Editorial: Efficiency, effectiveness, and productivity – widely used, but often misunderstood in healthcare

According to the World Health Organization, healthcare is a system that consists of subsystems, organizes people, institutions and resources and delivers healthcare services to meet the health needs of target populations (Braithwaite *et al.*, 2020). The three key elements of a system or subsystem are inputs, processes and outputs (Cusins, 1994). For instance, a hospital is a subsystem of a healthcare system consisting of inputs, processes and outputs. Input is the resources, such as human, capital, material, tools and information, required in an organization. Output is health services. The inputs are transformed by carrying out different activities and procedures to give output. These different activities and procedures are known as processes.

Efficiency, effectiveness and productivity are key performance indicators (KPIs) widely used when discussing any healthcare system or subsystem (Evans *et al.*, 2001). It is desirable that the healthcare system should be efficient, effective and productive (Street and Häkkinen, 2009). These three KPIs are related but have different concepts. An enormous amount of literature is available to define and differentiate these terms (Burches and Burches, 2020). However, it can be seen in the medical literature that they are used interchangeably (Lodge, 1991). For instance, Kao *et al.* (1995) explained, "Efficiency refers to the ratio of outputs and inputs, effectiveness refers to the extent to which outputs align with predetermined goals. Productivity refers to the sum of both efficiency and effectiveness." Very clearly, the definition of productivity is flawed.

The author of this paper tries to explain these terms using an illustrative diagram (Figure 1). Most of the explanations in this study are built upon two already-published research papers. They are:

(1) Great Companies Obsess Over Productivity, Not Efficiency by Mankins; and

(2) Demystifying Productivity and Performance by Tangen (Mankins, 2017; Tangen, 2005).

As can be seen in Figure 1, efficiency is defined as the "ratio of resource expected to be consumed and resource actually consumed," "doing the same with less" or "shrinking the denominator." Supposing we are efficient means the same output is received with less input. For instance, hospitals can achieve efficiency through various means, such as waste elimination, new tools, machinery and technology.

Likewise, effectiveness is defined as the "ratio of actual and expected output," doing more with the same" or "expanding the numerator (output)" (Tangen, 2005). The effectiveness is achieved by reducing the number of medical errors, readmissions and adverse drug reactions or by increasing the success rate of surgery or treatment provided using medicines. Last, productivity is defined as a ratio – of output/input. Productivity can result from "expanding numerator or output," "shrinking the denominator or input" or "both."

Apart from an illustrative diagram, an example can explain it more clearly. Suppose a medical practitioner runs a clinic for 4 h a day with the help of three support staff. One person worked as a registration clerk and was responsible for registering patients and collecting consultation fees. The practitioner could usually see 16 patients in a 4-h clinic, generating revenue of US$480 per day. After paying support staff salaries and other expenses, the practitioner could earn a net profit of US$240 per day. Later, practitioner

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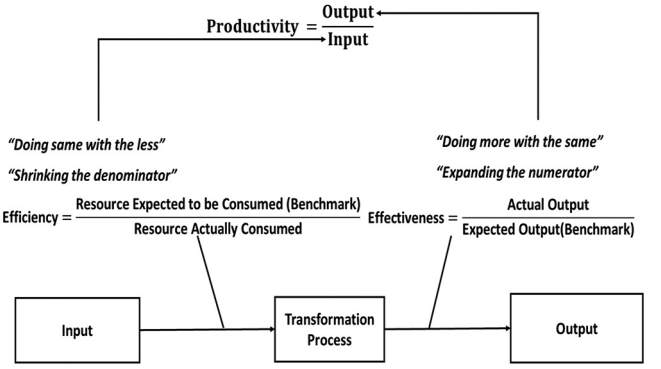

Figure 1.
An illustration showing the relationship between efficiency, effectiveness and productivity

Sources: Mankins, (2017); (Tangen, 2005)

upgraded his clinic with the introduction of a Web-based automation system and state-of-art devices for diagnosis. The practitioner does not need a registration clerk with the introduction of the Web-based automation system. Now patients self-register and pay online. Moreover, the practitioner could see 20 patients instead of 16 due to the clinic's introduction of contemporary diagnosis instruments. Now, the practitioner has a daily revenue of US$600 and a net profit of US$460 daily. Comparing the current state of the clinic with the earlier one, the practitioner could save an extra US$220:

- US$100 saving by reducing support staff (from three to two); and
- US$120 saving by seeing four extra patients.

The extra productivity worth US$220 resulted from two things – the first practitioner sees 20 patients instead of 16 – "expanding the numerator." Second, the practitioner reduced the input by removing one support staff – "shrinking the denominator."

In summary, efficiency, effectiveness and productivity are highly used but often misunderstood concepts in healthcare settings and stakeholders. Several researchers have differentiated them very accurately. Nevertheless, making sense of those explanations by healthcare stakeholders is not that easy. Some other works have described these concepts with simplicity but compromised with accuracy. The author of this paper brings the best of both articles by providing "simple" and "accurate" definitions of productivity, efficiency, effectiveness and their relationships.

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