Type 2 diabetes in Tuvalu: A drug use and chronic disease management evaluation

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Investigator

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Acknowledgement

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Without his organisational and data collection assistance this study would not have been possible.
Background

Type 2 diabetes is extremely prevalent in pacific island countries (Zimmet, Alberti, & Shaw, 2001). Furthermore, in pacific island countries type 2 diabetes is a leading cause of mortality, with non-communicable diseases (NCD’s) accounting for 59% of years of life lost in Tuvalu (World Health Organization, 2010).

Many factors contribute to the increased prevalence of type 2 diabetes in Tuvalu. The levels of obesity are high, facilitated by limited access to ‘healthy’ food and low amounts of physical activity. These two factors significantly contribute to the high levels of obesity in Tuvalu; with 67.6% of females and 46.6% of males in Tuvalu classified as obese (World Health Organization, 2010).

There are also high percentages of the adult population in Tuvalu classified as daily smokers (33.4%) and binge alcohol drinkers (21.8%) (Ministry of Health, Tuvalu, 2011). The decreased access and appreciation for the need of a range of ‘healthy’ food is highlighted in the preliminary results of the NCD Steps survey conducted in 2006; with 89% of the population having less than five servings of fruit and vegetables daily.

Tuvalu consists of the capital Funafuti, and three main groups of outer islands; the north, central, and southern island groups. The Princess Margaret Hospital in Funafuti is the only hospital in Tuvalu and provides a comprehensive health service. Health care in the outer islands is provided by medical centres run by nurses. The nurses have a large responsibility, as they manage the centre and the health care on that island.

A pharmacy tour is conducted to the outer islands twice a year. The main aims of visiting the medical clinics is to restock imprest systems, monitor stock rotation, assess inventory management, as well as the general provision of health care in these islands. This trip offers the opportunity to assess the management of diabetes across all islands, and therefore type 2 diabetes management in Tuvalu.

In 2010, Tuvalu released its first Standard Treatment Guidelines, which are closely adapted from the Fiji Standard Therapeutic Guidelines. As Fiji and Tuvalu have similar essential medicines lists and the majority of health practitioners are trained at the Fiji National University these guidelines are extremely suitable. This study offers the opportunity to assess the compliance of treatment to the recommendations included in the Tuvalu Standard Treatment Guidelines 1st Edition.

The chapter ‘Managing Diabetes Mellitus’ is an up-to-date and comprehensive resource for health workers managing type 2 diabetic patients’. Topics covered include drug therapy, diagnosis, patients at risk, clinical picture, as well as the multi-factorial approach to adequate blood sugar control and risk factor modification. Other topics include special situations in the management of diabetes and late complications of diabetes.

There are four medicines on the essential medicines list for the treatment of type 2 diabetes in Tuvalu. The available oral antidiabetic drugs are metformin, glibenclamide and glipizide. If blood glucose control with oral treatment is inadequate, insulin is available and recommended. Short-acting, intermediate acting and biphasic insulin formulations are available.
Objectives

i. Assess the management of type 2 diabetes in Tuvalu
ii. Assess the attitude and knowledge of type 2 diabetic patients to their medication and to the management of their chronic disease
iii. Compare and contrast the results between the outer islands to the capital, Funafuti.

Study design

Cross-sectional study

Methodology

Patients’ included in this study are diagnosed with type 2 diabetes. These patients’ reside in the capital or on the outer islands. The target number of patients’ at the beginning of the study was 75.

Type 2 diabetics residing in the capital were asked to participate in the study following presentation to the outpatient or pharmacy department at the Princess Margaret Hospital. Type 2 diabetics residing in the outer islands were asked to visit their medical centre if they wished to participate in the study.

To gather data patients were be interviewed using a data collection form and a chronic disease management questionnaire. Blood pressure measurements, fasting blood glucose and blood samples will be taken at this time. Blood samples were tested for HbA1c and lipid profile in the laboratory at Princess Margaret Hospital in Funafuti. Blood pressure will be taken in the sitting position for all patients. Height and weight will also be recorded. Body Mass Index (BMI) will be calculated using the standard BMI formula shown below.

\[ \text{BMI} = \frac{\text{mass (kg)}}{(\text{height (m)})^2} \]

Medication summaries for each patient are held at each facility in Funafuti or the outer islands. The medical centres on all islands are the only source of medication; therefore this medication profile will be accurate. These summaries will provide the information for current medication profile in the data collection form. The patients’ knowledge of their medication names and dosing schedule will be assessed against this information.

Following the data collection process, the interviewer will educate the patient on the management of type 2 diabetes, focusing on any knowledge gaps identified from the interview process. To assist this process, diabetes information leaflets have been produced by the public health department at Princess Margaret Hospital. These leaflets will be offered to the patients and excess stock will be kept at the medical centres for future use.

