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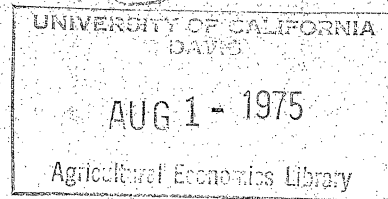
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*pesticides*



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Internalizing Health Effects of Pesticides

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Survey of 1416 California farm workers indicated significant under-reporting of pesticide injuries in official information sources. Institutions for internalization of externalities are operating inefficiently due to an imprecise data problem. Seventy percent of farm workers had never heard of Workmans' Insurance, and 20 percent could not understand pesticide warning labels.

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## INTERNALIZING HEALTH EFFECTS OF PESTICIDES

The banning of organochlorine base pesticides has forced farmers to shift to more expensive, more toxic organophosphates and carbamates to control pests. The hazard to the environment has also shifted from a long-term cumulative effect on certain birds, marine life, and links in the food chain to a more immediate effect on mammals, specifically to man.

The stated public policy of the Federal Government through the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), as well as of various state laws, is to protect the general public and the environment from pesticide hazards. The Act, by recognizing the extra market nature of many pesticide hazards, calls, in economic terms, for optimal internalization policies. Under Starrett's [1974] definition of an externality as "an absence of markets", the cause of externalities is rooted in market transaction costs.<sup>1/</sup> The principal transaction cost in this study is the cost of imprecise information.

In this paper, we report some results of a survey on the precision of information underlying farm worker pesticide injury policy in California, and draw policy conclusions based on two decision-theoretic concepts. The first is that a risk averse policy maker who ignores the precision of his information base will make suboptimal decisions, and the second is that the value of improved information is conditional on the present precision of information.

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<sup>1/</sup> Transaction costs are generally defined as the costs of information, bargaining, and enforcement of market transactions.

The information currently available to policy makers is contrasted with the results of a primary survey of field workers in California. Two of the areas are: (1) pesticide related injury incidence and cost/incidence, and (2) internalization methods of insurance and label regulations.

#### Current Data Base in California

The sole source of data on occupational injury from agricultural chemicals in California is the "Doctor's First Report of Work Injury". This is a mandatory report for State Workman's Compensation Insurance. Valuable though this report may be, there is strong evidence of under-reporting of the true level of injury. In addition, Doctor's First Reports contain very scanty data on the specific pesticide associated with the injury, and no information on the crop being worked or the task being performed by the injured farm worker at the time of exposure.

For the policy maker to set standards for the use of pesticides, it is highly important that he have a knowledge of the amount and use (crop and method of application) of toxic materials. In 1969, the California Department of Agriculture was assigned the task of collecting and summarizing the information on restricted pesticide use permits. Under the California system, growers and commercial pest control operators are required to obtain permits and report application of all restricted materials, under the supervision and control of the County Agricultural Commissioner. In California, the permits for agricultural use amount to approximately 700,000 per year.

The County Agricultural Commissioners, appointees of County Board of Supervisors, are the core of the day-to-day enforcement of pesticide safety regulations. Their regulation activities, reported to the State Department of Agriculture, fall into three broad categories -- inspection of equipment and fields, legal actions against violators, and registration and reporting of pesticide use.

The policy maker, in order to set optimal standards, also must have accurate information on the population exposed to a hazard. The sole source of information in California on the agricultural work force, its size, distribution, and type of work, is data collected by the California Department of Human Resource Development, which publishes bi-weekly estimates from its field offices.

One might expect that the mandatory Workman's Compensation Insurance program would internalize the pesticide externality and provide an excellent source of data on the social cost component imposed on farm workers. Unfortunately, premium rates to farm firms do not change with pesticide use or claim history. Also, the manner in which claims payout data are recorded prevents cost data from being extrapolated even under the broad heading of "agricultural chemicals" injury.

#### Primary Survey of Farm Workers

Estimates of injury incidence, cost, and contributing factors were obtained from a large sample survey of farm workers in Monterey and Stanislaus Counties in 1973. The principal relationships examined were: the incidence and severity of work-related injuries and the costs imposed on farm workers due to their ignorance of Workmen's Compensation rights, the contributing factors of the crop type and work type within

the agricultural industry on injury incidence, the cost of injuries reported from the point of view of the workers, and the effectiveness of pesticide hazard warnings on container labels.

The survey was conducted with three passes spaced 30 days apart in two counties with dissimilar cropping patterns. One county had predominantly tree fruit and field crops, and the second predominantly fresh vegetables. The middle pass was centered on the peak organophosphate application season. The recall time for pesticide injuries was 30 days. Interviews were conducted by professional bilingual interviewers due to the high proportion of Spanish-speaking workers in the population.

