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# Comparative assessment of migrant farm worker health in conventional and organic horticultural systems in the United Kingdom

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## ABSTRACT

This study describes the self-reported health and well-being status of field and packhouse workers in UK vegetable horticulture, and tests the null hypothesis that there is no difference in the self-reported health of workers on organic and conventional horticultural farms. The majority of those sampled were migrant workers (93%) from Bulgaria, Latvia, Lithuania, Poland, Russia and the Ukraine. More than 95% of the respondents were aged 18–34 and recruited through university agricultural faculties in East European or employed via UK agencies. The health of 605 farm workers (395 males and 210 females) was measured through the use of four standard health instruments. Farm workers' health was significantly poorer than published national norms for three different health instruments (Short Form 36, EuroQol EQ-5D and the Visual Analogue Scale). There were no significant differences in the health status of farm workers between conventional and organic farms for any of these three instruments. However, organic farm workers scored higher on a fourth health instrument the Short Depression Happiness Scale (SDHS) indicating that workers on organic farms were happier than their counterparts working on conventional farms. Multiple regression analysis suggested that the difference in the SDHS score for organic and conventional farms is closely related to the range and number of tasks the workers performed each day. These findings suggest that a great deal of improvement in the self-reported health of farmers will need to occur before organic farms meet the requirements of the 'Principle of Health' as described by IFOAM. Ensuring that farm workers have a varied range of tasks could be a cost effective means of improving self-reported health status in both organic and conventional farming systems.

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## 1. Introduction

Agriculture and horticulture are amongst the most dangerous occupations in the world (Gerrard, 1998; Reeves and Schafer, 2003). Agriculture has a fatality rate ten times that of the all-industry rate, and a self-reported ill-health prevalence rate of

6500 per 100,000 placing it among the highest prevalence rates of all industries (HSE, 2006). Not only are farmers and farm workers at risk from reduced physical health, but the nature of their work may also impact their mental health (Hounsomes et al., 2006).

While some work has considered the health of farmers (e.g. Gerrard, 1998; Hounsomes et al., 2006; Simkin et al., 1998), very

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little has considered the health of seasonally employed farm workers. This is a growing sector in the UK, and official estimates suggest there were 64,100 temporary workers employed in agriculture and horticulture in England & Wales in 2005 (DEFRA, 2006). Seasonal workers may be subject to increased mental stress by the temporary nature of their terms of employment (Benavides et al., 2000; Virtanen et al., 2005), while migrant workers may also be susceptible to problems of language, poor access to health care and violence (FAO-ILO-IUF, 2005; Villarejo, 2003). Despite the existence of these potential health risks, recording actual illness for this group can be problematic as many seasonally employed migrant workers only report occupation-related health symptoms upon their return to their homeland (Villarejo, 2003).

The health status of migrants working in horticultural systems may be further challenged by exposure to occupational hazards such as pesticides. A large number of studies have documented associations between pesticide exposure and a raft of different acute and chronic health complaints (Alavanja et al., 2003; Baldwin et al., 1997; Beach et al., 1996; Castro-Gutierrez et al., 1997; Cole et al., 1997; Eskenazi et al., 1999; Penagos, 2002; Reeves and Schafer, 2003; Senthilselven et al., 1992; Wilson and Tisdell, 2001; Zahm and Ward, 1998). As a result of such studies, pesticide-related public health concerns have been important drivers in bringing about change in production systems, including the development of organic farming (Browne et al., 2000; Guthman, 2004; Hall and Mogorodoy, 2001; Michelsen, 2001; Raynolds, 2000; Raynolds, 2004).

Developed as a critique of industrial values in agriculture (Pollan, 2006) the organic movement has repeatedly attempted to negate and overcome the negative aspects of conventional synthetic pesticide and fertiliser use (Vogl et al., 2005). More recently, the organic farming movement has itself been the subject of increasing levels of criticism as it adopts more industrialised scales of production. It now stands accused of resembling the large-scale conventional practices that organic farming was intended to replace (Guthman, 2004). Organic enterprises are further accused of employing large numbers of non-unionised, temporary employed, migrant labour creating an organic vision far removed from the small-scale family run farms of the organic idyll (Goodman, 2000).

As a reaction to this critique the organic movement is currently attempting to fashion a new niche for itself by focusing upon social justice (Freidberg, 2004; Pacini et al., 2003). As part of this process of redefinition the International Federation of Organic Movements (IFOAM) has published a set of four guiding principles intended to inspire farmers and to establish clear space between organic and conventional farming practices. The first of these principles relates to health, and claims that organic farming should "...sustain and enhance the health of ecosystems and organisms from the smallest in the soil to human beings. Health is the wholeness and integrity of living systems. It is not simply the absence of illness, but the maintenance of physical, mental, social and ecological well-being" (IFOAM, 2006). If the physical and mental well-being of farm workers is an integral component of the organic movement's attempts to make a difference, then it can reasonably be assumed that to a degree organic farm workers should display signs of ameliorated health compared to workers employed on conventional farms.

Although many workers in UK horticulture are both temporary migrants and work in environments where potentially harmful substances are an integral part of their everyday working lives, very little is known of their general health status. The few studies that have assessed aspects of farm worker health have tended to concentrate on UK nationals (National Assembly of Wales (NAFW), 1999), concentrating on specific health attributes such as mental health, stress, suicide prevalence (Hounscome et al., 2006; Simkin et al., 1998; Thomas et al., 2003) or health and safety issues (Gerrard, 1998). This study describes the self-reported health and well-being status of field and packhouse workers in UK vegetable horticulture and tests the null hypothesis that there is no difference in the self-reported health of workers on organic and conventional horticultural farms.

## 2. Methods

### 2.1. Instrument selection

A wide range of health instruments have been developed since the mid 1970s (Bowling, 1997). Their use can afford valuable insights into the economic validity of health interventions as well as the quality of life of individuals and groups (Hounscome et al., 2006). In this study four different health related instruments were utilised, three of these have been widely used in health research: the SF-36, EuroQol EQ-5D, Visual Analogue Scale (VAS). The fourth, the Short Depression Happiness Scale (SDHS), is a relatively new instrument which has not been widely used in other studies yet. A brief description of each of these instruments is given below.

