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RESEARCH

Community involvement in dengue vector control: cluster randomised trial

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ABSTRACT

Objective To assess the effectiveness of an integrated community based environmental management strategy to control *Aedes aegypti*, the vector of dengue, compared with a routine strategy.

Design Cluster randomised trial.

Setting Guantanamo, Cuba.

Participants 32 circumscriptions (around 2000 inhabitants each).

Interventions The circumscriptions were randomly allocated to control clusters (n=16) comprising routine *Aedes* control programme (entomological surveillance, source reduction, selective adulticiding, and health education) and to intervention clusters (n=16) comprising the routine *Aedes* control programme combined with a community based environmental management approach.

Main outcome measures The primary outcome was levels of *Aedes* infestation: house index (number of houses positive for at least one container with immature stages of *Ae aegypti* per 100 inspected houses), Breteau index (number of containers positive for immature stages of *Ae aegypti* per 100 inspected houses), and the pupae per inhabitant statistic (number of *Ae aegypti* pupae per inhabitant).

Results All clusters were subjected to the intended intervention; all completed the study protocol up to February 2006 and all were included in the analysis. At baseline the *Aedes* infestation levels were comparable between intervention and control clusters: house index 0.25% *v* 0.20%, pupae per inhabitant 0.44×10^{-3} *v* 0.29×10^{-3}. At the end of the intervention these indices were significantly lower in the intervention clusters: rate ratio for house indices 0.49 (95% confidence interval 0.27 to 0.88) and rate ratio for pupae per inhabitant 0.27 (0.09 to 0.76).

Conclusion A community based environmental management embedded in a routine control programme was effective at reducing levels of *Aedes* infestation.

Trial registration Current Controlled Trials ISRCTN88405796.

INTRODUCTION

No specific antiviral treatment or vaccine is available for dengue,[1] a mosquito borne viral disease. Control of its main vector, *Aedes aegypti,* is the only available strategy to prevent transmission. Vector control methods directed against the immature stages, such as larvicides and copepods, are increasingly used, with variable success, often claimed to result from the absence of community involvement.[2] However, evidence on the effectiveness of community based *Aedes* control is weak and controversial.[3 4] The *Ae aegypti* larval indices, classically used to measure entomological effects, do not necessarily reflect the risk of dengue transmission and it has been argued that pupae per inhabitant is a more appropriate measure.[1 5] We assessed the effectiveness of integrated community based environmental management compared with routine *Aedes* control in reducing pupal statistics as well as traditional indices.

METHODS

We carried out a cluster randomised controlled trial in Guantanamo (243 000 inhabitants), Cuba, which has one of the highest *Ae aegypti* infestation levels in the country.

In September 2004, 32 "circumscriptions" (a geopolitical unit of about 500 houses and 2000 inhabitants) were selected in central Guantanamo. In January 2005, these were randomly allocated to 16 control clusters and 16 intervention clusters. We aimed to detect a 50% reduction in house indices, with a power of 80% and an α error of 0.05, assuming a coefficient of variation (standard deviation divided by mean) of 0.25 for the clusters' house index. The trial was to last until the end of 2007, with an interim analysis in February 2006.

In the 16 control clusters the routine *Aedes* control programme was implemented throughout the study. The programme's vector control workers carried out surveillance and source reduction through inspection of houses (11 day cycles), larviciding (temephos) of water storage containers, adulticiding (cypermethrin or clorpyriphos), education on dengue prevention, and enforcement of mosquito control legislation. In the 16 intervention clusters, external researchers together with a local steering committee set up a community based environmental management strategy (see box) that complemented the routine control programme.

In January 2005, community working groups of 10 to 20 members were created in each of the 16 intervention circumscriptions to actively involve the community. From February 2005 onwards each community working group carried out a situation assessment with the community, identified needs and priorities for dengue control, and elaborated action plans (see bmj.com) such as

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Key elements of intervention

- Discussion on the intervention with relevant local stakeholders and formation of a local steering committee
- Creation of formal task forces (community working groups) at grassroots level to secure community involvement in environmental management
- Establishment of coordination mechanisms between community working groups, health services, and local government structures to strengthen intersectoral coordination
- Harmonisation of the intervention and the action plan of the local vector control programme

social communication intending to change behaviour (for example, to cover water storage containers correctly) and negotiations with community and governmental intersectoral groups to eliminate environmental risks. Implementation of the action plans in the intervention clusters started in April 2005.

Data collection and analysis

In November 2004 a baseline survey was carried out on a random sample of 800 households to assess knowledge, attitudes, and practices regarding dengue and its prevention, socioeconomic characteristics, and environmental risks in and around dwellings. In January 2006, 12 group discussions with 118 inhabitants and 16 group discussions with the community working group were held in the intervention clusters to assess perceptions on actual and preintervention involvement of the community.

Members of the national vector control programme carried out routine surveys in cycles of 11 days in all dwellings. This provided data for all clusters by cycle and by house block for January 2005 to February 2006: number of houses inspected, number of wet containers (any container with water—for example, non-utility containers such as waste bins that become filled with rain water) by type, number of houses and containers positive for immature stages of *Ae aegypti*, distribution of immature stages, and absolute number of pupae.

We carried out a descriptive analysis of the baseline survey. Members of the local research team analysed the transcripts of group discussions. The analysis was guided by the five criteria proposed for appraising community participation: needs identification, leadership, organisation, resource mobilisation, and management.[6] For every cluster a consensus score from 1 (none) to 5 (excellent) was assigned to each criterion. The distribution of the scores per criteria for all intervention clusters was summarised by the median and range. To obtain a measure of participation in each intervention cluster we averaged its scores.

The primary outcome was levels of *Aedes* infestation. We calculated, per cluster and per cycle, house index (number of houses positive for at least one container with immature *Ae aegypti* per 100 inspected houses), Breteau index (number of containers positive for immature *Ae aegypti* per 100 inspected houses), and pupae per inhabitant (number of *Ae aegypti* pupae per inhabitant).

