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# A Computational Aspect to Analyse Impact of Nutritional Status on the Performance of Anaesthesia on Surgical Patients

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**Abstract**

Use of anaesthesia is essential in clinical procedures, be it minor or major. Without anaesthesia, the procedure may be technically infeasible. Though the use of anaesthetic drugs help in painless and smooth conduction of medical procedures, yet it is not risk free. There are many factors that influence the performance of anaesthesia and so the associated risks. Among all factors, health of a person has the greatest impact on the performance of anaesthesia. In this study, we computationally analyse the impact of nutritional status of a person on the performance of anaesthesia in terms of required time and quantity. We formulate mathematical equations to relate all the three situations of nutritional status with the performance of anaesthesia. Our experimental results show that under-nutritional status and over-nutritional status have significant impact on the performance of anaesthesia while normal-nutritional status doesn't have much impact (negative or positive). This computational analysis can add an extra flavour to the pre-operative and post-operative preparations and decision making of the clinicians which can mitigate the associated risks.



*Keywords:* Anaesthesia; Surgical patient; Nutritional status; Anaesthetic drug.

## 1. Introduction

Anaesthesia is a condition of temporary loss of sensation or awareness that is induced under controlled environment for medical purposes. It can be prevention of or relief from pain (called as analgesia), muscle relaxation (called as paralysis), loss of memory (called as amnesia), and unconsciousness [15]. Anaesthesia creates an environment for painless procedures. Without anaesthesia the procedure may create severe or intolerable pain or even the procedure may be technically infeasible. There are mainly three types of anaesthesia- General anesthesia, Sedation, and Regional or local anaesthesia. In the preparation for a medical procedure, the clinician thoroughly checks different features as-

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sociated with that patient. Depending on the type of the procedure and other characteristics associated with the patient, the clinician chooses one or more number of drugs [1]. The type of drugs that are used include general anaesthetics, local anaesthetics, hypnotics, dissociatives, sedatives, adjuncts, neuromuscular-blocking drugs, narcotics, and analgesics [8]. Though the use of anaesthetic drugs assist painless procedure, yet it is not risk or complication free [2]. There are many factors that influence the associated risks, but, health of a person has the highest impact [17]. The associated risks can be mitigated by thorough investigation of medical history of the patient, physical examination of the patient before the procedure, and lab tests [4]. These can help the anaesthesiologist to decide appropriate quantity and approximate time required to complete the procedure [13].

The performance of anaesthesia is determined by many factors. In the clinical aspects, firstly the clinicians keep an eye on how the anaesthesia manages the temperature of the patient's body. It is observed if the anaesthetic drug creates any abnormality in the temperature. Secondly, the clinicians observe the effects after the operation [3]. The effects are different for different procedure type, length of the procedure, invasiveness level, presence of comorbidity etc [12]. It is also observed how many patients are moved to intensive care unit rather than moving to post-operative or recovery room [11]. Likewise, in the perspective of application, many quantitative and qualitative factors impact the performance of anaesthesia. The factors may be the disease type, seriousness of the patient, the technique that is used, experience of the doctor, time requirement of intermediate sub-procedures, anaesthesia type, drug category, complexity of the procedure, general health of the patient etc. The time requirement and the requirement of quantity of anaesthetic drug can be impacted by nutritional status of our body. The nutritional status can tell many important things about health of the patients [5]. There can have three different states of nutritional status namely under-nutritional status, normal-nutritional status, and over-nutritional status [7]. Out of these three levels of nutritional status, both under-nutritional status and over-nutritional status have negative impact while normal-nutritional status has positive impact on the activities that happen in our body [6]. In the case of anaesthesia also, there is a big role to play by the nutritional status or simply health of the patient.

To integrate some parameters regarding health of the patient, we decide to work on relating nutritional status with anaesthesia. To get an idea about the current status of this problem, we perform a literature survey and find that, recently a study by Ooba, S. et al. develops an exponential model of Stevens' power law and a sigmoidal model of Gompertz function by the use of differential equations and by adjustment of R values associated with Nociceptive Response formula in the patients undergoing procedures under general anaesthesia [10]. Another study by Korman, B. et al. mathematically models mixtures of nominal delivered concentrations of volatile agents with and without 70% nitrous oxide [9]. This study used state mass balance principle in the model and calculated magnitude of second gas effect on the patients under general anaesthesia. The study by Wang, I. et al. talks about multi outcome predictive modelling of anaesthesia patients [16]. This study mentions the possibility of gathering drug infusion data by using AI technology to generate patient specific computer models during a stage of surgical procedure. Another work by Sivia, D. S. et al. talks about mathematical model for risk assessment of drug error during anaesthesia [14]. This study develops a probabilistic mathematical model and claims that the model predicts Poisson distribution for uncommon serious errors.

