

# **Evaluation of Variability in Clinical Assessments**

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## **Abstract**

Variability in clinical assessments is a long-standing issue affecting the efficiency of care delivery, cost, and resource utilization. Despite its importance, so far, only limited research has been conducted to identify potential causes and contributory factors of variation in clinical assessments. This study, therefore, aims to provide background on variation in clinical assessments and evaluates why they occur. Moreover, potential solutions and challenges associated with variations are discussed. The results suggest that creating effective standardized systems that identify and mitigate root causes of variations may optimize resource utilization and service delivery without compromising patient care.

## **Keywords**

Variability, Physician Examination, Clinical Assessment, Unwarranted Variations, Resource Utilization.

## **1. Introduction**

Clinical assessment variation is defined in healthcare practice as “patients with similar diagnoses, prognoses and demographic status receive different levels of care depending on when, where and by whom they are treated, despite agreed and documented evidence of best practice” (Kennedy et al., 2010). There is a high degree of variability in medical practice among physicians that may have an impact on the service quality and costs. While evaluating the differences in a physician's practice is challenging, it is also suggested in the literature that understanding the clinical practice variation may lead to a reduction in healthcare costs and enhance healthcare outcomes (Van Parys, 2016). Therefore, hospitals and other healthcare organizations aim to continuously measure and control the level of variation in their entity and act according to where variation is challenging for quality.

Clinical variation is quite common in healthcare systems. For example, a study finds that 30% to 40% of patients in the US receive clinical care that is inconsistent with the guidelines. Besides, the study shows that patients receive clinical care that are not relevant to their cases resulting in 20% to 25% of errors or unnecessary care (Taichman et al., 2009). It should be added that clinical assessment variation is not only present in the diagnosis of patients, but also in the average consultation time of patients with their physicians, which is simply defined as the time that physicians and patients spend together. A comprehensive study, which describes the average primary care physician consultation length in 67 countries, covers over 28 million consultation length

sample and the results show that the average length of consultation varied across the world, ranging from 48 seconds in Bangladesh to 22.5 minutes in Sweden (Irving et al., 2017). Even though it can be said that patients and their needs are unique, such variation in the consultation length may raise various safety risks on patients (Simsekler et al., 2015, 2018). For instance, depending on the length of consultation, physicians document too little or too much patient information in Electronic Health Records (EHR). A recent study measures variation in EHR documentation, results show that documenting too much or too little of the patient's information may create inefficiencies and risk patient's health due to missed or misinterpreted information (Cohen et al., 2019). Another recent survey, conducted in some parts of Europe, Northern America and Australia, shows that over one-third of all primary care physicians are dissatisfied with the consultation length time available with their patients (Irving et al., 2017). In addition, it should also be noted that the demand for healthcare is increasing across the world, which would put even more pressure on healthcare providers and organizations and may cause further variation in the process to match supply with increased demand.

It should be noted that variability can affect the level of quality and safety in healthcare systems. Such issues raise the need for a standardized system that can prevent potential risks and improve the efficiency of healthcare systems. Creating an effective standardized system that minimizes clinical practice variation can enhance patient-focused care and help reduce mortality and morbidity (Kennedy et al., 2010). However, thorough research is needed to understand the basis for current variations to reduce and standardize the healthcare processes and systems. In order to shed light, this study aims to review and identify factors that have an impact on variation in clinical assessments. While the following sections review the literature on this topic, we then provide some insights and solutions on how variation could be minimized in clinical practice. We also identify some key challenges that may hinder the effectiveness of suggested solutions due to the current practice and culture in healthcare. The results of the study may support healthcare organizations to understand some potential root causes of the variation boost their efforts towards mitigating them.

## **2. Literature Review**

There is a growing need to understand why variations occur in healthcare. First, it should be noted that some variations can be justified in medical practice, particularly in clinical assessments, because of unique patient needs. Such variations can be considered as *warranted variation* and exist in practice with proper justification. Such warranted variations do not threaten the quality of healthcare systems (Mercuri and Gafni, 2011). Therefore, the focus should be on *unwarranted variation*, which is defined as "variation that is not explained based on illness, patient risk factors or patient preferences" (Cook et al., 2018; Corallo et al., 2014). Unwarranted variations may potentially generate threats to healthcare systems. It may lead to high-cost implications and excess of expenses in addition to risking patient's health.

There are various types of unwarranted variations in clinical assessments. One of the main variations is directly related to healthcare providers, such as nurses and physicians, due to their past medical training, perception, and experience. It is unlikely that graduates of different healthcare institutes have similar thoughts, skills, and experience. Indeed, physicians and nurses who are trained in different institutions acquire different knowledge and skills. Thus, it can be said that training may have a significant impact on the variation in clinical assessments. A physician's perception of a patient's socio-demographic characteristics may also affect their clinical assessment. For instance, knowledge about a patient's age, occupation, and gender may determine the kind of treatment received. However, not all physicians are aware of their demographic prejudices or their bias on the type of treatment they recommend (Taichman et al., 2009).

