

A proposed predictive model for assessing dental clinical performance

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تطوير نموذج تنبؤي لتقييم الكفاءة السريرية السنوية
ملخص البحث

الهدف: إن الهدف من هذا البحث هو عرض نموذج نظري للتنبؤ بالمقدرة السريرية لاستيعاب المرضى من قبل أخصائي الأسنان. تم عرض نموذج حسابي مفصل، مع أمثلة عديدة لتطبيقه. إن توقع الرقم الحقيقي لأي مقدرة سريرية هو هدف مستحيل بسبب تعقد العوامل المؤثرة. وعلى كل حال، يمكن أن يستعمل النموذج بتعدلات شخصية لتأمين تخمين مفيد قابل للتنبؤ بالمقدرة السريرية بالنسبة لأي طبيب سريري أو أخصائي. يمكن تشكيل النموذج للتنبؤ بشكل تقريبي بالمقدرة السريرية لأي أخصائي أسنان. وهذا يؤمن معلومات مفيدة لتخطيط الخدمات السنوية وتدريبها وتقييمها.

The aim of this article is to present a theoretical model for predicting patients clinical capacity for dental specialties from a practical point of view. A detailed mathematical model was presented, with several examples of its application. Predicting the exact number of any clinical capacity is an impossible task due to the complexity of the influencing factors. However, the model can be utilized with personal customization to provide a predictable educated guess of the clinical capacity for any clinician or specialty. It may provide useful information for planning, management, and evaluation of dental services.

Introduction

Planning and management are vital factors in dental services. The majority of articles related to planning of dental health services are directed towards the prevention¹⁰⁻¹⁷ Very few articles are directed towards evaluating the clinical capacity of a general or a specialized dental care.¹⁸⁻¹⁹

Therefore, the aim of this article was to present a predictable model for assessment of the clinical capacity and performance of dental specialists.

Mathematical Model

The suggested model is composed of time scale values of different treatment items per clinician.

	# of pts per hour	# of hrs per session	# of sessions per week	# of wks per month	# of mths per year	# of yrs per patient
Clinical capacity per clinician	x	x	x	x	x	x
total number of visits from start to finish per patient (ave.)						

Description of the developed introduction/module

• Clinical capacity per clinician

This represents the total number of patients treated by a clinician in any dental specialty per year in a private sector or a government sector.

• Number of patients per hour

This variable represents the number of patients seen per hour. It is related to the average length of time for a patient per visit. It ensures the customization of the optimal length of treatment procedure per visit, in accordance with the skills and speed of the clinician as well as the required time by specialty practice. For example, an orthodontist may see one patient per hour or two patients per hour. On the other hand, a prosthodontist may see one patient every 1.5 hours, whereas a maxillofacial surgeon may see one patient every 2 hours for complete surgical procedures.

• Number of hours per session

This variable represents the number of clinical hours for each clinician per session, which may vary from one clinic to another.

• Number of sessions per week

This variable represents the number of clinical sessions for each clinician per week.

• Number of weeks per month

Even though the average number of weeks per month is 4 weeks, however, this variable represents the number of weeks per month that the clinician utilizes for clinical treatment.

• Number of months per year

Even though a year consists of 12 months, this

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variable represents the number of months per year that the clinician utilizes for clinical treatment after taking into consideration non-clinical months and vacations.

- *Total number of visits from start to finish per patient*

This variable represents the average number of visits required to finish one patient or one case. This varies from one specialty to another. For example, an orthodontist requires an average of 24 visits (2 years) to complete a case seeing the patient once a month. On the other hand, an endodontist requires an average of 2 visits per case (tooth).

- *Number of years per patients*

This variable represents the average number of years required to complete or finish a case. For the majority of dental specialties which require one year or less to complete a case, the variable will be "1." However, for specialty such as orthodontics, it requires an average of two years to complete a case, therefore the variable will be "2."

The model can be summarized and compared as follows:

$$CCPC = (P \times H \times S) / N$$

Where CCPC = clinical capacity per clinician per year

- P = number of patients per hour
- H = number of hours per session
- S = Total number of sessions per clinician work in a year
- N = Total number of visits of a patient

The summarized model is presented in following examples with an actual model.

Examples of the model applications

The following applied examples represent the result of such module.

EXAMPLE (I):

An orthodontist examines 2 patients/hour. He has 6 clinical sessions/week. The duration of each session is 3 hours. He works 4 weeks/month, 10 months/year. Each patient requires 2 years of treatment for completion. [The orthodontist needs an average of 24 visits to treat a case].

Therefore,

$$\text{Actual CCPC (orthodontist)} = \frac{2 \times 3 \times 6 \times 4 \times 10 \times 2}{24} = \frac{2880}{24}$$

$$= 120 \text{ patients per clinician every two years}$$

$$\text{Summarized CCPC} = \frac{2 \times 18 \times 40}{24 \times 24} = \frac{1440}{24} = 60 \text{ patients per year}$$

EXAMPLE (II):

An endodontist treats 1 patient/hour. He has 6 clinical sessions/week. The duration of each session is 3 hours. He works 4 weeks/month, 10 months/year and he needs an average of 2 visits to treat a case within less than a year.

