Objective: To measure limitations in the daily activities of village life associated with having trichiasis for individuals with and without visual acuity loss.

Methods: Men and women 40 years and older in 6 randomly chosen rural villages in the Kongwa district of Tanzania had visual acuity measured and were examined by an ophthalmologist. Subjects indicated the degree of difficulty with daily activities of village life and whether the difficulty was related, in any way, to vision. Limitations were scored using an indicator of “any difficulty” and using a 4-point scale ranging from “no difficulty” to “unable to do.” Scores of individuals with and without trichiasis were compared separately for men and women.

Results: Among men, trichiasis was associated with excess functional limitation only for those with visual acuity loss (adjusted difference in proportion of tasks [AD] compared with men with neither trichiasis nor visual impairment, 0.35; 95% confidence interval [CI], 0.23-0.47). For women, trichiasis alone was limiting (AD, 0.15; 95% CI, 0.08-0.22) similarly to visual acuity loss alone (AD, 0.09; 95% CI 0.06-0.13), and the combination led to greater limitations (AD, 0.32; 95% CI, 0.26-0.39).

Conclusion: The burden of trichiasis is likely greater than previously estimated, especially in women for whom trichiasis alone was disabling.


Trachoma generally and trichiasis specifically represent a significant ophthalmologic public health problem in some countries in Asia and Africa but, until recently, few programs have focused on trachoma itself. The burden of disease associated with trachoma has been characterized by the number of cases of low vision and blindness caused by trachoma and the associated numbers of disability-adjusted and handicap-adjusted life years. The studies estimating disability-adjusted and handicap-adjusted life years associated with trachoma equated disability and handicap with low vision and blindness. None of these studies gave weight to the possibility of functional limitations among persons with trichiasis without visual acuity loss because of photophobia and eye pain that are commonly associated with trichiasis. As a result, while the prevalence of trichiasis has been described in several studies, the total burden associated with trichiasis, particularly in persons without visual acuity loss, has not been described well. Some prevalence studies suggest that the number of cases of trichiasis without visual acuity loss is greater than the number of cases of trichiasis with corneal opacity and visual acuity loss. Documenting a significant burden associated with trichiasis regardless of visual acuity loss would help capture the full effect of the condition.

Few data from earlier studies indicate whether cases of trichiasis before the onset of visual acuity loss are associated with activity limitations. In addition, a comparison of the limitations experienced by individuals with low vision with and without trichiasis has never been conducted. Given the pain and photophobia associated with trichiasis and anecdotal reports of functional limitations, trichiasis may lead to measurable limitations prior to visual acuity loss and, in combination with visual acuity loss, be associated with greater limitations than low vision associated with other etiologies. Thus, the burden associated with trachoma and trichiasis may be much larger than previously estimated.

This study used data from the Kongwa region of Tanzania, an area with hyperendemic trachoma, to examine the relationship between trichiasis and functional status among individuals with and without binocular visual acuity loss. Among those without visual acuity loss, individuals with and without trichiasis were com-
METHODS

DATA

The population for this study consisted of all residents 40 years and older of 6 rural villages of the Kongwa district of central Tanzania, East Africa. The population of the district was estimated to be 30,000, most of whom were Wagojo.

The 6 villages were randomly selected from the 33 eligible villages in the district that were within 1 hour of the town of Kongwa by road. A house-to-house census was conducted in each village 1 to 3 months before the beginning of examinations. A total of 3641 individuals were identified as eligible. The total number who completed an examination was 3268 (for a response rate of 89.8%). The total number of individuals who completed the trachoma grading and responded to the questionnaire was 3064 (94.4%) of those examined.

Details of the ocular examination of this study are described elsewhere. Trachoma was assessed in each person by examination of the upper eyelid using a 2.5 loupe and graded using the World Health Organization simplified grading scheme. Trichiasis was defined as 1 or more lashes touching the globe or evidence of epilation. The examination included obtaining measurements of visual acuity, refraction, and best-corrected visual acuity (if visual acuity was <20/60). Visual acuity was assessed monocularly by study technicians under ambient light conditions using a front-lighted tumbling E version of the modified Early Treatment for Diabetic Retinopathy Study chart calibrated for use at 4 meters. Age was based on self-report with the aid of a calendar of important events.

A trained interviewer interviewed study subjects in the local language. The questions included a series of inquiries on the degree of difficulty in performing activities of village living. The items were drawn from a quality of life instrument developed for the assessment of blindness prevention interventions in India. Additional items were generated from interviews with Tanzanian key informants. The tasks were then identified as important for function and sensitive to vision through focus group discussions with persons with visual impairment at the Mvumi Eye Health Department, which serves villages in another district that has demographic characteristics, socioeconomic status, and causes of vision loss similar to the villages of Kongwa. The items included visiting with neighbors, walking outside the village, attending parties, going to the market, recognizing faces, helping with the farm, weeding, housework, gathering wood for charcoal, gathering firewood, cooking, and caring for children. Four basic activities of daily living (ADL) were included: transferring, bathing, dressing, and eating. Some of the tasks were specific for women, such as child care activities, and some were specific for men, such as making charcoal. The possible answers ranged along a 4-point scale from no difficulty to no longer able to perform the activity. If the participant indicated having any level of difficulty, the interviewer queried the degree to which the difficulty was due to any problems with vision (including but not limited to visual acuity loss). The survey was translated and back-translated by a different translator to ensure its accuracy.

Individual verbal consent for examination was obtained from each participant. The project followed the tenets of the Declaration of Helsinki and was approved by the Johns Hopkins University Joint Committee for Clinical Investigation (Baltimore, Md) and the National Blindness Prevention Committee of Tanzania (Dar es Salaam).

ANALYTIC METHODS

Since some of the questions were sex-specific, data for men and women were analyzed separately. Prior to analysis, any item for which difficulty was indicated in any degree (a little, a lot, or unable to do) was recoded to none, if none of the

pared to ascertain whether trichiasis alone had an effect on functional status. Among those with visual acuity loss, individuals with and without trichiasis were compared to ascertain whether the functional loss was similar regardless of cause. This combination of analyses provides information useful to program planners who need more precise data on limitations associated with trachoma to secure resources for trichiasis prevention and trichiasis surgery.

RESULTS

The groups defined by a combination of visual acuity loss and trichiasis status are presented in Table 1. For both men and women, those with trichiasis were older than their counterparts with a similar visual acuity loss status, although the difference was smaller for women (5-year difference for men with no visual acuity loss; 6-year difference for men with visual acuity loss; 1-year difference for women with no visual acuity loss; and 5-year difference for women with visual acuity loss). Both men and women with trichiasis had a lower body mass index than their counterparts without trichiasis and with the same visual acuity status (differences range from 0.1 for men with visual acuity loss to 1.1 for men without visual acuity loss). The women were younger on average than the men, although this was only a small difference in the group with neither trichiasis nor visual acuity loss. The average visual acuity in the better eye (calculated using a logMAR scale and reconverted to a decimal) was slightly worse for the group with trichiasis compared with the group with no trichiasis.

The population responses to the items on the questionnaire are presented by sex in Table 2. The item for which the highest percentage of both men and women had difficulty related to vision was walking outside the village since more than one third indicated a problem with this task (39.1% for men; 38.4% for women). Individuals did not often indicate vision-related difficulties with the basic ADL in the table (2.3% overall for bathing; 1.9% overall for dressing; 1.1% overall for eating). Aside from bathing, dressing, and eating, the tasks with the least commonly mentioned difficulty for men were visiting with neighbors and recognizing faces (15% overall for each). For women, difficulty caring for children was the least frequently mentioned (5.9%).
There are differences in the overall average percentage of difficulty according to the presence or absence of trichiasis and visual acuity loss (Table 3). Regardless of visual acuity status, the average proportion of tasks with which women had difficulty was greater for those with trichiasis than for those without trichiasis. Of note, those with trichiasis and no visual acuity loss had difficulty with a similar proportion of tasks than those with no trichiasis and visual acuity loss (0.34 vs 0.31). Those with both conditions had difficulty with more than half of the tasks on the list (0.57). Among men, those with both conditions had difficulty with almost two thirds of the tasks on the list (0.64). In contrast to the finding among women, in men, trichiasis without visual acuity loss was not associated with more difficulty compared with having neither trichiasis nor visual acuity loss (0.25 vs 0.20).

Table 4 presents excess loss associated with trichiasis and/or visual acuity loss for men, calculated in 2 ways. The results of the unadjusted analysis for the “any difficulty” scoring method reflect the results in Table 3. Men experienced difficulty with 20% of the tasks on average because of vision; the similarity of the average score using the 4-point difficulty scale suggests that most were scored as “a little difficulty.” In all cases, adjusting for age and body mass index revealed that differences were attenuated but maintained their significance levels.

Men with only trichiasis did not experience excess difficulties compared with men with neither trichiasis nor visual acuity loss (adjusted difference in proportion of tasks, 0.01; 95% CI, −0.13 to −0.16). Men with trichiasis and visual acuity loss experienced difficulty with a greater proportion of tasks (adjusted difference, 0.35; 95% CI, 0.23−0.47) than both the men with neither condition and the men with only visual acuity loss (whose adjusted difference relative to the men with neither condition was 0.17; 95% CI, 0.13−0.21). Using the 4-point difficulty scale, the men with both conditions had an adjusted difference of 0.60 (95% CI, 0.43−0.78), suggesting that many responses were coded as “a lot of difficulty” or “unable to do.”

Table 5 presents results for women. Women with trichiasis and no visual acuity loss had difficulty with a similar number of tasks to those women with visual acuity loss from causes other than trichiasis. The adjusted difference in the proportion of tasks for women with trichiasis alone was 0.15 (95% CI, 0.08-0.22) compared with...
an adjusted difference of 0.09 (95% CI, 0.06-0.13) for women with visual acuity loss alone. Women with trichiasis and visual acuity loss had difficulty with significantly more tasks than those with visual acuity loss but no trichiasis (adjusted difference in proportion of tasks in comparison with women with neither condition, 0.32; 95% CI, 0.26-0.39). The differences in scores using the 4-point scale suggest that those with visual acuity loss, regardless of trichiasis status, indicated more than “a little” difficulty. The adjusted difference using the 4-point scale was 0.17 (95% CI, 0.12-0.22) for women with visual acuity loss only and 0.38 (95% CI, 0.47-0.69) for women with visual acuity loss and trichiasis.

**COMMENT**

Individuals need to perform tasks to maintain themselves and to be socially and economically productive members of society. Our data suggest that older men and women in the Kongwa district of Tanzania are able to bathe, dress, and eat regardless of their visual acuity loss or trichiasis status. However, the ability to perform other ADL tasks is limited by visual acuity and other visual symptoms associated with trichiasis. The analyses in this article have demonstrated that having trichiasis even without visual acuity loss limits the functional status of women and that those with visual acuity loss and trichiasis had greater functional limitation than those with visual acuity loss from other causes. Since women have almost 4 times the risk of trichiasis than men, these findings reflect a considerable excess of trichiasis-related functional loss for women.

The difference between the effect of trichiasis on men and women without visual impairment is intriguing. Data were not collected to measure the number or location of inturned lashes. There was no evidence that women with trichiasis but no visual acuity loss had more scarring or more corneal opacity than a similar group of men (data not shown). A reasonable conclusion would be that women had more severe cases of trichiasis, although the importance of the severity of trichiasis seems to diminish in individuals with visual acuity loss. However, a higher fraction of men had visual acuity loss associated with their trichiasis compared with women. It may also be that the sex-specific tasks for women are more affected by trichiasis than the sex-specific tasks for men. At present, the sex difference cannot be explained.

The results also shed some light on whether trichiasis and visual acuity loss simply affect the proportion of tasks with which an individual has difficulty or also affect the degree of difficulty with each task. For example, the results based on the indicator of any difficulty suggest that women with trichiasis alone have difficulty with a significantly larger proportion of tasks than women with neither trichiasis nor visual acuity loss. Adding visual acuity loss leads to difficulty with an even greater proportion of tasks. For women with trichiasis alone, the adjusted difference, in comparison with women with neither trichiasis nor visual acuity loss, is only slightly greater
when using the 4-point degree of difficulty scale than when using the simple indicator of any difficulty. In contrast, the adjusted difference for women with both trichiasis and visual acuity loss nearly doubles. This suggests that not only were women in this category having difficulty with more tasks, but that the degree of difficulty was higher. Thus, trichiasis seems to lead to difficulty with an increased number of tasks without leading to a higher degree of difficulty until it is accompanied by visual acuity loss. This reemphasizes the importance of early trichiasis surgery or trichiasis prevention; trichiasis cases without visual acuity loss should be able to return to or maintain full functioning without excess difficulty either in terms of the number of tasks or the degree of difficulty.

