greatly underreported worldwide. Further study is needed to determine if antipsychotics other than clozapine cause myocarditis or cardiomyopathy, particularly lithium, chlorpromazine, fluphenazine, haloperidol, and risperidone, and to consider the comparative risks and effectiveness of antipsychotics. This is especially important given the recent finding that older and newer drugs have similar efficacy.[9] Antipsychotic drugs should also be considered in unexplained sudden deaths in psychotic patients.

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Contributors: DMC suggested the study and made a provisional investigation of the data, AB and IRE planned and designed the study; AB carried out the study; and IRE, AB, and ML evaluated the results. RHBM drafted the first report of the study, AB and IRE wrote the paper, and all authors contributed to modifying the manuscript and the final editing of the paper. IRE is the guarantor.

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Effect of improved housing on illness in children under 5 years old in northern Malawi: cross sectional study

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Abstract

Objective To evaluate the effects of a Habitat for Humanity housing improvement programme in northern Malawi on the prevalence of childhood illnesses.
Design Household based cross sectional study.
Setting Rural communities centred near the small northern Malawi town of Ekwendeni.
Subjects 318 children under 5 years old.
Main outcome measures Prevalence of respiratory, gastrointestinal, and malarial infections according to maternal recall, laboratory, or clinical data.
Results Children living in improved homes were less likely to have respiratory, gastrointestinal, or malarial illnesses (odds ratio 0.56, 95% confidence interval 0.35 to 0.91) after confounding factors were controlled for. The reductions in individual diseases were not significant.
Conclusion Improved housing significantly reduced the burden of disease among children under 5 years old.

Introduction

Poor quality housing is generally accepted to be an important contributor to ill health.[1] Rates of disease have been associated with the quality and specific attributes of a house as well as the conditions that those qualities impose.[2–11]

Although the importance of housing for health is recognised,[1 12 13] few well designed studies have quantified this impact, especially in the developing world. The objective of this study was to assess the impact on children's health of a housing improvement project in rural Malawi. We examined the effect on illness of living in improved housing compared with living in traditional housing.

Participants and methods

The study was conducted in collaboration with Ekwendeni Hospital, Homeless International UK, and Habitat for Humanity International in the town of Ekwendeni, Malawi. Traditional houses in the area are constructed of mud brick walls with thatch roofing, hard packed mud floors, and possibly a pit latrine. Houses are usually about 25 m^2 and consist of two or three rooms. Houses constructed under the Habitat for Humanity programme in Ekwendeni have fired mud bricks, tile roofing, concrete foundation, and a pit latrine. Habitat houses have a mean size of 30 m^2 and three rooms. The cost of a habitat house at the time of the study was about $550 (£370), offset by a 10 year no interest loan. Habitat houses were built next to or replaced the traditional house of the intended owner and were non-systematically dispersed throughout the communities among traditional houses.

Participants in the habitat programme were selected by a village habitat committee. Applicants had to be unable to provide adequate housing for themselves because of financial, social, or physical reasons and to have shown their commitment to the programme by spending a standardised amount of time helping to build another applicant's house.

Sample

We used data from two surveys conducted in March and August 1997. Households for the first survey were randomly selected from a list of about 300 habitat

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homes built at that time. Households for the second survey were selected from the same list, but houses surveyed in March were excluded. At enrolment, we asked permission to complete the survey, collect water samples from the household storage container and water source to test for coliforms (Hach Bromcresol purple broth and broth with methylumbelliferyl-β-D-glucuronide presence or absence method), collect blood from the finger of children younger than 5 years, and give a medical examination. Once we had collected data from the habitat house, we obtained data from the closest traditional house.

Table 1 Construction of analytical dataset

Survey	No of houses (No of children)		Total
	Habitat	Traditional	
March:			
Houses surveyed	85	83	168
Houses with children <5 years	63 (97)	74 (114)	137 (211)
August:			
Houses surveyed	60	61	121
Houses with children <5 years*	39 (52)	47 (70)	86 (122)
Total houses with children <5 and complete data	98 (143)	114 (175)	212 (318)

*Slide smears were unusable for 6 children in 4 habitat homes and 9 children in 7 traditional homes.