A crude mid-term analysis in February 2006 showed a positive effect of the intervention. In view of this, and soaring entomological indices in Guantanamo as a whole, the health authorities decided to stop the trial and to generalise the intervention strategy to the whole city. Hence the preintervention period was defined as the three cycles covering January 2005 and the end of intervention period as the three cycles covering January 2006. To evaluate the effect of intervention on the larval indices and pupae per inhabitant statistic we constructed generalised linear random effect regression models with negative binomial link function. We evaluated the time effect (preintervention and end of intervention) and group effect (intervention or control) at cycle by cluster level.

We calculated the mean house index and pupae per inhabitant for three inspection cycles in each cluster and then averaged these values for the control and intervention groups. We computed the proportion of breeding sites that were positive for first and second instar larvae for each cycle and each cluster and averaged these by group for the preintervention period and end of intervention period. We assessed the percentage of blocks with repeated positivity during these periods. The influence of intervention on these secondary outcome measures was evaluated by a χ^2 test. We used Stata 9 and SPSS 15.0 for analyses.

RESULTS

All clusters received the intended intervention and were included in the analysis. The intervention clusters comprised 8422 houses (33 688 inhabitants) and the control clusters 10 748 (42 992 inhabitants). Baseline characteristics were similar between the clusters except for a higher frequency of water distribution in the intervention clusters (see bmj.com). In all houses at least one risk factor was observed.

In January 2006 community involvement in the intervention clusters was assessed as "fair" (average overall score 3.34) compared with almost non-existent before intervention. The median score for the needs identification and leadership criteria was 4 and for the other criteria was 3. For all criteria the variability between clusters was high. The highest score per cluster was 4.8 (almost excellent involvement) and the lowest was 1.4 (almost no involvement). Ten clusters were identified as good strategy adaptors (score $\geq$3) and six as poor strategy adaptors ($<$3).

At baseline the entomological indices were comparable between the clusters (figure and bmj.com). At the start of the intervention, when inspection of potential breeding sites was intensified, the larval indices peaked and thereafter declined. In the control clusters a steady increasing trend over time was observed. In January 2006, infestation levels in the intervention clusters were significantly lower than those in the control clusters (see bmj.com)—50% lower for the Breteau and house indices and 73% lower for pupae per inhabitant. The predominant breeding sites for both clusters remained the water storage containers at ground level (70-75%).

The proportion of early immature stages (first and second instar larvae) increased significantly more in the intervention clusters (9% preintervention, 43% end of

WHAT IS ALREADY KNOWN ON THIS TOPIC

Dengue prevention is mainly based on the control of its vector, *Aedes aegypti*

As previous vector control strategies showed variable success rates, effective and sustainable alternatives are awaited by policy makers

Community participation has been advocated for dengue control, but evidence from cluster randomised controlled trials is lacking

WHAT THIS STUDY ADDS

Community based environmental management integrated in a routine dengue prevention and control programme can reduce levels of *Aedes* infestation by 50-75% compared with a routine programme as a single strategy

intervention) than in the control clusters (6% and 12%; P=0.004). In the intervention area a non-significant (P=0.3) decrease in the percentage of repeatedly positive blocks (5.8% *v* 3.5%) compared with a significant increase (P=0.005) in the control area (13.2% and 17.0%) was observed.

DISCUSSION

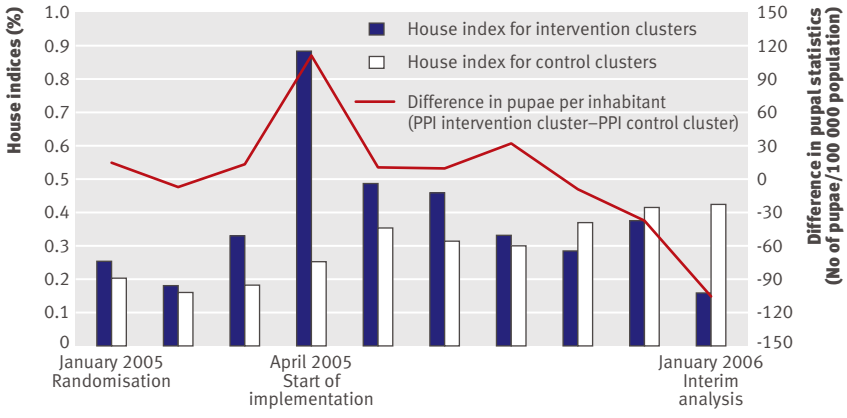
After one year *Aedes* foci were reduced to levels almost 50% lower in clusters where the community based environmental management strategy was embedded in the routine programme, compared with clusters that had the routine control programme alone. The difference in the number of pupae per inhabitant, an indicator of the abundance of adult vector and risk of dengue transmission,[7] reached 73%. Early immature stages (first and second instar larvae) were more common at the end of intervention, indicating more prompt elimination of breeding sites with involvement of the community.

One of the strengths of our study was the use of a cluster randomised controlled design taking into account possible confounding by ecological, climatic, and other unknown factors influencing *Aedes* infestation.[8]

Entomological indices and statistics were the outcome measures. The close involvement of the provincial vector control programme is potentially a methodological limitation, as it could have resulted in some improved quality of routine work; punctual initiatives by individual workers mimicking intervention activities in control clusters cannot be completely excluded either. Routine vector control activities were closely monitored and were found comparable in the control and intervention areas. Such "contamination," if any, would produce only an underestimate of the intervention effect.

