Table 3. Main Causes of Blindness, Low Vision, and Monocular Visual Impairment by Age Group

Cause	Age Group (Years)	Vision Status			Total, *n* (%)
		Blindness, *n* (%)	Low Vision, *n* (%)	Monocular Visual Impairment, *n* (%)	
Cataract	5–29	2 (22.2)	4 (13.3)	4 (9.8)	10 (12.5)
	30–49	9 (29.0)	15 (27.8)	9 (21.4)	33 (26.0)
	50+	31 (50.0)	37 (34.6)	11 (42.3)	79 (40.5)
	Overall	42 (41.2)	56 (29.3)	24 (22.0)	122 (30.3)
Trachomatous corneal opacity	5–29	2 (22.2)	18 (60.0)	14 (34.1)	34 (42.5)
	30–49	11 (35.5)	33 (61.1)	22 (52.4)	66 (52.0)
	50+	23 (37.1)	60 (56.1)	5 (19.2)	88 (45.1)
	Overall	36 (35.3)	111 (58.1)	41 (37.6)	188 (46.8)
Nontrachomatous corneal opacity[a]	5–29	1 (11.1)	3 (10.0)	2 (4.9)	6 (7.5)
	30–49	11 (35.5)	3 (5.6)	4 (9.5)	18 (14.2)
	50+	7 (11.3)	7 (6.5)	3 (11.5)	17 (8.7)
	Overall	19 (18.6)	13 (6.8)	9 (8.3)	41 (10.2)
Other[b]	5–29	4 (44.4)	5 (16.7)	21 (51.2)	30 (37.5)
	30–49	0	3 (5.6)	7 (16.7)	10 (7.9)
	50+	1 (1.6)	3 (2.8)	7 (26.9)	11 (5.6)
	Overall	5 (4.9)	11 (5.8)	35 (32.1)	51 (12.7)

[a]Ocular trauma, xerophthalmia, measles, corneal infections, and phthisis.
[b]Refractive errors, glaucoma, and diseases of posterior segment.
doi:10.1371/journal.pmed.0030477.t003

more likely to direct the survey teams to households where they knew there were persons with visual impairment. A response rate of 84.6% was achieved, which was considered adequate to meet the study objectives. It was not possible to go back to the villages on a different day to follow up absentees in participating households and households in which all members were not present on the day of the survey. Therefore, not including absentees in the sample may have resulted in selection bias since absenteeism was possibly associated with normal vision or less-severe visual impairment. Attempts were not made to assess visual impairment in absentees: reports by households' members on vision status of those absent were considered unreliable and were likely to be biased. It is possible that the high prevalence of blindness observed in Mankien could have been an overestimation resulting from selection bias due to use of the random walk method, exclusion of absentees, and exclusion of households in which nobody was found for enumeration. Sensitivity analysis adjusting prevalence estimates by including absent persons in the denominator on the assumption that they did not have visual impairment showed an upper bound for the degree of overestimation of 15%.

Assessment of vision status and causes of vision loss were based on basic examination of the eye because it was not possible to conduct refraction and detailed eye examination, due to logistical constraints. It was also not logistically possible for the ophthalmic nurse to re-examine VA and causes of visual impairment in all participants with visual impairment; therefore a reliability study was conducted prior to the survey. Six out of eight examiners were integrated eye care workers (IECW) who had good interobserver reliability compared to our standard, and there was no evidence of systematic examiner bias. We have reported vision status based on presenting VA and not best-corrected VA, which is consistent with a recent WHO recommendation of measuring presenting VA in blindness surveys [1]. Defining vision status based on presenting VA is not a potential source of bias because our results include vision-disabling refractive errors. In most blindness surveys of sub-Saharan Africa, natural refractive error has not been shown to be a considerable cause of blindness; nevertheless it is a major cause of low vision [18]. Our data on causes of vision loss do not allow for detailed differential diagnosis in persons with visual impairment. Therefore the causes of visual impairment may be biased towards the most preventable causes due to the study design. Nonetheless, these data underscore the severity of visual impairment and highlight the main causes of avoidable blindness in this population, thus allowing for planning of interventions within the VISION 2020 objectives.

The WHO considers blindness to be a public health problem when the prevalence of blindness in the general population exceeds 1.0% [7,8]. The prevalence of blindness revealed in Mankien payam greatly exceeds this WHO parameter, and is consistent with that reported in studies conducted in rural settings of northern Sudan: Al-Ginena province (3.2%) and River Nile State (2.74%) [19]. A study conducted in East and West Equatoria provinces of southern Sudan in 1983 reported a blindness prevalence of 6.4%; however, the sampling frame for this study was not well defined and the definition of blindness—VA less than 6/60 in the better eye—was not consistent with the WHO definition of blindness: VA less than 3/60 in the better eye [9]. Blindness prevalence in Mankien also exceeds that reported in other settings in sub-Saharan Africa: the Gambia (0.7%) [20], Nigeria (0.3%–0.9%) [21,22], Malawi (1.3%) [23], Tanzania (1.3%) [24], Kenya (0.7%) [25], and Ethiopia (0.9%–1.9%) [26–28]. Cataract was considered the commonest cause of blindness in Mankien (41.2%). This is consistent with findings from other countries in Africa where cataract has been found to be the leading cause of blindness: Kenya (38%) [25], Nigeria (48%) [22], Malawi (40%) [23], and the Gambia (45%) [20]. However, trachoma was almost as common a cause of blindness as cataract (35.3%) and was the leading cause of all forms of visual impairment (46.8%). The proportion of