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Original Article

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Influenza and pneumococcal vaccinations in dialysis patients in a London district general hospital

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Abstract

Background. Patients on dialysis mount reduced immune responses compared with the general population. The Department of Health advises that these patients receive influenza and pneumococcal vaccinations at regular intervals—once yearly and every five years, respectively. This article investigates the uptake of these vaccinations in this patient population and seeks to examine factors that may influence vaccination status such as patient's language and presence of a general practitioner (GP) electronic vaccination reminder system. It also explores preferred site of vaccination for patients and GPs as these are primary care vaccinations yet patients have more frequent contact with their dialysis unit than their GP, blurring the boundaries between primary and specialized care.

Methods. This is a retrospective study of all patients registered as dialysing at the North Middlesex University Hospital NHS Trust (NMUH) in September 2011. Information was obtained through GP letters, GP and patient questionnaires.

Results. Of 154 patients, 133 were included in the data analysis. Nineteen per cent were up-to-date with both vaccinations and 67% with their influenza vaccination. Fifty per cent had received the influenza vaccination in the last two consecutive years. Thirty per cent were not up-to-date with either vaccination. There was no evidence of a difference in uptake in 2009 ($P = 0.7564$) and in 2010 ($P = 0.7435$) among those who could and could not speak English. Twenty-five per cent of GPs and 58.6% of patients preferred vaccination to occur in the dialysis unit. Unfortunately a high number of GPs did not provide information on whether they used an electronic vaccination reminder but the analysis from the information provided by the few respondents did not reveal any correlation between the presence of an electronic reminder and vaccination status.

Conclusion. Most dialysis patients were not up-to-date with both vaccinations. They were, however, more up-to-date with their influenza than their pneumococcal vaccination. Non-English speakers did not appear to be disadvantaged. GP electronic reminder systems may have influenced influenza uptake but this study did not demonstrate a correlation and this is likely due to the lack of GP respondents; the effectiveness of electronic reminders merits further studies as a tool to improve vaccination rates in at-risk populations. Most patients visited their GP at least annually but preferred to receive their vaccinations at the hospital. Vaccinating in the dialysis unit and maintaining an electronic record accessible to GPs or generating a letter for GPs may help fill the vaccination gap in these patients. Overall, more evidence is required for the effectiveness of such vaccinations and their frequency, but in the meantime UK national guidelines were not being followed with a large proportion of patients remaining unvaccinated against influenza and in particular pneumococcal disease. This audit highlights the importance of local data collection, discussions around correlations influencing outcomes and publication of results to improve standards of care at a national level.

Keywords: dialysis; flu; influenza; pneumococcus; vaccination

Introduction

Patients with end-stage renal failure (ESRF) mount a reduced immune response to vaccination in comparison with the general population because of their immunosuppressed state. They have lower antibody titres than non-ESRF patients [1, 2]. Although the pathophysiology behind the attenuated T-cell-dependent antibody response to vaccination is poorly understood, it is thought to be related to high levels of uraemia. Despite decreased immunity in ESRF

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patients, the influenza vaccination has been shown to reduce hospitalization and death in such patients [3]. However, data on the efficacy and effectiveness of the 23-valent Pneumococcal Polysaccharide Vaccine (PPV23) is inconsistent, in particular in immunocompromised or high-risk patients [4]. The 13-valent Pneumococcal Conjugate Vaccine (PCV13) is recommended for use in children <2 years of age as it is more immunogenic in this population but it protects against less pneumococcal strains than the PPV23. Recent studies on immunogenicity of PCV13 in immunocompetent adults have led to a change in recommendation by the Centre for Disease Control to vaccinate immunocompromised adults with PCV13 in addition to PPV23 [5]. This policy has not yet been adopted in the UK where PCV13 is still only recommended for younger children [6].

Although the Department of Health (DOH) of the United Kingdom (UK) recognizes that further evidence is required, it currently recommends that patients with ESRF (including dialysis patients) are vaccinated annually against influenza and every five years against pneumococcal disease with PPV23 [6, 7]. Adherence to these recommendations is monitored by the DOH, which publishes national data for influenza and pneumococcal vaccination uptake per patient group on their website [8, 9].