Likewise we had to rely on entomological data collected through routine surveillance in 11 day cycles. Apart from possible non-differential underestimation of the number of breeding sites, the methods and procedures were no longer fully standardised after the start of the intervention. The motivation of the workers in the intervention clusters increased, and so did motivation in the communities. Inhabitants became more willing to cooperate with the vector control workers in their search for immature mosquitoes and even found "hidden" breeding sites. This observation bias explains the peak level in all entomological indices in the intervention clusters at the start of intervention. We have no hard data to substantiate that such differential observation did not fade over time, but key informants indicate that it was maintained. If this were the case, the reductions in indices observed between April 2005 and January 2006 in the intervention clusters would reflect real decreases—just as real as the increases in the control clusters. Also, the difference between control and intervention clusters in the number of pupae per inhabitant estimated in January 2006 would be an underestimate of the intervention effect. If, on the contrary, the search for breeding sites had returned to being comparable in all clusters, the observed difference in January 2006 would reflect the true intervention effect.

In February 2006, the health authorities decided on the basis of a crude interim analysis to extend the intervention to the whole city of Guantanamo. This led de facto to the end of the trial. At that moment the community involvement in the environmental management was not yet homogeneous over the intervention clusters, as involving the community takes time and is not a spontaneous activity. A suitable formal organisation must be identified or set up to guide the community involvement strategy,[9 10] and members of these organisations need training.[11] Then, the opportunity must be given for initiative and autonomous action. As institutionalisation of the approach is crucial for continuity of actions, we secured integration of the bottom-up approach into the top-down programme, as advocated by previous research,[12] by involving the provincial director in the design of the strategy, by assigning the routine vector control workers to specified areas, by taking into account feedback of community working groups, and by establishing links between the community working group and the government sectors. Such integration was possible only because the existing vertical vector control programme was already functioning well. Another influencing factor[10] is a favourable political and sociocultural context that supports discussion of issues affecting the wellbeing of individuals and the community, acquisition



House indices in intervention and control clusters and difference in pupae per inhabitant between clusters, January 2005 to February 2006, Guantanamo, Cuba

of knowledge, and active community involvement in implementation of the programme.

The approach used in Guantanamo was principally inspired by a strategy implemented in Santiago, which had equal effectiveness as an intensified routine programme.[13] By adapting this intervention to the specific context of Guantanamo and formally testing it, we showed not only the effectiveness of its main strategic components in other areas with relatively low infestation levels, but also its transferability.

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1 Farrar J, Focks D, Gubler D, Barrera R, Guzman MG, Simmons C, et al. Towards a global dengue research agenda. *Trop Med Int Health* 2007;12:695-9.
2 TDR for research on diseases of poverty. Report of the Scientific Working Group meeting on Dengue, 1-5 Oct, 2006. Geneva: WHO. (TDR/SWG/08 ed.)
3 Heintze C, Garrido MV, Kroeger A. What do community-based dengue control programmes achieve? A systematic review of published evaluations. *Trans R Soc Trop Med Hyg* 2007;101:317-25.
4 Perez D, Lefevre P, Sanchez L, Van der Stuyft P. Comment on: What do community-based dengue control programmes achieve? A systematic review of published evaluations. *Trans R Soc Trop Med Hyg* 2007;101:630-1.
5 Nathan MB, Focks DA, Kroeger A. Pupal/demographic surveys to inform dengue-vector control. *Ann Trop Med Parasitol* 2006;100(suppl 1):S1-3.
6 Rifkin SB, Muller F, Bichmann W. Primary health care: on measuring participation. *Soc Sci Med* 1988;26:931-40.
7 Focks DA, Chadee DD. Pupal survey: an epidemiologically significant surveillance method for Aedes aegypti: an example using data from Trinidad. *Am J Trop Med Hyg* 1997;56:159-67.
8 Ukoumunne OC, Gulliford MC, Chinn S, Sterne JA, Burney PG, Donner A. Methods in health service research. Evaluation of health interventions at area and organisation level. *BMJ* 1999;319:376-9.
9 Nam VS, Nguyen TY, Tran VP, Truong UN, Le QM, Le VL, et al. Elimination of dengue by community programs using Mesocyclops (Copepoda) against Aedes aegypti in central Vietnam. *Am J Trop Med Hyg* 2005;72:67-73.
10 Zakus JD, Lysack CL. Revisiting community participation. *Health Policy Plan* 1998;13:1-12.
11 Toledo Romani ME, Vanlerberghe V, Perez D, Lefevre P, Ceballos E, Bandera D, et al. Achieving sustainability of community-based dengue control in Santiago de Cuba. *Soc Sci Med* 2007;64:976-88.
12 Gubler DJ, Clark GG. Community involvement in the control of Aedes aegypti. *Acta Trop* 1996;61:169-79.
13 Toledo ME, Vanlerberghe V, Baly A, Ceballos E, Valdes L, Searret M, et al. Towards active community participation in dengue vector control: results from action research in Santiago de Cuba, Cuba. *Trans R Soc Trop Med Hyg* 2007;101:56-63.

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Inequalities in reported use of breast and cervical screening in Great Britain: analysis of cross sectional survey data

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ABSTRACT

Objective To investigate the relation between women's reported use of breast and cervical screening and sociodemographic characteristics.
Design Cross sectional multipurpose survey.
Setting Private households, Great Britain.
Population 3185 women aged 40-74 interviewed in the National Statistics Omnibus Survey 2005-7.
Main outcome measures Ever had a mammogram or cervical smear and, for each, timing of most recent screen.
Results 91% (95% confidence interval 90% to 92%) of women aged 40-74 years reported ever having had a cervical smear, and 93% (92% to 94%) of those aged 53-74 years reported ever having had a mammogram; 3% (2% to 4%) of women aged 53-74 years had never had either breast or cervical screening. Women were significantly more likely to have had a mammogram if they lived in households with cars (compared with no car: one car, odds ratio 1.67, 95% confidence interval 1.06 to 2.62; two or more cars, odds ratio 2.65, 1.34 to 5.26), and in owner occupied housing (compared with rented housing: own with mortgage, odds ratio 2.12, 1.12 to 4.00; own outright, odds ratio 2.19, 1.39 to 3.43), but no significant differences by ethnicity, education, occupation, or region were found. For cervical screening, ethnicity was the most important predictor; white British women were significantly more likely to have had a cervical smear than were women of other ethnicity (odds ratio 2.20, 1.41 to 3.42). Uptake of cervical screening was greater among more educated women but was not significantly associated with cars, housing tenure, or region.
Conclusions Most (84%) eligible women report having had both breast and cervical screening, but 3% report never having had either. Some inequalities exist in the reported use of screening, which differ by screening type; indicators of wealth were important for breast screening and ethnicity for cervical screening. The routine collection within general practice of additional sociodemographic information would aid monitoring of inequalities in screening coverage and inform policies to correct them.