Duration

The data was collected from Wednesday 9th to Wednesday 30th March 2011.

Approval

The commencement of the study was approved by the Director of Health, Dr Stephen Homasi.

Limitations

i. Interpreters were needed for some interviews as it was not always possible to conduct interviews in English. This introduced the risk of missing information or misinterpretation through translation.
ii. It was not possible to visit and gather data from the central islands. Therefore any comparisons between the outer islands and the capital assume similar conditions in the central islands to the southern and northern outer island groups.
iii. Blood samples were not assessed for all patients’; this was due to patient preference or destruction of blood
samples during transport. Therefore, HbA1c levels and lipid profile are not available for all patients. Blood samples for HbA1c testing from the northern islands were all destroyed; therefore this data is not available.

iv. Due to time restraints, the sample size is relatively small. This should be considered in the interpretation of the results of the study.

Sample size

Data was collected from 93 patients’ in total, with 26 residing in the capital.

Results

i. Assess the management of type 2 diabetes in Tuvalu

Treatment percentages are shown below.

| Patients taking antidiabetic medications | 85% |
| Metformin ONLY patients’ | 20% |
| Glibenclamide ONLY patients’ | 12% |
| Glipizide ONLY patients’ | 9% |
| Metformin and glibenclamide patients’ | 33% |
| Metformin and glipizide patients’ | 6% |
| Insulin patients’ | 4% |

The patients receiving insulin therapy were all receiving isophane insulin formulations and also taking oral antidiabetic medication. Patients’ were seldom treated with recommended maximum doses of a single or combined oral medication as listed in the Tuvalu Standard Treatment Guidelines.

Regular blood glucose monitoring was being undertaken in all but four patients’. The monitoring of blood glucose was conducted either at the medical clinics in the outer islands or Princess Margaret Hospital in the capital. Furthermore, eight patients also had their own blood glucose monitor. These patients’ did not measure their blood glucose more frequently when compared to others; as they still relied on sourcing the testing strips from the medical clinics or Princess Margaret Hospital. On average, patients’ had their blood glucose level tested 1.8 times a month.

The Tuvalu Standard Treatment Guidelines lists the following targets for diabetes control in the ‘Management of Diabetes Mellitus’ chapter. These targets closely reflect those recommended globally. For the purpose of this study, the management of type 2 diabetes in Tuvalu will be assessed against these recommendations.

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Very good control</th>
<th>Fair control</th>
<th>Could be better</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fasting blood glucose (mmol/L)</td>
<td>4-6</td>
<td>6.1-7</td>
<td>&gt;7</td>
</tr>
<tr>
<td>2-hour post prandial (mmol/L)</td>
<td>4-8</td>
<td>8.1-10</td>
<td>&gt;10</td>
</tr>
<tr>
<td>HbA1c (%)</td>
<td>&lt;6</td>
<td>6-6.9</td>
<td>7 or greater</td>
</tr>
<tr>
<td>Total cholesterol (mmol/L)</td>
<td>&lt;4</td>
<td>4.1-4.9</td>
<td>5 or greater</td>
</tr>
<tr>
<td>HDL-cholesterol (mmol/L)</td>
<td>&gt;1</td>
<td>0.9-1</td>
<td>&lt;0.9</td>
</tr>
<tr>
<td>LDL-cholesterol (mmol/L)</td>
<td>&lt;3</td>
<td>3-4</td>
<td>&gt;4</td>
</tr>
<tr>
<td>Triglycerides (mmol/L)</td>
<td>&lt;1.5</td>
<td>1.6-2</td>
<td>&gt;2</td>
</tr>
<tr>
<td>Blood pressure (mmHg)</td>
<td>&lt;130/80</td>
<td>130/80-140/90</td>
<td>140/90 or greater</td>
</tr>
<tr>
<td>Body mass index (kg/m2)</td>
<td>Males &lt; 25</td>
<td>Males &lt; 27</td>
<td>Males &gt; 27</td>
</tr>
<tr>
<td></td>
<td>Females &lt; 24</td>
<td>Females &lt; 26</td>
<td>Females &gt; 26</td>
</tr>
</tbody>
</table>


LDL levels were not measured in this study. The resources required to measure LDL levels are not available in Tuvalu and therefore are not measured on a regular basis.