### 2.2. SF-36

The SF-36 is a multi-purpose health instrument that enables comparisons within and between populations of the health burden of specific diseases, health outcomes of a variety of medical interventions and the health effects of differing lifestyles and work related illnesses. It has been translated for use in over 50 countries and its results have been reported in over 4000 publications. It has been judged to be the most widely evaluated of all generic health questionnaires, which strongly recommends its use here (Ware and Gandek, 1998).

The SF-36 is composed of 36 items which together measure eight different aspects of health (termed scales): Physical Functioning, Role Physical, Bodily Pain, General Health, Vitality, Social Functioning, Role-Emotional and Mental Health. Respondents' scores are transformed according to a standard protocol and range from 0–100 where a score of 100 for any given scale indicates no limitations for that particular health attribute (Picavet and Hoeymans, 2004; Shadbolt et al., 1997). Two further scales summarise the aggregate scores of relevant scales. The Physical Component Summary (PCS) aggregates scores for Physical Functioning, Role Physical, Bodily Pain and General Health whilst the Mental Component Summary (MCS) aggregates scores for Vitality, Social Functioning, Role Emotional and Mental Health.

National norms exist for the eight health scales and the two component scores. Scores are transformed and normalised to

facilitate comparison of individual or group aggregate scores with published national norms (Ware and Kosinski, 2001; Ware and Gandek, 1998; Ware, 2000). However the use of national norms is problematic for the UK vegetable horticultural workforce, as this workforce is multinational. Suitable norms do not exist for all nationalities represented in the horticultural workforce. Given that the workers are working in the UK, it would normally be acceptable to compare their health to UK norms. Unfortunately though, the UK norms for this instrument are not yet sufficiently robust for such a purpose (Bowling et al., 1999). Following standard practise, the 1998 US national norms were used as the comparator for this instrument (<http://www.SF-36.org/>).

### 2.3. EuroQol EQ-5D

The EQ-5D is a generic quality of life (QoL) health instrument comprising five questions designed to measure aspects of an individual's self-appraised physical and mental well-being (Brooks and EuroQol Group, 1996; EuroQoL Group, 1990; Schrag et al., 2000). It has been widely validated and proven to be sensitive, reliable and internally consistent when used to measure population and group health (Brooks and EuroQol Group, 1996; Dorman et al., 1997; EuroQoL Group, 1990; Hurst et al., 1994; Nowels et al., 2005; Schrag et al., 2000). A respondent's health status is described by five dimensions: mobility, self-care, usual activities, pain/discomfort and anxiety/depression with three possible scores for each dimension indicating whether the respondent has no problem, some problems or severe problems. Scores from the five dimensions are converted using an index to give 243 possible unique health states ranging from zero to one, where one indicates a perfect health state and zero the poorest. United Kingdom population norms exist for this instrument (Kind et al., 1998; Sapin et al., 2004).

### 2.4. Visual Analogue Scale (VAS)

The Visual Analogue Scale (VAS) is a conceptually simple health instrument which is often used as a complement to the EQ-5D. It comprises a vertical line with equally spaced gradations from 0–100 much like a thermometer. Respondents indicate their present health status by drawing a line on the scale with the understanding that zero represented their worst possible health status and 100 their best. The scale was included in the study as it was quick to complete and could capture both physical and mental health attributes simultaneously (Hounscome et al., 2006). Population norms for the UK exist for this instrument (Kind et al., 1998).

### 2.5. Short Depression Happiness Scale (SDHS)

The Short Depression Happiness Scale allows measurements of depression and happiness across sample populations (Joseph et al., 2004). The SDHS consists of six questions three of which are reverse scored. There are four possible responses available for each question. The four responses are scored from zero to three giving eighteen possible health states. High scores indicate greater levels of happiness and conversely low scores indicate greater levels of depression. It is a relatively

untried instrument, but was included in this study as it had potential to provide information that may have been missed by the other general health instruments. Whilst no population norms exist for this instrument, a score of 9 or below has been suggested as a threshold level indicating mild clinical depression (Joseph et al., 2004).

### 2.6. Translation of instruments

Health questionnaires are complex instruments that can not be assumed to be culturally invariant. So prior to use on an internationally diverse population formal, validated translations need to be obtained (Bullinger et al., 1998; Gandek and Ware, 1998). Validated, formally translated versions of the SF-36, EQ-5D and VAS were made available to respondents in five languages English, Latvian, Lithuanian, Polish and Russian. No formally translated versions of the SDHS were available and therefore recognised, professional translators who were native speakers of the target language translated from English into Latvian, Lithuanian, Polish and Russian. No backward translation was undertaken due to resource constraints.

It should also be noted that as this study is part of a wider investigation into the health status of farm workers in the UK, Spain, Uganda and Kenya, the SF-36 version 1 was preferred to version 2 as a Kiswahili translation exists for the former which is the target language to be used later in the study in Kenya and parts of Uganda.

### 2.7. Data collection

This work is part of a larger multi-disciplinary study<sup>1</sup> of vegetable production, and the types of farms and range of crops available to be studied here was determined by the aims of the parent project. The parent project focused on large commercial horticultural businesses. These businesses may comprise a series of smaller farms spread over a large geographical scale, and often include packing and storage facilities. These businesses typically employ hundreds of workers, with some employing more than a thousand.

Against this background the initial sampling frame included large vegetable producing farms in the UK which produced at least one of the following crops: brassicas, peas, beans, onions, leeks, lettuce and endives. The sample businesses were identified through a combination of personal knowledge, telephone listings and web sites. They were contacted by phone in a non-systematic manner, and successful initial phone calls were followed up with meetings with farmers and/or managers as appropriate. Having first recruited a series of large businesses to the study, several smaller horticultural farms were invited in order to provide some contrast.

Due to the potential sensitivity of the research topic it was agreed with participating businesses that absolute

<sup>1</sup> The parent project is 'Comparative assessment of environmental, community & nutritional impacts of consuming fruit and vegetables produced locally and overseas' funded by the Rural Economy and Land Use (RELU) programme of the UK Research Councils.

confidentiality would be maintained about their identity. For this reason minimal descriptive data on the sample farms are presented here. On completion of the research work each participating farm received a report summarising the findings of the research overall, which compared the results from their business with the whole sample.

