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Difficult socio-economic circumstances and the utilization of risk information: A study of Mexican agricultural workers in the USA

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Abstract
Experiences associated with challenging socio-economic conditions may impact on motivational and cognitive processes that influence risk or health information processing. Within a population living in poverty, this study explored whether differences in socio-economic circumstances, and the subjective evaluation of these conditions, were associated with the utilization of new scientific evidence when judging risks. Using an experimental design, scientific information (i.e., strength of risk evidence and chemical persistence) was systematically varied in profiles of hazardous chemicals, and presented to a sample of 437 immigrant farm labourers in the USA. Participants were measured on several socio-economic indicators including education, migrant status, expectations for stable employment and perceptions of economic options. As predicted, when compared to labourers who believed themselves to be less dependent on their employment situation, participants who felt more economically dependent utilized scientific evidence less when judging the risks presented by environmental chemicals. The subjective appraisal of challenging socio-economic conditions may affect risk judgements through the utilization or processing of relevant information. The research is discussed in reference to dual-process theories of reasoning, and public health and agricultural policies that depend on individual actions to minimize the health risks of pesticide exposure.

Keywords: Socio-economic status, risk judgements, information processing, economic dependency, reasoning strategy, poverty

Introduction
A growing number of strategies to manage threats to physical well-being rely on the actions of individuals at risk and the provision of information to prevent negative outcomes or to minimize the effects of a disease process (Institute of Medicine 1998, Tremblly and Peterson 1999, NRC 2001, Alaszewski 2005). Prevention and self-protective behaviour have become essential components of primary health care (Woolf and Atkins 2001), as well as public health strategies in several countries, including the USA and the UK (e.g., Alaszewski 2005, Gerberding 2005). However, the adoption of this approach in culturally and socially heterogeneous societies may have unintended consequences. Certain groups may be disadvantaged by an extensive reliance on individual-level actions if public health or clinical interventions fail to conceptualize health and risk decision-making as a process embedded...
within the daily events and broader circumstances of an individual’s life (e.g., Gielen et al. 1995, Lillie-Blamton and LaVeist 1996, Kok et al. 1997, Freudenberg et al. 2000, NRC 2001, Sturm et al. 2005). Responses to health threats develop within and emerge from physical, socio-economic, cultural, developmental and other psychosocial contexts that can either foster and sustain or thwart desirable behaviours and health-protective attitudes (e.g., Vaughan 1995, Lillie-Blanton and LaVeist 1996, Kok et al. 1997, NRC 2001). One of these contexts, socio-economic circumstances, is one of the strongest predictors of health for a broad range of acute and chronic diseases (e.g., Adler et al. 1994, Feachen 2000, US Department of Health and Human Services 2000, Gallo and Matthews 2003). Socio-economic status is a multidimensional construct that encompasses a range of social and economic factors, and has been defined in terms of both objective and subjective criteria such as income, education, occupation and judgement of social position (Adler and Ostrove 1999, Braveman et al. 2005). Regardless of the particular socio-economic status definition or measure used, its effects on health and health-related behaviours are apparent at every level of the hierarchy (e.g., Adler et al. 1994, Adler and Ostrove 1999, Chen et al. 2002, Gallo and Matthews 2003). For example, long-term poverty may yield predispositions towards precautionary actions (e.g., pessimism about future outcomes, lower perceived control over health, less motivation to carefully consider health communications) that neither support nor promote self-protective behaviours by individuals (e.g., Wister 1996, Yen and Kaplan 1998, Ashford et al. 2000, NRC 2001, Chen et al. 2002, Gallo and Matthews 2003). One fundamental goal of research in health, risk and society is to clarify how interacting systems (e.g., attitudes, values, socio-economic circumstances, socio-physical environments) facilitate or hinder effective response to risk information for individuals from varying social backgrounds and dissimilar life circumstances (Kok et al. 1997, Freudenberg et al. 2000, NRC 2001).

In particular, because of increased vulnerability to environmental and health risks for those living with severe economic hardships (Seeman and Crimmins 2001), within these populations it is essential to identify contributors to the success or failure of safety strategies that depend on the provision of, and subsequent response to, health information. Contemporary analyses of chronic poverty portray an experience not only defined by economic disadvantage but also characterized by social exclusion and limited control, capabilities, security and power with regard to affecting life circumstances (Office of the United Nations’ High Commissioner for Human Rights 2002, Brady 2003). Recent research commissioned by the World Bank and conducted in over 47 nations revealed the profound influence of poverty on the development of negative cognitions and emotions regarding life circumstances (Narayan et al. 2000). Interviews with 60,000 individuals living in poverty revealed remarkable similarities across countries as women and men recounted the daily physical, social and psychological experience of poverty. This experience was characterized as a sense of powerlessness, lack of control over life events, deprivation, humiliation, dependency and lack of self-efficacy about affecting change in one’s life.

