Person, place and the geographies of problem drinking : a multilevel comparison of England and Québec

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Abstract

Problematic levels of alcohol drinking have been implicated in many health problems and constitute a key indicator of health care need. The delivery of health care programmes to address problem drinking need to take account of the specific social and geographical characteristics which influence drinking behaviour. These characteristics can vary markedly. Previous research has suggested that drinking behaviour in England exhibits marked regional dimensions with heavy drinking being concentrated in metropolitan and industrial areas. Similarly, research in Canada has identified problem drinking in communities inhabited by native and Inuit communities. The English research suggests that these regional variations remain even after taking account of individual, person-level, influences on drinking behaviour. It is not however clear whether this is also the case in other societies. This paper examines this issue, presenting cross-national research using multilevel models to compare and contrast the dimensions of problem drinking in England and Québec. Two models are constructed using matched predictor variables and established measures of drinking behaviour. Both are based on large, representative official datasets: the Health Survey for England 1994 and the Québec Health and Social Survey 1993. The hierarchical structures of both datasets allow account to be taken of both individual person-effects and place (local or regional) effects on problem drinking behaviour. The paper's conclusions stress the differences and similarities between problem drinking behaviour in the two societies and comment on the appropriate scale for policies to address alcohol-related health inequalities.

Introduction

It is commonplace to assert that resource allocation policies often fail to operate at an appropriate spatial scale. In particular, their operational scales may be relatively crude; there may be greater variation within the spatial unit to which resources are allocated than there are between those units. Allocation to relatively large spatial units may « average out » or obscure considerable internal variations in need. The choice of operational scale is thus important. In practice it is frequently determined by organisational logic rather than any underlying geography of need as in the case of the original English Resource Allocation Working Party (RAWP) which worked at the spatial level of the regional health authority (RHA), at the time a key tier in the management of the NHS but, at the same time, with just fourteen authorities, a rather crude basis for the capture of need variations across England (Mays and Bevan 1987).

This paper addresses the question of an appropriate scale for resource allocation. Consideration is limited to the specific case of alcohol services. This limitation is, in large part, to ease the exposition of points concerning the importance of spatial scale ; no real world resource allocation policy would consider one service area in isolation. At the same time however, alcohol services are an important element of health policy, being implicated in the prevention and treatment of much morbidity and the subject, in some settings, of hypothecated budgets. The paper examines the question of appropriate scale in two contrasting settings: England and Québec. The choice of these two settings reflects the expertise of the authors and data availability but is also grounded in comparative logic : the investigation of the nature of difference - appropriate scales for resource allocation and, indeed, appropriate need indicators should not be expected to be globally or culturally uniform.

In the following section attention focuses on the current policies for resource allocation in England and Québec. Resource allocation flows are compared and contrasted with specific consideration given to the derivation of resourcing for alcohol services. The paper then reviews the data sources used in the subsequent analysis of drinking. We consider Québecois and English « performance » with regard to two standard measures : consumption (units) and self-defined problem drinking (CAGE scores). The main substantive section of the paper introduces setting-specific multilevel models as a basis for identifying both appropriate scale and comparative differences in problem drinking.

1. Resource Allocation Flows

Figure 1 summarises the resource allocation policies of Québec and England. While there are some similarities, there are also clear differences (Pampalon et. al., 1995). The similarities relate to the area basis of resource allocation, at least in the initial allocations from the « centre » ; the region/district level also involves areas of roughly equivalent population. The differences are rather more marked. Two points stand out. First, resource allocation in Québec integrates health and social care. In the case of alcohol services this is an important matter ; much alcohol-related morbidity will require social care either for the individual with an alcohol-related problem or for his/her carer. In England health and social care budgets are separate and subject to different resource allocation systems. Second, the Québec system also has a specific budget for alcohol and drug misuse services. This budget is determined by the resource allocation process. In contrast, in England, such a hypothecated budget does not exist, district health authorities will, of course, allocate resources for the NHS aspects of alcohol and drug misuse, but their allocation mechanisms will reflect local decision-making ; while many may consider need some may lean more to historically-determined incrementalism.