Fieldworkers were defined as those members of staff, whether seasonal or permanent, who spent the majority of their day working in the field. These included all workers who planted, harvested, weeded or sprayed crops as well as those who supervised the workers or drove tractors in the field. Packhouse workers were defined as all those employed in the packhouse and undertaking tasks that involved grading, packing, tray-lining, stacking, washing or tractor work within the packhouse or warehouse. Most field and packhouse workers were employed on a seasonal basis.

Questionnaires were distributed through the farm owner (on small farms) or the human resources department on larger farms. A researcher was present at the distribution stage on all but two farms. Collection was undertaken by asking workers to either place their completed questionnaires into a centrally located collection box or by placing it in a sealed envelope and handing it to their line manager who then returned the questionnaires to the researcher. All questionnaires were completed outside of work time and away from managerial supervision. The questionnaire was self-administered and the participants were adults of working age of both sexes. Ethical approval was obtained through the University of Wales, School of Agricultural and Forest Science ethics committee.

## 2.8. Data Analysis

Differences between groups were analysed using non-parametric Mann-Whitney U, Kruskal-Wallis and t-tests. Where appropriate, associations between mean scale scores were explored using Spearman's rank correlations. The SDHS, PCS and MCS data were normalised under the transformations  $x^{2.15}$ ,  $x^2$  and  $x^2$  respectively. Differences between groups and population norms were investigated using student t-tests.

Multiple regression analysis was used to examine the relationship between self-reported health status and fourteen potentially relevant variables (age, gender, education, smoking, nationality, residential status, marital status, number of children, income, number of hours worked, job type, number of

tasks, farm size and farm type). These fourteen variables were included in a backward stepwise elimination model to explore variation within SDHS, PCS and MCS scores. Multicollinearity can be problematic when including a large number of variables as it tends to increase parameter variance and increases the  $r^2$  value which can mislead researchers into committing a type II error (Mela and Kopalle, 2002). Multicollinearity was tested by ensuring that the tolerance value did not exceed 0.2 and the Variance Inflation Factor (VIF) remained well below 5.

## 3. Results

### 3.1. Sample description

A total of eight businesses agreed to participate in the work. Of these, five were entirely conventional, one was entirely organic and two were composite businesses which included both conventional and organic units. These units were self contained, geographically separated and did not exchange staff. Four of the farms employed between 100 and 1500 workers, a fifth employed 15 and the remaining three employed five or less.

A total of 1250 questionnaires were given to farm managers for dispersal to their workers, of these 698 were returned. This suggests a response rate of approximately 56%. However the precise response rate is difficult to determine as some farms did not keep an accurate record of the number of questionnaires actually given to workers. After sorting the questionnaires and rejecting incomplete and invalid responses the final sample comprised 605 seasonal field and packhouse workers, which represents more than 1% of the UK total for seasonal or casual employment in agriculture and horticulture. Respondents whose first language was not one of the five languages used in the questionnaires were given the option of completing a questionnaire in one of the available languages. It was made clear that the respondents were under no obligation to participate. All Latvian speakers preferred to answer the Russian version of the questionnaire rather than one prepared in Latvian. The breakdown of the number of field and packhouse workers employed on survey farms and included in this study was as follows: British (42), Bulgarian (68), Estonian (1), Latvian (24), Lithuanian (156), Moldovan (28), Polish (123), Romanian (2), Russian (28), Slovakian, (2), South African (5), Ukrainian (126).

**Table 1 – Socio-demographic characteristics of respondents**

Descriptor	All farms			Conventional		Organic	
	Total	Males	Females	Males	Females	Males	Females
Total	605	395	210	341	171	54	39
Place of work							
Fieldworkers	476	336	140	284	101	52	39
Packhouse	129	59	70	57	70	2	0
Age category							
18-34	581	377	204	331	168	46	36
35-44	9	6	3	4	2	2	1
45-54	12	9	3	4	1	5	2
55-64	3	3	0	2	0	1	0

**Table 2 – Spearman's rank correlation coefficient results for the Short Depression Happiness Scale, Eu0roqol-5D, Visual Analogue Scale and SF-36 health instruments**

	EQ-5D						VAS	SF-36									
	Mobility	Self-care	Usual activities	Pain	Anxiety	EQ-5D index	VAS	PF	RP	BP	GH	VT	SF	RE	MH	PCS	MCS
SDHS	-.25***	-.10*	-.21***	-.368***	-.45***	.47***	.43***	.24***	.32***	.41***	.45***	.52***	.47***	.36***	.62***	.27***	.60***
Mobility		.21***	.23**	.275***	.25***	-.39***	-.25***	-.21***	-.15***	-.27***	-.23***	-.22***	-.18***	-.16***	-.22***	-.25***	-.19***
Self-care			.25**	.12**	.16***	-.21***	-.09*	-.11**	-.11**	-.08*	-.11**	-.09*	-.12**	-.09*	-.11**	-.12**	-.11*
Usual act..				.35***	.28***	-.48***	-.27***	-.22***	-.24***	-.29***	-.23***	-.19***	-.27***	-.22***	-.21***	-.26***	-.24***
Pain					.39***	-.88***	-.53***	-.32***	-.33***	-.61***	-.42***	-.45***	-.37***	-.28***	-.43***	-.47***	-.42***
Anxiety						-.71***	-.41***	-.22***	-.31***	-.46***	-.41***	-.42***	-.39***	-.29***	-.51***	-.30***	-.51***
EQ-5D <sub>index</sub>							.58***	.34***	.39***	.67***	.51***	.52***	.45***	.34***	.55***	.51***	.54***
VAS								.39***	.33***	.60***	.57***	.57***	.45***	.26***	.55***	.52***	.52***
PF									.48***	.45***	.42***	.31***	.39***	.43***	.33***	.66***	.27***
RP										.46***	.35***	.39***	.45***	.60***	.39***	.59***	.43***
BP											.50***	.59***	.53***	.37***	.53***	.75***	.50***
GH												.51***	.42***	.32***	.51***	.62***	.48***
VT													.53***	.41***	.72***	.40***	.79***
SF														.49***	.59***	.37***	.76***
RE															.44***	.23***	.66***
MH																.29***	.89***
PCS																	.19***

Correlations between happiness and the EQ-5D scale scores for mobility, self-care, usual activities, pain and anxiety are negatively correlated because the EQ-5D scale scores reflect good health when scores are low. Thus when mobility is increasingly restricted the corresponding SDHS score will decrease (individuals become unhappier). All correlations were significant at the  $p < 0.05^*$  level except where indicated as follows: \*\* Correlation is significant at the 0.01 level (2-tailed), \*\*\*Correlation is significant at the 0.001 level (2-tailed). Visual Analogue Scale (VAS), Physical Functioning (PF), Role-Physical (RP), Bodily Pain (BP), General Health (GH), Vitality (VT), Social-Functioning (SF), Role-Emotional (RE), Mental Health (MH), Physical Component Summary (PCS), Mental Component Summary (MCS). The boxed areas relate to correlations between scales of the same health instrument.



