Author's response to reviews

Title: Assessment of the Direct Medical Costs of Diabetes Mellitus and its Complications in the United Arab Emirates

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Author's response to reviews: see over
I would like to express my sincere appreciation to the Bio Med Central Editorial Team for their sincere efforts in reviewing our paper.

Reviewer's report

Title: The Economic Costs of Diabetes Complications in the United Arab Emirates

Version: 3 Date: 12 February 2010

Reviewer: Nigel Unwin

Reviewer's report:

This is a well structured and well written paper, which describes a study to estimate the direct costs of diabetes treatment in one city in the United Arab Emirates. I am not well qualified to assess the costing methodology, and as I know that other reviewers have done this, I will largely limit my comments to issues concerning the collection of data on diabetes and the selection of the study participants.

Thanks for the sincere appreciation.

• Selection of the study participants

The stated aim of the study is, “to estimate the overall patient treatment costs of DM in UAE; including direct management costs of the disease and its chronic macro and micro vascular complications”. The study population chosen to meet this aim is from two hospital outpatient clinics in a city of half a million people. At present the authors give little idea of how typical the patients participating in the study are likely to be of all people with diabetes in Al Ain. For example, it seems plausible that patients attending hospital outpatient clinics will be systematically different to patients attending other types of facilities (e.g. primary health care, private doctors/facilities, non-governmental organisations), and so will not be representative of all, or perhaps even most people with diabetes in Al Ain.
I think that the following additions are required to the manuscript:

1. A short paragraph in the methods section providing an overview of the health care arrangements for diabetes in UAE/Al Ain, what proportions of patients receive their care in different types of facilities, and how access to care is influenced by such factors as ability to pay and nationality;

   **Response:**

   *The authors added a paragraph to the Methods section to describe the Health Care System in Al-Ain/UAE and the proportion of the population covered by government health care system, accessibility to the health care system, etc.*

2. More detail in the methods section on how the study participants were chosen. At present we are told only that “subjects, selected randomly, ……..”. How were subjects selected, was it from a patient register, or clinic lists, or by approaching patients actually attending the clinic? How was it done randomly? How were patients approached and asked if they would participate in the study?;

   **Response:**

   *The authors added more details to the Methods Section to describe in details the sampling procedures that have been used in the study.*

3. In the first part of the results section it needs to be described how many patients were approached to participate in the study and what proportion agreed, and what is known about the characteristics of those who agreed compared to those who did not agree;

   **Response:**

   *The authors added a detailed count of the sampling procedures that have been used. Also the details about the response rate and the population characteristics were added to the Methods section.*

4. Consideration needs to be given in the discussion as to how typical the findings are likely to be of diabetes patients in UAE – given the stated aim of the study.

   **Response:**

   *The authors addressed this important point and added few more interpretations to the findings already stated in the discussion section.*

**Definitions of diabetes and its complications**
At present there are no definitions/descriptions for the how the different types of diabetes (type 1 or 2) and diabetes related complications were determined. This is essential information, and needs to be part of the methods section. For example, how was type 1 diabetes distinguished from type 2? How were nephropathy, retinopathy, and neuropathy defined and diagnosed? Clearly, it is not expected in a pragmatic study of this nature that state of the art approaches to definition and diagnosis will have been used, but what was done needs to be made available to the reader, and is important information if the results are to be compared to other studies.

The authors added more elaborations, interpretations and definitions to the manuscript to clarify and better describe what have been measured, how, when and at which costs.

Presentation of results

A small and obvious comment on the presentation of the results is that summary statistics of mean and standard deviation (as in table 2) are clearly inappropriate (as the results are highly skewed) and should be substituted with medians and ranges (or interquartile ranges).

The authors are indebted to the reviewer for alerting them to a systematic error in most of the tables where the mean values, which were originally in UAE Dirham, were all converted to equivalent US$ value (at 3.68 AED) while the standard deviation values were left unconverted. The problem is now fixed in all tables.
Reviewer Prof. Mark Pennington

Minor essential revisions:

Point # 1 Pge 3, second para - 'most of these costs incurred by managing the squeal of DM [6].' squeal should be sequelae?

This paragraph was removed from the test of the MS.

Point # 2 Page 7, second para - 'In addition to the routine management the following sequel of chronic diabetic...' Sequel should again be sequelae?

Noted and fixed

Point # 3 Page 4 last para - I would prefer the following wording: 'However, despite that, few efforts have been made to estimate its costs in the Middle East; and only two studies have been published in the rest of the region. '

This paragraph was removed from the text of the MS.