The psychosocial consequences of economic hardship provide one explanation for the poorer health outcomes of those living in poverty. Experiences associated with economic conditions may contribute to the development of cognitions, motivations and emotions that affect how individuals process information about, judge and respond to health risks (Adler and Ostrove 1999, Chen et al. 2002, Gallo and Matthews 2003). Specifically for those who are severely economically disadvantaged, there is substantial evidence that the psychological results of this experience contribute to an increased risk of poor health, to some extent because of its effects on health behaviours and related attitudes (Adler et al. 1994, Gallo and Matthews 2003). Indeed, the adoption of many health-enhancing behaviours, or the
cessation of health-damaging ones, is less likely as the socio-economic circumstances of individuals’ lives are more severe and harsh (e.g., Lynch et al. 1997, DHHS 1998, Adler and Ostrove 1999, Gallo and Matthews 2003). Economic deprivation and accompanying life experiences can shape an individual’s general outlook on health issues and may create predispositions that influence or bias decisions about preventive behaviours, information processing strategies and health-related appraisals. These orientations include pessimism, a sense of dependency, lowered self-efficacy, hopelessness and a decreased sense of control over life events (e.g., Ross and Mirowsky 1992, Taylor and Seeman 1999, Gallo and Matthews 2003).

Although empirical evidence suggests the effects of economic deprivation and poverty on the development of particular negative cognitions, and supports the role of negative cognitions as possible contributors to health risk responses, there are limitations to this research. First, studies that have examined the effects of poverty on health behaviour or psychological responses to risk information have usually compared those labelled as ‘low income’ to others when a few broadly defined categories are used to classify individuals (Braveman et al. 2005). These comparisons neglect within-group differences and fail to determine whether proposed explanatory mechanisms also explain differences in health risk responses among individuals who fall within one of the traditional socio-economic categories. As an illustration, for those experiencing severe economic hardships, the typical between-group comparisons ignore the considerable within-group variability in physical and mental health, occupational and social conditions, cognitions about health, perceived opportunities or optimism about the future, risk perceptions and responsiveness to health information (Emmons et al. 2005, O’Hea et al. 2005, Franzini and Fernandez-Esquer 2006). Further research is needed to understand the dynamics of health attitudes and behaviours within vulnerable populations (e.g., Emmons et al. 2005, Harley and Eskenazi 2006), and to generate reasonable explanations for the differential effects of health information among those living with similar economic disadvantage (Gustafson et al. 2005).

A second limitation in the current literature on the socio-economic status-health gradient is inadequate attention to the possible effects of individuals’ interpretation of their life situation on health-related outcomes. By defining comparison variables on a broad level, focusing often on objective indicators of socio-economic conditions (e.g., Joassart-Marcelli 2004, Franzini and Fernandez-Esquer 2006), researchers have not fully explored implications of individual differences in the subjective evaluation of, or adaptation to, economic circumstances. Individuals in objectively similar socio-economic contexts can have quite different subjective appraisals or interpretations of their situation (e.g., Franzini and Fernandez-Esquer 2006). Recent data suggest that subjective evaluations of social position and life circumstances may display an even stronger relationship with health outcomes than some objective indicators (Adler 2000, Franzini and Fernandez-Esquer 2006). Additional research is needed to determine through what exact mechanisms can subjective appraisals of personal economic and life circumstances influence response to health risks or related information. Few empirical studies have explored, for example, whether initial cognitive tasks associated with the judgement process, such as the utilization and processing of new information about risk or health, are susceptible to the influences of subjective, as well as objective, indicators of socio-economic circumstances (Lindbladh and Lyttkens 2003). Research on variability in modes of reasoning and information processing strategies suggest why there may be an association between subjective evaluations of socio-economic circumstances, or objective indicators of socio-economic status, and responsiveness to new risk information.
Information utilization and socioeconomic status

At an early stage of the judgement process, individuals adopt strategies for information processing and determine the level of cognitive resources that will be commit to the task at hand (Miller et al. 1996). Individuals display considerable flexibility in how evidence or information is used to reason about an event, and judgements may be arrived at through two different but interacting routes (Chaiken 1980, Petty and Cacioppo 1986, Kunda 1990, Witte 1994, Miller et al. 1996). Significant cognitive effort may be exerted to scrutinize and deliberate about facts through an analytic/deliberate strategy, or in contrast, cognitive resources may be conserved through the use of heuristic or experiential approaches that apply simpler decision rules (e.g., Epstein et al. 1996, Bohner et al. 1998, Chen et al. 1999, Trumbo 1999, Trumbo and McComas 2003, Reyna 2004). Furthermore, new information may be ignored altogether in formulating a specific risk judgement (e.g., Alaszewski and Horlick-Jones 2003, Lindbladh and Lyttkens 2003).

Dual-process models of reasoning propose that information processing depends on motivation-cognition structures. Factors capable of modifying the motivation to engage in effortful decision-making may indirectly influence the mode and depth of processing (e.g., Chen et al. 1999, Stanovich and West 2000). Indeed, certain negative cognitions such as low self-efficacy, perceptions of vulnerability, low perceived control and pessimism affect the motivation to engage in more analytic reasoning (e.g., Witte 1994, Bohner et al. 1998, Taylor and Seeman 1999, Trumbo 2002). If activated, these beliefs diminish a positive expectancy that information processing will actually help achieve goals and that the individual is capable of successfully carrying out the activity (e.g., Bohner et al. 1998, Trumbo 1999). Expectancies about processing efficacy, the likely outcome of reasoning activities and the value of reasoning for goal achievement may be crucial components of the motivation to engage in extensive reasoning (e.g., Bohner et al. 1998). These expectancies can be modified by socio-economic circumstances, and therefore represent one explanation for how certain social contexts may influence the chances that individuals will adopt a more or less cognitively demanding strategy to process and evaluate health information (e.g., Gallo and Matthews 2003).