The percentages of patients are classified according to their type 2 diabetes management indicators below. Patients’ were categorised into a higher blood pressure category if either the systolic or diastolic value alone fitted into the higher blood pressure bracket.
<table>
<thead>
<tr>
<th>Indicator</th>
<th>Very good control</th>
<th>Fair control</th>
<th>Could be better</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fasting blood glucose (mmol/L)</td>
<td>2%</td>
<td>2%</td>
<td>95%</td>
</tr>
<tr>
<td>2-hour post prandial (mmol/L)</td>
<td></td>
<td>Measurement not taken</td>
<td></td>
</tr>
<tr>
<td>HbA1c (%)</td>
<td>0%</td>
<td>0%</td>
<td>100%</td>
</tr>
<tr>
<td>Total cholesterol (mmol/L)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HDL-cholesterol (mmol/L)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LDL-cholesterol (mmol/L)</td>
<td>Resources not available to measure</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Triglycerides (mmol/L)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Blood pressure (mmHg)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Body mass index (kg/m2)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Males 16%</td>
<td>Males 3%</td>
<td>Males 81%</td>
</tr>
<tr>
<td></td>
<td>Females 5%</td>
<td>Females 3%</td>
<td>Females 91%</td>
</tr>
</tbody>
</table>

Analysing the data in this manner does not give an indication of the location or spread of the data. Therefore, to highlight these, the distribution of fasting blood glucose is shown below. The average fasting blood glucose is 13.04mmol/L.

As mentioned under ‘Limitations’ the blood samples from the northern islands for HbA1c testing were destroyed in transport. The distribution of samples from the southern islands and the capital is shown below. The average HbA1c is 16.98%

As highlighted by previous research it is clear that the levels of obesity in Tuvalu are extremely high. This is also reflected in this study of type 2 diabetics, with the average BMI equalling 32.

The Tuvalu Standard Treatment Guidelines also recommends that diabetics complete at least thirty minutes of moderate intensity physical activity every day, they do not smoke, and their alcohol intake should not exceed two

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standard drinks a day (Ministry of Health, Tuvalu, 2010).

Of the patients included in the study 23% admitted to being a current smoker and only 3% admitted to being a current drinker. 32% of patients’ said they completed regular exercise, but only 6% completed 30 minutes of exercise daily as recommended in the Tuvalu Standard Treatment Guidelines. The main form of exercise completed by patients’ is walking. For the purpose of the study house chores or work was not considered as exercise, although many mentioned this when asked if they exercise.

ii. Assess the attitude and knowledge of type 2 diabetic patients to their medication and to the management of their chronic disease

The chronic disease management questionnaire was designed to assess how engaged patients’ were with their disease and the management of their condition.

Patients had a generally low knowledge about medicines they were taking to treat their type 2 diabetes. Only 35% of patients could recite the names of their medication. Furthermore, only 56% of patients identified that their medication lowered their blood sugar. Despite this, 79% of patients’ could recite the dosing schedule they were currently prescribed.

Patients’ medication compliance was also alarming, with 83% of patients’ regularly missing their medication. Furthermore, 35% of patients’ that regularly missed taking their medication were doing so three times a week or more. The main reason for missing doses was forgetting, as opposed to supply issues or side effects.

The medicines on the essential medicines list for Tuvalu available to treat type 2 diabetes are generally well tolerated and have few side effects. This is reinforced by the patients’ included in the study, with only 18% of patients’ experiencing side effects from their medication.

85% of patients recognised that they had high blood sugar. However, they clearly do not appreciate the importance of lowering their blood glucose as their knowledge of the complications of type 2 diabetes was extremely low. 54% of patients did not know of any complications associated with diabetes. Furthermore, only 27% of patients’ could identify two or more areas that may be affected. It was alarming to discover that only 53% of patients’ said their nurse or doctor had told them about the long-term consequences of type 2 diabetes. Most patients’ did not have an idea of the target fasting blood glucose and were surprised when told. Unfortunately, this was not assessed in the study.

iii. Compare and contrast the results between the outer islands to the capital, Funafuti.

There was no significant difference of blood glucose control between the capital and the outer islands. The average fasting blood glucose levels for patients’ in the capital and the outer islands were 12.8 and 13.1 respectively. The distribution of levels are shown below.
A large difference in blood pressure management in type 2 diabetic patients’ exists between the capital and the outer islands. Of the patients’ in the study, 60% from the outer islands and 35% from the capital had a blood pressure of 140/90 or greater. The percentages of patients’ with a blood pressure between 130/80 and 140/90 from the outer islands and the capital are 30% and 35% respectively.

There was a significant difference in the amount of exercise being completed between patients of the capital in comparison to the outer islands; with 77% of patients’ from the capital completing regular exercise compared with only 15% from the outer islands. However, the level of sufficient exercise as outlined in the Tuvalu Standard Treatment Guidelines is still extremely low, as mentioned under section i.

Findings and recommendations

Finding #1
Many type 2 diabetic patients’ had uncontrolled blood glucose. To avoid the consequences of uncontrolled blood glucose levels it is recommended that this is addressed.

