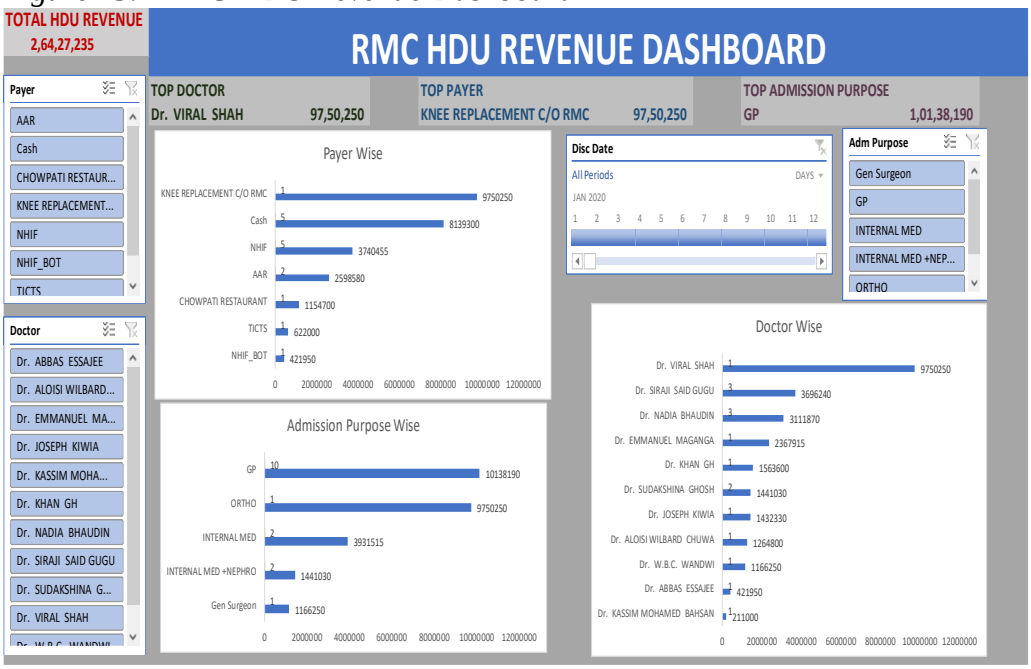
- **RESEARCH INSTRUMENTS-** The following research instruments were used to aid in the study process
    1. Microsoft Excel
    2. Pivot Tables and Pivot Charts
    3. Six Financial Performance Dashboards
    4. Brainstorming sessions
    5. Focus group discussions

- **STATISTICAL METHODS-** The following statistical methods were used as tools for the purpose of the study
    1. Bar graphs for data visualization
    2. Pie chart
    3. Tabular representation of data

- **ETHICAL CONSIDERATIONS-** The following ethical considerations were observed throughout the process
    1. **CONSENT-** The billing data was used with the consent of Regency Medical Centre
    2. **SECURITY-** Precautions were taken to ensure complete safety and security. The data or study was not shared with any third party.
    3. **CONFIDENTIALITY**- Secrecy and confidentiality were maintained and access to the data and the study was monitored and scrutinized.

RESULTS

Figure 15.1 RMC HDU Revenue Dashboard



Six dynamic revenue dashboards were designed, department-wise, using suitable filters, Pivot Tables and Pivot Charts in Microsoft Excel. VBA coding was used to automate the dashboards, so that any change in the source data would be reflected on the dashboards, thereby making them interactive living documents. A timeline was introduced to give access to data pertaining to any day of interest. Filters were inserted that made it possible to slice and dice the data, so that the user could drill down and extract relevant information. These dashboards were populated with RMC billing data for January,2020. They were then assessed and compared. Suggested modifications, like reflecting the overall department revenue as well as the outliers in performance on top, were made to optimize their performance.

Figure 15.1 depicts RMC HDU Revenue Dashboard. Revenue data has been presented here doctor-wise, payer-wise and admission purpose-wise. Filters pertaining to doctor, payer and admission purpose, to further drill down on the data have been added. A timeline has been provided in the form of a calendar. Total HDU revenue and outstanding performers, in terms of doctor, payer and admission purpose have been highlighted on the top. Similarly, *Figure 15.2* depicts RMC Revenue Dashboard for Laboratory. Here, data has been presented doctor-wise, payer-wise, patient-wise and service-wise. In addition to the filters and the timeline, a pie chart, depicting the share of revenue claimed by various branches of the laboratory, has been added. Key metrics of interest have again been highlighted on the top.