Figure 1: Resource Allocation

QUÉBEC	ENGLAND
Ministry of Health and Social Services	Department of Health
⇩	⇩
Regional Boards of Health and Social Services	District Health Authorities
⇩	⇩
Local Health and Social Services Specific budgets for local alcohol and drug misuse services	Service Agreements (Possibly) specific contrats for alcohol services

In both Québec and England sub-region/district allocation of resources takes place. In Québec this is driven by the resource allocation formula. In England it is effectively driven by the operation of the internal market purchaser-provider split introduced by the Conservative government in 1989 and inherited by the present New Labour administration. This management arrangement involves contracts or agreements between DHAs, who have received resources via the allocation formula, and service providers (hospitals, community services or primary care). Among the contracts which DHAs place would be those for alcohol services; while DHAs are charged with assessing and meeting the needs of their whole population, the question remains the extent to which those needs are uniform across the DHA area. While the sub-regional allocation in Québec indicates an assumption that this is not the case, the contracts/agreements in England are generally for district-wide services.

At present the resource allocation mechanism in Québec seems stable. The same cannot be said for the English system. Continued adjustment has been a hallmark of the system, particularly since the introduction of the internal market. While it is not possible at this stage to be absolutely certain how political decisions will evolve, it would seem likely that there will be greater formulaic direction of resources to smaller spatial units (Bevan 1997). Though DHAs are presently the key player in the process, the evolution of Primary Care Groups and the need for transparent resource allocation to these units is likely to enhance the case for sub-district resource allocation.

2. Data sources

We now turn to an outline of the sources used to investigate the geographies of problem drinking in Québec and England. We will consider the chosen sources for each geographical setting and reflect upon comparative differences in alcohol consumption and self-defined problem drinking. The chosen sources were both selected as fulfilling three general conditions. Each was expected to be routinely available and georeferenced to permit the identification of sub district/region variation. Each was also expected to be large in terms of the number of respondents and to feature a clear and sound sampling design. Finally, each was to be both of recent vintage and subject to regular repetition. The selected sources were the 1992-1993 Québec Health and Social Survey (Enquête Sociale et de Santé 1992-1993) and the 1994 Health Survey for England.

The Québec Health and Social Survey (QHSS) is an exhaustive survey which was conducted on the population of Québec as a whole with a view to collecting national and regional information on health and various social problems, and other related factors (Santé Québec, 1995). It was commissioned by the Ministère de la Santé et des Services Sociaux and its regional and sectorial partners, the regional health and social service boards, and their public health departments. The primary aims of the survey were to follow-up the 1987 general health survey, ensure regional representativeness, and address new issues, namely social aspects of health-related problems. The target population comprised all private households in health and social service regions across Québec with the exception of the Cree and Inuit regions and Indian reservations. The survey was conducted using a stratified two-stage sampling plan. The strata corresponded to subdivisions of the health and social service regions : urban or rural, socio-economic advantaged or disadvantaged area (n = 37). Within each strata, a proportional random sample of Primary Sampling Units (PSU) was selected. Each PSU corresponded to one or a combination of census enumeration tracts whose population rarely exceeded 200 households. Within each PSU, a systematic sample of households was drawn from a random starting point. All persons living in these households were surveyed. In total, 23 564 individuals aged 15 or over filled out a self-administered questionnaire (response rate = 85%) and among these individuals 22 111 completed the questions about their drinking behaviour.

The 1994 Health Survey for England (HSE) is the fourth wave of an annually-repeated cross-sectional survey. It uses a multi-stratified design to attempt interviews with around 16 000 individuals in 10 000 households and is deemed to be a representative sample of the English population (Colhoun and Prescott-Clarke, 1996). It is commissioned by the Department of Health and is used to monitor trends in the nation's health, estimate the proportion of the population with specific health conditions and investigate the prevalence of associated risk factors. Emphasis is also placed on facilitating the investigation of reported differences between population sub-groups. The survey is also used by the Department of Health to monitor progress towards some of the *Health of the Nation* (Department of Health, 1992) targets particularly in the areas of obesity and blood pressure. A similar set of questions relating to core topics are asked each year and questions on alcohol consumption and drinking behaviour make up part of this core. In total, approximately 15 800 individuals in the 1994 HSE supplied information on their drinking behaviour. The primary sampling unit for the survey is the postcode sector. These geographical areas, used in the

administration of the UK postal services, contain around 6 500 people. In the HSE, 720 postcode sectors are selected (with a probability proportional to the total number of delivery points) from a list stratified according to regional health authority, the percentage of elderly population, percentage of households with no car, percentage male unemployment and the percentage of the adult population who are non-white. Addresses are then systematically selected from each PSU via the « Postcode Address File » (PAF).