UK guidelines suggest that patients with chronic renal disease should be fully vaccinated against both influenza and pneumococcus [6, 7, 10, 11]. In the UK, a national programme is in place for general practitioners (GPs) to vaccinate their patients against influenza. The influenza vaccination is a Quality and Outcomes Framework (QOF) indicator. The QOF scheme is a monetary annual reward and incentive scheme for GPs based on National Institute for Clinical Excellence guidance. Dialysis patients should receive vaccinations at their GP practice, with optional home delivery for patients with restricted mobility. Confusingly, ESRF patients often receive blood-borne viral hepatitis vaccinations in the hospital, at the low-clearance clinic as part of the dialysis or transplantation work-up. In addition, renal physicians on the dialysis unit often provide general, non-renal-related healthcare. Subsequently, it is not surprising that hospital dialysis patients sometimes view their renal physicians as specialized GPs and expect other health care needs to be coordinated through the unit. A survey in Canada detailed how 54% of renal physicians spent a third of their time providing primary healthcare [12].

The aim of this study was to assess the level of influenza and pneumococcal vaccination in a sample of patients on dialysis compared with UK national data and to explore factors that may have influenced vaccination uptake.

Methods

The study was conducted at the North Middlesex University Hospital NHS Trust (NMUH), a London District Hospital, where dialysis is provided. A list of all 154 patients who were dialysing at the NMUH in September 2011 before the start of the vaccination season was obtained and the NMUH IT services matched this list of patients with their GPs using the hospital registration system. To obtain data on vaccination status for each patient, their GP practices (secretary and/or GP doctor) were contacted. Information on whether patients had received influenza vaccinations in 2009 and/or 2010 and the date for their last pneumococcal vaccination was collected. Afterwards, letters were sent to each GP practice reminding them of the DOH guidelines for influenza and pneumococcal vaccinations in ESRF patients, together with a questionnaire asking information on vaccination dates, availability of an electronic database in place to remind to vaccinate a specific group of patients, and their preference on where patients in dialysis should be vaccinated (at the dialysis unit or at the GP practice).

In addition, during their routine dialysis session, patients were visited by doctors completing the audit who filled in a questionnaire regarding the patients' preferred site of vaccination, their knowledge on which vaccinations they should be receiving and other information related to influenza and pneumococcal vaccination. The questionnaire was available only in English and therefore patients who could not speak English and who were not accompanied by a family member who could interpret did not fill the questionnaire. Reasons for not filling in the questionnaire were recorded.

Statistical methods

Frequencies were calculated for the demographic data, the information provided by the patients through the questionnaire regarding their knowledge on vaccination requirements and the data on pneumococcal and influenza vaccination uptake provided by the GP.

The 95% confidence intervals for the proportion of people who received vaccinations were calculated using the 'exact' (Clopper–Pearson) method for proportions and an equivalence test for the binomial proportion was performed to assess whether the uptake of vaccinations found in this study was statistically significantly different compared with that reported by the DOH in England. Associations between categorical variables, such as vaccination uptake and knowledge of the necessity of yearly vaccinations, were evaluated using chi-square test and Fisher exact tests (if expected frequencies were <5 in at least one cell) and a Wilcoxon-Mann-Whitney test was used to compare the median age in the different groups. The association between the distribution of preferred vaccination site amongst patients and their GPs was assessed using a Bhapkar's test, to take into account the match between patient and GP.

If the information was unavailable regarding whether a patient had had a vaccination or not, the patient was considered not to have had it.

Analyses were performed using the SAS software (version 9.3; SAS Institute, Cary, NC, USA). All tests of significance used two sided P-values <0.05 as the threshold for statistical significance.

Results

See Figure 1 for a summary of patients who took part in the study.

Information on age, whether they were born outside the UK, whether English was their first language and whether they could speak English was available for all 154 patients. One hundred and forty-three patients of the 154 patients were approached with a questionnaire. Eleven were omitted as they had either died, had not attended their dialysis slot during questionnaire distribution or had

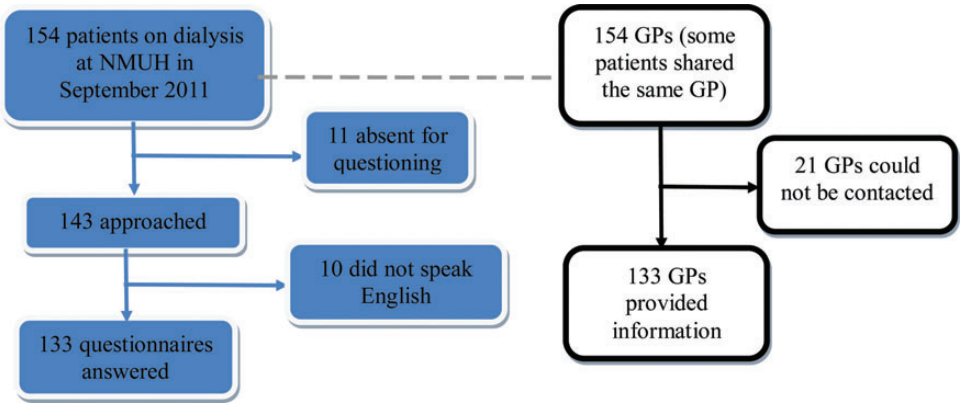

Fig. 1. Summary of patients and GPs who took part in the study.

changed dialysis centre and could therefore not be interviewed. Of 143, 10 did not speak English and therefore did not take part as there was no interpreter available at the time. One hundred and thirty-three patients were therefore included in the questionnaire analysis.

Characteristics of the patients who completed the questionnaire were summarized in Table 1. Of those who provided an answer, 73% were born outside of the UK, 53% spoke English as a foreign language and 6% could not speak English at all. The majority visited their GP more than once a year (79%) and understood the necessity of yearly vaccinations and only a small group (3.5%) deliberately refused vaccination. Median age was 66 years of age (interquartile range IR: 53–77) and significantly differed among those who were up-to-date with either one of the two vaccinations, both or none (P = 0.0011).

GP details were collected for all patients except 21 of them for the following reasons: the GP did not answer the phone, fax or letter; the GP practice did not exist or could not be located; patient died in between obtaining the list and starting the audit; the patient was not registered with a GP or at that practice. Therefore 133 were also included in the data analysis. These patients were from a total of 75 different GP practices in Haringey and Enfield, two relatively deprived boroughs served by NMUH.

As is shown in Figure 2, 19% ($n = 25$) of the 133 patients analysed were up-to-date with both vaccinations: they had received an influenza vaccination within the last year, and a pneumococcal vaccination within the last 5 years. Thirty per cent ($n = 40$) of the patients were not up-to-date with either vaccination, 48% ($n = 64$) were up-to-date with the influenza vaccination alone (they had it in 2010) and 3% ($n = 4$) were up-to-date with pneumococcal vaccination alone (they had it within the last 5 years). Regarding influenza vaccination (see Figure 3), 50% ($n = 67$) had received it for the last 2 consecutive years, 20% ($n = 27$) had not received it in 2009 or in 2010, while the rest had received in similar proportions either in 2009 (13%) or in 2010 (17%). Regarding pneumococcal vaccination (see Figure 4): 22% ($n = 29$) had received it in the last 5 years while the rest had either not received it (including patients who had received it but not within the past 5 years) or data on pneumococcal status was lacking. The mean (and median) time since the last pneumococcal vaccination in the number of patients who had received it was 6 years from 2011 (year 2005).

We compared our data with the national and regional DOH data (see Table 2). We found that the NMUH dialysis patients were significantly more up-to-date with influenza vaccinations than the corresponding national ESRF average: in 2009/2010 63.2% (95% CI: 54.3–71.4) of patients with ESRF attending NMUH received influenza vaccination compared with 53.4% reported by DOH (P = 0.0241), and in 2010/11 66.9% (95% CI: 58.2–74.8) in NMUH compared with 53% reported by DOH (P = 0.0013). However, the figures for pneumococcal vaccination status in the NMUH's dialysis patients were significantly lower (P < 0.0001) than the national high-risk group: 21.8% (95% CI: 15.1–29.8) in NMUH compared with 53% in 2011 in England.

The proportion of patients who were up-to-date with influenza vaccination among those who could and could not speak English was not significantly different: respectively—in 2009 60.0% versus 63.4% (P = 1.0) and in 2010 50% versus 68% (P = 0.2978).