Along with these studies about mathematical model development, we also find that, most of the studies about anaesthesia talk about pre-operative and post-operative cares. Some studies talk about relation of body mass index with performance of anaesthesia. Though body mass index can be considered to be close enough to identify the nutritional status, yet we find that there are limited studies about mathematical relationships between performance of anaesthesia and nutritional status. We find a scope to contribute in the analysis of the impact of three different nutritional status levels on the performance of anaesthesia. The main aim of this study is to analyse impact of nutritional status on the performance of anaesthesia. To achieve this aim, we incorporate the following:

- Formulate mathematical equations to relate all three situations of nutritional status with performance of anaesthesia in terms of time and quantity.
- Computationally simulate the formulated relations using two different sets of values.
- Separately analyse the impacts of under-nutritional status, normal-nutritional status and over-nutritional status on the performance of anaesthesia.

The newness/novelty of this work is in the mathematical representation of the performance in terms of required time and required quantity. The novelty lies in the integration of nutritional status with the performance of anaesthesia that is mathematically represented by quantitative parameters along with quantifying the associated qualitative parameters.

The next portion of the work, that is, Section 2 discusses proposed methodology that includes work flow, preliminary concepts, mathematical representations and experimentation; Section 3 lists out obtained results from the simulations; Section 4 discusses the obtained results while Section 5 concludes the work with future direction.

## 2. Methodology

### 2.1. Proposed workflow

The flow that we adopted in this work is shown in Fig. 1. Initially, we study about different types of anaesthesia and their procedure of working. Relation of anaesthesia with the health of the patient, associated risk factors, and also about the performance in terms of time and required quantity. Then we formulate mathematical relations between all the three situations of nutritional status and performance of anaesthesia in terms of time and required quantity. We computationally simulate the formulated equations using two sets of values. After that, we establish the relations of three situations of nutritional status with the performance of anaesthesia in terms of time and required quantity.

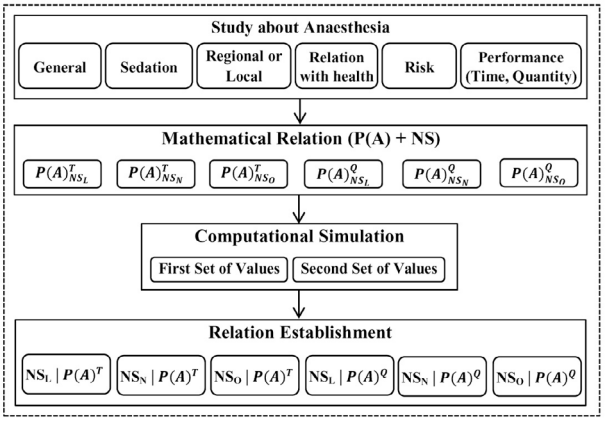


Fig. 1. Adopted flow of the work

### 2.2. Preliminary concepts

Since surgical procedures on patients are technically infeasible without the use of anaesthesia, clinicians are bound to use anaesthetic drugs whenever necessary. But there may have adverse effects on the patients if the time and quantity is not controlled as per the health of patient. There may have post-operative complications as well. There are many factors that determine the time required to apply anaesthesia on a patient. Out of all the factors that determine the required time to complete a procedure, the important factors are- the type of disease, severity of disease, used anaesthetic technique, expertise of the doctor, waiting time for intermediate sub-procedures etc. Like the required time, it is important to maintain required quantity of anaesthesia too. Obviously with increase in procedure time the quantity will increase. So, we can say that required quantity of a particular type of anaesthesia for a specific disease is proportional to the time required for the procedure. Mathematically-

$$Q(A_x^d) \propto T \tag{1}$$

Where, $Q$ denotes the quantity, $A$ is the anaesthesia of type $x$ for the disease $d$.

