

Delay of Surgery Start Time: Experience in a Nigerian Teaching Hospital

Chike John Okeke^{1,2}, Chukwudi Ogonnaya Okorie^{1,3}, Rufus Wale Ojewola^{2,4}, Njoku Isaac Omoke^{1,3}, Anselm Okwudili Obi^{1,3}, Agama Nnachi Egwu^{1,3}, Okechukwu Valentine Onyebum¹

¹Department of Surgery, Alex-Ekwueme Federal University Teaching Hospital, Abakaliki, Ebonyi State, Nigeria, ²Department of Surgery, Lagos University Teaching Hospital, Idi-Araba, Surulere, Lagos, Nigeria, ³Department of Surgery, Ebonyi State University, Abakaliki, Ebonyi State, Nigeria, ⁴Department of Surgery, College of Medicine, University of Lagos, Idi-Araba, Surulere, Lagos, Nigeria

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INTRODUCTION

The operating room is a very important component of any tertiary health-care institution. An adequately managed operating room results in increased surgical turnover as well as patient satisfaction. Delay in surgery start time is surgery starting later than the scheduled time. Delay in starting scheduled surgical procedure is a reflection of operating room inefficiency.^[1] It has negative financial implications for the institution and can cause frustration for the surgeons, anesthetists, and other support staff. More importantly, patients end up being dissatisfied with this delay.^[2]

Surgery is a complex procedure that involves patients, their relatives, surgeons, anesthetists, nurses, and

ABSTRACT **Background:** Operating room delay has multiple negative effects on the patients, surgical team, and the hospital system. Maximum utilization of the operating room requires on-time knife on the skin and efficient turnover. Knowledge of the reasons for the delay will form a basis toward proffering solutions. **Patients and Methods:** This was a prospective study of all consecutive elective cases done over a 15-month period from January 2016 to March 2017. Using our departmental protocol that “knife on skin” for the first elective case should be 8.00am, the delay was defined as a surgery starting later than 8.00am for the first cases while the interval between the cases of >30 min for the knife on the skin was used for subsequent cases. Reasons for delay in all cases of delay were documented. The prevalence and causes of the delays were analyzed. $P < 0.05$ was considered statistically significant. **Results:** Of 1178 surgeries performed during the period of study, 1170 (99.3%) of cases were delayed. The mean delay time was 151 min for all cases. First on the list had a longer delay time than others; 198.9 min versus 108.5 min ($P = 0.000$). Delay in the first cases accounted for 47.5% of all delayed cases. Overall, patient-related factor was the most common cause of delay (31.3%) followed in descending order by surgeon-related factor (28.5%) and hospital-related factor (26.2%). Patient-related factors accounted for 43.2% of first-case delays. **Conclusion:** Delays encountered in this study were multifactorial and are preventable. Efforts should be directed at these different causes of delay in the theater to mitigate these delays and improve productivity.

KEYWORDS: Delay, elective surgery, operating room, start time

technicians for the complete care of the patient.^[3] Any breakdown in communication among these disciplines will affect the effectiveness of surgical care delivery; therefore, effective communication plays an important role in surgical practice.^[3,4]

Surgical practice in this subregion is affected indirectly by a myriad of factors. Indispensable public utilities such as potable water, access roads, and electricity are almost nonexistent.^[5-9]

Address for correspondence: Dr. Chike John Okeke, Department of Surgery, Lagos University Teaching Hospital, Idi-Araba, Surulere, Lagos, Nigeria. E-mail: textchikeokeke@yahoo.com

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Health insurance covers only civil servants which is just a handful of the Nigerian population. The rest of the population fund their health-care out of pocket.^[10,11] In addition, the majority of the patients in the region as in other developing countries are of low socioeconomic status and oftentimes cannot afford the cost of care.^[6,12] To add to these, the literacy level is low.^[13] All these contribute in many ways to the timeliness of delivery of surgical care.

Delay in surgical start time has been attributed to factors ranging from human errors to system inefficiency.^[14] A good knowledge of these myriads of factors in a setting can facilitate measures aimed at improving operating room efficiency and timeliness of surgical procedures. Although delay in surgery starting time is a common problem in our subregion, there is a paucity of data on this important topic.