Table 2 Comparison of socioeconomic and housing characteristics in two groups. Values are numbers (percentages) of households unless stated otherwise

Variable	Habitat house (n=98)	Traditional house (n=114)	P value
Socioeconomic (responses from head of household)			
Education*:			
Primary (age 6-13)	63 (64)	73 (64)	0.80
Secondary (age 14-17)	22 (22)	26 (23)	
Able to read and write	91 (93)	105 (92)	0.94
Work status:			
Farmer	58 (59)	71 (62)	0.68
Wage earner	40 (41)	43 (38)	
Land ownership:			
Yes	94 (96)	103 (91)	0.17
Median area of land owned (acres)	2.0	2.0	0.63
Household characteristics			
Mean (SD) years in house	2.5 (1.8)	5.9 (6.0)	0.009
Mean (SD) No of inhabitants	6.07 (1.9)	5.5 (2.0)	0.22
Mean (SD) No of children <5 years	1.5 (0.7)	1.5 (0.7)	0.45
Drinking water source:			
Safe†	38 (39)	52 (46)	0.32
Unsafe‡	60 (61)	62 (54)	
Disposal of excreta:			
Bush or open field	4 (4)	9 (8)	<0.0001
Communal pit latrine	35 (36)	62 (55)	
Private latrine	59 (60)	43 (38)	

*Some people had no education. †Protected well, borehole, or piped. ‡River, lake, pool, or unprotected well.

Table 3 Numbers (percentages) of children in habitat and traditional houses with various illnesses in past four weeks for March survey and past two weeks for August survey

	Habitat	Traditional	Total
March survey:	97 children	114 children	
Any illness*	37 (38)	57 (50)	94
Respiratory infection†	15 (15)	27 (24)	42
Gastrointestinal disorder‡	11 (11)	15 (13)	26
Malaria§	18 (19)	30 (26)	48
August survey:	46 children	61 children	
Any illness*	18 (39)	32 (52)	50
Respiratory infection†	15 (33)	24 (39)	39
Gastrointestinal disorder‡	3 (7)	9 (15)	12
Malaria§	3 (7)	5 (8)	8
Combined surveys:	143 children	175 children	
Any illness*	55 (38)	89 (51)	144
Respiratory infection†	30 (21)	51 (29)	81
Gastrointestinal disorder‡	14 (10)	24 (14)	38
Malaria§	21 (15)	35 (20)	56

*One or more of the three key illnesses: respiratory infection, gastrointestinal disorder, or malaria.
†Mother reported persistent cough, chest retraction, or acute respiratory infection.
‡Mother reported vomiting or diarrhoea.
§Positive smear and palpable spleen.

Instrument and measures

We used the illness recall method to assess the health of children under 5 years. In the first survey mothers reported symptoms experienced during the past month. In the second survey they were asked to report symptoms in the past two weeks. Analyses stratified by recall period found that trends were consistent across the two surveys so we combined the data. All children were screened for malaria by blood film examination and examined by a doctor to detect palpable spleens.[14]

Analysis of data

We compared habitat and traditional households with bivariate analyses using EpiInfo version 6.0. We then used the Genmod procedure to fit generalised linear models on correlated data using SAS for Windows (version 6.11). The Genmod procedure fits models using maximum likelihood estimation, and we used it to account for some households having more than one child, to adjust for potential confounding factors, and to test for interactions.

Results

Table 1 shows the numbers of houses included in each survey. We found no significant differences in socioeconomic and demographic variables between the habitat and traditional houses (table 2). Overall, the comparability of the non-housing socioeconomic characteristics in the two groups suggests that any differences between the two groups are likely to be due to differences in housing.

Table 3 shows the proportion of children under 5 years with various illnesses. The percentage of children with any or each of the three illnesses is lower in the habitat houses than the traditional houses.