Figures 15.3, *15.4*, *15.5* and *15.6* depict Revenue Dashboards for ICU, Physiotherapy, Radiology and ENT, respectively. They have been created along the same template as those described above, albeit each with its own unique mix of parameters to present datapoints along.

Laboratory, Radiology and HDU were identified as the three most revenue generating departments while Physiotherapy, ICU and ENT were observed to be the three least revenue generating departments in RMC during January,2020.

Figure 15.2 RMC Laboratory Revenue Dashboard

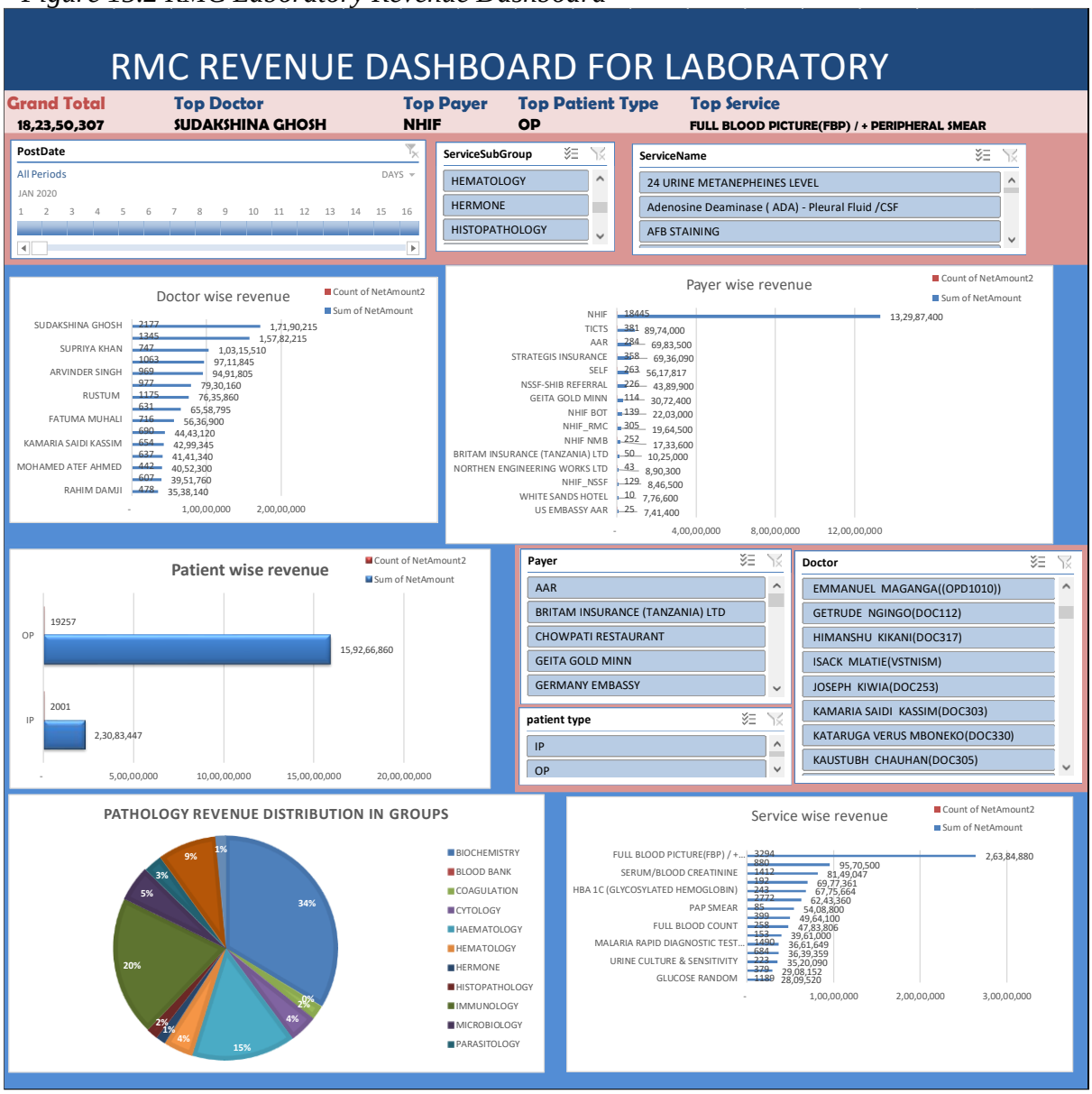


Figure 15.3 RMC ICU Revenue Dashboard

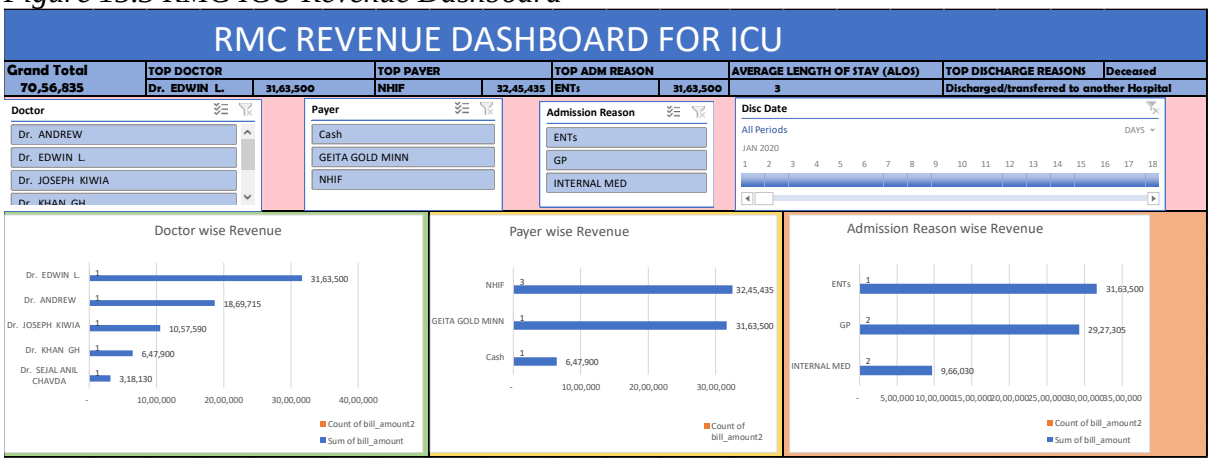


Figure 15.4 RMC Physiotherapy Revenue Dashboard

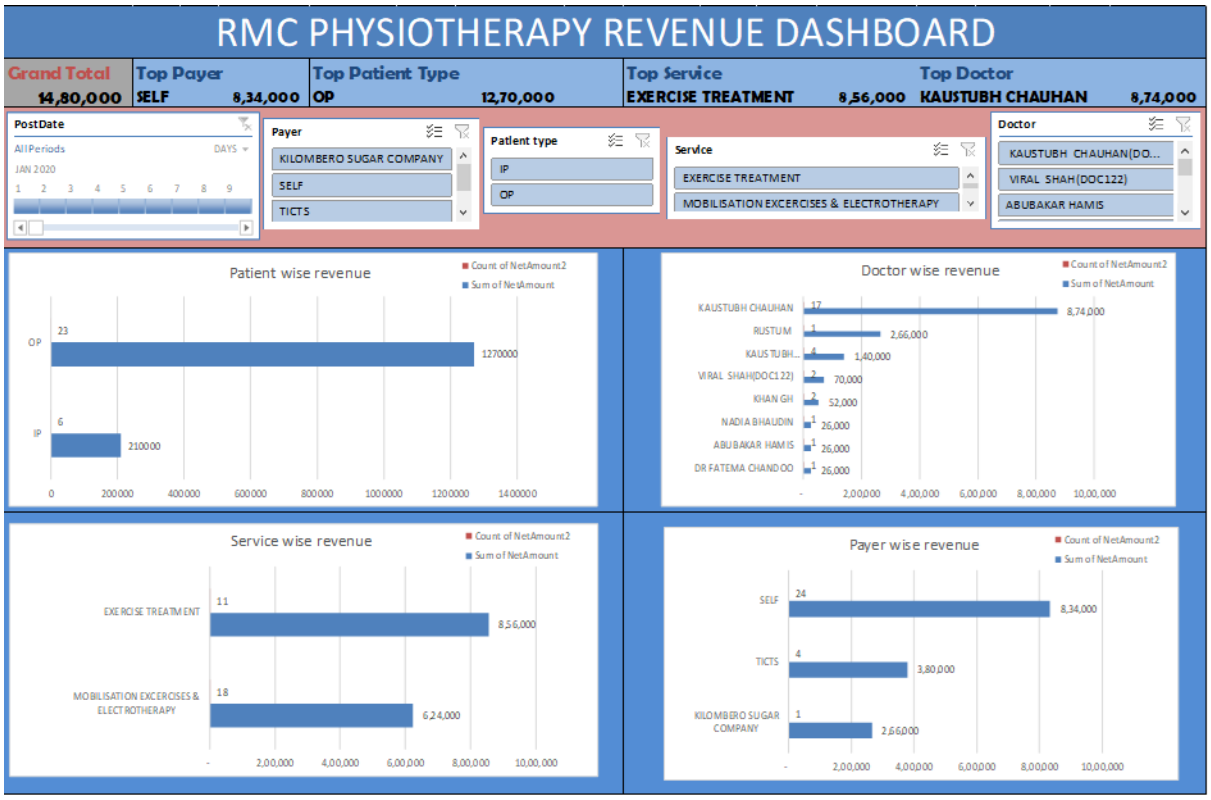
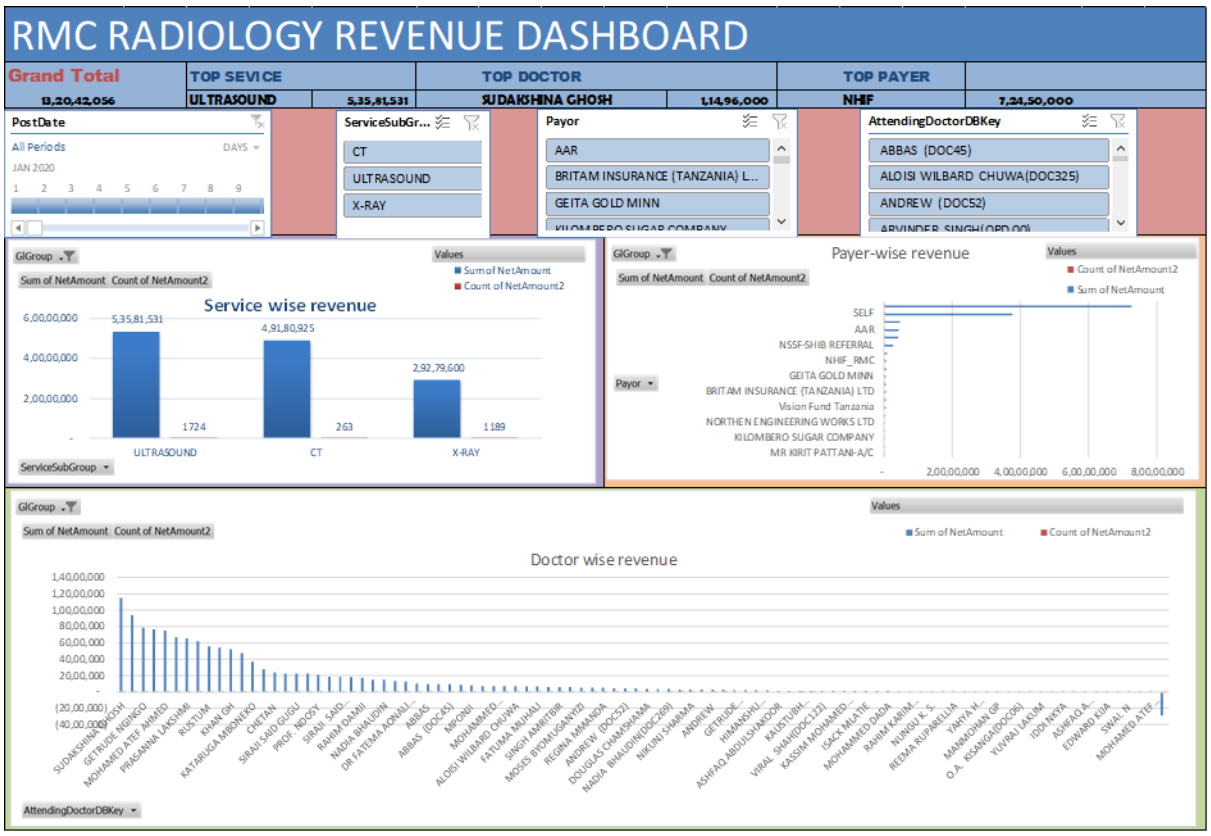