This study has some limitations. First, in the linear regression analyses of functional status differences among the groups defined by trichiasis and visual acuity loss status, there is a floor effect because many of the study subjects had no difficulty and the distribution of the dependent variable is not normal. Regression techniques, (ie, a 2-part model16) that account for the floor effect could further accentuate the differences between groups. Second, the 4-point difficulty scale treated the difference between each level of difficulty as constant. A supplemental analysis (data not shown) used weights for the 2 intermediate levels of difficulty obtained from a focus group exercise with 5 women from 1 village. The participants in the focus group were asked to score the 2 intermediate levels of difficulty on a 0 to 100 scale. The results of using these scores were similar to the results using the 0 to 3 scale. Additional research to more firmly establish the perceived distances between the levels of difficulty would strengthen the validity of the scale. Third, some of the groups were rather small, particularly men with trichiasis. Finally, while it was

<table>
<thead>
<tr>
<th>Visual Acuity Loss and Trichiasis</th>
<th>Men</th>
<th>Women</th>
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</thead>
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<tr>
<td></td>
<td>n</td>
<td>Proportion</td>
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<tr>
<td>Neither</td>
<td>938</td>
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</tr>
<tr>
<td>Trichiasis only</td>
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<tr>
<td>Visual acuity loss only</td>
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<td>0.42</td>
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<tr>
<td>Trichiasis and visual acuity</td>
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<td>0.64</td>
</tr>
</tbody>
</table>

*Average proportion of items with any difficulty.

| Table 4. Estimated Differences in Overall Score and 95% Confidence Intervals for Men, by Group and Scoring Method

<table>
<thead>
<tr>
<th>No Visual Acuity Loss</th>
<th>Visual Acuity Loss</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Trichiasis (Mean)</td>
<td>Trichiasis</td>
</tr>
<tr>
<td>Overall proportion of tasks with difficulty related to vision</td>
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</tr>
<tr>
<td>Unadjusted</td>
<td>Reference (0.20)</td>
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<tr>
<td>Adjusted*</td>
<td>Reference (0.01)</td>
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<td>Difficulty levels (0-3)†</td>
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<tr>
<td>Unadjusted</td>
<td>Reference (0.22)</td>
</tr>
<tr>
<td>Adjusted*</td>
<td>Reference (−0.02)</td>
</tr>
</tbody>
</table>

*Adjusted for age and body mass index.
†0 indicates no difficulty; 1, a little difficulty; 2, a lot of difficulty; and 3, unable to do.

| Table 5. Estimated Differences in Overall Score and 95% Confidence Intervals for Women, by Group and Scoring Method

<table>
<thead>
<tr>
<th>No Visual Acuity Loss</th>
<th>Visual Acuity Loss</th>
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</thead>
<tbody>
<tr>
<td>No Trichiasis (Mean)</td>
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<tr>
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<tr>
<td>Unadjusted</td>
<td>Reference (0.17)</td>
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<td>Adjusted*</td>
<td>Reference (0.15)</td>
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<td>Difficulty levels (0-3)†</td>
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</tr>
<tr>
<td>Adjusted*</td>
<td>Reference (0.20)</td>
</tr>
</tbody>
</table>

*Adjusted for age and body mass index.
†0 indicates no difficulty; 1, a little difficulty; 2, a lot of difficulty; and 3, unable to do.
not possible to identify the reason that individuals with no visual acuity loss indicated that their functional problems were related to vision, similar results have been found with the National Eye Institute Visual Function Questionnaire,\textsuperscript{17} and visual measures other than acuity have been found to predict task difficulty in the Activities of Daily Vision Scale.\textsuperscript{18}

This study suggests a larger burden of trichiasis in the population than is accounted for by simply measuring and assigning weights to visual acuity loss, at least in women. This reinforces the importance of trichiasis as an ophthalmic public health problem. A complete assessment of the burden associated with trachoma and the cost-effectiveness of trichiasis prevention would assign a limitation weight to trichiasis without visual acuity loss (at least for women) and should assign a higher limitation weight for low vision with trichiasis than for low vision from other causes. Without these adjustments, the cost-effectiveness of trichiasis prevention will be underrated.

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