Twelve nationalities were represented in the sample of which Lithuanians, Polish and Ukrainians accounted for 67% of the workforce. Only 7% of the respondents described themselves as UK nationals. The remaining 93% were either directly employed from recruitment fairs held in agricultural faculties in East European universities or were employed via recruitment agencies in the UK. Most workers signed agreements to work for an initial three months with the possibility to extend to six months.

The sample population comprised 395 males and 210 females. Males were proportionately better represented in the field (males 336, females 140) whilst women were marginally in the majority in the packhouse (males 59, females 70) (Table 1). The marital status category of the questionnaire allowed four possible responses; single (79%), married/partnered (20%), divorced (0.6%) and widowed (0.4%). Fourteen percent of the respondents said they had children and of these, 63% had at least one child less than five years of age. Three responses were possible for the 'do you smoke' question; smoker (28%), ex-smokers (10%) and never smoked (62%).

### 3.2. Health Instruments

#### 3.2.1. Correlations

With the exception of self-care, all scales of the SDHS, EQ-5D, VAS and the SF-36 showed highly significant correlations with each other ( $p < 0.0001$ ). The EQ-5D self-care scale was significantly correlated with all other scales but at lower degrees of significance (Table 2). Scales measuring similar health attributes such as mental health with anxiety/depression of the EQ-5D and the SDHS, or pain with bodily pain, vitality and PCS showed the strongest correlations. The negative correlations of the five EQ-5D items with the SF-36, EQ-5D<sub>index</sub>, VAS and SDHS scales

are explained by the scoring systems. The five EQ-5D scales are scored such that a higher score indicates a poorer health status, whereas with the SF-36, EQ-5D<sub>index</sub>, VAS and SDHS higher scores indicate better health. The SF-36 scale scores showed moderate to strong associations with each other which gave a degree of confidence in the validity of the respondents' answers (Ware and Kosinski, 2001).

#### 3.2.2. Farming system

As only 3.5% of respondents were aged 35 or over, the following analysis considers only those in the 18–34 age group, and compares these with the corresponding age-specific population norms.

There were no significant differences between workers on conventional and organic farms for SF-36 scale and component summary scores. Interestingly though, five of the eight scale scores and one component summary score of the SF-36 for workers on conventional farms were significantly lower than the age specific population norm (comparisons undertaken with Student t-test (two-tailed) Role Physical  $df$  901,  $p = 0.001$ , Bodily Pain  $p < 0.0001$ , General Health  $p = 0.002$ , Social Functioning  $p < 0.0001$ , Mental Health  $p < 0.0001$ , Physical Component Summary  $p = 0.0002$ ) while the score for Vitality was significantly higher ( $p = 0.0003$ ). However when considering workers on organic farms, only three of the component scores were significantly lower than the population norm for this age category (student t-test Bodily Pain  $df$  444  $p = 0.0046$ , Social Functioning  $p = 0.0002$  and Mental Health  $p = 0.0392$ ) (Fig. 1).

There were no significant differences in EQ-5D scores between conventional and organic farming methods ( $n = 552$ ,  $p = 0.567$ ). It was noted that mean scores for field workers on both organic and conventional farms were significantly lower

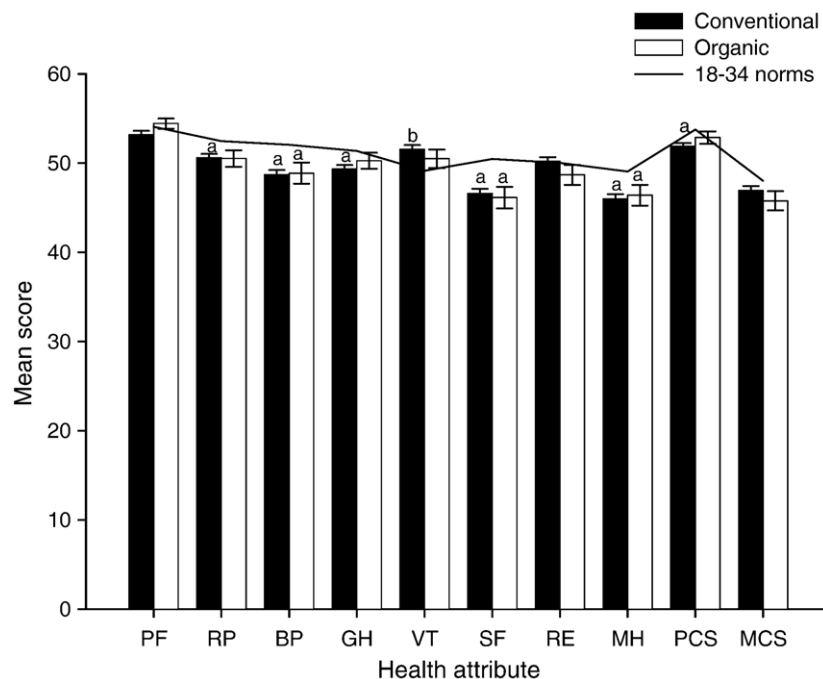


Fig. 1 – SF-36 scale and summary scores for respondents aged 18–34 by farming method. <sup>a</sup>Significantly lower than US norms for the 18–34 age group. <sup>b</sup>Significantly higher than US norms for the 18–34 age group. Physical Functioning (PF), Role-Physical (RP), Bodily Pain (BP), General Health (GH), Vitality (VT), Social-Functioning (SF), Role-Emotional (RE), Mental Health (MH), Physical Component Summary (PCS), Mental Component Summary (MCS).

than the population norm (student t-test organic df 841,  $p < 0.0001$ , conventional df 1225,  $p < 0.0001$ ). There were no significant differences between farm worker mean VAS scores on organic and conventional farms ( $n = 444$ ,  $p = 0.38$ ).