Further, the caregiver experience has a considerable impact on variation. For instance, a recent study shows that physicians with less than a couple of years of experience devote almost 5% more time with patients compared to physicians with more than six years of experience (Buisman et al., 2016).

Some variations arise because of social factors. For instance, some physicians recommend high-tech or comprehensive and expensive tests that may not be needed. Consequently, they justify their actions as their peers are doing so. They expect to be consistent with what others do (conformity with others). Also, some physicians may consider potential issues related to malpractice claims. Therefore, they may do unnecessary practices or recommend a specific type of treatment in order to meet patients' expectations about the care they would receive (Van Parys, 2016).

Another potential factor is the availability of information. Although physicians are trained well and possess adequate skills, the lack of information to assess a patient's condition and provide appropriate clinical care can create unwarranted variation (Taichman et al., 2009). Although some healthcare institutions have established

clinical guidelines (medical-based evidence), these guidelines may lack the support of high-quality data and thus may hinder consistency. According to Kennedy and colleagues (2010), while some guidelines are well structured and consistent, few are used in practice. Indeed, junior doctors do not always follow the guidelines because some senior or expert doctors do not. Moreover, some physicians prefer to make judgments based on their experience rather than the established guidelines, believing their experience is more valuable than the guidelines (Kennedy et al., 2010).

Having multiple languages, thoughts, and communication behaviors also affect the variation in clinical assessments. Patients with a low understanding of the healthcare terminology can have difficulties to understand physicians' instructions. Therefore, this impacts the interaction between the patient and physician and results in lower satisfaction at both sides (Sudore et al., 2009).

Patient no-shows to their appointments are also one of the reasons affecting the provider productivity and sufficient clinic capacity. Further, no-show increases the patient's waiting time as well as the variation of the service time in the clinic. In order to reduce no-shows, healthcare organizations apply overbooking for their appointments' scheduling to increase the productivity of the healthcare system. However, no-show still exists and impacts on the variation due to the fluctuation in patient's waiting time and the disturbance of the provider timeline (LaGanga and Lawrence, 2007).

Variability can be observed due to the difference in the quality and efficiency of healthcare services. The technical quality of the healthcare service can generate the variation as the characteristics of the service has a high impact on the clinical assessment via time or practice. Healthcare capability, availability, and dependability cause a variation in the healthcare system (Goodman, 2009). The supply of needed service and/or product at the right time with the right quantity is, therefore, imperative.

The variation can be investigated by looking at administrative policies and decisions made by healthcare leaders in each country. These policies and decisions vary in different aspects, where some countries are more supportive of their healthcare systems than others. The analytical study, conducted by Irving and colleagues (2017), investigates the relationship between average consultation length worldwide with some primary healthcare measurements and indicators. Results show that the average consultation length is proportionally related to the country's per capita health spending.

In summary, the factors mentioned above can be classified into six main categories, where each one plays a significant role in clinical assessments' variability. Future solutions to reduce variation should be designed to control the effects of these contributory factors:

- *Physicians.* Backgrounds, training and experience of caregivers may lead to variation in clinical assessments.
- *Patients.* Patient no-shows to scheduled appointments is an independent issue itself, but a contributory factor for variation in clinical assessments. Language may be another barrier as ineffective communication between physicians and patients causes variation.
- *Policies and Facilities.* Administrative policies and facilities play a critical role in all healthcare sectors. The support and spending on healthcare services by governments reflects clearly on the quality of service provided.
- *Guidelines.* Guidelines are essential for standardized clinical assessments. Poor guidelines and /or adherence to guidelines cause variation to increase leading to further issues and losses.
- *Service.* The quality and reliability of the service offered by healthcare providers can contribute to variation.
- *Social factor.* Peer impact and culture play a hidden role in variation making it hard to overlook it. Intensive social studies need to be conducted to help mitigating its effects on variation and other healthcare challenges.

### **3. Discussion**

#### **3.1. Potential Solutions**

Several strategies have been suggested to address the variation challenge in healthcare. Earlier studies suggested various strategies to overcome unwarranted variations in healthcare organizations (Gauld et al., 2011). These strategies are benchmarking, clinical practice guidelines and blinded report cards. Benchmarking takes the healthcare institution's performance metrics and compares it to standardized metrics. Blinded report cards are

formats showing the individual physician's performance in comparison with others. All these strategies are extensively used and have high effectiveness in reducing variations in the hospitals (Gauld et al., 2011).