This study, therefore, aims at determining the prevalence of delay in surgery start time as well as reasons responsible for delays in this teaching hospital in Nigeria.

PATIENTS AND METHODS

Approval for the study was obtained from the hospital ethical committee. It was a prospective study of all consecutive patients booked for elective surgery over a 15-month period from January 2016 to March 2017. The institution is a 720-bed capacity hospital located in Ebonyi State, Southeast Nigeria. It is the only referral center in the state and receives patients from satellite towns of neighboring states including Enugu, Benue, Cross River, and Imo states. It has a modular theater with five operating rooms serving non-obstetric, emergency, and elective surgical specialties in the hospital.

Patients were seen in the surgical outpatient clinics and thereafter admitted into the wards 1 or 2 days before the scheduled operation date. Day cases were admitted on the morning of surgery. They were reviewed by the anesthetist before surgery on the ward.

Using our departmental protocol that, excluding induction time, “knife on skin” for the first elective case should be 8.00am, the delay was defined as surgery starting later than 8.00am for the first cases while the interval between the cases of >30 min for the knife on the skin was used for subsequent cases. All elective cases were included in the study while all emergency and canceled cases were excluded.

Data collected included a patient’s position on the elective list, patient’s arrival time to theater, surgery start time and, cause of delay when applicable. The research assistant completed a questionnaire to fill in data on timing and cause of the delay.

Causes of delay in surgery were classified into: patient-related factors which included lack of funds, failure to procure materials for surgery, refusal of consent, and inability to provide blood for surgery. Surgeon-related factors included failure to obtain consent before a patient gets to the theater, late arrival of surgeon, and failure to identify/or control comorbidities. Hospital/system-related factors included lack of drapes, gowns, and boots; nonfunctional equipment; lack of theater space; and unavailability of light, oxygen, and water. Anesthetist-related factors included difficult intubation, difficult induction of spinal or epidural anesthesia, and unavailability of anesthetists. Nurse-related factors included failure to prepare the instruments for surgery.

Data collected on a pro forma were analyzed using IBM SPSS Statistics for Windows, Version 25.0. Armonk, NY, USA: IBM Corp. and presented as frequencies for categorical data, while continuous data were presented as means. Chi-square test was used to determine statistical significance for categorical data, while ANOVA and student independent *t*-tests were used for continuous data. $P < 0.05$ was considered statistically significant.

RESULTS

During the study period, 1296 cases were booked for elective surgery in different units of the department of surgery of our institution. One hundred and eighteen (118) cancelled cases were excluded therefore leaving a total of 1178 cases for the study. The distribution of the cases per specialty is shown in Table 1.

Of the 1178 cases studied, there was a delay in starting 1170 (99.3%) cases, while there was no delay in just 8 (0.7%) cases. The mean delay time for all cases was 151.08 min.

Patient-related factors were the most common cause of delay followed by surgeon- and hospital-related factors as shown in Table 2.

Table 1: Distribution of cases by specialty

Specialty	n (%)
General surgery	397 (33.7)
Orthopedic	284 (24.1)
Urology	130 (11)
Plastic surgery	120 (10.2)
Pediatric surgery	117 (9.9)
Ear nose and throat	82 (7.0)
Cardiothoracic surgery	26 (2.2)
Maxillofacial	19 (1.6)
Neurosurgery	3 (0.3)
Total	1178 (100)

$P=0.0000$

The first case on the list had a mean delay time of 198.1 ± 6.3 min, while other cases on the list had a mean delay time of 108.5 ± 3 min ($P = 0.000$), as shown in Table 3.

The mean delay for neurosurgery was the least (74.3 min) compared to other specialties ($P = 0.000$), as shown in Table 4.

Five hundred and fifty-six cases (47.5%) were first on the list, followed by the second on the list 277 (23.7%), as shown in Table 5.

Patient-related factors accounted for 240 (43.2%) of the reasons for the delay in first cases followed by surgeon factor (134, [24.1%]) and hospital factor (96, [17.3%]). Hospital factor was the most common cause of delay for the second cases on the list 119 (43.0%). For the third case on the list, surgeon and hospital factors accounted for 173 (95%) of delays with no patient-related reason, as shown in Figure 1.