Point # 4 Page 4 last para - (approximately 500,000 populations).

Noted and fixed

Point # 5 Page 11 last para - the first sentence of this paragraph is simply a repeat of the last sentence of the previous paragraph

The sentence is removed

Point # 6 Page 15 last para - 'However, to offset the potential costs of screening it may be worthy...' worthy should be worth

Noted and fixed

Point # 7 Page 14 last para - 'more efforts are thus needed to address the burden of problem on health care resources available in the country...' Do you mean burden of the problem?

Yes and this was corrected in the MS.
Point # 8 Page 14 first para - There is some interesting data here but the use of the terms per capita and per patient is confusing. I would interpret the denominator in per capita costs to be the entire population, whereas the denominator for per patient costs would be DM patients. The last sentence of the paragraph refers to both. We need some clarity here and I would like to know the prevalence of DM in Iran to underscore the per capita costs (if available).

We take this point of the reviewer. To avoid confusion we went back to original references to clarify and fix the source of the confusion. For simplicity, we removed per capita and replace it with “per patient”. The prevalence of DM in Iran is 8%.

Point # 9 Page 4 first para - can we have the cost year for the data from Europe (Code-2)?

The cost year 1999 is added..

Point # 10 Page 15 second para and in general. You observe that costs are higher for patients diagnosed incidentally and suggest that their disease has progressed further. I'm sure that this is true. It's not clear, however, that patient costs would fall if they were diagnosed earlier. They are likely to commence treatment earlier and undoubtedly initial costs would rise. Whether this is offset by a delay on the onset of micro and macro vascular complications, and the costs that accompany it, is not clear. I would expect the progression of the disease to be slowed in patients with earlier diagnosis, but the overall costs for these patients may not be lower once future costs are discounted.

It is highly likely that patients will enjoy increased HRQoL through earlier diagnosis. I would be very surprised if any cost savings would offset the cost of a mass screening campaign. However, the benefits in terms of increased HRQoL MAY justify the cost of screening. To answer this question would require an economic evaluation of screening for DM.

I certainly do not support the assertion that, 'no matter how these costs are calculated, the price in terms of human suffering is always greater and should justify all prevention efforts.' Firstly, if the price in human suffering is less than the cost of prevention then that prevention is an inefficient use of resources. Few health care systems would prescribe treatments for headaches that cost hundreds of dollars - the human suffering is not worth that cost. However great the suffering
from DM may be it cannot justify prevention at any cost. There are clearly competing uses of those scarce health care resources. A large burden of disease of itself does NOT justify a large preventative programme. There must be evidence that the programme can reduce the burden sufficient to justify its cost. Alzheimers disease exacts a large burden in the UK, but we do not fund large preventative health care programmes for Alzheimers. This would only be justified if there were programmes available that could reduce this burden. There are a number of potential programmes to reduce the incidence of DM, and to help sufferers manage their condition better, but we should be confident that their impact justifies their cost before implementing them.

We reconfirm our remark relating to the association of late diagnosis with higher costs. We also share the opinion that no evidence is available to suggest that that costs will fall if the diagnosis is made earlier. Apparently, there are many other factors to take into consideration to achieve that. In general, we believe that the overall direct and indirect benefit of early screening are beneficial but to verify the cost effectiveness of screening as an interventional measure apparently more research and evaluation would be needed. Due to that understanding, we changed our recommendation relating to screening of DM to include only the high risk group.

Discretionary Revisions

Point # 11 the data you cite on page 3/4 on the costs of DM is quite old, are there any newer estimates available?

New literature was used instead of the old references.

Point # 12 Page 7 middle para - you say that you did not correct for costs not attributable to DM and hence that you have overestimated. I appreciate that this may be difficult to do, but my concern is that you may have significantly overestimated. How can I be confident that you have not? Do you have some way to estimate what proportion of costs should actually have been attributable to another condition? I think you should present some estimate of this or state more clearly that the costs you estimate are an overestimate, and the true costs are likely to be less than your estimates.

We noted the comment by the reviewer and we appreciate his remarks. However, as he noted it is difficult to integrate the proportional costs which might be
attributable to other conditions. We already stated in general terms that the present estimates could be higher due to multiple conditions.

**Reviewer: Awad MATARIA**

**Introduction:**

The paper addresses an important topic of international, regional and local relevance. Researching the burden of illnesses, in different part of the worlds, in an attempt to attract attention and formulate proper policies remains an area of utmost importance. The authors justified well the importance of the study although they focused their attention to the novelty of the study in the local context. More could have been said about the usefulness of the study result in informing public health policies of preventive and management nature. The paper still needs some attempts to improve its conceptual and empirical coherence and can benefit from the comments below to fulfill its purpose.