Table 4 shows the results of the multivariate analysis to determine the relation between housing and the health of children under 5 years old. Although none of the unadjusted odds ratios are significant, all the relations are roughly of the same magnitude and direction. When access to safe water was controlled for, children in habitat houses were 45% less likely to have any illnesses (odds ratio = 0.55, 95% confidence interval 0.34 to 0.75) than children in traditional houses. The incidence of respiratory infection was also significantly reduced among children in habitat houses.

The reduced rate of overall illness in children in habitat houses remained after adjustment for other potential confounding factors (0.56, 0.35 to 0.91; table 4). However, the effect on individual illnesses was not significant. Interactions between housing type and water source and between housing type and method of disposal of excreta were not significant.

Table 4 Estimated odds ratios for effect of housing on illness in Malawian children under 5 years old

	Any illness*	Respiratory infection	Gastrointestinal disorder	Malaria
Unadjusted odds ratio				
Traditional house	1.00	1.00	1.00	1.00
Habitat house	0.64 (0.40 to 1.01)	0.64 (0.49 to 1.13)	0.69 (0.33 to 1.43)	0.69 (0.36 to 1.30)
Adjusted odds ratio†				
Housing type:				
Traditional	1.00	1.00	1.00	1.00
Habitat	0.55 (0.34 to 0.75)	0.60 (0.34 to 1.06)	0.60 (0.29 to 1.25)	0.63 (0.33 to 1.21)
Water source:				
Unsafe	1.00	1.00	1.00	1.00
Safe	0.40 (0.25 to 0.65)	0.48 (0.26 to 0.87)	0.31 (0.14 to 0.70)	0.47 (0.23 to 0.94)
Fully adjusted odds ratio‡				
Housing type:				
Traditional	1.00	1.00	1.00	1.00
Habitat	0.56 (0.35 to 0.91)	0.56 (0.31 to 1.01)	0.58 (0.26 to 1.28)	0.73 (0.36 to 1.40)
Water source:				
Unsafe	1.00	1.00	1.00	1.00
Safe	0.46 (0.28 to 0.76)	0.56 (0.31 to 1.02)	0.29 (0.13 to 0.68)	0.59 (0.28 to 1.26)
Method of waste disposal:				
Bush or community latrine	1.00	1.00	1.00	1.00
Private latrine	0.95 (0.58 to 1.53)	1.33 (0.73 to 2.40)	1.11 (0.93 to 2.39)	0.44 (0.21 to 0.92)
Knowledge of malaria prevention:				
Average	—	—	—	1.00
Above average				0.37 (0.15 to 0.77)

*One or more of the three key illnesses: respiratory infection, gastrointestinal disorder, or malaria.
†Generalised linear model adjusting for water source.
‡Generalised linear model adjusting for water source, occupation (farmer or wage earner), level of education (completing secondary school or not), knowledge of methods to prevent malaria (number of methods that could be named), and method of waste disposal.

Discussion

This study shows that the five year housing programme significantly improved the health of children under 5 years old. Children living in an improved house had 44% reduced odds of respiratory infection, gastrointestinal illness, or malaria. Access to a safe water source, having above average knowledge about the methods used to prevent malaria, and owning a private latrine were also significantly associated with lower odds of some illnesses. These associations were independent of the level of education and occupation of the head of the household. The size of the effect of housing was roughly equivalent for respiratory infections, gastrointestinal disorders, and malaria. Incorporating bed nets or ceilings into houses may increase the health benefits of better housing by reducing malaria further.

Our investigation has several limitations. Firstly, there is potential for bias in the selection of people into the housing programme by the habitat village committee. The similarity in the sociodemographic profiles between the two groups, however, suggests selection bias was minimal. Secondly, mothers could have misreported respiratory infection and gastrointestinal disorders. However, the hospital had a long association with the communities in this area, which has resulted in trust between the interviewer and interviewee. The final limitation is that disposal of excreta was improved in some traditional houses, with 38% having private latrines. We controlled for method of disposal in the final model.

The effect sizes in our study are similar to those reported for many other health interventions, such as improving water and sanitation, that receive more attention and financial support. Programmes in which simultaneous improvements in housing, water, and sanitation are combined with education on how to take advantage of these improved resources are likely to have the greatest effect on health.