In the Québec Health and Social Survey, two questions refer to the amount of alcohol consumed. First the respondent is asked whether they have consumed any alcoholic beverages in the past 7 days. If the answer is « yes », the respondent is asked to state how much alcohol has been consumed in this same time period. The information is converted to units consumed whereby a unit is equivalent to a small bottle of beer, a small glass of wine or a small shot of hard liquor or spirits, with or without mix. In the 1994 Health Survey for England an attempt is made to ask all adults (+16) in the household questions relating to their drinking behaviour. The schedules which individuals are asked to complete are fairly detailed in terms of the varying frequencies different types of alcoholic beverage are consumed. Respondents are asked to think back over the last 12 months and indicate which drinks have been consumed in any one week and then provide information of the amounts consumed in any one day. From these responses a weekly « unit » score is produced whereby units are defined in a similar manner to those in the Québec survey.

There are stark differences in drinking behaviour between Québec and England. Over 22 000 individuals were interviewed for the QHSS but only 844 (3.9%) were found to be consuming above the recommended « safe » number of weekly units (21 for a man, 14 for a woman). In England, the proportion is much higher at almost one-fifth (n=3021) of the adult respondents. Although some of these differences can be attributed to variations in the question wording and the time spans used for drinking behaviour recall, there is evidence to suggest that such large differences do exist between nations in terms of their levels of alcohol consumption (see e.g. Skog, 1985) and they are not simply an artefact of different survey mechanisms.

To allow for a fuller understanding of cross-national comparisons in drinking behaviour, survey responses for CAGE scores were also analysed. The CAGE score is based on four questions referring mainly to people's own feeling about their drinking behaviour. These questions were developed by the Centre for Alcohol Studies in North Carolina, USA (Ewing, 1984). The questions have been further adapted and are now used widely either in clinical examinations or general household-based social surveys. Two or more positive responses to these questions are sufficient to raise suspicion of alcoholism. A comparison of CAGE responses for England and Québec provide further evidence of difference now translated to a subjective notion of self-assessed problem drinking. In England 5.4% of respondents (n=673) had two positive answers or more while in Québec the level rose to 13.7% (n=3029). Comparing this information with that provided through the « objective » questions relating to actual consumption, it would seem that there are stark cultural differences relating to drinking behaviour - and attitudes to that behaviour - between the two chosen settings.

3. Modelling Framework

Attention now turns to modelling drinking behaviour in Québec and England. Multilevel methods - as opposed to traditional techniques - were employed because they allow for the simultaneous consideration of individual and ecological or areal factors in the explanation of drinking behaviour. Furthermore, the techniques are technically superior when modelling clustered data such as that generated from multi-stage samples (Jones, 1992). Such surveys are inherently autocorrelated and with traditional techniques this may result in the generation of biased standard errors. In contrast, multilevel techniques take into account the autocorrelation during the modelling process and the standard errors are adjusted accordingly. For a fuller description of the general concepts underlying these techniques with worked examples see Goldstein (1995). Duncan *et. al.* (1993;1996) provide

examples of their use within the arena of health-related behaviour whilst Rice and Leyland (1996) provide a useful review of multilevel models in health services research.