Sample size was very important because of the low incidence rate response anticipated for key variables, such as reported injuries from pesticides. A total of 1477 interviews of farm workers were made based on a random cluster sample of farm-worker residences, including migrant-labor housing.

Because pesticide injuries revealed by the survey were not clinically verified, the schedule was designed to separate out responses concerning attribution of the injury (cause) and degree of confirmation of the attribution. To be included in the survey, an injury required that the worker had taken at least one-half day off from work, or had visited a physician. This minimum level of severity we felt was necessary to eliminate the background level of headaches, hangovers, and other nuisance impairments.

### Injury Incidence and Cost

Table 1 indicates the hours lost per 1,000 hours worked, attributed to pesticides from our farm worker survey, Doctor's First Reports, and, for comparison, the time-lost rate due to all causes as reported from a California Department of Industrial Health survey in 1973.

The lost-time rates in the table are cumulative. That is, level two injury rates include level one injury rates, and level three includes both confidence levels one and two. The data in Table 1 reveal the magnitude of the under-reporting problem of pesticide injuries. Under the highest level of confidence, level one, the results of the farm worker survey indicate an injury level several orders of magnitude greater than the injury rate reported from Doctor's First Reports. This same confidence level also indicates an injury rate about 50 percent of the injury rate from all causes in manufacturing.

The cost-per-injury incident was obtained from the Doctor's First Reports and the primary survey. When expressed in the more meaningful form of cost-per-day lost by injury, the two sources are in close agreement. To obtain a uniform cost basis, the Doctor's First Report costs were adjusted for time lost by the worker that was insufficient to claim under Workmen's Compensation regulations. Currently, a worker must lose more than three consecutive days to be eligible for lost time compensation. Standard costs of medical treatment had to be used for many of the respondents to the primary survey, who were only aware of their direct costs of treatment and not those paid by insurance or Medi-Cal schemes. The results are contained in Table 2.

TABLE 1

Hours Lost Per 1,000 Hours Worked

Attributed to pesticides			Statewide av, Dr.'s First Report, 1973		All causes Dept. Industrial Health Survey, 1973	
1973 Farm worker survey			Farm workers	P.C.O. <sup>2</sup> workers	Highest cons- truction	average manu- facturing
Confidence level <sup>1</sup>						
1	2	3				
1.467	2.653	5.251	.0056	.6973	4.740	3.004

<sup>1</sup>Level 1: Definitely pesticide related.

Level 2: Probably pesticide related.

Level 3: Possibly pesticide related.

<sup>2</sup>P.C.O. denotes workers for Pest Control Operators.



TABLE 2

Doctor's First Reports, 1973Field worker

Cost per incident reported	Mean	\$101.71
	Standard deviation	38.53
Cost per day lost	Mean	\$ 33.42

Primary Survey of Field Workers - Monterey, Stanislaus, Counties, 1973

Cost per incident reported	Mean	\$130.48
	Standard deviation	126.64
Cost per day lost	Mean	\$ 31.86

It must be emphasized that these cost figures are only the social opportunity costs of the injuries, and do not reflect the costs of the pain, discomfort, and anxiety suffered by the injured person.

The discrepancies in the injury incidence estimates in California should be viewed within the context of the sketchy or nonexistent pesticide injury reporting systems in other states. A policy maker must either dismiss the primary survey results as the product of skilled and systematic fabrication by large numbers of people in different times and places, or recognize that the incidence of pesticide injuries is a significant problem and worthy of additional effort.

#### Internalization Approaches

##### Insurance

One current institution for internalization is liability or accident insurance. The premiums paid by the farm employer are used to compensate farm workers for medical bills and lost work time. If insurance premiums were set for each grower based on the history of claims for each farm, so that the careful farmer was rewarded and the careless grower penalized, an insurance program would increase the degree of internalization. In California, Workmen's Compensation Insurance premiums are set as a percent of wages paid on a farm, and the rate varies only by broad categories of type of farm. This inability of the insurance carrier to distinguish between the truly exogenous causes of accidents and contributing carelessness by the employer, is termed "moral hazard," and has been shown by Arrow [69] to produce inefficiency in the insurance market.

The effective coverage of any insurance scheme is restricted by the unawareness of the eligible to claim coverage and by the claim procedure. The results of the farm worker survey indicate that 70 percent of the workers had not heard of Workmen's Compensation Insurance (see Table 3). Most of those (76 percent) who reported in the negative were of Spanish-speaking origin, and 26 and 41 percent, respectively, were Anglos and Blacks with an English-speaking origin. Obviously, in order to increase the efficacy of Workmen's Compensation Insurance as an internalizing institution, some sort of greatly expanded outreach program explaining the rights and benefits to farm workers will be needed.

