The relativity of relative risks: disadvantage or opportunity?

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Psychiatric epidemiologists use many tools, such as relative risks and the related odds ratios, that were developed to study chronic somatic disease. Cancer epidemiologists identify as a major advantage of relative risks that, when appropriately adjusted for confounding and effect modification and the individual level,

> they provide stable measures of association in a wide variety of populations. When there are differences in the effect of exposure for different populations, it is often true that exposure levels are not the same, or that there are biological reasons for the discrepancies in response to the same exposure (Breslow & Day, 1980).

This may apply in cancer epidemiology, but the special nature of the risk factors and outcomes studied by psychiatrists (and also by those concerned with infectious disease) suggests a more substantial role for the sociocultural, environmental and epidemiological contexts in which individuals fall ill. In psychiatric epidemiology relative risks are often conditional, depending first on the 'overall community's mental health' (Rose, 1989) and second on individuals' 'competing' risks. This limits their applicability outside the original study groups. However, increased attention by psychiatric epidemiologists to the origins of this variability may give new impetus to social psychiatric research and practice, and stimulate interdisciplinary liaison.

THE OVERALL MENTAL HEALTH OF POPULATIONS

The relative risk can be calculated if the joint distribution of outcome and exposure in the study population is known. Overall prevalences, reflecting the population's global (mental) health, do not enter the equation.

Disease risk may depend on disease prevalence

Most analyses that generate relative risks are based on the premise that disease incidence is not influenced by its prevalence. Phrased differently, it is – often implicity – assumed that individuals' disease risk is independent of how many others are ill (Koopman & Longini, 1994). This does not apply in infectious disease epidemiology, where the risk of inter-individual transmission (contagion) increases as infection becomes more widespread. Some mental disorders also have contagious qualities. The risk of recruitment into substance misuse depends not only on personal susceptibilities but also on the existing prevalence of substance misuse (Petronis & Anthony, 2000). Similar processes, related to peer-group pressure, imitation, modelling and socialisation, may be at work in delinquency and suicidal behaviour.

Contagion depends on patterns of mixing between affected and non-affected individuals and can have profound effects on apparent links between risk factors and diseases. For instance, impulsivity is associated with an increased risk of alcohol dependence. However, this may be partly attributable to the fact that impulsive individuals are more likely than others to select social environments where alcohol use is encouraged. In that situation, the overall link between impulsivity and alcohol dependence has an indirect component mediated by transmission effects. When overall levels of drinking increase, inter-individual transmission will generate relatively more cases of problem drinking among the majority of non-impulsive individuals. This implies that relative risks associated with personal characteristics – in this example, impulsivity – will often decline as the prevalence of the outcome in question rises.

Disease risk may depend on exposure prevalence

Risk–outcome associations in individuals depend not only on the number of ill people in study groups but also on the number at risk. This is known as ecological effect modification. Among other examples, it has been described for the link of ethnicity with suicidal behaviour (Neeleman & Wessely, 1999) and schizophrenia (Boydell *et al*, 2001), and that of depression with cocaine use (Weiss *et al*, 1998). Generally, the strength of relative risk varies inversely with the risk factor's prevalence. Members of ethnic minority groups living in areas where they represent a larger part of the population have a lower suicide risk than others (Neeleman & Wessely, 1999); cocaine use is associated more strongly with depression when or where this habit is rare (Weiss *et al*, 1998).

Selection effects may account for this phenomenon, since the most vulnerable are more likely than others to become exposed to relatively rare psychosocial risk factors. Causal effects are also possible since the negative consequences of being in undesirable or risky situations generally increase when they are a minority experience. This is known as deviancy amplification (Halpern, 1995); stigmatisation, loss of social control, erosion of social networks and poor social integration associated with minority status may account for it. A comparable phenomenon occurs with respect to the link between attitudes and beliefs (e.g. regarding the acceptability of suicide or drug use) and mental health outcomes, but in this case its direction may vary. Attitudes can have a greater impact on behaviour when shared with a larger majority and also when held in the context of smaller, tightly knit (religious) communities. In both cases informal behavioural restraints can become officially sanctioned norms, a mechanism called formalisation of restraints (Halpern, 1995).

Disease risk depends on the risk of other diseases

A person cannot die of suicide *and* accidental death. Morbidity or mortality categories can exclude (compete with) each other in real life, and also artificially, as a result of diagnostic exclusion criteria that do not allow syndromes to co-occur freely. Exclusion also occurs in single-outcome epidemiological studies when persons who do not fulfil exact outcome criteria (e.g. because of comorbidity or somatic problems) are excluded. When competing outcomes share risk factors, which is common, observed (extrinsic) risks underestimate 'real' (intrinsic) risks since the exposed

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are not 'able' or 'allowed' to develop more than one outcome. This has important but largely overlooked implications for the interpretation of single-outcome studies (the majority), the conceptualisation of co-morbidity, and the understanding of health differences between populations and individuals. Consider, for example, recent debates over the wisdom of maintaining people with opiate addiction on methadone. Relatively high overdose mortality rates among those prescribed methadone have generated concern. However, this should be offset against the far higher mortality due to other causes among addicted people not receiving methadone.