It has already been indicated that CAGE is not an adequate means of measuring « problem » drinking for English residents whilst the number of units consumed is not appropriate for the people of Québec. Two different response variables were therefore used to investigate problem drinking. For Québec this is whether an individual scores 2 or more on the CAGE questions and is therefore a « yes/no » dichotomy. A dichotomous response is also used for modelling the HSE data but this time it is applied to whether the individual is consuming above the number of safe recommended weekly units. The individual explanatory variables used were sex, age (categorised into 7 groups) and marital status (married/cohabiting or single) and their main interactions. A relatively restricted set of individual explanatory variables was used in order to provide an analogy with age-sex standardisation while retaining scope for significant residual variation at the higher levels at which resource allocation policies operate. The multilevel structure for the QHSS data is 22, 111 individuals nesting in 1841 census tracts, nesting in 37 regional sub-divisions and for the HSE this is 15, 759 individuals within 712 postcode sectors in 177 DHAs. Although there is evidence to suggest that the level of household is an important element in multi-level analyses of alcohol consumption (Rice *et. al.,* 1998) it has not been included here for a number of technical and academic reasons (see Endnote).

A number of ecological variables were also included in the analyses and, whilst an attempt was made to try and keep these consistent between the two models, differing definitions did not always allow for this. What appeared to be statistically significant in the English model was not necessarily so in the Québec model. For England the significant ecological variables assigned at the PSU level were the percentage of households with 2 or more cars, the percentage of households which were private rented and the percentage of households categorised as Social Class I or II. For Québec, the significant ecological variables at the census tract level were the proportion of non-married people (single, separated, divorced or widowed), those speaking French or English at home and those working in the tertiary sector (services).

The technique of contrast coding was used to include all dummy variables in the multilevel models. This simply means that the constant term in the fixed results represents the stereotypical individual. In this case this is a woman aged between 25 and 34 and is married (or cohabiting). The differential effect for being (say) male or single, or male and single in a particular age group can then be estimated by the modelling process. Furthermore, due to the fact that the ecological percentage values were centred around either their QHSS or HSE average, the results of the constant term in the fixed part of the model represents the logit of being an « unsafe » drinker for the stereotypical individual (i.e. a woman, aged 25-34 and married) living in an area where the ecological variables are at their average. Again the results provided for the ecological variables allow investigation of the effect upon the stereotypical individual when the ecological variables are above or below their national averages.

4. Results

The MLn software (Rasbash and Woodhouse, 1996) and appropriate macros for the analysis of a dichotomous response (i.e. a logistic binomial model) were used to generate the final multilevel models The results from both the England and Québec models are shown in Table 1. The figures are reported as logits and these can be transformed back to proportions to aid in the interpretation of results (i.e. to work out the percentage who are likely to be « unsafe » drinkers in terms of units or suspicion of alcoholism via CAGE scores). Thus when the logits for the constant term are transformed it can be shown that there is a 12% chance that the survey «stereotype», a married woman, aged 25-34 will be consuming above the safe recommended limits in England and a 4.8% chance that a similar person will be scoring high on CAGE in Québec. The effect for a male can be

determined by finding the antilogit of the sum of the constant term and male term : the chances rise to 28% in the English model and 18% in the Québec model. From the results it can generally be seen that being young, male and single increases the risks related to drinking behaviour.

The ecological estimates for the HSE model show that living in PSUs with a high percentage of households with two or more cars increases the chances of drinking heavily as does living in an area with a high percentage of private rented tenure or a high percentage of high social class households. However, the cross-level interactions for this model show that some of these ecological effects are reduced for males in areas with a high percentage of social class 1 or 2 households or males in areas with a high level of private rented tenure. In contrast, being single in an area with a high private-rented tenure increases the chances of drinking above the safe limits. For the QHSS data being in an area with a high percentage of households speaking French and areas where a high percentage speak English increases the likelihood of scoring high on CAGE - as does living in areas where a high percentage are employed in the tertiary sector. Being in an area with a high percentage of non-married people has the opposite effect and reduces this likelihood. Cross-level interactions show that non-married individuals in areas with a high level of tertiary workers reduced the chances of scoring high whilst non-marrieds living in areas with a high percentage of non-married people increases the likelihood.