#### Label Standards

Labeling standards and other safety measures imposed to reduce and internalize pesticide injury externalities have little effect if the worker to be protected does not comprehend the message or the significance of the standard or safety measure. A case in point is the warning required on the labels of pesticide containers. During the personal interviews, the farm workers were shown a warning label from an organophosphate container which had a large skull and cross bones, pictures of drops entering a wounded hand covered with a large "X," and a printed notice (in English) indicating that if a person came in contact with the contents, a physician should be called immediately. The farm workers were asked to explain what the label meant to them, and were further questioned as to their ability to read or write English and Spanish.

TABLE 3

## Knowledge of Workmen's Compensation Insurance by Ethnic Groups

Survey responses	Ethnic group:	Mexi-can	Anglo	Black	Fili-pino	Other	Row total
"haven't heard of it"	Count:	894	37	15	30	12	988
	Row %:	90.5	3.7	1.5	3.0	1.2	69.8
	Col %:	75.8	26.1	41.7	69.8	80.0	
"for job-related sickness"	Count:	70	33	4	3	2	112
	Row %:	62.5	29.5	3.6	2.7	1.8	7.9
	Col %:	5.9	23.2	11.1	7.0	13.3	
Sickness, not job related	Count:	50	22	3	1	0	78
	Row %:	66.7	28.2	3.8	1.3	0.0	5.5
	Col %:	4.4	14.5	8.3	2.3	0.0	
Old age assistance	Count:	46	21	3	8	1	79
	Row %:	58.2	26.6	3.8	10.1	1.3	5.6
	Col %:	3.9	14.8	8.3	18.6	6.7	
Other	Count:	27	7	4	0	0	38
	Row %:	71.1	18.4	10.5	0.0	0.0	2.7
	Col %:	2.3	4.9	11.1	0.0	0.0	
Insurance	Count:	9	1	0	0	0	10
	Row %:	90.0	10.0	0.0	0.0	0.0	0.7
	Col %:	0.8	0.7	0.0	0.0	0.0	
"Yes, but don't know what it is"	Count:	82	21	7	1	0	111
	Row %:	73.9	18.9	6.3	0.9	0.0	7.8
	Col %:	6.9	14.8	19.4	2.3	0.0	
Column Totals:		1180	142	36	43	15	1416
		83.3	10.0	2.5	3.0	1.1	100.0

The data in Table 4 are cross tabulations of the degree of label comprehension and the workers stated ability to read Spanish, English, or both. The results indicate that label warning comprehension is highly related to reading ability. Of those interviewed, 20 percent had no comprehension of the printed label or the picture. Of these 277 people, 210 (76 percent) stated they could read neither Spanish nor English, or could only read Spanish. The general message of the warning label that the containers held a poison that was injurious was understood by 61 percent of the workers interviewed, but only 14.5 percent had a complete understanding of the pictorial and written messages.

Over half of the sample stated they could not read English,. As would be expected, this same group had the lowest overall comprehension. The ability to read any language greatly improved comprehension. In order to significantly increase the efficacy of the warning label, it appears that a move to bilingual labels would be very helpful.

#### Conclusions

The reciprocity of externalities results in costs to society for excessive or inadequate internalization policies. The results presented here indicate that the problem of pesticide injuries to field workers in California is more serious than the statewide figures reveal. In addition, the insurance scheme and labeling regulations suffer in efficiency from imprecise information.

TABLE 4

## Label Comprehension by Ability to Read Spanish and English

		(S = Spanish; E = English)				
Level of comprehension		S-No, E-No	S-Yes, E-No	S-Yes, E-Yes	S-No, E-Yes	Row total
No comprehension	Count:	26	83	27	8	144
	Row %:	18.1	57.6	18.8	5.6	10.2
	Col %:	26.5	12.5	6.3	3.8	
Used pictures, no understanding	Count:	11	90	23	9	133
	Row %:	8.3	67.7	17.3	6.8	9.5
	Col %:	11.2	13.6	5.3	4.2	
Used pictures "Don't touch"	Count:	4	45	16	3	68
	Row %:	5.9	66.2	23.5	4.4	4.8
	Col %:	4.1	6.8	3.7	1.4	
General understanding, "Poison"	Count:	51	404	261	141	857
	Row %:	6.0	47.1	30.5	16.5	61.0
	Col %:	52.0	60.8	60.6	66.2	
Understood completely	Count:	6	42	104	52	204
	Row %:	2.9	20.6	51.0	25.5	14.5
	Col %:	6.1	6.3	24.1	24.4	
Column Totals:		98	664	431	213	1406
		7.0	47.2	30.7	15.1	100.1

An analytical solution to the optimal internalization and information policy is derived in Howitt [1975]. The survey results, although simply stated here, indicate the need for changes in the information base in California, and explicit consideration of information as part of all empirical externality policy proposals.

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