The dependence of a person's risk of one outcome on that of the other risks that the person also faces affects the stability of relative risks, especially when the mutually competing outcomes share determinants. The observed link of such determinants with an outcome of interest will be weaker in study groups or periods with higher base rates of competing diseases, and stronger in those with lower rates.

TURNING DISADVANTAGE INTO OPPORTUNITY

Relative risk is not a stable measure of associations in most epidemiology and in psychiatric epidemiology in particular. It often depends on how sick the study population is, in terms of disease and risk factor levels, and on the other jeopardies that individuals face. This prevents simple application of research findings outside the original study groups, which may be considered a disadvantage. Relative risks, and population-attributable fractions derived from them, are increasingly used to estimate the potential public health effects of risk factor reduction. Such exercises have limited value if they do not take into account that public health returns may be smaller than those calculated on the basis of invariant relative risks, since reducing risk factor prevalence may unintentionally achieve risk concentration in the most vulnerable and difficult-to-reach sections of the population.

Ecological effect modification, one mechanism contributing to the relativity of relative risks, has long been considered a nuisance factor that, as part of the ecological fallacy, precludes application of aggregate-level associations to individuals (Koopman & Longini, 1994). However, from another viewpoint, awareness of the relativity of relative risks should help avoid the complementary 'atomistic fallacy' (Marmot, 1998) which arises when individuals are separated from their sociocultural contexts, or morbidity is split into multiple single disorders without links allowed between them. Multi-level models increasingly allow analysis of how individuals' risk depends on their personal exposure *and* on the level of risk in their contexts. Mixing patterns and contact rates between ill and well people might also be a worthwhile new research focus in psychiatric epidemiology, taking greater advantage of tools developed in infectious disease epidemiology to examine transmission dynamics. The competing-risks issue illustrates the limits of a narrow focus on single specific diagnoses and emphasises the need to view ill health as a continuum straddling even the boundary between the somatic and the psychiatric domains (Neeleman *et al*, 2002). In clinical practice, awareness of how individual patients' characteristics fit with their sociocultural contexts may help refine risk assessment. The successes of the multi-level approach in research support efforts by clinicians to develop a multi-disciplinary, community-oriented psychiatry focusing on patients and on their sociocultural matrices. The relativity of relative risks provides a timely reminder that treatment of one disorder or syndrome may affect, and even raise, patients' risk of other illness, including somatic disease. As in psychiatric epidemiology, in clinical practice the trap of single-outcome studies should be avoided, because many disorders for which patients seek help indicate a general vulnerability that also leads them to consult somatic specialists.

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DECLARATION OF INTEREST

None.

REFERENCES

Boydell, J., van Os, J., McKenzie, K., *et al* (2001) Incidence of schizophrenia in ethnic minorities in London: ecological study into interactions with environment. *BMJ*, **323**, 1336–1338.

Breslow, N. E. & Day, N. E. (1980) *Statistical Methods in Cancer Research. Vol. I. The Analysis of Case–Control Studies*, p. 59. Lyon: International Agency for Research on Cancer.

Halpern, D. (1995) Values, morals and modernity: the values, constraints and norms of European youth. In *Psychosocial Disorders in Young People: Time Trends and their Causes* (eds M. Rutter & D. J. Smith), pp. 324–387. Chichester: John Wiley & Sons.

Koopman, J. S. & Longini, I. M. (1994) The ecological effects of individual exposures and nonlinear disease dynamics in populations. *American Journal of Public Health*, **84**, 836–842.

Marmot, M. G. (1998) Improvement of the social environment to improve health. *Lancet*, **351**, 57–60.

Neeleman, J. & Wessely, S. (1999) Ethnic minority suicide: a small area geographical study in south London. *Psychological Medicine*, **29**, 429–436.

——, Sytema, S. & Wadsworth, M. E. J. (2002) Propensity to psychiatric and somatic ill-health: evidence from a birth cohort. *Psychological Medicine*, **32**, 793–803.

Petronis, K. R. & Anthony, J. C. (2000) Perceived risk of cocaine use and experience with cocaine: do they cluster within US neighborhoods and cities? *Drug and Alcohol Dependence*, **57**, 183–192.

Rose, G. (1989) The mental health of populations. In *The Scope of Epidemiological Psychiatry* (eds G. Williams & P. Wilkinson), pp. 75–85. London: Routledge.

Weiss, R. D., Mirin, S. M., Griffin, M. L., *et al* (1998) Psychopathology in cocaine abusers: changing trends. *Journal of Nervous and Mental Disease*, **176**, 719–725.

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