Figure 15.5 RMC Radiology Revenue Dashboard



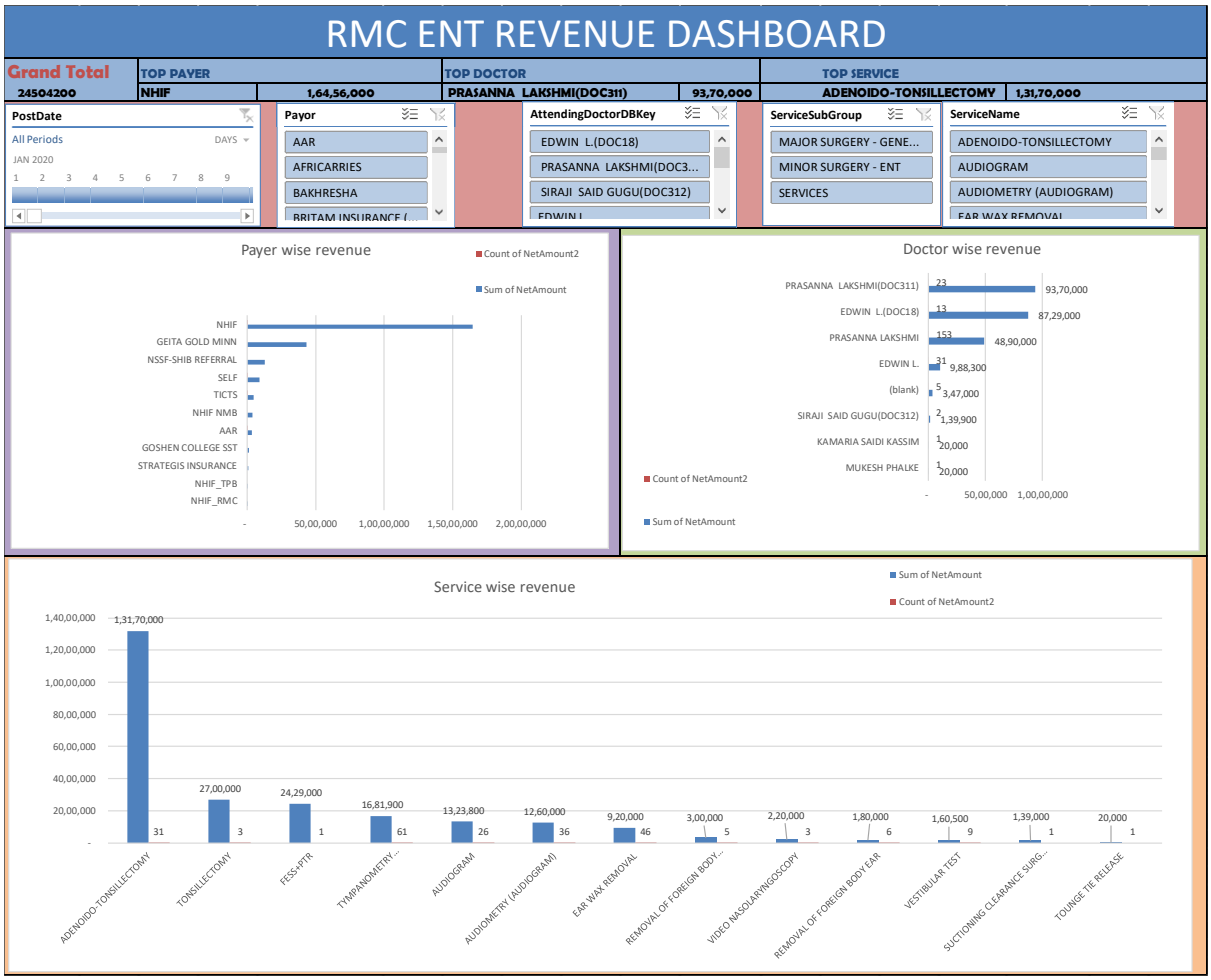


Figure 15.6 RMC ENT Revenue Dashboard

Revenue data has been presented doctor-wise, payer-wise and service-wise in Radiology and ENT Dashboards, doctor-wise, payer-wise and admission reason-wise in ICU Dashboard and doctor-wise, payer-wise, patient-wise and service-wise in Physiotherapy Dashboard.

Several key revenue patterns and trends were observed. It was noted that diagnostic departments like Laboratory and Radiology tend to generate the most revenue. Also, a far greater footfall of patients opting for either private or public health insurance was seen as opposed to those choosing to pay by cash. It was also seen that outpatients brought in more revenue as compared to inpatients.

Dashboards as tools for revenue analysis have a distinct advantage of allowing the researcher to drill down and extract the data of interest along the parameter of their choice. However, they require a certain degree of skill to operate.