*To highlight the ‘usefulness of the study’ to Health Care practice and decision making in the UAE, the authors took note of the reviewer’s comments and made additional insertions to the introduction to further highlight the importance of studies addressing DM costs:*

**Comments:**

*Title:* The paper does indeed neither assess the total economic cost of DM nor it limits the analysis to DM complications. It is needed to change the title to correspond to what has effectively been pursued in the paper (an assessment of the Direct Medical Costs of Diabetes Mellitus and its Complications). This is indeed clarified by the authors in the last sentence of the Background section.

*The comments by the Reviewer relating to the title are sustained. The title of the paper has been changed “Assessment of the Direct Medical Costs of Diabetes Mellitus and Its Complications in the United Arab Emirates”.*
Abstract: Need to be reworked in line with the changes below. *Agreed.*

**Background:**
- The section is better labeled: “Introduction”.
  *Sorry, the labeling is dictated by the journal.*
- There is a need to refer to some studies conducted in other developing countries in this section including countries other than Middle Eastern ones.

*The comments by the Reviewer are sustained. More fresh literature is added.*
- The term “intangible losses” is mentioned only once in the paper – in the Background/Introduction section. These indeed represent an important component of the total economic cost of non-communicable diseases. Given that those are not attempted in the paper, it is suggested that such reference to intangible costs be left to the Discussion section, with elaboration as with regard to what those costs would include, and whether there exclusion would bias the study results given the adopted perspective.

*The comments by the Reviewer are sustained. Intangible costs are discussed at the discussion section.*

**Methods:**
- The 1st and 2nd paragraphs in the Methods section need to be placed in the Introduction section, as the Methods section needs to be reserved to describing the particular methodology as applied in the study at hand.

*Sustained. The first and second paragraphs in the Methods section are removed and placed in the Introduction section.*

- Page 5, 2nd paragraph: The opposite could also be said about these studies, as attributing all medical management costs to DM, might as well over-estimate the cost because some of these complications might not necessarily be due to DM. This has been also referred to by the authors at the end of the second
The authors added further clarifications, on line with the reviewer’s comments, relating to possibility of over estimating DM costs if the primary cause was DM;

• Page 6, 2nd paragraph: as presented in the paper the perspective of the study is that of the health sector (the financer or the purchaser in a publicly financed system) more than it is of the provider. It is true that these might be confounded in the public sector in the context of the UAE but it is still better to make the distinction and use the proper identification.

Thanks. More clarification to the roles of funding agency for health care services is added to the text. A precise interpretation to the ‘role’ of the health sector in the UAE, which used to be the public ‘funding’ and ‘providing’ sector of health care services to the public at the time, were introduced to the manuscript.

• It is confusing that while a provider (health sector) perspective is aimed for, still costing is done using a users’ perspective, via the use of the list of charges. In Health Economics, a distinction is made between costs and charges/prices, where the latter refers to payments made by the users and the former represents the burden on the provider. The paper indeed seems to confuse both by using charges as proxy of cost, something which could be very far from reality and needs to be alluded to. The authors can still mention that prices and charges are used as proxy of costs, and discuss the implication of this on the results in the Discussion section.

While the precise interpretation to the role of ‘health sector’ stated above is held here as well, the authors like to add that the decision to use the ‘list of charges’ for patients NOT covered by health insurance was based on the fact that those costs, when determined by the ‘health sector’ were based on the real market rates, i. e, the rates at which patients without insurance are treated at the private sector, which in turn reflect the competitive or ‘actual’ cost of obtaining these services elsewhere, without subsidization. The same practice is common in cost studies elsewhere. Equally important, it is also known in economics that charges or costs...
are reciprocal to each other depending on the viewpoint of the party commissioning the cost analysis. For example, the costs incurred by the health care sector are usually reflected as charges to the ‘user’ but in turn those ‘user’ charges are costs to the entire society from the societal view point of the ‘society’, etc.

• It is well known that the market almost always fail in the area of health care and hence any price tag does not represent the value of a commodity, therefore, one should not mention that “charges are based on real market rates” because those are usually set using several factors; e.g., subsidies or profit making goals. This is very important because the analysis is said to be pursued from the perspective of health care provider and not the users or the patients.

The authors agree to the concept of ‘market failure’ in health care and that is why they opted to use the ‘shadow pricing’ through using the ‘real market rates’ implied by the rates of the private sector, upon which the UAE health care sector based its ‘list of charges’ for patients without health insurance. The manuscript is revised to further elaborate about the approach used by the authors.