INTRODUCTION

Statistics on the population coverage of the breast and cervical screening programmes for England are published annually.[1,2] These data are derived from the NHS call and recall system and are therefore based on women ever in contact with the NHS. However, these data have limitations, especially for investigating

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inequalities. As information on patients' ethnicity and socioeconomic characteristics is not routinely collected in general practice, little is known about the characteristics of women attending for screening and how screening coverage varies across sociodemographic groups.[3 4] Some studies on inequalities in screening have used information other than the routine administrative data. Some use nationally representative survey data and individual sociodemographic characteristics,[5 6] but most are for small geographical areas and use measures of area deprivation rather than individual characteristics.[7-9] A review of studies on inequalities in access to cancer screening published between 1998 and 2003 found a dearth of information relating to the United Kingdom.[10]

A further limitation of the routine statistics is that they are based on registered general practice lists and therefore can be affected by list inflation—that is, patients remain registered at a specific general practice despite having died, emigrated, or moved home. This can result in performance indicators and health promotion measures being underestimated.[11] Furthermore, routine statistics largely provide cross sectional estimates of coverage rather than information on lifetime use of screening.

We investigated the relation between women's reported use of breast and cervical screening and their individual and household sociodemographic characteristics by using data from a general population survey of Great Britain.

Table 1 | Odds ratios of screening history (ever mammogram, ever cervical smear) by sociodemographic characteristics, Great Britain 2005-7*

	No in sample†: age 53-74/40-74 (n=1895/3148)	No in sample†: ever mammogram 53-74/ ever cervical smear 40-74 (n=1754/2851)	Odds ratio (95% CI)			
			Ever *v* never mammogram (age 53-74)		Ever *v* never cervical smear (age 40-74)	
			Age adjusted	Fully adjusted‡	Age adjusted	Fully adjusted‡
Cars available to household						
0	462/674	403/575	1.00	1.00	1.00	1.00
1	950/1459	888/1307	2.30	1.67 (1.06 to 2.62)	1.39	1.03 (0.72 to 1.46)
≥2	483/1015	463/969	3.92	2.65 (1.34 to 5.26)	2.58	1.61 (0.97 to 2.67)
P value				0.01		0.09
Housing tenure						
Rents	363/664	307/574	1.00	1.00	1.00	1.00
Owns with mortgage	377/1128	357/1069	3.10	2.12 (1.12 to 4.00)	2.30	1.35 (0.87 to 2.10)
Owns outright	1155/1356	1090/1208	3.04	2.19 (1.39 to 3.43)	1.90	1.25 (0.89 to 1.77)
P value				0.002		0.3
Highest level of education qualification						
No qualifications	902/1117	823/955	1.00	1.00	1.00	1.00
Below degree level (including other)	800/1569	749/1459	1.37	1.00 (0.61 to 1.62)	2.00	1.48 (1.03 to 2.14)
Degree or equivalent	193/462	182/437	2.29	1.58 (0.70 to 3.60)	2.42	1.78 (1.01 to 3.13)
P value				0.5		0.06
National Statistics socioeconomic classification						
Routine and manual occupations	839/1259	771/1102	1.00	1.00	1.00	1.00
Intermediate occupations	459/739	424/686	0.99	0.71 (0.42 to 1.18)	1.92	1.51 (1.03 to 2.20)
Managerial and professional occupations	538/1038	506/967	1.55	0.97 (0.56 to 1.68)	1.83	1.24 (0.83 to 1.85)
Not classified	59/112	53/96	0.43	0.46 (0.17 to 1.25)	0.51	0.69 (0.37 to 1.28)
P value				0.3		0.06
Ethnicity						
Other	119/259	105/222	1.00	1.00	1.00	1.00
White British	1776/2889	1649/2629	1.74	1.29 (0.62 to 2.67)	2.62	2.20 (1.41 to 3.42)
P value				0.5		0.0005
Region						
North	501/829	464/759	1.00	1.00	1.00	1.00
Midlands and East Anglia	506/845	466/766	1.10	1.00 (0.57 to 1.74)	0.95	0.95 (0.66 to 1.38)
London	163/300	145/264	0.74	0.78 (0.40 to 1.51)	0.55	0.71 (0.46 to 1.12)
South East	280/443	265/412	1.42	1.22 (0.63 to 2.35)	1.42	1.28 (0.76 to 2.17)
South West	177/284	170/261	2.80	2.37 (0.97 to 5.78)	1.15	1.06 (0.64 to 1.77)
Wales	71/125	66/110	1.50	1.25 (0.48 to 3.22)	0.74	0.77 (0.35 to 1.70)
Scotland	197/322	178/279	0.98	1.07 (0.60 to 1.93)	0.67	0.73 (0.44 to 1.19)
P value				0.9		0.4

*35 women with missing values on sociodemographic variables omitted from analysis.
†Numbers refer to unweighted sample.
‡Adjusted for age, cars, housing tenure, highest level of education, National Statistics socioeconomic classification, ethnic group, and region.

METHODS

This study uses data from the women's health screening module of the National Statistics Omnibus Survey. This is a multipurpose survey carried out monthly by the Office for National Statistics in a representative sample of adults living in private households in Great Britain.[12] The screening module was included in nine surveys in total: four in 2005, four in 2006, and one in March 2007. It was administered to women aged 40-74 years. Respondents were asked if they had ever had a mammogram or cervical screening. The Omnibus Survey also collects a range of demographic and socioeconomic information.

