

Impact of urban agriculture on malaria prevalence in young children in two cities of Ghana

Klinkenberg, E^{1,2}, McCall, P. J.², Wilson, M.D.³, Akoto, A.⁴ and Donnelly, M.J.²

¹International Water Management Institute, Ghana; ²Liverpool School of Tropical Medicine, UK;
³Noguchi Memorial Institute for Medical Research, Ghana; ⁴School of Medical Science, University of
Science and Technology, Ghana

In Africa, malaria is usually considered a rural disease, as the *Anopheles* vectors prefer pools with relatively clean water, a habitat type that is uncommon in densely populated city environments. With increasing population growth driving more people into the city - in West Africa today more people live in cities than in rural areas - urban agriculture is being promoted as a means to increase food security for the growing urban population. But by creating favourable breeding sites for malaria vectors, there is concern that urban agriculture might result in an increased human health risk. Based on a pilot study by IWMI and collaborators indicating differences in entomological parameters between areas with and without urban agriculture (Afrane et al., in prep.) we have initiated a project in two cities in Ghana West Africa, to establish whether or not practicing of urban agriculture will result in increased malaria transmission. We report here on preliminary analyses of the epidemiological and sociological baseline study.

Prevalence of malaria parasitaemia and anaemia was assessed in children under five years old, in areas close to and distant from urban agriculture sites. Preliminary analysis showed that in 14.7 % and 6.5% of children had malaria parasitaemia in Accra and Kumasi respectively. In both cities, significantly more children in communities around cultivated sites than children in communities without irrigated urban agriculture were parasitaemic (16.7% vs. 12.7%; $p < 0.05$; 8.4% vs. 4.9%, $p < 0.01$ for Accra and Kumasi respectively). To investigate the effect of distance from cultivated sites on malaria prevalence, a spatial analysis using buffer analysis was carried out to compare households located closer to cultivated sites with those further away. Households living within 500 m of cultivated sites had a significantly greater proportion of parasitaemic children than those outside (RR 1.28; $p < 0.05$). Analyses are continuing to investigate whether these differences are the result of urban agriculture or other factors. It is hoped that the significance of urban agriculture in urban malaria in Africa can be elucidated and if necessary, a suitable control strategy devised, taking into account the different interest of the different stakeholders, i.e. farmers, urban communities, health and agriculture authorities.

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Eveline Klinkenberg, Martin Donnelly, Philip McCall, Michael D. Wilson and Alex Osei Akoto



Contact address: Eveline Klinkenberg
IWMI, P.M.B CT 112, Accra, Ghana
email: e.klinkenberg@cgiar.org

Background

- Rapid increase in city populations (by the year 2020: 2 out of 3 West Africans will live in urban areas¹)
- Urban agriculture (UA) promoted to feed growing population, improve nutrition and alleviate poverty²
- Malaria considered a rural disease and low in urban areas
- UA could create breeding sites for malaria vectors
- Pilot study in city of Kumasi, Ghana confirmed Anopheles breeding in UA sites and higher Anopheles densities in communities living near UA sites³



QUESTION:
Does irrigated urban agriculture allow Anopheles mosquitoes to encroach into the city and increase the malaria risk for communities living near those sites?

If yes, this may:

- Lead to municipalities withdrawing support for UA
 - Hamper the promotion of clean water for irrigation. Leading to the continued use of waste water/ sewage with its associated health risks
- Therefore there is a need to establish risks and, if necessary, to develop risk reduction measures.

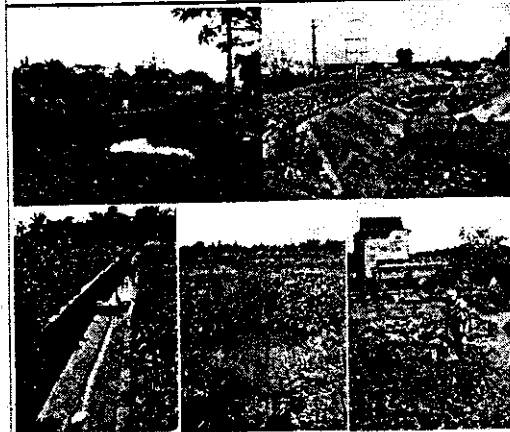


Figure 1. Urban agriculture in Accra

Material & Methods

- Two cities, Accra & Kumasi, Ghana
- Epidemiological & sociological baseline survey
- 5 communities around UA areas, 5 communities without UA
- Children 6 months to 5 years
- Bloodfilm and hemoglobin level
- Household questionnaire on socio-economical characteristics, use of preventive measures and knowledge of malaria
- Use of Worldbank asset factors score for economic status⁴
- Geo-coordinates of each household for spatial analysis