• Page 6, 2nd paragraph: given that DM complications are limited to cardiovascular ones, this might underestimate the total cost and hence this should be mentioned as limitation at the end of the Discussion section.

Cardiovascular complications include all complications enlisted in the 5th paragraph of the methods section.

• Need to comment in the Discussion section on the completeness of the patients’ treatment profiles’ used for estimating DM costs, in terms of coverage of patients and the continuity aspect, as a year time period is used for tracking all costs. Also, something should be mentioned there (in the Discussion) about why Al-Ain District was chosen and what impact this would have on the possibility to generalize the study results to the UAE and other countries in the region. Another sampling issue that needs to be defended and alluded to in the limitation in the Discussion section is why only hospitals and both primary care centers were used to recruit patients.
The authors revised the manuscript especially the methods section, along the lines indicated by the reviewer to further clarify the design, the setting, the methods, the study population and procedures used to obtain and analyze data and calculate costs, etc. The same has been reflected upon in the Discussion section.

- The Methods section needs to mention how randomness was guaranteed in selecting the study sample and whether stratification was attempted to compare the various subcategories of the study population mentioned in the paper.

**More elaboration is made about the sampling methods that has been used and added to the text in the methods section.**

- The Methods section needs to explain how the different information and data from secondary and primary sources were put together to follow up with the analyses.

**More elaboration is made about calculation methods that has been used and added to the text in the methods section.**

- It is not clear why one would need ‘expert opinion’ and a ‘mean’ to assign the unit cost if the list of charges is used to estimate management costs. Those are in principle set to be used in charging private (not covered by any mean of prepayment scheme) patients. Any payment based on a pricing schedule is expected to take into account all costs (and possibly a margin of profit) and so no need to look for other cost components. This need to be checked and clarified.

**More elaboration is made about the methods used for calculating the costs. More clarification is added to the text to reflect how these costs were used for estimating DM patients costs. The revisions were added in the text in the methods and results sections.**

- The paper mentions that a “case management costs per episode per patient” was estimated. For this to be done, patients should be followed in time from the occurrence of the event until recovery or sustained repeated management. For
this to be done a longitudinal study would be needed. The present study however is said to be cross-sectional. It is nevertheless not clear what has been exactly done in the analysis. Did the authors estimate and average for per visit or per case? It is clear that the authors aimed to estimate the cost per case but for this to be done, patients need to be followed in time (prospectively or retrospectively). In this case, the issue of over sampling is no more a problem (see below)!

Patients were followed retrospectively for one through the medical file, from the point of the recruitment and initial interview. More elaboration on this is added to the methods, results and discussion sections.

• A full listing of all cost components should be presented.

Further details of all cost components were added to the methods and reflected in the results table.

Statistical analysis:

• The use of logarithmic transformation needs to be justified.

More justification for the need for logarithmic transformations were added.

• The manner in which the over-sampling due to more frequent visits is dealt with needs to be reconsidered as if the approach is based on estimating total management cost per case, then having more frequent visits does not indeed bias the results as it should reflect what a certain group of patients does and hence this should in principle be taken into account by the analysis.

More elaborations are added both to the methods and the discussion sections.

• It is needed to make clear how costs was estimated and to mention that these are only average costs over a year and hence does neither represent total costs or even annual costs for a single patient. Indeed, there is a major problem with the approach used to estimate the cost of DM in the paper, where the results seem to represent the average cost per visit. It is not clear in the paper if the
authors have added up the costs borne by the same patient and then estimated an average of those. This seems not to be the case and hence the authors’ worry of over-representing patients with repeated visits. The way the cost estimation is to be conducted should consist of listing all services received by an average patient during a certain period of time, multiplying those with the unit cost for each and then adding up and taking the average before generalizing to all DM population in a society to have an estimation of the total burden of DM in a society.

*The (Unit cost) estimates of medical consumption per patient category (e.g. type 1 or 2 or gender, etc.) were measured over a year time using exactly the procedure described by the reviewer: i.e. through listing all services received by an average patient during a certain period of time (profile by frequency of visits) multiplying those with the unit cost for each (Unit Costs) and then adding up and taking the average before generalizing to all DM population in a society to have an estimation of the total burden of DM in a society. More elaboration is made in the manuscript to clarify the procedures used to analyze DM costs in the UAE*

Results:

- It seems from this section that the authors had indeed considered patients and not visits and this confirms the validity of the comment made above with regard to repeated visit as it does not imply over-sampling a certain category patients, except if the sampling was done using the visits as a sampling frame, something which should bias the whole study results. This seems not to be the cases, otherwise, how the estimations 27% and 9% (1st paragraph, page 10) were calculated.