Of the 133 patients who answered the questionnaire, 53% understood that they needed yearly vaccinations. There was no evidence of a significant difference in influenza vaccination uptake in 2009 (P = 0.1182) and 2010 (P = 0.0665) among those who understood that they needed yearly vaccinations and those who did not demonstrate that understanding. In 2009, 69% of those who understood they needed yearly vaccination were vaccinated compared with 57% in those who did not and in 2010 the figures were 74% compared with 59%.

Administering timely influenza vaccination is a Clinical Quality and Outcomes Framework (QOF) indicator, encouraging GPs to vaccinate their eligible patients. GP practices have developed systems to monitor and improve their performance in meeting QOFs. Unfortunately a large proportion of GPs (55%) did not answer our question regarding the presence or absence of electronic reminders on their electronic database to alert them about specific vaccination due dates. Thirty-nine per cent of GPs answered that they did have an electronic reminder system, and only 6% that they did not. There was no evidence of a difference in influenza vaccination uptake based on whether the GP had an electronic reminder or did not provide an answer to this question (P = 0.7208). The proportion of people vaccinated for influenza in the past year was respectively 63.5, 62.5 and 69.9% in GP practices with an electronic reminder, without an electronic reminder and where the GP did not reply.

We asked GPs and dialysis patients what their preferred vaccination site would be and compared their answers (see Table 1). Twenty-five per cent of GPs and 58.6% of

Table 1. Demographic characteristics and vaccination knowledge and preferences of the patients and information on preferences provided by GPs (sample size is 133 unless stated differently)

Variable	Overall	Up-to-date with both vaccination ($n = 25$)[a]	Only up-to-date with either influenza or pneumococcal[a]	Not up-to-date with both vaccinations[a]	P-value[b]
Patients					
Age, ($n = 154$), median (IQR)	66 (53–77)	72 (62–75)	72 (58–79)	55 (46–67)	0.0011^
Born outside UK ($n = 154$), *n*(%)					
Yes	113 (73)				
Missing	0 (0)				
English first language ($n = 154$), *n*(%)					
Yes	73 (47)				
Missing	0 (0)				
Non-English speaker ($n = 154$), *n*(%)					
Yes	10 (6)	1 (4)	5 (7)	4 (7)	0.0887^^
Missing	11 (7)	0 (0)	0 (0)	0 (0)	
Deliberately declined vaccination, ($n = 154$), *n*(%)					
Yes	5 (3)				
Missing	11 (7)				
Frequency of GP visits, *n*(%)					
More than once a year	104 (7)				
About once a year	15 (11)				
Less than once a year	10 (8)				
Unsure	3 (2)				
Missing	1 (0)				
Understood necessity of yearly vaccination, *n*(%)					
Yes	70 (60)	14 (56)	41 (60)	15 (37)	0.0676
Missing	0 (0)	0 (0)	0 (0)	0 (0)	
Diseases they believed they needed protection against, *n*(%)					
Flu mentioned (alone or in combination with other diseases)	61 (46)				
Flu and pneumonia	7 (5)				
Pneumonia (alone or in combination with other diseases)	9 (7)				
Did not know	55 (41)				
Missing	1 (0)				
Preferred vaccination site for the dialysis patients, *n*(%)					
dialysis unit	78 (59)	16 (64)	40 (59)	22 (55)	<0.0001^^
GP surgery	22 (17)	3 (12)	11 (16)	8 (20)	
No preference	13 (10)	3 (12)	7 (10)	3 (7)	
Missing	20 (15)	3 (12)	10 (15)	7 (18)	
GP					
Preferred vaccination site for the GP, *n*(%)					
dialysis unit	33 (25)	3 (12)	16 (24)	14 (35)	<0.0001^^
GP surgery	12 (9)	4 (16)	8 (12)	0 (0)	
No preference	14 (10)	3 (12)	6 (9)	5 (12)	
Missing	74 (56)	15 (60)	38 (56)	21 (52)	
Presence of electronic reminder, *n*(%)					
Yes	52 (39)	10 (40)	25 (37)	17 (–42)	0.7325^^
No	8 (6)	0 (0)	5 (7)	3 (7)	
Missing	73 (55)	15 (60)	38 (56)	20 (50)	