Although the previous three health instruments did not reveal any differences between workers on organic and conventional farms, workers on organic farms did score statistically higher than workers from conventional farms for the SDHS ( $n = 334$ ,  $p < 0.012$ ). In this instrument the higher scores equate to a happier state of mind. Nearly a quarter (23.7%) of respondents on conventional farms scored 9 or below on the SDHS scale, which is suggestive of mild clinical depression, whilst only 14.7% of farm workers on organic farms scored 9 or below on the same scale.

To better understand and explain the differences in SDHS scores according to farming method, the mean SDHS scores were plotted against the number of tasks that employees performed in a typical day (e.g. harvesting, weeding, sowing, packing etc). Organic farm workers generally performed at least two tasks each per day (87%) with only 13% performing one task. Only 37% of farm workers on conventional farms performed two or more tasks (63% performed a single task). The mean scores for the SDHS for respondents performing one to five tasks per day were 11.77, 12.30, 13.07, 12.84 and 13.27 respectively. A best fit line for the means of each SDHS score by task number gave an  $r^2$  value of 0.84. These results clearly show that self reported happiness is positively related to the number of tasks performed per day.

### 3.2.3. Regression analysis

Two components of the SF-36 instrument each serve to aggregate scores from four of the eight scales. These are the Physical Component Score (which aggregates Physical Functioning, Role Physical, Bodily Pain and General Health) and the Mental Component Score (which aggregates Vitality, Social Functioning, Role Emotional and Mental Health). In an attempt to better understand the relative contribution of different socio-demographic and occupational factors to health the PCS and MCS scores were utilised as dependent variables in a multiple linear regression model. Independent variables entered into the first model were farm, farm size, farming method, number of tasks per day, wages, age, gender, nationality, marital status and children. Stepwise backwards regression was used to remove the variables with the entry criteria being set at 0.01 probability of  $F$  and removal set at 0.055 probability of  $F$ . Multicollinearity did not appear to be an issue, as tolerance statistics were above 0.2 and the Variance Inflation Factor (VIF) statistics were below 5.

A significant model emerged for the PCS ( $F_{4,421} = 7.64$ ,  $p < 0.001$  adjusted  $r^2 = 0.059$ ) with the significant variables being tasks ( $\beta = 0.153$ ,  $p = 0.001$ ), marital ( $\beta = -0.17$ ,  $p = 0.003$ ), children ( $\beta = -0.127$ ,  $p = 0.027$ ) and farm ( $\beta = -0.179$ ,  $p < 0.001$ ). A significant model also emerged for MCS ( $F_{4,421} = 9.799$ ,  $p < 0.001$  adjusted  $r^2 = 0.076$ ). Significant variables were farming method (whether the farm worker worked on an organic or conventional farm  $\beta = 0.134$ ,  $p = 0.011$ ), children ( $\beta = -0.133$ ,  $p = 0.005$ ), farm ( $\beta = -0.186$ ,  $p < 0.001$ ) and farm size (farm size was measured by the number of seasonal employees  $\beta = -0.228$ ,  $p < 0.001$ ).

The contributing factors to SDHS scores were explored by entering the independent variables farm, farm size, farming

method, number of tasks per day, wages, age, gender, nationality, marital status and children into a stepwise backwards model. Entry criteria were set at 0.01 probability of  $F$  and removal criteria set at 0.055 probability of  $F$ . A significant model emerged ( $F_{3,306} = 9.986$ ,  $p < 0.001$  adjusted  $r^2 = 0.08$ ). Significant variables were farm ( $\beta = -0.171$ ,  $p = 0.002$ ), farm size ( $\beta = -0.159$ ,  $p = 0.01$ ) and number of tasks per day ( $\beta = 0.128$ ,  $p = 0.036$ ).

## 4. Discussion

Farmworkers on organic and conventional farms showed no significant differences between their self-reported health scores for the SF-36, EQ-5D<sub>index</sub> and VAS health instruments. Scores from SDHS were significantly higher for farm workers working on organic farms than on conventional ones.

Farm workers scored significantly lower than the population norm for five of the eight SF-36 scales with only the vitality scale scores being significantly higher. The low scores for the physical components Role Physical, Bodily Pain, General Health and the Physical Component Summary were unexpected as almost all of the workers on the larger farms were pre-selected for characteristics of physical strength at recruitment drives held in their native countries. According to a human resources manager at one of the larger farms 'those workers who looked physically robust were considered suitable for employment'. It was less surprising to discover low scores for mental health related scales (SF and MH) and the summary component score (MCS) as previous studies have identified farmers as having poor mental health. In particular previous studies have identified links between suicide prevalence and ideation and farmers' mental health status (Thomas et al., 2003) and links between farmers and stress (Simkin et al., 1998).

### 4.1. Critique of instruments for measuring health

Extensive research in the last 30 years has led to a wide range of health measurement instruments (questionnaires) being devised. These can be used to give insight into quality of life and allow meaningful, clinical assessment and economic evaluation of health care interventions. A number of factors determine the form, length and layout of such questionnaires. These include the method of administration (personal interview or self completion), time availability (lengthy questionnaires take longer) and whether the questionnaire is designed to investigate a particular condition or is non-disease specific (Bowling, 1997).

Development of these questionnaire measures has led to the need for population 'norms' to be established. Norms are benchmark scores for the general population that have been established through a survey, which is usually sufficiently large scale to allow analysis by sub-sample using various demographic variables. More specifically, "norm-based comparisons require valid norms for a well-defined and representative sample of the population of interest" (Ware and Kosinski, 2001). This enables scores for individual respondents, or the average score for a group, to be compared to those obtained from the general population. Unfortunately, such

validation studies are expensive to conduct and this limits the number of instruments for which normative data exist.