Response rates for the nine surveys ranged between 64% and 69% of the eligible sample; an additional 24% to 27% were refusals, and the remainder were non-contacts. Interviews were achieved for a total of 95% of the women in these nine surveys. We combined the data from the nine surveys, giving responses from a total of 3185 women aged 40-74.

Outcome measures

The main outcome measures were ever having had a mammogram and ever having had a cervical smear. We also looked at the reason for the most recent mammogram and the time since most recent mammogram

Table 2 | Odds ratios of screening history (ever both screenings, ever some screening) by sociodemographic characteristics, Great Britain 2005-7*

	No in sample†: age 53-74 (n=1895)	No in sample†: ever both 53-74/ever some 53-74 (n=1578/1843)	Odds ratios (95% CI)			
			Ever both mammogram and cervical smear *v* not both‡ (53-74)		Ever mammogram, cervical smear, or both *v* never either§ (53-74)	
			Age adjusted	Fully adjusted¶	Age adjusted	Fully adjusted¶
Cars available to household						
0	462	349/436	1.00	1.00	1.00	1.00
1	950	791/928	1.64	1.31 (0.95 to 1.80)	2.73	1.83 (0.98 to 3.41)
≥2	483	438/479	2.92	2.11 (1.34 to 3.34)	5.11	3.21 (1.00 to 10.26)
P value				0.006		0.06
Housing tenure						
Rents	363	267/342	1.00	1.00	1.00	1.00
Owns with mortgage	377	334/373	2.32	1.60 (0.99 to 2.57)	5.08	2.49 (0.62 to 10.06)
Owns outright	1155	977/1128	2.07	1.52 (1.09 to 2.12)	2.80	1.51 (0.69 to 3.31)
P value				0.04		0.4
Highest level of education qualification						
No qualifications	902	720/866	1.00	1.00	1.00	1.00
Below degree level (including other)	800	685/786	1.45	1.17 (0.81 to 1.69)	2.40	1.54 (0.67 to 3.54)
Degree or equivalent	193	173/191	2.64	2.13 (1.20 to 3.80)	7.14	5.31 (1.06 to 26.70)
P value				0.04		0.1
National Statistics socioeconomic classification						
Routine and manual occupations	839	682/809	1.00	1.00	1.00	1.00
Intermediate occupations	459	386/452	1.20	0.90 (0.63 to 1.29)	2.21	1.48 (0.50 to 4.35)
Managerial and professional occupations	538	464/526	1.52	0.98 (0.66 to 1.44)	1.82	0.91 (0.39 to 2.12)
Not classified	59	46/56	0.62	0.68 (0.35 to 1.33)	0.32	0.42 (0.12 to 1.42)
P value				0.7		0.4
Ethnicity						
Other	119	95/110	1.00	1.00	1.00	1.00
White British	1776	1483/1733	1.65	1.51 (0.86 to 2.66)	4.11	3.01 (1.22 to 7.38)
P value				0.1		0.02
Region						
North	501	417/490	1.00	1.00	1.00	1.00
Midlands and East Anglia	506	428/486	1.26	1.21 (0.81 to 1.81)	0.73	0.65 (0.28 to 1.48)
London	163	132/155	0.93	0.98 (0.61 to 1.57)	0.53	0.67 (0.26 to 1.73)
South East	280	242/277	1.42	1.27 (0.82 to 1.97)	2.01	1.50 (0.40 to 5.70)
South West	177	153/176	1.58	1.41 (0.81 to 2.44)	7.19	5.55 (0.67 to 45.73)
Wales	71	55/70	0.82	0.76 (0.34 to 1.73)	3.29	2.98 (0.39 to 22.92)
Scotland	197	151/189	0.79	0.85 (0.52 to 1.40)	0.77	0.97 (0.39 to 2.40)
P value				0.5		0.3

*35 women with missing values on sociodemographic variables omitted from analysis.
†Numbers refer to unweighted sample.
‡Compares women who have had both screening types with those who have had only one screening type or neither screening (that is, both screenings versus not both).
§Compares women who have had either or both screening types with those who have had neither screening (that is, some screening versus none).
¶Adjusted for age, cars, housing tenure, highest level of education, National Statistics socioeconomic classification, ethnic group, and region.

WHAT IS ALREADY KNOWN ON THIS TOPIC

Breast and cervical screening has been shown to reduce mortality from cancer

The 2007 Cancer Reform Strategy places great emphasis on tackling inequalities in incidence, treatment, and prevention of cancer, including screening

Routine administrative data are a rich source of information on the coverage of each screening programme but cannot be used to ascertain inequalities according to individual sociodemographic characteristics

WHAT THIS STUDY ADDS

Survey data indicate that 84% of eligible women in Great Britain report having had both breast and cervical screening and 3% report never having been screened for either

Screening does not extend equally to all segments of the population; indicators of wealth are associated with greater use of breast screening, and ethnicity is the strongest predictor of cervical screening

Routine collection of additional sociodemographic information on patients in general practice would aid monitoring of inequalities in screening coverage and inform policies to reduce them

and most recent cervical smear. We excluded women who had had a hysterectomy from the analysis of time since most recent cervical smear.

Statistical analyses

We used supplied weighting factors and took into account the impact on standard errors of clustering of interviews within postcode sectors, stratification, and probability weighting. The analyses concerning only cervical screening included all women aged 40-74, as women are first invited for cervical screening in their 20s. However, we included only women aged 53-74 in the breast screening analyses; all women in this age group should have had at least one invitation for a routine mammogram. Analyses involving both screening types focused on women aged 53-74. The two women who did not state whether they had ever had a mammogram or a cervical smear were omitted from all analyses. Women with missing values on any of the sociodemographic variables were omitted from the regression analyses (35 women in total).

