Eye disease in the West Bank and Gaza strip

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SUMMARY A random sample of 9548 Palestinian Arabs living in the West Bank and Gaza Strip was identified, and 9054 (95.7%) were examined. Particular attention was directed to reduced visual acuity (VA) and its cause and to trachoma. Low visual acuity was defined as less than 6/18 in both eyes and binocular blindness as a VA less than 3/60 in both eyes. The overall incidence of low VA was 6.8% and of binocular blindness 1.7%. The three principal causes of blindness in order of frequency were cataract, trachoma, and corneal leucoma. These three conditions accounted for 66.7% of binocular blindness. Trachoma was present in 2568 (28.4%) of the 9054 people examined.

The West Bank and Gaza Strip are geographically separate but related areas, both being overwhelmingly (>90%) populated by Palestinian Arabs. Most of the West Bank is upland, rising to 1012 m in the Hebron area, but to the east falls to below sea level (−325 m) in the Jordan Valley. The Gaza Strip is a low lying coastal belt, measuring 40 by 6 km. The population of the West Bank is estimated at 800,000 and that of the Gaza Strip at 440,000.

To our knowledge there has been no previous population-based study of eye disease in the areas described.

Material and methods

The survey was population based on the Israeli census of 1967 (the latest available). Primary sampling units were based on (a) the West Bank Districts (Jordanian Boundaries), (b) the Gaza Strip, and (c) East Jerusalem.

Within these districts sampling subunits were derived from a detailed analysis of the census data, and specific cluster assignments were made with a random sampling technique (Tables 1 and 2).

Within each cluster a group of 15–25 houses were randomly selected and an attempt made to examine every member of each household. With an average family size of eight it was expected that about 150 people would be included in each cluster. Sixty-one clusters were selected (Table 2).

One working day was allowed for each area. Revisits were made as necessary, within that same day, to examine family members missing on the first visit.

For each person a detailed proforma was completed and precoded for subsequent computer analysis.

The visual acuity (VA) was measured at 6 m with 6/18 illiterate E characters. Spectacles were worn if normally used for distance. Those unable to read the characters with either eye were retested at 3 m with a 6/60 illiterate E character (VA 3/60). Most children under the age of 5 and a small number of older children and adults were unable to understand or co-operate in VA testing.

Each person was then examined for trachoma by everting the upper lid and looking at the upper tarsal conjunctiva with a ×4 binocular loupe. External eye disease was noted and recorded. The lens and posterior segment were not examined unless the VA in that eye was less than 6/18. If the VA was reduced, an attempt was made to assign a principal cause of visual loss. Schiötz tonometry was done only on

<table>
<thead>
<tr>
<th>Region</th>
<th>No. of clusters</th>
<th>Urban</th>
<th>Rural</th>
<th>Camp</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jenin</td>
<td>4</td>
<td>1</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Nablus</td>
<td>8</td>
<td>3</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Tulkarm</td>
<td>4</td>
<td>1</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Ramallah</td>
<td>5</td>
<td>2</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Bethlehem</td>
<td>3</td>
<td>11</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Jericho</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Hebron</td>
<td>7</td>
<td>2</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>Jerusalem</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>E. Jerusalem</td>
<td>7</td>
<td>7</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Gaza</td>
<td>20</td>
<td>16</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>61</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 2 Specific clusters

<table>
<thead>
<tr>
<th>Region</th>
<th>Clusters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jenin</td>
<td>Jenin (1), Nazlat Zeid, Beit Oad, Kafr Dan.</td>
</tr>
<tr>
<td>Nablus</td>
<td>Nablus (3), Duma, Beit Iba, Kafr Lakif, Zeita.</td>
</tr>
<tr>
<td>Tulkarm</td>
<td>Tulkarm (1), Nazla Gharbiya, Habla, Nazla Shargiya.</td>
</tr>
<tr>
<td>Ramallah</td>
<td>Ramallah (1), Bira (1), Ras Karkar, Atara, Bir Zeit.</td>
</tr>
<tr>
<td>Bethlehem</td>
<td>Bethlehem (1), Artais, Dahisha Camp.</td>
</tr>
<tr>
<td>Jericho</td>
<td>Jericho (1).</td>
</tr>
<tr>
<td>Hebron</td>
<td>Hebron (2), Qila, Beit Anun, Tarqumiya, Idna, Dhahiriya.</td>
</tr>
<tr>
<td>Jerusalem</td>
<td>Nabi Samuil, Beit Inan.</td>
</tr>
<tr>
<td>E. Jerusalem</td>
<td>E. Jerusalem (7).</td>
</tr>
<tr>
<td>Gaza</td>
<td>Gaza (7), Khan Younis (3), Jahaliya (3), Rafah (3), Abassan, Beit Hanun, Burcig Camp, Beach Camp</td>
</tr>
</tbody>
</table>

people over 40 with visual loss and either no other obvious cause of that visual loss or with disc signs suggestive of glaucoma.