In sum, many of the cognitions, motivations and behavioural predispositions that frequently characterize the experience of poverty or long-term economic deprivation are also associated with a lower likelihood of deliberate and effortful processing of health or risk information. Yet, individuals from similar difficult circumstances, such as those living in poverty, can vary in responsiveness to health or risk information (e.g., O’Hea et al. 2005). This finding implies that subjective appraisals of circumstances also may independently contribute to how individuals respond to health or risk problems. The factors linking risk attitudes and behaviours to socio-economic circumstances across income groups may operate within groups even at an extreme point along the socio-economic status—health gradient (Adler and Ostrove 1999). Because socio-economic and psychosocial factors also vary among individuals usually classified into broad socio-economic status categories, we designed a study to examine associations between socio-economic variables and the use of health risk information within a vulnerable and very low-income population. Contemporary definitions of socio-economic status as a multidimensional variable that includes objective variables, as well as subjective evaluations of life circumstances (e.g., Adler et al. 1994, Braveman et al. 2005) and dual-process theories of information processing and reasoning (e.g., Stanovich and West 2000) informed the present investigation.
The present study

The purpose of this study was to explore, within a population living in poverty, whether variability in socio-economic factors, and in the evaluation of personal economic circumstances, were associated with differences in information utilization when judging risk. Hypotheses were tested within a sample of low-income agricultural labourers whose country of origin was Mexico but who worked primarily in the USA during the agricultural season. This immigrant population is among the most impoverished in the USA and has been described as the ‘poorest of the working poor’ (Farmworker Health Services 2002) with more than 80% living in extreme poverty (Reeves and Shafer 2003, Villarejo 2003). Housing and working conditions span a range of circumstances, but many labourers live in poorly maintained, severely overcrowded units that often lack sanitary facilities or indoor plumbing (Farmworker Health Services 2002, National Center for Farmworker Health 2002). These workers also are among those in the USA facing the greatest occupational health risks (Larson 2000, Farmworker Health Services 2002), including exposure to multiple hazardous pesticides (Arcury et al. 2001).

The reduction of significant chemical risks among field labourers largely depends on the provision of risk and protection information, and the subsequent adoption of health-protective behaviours by the exposed population (Flocks et al. 2001, Murphy-Greene and Leif 2002). However, some research suggests that responsiveness to health messages or communications may be less than optimal in some populations, particularly among those individuals living in poverty (Lynch et al. 1997). Empirical evidence is inconsistent or, at best, limited, regarding whether audiences carefully review and deliberate about risk and protection information to make behavioural choices that maximize health (Alaszewski and Horlick-Jones 2003). Consistent with this perspective, Vaughan (1995) found that for the sample used in the present study, many individuals reported receiving information about pesticide risks in the workplace, but for a significant proportion this knowledge did not impact on the likelihood of adopting self-protective methods.

For the present study, we used previously unpublished data from an experimental component of the research to examine how novel risk information was utilized and integrated into the judgement process. Some recent discussions in the literature about farmworkers’ risk perceptions, response to occupational exposures and the utility of safety information raise questions about the effectiveness of relying on the provision of information alone to protect these workers from chemical exposures (e.g., Arcury et al. 2002). Although originally collected more than 10 years ago, the existing dataset and unpublished results from the experimental study of risk information processing among these immigrant farm labourers offer a unique examination of how risk evidence might be utilized within particular social contexts. Most participants in this study were living in poverty, but there was still sufficient variability in the severity of economic circumstances, although within a restricted range, to examine the effects of economic differences and interpretations of these circumstances on risk information utilization. The risk information presented to participants in the study reflected the type of scientific evidence frequently used by experts to quantify and communicate the risk of an environmental chemical (Feldman 1995, Czub and McLachlan 2004).

To determine whether the severity of socio-economic circumstances influenced the use of scientific information when judging risk, evidence for a chemical risk was systematically varied in brief hazard profiles. We measured the effects of several distinct components of socio-economic status on information utilization, and distinguished between objective and subjective indicators. The separable factors that comprise an individual’s socio-economic
status (i.e., education, income, occupational circumstances, subjective judgements of socio-economic conditions), although moderately correlated, may independently contribute to health or risk-related judgements and behaviours (Lynch et al. 1997, Adler 2000, Braveman et al. 2005). We predicted that those individuals who experienced or perceived their economic situation as more severe would be less likely to systematically utilize scientific risk information when forming new judgements.