These models are relatively simple and in multilevel modelling terms only the variance components models have been generated. This means that places at each higher level have been allowed to vary only in terms of their intercepts. There is no assumption of differing age-drinking relationships or marital status-drinking relationships across places. The place specific slopes are constant but may start from a different overall base (i.e. a different intercept). Multilevel modelling techniques allows the intercept differential or « residuals » for each place at each level to be generated. This represents the differences between places which cannot be explained by the fixed variables or « composition » of an area. The variances for both the level 2 and level 3 differentials for both the Québec and England models are significant. Whilst the « composition » variables have explained some of the geographical variation in « unsafe » drinking or « high » CAGE scores, there still remains significant variation at both the postcode sector (estimate = 0.1378, standard error= 0.02656) and census tract level (estimate= 0.06538, s.e. = 0.02175) for England and Quebec respectively. The variation remaining at the DHA and regional sub-division level, although significant, is less than the level 2 variation. To explore this further, the level 2 residuals can be plotted against higher level geographies. Examples of these plots are shown in Figures 2a, 2b and 2c.

In Québec administrative regions extended lines and stars within regions indicate important local area (cencus enumeration tract) variations within both rural and urban sub-regions. In urban areas this variation resolves to reasonably similar sub-regional means (Figure 2a). Between sub-regional variation appears to be slightly higher in rural Québec (Figure 2b).

