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# Prevalence and Risk Factors Associated with Pediculosis Capitis in an Impoverished Urban Community in Lima, Peru

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## ABSTRACT

**Background:** Pediculosis capitis is a ubiquitous parasitic skin disease associated with intense pruritus of the scalp. In developing countries it frequently affects children and adults, but epidemiological data at the community level are rare. **Objectives:** To assess prevalence and risk factors associated with pediculosis capitis in a resource-poor community in Lima, Peru. **Materials and Methods:** In total, 736 persons living in 199 households in a circumscribed neighbourhood were examined for head lice and nits by visual inspection. At the same time, socio-demographic data were collected using a structured questionnaire. Variables associated with pediculosis were identified by performing a bivariate analysis, followed by a multivariate logistic regression analysis. **Results:** Prevalence of pediculosis capitis was 9.1% (95% confidence interval (CI): 7.0-11.2 %) in the general population and 19.9% (CI: 15.4-24.4%) in children ≤15 years of age. Multivariate analysis showed that pediculosis capitis was significantly associated with age ≤ 15 years (OR: 16.85; CI:7.42-38.24), female sex (OR: 2.84; CI: 1.58-5.12), household size of >4 persons (OR: 1.98; CI: 1.11-3.55), low quality of house construction material (OR:2.22; CI: 1.20-4.12), and presence of animals in the household (OR: 1.94; CI: 1.11-3.39). **Conclusion:** Pediculosis capitis was a very common disease in the studied community in Lima, Peru. Our logistic regression analysis affirms that young age is the most important risk factor for pediculosis capitis. Moreover, female sex, large household size, living in wooden houses and the presence of animals were identified as being significantly associated with head lice infestation.

**Key words:** Ectoparasites, Epidemiology, Head lice, Logistic regression analysis, Pediculosis capitis, Peru, Poverty, Risk factors

## INTRODUCTION

Pediculosis capitis is an epidermal parasitic disease caused by infestation of the scalp with head lice (*Pediculus humanus capitis,* De Geer 1778). It is a ubiquitous disease in children[1] and is especially frequent in resource-poor communities in developing countries, where prevalences of around 40% have been reported in some studies.[2-6] The main symptom of pediculosis capitis is pruritus of the scalp, but excoriations, impetiginization and cervical lymphadenopathy may also be present.[7,8] Intense itching with subsequent sleep disturbances may result in concentration difficulties and poor performance in school.[9] Transmission occurs by intimate head-to-head contact and theoretically also through sharing fomites (hair brushes, combs, towels and bedding); however, the importance of the latter route of transmission remains a matter of debate.[10,11]

Together with scabies, cutaneous larva migrans and tungiasis, pediculosis capitis belongs to the family of neglected poverty-associated skin parasitoses.[11]

Hitherto, there are few studies on the occurrence and risk factors of pediculosis capitis in resource-poor settings in the developing world. In Peru, a few epidemiological studies have been performed in 1990s,[12-14] but recent data do not exist. The high prevalence observed in these studies is a matter of concern, especially since head lice are suspected of transmitting rickettsia, and endemic typhus occurs in some areas of Peru.[15]

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Our community-based study aims at describing the prevalence and risk factors of pediculosis capitis in an impoverished neighborhood in the center of Lima, Peru.

## MATERIALS AND METHODS

### Study area

The study was performed in the urban neighborhood Barrios Altos, a typical resource-poor community in Lima, Peru. The community is situated in Lima's historical center and has a population of about 290,000 persons. Population density is high (Instituto Nacional de Estadística e Informática census 2005). In Barrios Altos, most people live in decayed so-called *quintas*, complexes of old adobe houses with backyards and small alleys. Adjacent to the *quintas* some people have built small wooden dwellings. Sanitation is insufficient and living conditions are precarious.

Out of the various impoverished communities in Lima, Barrios Altos was chosen because it was easily accessible and considerably safe for the investigators. Furthermore, at the time of the study the Universidad Peruana Cayetano Heredia (UPCH) used to run a center for children and health care, called Casa Carrillo Maúrtua, in the neighborhood, which served as a contact base with the population. Five *quintas* in the area were considered to be relatively safe by our local assistants and were therefore chosen for the study. They were inhabited by 840 individuals belonging to 199 households.