Other than required time, the required quantity depends on type of anaesthesia, category of anaesthetic drug, complexity of the procedure, anaesthetic technique used, health of the patient etc. It is always suggested to maintain an optimal amount of anaesthesia and so the required time.

### 2.3. Mathematical representation

For this study, performance of anaesthesia is considered in terms of time and required quantity. Health of a patient has the highest impact on required time and quantity to complete a procedure. To formulate the relation between performance of anaesthesia and levels of nutritional status of our body, we make some assumptions. The assumptions

are different for performance in terms of time and performance in terms of required quantity. These are discussed in subsequent sections.

### 2.3.1. Performance in terms of time

There are many factors that affect the time required for completing a procedure. We consider the factors that are very important for formulation of the equations to relate performance of anaesthesia with different nutritional status. The equations that we formulate considering different assumptions, situations, and conditions are as follows:

$$\left(P(A)^T_{N_l}\right)' = a \cdot D_i + \left(\alpha \cdot S_j \cdot N_l\right) \cdot \left(P(A)^T_{N_l}\right) + b \cdot Tech_k + c \cdot E_n + (W_m \cdot N_l) \cdot \left(P(A)^T_{N_l}\right) \tag{2}$$

$$\left(P(A)^T_{N_n}\right)' = a \cdot D_i + \left(\frac{\beta \cdot S_j}{N_n}\right) \cdot \left(P(A)^T_{N_n}\right) + b \cdot Tech_k + c \cdot E_n + \left(\frac{W_m}{N_n}\right) \cdot \left(P(A)^T_{N_n}\right) \tag{3}$$

$$\left(P(A)^T_{N_o}\right)' = a \cdot D_i + \left(\gamma \cdot S_j \cdot N_o\right) \cdot \left(P(A)^T_{N_o}\right) + b \cdot Tech_k + c \cdot E_n + (W_m \cdot N_o) \cdot \left(P(A)^T_{N_o}\right) \tag{4}$$

Here, Eq. (2) is the performance of anaesthesia in terms of time under the condition of under-nutrition, Eq. (3) is the performance of anaesthesia in terms of time under normal-nutritional status, and Eq. (4) is for the performance of anaesthesia in terms of time under the situation of over-nutrition.

$D_i$ is the disease of type $i$ and its impact is quantified by a quantifying factor $a$. The quantifying factor will be same for all three situations of nutritional status because the type of disease is not dependent on nutritional status.

$S_j$ is the severity of level $j = low, moderate, high$, which is quantified by the factors $\alpha, \beta$, and $\gamma$ in the equations under the conditions of under-nutrition, normal-nutrition and over-nutrition respectively. The value of $\alpha$, $\beta$, and $\gamma$ will change with the type of $j$ and it will be accompanied by the quantifying factor $N_l$ for under-nutrition, $N_n$ for normal-nutrition, and $N_o$ for over-nutrition.

$Tech_k$ is the anaesthetic technique $k$ which is quantified by the factor $b$. The quantifying factor will be same for all three situations of nutritional status because the technique is not dependent on nutritional status.

$E_n$ is the expertise of the clinician with a level $n = 1, 2, \ldots, 5$. 5 being the top level expertise while 1 being the clinician to be new to that procedure. The expertise is quantified by the quantifying factor $c$. The quantifying factor will be same for all three situations of nutritional status because the expertise of clinician is not dependent on nutritional status.

$W_m$ is the total waiting time for $m = 0, 1, \ldots, m$ intermediate procedures. So, $W_m = W_1 + W_2 + \ldots + W_m$. This is accompanied by the nutritional status $N_l, N_n$ and $N_o$ in the equations designed for the conditions of under-nutritional status, normal-nutritional status, and over-nutritional status.