It has been noted in some previous studies (Brazier et al., 1993; Myers and Wilks, 1999) that the EQ-5D instrument lacks sufficient sensitivity to detect differences in the physical health status of the sample population compared to the general population when respondents only report low levels of ill-health. This also probably occurred in this study, and it arises as the workers were employed on the basis that they had no problems with mobility and would therefore be unlikely to have difficulty with self-care. For this reason they generally scored one (best health status) for the mobility and self-care scales of the instrument. This had the effect of reducing the first two components of the instrument to two-point scales. In spite of this ceiling effect the age adjusted t-test results still showed farm workers scoring significantly below the population norm for this age group. This is borne out by the mean scores for each of the scales of the EQ-5D where high scores indicate poorer health and can range between one and three. Thus, pain and anxiety mean scores were higher than those for the other three scales (mobility 1.08, self-care 1.01, usual activities 1.14, pain 1.41 and anxiety 1.36). Both pain and anxiety had strong correlations with the SF-36 equivalent scales (bodily pain and mental health) whilst mobility, self-care and usual activities had much weaker correlations with all SF36 scales, suggesting that pain and anxiety are in large part responsible for the low scores when compared with the national norm. Ceiling effects are less prominent for VAS scores which are a simultaneous measure of both physical and mental health attributes and yet farm workers scored significantly lower than the population norm. The mean score for men aged 18–34 (79.67) was close to the norm score for men aged 55–64 (78.99) whilst women's mean score (75.6) was closer to the mean score for the 65–74 age group (76.55).

When interpreting the multiple regression results for the SDHS it is important to note that due to the relative novelty of the instrument no validated translations were available for use. For this reason they were translated as part of this study. Unfortunately as none of the SDHS translations were back translated, as is suggested to be best practice (Wild et al., 2005), the parity of translations can not be guaranteed. Whilst it may have been desirable to have used back translated questionnaires it should be noted that firstly, there is debate as to the necessity of backward translation if a professional translator has already translated forwards into the target language (McKenna and Doward, 2005). Secondly, in reality backward translation may not have had a large bearing on the interpretation of the results as the stepwise regression analysis removed the effects of nationality at an early stage of model development.

#### 4.2. Farm worker stress

Worries over the amount and variation in income have been reported as a cause of low mental wellbeing in farmers (McGregor et al., 1995). It is not unreasonable to assume that this may also be a stressor for farmworkers, particularly as the amount of income varies over time in relation to the demand for fresh produce. For example, there were considerable

amounts of work to be done around national holidays and prior to any forecasted warm weekend as consumer demand for salad crops generally increased. However, periods of lower demand during the summer months resulted in a reduced number of hours for field and packhouse workers whose expectations were of season-long elevated work hours. Lack of orders or quiet weeks occasionally resulted in complete days of non-work. Added to the worry of not earning sufficiently during the three or six month contract were stressors such as social isolation, long working hours, reduced leisure time and the inseparability of the workplace and home all of which have been previously cited as causal in farmer depression or stress (Hounsborne et al., 2006; McGregor et al., 1995; Simkin et al., 1998). However, this list may not be inclusive as evidenced by the fact that when farm workers were asked to cite one of the worst aspects of their work, a number answered 'homesickness'. This feeling could be aggravated by the remote location of many of the dormitories on farms in the study which were frequently located some distance from towns and shopping, the tough work regime they were under and language difficulties.

The number of tasks performed each day was a significant explanatory variable in the regression models relating to Physical Component Summary, Mental Component Summary and the Short Depression Health Scale. Studies in other, non-agricultural, industries have also demonstrated a causal link between worker well-being and the number of tasks performed (Drory and Shamir, 1988; Haworth and Paterson, 1995; van Veldhoven et al., 2002). These relationships may be particularly important in horticulture where a person's entire working environment is inextricably tied to their living environment to the extent that the two are difficult to disentangle, as appears to be the case with the farm workers in this survey. In this situation the need for variety within the workplace may be even more critical than is normally the case.

With this in mind one possible area within which both conventional and organic farming might militate against poor self-reported health is by altering the range and number of tasks that workers might be expected to perform. Workers on organic farms already perform more different tasks than on conventional farms (Jansen, 2000; Morison et al., 2005) and it may be more cost effective for organic farms to extend and deepen this practice rather than attempting radical changes elsewhere in an attempt to differentiate organic from conventional production.

#### 4.3. Implication for organic agriculture and the IFOAM aspirations

As pesticides have become more sophisticated and less harmful to both humans and the wider environment (Cross and Edwards-Jones, 2006a; Cross and Edwards-Jones, 2006b), the environmental and human health impact of these elements would be expected to decrease. Simultaneously changes in the accreditation criteria (through supermarket pressures to meet growing demand for organic products) have allowed large-scale conventional farms to develop organic sectors within their pre-existing farms. This has served to blur differences between industrial conventional and organic



farming (Vogl et al., 2005). The sublimation of the organic ideal to industrialised horticultural processes is symptomatic of many radical organisations obeying Michel's iron law of oligarchy whereby the pressures to organise and bureaucratised increase to the extent that the movement is compromised and assimilated to such an extent that it resembles that which it intended to replace (Michelsen, 2001). The findings of this research suggest that a great deal of improvement in farm worker self-reported health will need to occur before organic farms meet the requirements of the 'Principle of Health' as described by IFOAM.

#### 4.4. Wider ethical implications

Policy makers need to consider the consequences of poor farm worker health, and factor the health costs of production into their policies. This may be difficult as the costs of any long-term ill health caused to non-UK nationals as a consequence of working in UK horticulture may ultimately be incurred by the workers' country of origin. A similar situation has been recorded in the USA where migrant workers return to the health services of their native country and as a result the health impact of agriculture on farm workers' health goes largely unrecorded (Villarejo, 2003). This situation clearly raises ethical issues relating to who receives the benefits from migrant workers, the donor or the host country, and consequently who should bear the costs?

Given that the health of horticultural workers was poorer than that of the population average, it is also unclear if it is ethical to create more jobs in UK horticulture, as this may potentially reduce the well-being of even more people. This is a particular dilemma for organic farming systems which would create more jobs per unit of output than conventional farming (Morison et al., 2005).

One potential solution to this dilemma would be to shift horticultural production to developing countries where substantial improvements in well-being (both health and economic) might accrue to the workers engaged in waged work (Dorward et al., 2004; Kydd et al., 2004; Mellor, 1999). However, such a potential solution then raises other issues relating to the environmental impacts of growing vegetables in tropical regions and transporting them to Europe for consumption (Singer and Mason, 2006).

## 5. Conclusions and further research

This study indicates that the self-perceived health status of horticultural vegetable farm workers is significantly lower than population norms for a number of health scales. There were no significant differences in health status between workers on conventional or organic farms. Workers on organic farms were happier than those employed on conventional farms although this difference can best be explained in terms of the number of different tasks each employee must perform rather than issues related to variables such as exposure to pesticides.