### Study design

Contact with the local population and neighborhood associations was made through the Casa Carrillo Maúrtua in Barrios Altos. From January to March 2006, during the summer season, all 199 households of the five *quintas* were visited in a door-to-door-survey. To increase the acceptability of the survey, the clinical investigator (A.B.) was always accompanied by a female volunteer from the neighborhood. When a family member was absent, the household was visited a second time. If still absent, the person was invited to be examined the following weekend in the parish hall.

The entire scalp and hair shafts of each person were carefully inspected for the presence of pediculosis capitis. Active or recently experienced pediculosis was diagnosed when nymphs, adult lice, or nits were visible. Socio-demographic and clinical information was assessed using two pre-tested questionnaires: one for the household (number of persons living together, number of beds in the household and presence of animals) and one for the individual (sex, age, marital status and presence of head lice).

### Ethical considerations

Permission for the study was obtained from the Institutional Ethics Committee of the UPCH in Lima. All participants or, in the case of minors, their legal guardians provided informed written consent.

When pediculosis capitis was diagnosed, patients or care-takers received a shampoo containing permethrin 1% (Nopucid, Farmindustria, Lima, Peru) and a lice-comb. They were instructed to treat all household members as follows: Apply the shampoo to wet hair for 10 minutes, then comb the hair thoroughly with the lice-comb and rinse. It was recommended to repeat the procedure after 3-6 days and patients as well as care-persons were informed about the nature of the disease and its transmission.

### Statistical analysis

For data storage and statistical analysis, we used Statistical Package for the Social Sciences (SPSS) for Windows (version 15.0 SPSS Inc., Illinois, USA). Data were entered twice into the database and were checked for entry-related errors. We applied Fisher´s exact test to determine the significance of differences in relative frequencies and assessed odds ratios (ORs) with 95% confidence intervals (CIs). Variables that were significant ($P < 0.05$) in bivariate analysis entered a logistic regression to identify independent associated factors. In order to avoid multicollinearity, the variable 'beds per person' was excluded from logistic regression because of its connection with the variable 'number of persons in the household'. The Omnibus test was applied to test model performance. The adjusted ORs of the multivariate regression analysis were calculated with 95% CI.

## RESULTS

In the door-to-door survey, we collected clinical and socio-demographic data of 736 out of 840 persons (87.6%) from all 199 households in the study area. The proportion of children ≤15 years was 41.0% ($n$ = 302) [Table 1]. The median number of persons per household was 5 (range: 1-14; interquartile range (IQR): 4-6). About two-thirds (65.5%) of the households had 3 beds (range: 1-9; IQR: 2-3). The median number of beds per person was 0.56 (range: 0.2-1; IQR: 0.4-0.75). The houses were made from adobe (77.4%; *n* = 154) or wood (22.6%; *n* = 45) and usually had a concrete floor (94.8%). More than half of the households (58.3%; *n* = 116) used a communal water source while the others had private water supply.

Pediculosis capitis was present in 67 of the 736 participants (9.1%; CI: 7.0-11.2%). Among children ≤15 years, 60 out of 302 (19.9%; CI: 15.4-24.4%) were affected. Forty-three out of 202 (21.3%; CI: 15.7-26.9%) school children between 5 and 15 years presented signs of pediculosis capitis. Peak prevalence was found in the age group of 8-11 years with 23 cases among 78 children (29.5%; CI: 20.1-44.3%). Table 1 and Figure 1 show the results according to different age groups.

The bivariate analysis showed that head lice infestation was significantly associated with female sex, young age, household size >4 persons, a low ratio of beds per person, wooden houses and presence of animals (dogs and cats) in the household [Table 2].

In the logistic regression analysis, we identified age ≤15 years, female sex, household size >4 persons, wooden houses and the presence of animals as factors associated with pediculosis capitis [Table 3]. Young age was shown to be by far the most important risk factor, with an adjusted OR of 16.9 between children ≤15 years and older individuals [Table 3].