Therefore,

$$\text{Actual CCPC (endodontist)} = \frac{1 \times 3 \times 6 \times 4 \times 10 \times 1}{2} = \frac{720}{2}$$

$$= 360 \text{ patients per clinician per year}$$

Summarized

$$\text{CCPC} = \frac{1 \times 18 \times 40}{2} = 360 \text{ patients per year}$$

EXAMPLE (III):

A full time pedodontist who treats 1 patient/hour. He has 10 clinical sessions/week and the duration of each session is 4 hours. He works 4 week/month, 10 months/year and he needs an average of 5 visits to treat a case within less than a year.

Therefore,

$$\text{Actual CCPC (pedodontist)} = \frac{1 \times 10 \times 4 \times 4 \times 10 \times 1}{5}$$

$$= \frac{1600}{5} = 320 \text{ patients per clinician per year}$$

$$\text{Summarized CCPC} = \frac{1 \times 40 \times 40}{5 \times 5} = \frac{1600}{5} = 320 \text{ patients per year}$$

EXAMPLE (IV):

If we consider a periodontal patient for non-surgical periodontal therapy, a periodontist treats 1 patient per hour. He has 6 clinical session per week, the duration of each session is 3 hours. He works 4 weeks per month, 10 months/year and he needs an average of 6 visits to treat a case.

$$\begin{aligned} \text{Actual CCPC} &= \frac{1 \times 3 \times 6 \times 4 \times 10 \times 1}{6} = 120 \text{ per year} \\ \text{Summarized CCPC} &= \frac{1 \times 18 \times 40}{6} = 120 \text{ per year} \end{aligned}$$

A periodontist will complete 120 patients per year by ACCPC and SCCPC model. So the author would recommend the CCPC model due to the same outcome of both models.

Discussion

It is extremely difficult, if not impossible, to consistently predict the exact number of patients that could be treated by different clinicians in any specified dental specialty. The following influencing factors are the reasons behind such difficulty.

1. The variation between clinicians of the same specialty in their skills, speed and performance.
2. The variation in the severity or complexity of the cases which is reflected in the time needed for treatment.
3. The variation in the nature of the make up of the clinical patients since there is always a new influx of patients who may or may not go through the treatment from start to completion since some are only for consultation or others may transfer.
4. The variations in the clinical time and schedule available for each clinician which differ from one clinic to another.

If that is the case within the same specialty, then it is more of a challenge to consistently predict the exact number of patients treated in different specialties. Since in the latter case, we are adding another variable or influencing factor which is "different specialties have different time requirements." Therefore, if such a task is impossible, then achieving an educated guess in predicting the number of patients treated by a clinician may be the second best choice from a practical point of view.

Even though the module cannot take into consideration all the influencing factors in their exact details, the clinician, however, has the ability to customize the module by considering the minimal number of patients per hour or increasing the total number of visits to finish a case according

to his experience. This will account for influencing factors such as skill, speed and efficiency of the clinician, in addition to the severity of the cases and the make up of his clinical patients.

In Example No. (I), the total number of visits for an orthodontic patients is 24 and it is extended over an average period of 2 years. During any given year, new patients are seen for consultation or starting treatment. Then we can conclude that at any given year, the orthodontist can accommodate up to 144 patients. However, the number of patients that an orthodontist will finish every two years will be 120 patients or 60 patients yearly due to the overlap of new patients and old patients at any given year.

In Example No. (II), an endodontic case means an endodontically treated tooth or patient requiring one tooth to be endodontically treated. Since an endodontically treated case requires less than one year to complete, therefore, in every year, the endodontist has the capacity to treat and complete 360 new cases.

The outcome of the module can be helpful in providing a theoretical justification for the concept of "dental prevention" versus "dental treatment." This could be explained by the following hypothetical example.

If 30 percent out of a population of 10 million people require a specific dental specialty service* like, pedodontic treatment, and there are 500 full time pedodontic clinicians, utilizing the outcome of pedodontic Example No. III, then we will come to the following conclusions:

1. We have 3 million patients needing pedodontic treatment.
2. The predicted number of patients that could be treated and completed by the 500 full time clinicians will be 160,000 patients [from Example III] $320 \text{ patients} \times 500 \text{ clinician} = 160,000 \text{ patients/year}$.
3. If we need to treat all 3 million patients, then we need $\frac{3,000,000}{320} = 9375$ full time clinicians.
4. If we take into consideration, on one hand, the continuous increase in population, awareness, needs, demands and cost, and on the other hand, the limitations in manpower and resources, then it will be very obvious that "prevention" is the key factor in dental management rather than "treatment," and a waiting list in dentistry is a non- avoidable reality.

Finally, establishing an exact prediction seems

to be an impossible task; however it would be of importance to test the practical reliability of such theoretical module against actual clinical data obtained from different dental specialties.

Conclusion

The presented theoretical module could be helpful in the planning and management of any dental care providing sector, whether government or private. It could be used as a practical instrument in predicting the clinical capacity or performance, as well as an evaluation tool of the productivity of clinicians within a clinical set up.

Clinical testing of such module is necessary by future studies.

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