It could be argued that the results reported here do not conclusively prove that working in horticulture reduces health. An alternative hypothesis is that the respondents had poor health before beginning to work in the sector. This

seems unlikely as horticultural businesses tend to select physically fit workers, however only a longitudinal study of worker health can test this hypothesis (i.e. test workers health before, during and after participating in the horticultural sector). Other future research could be conducted in countries which export products to the UK in order to ascertain if the health of their horticultural workers is significantly different to that of the general population. This would then enable an assessment of the relative merits of shifting horticultural production to these countries.

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## REFERENCES

- Alavanja MCR, Samanic C, Dosemeci M, Lubin J, Tarone R, Lynch CF, et al. Use of agricultural pesticides and prostate cancer risk in the Agricultural Health Study cohort. *Am J Epidemiol* 2003;157:800–14.
- Baldwin CM, Bell IR, Rourke MK, Lebowitz MD. The association of respiratory problems in a community sample with self-reported chemical intolerance. *Eur J Epidemiol* 1997;13:547–52.
- Beach JR, Spurgeon A, Stephens R, Heafield T, Calvert IA, Levy LS, et al. Abnormalities on neurological examination among sheep farmers exposed to organophosphorous pesticides. *Occup Environ Med* 1996;53:520–5.
- Benavides FG, Benach J, Diez-Roux AV, Roman C. How do types of employment relate to health indicators? Findings from the Second European Survey on Working Conditions. *J Epidemiol Community Health* 2000;54:494–501.
- Bowling A. Measuring health: a review of quality of life measurement scales. Buckingham: Open University Press; 1997.
- Bowling A, Bond M, Jenkinson C, Lamping D. Short Form 36 (SF-36) Health Survey questionnaire: which normative data should be used? Comparisons between the norms provided by the Omnibus Survey in Britain, the Health Survey for England and the Oxford Healthy Life Survey. *J Public Health Med* 1999;21:255–70.
- Brazier J, Jones N, Kind P. Testing the validity of the Euroqol and comparing it with the SF-36 health survey questionnaire. *Qual Life Res* 1993;2:169–80.
- Brooks R, EuroQol Group. EuroQol: the current state of play. *Health Policy* 1996;37:53–72.
- Browne AW, Harris PJ, Hofny-Collins AH, Pasiecznik N, Wallace RR. Organic production and ethical trade: definition, practice and links. *Food Policy* 2000;25:69–89.
- Bullinger M, Alonso J, Apolone G, Leplege A, Sullivan M, Wood-Dauphinee S, et al. Translating health status questionnaires and evaluating their quality: the IQOLA Project Approach. *J Clin Epidemiol* 1998;51:913–23.