Treatment and/or referral to hospital was offered as appropriate to all those with eye disease. The field work was carried out between November 1982 and April 1983.

Results

There were 61 clusters containing a target population of 9548 persons (average 157 persons per cluster) in the study. Of this target population of 9548 persons 9054 (95.7%) were examined. Of the 9054 persons examined 5012 (55.4%) females and 4042 (44.6%) males. Of the 9054 persons seen, the VA was recorded in 6038 (66.6%).

Table 3 Binocular blindness: same cause in each eye

<table>
<thead>
<tr>
<th>Cause</th>
<th>Number</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cataract</td>
<td>52</td>
<td>31.6</td>
</tr>
<tr>
<td>Trachomatous keratitis</td>
<td>22</td>
<td>13.4</td>
</tr>
<tr>
<td>High myopia</td>
<td>8</td>
<td>4.9</td>
</tr>
<tr>
<td>Cornical leucoma</td>
<td>6</td>
<td>3.6</td>
</tr>
<tr>
<td>Leucoma from trichiasis</td>
<td>4</td>
<td>2.4</td>
</tr>
<tr>
<td>Optic atrophy</td>
<td>4</td>
<td>2.4</td>
</tr>
<tr>
<td>Aphasia</td>
<td>3</td>
<td>1.8</td>
</tr>
<tr>
<td>Phthisis</td>
<td>3</td>
<td>1.8</td>
</tr>
<tr>
<td>Glaucoma</td>
<td>2</td>
<td>1.2</td>
</tr>
<tr>
<td>Retinitis pigmentosa</td>
<td>2</td>
<td>1.2</td>
</tr>
<tr>
<td>Albinism</td>
<td>2</td>
<td>1.2</td>
</tr>
<tr>
<td>Trauma</td>
<td>1</td>
<td>0.6</td>
</tr>
<tr>
<td>Diabetic retinopathy</td>
<td>1</td>
<td>0.6</td>
</tr>
<tr>
<td>Giant drusen</td>
<td>1</td>
<td>0.6</td>
</tr>
<tr>
<td>Chorioretinitis</td>
<td>1</td>
<td>0.6</td>
</tr>
</tbody>
</table>

| Mixed causes (Table 4) | 53 | 32.1 |
| Total                  | 165 | 100.0 |

Table 4 Bilateral blindness with each eye having a different cause

<table>
<thead>
<tr>
<th>Cause</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cataract + aphakia</td>
<td>10</td>
</tr>
<tr>
<td>Cataract + cornical leucoma</td>
<td>7</td>
</tr>
<tr>
<td>Cataract + phthisis</td>
<td>5</td>
</tr>
<tr>
<td>Cataract + trachomatous keratitis</td>
<td>4</td>
</tr>
<tr>
<td>Phthisis + aphakia</td>
<td>4</td>
</tr>
<tr>
<td>Aphakia + cornical leucoma</td>
<td>3</td>
</tr>
<tr>
<td>Cataract + ecnucleation</td>
<td>2</td>
</tr>
<tr>
<td>Phthisis + leucoma from trauma</td>
<td>2</td>
</tr>
<tr>
<td>Phthisis + optic atrophy</td>
<td>2</td>
</tr>
<tr>
<td>Phthisis + cornical leucoma</td>
<td>2</td>
</tr>
<tr>
<td>Leucoma from trichiasis + leucoma from trauma</td>
<td>1</td>
</tr>
<tr>
<td>Trachomatous keratitis + optic atrophy</td>
<td>1</td>
</tr>
<tr>
<td>Optic atrophy + cornical leucoma</td>
<td>1</td>
</tr>
<tr>
<td>SMD + optic atrophy</td>
<td>1</td>
</tr>
<tr>
<td>Optic atrophy + aphakia</td>
<td>1</td>
</tr>
<tr>
<td>Corneal tumour + ecnucleation</td>
<td>1</td>
</tr>
<tr>
<td>Phthisis + trachomatous keratitis</td>
<td>1</td>
</tr>
<tr>
<td>Cataract + leucoma from trichiasis</td>
<td>1</td>
</tr>
<tr>
<td>Cataract + uveitis</td>
<td>1</td>
</tr>
<tr>
<td>Cataract + SMD</td>
<td>1</td>
</tr>
<tr>
<td>Aphakia + leucoma from trauma</td>
<td>1</td>
</tr>
<tr>
<td>Cataract + unknown</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>53</td>
</tr>
</tbody>
</table>

SMD = senile macular degeneration.