*Please refer to comments in the previous sections.*

- Page 9, last paragraph: do not use the past participle ‘paid’ in this context as it is confused with monetary payment.

*Sustained.*
• It is needed that some statistical testing be conducted to assess the statistical significance across the difference socio-demographic groups. It is mentioned that Chi-2 and t-test statistics were calculated. The results from those need to be put in Table 1 and summarized in the text when talking about differences.

_Sustained._

• The Discussion section should include some explanations of the obtained results. First, it should be reminded that these are only costs from the purchaser/payer/providers perspective; and hence, and explanation for higher costs on those coming from nearby GCC countries might be due to complicated cases coming to those hospital for lack of care in own countries. Expatriates are relatively healthier, something which could explain the lower cost. Another explanation is that they might be discriminated against or simply do not have the resources to demand needed care.

_The comments by the reviewer are valuable and were used by the authors to further interpret the findings._

• In Table 1, confidence intervals should be presented for costs themselves and not for the % from total.

_Sustained._

• Page 11, last paragraph, it should be mentioned “other GCC patients” because those exclude UAE patients.

_Thanks; sustained._

• Do not use unit management cost because this is not what was done and it looks meaningless in the present context.

_The terms used in the manuscript are further interpreted by the authors along the lines stated by the reviewer._
• Table 2: having “provider” among the list of classifying variables is confusing as the same patient might be going to several providers. The Table indeed confuses unit costs with management cost of a category of patients.

*The authors fixed the confusion between providers and health care settings.*

• Page 12, last paragraph: do not use the word “model”.

*OK.*

• Type of Diabetes and Insulin: there might be a problem of colinearity to be checked between both variables.

*The remark has been noted, we checked for collinearity between variables and the result was negative.*

• Stroke: may be due to sample size.

*The remark has been noted.*

• The analysis as conducted does not indeed consider the presence of covariance between variables. It just adjusts for collective effect but not interactions.

*The logistic regression has been used to deal with covariance, correlations, and interrelations, etc.…*

Discussion:

• Page 13, 1st paragraph: one cannot say that the result shows that …

*“reveal” instead of “show” is now used in the text.*

• Page 13, 2nd paragraph: information presented at the end of the paragraph is not accepted as such and results need to be compared and differences need to be explained.
The remark is noted. The discussion section is more about comparative analysis.

• Information presented in the first two paragraphs on page 14 needs to go to the introduction. The Discussion section should be used to discuss differences and compare comparable results.

Thanks. The remark is noted and fixed.

• The conclusion made at the end of page 14 on the importance of prevention is outside the scope of the present paper and no evidence is being presented in the paper to support it.

The remark is noted and fixed.

Minor Comments:

1. Page 3, paragraph 1: DM is mentioned for the first time; need to be put in full with the abbreviation DM in brackets.
2. Page 3, paragraph 1: the 3rd statement in the paragraph is mal-placed and does not go with the flow of the paragraph, as the following statement mentions cardiovascular and other complications that could be attributed to DM mismanagement. Better to remove or place after the statement that follows.
3. Page 3, paragraph 1: Does the term “non-national” refers to other GCC countries and expatriates? Please clarify as the distinction is made later on in the paper.
4. Page 3, paragraph 1: The last sentence needs to be qualified as while the authors mention that DM is rarely reported as the underlying cause of death in UAE, they also report that, as per MoH records, DM is the 6th leading cause of death. One would expect that MoH reporting is based on actual numbers and hence the conflicting information in the statement.
5. Page 3, paragraph 2: 1st sentence needs a reference.
6. Page 4, paragraph 2: to which countries does the phrase “in these countries” refer? US, Canada and the EU? As the UAE is mentioned in between!
7. Some calculated percentages are presented along with the associated CI and others are not. Please keep consistent in presenting the study results. It is also
preferred that such CI be presented in all the associated Tables.
8. Table 4 could be more helpful if the percentage of those seeking treatment is also presented along with the prevalence of the various health conditions.
9. The order of Tables is mixed up and the reader finds that after presenting the results in Table 4, one has to go back to Table 1. This needs to be amended.

All the minor remarks are noted and fixed by the authors.

Level of interest: An article whose findings are important to those with closely related research interests
Quality of written English: Acceptable
Statistical review: No, the manuscript does not need to be seen by a statistician.
Declaration of competing interests: I declare that I have no competing interests.