Method
Participants

The sample included 437 male immigrant farm labourers who were recruited from five agricultural regions in California. Potential study sites were identified through public health officials, former agricultural workers, and representatives from government agencies who had frequent contact with the population in providing health or social services. Living conditions and employment opportunities varied among the five agricultural regions, and participants included labourers who resided in permanent farm labour camps, individuals who routinely crossed the USA – Mexico border to obtain farm work, and those who lived in tent cities or slept near agricultural fields without any sanitary bathroom facilities. In Region 1 (29% of sample), farm labourers lived in low-cost housing units that were integrated into surrounding communities. Region 2 labourers (12% of the sample) lived in self-contained farm labour camps that were geographically isolated from more affluent nearby neighbourhoods. In Region 3 (24% of the sample), labourers resided in temporary housing facilities (e.g., trailers or hollowed out buses) that were located in close proximity to agricultural fields. Region 4 sites (25% of the sample) were located at border crossings between Mexico and the USA where farm workers crossed nightly on foot seeking work in the fields. Region 5 participants (10% of the sample) lived in temporary ‘tent cities’ located in an isolated portion of a canyon near agricultural fields. For those sampled from Regions 3 and 5, there were no sanitary bathroom facilities, electricity or running water in living accommodations.

Participants ranged in age from 16 – 73, and most had been born in Mexico (97%). Nearly half of the sample (41%) migrated between counties or states during an agricultural season (migrant workers), and the remainder had established a primary residence during the season (seasonal workers). This distinction is meaningful for this study because migrants generally experience more severe occupational, living and economic conditions during a season (e.g., Villarejo 2003). In general, participants had worked in agriculture an average of 12.7 years \( (SD = 10.9) \), mostly in the harvesting and packing of crops such as oranges, lettuce, strawberries and tomatoes.

Procedure and design

Data were collected during the peak months of the agricultural season over 4 consecutive years. Researchers (15 – 25 bilingual interviewers) visited study sites near agricultural fields at times of the day or night when the most labourers were likely to be present. Bilingual interviewers were trained over the course of several sessions in interviewing techniques, and received extensive instruction in research ethics and in the logistics of involving this particular population in a research study. When data collection began, farm labourers were approached individually and given information about the study. Because of ethical considerations, individuals were not recruited for the study when they were engaged in
tasks associated with their employment or actually in the fields. Before beginning an interview session, all research assistants read aloud in Spanish a short consent form that provided information about the study. As part of the verbal consent procedure, individuals were told that participation in the study was completely voluntary, that all responses were confidential and anonymous, and that no identifying information would be collected during the interview. Research assistants explained that the purpose of the study was to examine farm workers’ beliefs and attitudes about health issues and the workplace. Verbal consent was obtained from each participant prior to the interview, and a research assistant explained that the respondent could withdraw from the interview at any point. Responses to interview items were recorded on data forms that did not include any personal identifying information about the respondent. At the end of the interview, participants were encouraged to ask any questions about the study and were thanked for their participation. Data were stored in a secured location at the University of California, Irvine.

Individuals who agreed to take part in the semi-structured interview were included as participants (fewer than 5% refused to participate). During the 30 minute interview, scaled items and open-ended questions were presented verbally in Spanish. The initial part of the interview session assessed several indicators of socio-economic circumstances including perceived economic dependency on agricultural work, migrant status, educational level and total months expected to work during the year, as well as responses and risk beliefs related to pesticide exposure in the agricultural setting (see Vaughan 1995). During the second half of the interview, an experimental procedure was implemented where new scientific risk information was systematically varied and presented to participants in four brief chemical profiles. The order of presentation was randomized and none of the chemicals described in scenarios were pesticides or any other substance that farm workers encountered in daily occupational activities. Each scenario described a chemical substance, its usage and scientific evidence suggesting a cancer risk.

Two variables representing different aspects of scientific risk information were systematically combined in a 2 (strength of scientific evidence) × 2 (persistence of chemical) within-subjects factorial design. The ‘strength of evidence’ variable included two levels: weaker evidence for a health risk (i.e., animal evidence for a cancer risk) and stronger evidence for a health risk (i.e., human evidence for a cancer risk). For the second information variable, ‘chemical persistence,’ values for the two levels were: shorter chemical persistence (i.e., a substance was described as being expelled from the body or environment after a brief period) and longer chemical persistence (i.e., a substance was described as being stored in the body or environment for extended periods). Several judgements about the risk presented by each of the profiled chemicals were assessed immediately following each scenario presentation.

Measures

Interview and experimental materials were subjected to extensive pretesting, and multiple revisions were completed prior to the main data collection efforts. A selected sample of 43 farm workers from the study population participated in this pilot phase of the study. Response scales and the wording of individual interview items were modified as necessary based on feedback received from government officials working with this population, an anthropologist who had conducted previous investigations with migrant labourers and a group of farm workers, themselves. Analyses of responses gathered during the preliminary stage also guided revisions of measures. Several rounds of translation into Spanish and back
translation into English were completed before final versions of instruments were used in the study.

**Perceived economic dependency**

The extent to which respondents believed themselves economically dependent on farm work was assessed through three items. Using a 4-point scale ranging from 1 (not difficult) to 4 (difficult), the first item assessed farm workers’ perceptions about the difficulty of finding work outside of agriculture. The second asked about current knowledge of other jobs that pay the same as or more than agricultural work, and responses were indicated on a 3-point scale ranging from 1 (can think of several possibilities) to 3 (not sure of any other jobs). The third item asked if agriculture had been participants’ only job in the USA. Responses for this item were coded 1 (yes) or 0 (no). Principle components analysis of the three items revealed the presence of one underlying factor with individual item loadings ranging from .61 to .72 (eigenvalue = 1.38). This analysis demonstrated that the economic dependency items reliably measured one latent factor. Consequently, standardized scores for the three items were averaged to create an overall index of perceived economic dependency, which was then dichotomized by a median split to create a between-subjects categorical variable (‘higher perceived economic dependency’ versus ‘lower perceived economic dependency’).

**Migrant status**

Farm workers’ migration status during an agricultural season was determined through the following item: ‘In what other counties or areas would you work this year?’ Labourers who worked in at least one other county or area and who named at least one additional region in a subsequent open-ended question were designated as migrants (coded 1). Farm workers who did not indicate any other counties or areas were considered to be non-migrants or seasonal workers (coded 0).

**Education level**

Farm workers’ level of education was assessed through the following open-ended item: ‘What is the highest grade that you finished in school?’ Due to the high number of participants who reported fewer than 6 years of formal education (45%), education level was dichotomized by a median split (‘higher level of education’ versus ‘lower level of education’).

**Expectations for stable employment**

Responses to two open-ended items were combined to reflect a labourer’s expectations for stable employment and income during a year. The first item asked: ‘How many months have you worked so far this year?’ A second item assessed, ‘How many more months do you expect to work this year.’ Values on the questions were summed to create a variable indicating how many total months an individual anticipated being employed for the current year. This variable was dichotomized by a median split (‘shorter expected length of employment’ and ‘longer expected length of employment’) due to the large number of individuals who expected to work 8 or more months during that season (66.7%).
Novel risk judgements

In the experimental portion of the interview session, three items assessed novel risk judgements after the presentation of each chemical profile. The first item asked, ‘How dangerous do you believe it is to have contact with this substance?’ Responses ranged from 1 (not dangerous) to 4 (extremely dangerous). The second asked, ‘How likely is it that contact with this substance will result in a serious health problem?’ These responses were indicated on a 4-point scale ranging from 1 (not likely) to 4 (very likely). A third question asked participants to indicate on a 4-point scale that ranged from 1 (not at all certain) to 4 (very certain), ‘How certain are you that this substance could cause serious health problems?’ Values for the three items were averaged to create a combined risk judgment score. This composite indicator of risk judgment was highly reliable and internally consistent. The value of Cronbach’s alpha for the four risk profiles ranged from .77 to .82.

Data analyses

Prior to data analyses, variables were screened for violations of statistical assumptions (e.g., normality, linearity). A mixed model repeated-measures analysis of variance procedure (ANOVA) examined the effects of socio-economic status indicators on the use of scientific evidence to formulate risk judgements. The within-subjects factors were strength of scientific evidence (lower vs. higher) and chemical persistence (shorter vs. longer). The between-subjects factors represented different aspects of socio-economic status and included migrant status (migrant vs. seasonal worker), education level (lower vs. higher), employment expectation (‘shorter’ vs. ‘longer’) and perceived economic dependency (lower vs. higher). The dependent variables were the risk judgements scores. Preliminary repeated-measures ANOVAs tested which of the socio-economic status variables should be included in the final model. Variables yielding a significant socio-economic status level-by-risk information interaction were retained. In the final repeated-measures analyses, a custom model was specified that tested the main effects of the scientific risk information variables (i.e., evidence strength and chemical persistence), and all two-way interactions between scientific risk information and socio-economic status components.

Results

The labourers interviewed for this study were primarily of low socio-economic status with limited formal education and significant economic dependence on farm work. All of the participants were of Mexican descent and the vast majority had been born in Mexico. Agricultural work was the primary source of income for 82% of these farm workers. Other sample demographics and economic characteristics are summarized and presented in Table I.

Variable screening determined potential socio-economic status variables to include in the final repeated-measures ANOVA. In reporting the results of statistical analyses, effect sizes for the factors in the ANOVA model, partial eta squared ($\eta_p^2$) values, are provided. Although there were no between-group differences in risk judgements for participants who differed in perceived economic dependency, $F(1, 415) = 0.59, \eta_p^2 = .001$, or level of education, $F(1, 415) = 0.32, \eta_p^2 = .001$, results revealed that these socio-economic status indicators affected the weighing of risk evidence. Education level had a significant effect on the weighing of evidence strength to formulate risk judgements, $F(1, 415) = 3.82, p = .051, \eta_p^2 = .009$, but not chemical persistence information, $F(1, 415) = 1.35, \eta_p^2 = .003$. Risk
judgements were greater when stronger scientific evidence was presented, but this effect was mostly limited to those individuals who had higher levels of education. Results also showed that perceived economic dependency had a significant effect on the weighing of evidence strength, $F(1, 415) = 4.43, p = .036, \eta_p^2 = .011$, and chemical persistence information when judging risk, $F(1, 415) = 5.65, p = .018, \eta_p^2 = .013$. The effect of scientific information on risk judgements was greater for individuals who reported less economic dependence on farm work, as compared to labourers who believed themselves to be more economically dependent. In contrast, neither migrant status nor expectations for stable employment influenced the weighing of novel risk information to evaluate risk. Therefore, only education level and perceived economic dependence were included as between-subjects factors in the final repeated-measures ANOVA.

Results for the final model are shown in Table II. The analysis yielded a significant main effect of chemical persistence on risk judgements. Risk perceptions were greater when messages described chemicals that persisted in the body for longer ($M = 3.12, SD = 0.76$) as compared to shorter ($M = 2.89, SD = 0.80$) periods of time. There also was a significant main effect of evidence strength such that participants perceived significantly more risk when messages provided stronger ($M = 3.09, SD = 0.77$) as compared to weaker ($M = 2.93, SD = 0.79$) scientific evidence for a cancer risk. However, as predicted, both of these effects were qualified by factors related to socio-economic circumstances, specifically, subjective judgements of economic dependency.

After controlling for education level (we found that education level did not influence the weighing of risk information beyond the effects of perceived economic dependency), the persistence effect was greater for those individuals who believed they were less economically dependent on farm work. This interaction was significant (see Figure 1, Panel A). In order to further explore the nature of this interaction, we compared the economic dependency subgroups’ standardized effect size for the persistence variable (Thompson 2002, Olejnik and Algina 2003). For those individuals who believed that they were less dependent on farm work for economic subsistence, the presentation of chemical persistence information had a
Table II. Mixed model repeated-measures analysis of variance (ANOVA) examining the effects of chemical persistence, evidence strength, economic dependency, and education on risk judgements ($n = 416$)

<table>
<thead>
<tr>
<th></th>
<th>df</th>
<th>$F$</th>
<th>$\eta_p^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemical Persistence (CP)†</td>
<td>1, 414</td>
<td>63.98***</td>
<td>.134</td>
</tr>
<tr>
<td>Evidence Strength (ES)†</td>
<td>1, 414</td>
<td>27.89***</td>
<td>.063</td>
</tr>
<tr>
<td>Economic Dependency (ED)‡</td>
<td>1, 414</td>
<td>1.20</td>
<td>.003</td>
</tr>
<tr>
<td>Education (E)‡</td>
<td>1, 414</td>
<td>0.11</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>CP × ED</td>
<td>1, 414</td>
<td>4.93*</td>
<td>.012</td>
</tr>
<tr>
<td>ES × ED</td>
<td>1, 414</td>
<td>3.92*</td>
<td>.009</td>
</tr>
<tr>
<td>CP × E</td>
<td>1, 414</td>
<td>0.51</td>
<td>.001</td>
</tr>
<tr>
<td>ES × E</td>
<td>1, 414</td>
<td>2.37</td>
<td>.006</td>
</tr>
</tbody>
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$\eta_p^2$ = effect size (partial eta squared).
†within-subject effect.
‡between-subject effect.
***$p < .001$; *$p < .05$.

Significant effect (i.e., Kirk 1996) on new risk judgements ($\eta_p^2 = .189$, CI$_{95\%} =$ .10 to .28). In contrast, chemical persistence information had a much smaller influence on the risk judgements of those who believed themselves to be more economically dependent on their current difficult employment circumstances ($\eta_p^2 = .090$, CI$_{95\%} =$ .03 to .17).

Similarly, the effect of evidence strength on judgements was greater for labourers who felt less economically dependent on agricultural work. The interaction between perceived economic dependence and strength of scientific evidence was statistically significant (see Figure 1, Panel B). When formulating new risk judgements, individuals who believed that they were less dependent on current economic circumstances weighed the strength of scientific evidence more ($\eta_p^2 = .120$, CI$_{95\%} =$ .05 to .20) than those with greater perceived economic dependence ($\eta_p^2 = .029$, CI$_{95\%} =$ .00 to .09).

Discussion

Results from the present research demonstrated that within a sample of immigrant farm labourers, there was variability in the extent to which risk information was used to form new judgements. The perception of more limited economic or occupational choices in life was associated with less utilization of new scientific information when judging risks. Individuals who perceived few employment options outside of agriculture minimally weighed evidence about the biological or environmental persistence of a substance, and minimized information about the strength of scientific evidence that indicated a possible hazard. Individuals in conditions of severely limited economic resources are more likely than others to have repeated experiences where control over desirable outcomes is minimal and the ability to predict the outcome of events limited (Adler and Snibbe 2003, Gallo and Matthews 2003, Lindbladh and Lyttkens 2003). Several studies of the occupational and living conditions of immigrant farm labourers have revealed that these workers have little control over pesticide exposure or other risk circumstances (e.g., Reeves and Schafer 2003, Quandt et al. 2006). The increased likelihood of particular life experiences within a context of economic deprivation can foster a decreased sense of mastery or control over life events, and there may be less motivation to carefully weigh health information, or to engage in a more deliberate reasoning process.
The experimental methodology utilized in this investigation offered a reliable way to measure the extent to which scientific evidence was systematically weighed in the judgement process. Psychosocial responses to economic conditions can influence a range of judgement tasks including information encoding, processing and utilization (Adler and Ostrove 1999, Adler and Snibbe 2003, Gallo and Matthews 2003). These effects may extend beyond appraisals of risk that are directly related to current life circumstances and also may include judgements of new health risks. In the present study, the chemicals described in the experimental materials did not include substances that the participants routinely encountered in the workplace or home environment.