Surgeon-related factor was the most common cause (36.6%) with patient-related factor contributing the least (24.7%) for the delays in general and orthopedic surgery. Urology and cardiothoracic surgery shared similar patterns in terms of reasons for the delay. Hospital-related factor was the most common cause of delay (40.5%), with surgeon-related factor being the least (16.7%). In other specialties, patient-related factors were the most common cause of delays with variable contributions of hospital and surgeon factors, as shown in Figure 2.

Of the 8 cases that begun according to schedule, 4 (50%) were from general surgery, while the remaining 4 (50%) came from urology. Seven (87.5%) cases that started on time were the first cases, while 1 (12.5%) was a second case on the list, as shown in Figure 3.

DISCUSSION

In this study, the prevalence rate of delay in surgery start time is within the worldwide range in the previous published reports.^[15,16] Delay in surgery start time, a prevailing problem in developing countries, cuts across hospitals in Nigeria.^[16-18] It has led to several cancellations with attendant low output and increased morbidity and mortality.^[12,16,19,20] Maximum utilization of the operating room requires on-time knife on the skin and efficient turnover.^[21] Hence, effective utilization of every minute in the operating room before and during surgery is highly desirable and should be pursued. Late start invariably leads to a late finish. The scheduled time which had been budgeted earlier will be wasted. With the late finish, unplanned overtime costs are incurred.^[20] As a result, start times are routinely monitored by Trusts

Table 2: Reasons for delay in surgery start time

Factor	n (%)
Patient factor	367 (31.40)
Surgeon factor	333 (28.50)
Hospital	307 (26.20)
Anesthetic factor	53 (4.50)
Nurses	34 (2.90)
Patient and hospital	26 (2.22)
Patient and surgeon	22 (1.90)
Hospital and anesthetist	7 (0.60)
Surgeon and hospital	5 (0.42)
Surgeon and anesthetist	4 (0.34)
Patient and anesthetist	6 (0.51)
Patient, surgeon, anesthetist, and hospital	6 (0.51)
Total	1170 (100)

$P=0.0000$

Table 3: Mean delays during the study period

Category	n	Mean±SD	P
First case	556	198.106±147.919	0.000
Other cases	614	108.487±73.669	

SD: Standard deviation

Table 4 Mean delay per specialty

Specialty	Mean delay (min)	P
General surgery	147.84	
Urology	171.90	
Orthopedic surgery	121.51	
Pediatric surgery	180.08	
Burns and plastic surgery	156.95	
Cardiothoracic	156.85	
Neurosurgery	74.33	
Ear nose and throat	180.00	
Maxillofacial unit	185.42	0.000

Table 5: Distribution of cases delayed by the position of case on the list

Number on list	n (%)
1	556 (47.5)
2	277 (23.7)
3	182 (15.6)
4	88 (7.5)
5	41 (3.5)
6	19 (1.6)
7	7 (0.6)

$P=0.0000$

as key performance indicators have been used to implement attitudinal change and policies.^[22]

Delay occurred in almost all cases done in the study center (99.3%). This is similar to what Cox Bauer *et al.*^[15] observed when they retrospectively studied 5,598 first cases done in three urban hospitals in Wisconsin, USA. They noted that in one of the hospitals under