We used logistic regression to investigate relations between screening history and sociodemographic characteristics, including the number of cars/vans available to the household, housing tenure, highest level of education qualification, socioeconomic classification, ethnicity, and region of residence. The categories used were determined by the survey questions, although in some instances they were aggregated from the original categories because of small numbers. We adjusted regression analyses for age and sociodemographic characteristics. We present odds ratios adjusted for age only and fully adjusted odds ratios. Numerators and denominators given in the text and tables refer to the unweighted sample.

RESULTS

Ninety one per cent (2884/3183) of women aged 40-74 years reported ever having had a cervical smear, and 93% (1778/1919) aged 53-74 years reported ever having had a mammogram. We found similarly high rates in all age groups for each screening type, except for women aged 65-69 and 70-74 years among whom a much lower percentage reported ever having had a cervical smear (84% (330/391) and 81% (314/390)). One in 40 (52/1919) women aged 53-74 years reported never having had either breast or cervical screening, and 84% (1600/1919) reported having had both screening types. Only 1% (12/940) of women aged 55-64 reported never having had a mammogram or a cervical smear.

Cars available to the household (P=0.01) and housing tenure (P=0.002) were both significant predictors of ever having had a mammogram, after adjustment for age and sociodemographic factors (table 1). Women in households with one car had an odds of ever having had a mammogram 1.67 (95% confidence interval 1.06 to 2.62) times that of women in households with no cars, and those in households with two or more cars had an odds 2.65 (1.34 to 5.26) times that of women in households with no cars, after adjustment for all the other factors. Women who owned their home with a mortgage had an odds ratio of ever having had a mammogram of 2.12 (1.12 to 4.00), and those who owned their home outright an odds ratio of 2.19 (1.39 to 3.43), compared with women in rented housing. We found no significant associations between ever having had a mammogram and highest level of education, National Statistics socioeconomic classification, ethnicity, or region.

Only ethnicity was a significant predictor of ever having had a cervical smear after adjustment for age and sociodemographic factors (P=0.0005). White British women had an odds of ever having had a cervical smear 2.20 (1.41 to 3.42) times that of women of other ethnicity.

We combined the two types of screening to investigate women who were good overall screeners (table 2). Cars (P=0.006), housing tenure (P=0.04), and education (P=0.04) were significant predictors of having had both breast and cervical screening compared with having had only one or neither screening type, after adjustment for age and sociodemographic factors. Ethnicity was the only statistically significant predictor when we compared women who had had some screening with those who had had none (P=0.02). White British women had a fully adjusted odds ratio of having had some screening versus none of 3.01 (1.22 to 7.38) compared with women of other ethnicity.

Among the 1778 women aged 53-74 who had ever had a mammogram, 1553 (87.7%, 95% confidence interval 85.9% to 89.3%) had had their most recent mammogram as routine screening by the NHS Breast Screening Programme; a further 80 (4.3%, 3.4% to 5.4%) were non-routine referrals to the NHS, and 57 (3.5%, 2.6% to 4.6%) were follow-ups after treatment for breast cancer. Just under two thirds (1172/1919) of women aged 53-74 had had a mammogram in the previous three years, decreasing from 80% (154/198) of those aged 53-54 to 58% (223/391) in the 65-69 age group and 27% (108/390) in the 70-74 age group. Of women who had not had a hysterectomy, around three quarters of those in each age group from 40-44 and 55-59 years had had a cervical smear in

the previous five years and a further approximately 5% had one more than five years previously.

DISCUSSION

Using survey data from a representative sample of the population of Great Britain, this study shows, for both breast and cervical screening, high rates of ever having been screened. About three in every 100 women aged 53-74 reported never having had either screening type. Screening does not extend equally to all parts of the population. Women in households with a car were significantly more likely to have had a mammogram than those in households with no car, as were women in owner occupied housing compared with rented housing. These characteristics, which can be interpreted as indicators of household wealth (and possibly in the case of cars, mobility), were not found to be important for cervical screening. Here ethnicity was the most important predictor; white British women were significantly more likely to have had a cervical smear than were women in other ethnic groups.

Strengths and limitations of the study

This survey provides estimates of aspects of lifetime screening experience for all women in the age group concerned. The data are not affected by list inflation, and the individual and household sociodemographic data provide the opportunity to investigate inequalities in screening.

The survey data do have limitations. More than 30% of selected people in the surveys used in this analysis declined to take part or could not be contacted. Little information is available on the non-responders and how they differ from the responders. Weighting the data to Office for National Statistics population totals deals with aspects of non-response, but some bias may remain.

Although our study shows inequalities in screening, we cannot say whether these result from women being missed by the call-recall system, women failing to attend after invitation, or sociodemographic differences in recall bias or reporting. Some studies have suggested that self reported data overestimate screening rates, but most research in this area relates to Australia and the United States.[13 14] Our findings are unlikely to be attributable to differential reporting across sociodemographic groups, as we would then expect to see similar patterns for breast and cervical screening, which we do not see.

Our findings in relation to other studies

Our finding of lower rates of ever having had a cervical smear among women of ethnic groups other than white British is compatible with other studies that have indicated low rates among Asian women.[6 10] Our other findings are broadly in line with those from other studies, which indicate lower use of screening in more deprived areas and higher rates of cervical screening among more educated women.[5-8 10]

Although the lower cervical screening rate seen in our data among older women could result from underreporting of events in the more distant past, it is plausible that the rates are low in this age group. Women aged 65-74 in 2005 would have been in their 50s in 1990 when the screening programme became more comprehensive. Our estimates of the proportion of women who had had a cervical smear in the previous five years match quite closely the routine coverage statistics for 2006/7.[2] Our data and the routine statistics on women having a mammogram in the previous three years also agree quite closely.[1]

Our findings apply directly to Great Britain. The findings may be relevant in other settings, but we are not in a position to know.

Implications for practice and policy

In showing inequalities in screening, our study highlights the importance of ensuring that the provision and uptake of screening services reach all parts of the population. It shows that inequalities in screening are characterised by indicators of household wealth in the case of breast screening and ethnicity in the case of cervical screening and shows the need for information on patients' ethnicity and socioeconomic position to be collected routinely in general practice. This would facilitate the routine monitoring of coverage of screening among different ethnic and socioeconomic groups and could be used to inform policies to reduce inequalities in coverage.