### 2.3.2. Performance in terms of required quantity

Like the previous case of required time, there are many factors that affect the required quantity for completing a procedure. We consider only the important factors in the formulation of equations to relate performance of anaesthesia with different nutritional status. The equations that we formulate considering some assumptions, some situation, and some conditions are as follows:

$$\left(P(A)^Q_{N_l}\right)' = \left(\left(x \cdot A^q_p\right) \cdot \left(P(A)^T_{N_l}\right)\right) \cdot N_l + (C_r \cdot N_l) \cdot \left(P(A)^Q_{N_l}\right) \tag{5}$$

$$\left(P(A)^Q_{N_n}\right)' = \left(y \cdot \frac{A^q_p}{N_n}\right) \cdot \left(P(A)^T_{N_n}\right) + \left(\frac{C_r}{N_n}\right) \cdot \left(P(A)^Q_{N_n}\right) \tag{6}$$

$$\left(P(A)^Q_{N_o}\right)' = \left(z \cdot A^q_p\right) \cdot \left(P(A)^T_{N_o}\right) \cdot N_o + (C_r \cdot N_o) \cdot \left(P(A)^Q_{N_o}\right) \tag{7}$$

Here, Eq. (5) is the performance of anaesthesia in terms of quantity under the condition of under-nutrition, Eq. (6) is the performance of anaesthesia in terms of quantity under normal-nutritional status, and Eq. (7) is for the performance of anaesthesia in terms of quantity under the situation of over-nutrition.

$P(A)^T_{N_l}$, $P(A)^T_{N_n}$, and $P(A)^T_{N_o}$ are the time required under the conditions of under-nutrition, normal-nutrition, and over-nutrition respectively. The calculation of these are shown in Eq. (2), Eq. (3), and Eq. (4) respectively.

$A_p^q$ denotes the anaesthetic drug $q$ for the type of anaesthesia $p$. This is quantified by the factors $x$, $y$, and $z$ for the conditions of under-nutrition, normal-nutrition, and over-nutrition respectively. The values of $x$, $y$, and $z$ will change with anaesthetic drug of a specific anaesthesia and it will be accompanied by the factors $N_l$, $N_n$, and $N_o$ respectively.

$C_r$ is the complexity of a procedure for disease $r$ which is quantified by the factors $N_l$, $N_n$, and $N_o$ for the conditions of under-nutrition, normal-nutrition, and over-nutrition respectively.

### 2.4. Experimentation

To simulate the formulated equations, a system with 8GB RAM, 9MB Cache memory, and 3.00GHz of clock speed has been used. The experiments have been performed under Ubuntu 18.04 LTS 64-bit operating system. For programming, Python 3.6 has been used in Jupyter notebook environment. The experiments are carried out considering two sets of values. The values that are considered for experiments are tabulated in Table 1. In the Table 1, it is seen that, for some parameters qualitative values are used. Though these parameters are also present in the formulation, the values of all these parameters have been kept as 1 such that its value works only with the associated parameters. These

Table 1. Parameter values used in the experimentation

| Parameter | Symbol | Set-1 | Set-2 |
|---|---|---|---|
| Disease of a type | $D_i$ | Type1 | Type2 |
| Quantifying factor for contribution of the disease in time requirement | $a$ | 20% | 40% |
| Severity of the disease | $S_j$ | Low | High |
| Quantifying factor for contribution of the severity of disease in time requirement with under-nutrition | $\alpha$ | 1.25 | 1.75 |
| Quantifying factor for contribution of the severity of disease in time requirement with normal-nutrition | $\beta$ | 1.00 | 1.50 |
| Quantifying factor for contribution of the severity of disease in time requirement with over-nutrition | $\gamma$ | 1.50 | 2.00 |
| Quantifying factor for under-nutrition | $N_l$ | 1.25 | 1.75 |
| Quantifying factor for normal-nutrition | $N_n$ | 1.00 | 1.50 |
| Quantifying factor for over-nutrition | $N_o$ | 1.50 | 2.00 |
| Anaesthetic technique of a type | $Tech_k$ | Tech1 | Tech2 |
| Quantifying factor for contribution of anaesthetic technique in time requirement | $b$ | 20% | 40% |
| Expertise level of the clinician | $E_n$ | 1 | 5 |
| Quantifying factor for contribution of expertise level of clinician in time requirement | $c$ | 50% | 75% |
| Number of intermediate procedures | $m$ | 1 | 2 |
| Time requirement for single procedure | $t$ | 5 mins | 10 mins |
| Total Waiting time for intermediate procedures | $W_m(= m \times t)$ | 5 mins | 20 mins |
| Type of anaesthesia | $p$ | General | Local |
| Anaesthetic drug under the a type of anaesthesia | $q$ | Drug1 | Drug2 |
| Quantifying factor for the required quantity of an anaesthetic drug of a type of anaesthesia for under-nutrition | $x$ | 1.25x | 1.75x |
| Quantifying factor for the required quantity of an anaesthetic drug of a type of anaesthesia for normal-nutrition | $y$ | 1.00x | 1.50x |
| Quantifying factor for the required quantity of an anaesthetic drug of a type of anaesthesia for over-nutrition | $z$ | 1.50x | 2.00x |
| Complexity of the procedure for a disease | $C_r$ | Low | High |