The most common strategy is the development and use of guidelines and/or protocols to reduce the variation in clinical assessments. Protocol development is defined as an evidence-based practice, which gathers most of the decisions and suggestions for most of the cases in clinical assessments. As an example, a protocol was developed by healthcare providers to treat patients with acute respiratory distress syndrome more efficiently. After implementing this strategy, it was noted that the overall treatment cost was reduced by around 25% per patient. Such reduction is achieved mainly due to the efficient and standardized processes and having fewer errors occurring during the hand-offs among healthcare providers.

Further, the patient survival rate increased from 9.5% to 44% (James and Hammond, 2000). As suggested by Kennedy et al. (2010), healthcare managers should focus on multi-dimensional efforts in order to reduce the gap existing between the evidence-based medicine and the practice outcomes through potentially having such protocols and guidelines. In the meantime, healthcare institutions should provide clinical guidelines that are easy to implement and sustainable. Furthermore, such guidelines should be comprehensive and applicable to all aspects.

Another example to reduce variation through guidelines is Standardized Clinical Assessment and Management Plans (SCAMPs). SCAMPs offer a promising alternative to clinical practice guidelines. As a strategy, it aims to reduce variation, optimize resource utilization and improve the patient's care. SCAMPs are improvements on the clinical practice guidelines, which allow providers to assess their clinical judgments and adapt treatment pathways regarding the chosen patient population. Having the flexibility to implement and modify a SCAMP even help further to optimize the clinical assessment process based on current medical management standards. Developing and modifying the SCAMP starts with formulating the background and conducting literature review about the situation, choosing the population who will be included in the SCAMP and highlighting the knowledge gap to identify the required data. Then, the SCAMP team gathers the required clinical data to implement the proper statistical analysis. From the results of the analysis and new medical literature, the team modifies the SCAMP and implement it in around three to six months. Clinicians who are implementing SCAMPs find that they adhere to their recommendations at a rate of over 80 percent; thus, the variation in their clinical practice has been reduced (Farias et al., 2013).

It should be noted that the cost-effectiveness of such strategies is also essential to consider. Thus, clinical assessment variation is accompanied by financial challenges and threats to hospitals. The World Health Organization (WHO) recommends the implementation of Cost-Effectiveness Analysis (CEA) on the hospital level (Buisman et al., 2016). CEA is a useful tool that can be customized in healthcare systems to assess the existing care as the comparator, with other clinical assessment guidelines as a proxy. CEA provides the feasibility of a new strategy and its potential costs. Therefore, whenever extreme variations are noticed in a hospital, managers should conduct a CEA to help decision-makers in the healthcare industry to prioritize their allocation of resources to health interventions. Also, it helps to identify what strategies and guidelines will have the highest yield on the service provided and the performance level of a hospital (Buisman et al., 2016).

### 3.2. Challenges in implementing the proposed solutions

Challenges to implementing the above solutions are mostly related to human behaviour. Healthcare experts vary in their opinions, which makes the physicians confused in determining the best practice. Moreover, the decision-making capability varies from physician to physician and from time to time as a result of variations on health, time constraints and level of stress (James and Hammond, 2000).

Another potential challenge is observed in the characterization of the physician practice style. In many healthcare settings, both patients and physicians can select each other. It can be said that if a physician always treats healthier patients, their practice style may be seen efficient. However, it should be noted that this only shows their patients' underlying healthcare needs (Van Parys, 2016). Another challenge is observed when expecting physicians to adapt to using guidelines since they believe their practice is ideal and refuse the application of evidence-based medicine. Another problem is that the providers think that the guidelines are already consistent with their practices, and there is no need to review or follow them (Kennedy et al., 2010).

#### **4. Conclusion**

This study aims to identify causes and contributory factors to the variations in clinical assessments. The paper evaluates this significant challenge in healthcare by understanding the nature of the problem and its potential causes. As highlighted throughout the paper, unwarranted variations may have an impact on optimal resource use, patient care and costs. Reducing this type of variation requires better knowledge of all the primary factors that are summarised in this study. Future research can zoom in each factor and identify all potential root causes in a systematic way in which industrial engineering tools can be implemented, such as lean and system modelling techniques. Such tools and methods can help identify sources of variations to optimize resource utilization and implement evidence-based practices in healthcare. Though this study is mainly based on the literature review covering this topic, further study can elaborate on the findings in an existing healthcare setting. Such a study can gather qualitative and quantitative data together to make insightful suggestions and develop better tools for variation reduction to optimize resource utilization and service delivery.