Study sites Accra & Kumasi

- Irrigated vegetable production sites scattered throughout both cities.
- extent of vegetable farming is estimated to be 300 ha in Accra and 120 ha in Kumasi.
- For the city of Kumasi it is estimated that 90% of the vegetables consumed in the city are produced in the city⁵

Figure 2. Blood film sampling in Accra, Ghana



Results (preliminary)

- No apparent differences in the socio economic status of urban communities around urban agricultural sites (UA) and urban communities without urban agriculture (U)
- For Accra, the asset score calculations placed all communities in the same wealth quartile for Ghana and average household size was 4.9 members in both areas.
- In Accra, 14.7% of the children had malaria parasitaemia while only 6.5% had parasitaemia in Kumasi (Table 1)
- Age profiles and mean Hb levels were similar in Accra and Kumasi (Table 1)
- In both cities, significantly more children in communities with UA were found positive than children living in communities without UA (Accra: Chi-square 5.889, p<0.05; Kumasi: Chi-square 6.993, p<0.01).

Table 1 Malaria data characteristics for the two cities

| | ACCRA | | | | |
|--------|------------|------------|--------------------------|-------------------------|----------------------------|
| | # children | # positive | % positive ¹⁾ | Hb ²⁾ (g/dl) | Age ²⁾ (months) |
| Com U | 877 | 111 | 12.7 | 10.7 (1.5) | 34 (18) |
| Com UA | 915 | 153 | 16.7 | 11.0 (1.4) | 33 (19) |
| | KUMASI | | | | |
| | # children | # positive | % positive ¹⁾ | Hb ²⁾ (g/dl) | Age ²⁾ (months) |
| Com U | 854 | 42 | 4.9 | 11.2 (1.5) | 35 (18) |
| Com UA | 735 | 62 | 8.4 | 11.2 (3.8) | 35 (18) |

¹⁾ This excludes one area in Kumasi with very high prevalence (33.5%) probably due to a local epidemic

²⁾ Standard deviation in brackets

GIS Analysis

We performed spatial analysis to investigate the effect of distance to UA sites on malaria prevalence. Using buffer analysis in Arcview, households (HH) within a 300m and a 500m certain radius of UA sites were compared with HH living outside this radius. These distances were based on the estimated flight range of appetitive female mosquitoes^{6,7)}

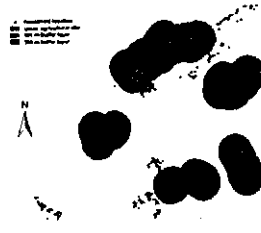


Figure 3. Buffer analysis to determine location in Arcview.

A radius of 300 m did not show any significant difference in malaria parasitaemia (RR 1.22) but living within 500 m of UA sites showed significant higher proportion of parasitaemic children (RR 1.28; Chi-square 4.53, p<0.05). We suggest that failure to detect a significant difference within 300m of a UA site reflects the small number of houses within this boundary rather than a biological phenomenon.

Table 2. Malaria related characteristics of children living more or less than 500 m from urban agricultural areas in Accra, Ghana.

| Children living | # children | % positive | % traveled to village | % taken malaria medication |
|-----------------|------------|------------|-----------------------|----------------------------|
| < 500m UA | 669 | 17.0 | 9.0 | 26.2 |
| >500m of UA | 1123 | 13.4 | 4.5 | 20.8 |

Preliminary conclusion

- First analysis indicates a slightly higher malaria risk for children living in the vicinity of urban agriculture
- HOWEVER, further multivariate analysis is needed to assess the contribution of different factors, like travel to the village and use of preventive measures in explaining the differences found and to account for possible confounding variables, like age, socio-economic status, and housing (Table 2).

Further Research

- Entomological studies to support the epidemiological findings
- Second epidemiological study in the wet season to account for seasonal differences and to reconfirm patterns found.
- Subject to confirmation of findings controlled intervention study to minimize risks.
- Extension of study to other West African cities in different agro-ecological zones and with different irrigation practices (funding needed)

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