Figure 1. Effects of chemical persistence information on risk judgements by perceived economic dependency (Panel A: $n = 417, p = .027$). Effects of strength of scientific evidence on risk judgements by perceived economic dependency (Panel B: $n = 417, p = .048$).
We had expected to find a significant association between objective measures of socio-economic status on risk information utilization. We had predicted an independent influence of subjective and objective indicators based on previous research (Adler and Ostrove 1999, Gallo and Matthews 2003). However, the relationship between socio-economic factors and the impact of information on risk judgements was observed primarily when socio-economic status was defined as the subjective assessment of economic dependency. These findings could be attributed in part to the sample’s restricted range of values on several of the objective socio-economic status indicators. However, distinguishing objective from subjective assessments of socio-economic circumstances may be useful in research linking socio-economic status to health information processing and other decision tasks (Braveman et al. 2005). Individuals in similar socio-economic contexts, as determined by objective measures, vary in perceptions of their situation (Adler 2000). Recent data suggest that appraisals of one’s socio-economic circumstances may display an even stronger relationship with outcomes than some objective measures (Adler 2000). These findings are consistent with research in numerous other areas of health and social psychology (e.g., stress and coping, emotional response to situations) where appraisals and subjective evaluations have been shown to be better predictors of psychological responses than objective characteristics of events (e.g., Lazarus 1993, Miller et al. 1996). Future studies that examine links between socio-economic status and reasoning about risk should consider the benefits of using multiple measures of socio-economic status and including both objective and subjective indicators that are relevant to the population of interest (Braveman et al. 2005).

Limitations of the study

In the present investigation, we did not directly measure factors that could explain the effect of perceived economic dependency on information utilization, but the literature on control as a motivational mechanism and research on motivated reasoning (e.g., Edwards 2002) offer plausible explanations. Heckhausen and Schultz (1995) presented compelling arguments and summarized substantial empirical evidence supporting the notion that throughout the lifespan, aspirations for and beliefs about control over important outcomes is a primary motivational force for individuals. When control is unlikely or limited, individuals experience a threat to self-efficacy, feelings of mastery and positive expectancies about affecting external events. Compensatory responses that deal with a reduction in the ability to influence external events regulate motivation and effort directed towards future cognitive and behavioural tasks (Heckhausen and Schultz 1995). The perceived economic dependency variable in the present study may reflect beliefs about control over the circumstances of economic subsistence. Independent of objective circumstance, perceptions of limited employment options or lower perceived control may influence those motivational and cognitive orientations that are related to information processing in such a way that lessens the careful consideration of information (e.g., Gallo and Matthews 2003). Consistent with this suggestion, a recent study of medical treatment adherence, conducted within a low-income population, found that participants who believed that they had little personal control over health and that certain other external factors were responsible for health status were less likely to follow specific recommendations to manage a disease risk (O’Hea et al. 2005).

Other unmeasured individual differences factors could offer alternative explanations for the observed association between perceived economic dependency and the utilization of risk information. Data analyses indicated that neither education level nor actual economic and living conditions (as measured by migrant status during the agricultural season) could
account for the effect of perceived economic dependency on information utilization. However, individuals who reported that they had little choice over their economic circumstances may have differed from others in additional ways that could have influenced information processing. For example, these individuals may be higher in trait or state anxiety, depression, pessimism and other affective/motivational states that affect whether information processing is likely to be more of an effort (e.g., Epstein et al. 1996, Gallo and Matthews 2003). In addition, this group’s responses on quantitative measures may have reflected a general negative response bias when they reported risk judgements and economic dependency. We explored the response bias possibility by examining the association between perceived economic dependency and various perceptions about pesticide risks in the workplace. Pesticide-related judgements had been elicited in the initial part of the interview session, and these judgements and details of their measurement have been reported elsewhere (Vaughan 1995). Perceptions of economic dependency did not correlate with beliefs about control over pesticide exposure, fears and worry about pesticide risk, beliefs about the likelihood of future health effects from exposure or perceptions about the effectiveness of safety measures. Moreover, none of these other variables were predictive of how information was utilized in the experimental judgment task. Thus, it seems unlikely that the association between perceived economic dependency and information utilization resulted from a general negative response bias on the survey. Future studies could improve on the present study by explicitly measuring and testing for hypothesized psychosocial mediators of the effect, and controlling for alternative explanations.

Some findings and methodological features of the present study suggest caution should be exercised in generalizing conclusions. First, although perceived economic dependency was a significant factor in explaining the utilization of scientific information to judge risk, clearly the absolute size of the effect suggests that additional unmeasured factors also influenced risk judgements and information utilization. Second, the restricted range of values on socio-economic measures for a sample living in extreme poverty may have precluded finding significant associations between objective socio-economic status indicators and information processing. These associations are likely to be stronger with the inclusion of more heterogeneous samples in studies (Adler and Ostrove 1999, Gallo and Matthews 2003).