Figure 2a : Residuals withinQuebec rural sub-regions

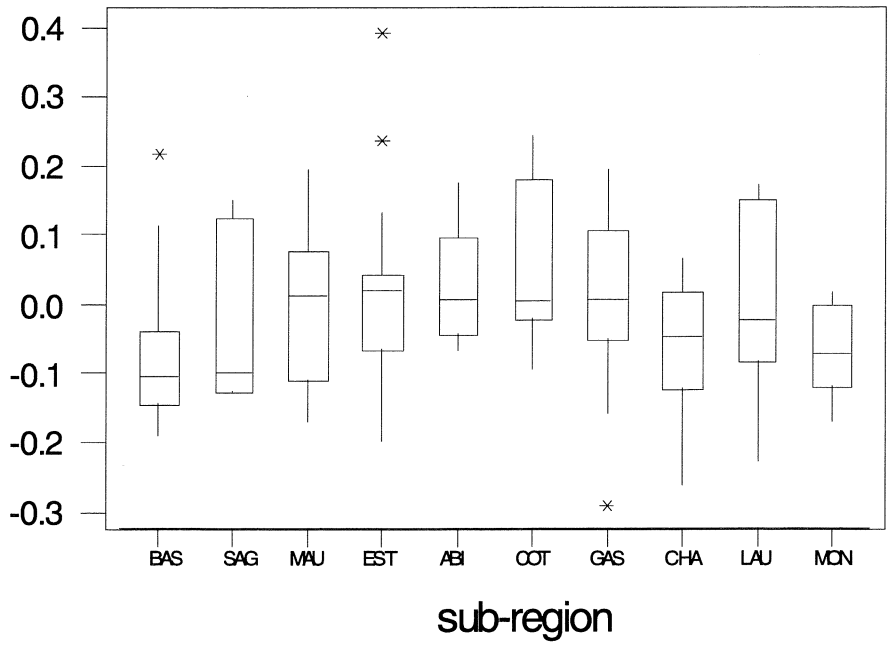
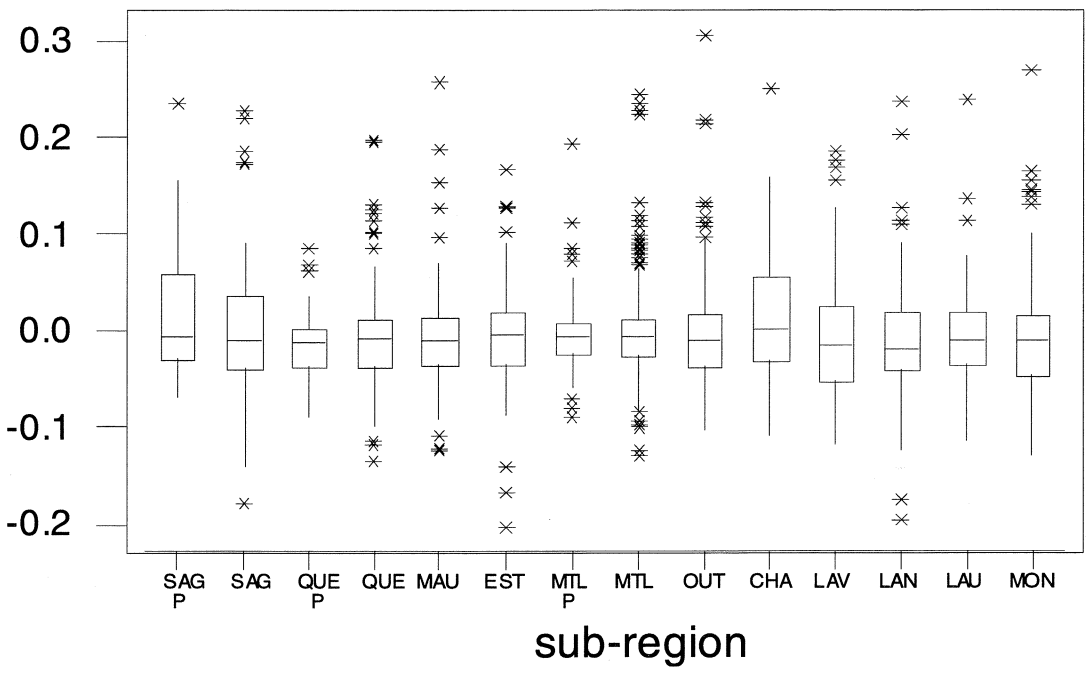
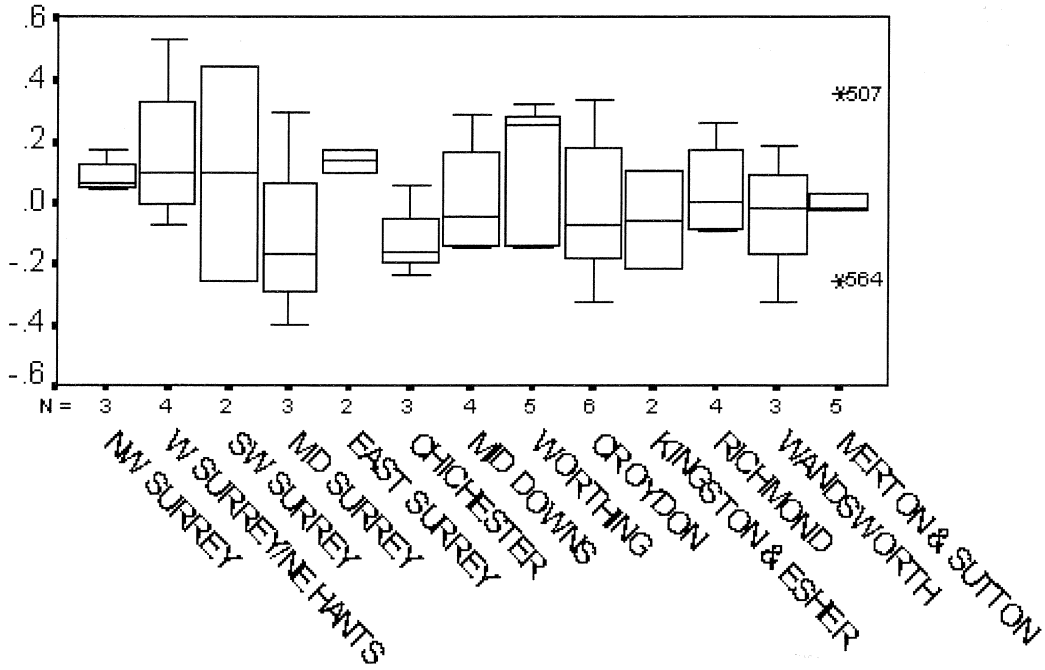


Figure 2b : Residuals for Quebec Metropolitan Regions



The HSE reveals similar results (Figure 2c). Taking the former South-West Thames RHA as an example and focussing on its constituent district health authorities, the areas to which resources are presently directed, it is clear that there are PSUs within each district where drinking is substantially different from the district mean. It is however also evident that district means vary substantially as anticipated by the current general resource allocation formula.