qualitative values are quantified by the associated quantifying parameters. For the quantifying factors of severity of the diseases, we keep the values of $\beta < \alpha < \gamma$ in both the sets of values. This is to match the global fact that the severity of surgical patients is highest under the condition of over-nutrition followed by under-nutrition and normal-nutrition.

Similarly, we keep the values of $N_n < N_l < N_o$ for both the sets of values. This is also to match the global fact that more time and quantity are required by the over-nutrient patients followed by under-nutritional and normal-nutritional patients. Likewise, we keep the values of $y < x < z$ for both the sets of values. This is also to keep a global match for the required amount of anaesthetic drug of a type in different cases of nutritional status. These values can be adjusted depending on the situations.

## 3. Results

To run the experiment for any differential equation, we need an initial value. We consider 10 and 20 as the initial values for all the differential equations. This is shown in the legends of the plots. The results obtained for the change in

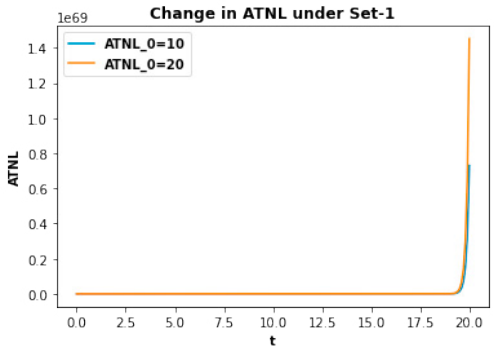


Fig. 2. Change in performance of anaesthesia in terms of time for the situation of under-nutrition under Set-1

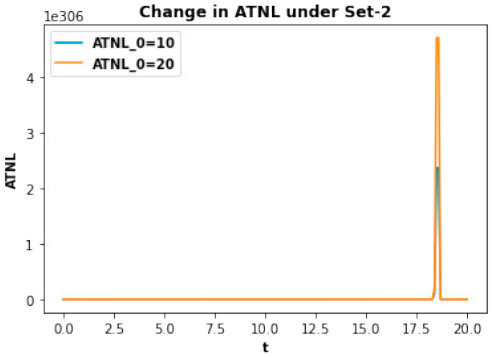


Fig. 3. Change in performance of anaesthesia in terms of time for the situation of under-nutrition under Set-2

performance of anaesthesia in terms of time for the situation of under-nutritional status for Set-1 and Set-2 are shown in Fig. 2 and Fig. 3. Here, the plot with blue color is for the initial value of 10 and the plot with yellow color is for the initial value of 20. The X-axis represents the time while the Y-axis represents the change in required quantity or change in required time to complete the procedure. The results obtained for the change in performance of anaesthesia

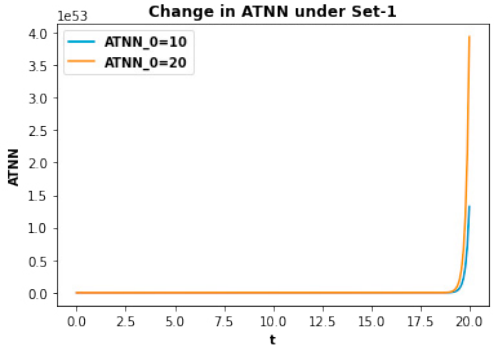


Fig. 4. Change in performance of anaesthesia in terms of time for the situation of normal-nutrition under Set-1

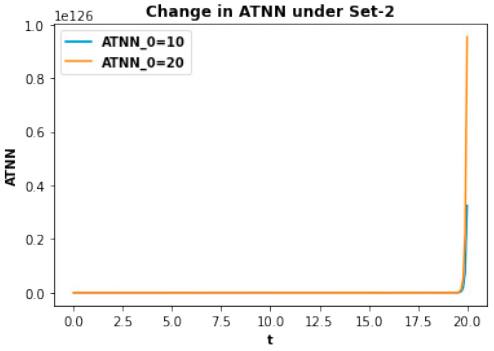


Fig. 5. Change in performance of anaesthesia in terms of time for the situation of normal-nutrition under Set-2

in terms of time for the situation of normal-nutritional status for Set-1 and Set-2 are shown in Fig. 4 and Fig. 5. The results obtained for the change in the performance of anaesthesia in terms of time for the situation of over-nutritional status for Set-1 and Set-2 are shown in Fig. 6 and Fig. 7.