The Omnibus test (Chi-square 108.8; $P$ <0.001) showed good overall fit of the logistic regression.

## DISCUSSION

The overall prevalence of pediculosis capitis found in our study area was 9.1% and therewith lower than prevalences observed in population-based studies in resource-poor settings in Brazil (43%)[3] and Egypt (19%),[16] but higher than in a study in a rural community

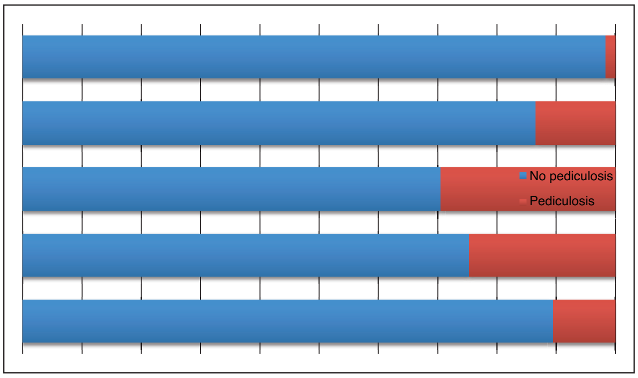


**Figure 1:** Prevalence of pediculosis capitis according to age (in years)

**Table 1: Prevalence of pediculosis capitis according to age (in years). *N*=736**

| Age group in years | Pediculosis (%) |
|---|---|
| 0-3 | 8/76 (10.5) |
| 4-7 | 20/81 (24.7) |
| 8-11 | 23/78 (29.5) |
| 12-15 | 9/67 (13.4) |
| >15 | 7/434 (1.6) |
| Total | 67/736 (9.1) |

**Table 2: Bivariate analysis of exposure variables associated with pediculosis capitis (*n*=736)**

| Variable | Pediculosis (%) | OR (95% CI) | *P* value |
|---|---|---|---|
| Total | 67 (9.1) | | |
| Sex | | | |
| Female | 46/461 (11.2) | 1.82 (1.07-3.13) | 0.028 |
| Male | 21/365 (6.5) | | |
| Age group | | | |
| <15 years | 60/302 (19.9) | 15.12 (6.81-33.61) | <0.001 |
| >15 years | 7/434 (1.6) | | |
| Beds per person in the household | | | |
| <0.5 | 46/358 (12.9) | 2.51 (1.46-4.29) | 0.001 |
| >0.5 | 21/378 (5.6) | | |
| Number of household members | | | |
| <4 | 17/354 (4.8) | 0.34 (0.19-0.59) | <0.001 |
| >4 | 50 (13.1) | | |
| House construction material | | | |
| Wood | 27/166 (16.3) | 2.57 (1.53-4.34) | 0.001 |
| Adobe | 40/570 (7.0) | | |
| Floor in the house | | | |
| Sand/stamped earth | 7/38 (18.4) | 2.40 (1.01-5.68) | 0.073 |
| Concrete | 60/698 (8.6) | | |
| Animals in the house/on the compound | | | |
| Yes | 36/303 (11.9) | 1.75 (1.06-2.90) | 0.037 |
| No | 31/433 (7.2) | | |
| Water source | | | |
| Public tube | 44/428 (10.3) | 1.42 (0.84-2.41) | 0.197 |
| Own | 23/308 (7.5) | | |

OR: Odds ratio; CI: Confidence interval

**Table 3: Logistic regression analysis for risk factors for pediculosis capitis**

| Variable | Adjusted OR (95% CI) | *P* value |
|---|---|---|
| Age <15 | 16.85 (7.42-38.24) | <0.001 |
| Female sex | 2.84 (1.58-5.12) | <0.001 |
| Wooden houses | 2.22 (1.20-4.12) | 0.011 |
| Persons/household >4 | 1.98 (1.11-3.55) | 0.021 |
| Presence of animals in the household | 1.94 (1.11-3.39) | 0.020 |