[a]The vaccination status could be determined only on the 133 patients who replied to the questionnaire. Because only four patients were up-to-date only with pneumococcal vaccination, they have been merged with those who were up-to-date only with influenza vaccination.
[b]P-value comparing distributions across the three groups: those up-to-date with both vaccinations; with none; with one of the two vaccinations. If not otherwise indicated a Chi-square test was used.
^Wilcoxon Mann Whitney test, ^^Fisher exact test.

patients chose the dialysis unit as favourite site, 9% of GPs and 16.5% of patients chose the GP surgery, 11% of GPs and 10% of patients expressed no preference. Fifty-six per cent of GPs and 11% of patients did not reply. These distributions were statistically different between patient and GPs ($P < 0.0001$). A recurring comment made by several GPs was that they wanted to be updated on vaccination status if vaccinations were to be given on the dialysis unit for their own records.

Discussion

Evidence to support influenza and pneumococcal vaccination in reducing morbidity and mortality in chronic kidney disease populations is lacking, and further studies are required. Current government policy, however, advises that such target populations receive these vaccinations regularly. GPs are required to maintain a database of all eligible influenza vaccination recipients and the corresponding QOF provides incentives for vaccination targets to be met. Only 53% of ESRF patients had received their influenza vaccinations in 2009 and another 53% in 2010 [13, 14]. The numbers were higher at the NMUH: 63% in 2009 and 67% in 2010 but only 50% had received a vaccination in the last 2 consecutive years (i.e. yearly). The UK recommends five yearly vaccination with PPV23 in ESRF patients, despite lack of evidence regarding protective efficacy and antibody response in high-risk groups, including optimal time interval between vaccinations. Uptake in our dialysis patients was lower than the national average (21.8% at NMUH versus national averages of 53% in at-risk patients and 69.4% in >65 year olds). In total, only 19% of all dialysis patients at NMUH were up-to-date with both vaccinations and 30% were not up-to-date with either.

Due to the high number of GPs who did not respond, a lack of correlation between electronic reminders and vaccination status must be interpreted with caution. The question was asked whether GPs had an electronic reminder system for influenza or pneumococcal vaccinations, and was left unanswered in most cases. Unfortunately when the GP answered 'Yes', we could not distinguish between influenza or pneumococcal vaccinations, but it is highly likely that these only referred to influenza alone, since these are QOFs, and some GPs specifically added 'flu only' to their answers. It is difficult to believe that an electronic reminder had no effect, and this study did not manage to extrapolate this data due to a lack of respondents and of clarity concerning which vaccination the reminder addressed. Of note, there was no clear and timely electronic reminder system for each vaccination on the dialysis unit at NMH where an electronic patient record system is in place.

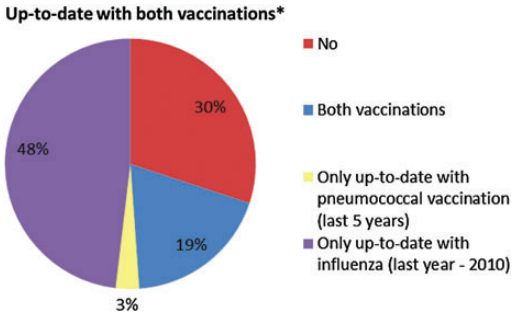

Fig. 2. Pie-chart on uptake of influenza and pneumococcal vaccination among participants in the study ($n = 133$). *Nine individuals had missing values for one or both vaccinations. The missing values are treated as not having the vaccination.

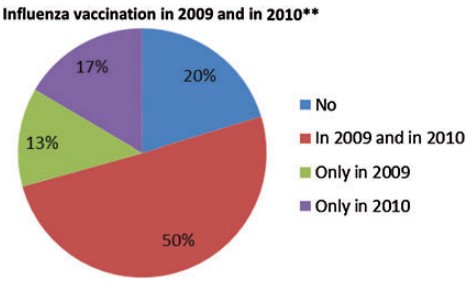

Fig. 3. Pie-chart on influenza vaccination uptake among participants in the study ($n = 133$). **Eleven individuals had missing values for one or both vaccinations. The missing values are treated as not having the vaccination.

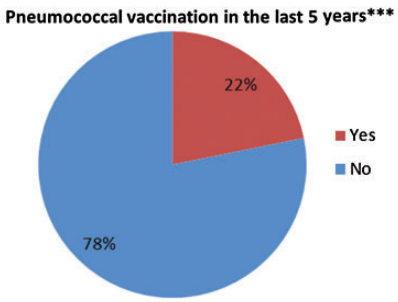

Fig. 4. Pie-chart on pneumococcal vaccination uptake (in the last 5 years) among participants in the study ($n = 133$). ***Six individuals had missing values for one or both vaccinations. The missing values are treated as not having the vaccination.

Despite most dialysis patients (79%) visiting their GP more than once a year, a majority (59%) of patients expressed their preference for vaccinations to be coordinated through the dialysis unit where they spend a lot of their time. Again, many (56%) GPs did not reply, but among those who did, 60% ($n = 33$) also agreed that the dialysis unit may be a better place for vaccination in this high-risk group, provided that the GPs were informed. NMUH uses a computerized electronic patient record system, so influenza and pneumococcal status could be added to this record. However for these additional and timely vaccinations to occur on the dialysis unit funding would be required to sustain the vaccination programme. Vaccinating on the unit may be the best way of increasing uptake in this specific population.

Not speaking English does not appear to be a barrier to accessing vaccination. Only 10 patients could not speak English, and half were up-to-date with their vaccinations, comparable with the uptake found in the rest of the population. Languages (other than English) spoken by renal physicians/GPs were not recorded. A higher uptake of influenza vaccination was observed among 53% of people who were aware of the yearly flu vaccination, but this was not statistically significant, most likely because of lack of power. Very few were aware of the necessity of the pneumococcal vaccination.

The dialysis cohort studied at the NMUH revealed interesting findings regarding the uptake of influenza and pneumococcal vaccinations in a high-risk group. Many more patients were up-to-date with their influenza vaccination than with their pneumococcal vaccination possibly reflecting patient knowledge about the two illnesses. Only one in five was up-to-date with both vaccinations and one in three were not up-to-date with either despite a national influenza programme, a QOF for influenza vaccinations and clear DOH guidelines surrounding the two vaccinations. Uptake could be improved significantly throughout the UK and at the NMUH dialysis unit. One possible strategy would be to provide these vaccinations on the dialysis unit, with a clear electronic record of vaccination status for each patient, and an automatically generated letter to update the GP as information is entered onto the

Table 2. Influenza and pneumococcal vaccination status: England versus NMUH ($n = 133$)

	England (Source: DOH [13, 14])			NMUH
	<65 years at risk	Specifically ESRF	>65 years	ESRF
Influenza vaccination status				
2009/2010	51.6% (E 50.1%, H 50.7%)	53.4% (E 50.1%, H 49.5%)	72.4% (not broken down)	63.2% (11 missing)
2010/2011	50.4% (E 49.8%, H 44%)	53% (no data available by PCT)	72.8% (E 73.3%, H 71%)	66.9% (6 missing)
Pneumococcal vaccination status				
2011	53%	No data published for this group	69.4%	21.8% (6 missing)

E, Enfield; H, Haringey.

patient's dialysis electronic record. Funding would need to be considered. Further studies are also required to provide better evidence for such vaccinations in dialysis patients and on the effectiveness of electronic reminders for GPs and/or on dialysis units.

Key limitations may have impacted on the findings of this study are as follows:

1. The sample size was relatively small, including 154 patients, due to the size of the dialysis unit. Nevertheless the response rate was good with 93% of the patients taking part in the study. Unfortunately the GPs were not as responsive as the patients.
2. For 21 patients no information was available from GPs. Though to counter this limitation, this is a relatively small proportion of those included.
3. The individuals who did not speak English, and subsequently did not take part, may have provided valuable information should we have had appropriate translators. Hence, though not feasible at the time, this may represent a missed opportunity.
4. As 55% of GPs did not answer our question regarding an electronic reminder, conclusions regarding this potential intervention are built on relatively weak data.
5. The specific population we looked at is unlikely to be representative of the total UK dialysis population, particularly with reference to the high levels of individuals born outside the UK and not having English as their first language. This could be seen as a potential weakness, though could equally be seen as an interesting group of patients, for whom such research is valuable for improving care delivery.

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Conflict of interest statement. None declared.

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