Binocular blindness

There were 165 people with a VA less than 3/60 in both eyes, and we have classed this level of VA as binocular blindness, according to currently accepted criteria. Using the above definition of bilateral blindness we could not confirm, by subjective vision testing, cases of binocular blindness among the 2360 persons (mostly small children) who were examined but did not have their VA measured. If we further assume no binocular blindness among the 404 missing from the sample, then the minimal overall prevalence of blindness was 165/9548 (1.7%).

There were 112 (67.9%) of the 165 whose cause of blindness was the same in each eye (Table 3). If we consider the remaining 53 with a different cause of blindness in each eye, we find the combinations listed in Table 4.

If eyes rather than people are considered, then the causes of blindness in the 330 eyes of the binocularly blind are as shown in Table 5.

There were significantly more blind females than males, namely, 108 (65.5%) to 57 (34.5%), giving an overall prevalence of blindness in females of 2.2% compared with 1.4% in males.

As expected, blindness increased with increasing age, with 40% of the over 80s being blind and nearly 50% of the over 90s. The percentage blind in the economically active age group of 20–60 was 1.4%.

There was more blindness in villages than in towns.
Table 5  
Binocular blindness by eye

<table>
<thead>
<tr>
<th>Cause</th>
<th>Number of eyes</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cataract</td>
<td>137</td>
<td>41-5</td>
</tr>
<tr>
<td>Trachomatous keratitis</td>
<td>50</td>
<td>15-2</td>
</tr>
<tr>
<td>Leucoma of other aetiology</td>
<td>25</td>
<td>7-6</td>
</tr>
<tr>
<td>Phthisis</td>
<td>22</td>
<td>6-7</td>
</tr>
<tr>
<td>Aphakia</td>
<td>22</td>
<td>6-7</td>
</tr>
<tr>
<td>Myopia</td>
<td>19</td>
<td>5-8</td>
</tr>
<tr>
<td>Optic atrophy</td>
<td>16</td>
<td>4-8</td>
</tr>
<tr>
<td>Leucoma from trichiasis</td>
<td>8</td>
<td>2-4</td>
</tr>
<tr>
<td>Glaucoma</td>
<td>4</td>
<td>1-2</td>
</tr>
<tr>
<td>Albinism</td>
<td>4</td>
<td>1-2</td>
</tr>
<tr>
<td>Retinitis pigmentosa</td>
<td>4</td>
<td>1-2</td>
</tr>
<tr>
<td>Trauma</td>
<td>1</td>
<td>0-5</td>
</tr>
<tr>
<td>Enucleated</td>
<td>3</td>
<td>0-9</td>
</tr>
<tr>
<td>Diabetic retinopathy</td>
<td>2</td>
<td>0-6</td>
</tr>
<tr>
<td>Senile macular degeneration</td>
<td>2</td>
<td>0-6</td>
</tr>
<tr>
<td>Giant drusen</td>
<td>2</td>
<td>0-6</td>
</tr>
<tr>
<td>Uveitis</td>
<td>1</td>
<td>0-3</td>
</tr>
<tr>
<td>Corneal tumour</td>
<td>1</td>
<td>0-3</td>
</tr>
<tr>
<td>Unknown</td>
<td>1</td>
<td>0-3</td>
</tr>
<tr>
<td>Total</td>
<td>330</td>
<td>100-0</td>
</tr>
</tbody>
</table>

(2-4% to 1-3%). the numbers in refugee camps was between the two extremes at 1-8%.

As regards the prevalence of blindness in each geographical location, the highest prevalence in the Hebron district with 2-9%. Bethlehem had the lowest prevalence with 0-9%. The prevalence of binocular blindness for the West Bank as a whole was 2%, while the figure for the Gaza Strip was 1-4%.

Considering the percentages of those blind from bilateral cataracts (Table 6) we again found the highest prevalence in Hebron and the lowest in Bethlehem. For the West Bank the percentage of those blind from bilateral cataracts was 0-6%, while the figure for the Gaza Strip was 0-5%.

Further analysis of the 165 blind suggests that treatment could be effective in improving vision in one or both eyes in 116 people (70-3%). A further 31 (18-8%) had binding disease in one or both eyes where the possibility for prevention had existed. Only 18 (10-9%) were blind with conditions for which no existing treatment or prophylaxis is effective.