OR: Odds ratio; CI: Confidence interval

in Tanzania (5.3%).[17] However, the age distribution in these studies was similar to our findings, with school-age children being the most affected group.[3,16,17] The high prevalence among school children is generally ascribed to facilitated transmission of head lice during head-to-head contact while children study and play in groups.[18] The pediculosis prevalence of 21.3% in school children in our study is lower than the frequencies observed in previous studies on school children in Peru (39.4-49.0%)[12-14] and other South American Countries, namely Venezuela (28.8%),[19] Argentina (29.7% and 61.4%)[4,20] and Brazil (35%).[21] Lower prevalences between 1.8% and 13.3% were observed in studies on school children in Turkey, Yemen, Iran and Korea.[22-26] The considerable variation may be partly related to a different sensitivity of the diagnostic methods used in these studies. Furthermore, the incidence of head lice infestation may vary according to the season of the year[27] and pediculosis capitis often occurs in epidemics.[28] Obviously, the point of time of a cross-sectional study of pediculosis capitis will influence the prevalence. Hence, prevalence of head lice infestation in different settings can only be compared if the studies are performed during, for instance, peak transmission season.

We found girls to be more frequently affected by pediculosis capitis than boys (female: Male ratio 2.2:1, adjusted OR 2.84, $P < 0.001$) [Table 3]. This corroborates previous findings where female:male ratios varied between 2:1 and 10:1.[3,4,19,22,23,26,29] The preponderance of girls reflects the observation that they tend to have closer and more frequent head-to-head contact among each other than boys.[30] Moreover, they usually have longer hair than boys, thereby increasing the odds that during head contact the head lice can grasp a hair and migrate from one host to another. However, whether hair length indeed affects pediculosis capitis infestation is still discussed controversially in the literature.[21,22,28,31]

Our finding that living in a household with >4 persons is a significant risk factor for head lice is in accord with studies from Greece, Malaysia and Iran, which show a significant positive association of family size with the occurrence of pediculosis capitis.[5,32,33] In the bivariate analysis, the number of beds per person was found to significantly predict pediculosis capitis [Table 2]. Sharing beds is a sign of crowding and facilitates the direct and indirect head lice transmission through head-to-head contact and fomites. In concurrence, previous studies in Venezuela, Yemen and Iran also showed that sharing beds increased risk of pediculosis.[19,22,34]

It is difficult to explain why the presence of animals (dogs, cats) and houses constructed from wood were identified as independent associated factors. The insect's entire life cycle takes place on the human head and animal reservoirs do not exist.[11] The families who owned animals were not significantly larger than those who did not (mean = 3.85 persons vs. 3.75 persons respectively, $P = 0.66$).

Living in makeshift wooden houses indicates a lower socio-economic status this area, where most people live in older, run-down adobe houses. In developing countries, pediculosis capitis is considered a poverty-associated disease[11] and an association with the low economic status has been demonstrated in previous studies.[4,19,33,35] This may explain the link between house construction material and head lice infestation.

### Limitations

The prevalence of head lice in our study population may be underestimated as visual inspection is a rather insensitive tool to diagnose active infestation;[36,37] even though, it is applied in most pediculosis capitis studies. On the other hand, we defined the presence of nits as a diagnostic criterion although nits in fact only prove recent, but not necessarily active infestation.[37]

In the study population >15 years of age, men were underrepresented as they were often at work during our visits. Since they are not considered a risk group for pediculosis capitis, the overall prevalence in the community may be slightly overestimated.

The fact that Barrios Altos was chosen as a study site that was considerably safe for the investigators in terms of criminality indicates that in other areas social and safety standards are even poorer. In these communities, head lice infestation may supposedly be even more common.

## MAIN CONCLUSIONS

With an overall prevalence of 9.1%, pediculosis capitis was a very common disease in the studied community. Although studies from different countries show great variation in head lice prevalence, the age distribution seems to be very stable, with school children being the most affected age group. Our logistic regression analysis affirms that young age is the most important risk factor for pediculosis capitis. Moreover, female sex, large household size, living in wooden houses and the presence of animals were identified as being significantly associated with head lice infestation.

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