The Omnibus Survey is carried out by the Office for National Statistics (ONS); the ONS Omnibus Survey team bears no responsibility for this analysis and interpretation of the data.

Contributors: See bmj.com..

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Competing interests: JP is director of the NHS Breast Screening Programme, and VB is chairman of the Advisory Committee on Breast Cancer Screening.

Ethical approval: Not needed.

1 NHS Health and Social Care Information Centre. *Breast Screening Programme, England: 2006-07*. Leeds: The Information Centre, 2008.
2 NHS Health and Social Care Information Centre. *Cervical Screening Programme, England: 2006-07*. Leeds: The Information Centre, 2007.
3 Raleigh VS. Collection of data on ethnic origin in England. *BMJ* 2008;337:645-6.
4 Fell G, Gregory L. *Equality review: national screening programmes: a scoping report for the National Screening Committee*. London: National Screening Committee, 2007.
5 Sutton S, Rutherford C. Sociodemographic and attitudinal correlates of cervical screening uptake in a national sample of women in Britain. *Soc Sci Med* 2005;61:2460-5.
6 Sabates R, Feinstein L. The role of education in the uptake of preventative health care: the case of cervical screening in Britain. *Soc Sci Med* 2006;62:2998-3010.
7 Banks E, Beral V, Cameron R, Hogg A, Langley N, Barnes I, et al. Comparison of various characteristics of women who do and do not attend for breast cancer screening. *Breast Cancer Res* 2002;4(1):R1.
8 Maheswaran R, Pearson T, Jordan H, Black D. Socioeconomic deprivation, travel distance, location of service, and uptake of breast cancer screening in North Derbyshire, UK. *J Epidemiol Community Health* 2006;60:208-12.
9 Moser KA, Naish J, Chambers MG. Cervical smear uptake rates [correction at *BMJ* 1994;309:674]. *BMJ* 1994;309:476-7.
10 Chiu LF. *Inequalities of access to cancer screening: a literature review*. Sheffield: NHS Cancer Screening Programmes, 2003. (Cancer Screening Series No 1.)
11 Ashworth M, Jenkins M, Burgess K, Keynes H, Wallace M, Roberts D, et al. Which general practices have higher list inflation? An exploratory study. *Fam Pract* 2005;22:529-31.
12 Office for National Statistics. Omnibus survey. www.ons.gov.uk/about/who-we-are/our-services/omnibus-survey/index.html.
13 McGovern PG, Lurie N, Margolis KL, Slater JS. Accuracy of self-report of mammography and Pap smear in a low-income urban population. *Am J Prev Med* 1998;14:201-8.
14 Bowman JA, Sanson-Fisher R, Redman S. The accuracy of self-reported Pap smear utilisation. *Soc Sci Med* 1997;44:969-76.

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Outcomes for births booked under an independent midwife and births in NHS maternity units: matched comparison study

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STUDY QUESTION What are the differences in clinical outcomes between women employing an independent midwife and comparable pregnant women using NHS services?

SUMMARY ANSWER Women using an independent midwife were more likely to have a spontaneous labour and unassisted vaginal delivery, were less likely to require pharmacological analgesia, had less perineal trauma, had a lower incidence of admission of infant to neonatal intensive care, and were more likely to breast feed. However, they also experienced a significantly higher perinatal mortality rate.

Participants and setting
Anonymised records for 8676 women (1462 booked under an independent midwife, 7214 under the NHS).

Design, size, and duration
We obtained an anonymised dataset for 2002-5 (n=1462) from the UK Independent Midwives Association (IMA). The Information and Statistics Division of the NHS in Scotland matched each IMA record with up to five NHS records on four variables: age, parity, year of birth, and socioeconomic status. We used the SMR02 and linked SMR dataset for neonatal deaths. Multivariable logistic regression models explored the relation between explanatory variables and outcomes, with analyses controlled for potential confounding factors and stratified to account for matching. The main outcome measures were unassisted vertex delivery, live birth, perinatal death, onset of labour, gestation, pharmacological analgesia, labour duration, perineal trauma, Apgar scores, admission to neonatal intensive care, and infant feeding.

Main results and the role of chance
The rate of unassisted vertex delivery was significantly higher in the IMA cohort (77.9% *v* 54.3%), as was perinatal mortality (1.7% *v* 0.6%). The rate of home birth was higher (66.0% *v* 0.4%), and spontaneous onset of labour was more common (96.6% *v* 74.5%). Fewer IMA cohort mothers used pharmacological analgesia (40.2% *v* 60.6%). They were less likely to sustain perineal trauma (47.1% *v* 52.4%) and more likely to breast feed (88.0% *v* 64.0%). Prematurity (4.3% *v* 6.9%), low birth weight (4.0% *v* 7.1%), and admission to neonatal intensive care (4.4% *v* 9.3%) were all lower in the IMA cohort.

Exclusion of "high risk" cases from both cohorts showed a non-significant difference in perinatal mortality (0.5% *v* 0.3%); the "low risk" IMA perinatal mortality is comparable with that in other studies of low risk births. "High risk" mothers in the IMA cohort had a significantly higher perinatal mortality (4.4% *v* 1.4%).

Bias, confounding, and other reasons for caution
This was a retrospective study. The IMA believed its database accounted for about 70% of births booked under an independent midwife but was confident that participating midwives had not excluded any perinatal deaths. Different models of care (for example, affecting continuity rates) might help to explain different outcomes.

Generalisability to other populations
The way in which independent midwives are employed in the UK may not be generalisable to other countries. Services for home and hospital birth are not standardised.

Study funding/potential competing interests
This project was fully funded by a grant from the East of Scotland Research Network. CW was formerly a full member (and is now an honorary member) of the IMA.