Recommendations
- The treatment of type 2 diabetes in Tuvalu should show greater compliance to the Tuvalu Standard Treatment Guidelines.
- Promotion of the use and adherence to the Tuvalu Standard Treatment Guidelines is recommended. This may include promotion of blood glucose targets in the Princess Margaret Hospital or medical centres in the outer islands.
- Promote the need for regular measurement of type 2 diabetic patients’ blood glucose and routine HbA1c levels.
- Medicines should be adjusted according patients’ blood glucose and HbA1c measurements.
- The diabetic cards should include an area for HbA1c recording. The recommended frequency of testing could also be listed here. A section where fasting blood glucose can be graphed against time may also be useful.

Finding #2
HbA1c levels were not measured routinely in type 2 diabetic patients’ (cost Approx $600 for 50 tests). As HbA1c levels are used to help guide therapy it is important that this is undertaken. Furthermore, a recommended frequency of testing HbA1c levels is not listed in the Tuvalu Standard Treatment Guidelines.

Recommendations
- HbA1c levels should be measured regularly. Certain times of the year could be designated to promote and measure HbA1c levels in type 2 diabetics.
- The frequency of measurement of HbA1c should be defined and listed in the Tuvalu Standard Treatment Guidelines. The recommended frequency Endocrinology Therapeutic Guidelines 2009 recommend HbA1c levels are measured every six months.
- The determined frequency of testing should be promoted.
- The diabetic cards should include an area for HbA1c recording. The recommended frequency of testing could also be listed here.

Finding #3
Many type 2 diabetic patients’ had blood pressure measurements above the target, 130/80mmHg. To avoid increased risk of microvascular and macrovascular complications it is recommended that this is addressed.

Recommendations
- The treatment of type 2 diabetes in Tuvalu should show greater compliance to the Tuvalu Standard Treatment Guidelines.
- Promotion of the use and adherence to the Tuvalu Standard Treatment Guidelines is recommended. This may include promotion of blood pressure targets in the Princess Margaret Hospital or medical centres in the outer islands.
- Promote the need for regular measurement of type 2 diabetic patients’ blood pressure.
- Medicines should be adjusted according to patients’ blood pressure measurements.

Finding #4
Many type 2 diabetic patients’ had total cholesterol levels above the recommended target. To avoid further increasing
risk of macrovascular complications it is recommended that this is addressed.

**Recommendations**

- The treatment of type 2 diabetes in Tuvalu should show greater compliance to the Tuvalu Standard Treatment Guidelines.
- Promotion of the use and adherence to the Tuvalu Standard Treatment Guidelines is recommended. This may include promotion of blood lipid targets in the Princess Margaret Hospital or the medical centres in the outer islands.
- Promote the routine testing of blood lipids.

**Finding #5**

Blood lipids are not measured routinely in type 2 diabetic patients'. Furthermore, a recommended frequency of testing blood lipids is not listed in the Tuvalu Standard Treatment Guidelines.

**Recommendations**

- Blood lipids should be measured regularly. Certain times of the year could be designated to measure blood lipids in type 2 diabetics.
- The frequency of measurement of blood lipids should be defined and listed in the Tuvalu Standard Treatment Guidelines. The recommended frequency Endocrinology Therapeutic Guidelines 2009 recommend blood lipids are measured once a year. If this is not feasible, blood lipids could be measured upon diagnosis.
- The determined frequency of testing should be promoted.
- The diabetic cards should be revised to include an area for blood lipid recording. The recommended frequency of testing could also be listed here.

**Finding #6**

Many type 2 diabetics do not meet lifestyle targets recommended in type 2 diabetes.

**Recommendations**

- Promotion of lifestyle targets for type 2 diabetic patients’ should increase.
- Promotion of the recommendations as listed in the Tuvalu Standard Treatment Guidelines should occur within health care facilities and the wider community.
- If possible, a diabetes educator is likely to be effective in patient education and promotion of the effect lifestyle risk factors on complications of type 2 diabetes.

**Finding #7**

There is an extremely low level of patients’ engagement with their condition. This was displayed by low knowledge of their medication, medication compliance issues, and low knowledge of the complications of diabetes. The materials produced by the public health department were useful in the promotion of the complications of diabetes.

**Recommendations**

- Promotion of the complications of diabetes should increase and be expanded to different media formats.
- If possible, a diabetes educator is likely to be effective in this area. A diabetes educator has the ability to increase the involvement and understanding patients’ have of their condition.
- Continued use and revision of the materials produced by the public health department for use in this study. Further pamphlets should be created to cover topics not currently addressed by the existing pamphlets.

**Dissemination**

A meeting was held on Wednesday 6th April to present the data from the study to medical staff. Members in attendance included

The meeting included presentation of the findings and recommendations of the study. Following the presentation a workshop was conducted to discuss the findings and potential action.

The full report was made available to all members of the medical staff
Bibliography