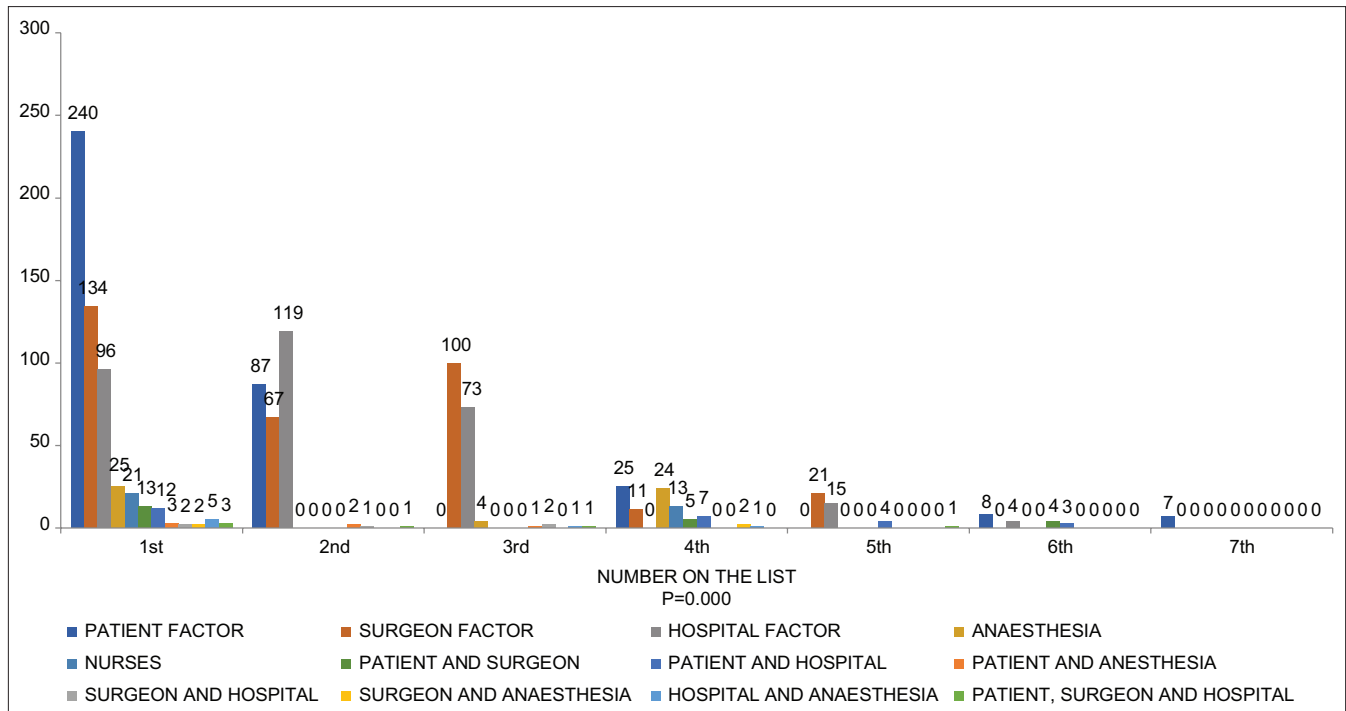


Figure 1: Bar chart showing the causes of delay per number on the list

study, 98% of cases done were delayed. Our finding was also higher than what was found by Wong *et al.*^[23] in Toronto, Canada, where the prevalence of delay was 51.4%. This wide gap in prevalence may be attributed to the fact that it is a neurosurgical center and has theater suites dedicated purely to neurosurgical procedures in sharp contrast to our setting where the theater is shared by all specialties with varied needs. Another factor is the setting of the study. Public utilities are readily available and the funding of the health sector is a priority; hence, factors such as unavailability of basic elements such as electricity and water were never encountered as a cause of delay in their study.

The reasons for delays were multifactorial. Patient, surgical team, and hospital system factors were the three most common causes of delay in our study. We found that patient-related factors were the most common reason for delay in this study (31.1%). Similarly, Ifesanya *et al.*^[17] in Ibadan noted in their study that lack of funds by the patient contributed between 9% and 25% of the causes of surgical delay in the three groups of patients. This is in sharp contrast to other studies carried out in other climes where patient-related factors played little or no role in theater delays.^[15,23] This observation can be explained by endemic poverty coupled with the fact that health-care financing is out-of-pocket for almost all the patients.^[11] Hence, often times, even up till the morning of the surgery, patients are still sourcing for funds to foot

their operation bill, hence delaying surgery start time. Universal health coverage for all Nigerian citizens will go a long way in sorting the issue of delay in the payment of surgery fees. The surgeon-related factor was the second most common cause of delay in this study. This is in contrast to the findings of Overdyk *et al.*^[24] in the USA where surgeon unavailability was the most common cause of delay in their study. While other studies found hospital-related factors such as lack of theater space and equipment failure to be the most common cause of theater delay,^[17,23] this factor was found to be the third most common cause of delay in this our study accounting for 26.2% of causes of delays. In 76 cases (6.5%), combinations of factors played a role in delaying surgery start time. In one of them, the patient presented late, the case note was retrieved late and when it was finally retrieved, there was no theater space available for his procedure. Overall, the mean delay time was 151 min. This was higher than what Cox Bauer *et al.*^[15] found in Wisconsin. In their study, the delay time was 28.2 min. The reason for this difference was the peculiarities of operating in developing countries as was observed in our study; unavailability of water, surgical drapes, operating boots, funds for surgery among other things which were not mentioned in their study.