Similar to the change in performance of anaesthesia in terms of time, we plot the changes in performance of anaesthesia in terms of required quantity. These experiments are also performed under the three situations of nutritional status. The obtained results for the change in performance of anaesthesia in terms of required quantity for the situation of under-nutritional status for Set-1 and Set-2 are shown in the Fig. 8 and Fig. 9. Here also the blue colored

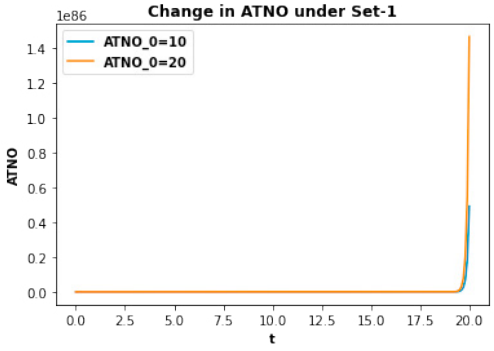


Fig. 6. Change in performance of anaesthesia in terms of time for the situation of over-nutrition under Set-1

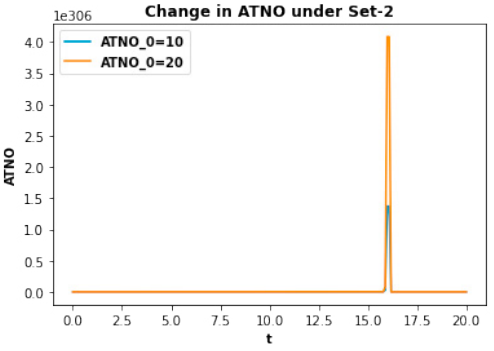


Fig. 7. Change in performance of anaesthesia in terms of time for the situation of Over-nutrition under Set-2

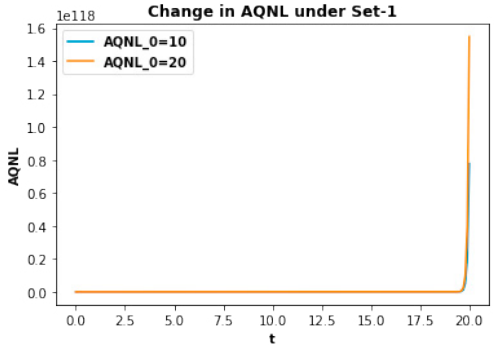


Fig. 8. Change in performance of anaesthesia in terms of required quantity for the situation of under-nutrition under Set-1

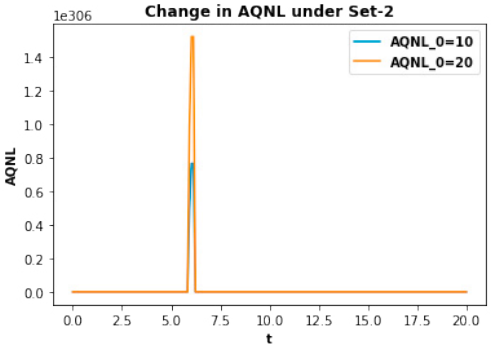


Fig. 9. Change in performance of anaesthesia in terms of required quantity for the situation of under-nutrition under Set-2

plot is for the initial value of 10 and the yellow colored plot is for the initial value of 20. The plots to represent the

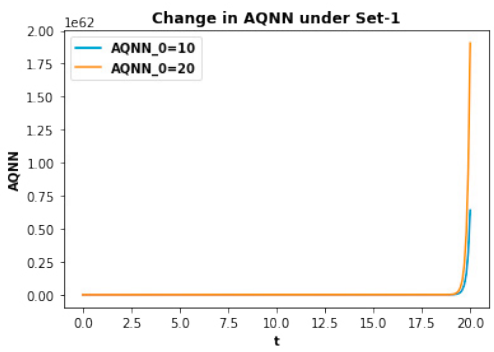


Fig. 10. Change in performance of anaesthesia in terms of required quantity for the situation of normal-nutrition under Set-1