## 5. References

- Buisman, L.R., Rijnsburger, A.J., den Hertog, H.M., van der Lugt, A. and Redekop, W.K. (2016), “Clinical Practice Variation Needs to be Considered in Cost-Effectiveness Analyses: A Case Study of Patients with a Recent Transient Ischemic Attack or Minor Ischemic Stroke”, *Applied Health Economics and Health Policy*, Vol. 14 No. 1, pp. 67–75.
- Cohen, G.R., Friedman, C.P., Ryan, A.M., Richardson, C.R. and Adler-Milstein, J. (2019), “Variation in Physicians’ Electronic Health Record Documentation and Potential Patient Harm from That Variation”, *Journal of General Internal Medicine*, available at:<https://doi.org/10.1007/s11606-019-05025-3>.
- Cook, D.A., Pencille, L.J., Dupras, D.M., Linderbaum, J.A., Pankratz, V.S. and Wilkinson, J.M. (2018), “Practice variation and practice guidelines: Attitudes of generalist and specialist physicians, nurse practitioners, and physician assistants”, *PloS One*, Vol. 13 No. 1, p. e0191943.
- Corallo, A.N., Croxford, R., Goodman, D.C., Bryan, E.L., Srivastava, D. and Stukel, T.A. (2014), “A systematic review of medical practice variation in OECD countries”, *Health Policy*, Vol. 114 No. 1, pp. 5–14.
- Farias, M., Jenkins, K., Lock, J., Rathod, R., Newburger, J., Bates, D.W., Safran, D.G., et al. (2013), “Standardized Clinical Assessment And Management Plans (SCAMPs) provide a better alternative to clinical practice guidelines”, *Health Affairs (Project Hope)*, Vol. 32 No. 5, pp. 911–920.
- Gauld, R., Horwitz, J., Williams, S. and Cohen, A.B. (2011), “What Strategies Do US Hospitals Employ to Reduce Unwarranted Clinical Practice Variations?”, *American Journal of Medical Quality*, Vol. 26 No. 2, pp. 120–126.
- Goodman, D.C. (2009), “Unwarranted variation in pediatric medical care”, *Pediatric Clinics of North America*, Vol. 56 No. 4, pp. 745–755.
- Irving, G., Neves, A.L., Dambha-Miller, H., Oishi, A., Tagashira, H., Verho, A. and Holden, J. (2017), “International variations in primary care physician consultation time: a systematic review of 67 countries”, *BMJ Open*, Vol. 7 No. 10, p. e017902.
- James, B.C. and Hammond, M.E. (2000), “The challenge of variation in medical practice”, *Archives of Pathology & Laboratory Medicine*, Vol. 124 No. 7, pp. 1001–1003.
- Kennedy, P.J., Leathley, C.M. and Hughes, C.F. (2010), “Clinical practice variation”, *The Medical Journal of Australia*, Vol. 193 No. 8, p. S97.
- LaGanga, L.R. and Lawrence, S.R. (2007), “Appointment Scheduling with Overbooking to Mitigate Productivity Loss from No-shows”.
- Mercuri, M. and Gafni, A. (2011), “Medical practice variations: what the literature tells us (or does not) about what are warranted and unwarranted variations”, *Journal of Evaluation in Clinical Practice*, Vol. 17 No. 4, pp. 671–677.
- Simsekler, M.C.E., Card, A.J., Ruggeri, K., Ward, J.R. and Clarkson, P.J. (2015), “A comparison of the methods used to support risk identification for patient safety in one UK NHS foundation trust”, *Clinical Risk*, Vol. 21, pp. 37–46.
- Simsekler, M.C.E., Ward, J.R. and Clarkson, P.J. (2018), “Design for patient safety: a systems-based risk identification framework”, *Ergonomics*, Vol. 61 No. 8, pp. 1046–1064.
- Sudore, R.L., Landefeld, C.S., Pérez-Stable, E.J., Bibbins-Domingo, K., Williams, B.A. and Schillinger, D. (2009), “Unraveling the relationship between literacy, language proficiency, and patient-physician communication”, *Patient Education and Counseling*, Vol. 75 No. 3, pp. 398–402.
- Taichman, D.B., McGoon, M.D., Harhay, M.O., Archer-Chicko, C., Sager, J.S., Murugappan, M., Chakinali, M.M., et al. (2009), “Wide Variation in Clinicians’ Assessment of New York Heart Association/World Health Organization Functional Class in Patients With Pulmonary Arterial Hypertension”, *Mayo Clinic Proceedings*, Vol. 84 No. 7, pp. 586–592.
- Van Parys, J. (2016), “Variation in Physician Practice Styles within and across Emergency Departments”, *PLoS ONE*, Vol. 11 No. 8, available at:<https://doi.org/10.1371/journal.pone.0159882>.

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