Figure 2c: Residuals within South West Thames RHA



Conclusions

By working with individual-level survey data it becomes possible to explore in greater detail the implications of resource allocation processes. In this case-study it is clearly evident that drinking behaviour is characterised by variation at a relatively localised geographical scale. There is more variation within than between districts/regions. Improvements to resource allocation policies need to progressively begin to take account of such localised variation. The multilevel framework also enables resource need to be seen in the context of both individual and contextual factors ; while resources should ideally be allocated on the basis of simple need, there is a case, in an era of fiscal restraint, for focussing resource allocation on areas which depart significantly from predicted values derived from contextualised models using known determinants of need.

The paper also underlines the importance of cultural context in considering needs-based resource allocation. The differing utility of units and CAGE as measures of need in the chosen case-study settings acts as a salutary reminder that need indicators are not constant across different settings. While, interestingly, the magnitudes and signs of the coefficients for the level-one explanatory variables were remarkably similar for both units and CAGE, the paper indicates clear lessons for comparative analysis as well as for the advisability of taking account of cultural differences when choosing indicators to guide resource allocation.

Endnote

Whilst acknowledging the possible importance of « household cultures of drinking » this spatial level has not been included in the multilevel models here for several reasons. First, there remain technical difficulties in estimating the random part for a binomial logistic model with household as level 2. When drinking behaviour is measured on a safe/unsafe dichotomy, the assumption of normality is unlikely to exist at the household level. The problem is further complicated by the fact that there exists a high proportion of one person households in both the HSE and the QHSS. It therefore becomes very difficult to separate out between - and within - household variation because of the confounding across levels 1

and 2. Indeed, if an unconstrained logistic model is run with individuals at level 1 and households at level 2 then apparent severe under-dispersion occur at level 1. With a continuous response, the assumption of normality is not so severe a problem however the difficulties of confounding the level 1 and level 2 variation still remain, especially when the proportion of one person households is high. Apart from these technical problems, there are also substantive reasons for not including this level in a model concerned with exploring small area differences in problem drinking for the purpose of resource allocation. In a correct model, the overall effect of including the level of household is to reduce variation at the higher levels. However, because resource allocation does not occur at the household level, then it may be appropriate to allow these higher level differences to exist even if some of their variation can be explained by household differences. These higher areal settings may be considered as appropriate divisions with which to consider the sub-regional or sub-DHA allocation of funds.

Table 1: Fixed Part Results for QHSS and HSE

	QHSS	HSE
CONSTANT	-2.966*	-2.037*
MALE	1.444*	1.113*
SINGLE	1.05*	0.4234*
16-24	-1.123	-0.142
35-44	0.2796	0.1405
45-54	0.05982	-0.01194
55-64	-0.3985	-0.258
65-74	-1.002*	-0.6332*
75+	-2.014*	-0.6759*
MALE16-24	1.312	0.1962
MALE35-44	0.01455	-0.1565
MALE45-54	0.1212	-0.03455
MALE55-64	0.3558	-0.1211
MALE65-74	0.4005	-0.1168
MALE75+	0.9753	-0.6932
SINGLE16-24	0.7713	0.1767
SINGLE35-44	-0.06504	-0.16
SINGLE45-54	-0.5749*	-0.1071
SINGLE55-64	-0.8712*	-0.8222*
SINGLE65-74	-1.553*	-0.5524*
SINGLE75+	-1.878	-1.074*
SMALE15-24	-1.477	-0.4336
SMALE35-44	-0.07371	-0.1837
SMALE45-54	0.3728	0.1682
SMALE55-64	0.4744	0.357
SMALE65-74	1.134	0.3423
SMALE75+	0.8775	0.8638
SINGLEMALE	-0.5669*	0.07103
Ecological and cross level variables		
%2CARHHOLDS		0.005136*
%PRIVATERENT		0.005574*
%1/2CLASS		0.007886*
%NON-MARRIED	-0.005412*	
%FRANCOPHONE	0.01608*	
%ANGLOPHONE	0.01555*	
%TERTIARY	0.008285*	
MALE%CLASS1/2		-0.007472*
MALE%PRIVRENT		-0.008985*
SINGLE%CLASS1/2		-0.006316*
SINGLE%PRIVRENT		0.008062*
SINGLE%SINGLE	0.01667*	
SINGLE%TERTIARY	-0.009467*	

* These estimates are more than twice their standard error and are therefore considered to be statistically significant

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