**Binocular low vision**

We defined low vision as a VA of less than 6/18 in both eyes.2 There were 651 (6-8%) of the sample in this category. Over 70% of those could be accounted for by five bilateral conditions (Table 7). The 183 'others' had either less common bilateral disease or different causes in each eye.

**TRACHOMA**

In our study we found trachoma to be present in 28-4% of the sample (2567 of 9054 examined). We classified the disease into stages.3 Active trachoma (stages 1–3) was present in 20% (1812 of 9054).

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**Table 6  Percentage blind from bilateral cataract for each geographical location**

<table>
<thead>
<tr>
<th>Location</th>
<th>% blind</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hebron</td>
<td>1-0</td>
</tr>
<tr>
<td>Tulkarm</td>
<td>0-7</td>
</tr>
<tr>
<td>Ramallah</td>
<td>0-7</td>
</tr>
<tr>
<td>Jerusalem</td>
<td>0-6</td>
</tr>
<tr>
<td>Jericho</td>
<td>0-6</td>
</tr>
<tr>
<td>Nablus</td>
<td>0-5</td>
</tr>
<tr>
<td>Gaza</td>
<td>0-5</td>
</tr>
<tr>
<td>Jenin</td>
<td>0-3</td>
</tr>
<tr>
<td>Bethlehem</td>
<td>0-2</td>
</tr>
</tbody>
</table>

We looked at the prevalence of binocular blindness from trachoma in each geographical location. The highest prevalence was found in the Tulkarm and Hebron Districts (0-8% and 0-6% respectively). We found no cases of binocular blindness due to trachoma in Bethlehem District.

There was more binocular blindness from trachoma in villages (0-7%) than in towns (0-1%) and refugee camps (0-2%). For the West Bank as a whole the prevalence of binocular blindness from trachoma was 0-4%, while the figure for the Gaza Strip was 0-2%. The prevalence, distribution, and severity of trachoma in the West Bank and Gaza Strip will be the subject of further reports.

**Other eye disorders**

*Strabismus* of any sort was present in 2-2% of the population (202 of 9054). It is generally accepted that treatment to restore binocular vision is most effective in the younger age groups. In the under 7s, among whom better than a cosmetic result could be hoped for from therapy, we found a prevalence of 1-3% (35 out of 2728 children).

*Nystagmus* was found in 13 people (0-1%).

*Lacrimal system*. Epiphora due to obstruction was present in 25 people (0-27%), affecting the right eye in 10 instances and the left eye in 15. *Ptosis* was found in only two children. *Purulent conjunctivitis* was noted in 64 people. It

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**Table 7  Causes of bilateral low vision**

<table>
<thead>
<tr>
<th>Cause</th>
<th>Number</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cataract</td>
<td>248</td>
<td>38-1</td>
</tr>
<tr>
<td>Refractive error</td>
<td>160</td>
<td>24-6</td>
</tr>
<tr>
<td>Trachomatous keratitis</td>
<td>33</td>
<td>5-0</td>
</tr>
<tr>
<td>Congenital abnormality</td>
<td>14</td>
<td>2-2</td>
</tr>
<tr>
<td>Corneal leucoma of unknown aetiology</td>
<td>13</td>
<td>2-0</td>
</tr>
<tr>
<td>Others</td>
<td>468</td>
<td>71-9</td>
</tr>
<tr>
<td></td>
<td>183</td>
<td>28-1</td>
</tr>
<tr>
<td>Total</td>
<td>651</td>
<td>100-0</td>
</tr>
</tbody>
</table>

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was bilateral in each case, giving an overall prevalence of 0-7%.

Vernal catarrh was present in 40 children (0.5%). Pterygium was common and present in 188 (2.1%) of right eyes and 171 (1.9%) of left eyes.

Discussion

This study is based on a random sample of the population and includes almost 1% of the total population. We were able to examine more than 95% of the target population, and we believe that this represents a true cross-section of the total population and of the prevalence of eye disease.

There were somewhat more women than men in the sample—55.4% to 44.6%. We think this can be accounted for by two factors. First, the majority of the missing 404 people were men working far from home and returning either late at night or returning home only at the weekend. Secondly, migratory labour is common, and large numbers of men travel to neighbouring countries to seek work, leaving their families at home.