Contributors: CGW and MWY had the original idea for the study, contributed to its design, and coordinated the collection, compilation, and checking of the data. DGS contributed to the design of the study. CGW directed and DGS supervised the analyses. CGW wrote the first draft of the manuscript, and DGS and MWY reviewed and contributed to subsequent drafts. CGW and DGS are the guarantors.

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What is already known on this topic

Poor quality housing is generally accepted as an important contributor to ill health

Few designed studies have quantified the impact of improved housing on health in the developing world

What this study adds

Improved housing reduced the odds of respiratory infection, gastrointestinal illness, or malaria by 44% in children under 5 years old

The reductions in individual illnesses were not significant

Housing development programmes are an important component of efforts to improve global health

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Eligibility for home treatment of deep vein thrombosis: prospective study

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Low molecular weight heparin is safe and effective for the treatment of deep vein thrombosis.[1] We have recently shown in a randomised study that immobilisation is not necessary.[2] The results challenge the traditional notion that these patients must be treated in hospital. For selected patients, outpatient treatment has been shown to be safe and effective.[3 4] We determined the proportion of patients who still require admission to hospital and why.

Methods and results

Between 1 November 1998 and 15 August 1999 all patients presenting to the vascular diagnostics unit of the University Hospital Dresden, Germany, as outpatients with acute deep vein thrombosis in the leg were prospectively evaluated regarding eligibilty for home treatment. We defined acute deep vein thrombosis as non-compressible deep veins on ultrasonography (UM9 HDI, linear array 4-7 MHz, ATL, Bothell, Washington, DC) and symptoms that had been present for less than two weeks. Written informed consent was obtained from all patients.

On the day of diagnosis patients were started on oral anticoagulation with phenprocoumon (adjusted to a target international normalised ratio of 2-3) and the low molecular weight heparin nadroparin (90 IU/kg body weight twice daily) until a therapeutic ratio was achieved. All patients received class II compression stockings. At presentation, the decision regarding hospital admission was based on medical reasons, home care situation, patients' and general practitioners' rejection of outpatient treatment, and hospital service logistics. The 95% confidence intervals were calculated according to the Wilson procedure.

We assessed recurrent venous thromboembolism (verified by sonography, ventilation-perfusion scan, or pulmonary angiography), major bleeding, and death at clinical follow up of patients treated at home. Assessments were at three and six days and two, four, and 12 weeks after initiation of treatment. The study was approved by the local ethics committee.

A total of 117 consecutive outpatients (48 men, 69 women) were diagnosed as having acute deep vein thrombosis. Of these, 92 received home treatment—that is, they were not admitted at all. The median (range) age was 62.0 (19-95) years. Three patients were admitted to hospital for medical reasons; 11 because of the home care situation; and 11 for reasons of hospital service logistics (table). At the 12 week follow up of the 92 patients, eight had died (six from cancer and two from chronic heart failure; three had recurrent thrombosis; and four had developed minor bleeding. No clinical pulmonary embolism or major bleeding occurred. Safety and efficacy figures are similar to those previously published.[5]

Comment

Most outpatients presenting with acute deep vein thrombosis do not need to be admitted to hospital. The proportion who do require admission depends mainly on factors to do with infrastructure rather than medical reasons. In our study, only 3% of patients were admitted for medical reasons, and in 9% admission was because medication and international normalised ratio

Reasons for admission to hospital in 117 consecutive outpatients with deep vein thrombosis

Reason for admission	No of patients (%; 95% CI)	Details
Medical reason	3/117 (2.6; 0.9 to 7.1)	Massive leg swelling and severe pain (n=2); concomitant pneumonia (n=1)
Home care situation	11/117 (9.4; 5.3 to 16.1)	Self injection with heparin not possible (n=7; poor compliance in 5, social reasons in 2); daily INR testing not possible (n=5)
Patient or general practitioner rejects outpatient treatment	0 (0 to 3.2)	NA
Hospital service logistics	11/117 (9.4; 5.3 to 16.1)	Presented at weekend (n=7) or after 5 pm (n=4)

INR=international normalised ratio.
NA=not applicable.