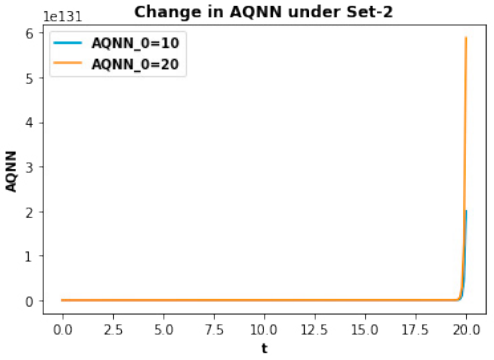


Fig. 11. Change in performance of anaesthesia in terms of required quantity for the situation of normal-nutrition under Set-2

performance of anaesthesia in terms of required quantity for Set-1 and Set-2 under normal-nutritional status are shown in Fig. 10 and Fig. 11. Similarly, the plots to represent the performance of anaesthesia in terms of required quantity for Set-1 and Set-2 under the situation of over-nutritional status are shown in Fig. 12 and Fig. 13.

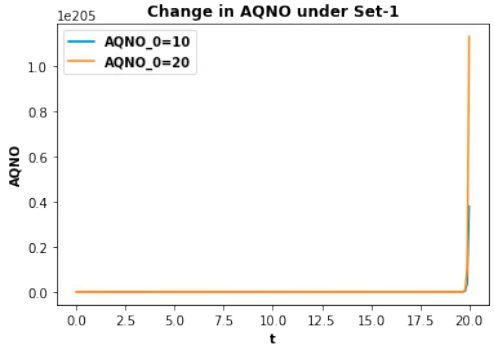


Fig. 12. Change in performance of anaesthesia in terms of required quantity for the situation of over-nutrition under Set-1

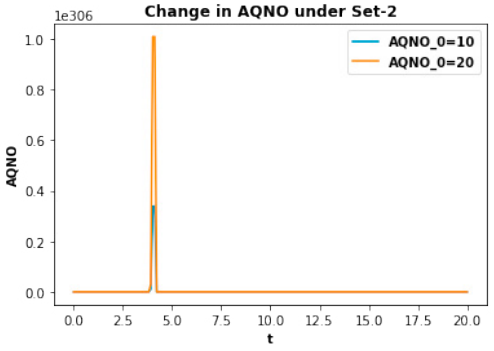


Fig. 13. Change in performance of anaesthesia in terms of required quantity for the situation of over-nutrition under Set-2

## 4. Discussions

The results are produced under three different situations of nutritional status. Under each nutritional status we get the performances of anaesthesia in terms of time and and required quantity. We discuss the obtained results under the different situations of nutritional status individually in the subsequent sections.

### *4.1. Performance of anaesthesia with under-nutritional status*

The Fig. 2 and Fig. 3 show the plots for change in performances of anaesthesia in terms of time under the condition of under-nutritional status. The Fig. 8 and Fig. 9 show the plots for change in performance of anaesthesia in terms of required quantity under the condition of under-nutritional status. We see that, the movement of the curves with different initial values are identical for both the sets of values in all the four figures. For the case of performance in terms of time, we see that under the first set of values the changes remain almost constant up to $t \approx 19$ and thereafter move up sharply. For the second set of values, the movement is seen constant except a sharp upward and downward movement around $t \approx 18$ to 19. For the case of performance in terms of required quantity, we see similar kind of movement like the case of performance in terms of time. But it is much different in the case of required quantity. Here, the sharp upward and downward movements have been seen around $t \approx 6$ to 7 unlike the previous case of around 18 to 19.

### *4.2. Performance of anaesthesia with normal-nutritional status*

The Fig. 4 and Fig. 5 show the plots for change in performances of anaesthesia in terms of time under the condition of normal-nutritional status. The Fig. 10 and Fig. 11 show the plots for change in performance of anaesthesia in terms of required quantity under the condition of normal-nutritional status. We see that, in the case of performance in terms of time, the plots are almost identical. For both the sets of values the curves show similar kind of movements. However, the curves under first set of values show upward movement a bit earlier than that of second set of values. Also, it is seen that the curves for different initial values are more closer in the second set than that of first set. In the case of performance in terms of required quantity also, the curves show similar kind of movement. The curves are almost similar with the curves for the performance in terms of time. Here also, the curves under first set of values show upward movement earlier than that of second set of values. The curves for different initial values in second set are more closure to each other than the curves for different set of values under first set of values.