First case tardiness, an important metric of operating room efficiency, is defined as the difference between the unit specific start target and incision of the first case of

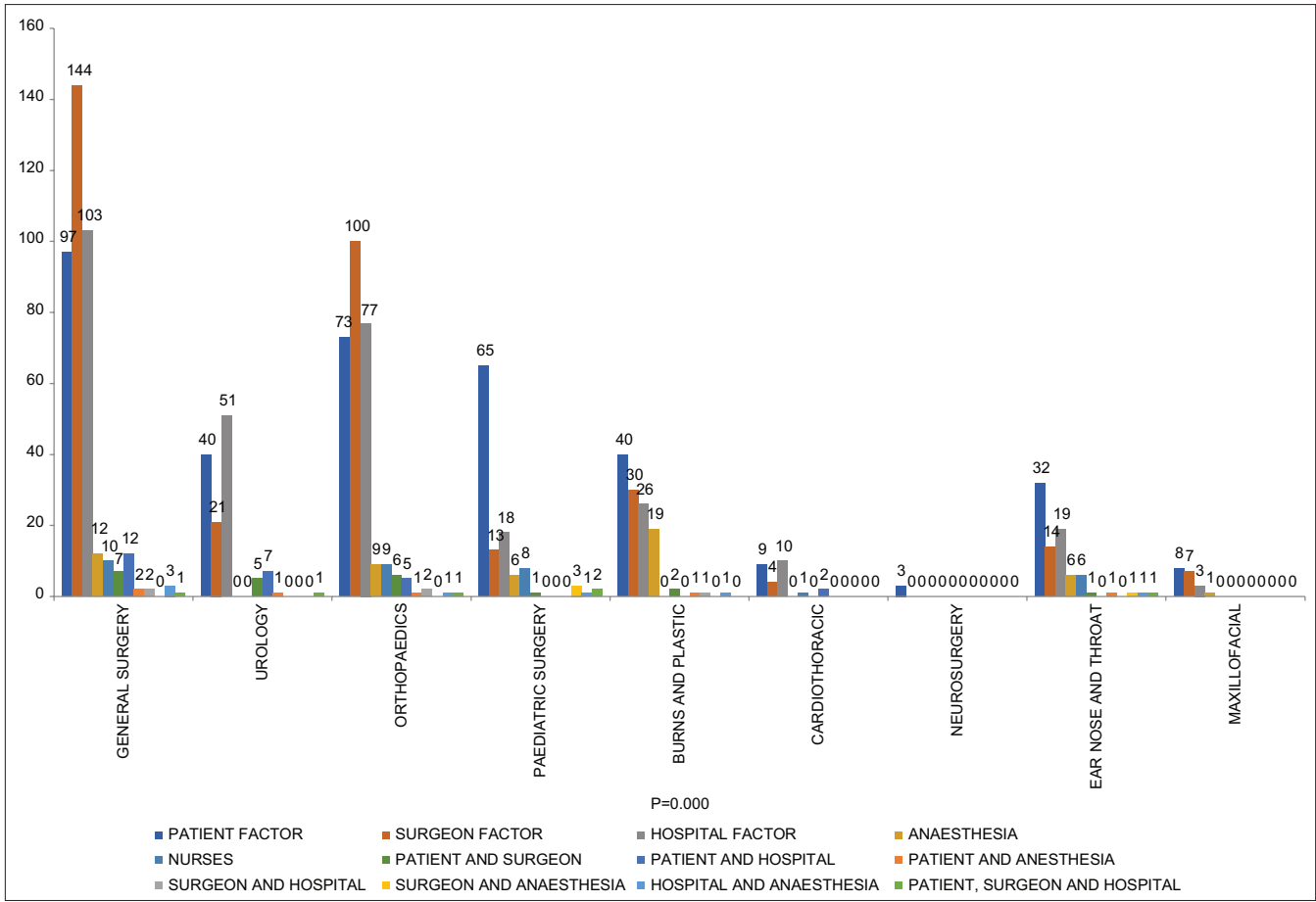


Figure 2: Bar chart showing the causes of delay per specialty

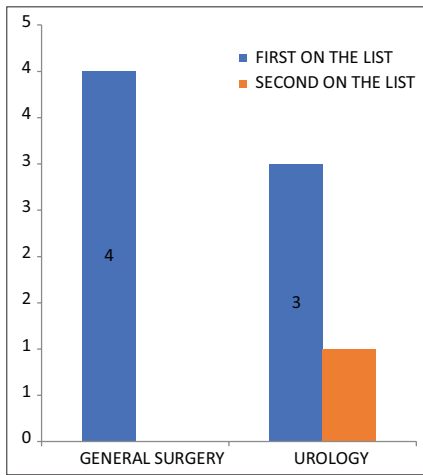


Figure 3: Bar chart showing a summary of the surgeries that were performed on time

the day.^[25] The mean delay time for the first cases in this study was 198.1 min. This is significantly higher than the average first case tardiness of 11–12 min reported by authors in Europe and America.^[22,25] Furthermore, the mean delay time was more for the first cases than other cases: 198.1 min versus 108.0 min ($P = 0.000$). This was statistically significant. Wong *et al.*^[23] in Canada

reported a similar finding and noted that the initial delay was associated with subsequent delays. The reason for this is that all specialties are expected to start their cases by 8am, and so, there is pressure on the limited human resource available to cater for all cases. Furthermore, having identified the cause of the delay in the preceding cases, this will be tackled in subsequent cases leading to a reduction in the delay in subsequent cases. The sum of all the first cases on the list was almost equivalent to all other cases combined. This can be explained by the attendant risk of cancellation of cases caudal to preceding cases either due to the absence of anesthetic time or due to surgeon fatigue. Oluwadiya *et al.*^[18] in Oshogbo noted a completion rate of 0% when the theater list exceeded three on the list.

Patient-related factor was the most common cause of delay in the first on the elective list accounting for 240 (43.2%) of delays followed by surgeon factor (134, [24.1%]), then hospital factor 96 (17.3%). This finding is similar to a study in the USA by Hicks *et al.*^[22] where patient- and surgeon-related factors were the most common cause of delays for first case starts. However, the contribution of patient-related factors to