We found a high prevalence of binocular blindness of 1.7%. This is more than eight times the prevalence for England and Wales, where the figure is 0.2%.4

The World Health Organisation has distinguished three main groups of blindness prevalences.5 The first comprises countries or areas with advanced medical services where blinding infections are controlled and where curable blindness is treated, the blindness prevalence rates being likely to range around 0-15-0-25%. The second group comprises countries or areas at an interim stage of development where the blindness rate is not massively augmented by curable or preventable blindness disorders, but blinding infections are only partially controlled and people can remain blind from curable conditions because surgical treatment is not readily available. In such countries the blindness rate is likely to range around 0-40-0-65%. The third category comprises countries or areas where, at least among the rural majority, eye care has not yet reached the interim stage of development of the previous group, and blindness rates reach the proportion of ‘overburden’ because of the massive prevalence of one or more of the following conditions: trachoma, onchocerciasis, xerophthalmia, cataract, and accidents.6 The West Bank and Gaza Strip belong to this third category, with an overburden resulting chiefly from cataract and trachoma.

For comparison, the top five causes of blindness in England and Wales and in the West of Scotland are shown (Table 8).4†.

Direct comparison is often misleading. For example, glaucoma as a cause of bilateral blindness was found in only 1-2% of our cases of binocular blindness compared with an incidence of 12% in England and Wales. However, it is estimated7 that the number blind from glaucoma in the UK is 25/100 000.

Since we found 29548, the comparable figure for the West Bank and Gaza Strip is 21/100 000 which correlates well with the UK figures.

Cultural differences also play a major role. It is socially unacceptable to wear spectacles, particularly in rural areas. Thus, we found 20 people whose major cause of blindness was aphakia and who would not wear aphakic spectacles. They seemed content with navigational vision and would not themselves consider that they were blind. At a less extreme level there were 160 people (24.6% of those with VA less than 6/18 in both eyes) whose loss of vision was due to uncorrected refractive error.

Our study suggests that there may be 20000 binocularly blind in the West Bank and Gaza, of whom 70% could be treated surgically with some prospect of visual improvement. Over 3000 people are blind as a direct result of trachoma. At present we are conducting a trial of various therapeutic regimens to find out the most efficient and effective means of preventing the progress of blinding trachoma. So far as low vision is concerned, our figures suggest that 20000 people would benefit from wearing spectacles. We suggest that some type of education programme to remove the stigma of wearing spectacles could be tried. There are some 5000 children under the age of 7 with strabismus who could benefit from treatment.

Table 8 Causes of blindness in the binocularly blind by eye

<table>
<thead>
<tr>
<th>England and Wales</th>
<th>W. Bank and Gaza</th>
<th>West of Scotland</th>
</tr>
</thead>
<tbody>
<tr>
<td>SMD</td>
<td>Cataract</td>
<td>SMD</td>
</tr>
<tr>
<td>27.0</td>
<td>41.5</td>
<td>29.8</td>
</tr>
<tr>
<td>Cataract</td>
<td>Trachoma</td>
<td>Glaucoma</td>
</tr>
<tr>
<td>22.6</td>
<td>17.6</td>
<td>14.6</td>
</tr>
<tr>
<td>Glaucoma</td>
<td>Corneal leucoma</td>
<td>Cataract</td>
</tr>
<tr>
<td>12.0</td>
<td>7.6</td>
<td>10.4</td>
</tr>
<tr>
<td>Myopia</td>
<td>Aphakia</td>
<td>Diabetic retinopathy</td>
</tr>
<tr>
<td>8.2</td>
<td>6.7</td>
<td>8.5</td>
</tr>
<tr>
<td>Diabetic retinopathy</td>
<td>Myopia</td>
<td>Myopia</td>
</tr>
<tr>
<td>7.1</td>
<td>5.8</td>
<td>6.0</td>
</tr>
<tr>
<td>Others</td>
<td>Others</td>
<td>Others</td>
</tr>
<tr>
<td>23.1</td>
<td>20.8</td>
<td>30.7</td>
</tr>
<tr>
<td>Total</td>
<td>100.0</td>
<td>100.0</td>
</tr>
</tbody>
</table>

SMD = senile macular degeneration.
Epiphora due to lacrimal obstruction was found in 0.27% of the sample, indicating that there may be up to 3000 people who might benefit from lacrimal surgery.

The present report indicates that the West Bank and Gaza Strip can be considered as areas of ophthalmic need. This survey points to ways that further preventive and curative ophthalmic efforts might be applied. The recently inaugurated 'outreach' programme of St John Ophthalmic Hospital, Jerusalem, emphasising peripheral primary and secondary eye care via mobile eye units, could give an additional ophthalmic input into the existing health structure to assist in addressing these problems. It is hoped that this type of programme could have a positive impact on eye health in the West Bank and Gaza Strip in the future by helping to reduce and, if possible, eliminate the overburden of preventable and curable types of blindness there.

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References
Eye disease in the West Bank and Gaza strip.

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