Author's response to reviews

Title: Cost-outcome description of clinical pharmacist interventions in a university teaching hospital

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Author's response to reviews: see over
Dear sir / madam,

The authors of this manuscript would like to thank the referees for the time they have given to reviewing this paper. Their comments on the initial manuscript have allowed us to appreciably improve the quality and impact of the paper.

Please find below the response of the authors of this manuscript to the comments made by the reviewers on the original manuscript. Each issue raised by the reviewer has been addressed independently and details of revisions made to the manuscript are included in the response.

Referee 1:

Part A: Major compulsory revisions

1. It is clear (paragraph 4, page 2) that the authors do not approach the question posed from a neutral perspective. Cost-effectiveness data is required to use public resources efficiently, not to vindicate the role of any particular healthcare worker.

Response: The authors agree with this point. It was never the intention of the authors to approach this paper in a biased manner. However, as four of the authors are pharmacists, their views on the profession may have inadvertently influenced the manuscript. Any entry in the introduction section of the manuscript which attempted to use health economic evaluations as justification for clinical pharmacist roles has been removed. Two additional paragraphs has been included (page 2, paragraph 4 & 5) demonstrating that the main function of health economics is to ensure the equitable distribution of healthcare resources within a society.

2. The question posed is itself unclear in relation to the existing literature. The authors attempt to make a distinction between costs saving and cost avoidance, but with no clarity or support from previous published work or economic theory. (paragraph 5, page 2)

Response: References for the definitions of cost avoidance and cost savings have been included in the revised draft. This study adds to the existing literature, as the interventions conducted by clinical pharmacists have not previously been analysed over such an extended duration and in a tertiary care facility which has such a diverse range of departments including a maternity unit. The authors have been unable to find a study where cost
avoidance generated by a full department of clinical pharmacists in a full calendar year has been calculated.

3. The calculation of input costs appears flawed (see detail in points 4, 5 and 6).
Response: Individual responses are given for points 4, 5 and 6.

4. Only the time to conduct an intervention appears to have been measured. However, to conduct interventions problems must be found and this ‘screening’ or ‘case finding’ activity takes time. Pharmacists also conduct essential legal checks and ensure appropriate medicines supply. However, it seems likely that the time allocated to intervention is under-estimated, especially when the associated administration tasks are taken into account. There may also be costs involved when doctors and nurses respond to the suggested intervention.
Response: While the authors agree that ‘screening’ or ‘case finding’ activity does indeed account for significant amounts of time, not all interventions are identified in this manner. Potential interventions are brought to pharmacist’s attention through medical information queries from other health professionals, during ward rounds and by various other means as the pharmacist fulfils their daily tasks. The purpose of this paper was not to evaluate the benefit associated with conducting essential legal checks and ensuring adequate medical supply, therefore time associated with these tasks was not accounted for.

The absence of accounting for ‘screening’ or ‘case finding’ activity is now described as a major limitation of the study (page 11, paragraph 3) ensuring the manuscript is as transparent as possible. Similarly, the absence of costs associated with doctors and nurses reviewing pharmacist interventions has been included as a limitation. This was not possible to calculate as only the pharmacy department in the hospital where study was undertaken were willing to provide data for the study.

While an argument could be made that the time associated with interventions was underestimated for the aforementioned reasons, 22.5 minutes is a considerable time to assign for a single intervention. 15 – 30 minutes was the most common time duration (n = 21) associated with an intervention. Study showed that in cases where intervention time was recorder only n = 6 (18.75%) were greater than 30 minutes. This would indicate that 22.5 minutes is a conservative estimate for an average intervention time.
5. An hourly rate for the valuation of pharmacist time fails to account for on costs (employers’ costs) and training costs etc. The methodology for valuation of health workers’ time has been well-developed by the University of Kent, and their guidelines should perhaps be consulted.

Response: The Health Information and Quality Authority (HIQA) provide guidelines on the calculation of an hourly salary for employees within the Irish healthcare system. These guidelines include methods for calculating pension contribution, employer related costs and hospital overhead costs.

The Department of the Taoiseach in Ireland has published guidelines on “How to conduct a regulatory impact analysis” which details how to calculate an hourly wage for a civil servant in Ireland.

Hourly wage for a pharmacist has been updated based on recommendations in these 2 documents.

University of Kent guidelines were not used. While having the advantage of being pharmacy specific, guidelines are based on NHS costs.

The cost per hour for a hospital pharmacist is €51.33. Upper and lower limit salary costs used in sensitivity analysis were updated in an identical manner.

6. The pharmacy department must have some identifiable running costs.

Response: Hospital overhead costs were included in hourly rate for employing a pharmacist in line with HIQA guidelines.

7. The cost-benefit terminology (paragraph 1, page 5) appears to be both confusing and misused. All costs contained within the health service are ‘direct’ costs. The only ‘outcome’ measure is the count and classification of ADEs.

Response: Methods section has now been revised to include two separate sections. An intervention analysis section which deals with the count and classification of ADEs. There is also an economic analysis section which details the input costs and the cost avoidance associated with the prevention of ADEs.
The cost benefit terminology used here is not used in an attempt to claim that this study is a “cost-benefit analysis” as defined by Drummond (1). These terms “net cost-benefit” and “cost-benefit ratio” have been used in multiple published papers which evaluated similar interventions. The manner in which they have been calculated has been made clear in the results section of the manuscript.

References to direct and indirect costs have been clarified.

8. The decision not to discount may need to be reviewed when the distinction between avoidance and savings (point 2 above) has been clarified.

Response: The cost avoidance calculated during this study, refers to likelihood that an ADE was prevented during the hospital admission in which the pharmacist performed the intervention. As the average length of stay in an Irish hospital is 7.2 days (2), it was felt that discounting was not warranted.