### *4.3. Performance of anaesthesia with over-nutritional status*

The Fig. 6 and Fig. 7 show the plots for change in performance of anaesthesia in terms of time under the condition of over-nutritional status. The Fig. 12 and Fig. 13 show the plots for change in performance of anaesthesia in terms

of required quantity under the condition of over-nutritional status. We see that, the plots with different initial values identically move for both the sets of values in all the four figures. For the case of performance in terms of time, we see that under the first set of values, the changes remain almost constant up to $t \approx 19.5$ and around $t \approx 20$ the curves show sharp upward movement. For the second set of values, the curves show constant and straight movement till $t \approx 16$. In between $t \approx 16$ and 17, the curves show sudden spike and again come back to initial values and move till the end maintaining that value. For the case of performance in terms of required quantity, we see similar kind of movement like the case of performance in terms of time but the curves are more close to each other. A significant difference is seen in the movement for the case of required quantity. Here, the spike is seen around $t \approx 4$ to 4.5 unlike the previous case of around 16 to 17.

### *4.4. Important takeaways*

From the experimental results and above discussions, we observe the following:

- For the case of malnutrition (both under-nutrition and over-nutrition), we observe that the performance of the anaesthesia in terms of time and required quantity show similar kind of trend. The time requirement for completion of the procedure/intermediate procedures in the patients with malnutrition is more and hence the required quantity of anaesthesia is also more.
- For the case of normal-nutritional status, we observe that the performance of the anaesthesia in terms of time and required quantity show almost same kind of movement. This doesn't have much impact (negative or positive) on the performance of anaesthesia.

### *4.5. Comparison with existing works*

The literature survey shows different perspective of working on anaesthesia. Due to different perspective of analysing various aspects of anaesthesia, the comparison may be uneven. The work in [10] analyses the responses to surgical stimuli under general anaesthesia. This study builds mathematical model and find that the formulated model appropriately works as per the expectation. Another study in [9] analyses an aspect of anaesthesia by measuring the magnitude of second gas effect. The results and related discussions of this study show that the findings are consistent with clinical findings. A study in [16] builds predictive model of anaesthesia patients that improves current anaesthesia monitoring technology. It provides future-impact information, data-driven individual patient outcome monitoring, reliability, and decision making. Similarly, the study in [14] builds a model to analyse risk of drug error during anaesthesia. This study uses probabilistic approach and finds that intrinsic error rate of this model is not necessarily the actual administration of incorrect drug, but rather an incorrect initial selection as well. This model finds that intrinsic error rate should be low and it can be influenced by environmental or individual factors. Now, as another perspective to analyse the impact of nutritional status on the performance of anaesthesia on surgical patients, we carry out this work and our mathematical simulations show that the impact is as per the clinical expectations.

## 5. Conclusions and future work

Anaesthetic drugs are essential for clinical procedures. It helps the clinicians to perform painless and smooth procedures. It may be technically infeasible to perform a procedure without the use of anaesthesia. Though the use of anaesthetic drugs provides a favourable environment for the clinicians to perform the procedures, yet it is not risk free. Prior performance analysis of anaesthesia may mitigate the associated risk to a significant level. The performance analysis may be considered for clinical level or application level. This study is about the performance analysis of anaesthesia in the application level. Out of all factors that impact the application level performance of anaesthesia, health of the patient is considered to be the most important one. We computationally analyse the impact of different nutritional status on the performance of anaesthesia. We consider all the three situations of nutritional status and formulate mathematical relations between the nutritional status and the performance of anaesthesia in terms of time and required quantity. The experimental results of this work show that under-nutritional and over-nutritional conditions have significant impact on the performance of anaesthesia both in terms of time and required quantity. The normal-

nutritional status remains almost neutral without affecting the performance of anaesthesia both in terms of time and quantity. As a future work, real time health related, and outcome of clinical procedure data can be collected from the hospitals and machine learning models can be applied to automate the decision making process of anaesthesiologists.

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