CLINICAL OUTCOMES FOR PREGNANCIES IN NHS AND IMA COHORTS

Variable	No (%) in IMA	No (%) in NHS	Adjusted OR (95% CI)*
Unassisted vertex delivery	1139 (77.9)	3918 (54.3)	3.49 (2.99 to 4.07)
Spontaneous onset of labour	1405 (96.6)	5365 (74.5)	10.43 (7.74 to 14.0)
Pharmacological analgesia	588 (40.2)	4370 (60.6)	0.42 (0.38 to 0.47)
Perineal trauma (any)	688 (47.1)	2565 (52.4)	0.55 (0.48 to 0.64)
Breast feeding	1286 (88.0)	2759 (64.0)	3.46 (2.84 to 4.20)
Preterm <37 weeks	63 (4.3)	498 (6.9)	0.49 (0.35 to 0.69)
Admission to neonatal ICU	65 (4.4)	667 (9.3)	0.43 (0.32 to 0.59)
Perinatal death :			
All babies	25 (1.7)	46 (0.6)	5.91 (3.27 to 10.7)
"Low risk" mothers	5 (0.5)	18 (0.3)	2.73 (0.87 to 8.55)
"High risk" mothers	20 (4.4)	28 (1.4)	13.8 (5.75 to 33.3)

Odds ratio >1.0 indicates association with IMA mothers; <1.0 indicates association with NHS mothers
**Adjusted for previous conditions, previous obstetric complications, gestation, presentation, induction, pharmacological analgesia; for non-mortality outcomes, also adjusted for duration of labour, low birth weight, Apgar score <7, twin births*

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Statin use and risk of community acquired pneumonia in older people: population based case-control study

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STUDY QUESTION Do hydroxymethyl glutaryl coenzyme A reductase inhibitors (statins) decrease the risk of community acquired pneumonia (as their known anti-inflammatory and immunomodulatory effects might suggest)?

SUMMARY ANSWER Use of statins was not associated with decreased risk of pneumonia among immunocompetent, community dwelling older adults.

Participants and setting
Adults aged 65-94 who were members of Group Health, an integrated healthcare delivery system, with at least two years of continuous membership, who were living in the community and not immunosuppressed.

Design, size, and duration
This was a population based case-control study. We identified presumptive cases of ambulatory and inpatient community acquired pneumonia in 2000-3 on the basis of ICD-9 codes associated with medical encounters and validated these by review of medical records (n=1125). We selected 2235 controls from the source population by using incidence density sampling and matched them to cases on age, sex, and calendar year of diagnosis. We assessed inclusion and exclusion criteria from electronic data and detailed review of medical records.

Primary outcome(s), risks, exposures
We ascertained current statin use from computerised pharmacy data, defining it as receipt of at least two prescriptions in the six months before the date of diagnosis of the case. Information on comorbid illnesses and functional and cognitive status, potential confounders of the association between statin use and risk of pneumonia, came from medical record review and computerised pharmacy data.

Main results and the role of chance
Statin use occurred in 16.1% (181/1125) of cases and 14.6% (327/2235) of controls (adjusted odds ratio 1.26, 95% CI 1.01 to 1.56). It occurred in 17.2% (68/395) of cases admitted to hospital and 14.2% (112/788) of their matched controls (adjusted odds ratio 1.61, 1.08 to 2.39, compared with non-use). In people in whom statins were indicated for secondary prevention, the adjusted odds ratio for pneumonia risk in relation to statin use was 1.25 (0.94 to 1.67); in those with no such indication, it was 0.81 (0.46 to 1.42). Results were robust to a variety of sensitivity analyses, including alternative definitions of exposure.

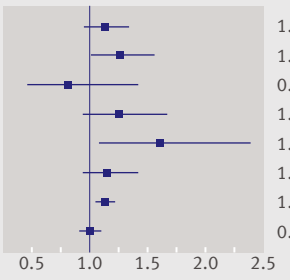
Bias, confounding, and other reasons for caution
Potential for residual confounding by unmeasured characteristics exists, although we made extensive efforts to measure and account for characteristics including comorbidity and functional and cognitive status. Misclassification of exposure could have occurred if participants presented prescriptions outside of Group Health pharmacies or presented a prescription but did not actually take the drug.

Generalisability to other populations
Because this study focused on community acquired pneumonia in a relatively healthy elderly population, we cannot answer the question of whether statins may be beneficial in a sicker, more frail population. The study population was predominantly white.

Study funding/potential competing interests
SD was funded by a Paul Beeson Career Development Award from the National Institute on Aging. The Beeson award is also supported by the Hartford and Starr Foundations and Atlantic Philanthropies.

RISK ESTIMATES FOR ASSOCIATION BETWEEN STATIN USE AND COMMUNITY ACQUIRED PNEUMONIA: SENSITIVITY ANALYSES

Model	Cases	Controls	Odds ratio (95% CI)
Primary analysis (minimally adjusted)	1125	2235	1.13 (0.95 to 1.34)
Primary analysis (fully adjusted)	1125	2235	1.26 (1.01 to 1.56)
No indication for statin use for secondary prevention (fully adjusted)*	360	504	0.81 (0.46 to 1.42)
Indication for statin use for secondary prevention (fully adjusted)*	492	649	1.25 (0.94 to 1.67)
Cases admitted to hospital only (fully adjusted)	395	788	1.61 (1.08 to 2.39)
Alternative definition for "current" statin use (fully adjusted)†	1125	2235	1.15 (0.94 to 1.42)
Cohort analysis (minimally adjusted) – no restriction of cohort	5021	NA	1.12 (1.03 to 1.21)
Cohort analysis (fully adjusted) – restricted cohort‡	3712	NA	0.99 (0.90 to 1.09)



NA=not applicable. *Indication for secondary prevention defined as presence of at least one of congestive heart failure, stroke, diabetes, history of myocardial infarction or coronary revascularisation, or other heart disease. †On basis of days' supply of most recent filled prescription. ‡All restrictions and adjustments based on administrative and pharmacy data.

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