9. The number of interventions (paragraph 4, page 6, line 1) is confusing. I presume ‘outcome’ in this context means acceptance of a recommendation by a doctor. Has it simply been assumed that all recommendations were accepted?

Response: The authors also agree that this section was unclear. ‘Outcome’ in this context refers to the acceptance or rejection of a suggested intervention by a doctor. An additional paragraph (page 6, paragraph 5) has been added to further clarify the number of interventions which were accepted, rejected and of unknown outcome.

The base case analysis of the cost avoidance is based on a 100% acceptance. Sensitivity analysis now includes scenarios where there was only 50% acceptance and the known acceptance rate (29.9%).

10. The discussion draws strong conclusions that are not justified by the data and should be more tentative.

Response: The authors concur that some elements of the discussion include conclusion which are not adequately supported by the results in this manuscript. The following declarations have been removed as sufficient evidence to supporting their inclusion is unavailable:
• Increasing the number of pharmacists, increases the associated cost avoidance
• Electronic prescribing will reduce the number of medication omissions
• Pharmacist led medication reviews will improve optimise pharmacotherapy in the long term

11. An element of method concerning purchasing power parity, inflation and the choice of base year is presented in the discussion.

Response: This information has been transferred the methods section (page 5, paragraph 2).

12. The discussion highlights that previous studies have based major costs on pharmacists’ full salaries. I suspect there is a happy medium between this and the authors’ own approach (see point 4 above).

Response: This has been discussed in point 4. The main purpose for highlighting this difference was for transparency purposes, as cost benefit ratios were being compared. Although methods to calculate cost avoidance were similar, studies would have had different methods for calculating input costs.

13. As the discussion draws on (paragraph 2, page 11), issues are incorporated that have no direct bearing on the authors’ own results. It is tempting but inappropriate to extend the background and scope of the study at this point.

Response: The authors accept that some points in the discussion had no relevance to the findings of their study. Specifically, the inclusion of references to generic substitution, the long-term impact of medicine use reviews and the increase in numbers of graduate pharmacists have been excluded from the revised manuscript.

**Part B: Minor essential revisions**

1. In paragraph 5, page 6, line 1 ‘prospective’ should read ‘perspective’.

Response: This correction has been made accordingly.
Referee 2

Minor essential revision

1. The first paragraph of the results section of the paper is confusing. It is not clear whether the interventions recorded were the same number as the patients or whether some patients had more than one intervention. This really needs to be set out in a table so that it is possible to see the number patients in relation to the interventions.

Response: The authors agree that this particular paragraph was unclear. Paragraph has been substantially revised. A total of 4,257 interventions were documented on 2,147 individual patients. An additional table (Table 2) has been included in the manuscript. This table provides a description of the overall patient and intervention numbers from the study. It also provides summary statistics on the interventions included in this study.

2. The number of unknown outcomes needs further explanation and if tabulated with the other intervention data it would be easier to understand and draw conclusions.

Response: The authors agree that the presentation of unknown outcome data in the previous draft of the manuscript was confusing. An additional paragraph (page 6, paragraph 5) has been included to provide clarification on the numbers of interventions which were accepted, rejected or of unknown outcome. The high number of unknown outcomes was likely due to the time constraints on the pharmacist’s behalf. On initial identification of an intervention, the details of it are entered into the “eClinical Pharmacy Suite” with the “status” or “outcome” labelled as unknown pending review by the attending physician. Following acceptance or rejection the system is updated accordingly. However due to the pressures on their available time, the pharmacist may not have the opportunity to update the status of the intervention. The high number of outcomes has been elaborated on in discussion section (page 10, paragraph 4).

3. We need to know the impact of the missing data of the ‘unknown acceptance’ outcomes and why they did not include these in the sensitivity analysis.
Response: The impact of the ‘unknown acceptance’ outcomes was minimal. In cases where the intervention outcome was available, the vast majority were accepted. The base case scenario assumed 100% acceptance of interventions. Sensitivity analysis has been updated to include scenarios of 50% acceptance and “known outcome” acceptance (29.92%).

4. (no revision) The analysis is basic but that is not necessarily a criticism as it need not be over analysed.

Response: Additional summary statistics have been provided in a table labelled – Intervention analysis (Table 2).

5. (Discretionary revision) The omissions category it is not clear whether they are medicines reconciliation issues or drug administration issues. This is mention in the discussion as a reconciliation problem but not explained.

Response: Previous draft of manuscript did not include an adequate description for the omissions category. Omissions category refers to medication reconciliation issues, specifically the omission of an item from a patient’s regular preadmission medication. This expanded explanation has been included in the results section of the manuscript (page 7, paragraph 3).

Additional comments from referee 2.

I wanted to know if the German paper they used in their model was translated or if they just used the figures.
The figures from the paper were used. A description of the key results was provided in another published paper.

I found the inclusion of subheadings intrusive and disrupted the flow of the argument.
Subheadings have been removed from discussion.

Further changes to be made during revision:
Tables: Please ensure that the order in which your tables are cited is the same as the order in which they are provided. Every table must be cited in the text, using Arabic numerals. Please do not use ranges when listing tables. Tables must not be subdivided, or contain tables within tables. Please note that we are unable to display vertical lines or text within tables, no display merged cells: please re-layout your table without these elements. Tables should be formatted using the Table tool in your word processor. Please ensure the table title is above the table and the legend is below the table. For more information, see the instructions for authors on the journal website.

Response: Citation and formatting of tables has been updated and now conforms to journal guidelines.

I hope we have dealt adequately dealt with all issues. If further clarification is required, please do not hesitate to contact me.

Kind regards

James Gallagher
Corresponding author

References: