Operating Room Workload

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Introduction

Operating room work poses numerous challenges due to its complex and dynamic nature as well as being largely under-resourced. Increase in surgery complexity and reliance on technology has amplified mental and physical demands on surgery teams. High workloads are associated with diminished surgical team performance and impaired patient safety. Studies indicate that a significant number of adverse events result from cognitive errors. In this paper, issues on operating room workload such as appropriate definition, key theories, management, and evaluation will be explored by investigating quantitative and qualitative studies. The review will draw on research conducted in operating environments. Findings will lay the foundation for statistical analysis and understanding of operating room workload.

Definitions of Workload

He et al. (2011) defines workloads as the number of operating room hours used by a medical specialty on a given day to perform surgical procedures. Therefore, determining optimal staffing levels with different information sets available at the time of decision: no information, information on number of cases, and information on number and types of cases is one major problem that continues to persist in Operating Room (OR) workload. OR is without doubt one of the most complex work environments in health care (He et al., 2011). Further, OR workload entails considerations in the magnitude of patient and treatment protocol, as well as high level of technology and coordination required to effectively manage rapidly changing conditions in surgical operations (Christian et al., 2006).

Leedal and Smith (2005) provide another key definition of OR workload. According to them, definitions of workload are rarely short and simple. Workload may as such be best described as a dynamic balance between the challenge of a task and an individual's response to that task. Minnick et al. (2012) outlines that OR activities entail describing the differences

and similarities in OR nurses', anaesthesia providers', and surgeons' beliefs about team function, case difficulty, non-routine event (NRE), and error causation using a qualitative design in hospitals.

Theories of Workload

Numerous theoretical approaches can be adopted in the management of OR workload. First, the multiple stage process is used by many hospitals and starts with the long term allocation of operation room time to the surgical specialties, e.g. the number of surgery hours per year (Vanberkel et al., n.d.). The systems theoretical approaches to surgical quality and safety is also a major theoretical approach in OR workload management. As pointed out by Vincent et al. (2004), this approach aims at expanding the operative assessment beyond patient factors and the technical skills of the surgeon; to extend assessment of surgical skills beyond bench models to the operating theatre; to provide a basis for assessing interventions; and to provide a deeper understanding of surgical outcomes.

U.S Department of Health & Human Services (n.d.) advances that using the systems theory, which posits that team inputs, team processes, and team outputs are arrayed over time; it is possible to enhance patient safety in an OR set up. The game theory is extensively applicable in OR workload management. Game theory is an economic system of strategic behaviour, often referred to as the "theory of social situations." In application of this theory it is patent that the practice of surgery and the operating room environment clearly involves multiple social situations with both cooperative and non-cooperative behaviours (McFadden et al., 2012).

According to Athanasiou and Darzi (2011), the ultimate aim of game theory modelling in health care is to identify a dominant solution for a pre-defined game setting. Notably, surgical oncology features as a main theoretical approach to OR workload. The position of surgical oncology is clearly delineated in clinical oncology as a major discipline

with well-defined theory and practice (Raven, 1985). Lastly, as advanced by Salmon and Hall (1997), the application of the postoperative fatigue theory is central in the management of OR workload. The application of this theory to the behavioural and subjective changes that characterize postoperative convalescence has led to the assumption that these changes reflect the physiological and metabolic consequences of surgery.

Workload Management

Workload management entails the consideration of the allocation of OR time at facilities where the strategic decision had been made to increase the number of ORs. Allocation occurs in two stages: a long-term tactical stage followed by short-term operational stage (Dexter et al., 2005). Effective OR management is essential in the sustainability of a hospital. As noted by Cardeon et al. (n.d), since this facility is the hospital's largest cost revenue centre, it has a major impact on the performance of the hospital as a whole. As such, OR managers are primarily measured on cost accounting standards and variances to determine how well they met their budget (Protzman et al., 2011).

Based on a study conducted on operation room time, although intervention management had little effect on costs, it reduced the operation time. Dexter et al. (2006) notes that, even if these factors (management factors) had been associated with differences in OR time per case, any changes resulting from management interventions would still not have reduced labour costs. This is because hospital operating rooms often experience uncertain workload that results in overtime and inefficiency. OR workload management entails development of empirical models to predict the daily workload distribution and study how its mean and variance change with the information available (He et al., 2010).

Therefore, as pointed out by He (n.d.), in OR workload management, several factors come into place; this may include: identifying the (1) key factors that can reduce the workload uncertainty and develop effective methods to predict future workload; (2) exploring

how information, data and forecasting methods can be used to facilitate the staffing decision, and how these elements affect the cost performance; (3) improving the decision process, allowing adjustments to be made to the allocated staffing levels as new information of the workload becomes available; (4) integrating forecasting methods with the dynamic staffing model to provide practitioners with an implementable solution.

Evaluation of Workload

According to Larson et al. (2005), OR workload evaluation involves global assessments including clinical performance, professional behaviour, technical skill, and number of procedures performed. Equally, evaluation of Non-technical Skills for Surgeons is instrumental in OR workload evaluation. Previous research has shown that surgeon's intra-operative non-technical skills are related to surgical outcomes (Yule et al., 2008). As such, as suggested by Yule et al. (2006), the major non-technical skills that form the basis of an evaluation of OR workload includes: communication, teamwork, leadership, and decision making.

Task analysis features as major element in OR workload evaluation. This entails developing techniques to allow objective description of task characteristics, workload, and vigilance in operating room settings (Weinger et al., 1994). Self-Organising Maps (SOM) can be used in OR evaluation. These are a means of unsupervised clustering that are widely used in this type (SOM) of exploratory data analysis (Houliston et al., 2010). Thijs (2010) argues that OR efficiency is measured by two measures: (1) idle time of the OR at the end of the day, after having performed all planned surgeries, (2) overtime required for performing all planned surgeries.

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The OR workload entails formulation of classification schemes. As noted by Cardoen (n.d.), one major concern in the development of classification schemes is the trade-off

between the amount of information and the simplicity of the notation. Generally, the OR workload entails preparation of the surgery by the OR team. This involves positioning, draping and disinfection of the incision area. After this, the actual procedure is performed by the surgeon (Thijs 2010). As highlighted by Augusto (2009), after the surgery, the patient is transported to the recovery room and the operating room is cleaned as soon as the patient leaves.

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