delay in their study differed significantly. In their study, patient-related factor contributed to 25% of delay. Similar rates were noted in anesthesia and surgeon-related factors.^[22] This aberration in patient-related reasons may be linked to a lack of health insurance and subsequent out-of-pocket financing in our setting. Hospital-related causes of delay rose to 119 (43%) to become the most common cause of delay for second cases. In the third on the elective list, hospital- and surgeon- related factor accounted for 173 (95%) of delays with no patient-related reason. This pattern may be due to a strain on the already depleted human and infrastructural resources. General surgery and orthopedic accounted for more than half (57.8%) of cases that were done and took a huge part of the delays. The reason for this was not found in this study. A similar prevalence of this magnitude was noted by Cox Bauer *et al.*^[15] in the USA where orthopedic and general surgery accounted for 53.2% of cases done in three urban hospitals under study.

Across all specialties, patient, surgeon, and hospital-related factors were the three most common reasons for delays, with certain specialties having similar patterns of reasons for delay. In general and orthopedic surgery, surgeon factor was the most common reason accounting for 36.6%, followed by hospital factor (26.2%) and patient factor (24.7%). In contrast, urology and cardiothoracic have a common feature with hospital, patient, and surgeon factors accounting for 40.5%, 34.6%, 16.7%, respectively. The remaining five specialties had patient factors being the most common cause of delay with varying contributions for other reasons. The reason for this difference across the specialties could not be evident.

Data on the prevalence of theater delay in the West African subregion are scarce. This study will serve as a frame for subsequent studies. It is a single center study. Its findings need to be validated by multicenter studies.

CONCLUSION

Delays of surgery start in the operating room are common in this subregion. Patient, surgical team, and hospital system factors were the three most common causes of delay in our study. The majority of these delays are preventable. Attitudinal change by all theater users, good inter-departmental communication, universal health insurance, operative check list, dedicated specialty theaters, preoperative anesthetic clinic, and regular auditing of hospital equipment will go a long way in mitigating these delays.

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Conflicts of interest

There are no conflicts of interest.

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