DISCUSSION

The broad revenue trends of the hospital system captured by the dashboard were consistent with the findings of similar studies undertaken previously. For instance, it was observed that the OPD generated more revenue when compared to the IPD, which is in keeping with the general shifting trend. Also, with regards to payer related data, patients opting for either state-sponsored or private insurance had a significantly greater footfall as opposed to those opting for cash payments.

Dynamic revenue dashboards created for RMC have several strengths that put them at an advantage when compared with other similar dashboards described in the literature review section. We have listed them below.

- *Ease of use* – The use of Microsoft Excel made them easy to populate and update, while the visual graphics enabled effortless reading of data.
- *Scalability* – Since the source data is also in the same format as the dashboard, it is not difficult to scale it up to include a broader time frame, more departments or other aspects of the hospital system.
- *Comparibility* – All six dynamic revenue dashboards draw data from the same source, thereby making them comparable for the purposes of evaluation and analysis.
- *Affordability* – Platforms like Tableau and IBM require significant capital investment, unlike the one we chose for this study. Also, Microsoft Excel would not require any significant additional training or skill development of the hospital staff.
- *Accessibility* – The choice of Excel also made the revenue data accessible to all stakeholders.

However, these dashboards also have some limitations. Our data is only as accurate as that recorded by the hospital and any flaw in data collection is not accounted for. Furthermore, these dashboards only deal with one private hospital in Tanzania. So, the findings may not be generalizable to hospitals in the public sector or those in other countries. Moreover, the dashboards were of moderate analytical intensity and maturity, making them unable to perform complex functions like revenue forecasting and blending multiple datasets. But since such dashboards would have necessitated a high level of skill and expertise, therefore, in the interest of feasibility, we settled for dashboards of moderate maturity and intensity. We recommend improving the degree of maturity of the dashboard in the future, to allow these complex functions.

However, in the context of the dashboard, it proved to be a tool uniquely suited to fill up the gaps existing in the hospital administration while accounting for and managing its revenue. A platform like Microsoft Excel is readily accessible and can be easily populated with new data on a real time basis. Another strength of this intervention is that it is easy to implement and is tailor-made to cater to the needs of the administration of the institution. It helps in real time monitoring owing to its interactive dynamic design. Any datapoint of interest can be extracted by making use of the various filters embedded in the design concept. But lack of skilled manpower in developing countries poses a serious challenge to such interventions. There was also some reluctance shown by the staff in the area of behaviour change and taking to new technology.

CONCLUSION

Dashboards have emerged as useful instruments in the arena of hospital administration, especially when dealing with key aspects like revenue. Of late, many hospitals have begun to realise the important role they can play in bridging the gap between demand and supply. In developing countries, it is even more important to allocate resources effectively and judiciously, in order to achieve the important balance between demand and supply.

Dashboard is also a significant platform that allows the administration to keep a tab on the day to day functioning of the hospital. The insights it provides can be used to inform key strategic decisions regarding allocation of resources. It can serve as a useful link between the administration and various other departments of the hospital, besides being a milestone in the process of digitization of hospitals and going paperless.

The study pertaining to the development of dashboards for analysis of hospital revenue in RMC, Dar es Salaam, Tanzania began with the focus on identifying key revenue related datapoints to be reflected on the dashboard. Data was presented in the form of visual graphics like bar graphs and pie charts to ease reading and analysis of data. Microsoft Excel was chosen as the platform for this exercise because it is accessible and easy to populate. Outliers in performance were spotted and reflected on the top of the respective dashboards. A comparative analysis was done between the six departmental dashboards to identify the patterns of revenue generation in the hospital. Diagnostic departments were found to generate the major share of revenue. Our results also reflected the general trend in greater revenue generation by outpatients and those with health insurance.

Various shortcomings were noted in the degree of complexity of the dashboards and skilling of the staff. Hence, this study offers several suggestions to address these limitations. Regular interventions in the form of training and skill development of hospital staff can prove to be a game changer as far as the success in adoption of any new technology is concerned. It can enable the introduction of dashboards that can blend multiple datasets and offer new and untapped insights into hospital revenue patterns and trends. The dashboards should also be upgraded in the future to facilitate forecasting, which can be an indispensable aid in financial decision making.

STUDY INSTRUMENTS

1. Microsoft Excel
2. Pivot Tables
3. Pivot Charts
4. Dashboards
5. Visual Basic for Applications

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