A third methodological consideration for the present study is the fact that all of the participants in this study were male. This raises the question of whether results generalize to the many women who are employed in this occupation (Tran and Perloff 2002). For a variety of environmental and health risks, investigations consistently have found significant gender differences in perceptions of risk (e.g., Finucane et al. 2000, Palmer 2003, Satterfield et al. 2004), judgements of control over risk (e.g., Finucane et al. 2000) and trust in authorities responsible for ensuring safety (e.g., Gustafson 1998). Moreover, the predictors of risk attitudes and reasoning strategies about health-related issues may differ between women and men (e.g., Gallant and Dorn 2001). Future research should explore the consistency of the association between subjective evaluation of economic dependency and information utilization for women and men, and whether other variables such as social networks or social support might be stronger contributions to health attitudes and behaviours for women (e.g., Gustafson 1998, Gallant and Dorn 2001, Harley and Eskenazi 2006).

Participants in this investigation were culturally and socially distinct from other groups who have been included in psychosocial research on socio-economic status and judgement processes. When compared with other groups living in poverty, the population of immigrant farm workers differs along cultural, social and other psychosocial dimensions that could affect observed variable relationships including risk perceptions (Farmworker Health Services 2002, Palmer 2003). However, studying how scientific information is utilized to
form judgements within this group contributes to the social science literature on the effects of social context on cognitive processes related to health or risk decision-making. In a resolution on poverty and socio-economic status, the American Psychological Association (APA) called for more research that adequately defines the mechanisms through which poverty influences psychological and physical health across diverse communities (APA 2000). The resolution emphasized the importance of studying special populations such as undocumented immigrants who are particularly vulnerable to the adverse effects of economic deprivation.

Policy implications

The provision of health and exposure information as one public health strategy to reduce risk assumes that individuals will utilize and process this information in ways that maximize health-protective responses and judgements (Alaszewski 2005). Yet, the extent to which risk information influences appraisals and behaviours depends in part on the broader social and psychological contexts in which communications are received. The results of the present research, if confirmed, have implications for policies intended to protect the health of workers in the USA agricultural industry. Results suggest that policies relying on self-protective strategies may disadvantage some individuals. Severe economic deprivation can contribute to cognitive predispositions that lessen the probability of effective health information processing and subsequent behaviour change.

Understanding the mechanisms through which social and economic circumstances affect health-protective behaviours and judgements is required for effective policy making, especially for economically disadvantaged populations such as the immigrant workers who make up a substantial proportion of the agricultural labour force in the USA (Reeves and Schafer 2003, Villarejo 2003, Arcury et al. 2006). These individuals are vulnerable to serious environmental and occupational illnesses related to pesticide exposure, and housing and work conditions often amplify this risk (Halfacre-Hitchcock et al. 2006). In the USA, state and federal laws to protect hired farm labourers rely heavily on the provision of information as a safety strategy, and risk reduction depends largely on the personal adoption of preventive measures (Murphy-Greene and Leif 2002, Reeves and Schafer 2003, Quandt et al. 2006). However, individuals in this occupation and others are not equally responsive to safety information (e.g., Reeves and Shafer 2003).

Efforts to improve the health status of economically vulnerable agricultural workers through modifications in health-related ‘choices’ must first identify and address the profound psychological influences of certain social, occupational and economic circumstances on reasoning strategies about, and perspectives on, health. Without this approach, policies may implicitly make assumptions about the adoption of preventive measures that are not tenable. Some research, in fact, suggests that simply supplying farm workers with risk information with the goal of reducing pesticide exposure is not the most effective strategy to protect the health of these workers (e.g., Reeves and Shafer 2003, Quandt et al. 2006). Consequently, an alternative approach might be to focus on implementation and vigorous enforcement of industry-wide regulations that require employers to provide self-protective clothing, prohibit workers from entering fields immediately after pesticides have been applied and discontinue economic incentives that compromise safety (Murphy-Greene and Leif 2002). For this population, enforcement of laws limiting exposure is crucial for adequate protection from the harmful effects of pesticide exposure, and the provision of risk and safety information alone cannot be expected to reduce risk to acceptable levels (Murphy-Greene and Leif 2002). There is a greater likelihood that information will have a
significant effect on safety if the broader social and occupational environment supports the adoption of self-protective actions and fosters an increased sense of personal control over health-related issues.

Conclusion

The results of the present research add to the limited but growing body of work on mechanisms that may be responsible for associations between socio-economic conditions and health outcomes within varied social, cultural and physical contexts (Adler and Ostrove 1999). In the social and health psychology literatures, reasoning and information processing strategies have been somewhat neglected as possible pathways linking economic hardship with risk judgements, decision-making and health behaviours. The mode of processing new information should be pursued as one possible explanation for persistent within and between social group differences in responsiveness to risk or health messages (e.g., Miller et al. 1996, Kahlor et al. 2003). Linking socio-economic conditions and subjective assessments of these situations to information utilization reminds us that broader life circumstances associated with an individual’s social position may affect human judgement and fundamental cognitive processes that determine response to health threats and risk communications. Public health policies that rely on individual-level responses to prevent or reduce harmful environmental exposures will benefit from acknowledging that personal economic conditions impact the likelihood that individuals will be active and effective partners in risk management efforts.

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