- Castro-Gutierrez N, McConnell R, Andersson K, Pacheco-Anton F, Hogstedt C. Respiratory symptoms, spirometry and chronic paraquat exposure. *Scand J Work Environ Health* 1997;23:421–7.
- Cole DC, Carpio F, Math JJ, Leon N. Dermatitis in Ecuadorean farm workers. *Contact Dermatitis* 1997;37:1–8.
- Cross P, Edwards-Jones G. Variation in pesticide hazard from arable crop production in Great Britain from 1992 to 2002: Pesticide risk indices and policy analysis. *Crop Prot* 2006a;25:1101–8.
- Cross P, Edwards-Jones G. Variation in pesticide hazard from vegetable production in Great Britain from 1991 to 2003. *Pest Manag Sci* 2006b;62:1058–64.
- DEFRA. Joint announcement by the agricultural departments of the United Kingdom agricultural and horticultural census: June 2005 United Kingdom. DEFRA; 2006.
- Dorman PJ, Waddell F, Slattery J, Dennis M, Sandercock P. Is the EuroQol a valid measure of health-related quality of life after stroke? *Stroke* 1997;28:1876–82.
- Dorward A, Kydd J, Morrison J, Urey I. A Policy Agenda for Pro-Poor Agricultural Growth. *World Dev* 2004;32:73–89.
- Drory A, Shamir B. Effects of Organizational and Life Variables on Job Satisfaction and Burnout. *Group Organ Manage* 1988;13:441–55.
- Eskenazi B, Bradman A, Castorina R. Exposures of children to organophosphate pesticides and their potential adverse health effects. *Environ Health Perspect* 1999;107:409–19.
- EuroQoL Group. EuroQoL: a new facility for the measurement of health-related quality of life. *Health Policy* 1990;16:199–208.
- FAO-ILO-IUF. Agricultural workers and their contribution to sustainable agriculture and rural development. FAO-ILO-IUF; 2005.
- Freidberg S. French beans and food scares: culture and commerce in an anxious age. Oxford: Oxford University Press; 2004.
- Gandek B, Ware Jr JE. Methods for validating and norming translations of health status questionnaires: The IQOLA Project Approach. *J Clin Epidemiol* 1998;51:953–9.
- Gerrard C. Farmers' occupational health: cause for concern, cause for action. *J Adv Nurs* 1998;28:155–63.
- Goodman D. Organic and conventional agriculture: Materializing discourse and agro-ecological managerialism. *Agric Hum Values* 2000;17:215–9.
- Guthman J. *Agrarian dreams: the paradox of organic farming in California*. London: University of California Press; 2004.
- Hall A, Mogorodoy V. Organic farmers in Ontario: An examination of the conventionalization argument. *Sociol Rural* 2001;41:322–99.
- Haworth J, Paterson F. Access to Categories of Experience and Mental Health in a Sample of Managers. *J Appl Soc Psychol* 1995;25:712–24.
- Hounsby B, Edwards RT, Edwards-Jones G. A note on the effect of farmer mental health on adoption: The case of agri-environment schemes. *Agric Syst* 2006;91:229–41.
- HSE. Health and safety in agriculture. Health and safety executive vol. 2006; 2006.
- Hurst NP, Jobanputra P, Hunter M, Lambert M, Lockhead A, Brown H. Validity of EuroQol-a generic health status instrument in patients with rheumatoid arthritis: Economic and health outcomes research group. *Rheumatology* 1994;33:655–62.
- IFOAM. The principles of organic agriculture. 2006. International Federation of Organic Movements; 2006. [http://www.ifoam.org/about\\_ifoam/principles/index.html](http://www.ifoam.org/about_ifoam/principles/index.html).
- Jansen K. Labour, livelihoods and the quality of life in organic agriculture in Europe. *Biol Agric Hortic* 2000;17:247–78.
- Joseph S, Linley PA, Harwood J, Lewis CA, McCollam P. Rapid assessment of well-being: the Short Depression-Happiness Scale (SDHS). *Psychol Psychother: Theor, Res Pract* 2004;77:463–78.
- Kind P, Dolan P, Gudex C, Williams A. Variations in population health status: results from a United Kingdom national questionnaire survey. *BMJ* 1998;316:736–41.
- Kydd J, Dorward A, Morrison J, Cadisch G. Agricultural development and pro-poor economic growth in sub-Saharan Africa: potential and policy. *Oxf Dev Stud* 2004;32:37–57.
- McGregor M, Willock J, Deary I. Farmer stress. *Farm Manage* 1995;9:57–65.
- McKenna SP, Doward LC. The Translation and Cultural Adaptation of Patient-Reported Outcome Measures. *Val Health* 2005;8:89–91.
- Mela CF, Kopalle PK. The impact of collinearity on regression analysis: the asymmetric effect of negative and positive correlations. *Appl Econ* 2002;34:667–77.
- Mellor JW. *Pro-Poor Growth-The Relation between Growth in Agriculture and Poverty Reduction*. USAID, Washington: John Mellor Associates, Inc; 1999.
- Michelsen J. Recent development and political acceptance of organic farming in Europe. *Sociol Rural* 2001;41:3–20.
- Morison J, Hine R, Pretty J. Survey and analysis of labour on organic farms in the UK and Republic of Ireland. *Int J Agric Sustain* 2005;3:24–43.
- Myers C, Wilks D. Comparison of Euroqol EQ-5D and SF-36 in patients with chronic fatigue syndrome. *Qual Life Res* 1999;8:9–16.
- National Assembly of Wales (NAFW). *Welsh Health Survey 1998: results of the second Welsh Health Survey*. Norwich: HMSO; 1999.
- Nowels D, McGloin J, Westfall JM, Holcomb S. Validation of the EQ-5D quality of life instrument in patients after myocardial infarction. *Qual Life Res* 2005;14:95–105.
- Pacini C, Wossink A, Giesen G, Vazzana C, Huirne R. Evaluation of sustainability of organic, integrated and conventional farming systems: a farm and field-scale analysis. *Agric, Ecosyst Environ* 2003;95:273–88.
- Penagos HG. Contact dermatitis caused by pesticides among banana plantation workers in Panama. *Int J Occup Environ Health* 2002;8:14–8.
- Picavet HSJ, Hoeymans N. Health related quality of life in multiple musculoskeletal diseases: SF-36 and EQ-5D in the DMC3 study. *Ann Rheum Dis* 2004;63:723–9.
- Pollan M. *Big organic*. In *The omnivore's dilemma: the search for a perfect meal in a fast-food world*. London: Bloomsbury Publishing; 2006. p. 134–84.
- Raynolds LT. Re-embedding global agriculture: The international organic and fair trade movements. *Agric Human Values* 2000;17:297–309.
- Raynolds LT. The globalization of organic agro-food networks. *World Dev* 2004;32:725–43.
- Reeves M, Schafer KS. Greater risks, fewer rights: U.S. farmworkers and pesticides. *Int J Occup Environ Health* 2003;9:30–9.
- Sapin C, Fantino B, Nowicki M-L, Kind P. Usefulness of EQ-5D in assessing health status in primary care patients with major depressive disorder. *Health Qual Life Outcomes* 2004;2:20.
- Schrag A, Selai C, Jahanshahi M, Quinn NP. The EQ-5D, a generic quality of life measure, is a useful instrument to measure quality of life in patients with Parkinson's disease. *J Neurol Neurosurg Psychiatr* 2000;69:67–73.
- Senthilselven A, McDuffie JA, Dosman JA. Association of asthma with use of pesticides-results of a cross-sectional survey of farmers. *Am Rev Respir Dis* 1992;146:884–7.
- Shadbolt B, McCallum J, Singh M. Health outcomes by self-report: validity of the SF-36 among Australian hospital patients. *Qual Life Res* 1997;6:343–52.
- Simkin S, Hawton K, Fagg J, Malmberg A. Stress in farmers: a survey of farmers in England and Wales. *Occup Environ Med* 1998;55:729–34.
- Singer P, Mason J. *The way we eat: why our food choices matter*. USA: Rodale; 2006. 328 pp.
- Thomas HV, Lewis G, Thomas DR, Salmon RL, Chalmers RM, Coleman TJ, et al. Mental health of British farmers. *Occup Environ Med* 2003;60:181–6.
- van Veldhoven M, de Jonge J, Broersen S, Kompier M, Meijman T. Specific relationships between psychosocial job conditions and

- job-related stress: A three-level analytic approach. *Work Stress* 2002;16:207–28.
- Villarejo D. The health of US hired farm workers. *Ann Rev Pub Health* 2003;24:175–93.
- Virtanen M, Kivimäki M, Joensuu M, Virtanen P, Elovainio M, Vahtera J. Temporary employment and health: a review. *Int J Epidemiol* 2005;34:610–22.
- Vogl CR, Kilcher L, Schmidt H. Are standards and regulations of organic farming moving away from small farmers' knowledge? *J Sustain Agric* 2005;26:5–26.
- Ware JE. SF-36 Health Survey Update. *Spine* 2000;25:3130–9.
- Ware JE, Gandek B. Overview of the SF-36 Health Survey and the International Quality of Life Assessment (IQOLA) Project. *J Clin Epidemiol* 1998;51:903–12.
- Ware J, Kosinski M. SF-36 Physical and Mental Health Summary Scales: A Manual for Users of Version 1. Lincoln, RI: QualityMetric Incorporated; 2001.
- Wild D, Grove A, Martin M, Eremenco S, McElroy S, Verjee-Lorenz A, Pennifer E. Principles of Good Practice for the Translation and Cultural Adaptation Process for Patient-Reported Outcomes (PRO) Measures: Report of the ISPOR Task Force for Translation and Cultural Adaptation. *Value Health* 2005;8:94–104.
- Wilson C, Tisdell C. Why farmers continue to use pesticides despite environmental, health and sustainability costs. *Ecol Econ* 2001;39:449–62.
- Zahm SH, Ward MH. Pesticides and childhood cancer. *Environ Health Perspect* 1998;106:893–908.