NOTIFICATION OF PESTICIDE POISONING:

Knowledge, Attitudes and Practices of Doctors in the Rural Western Cape

Abstract

Objective: To evaluate the impact of a surveillance intervention on the knowledge, attitudes and practices of rural doctors in the Western Cape.

Study Design: Intervention study. Comparison of subjects in an index area in the Western Cape with those of a control before and after an intervention aimed at improving notification of pesticide poisoning.

Subjects: Doctors in private and public practice who provide primary or secondary care services to victims of pesticide poisoning.

Main Outcome Measures: Knowledge, attitudes and reported practices relating to the diagnosis, management and notification of pesticide poisoning.

Results: An increase in awareness of pesticide poisoning as a notifiable condition was achieved in the intervention area, particularly for non-hospital doctors, as was an increase in the number of reported pesticide poisonings diagnosed in the preceding year in both intervention and control areas. Doctors in the intervention area also appeared to improve their perceptions as to the main causes of pesticide poisoning. However, none of the other measures of knowledge, attitude or practice were improved, including the percentage of poisonings that were notified. Obstacles to notification included excessive paperwork, poor contact with health authority staff and previous experience of lack of feedback in notified cases. The intervention appeared to address the last problem but failed to address the other main reasons.

Conclusion: Limited objectives of increasing awareness of pesticide poisoning as a notifiable condition (and of increasing practitioner's diagnostic index of suspicion for pesticide poisoning) may be achievable with a relatively low input surveillance intervention. However, other strategies may be more fruitful in improving notification in rural areas. Attention needs to be paid to improving the orientation of rural practitioners to the prevention of pesticide poisoning.

Key words: pesticide poisoning, surveillance, general practitioners, notification

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Public health surveillance has been identified as a key element in the control of acute pesticide poisoning[1]. In South Africa, pesticide poisoning (PP) is a notifiable condition and approximately 280 cases were notified nationally over the past two years, with a case fatality rate of about 4%[2]. However, under-reporting of poisoning is well documented[3] with estimates of the proportion of poisonings reported from 5% to 20%[4-6]. Rural health care providers are key personnel in the public health control of pesticide poisoning[7,8,9]. In South Africa, the importance of this role has recently been reinforced by two measures in terms of the Occupational Health and Safety Act.

1. Doctors are now obliged to report to the Inspector of Labour any medical conditions in their patients which they believed to be caused by workplace exposure[10];
2. The Hazardous Chemical Substances Act obliges employers to institute medical monitoring of farm workers exposed to cholinesterase-inhibiting compounds and other hazardous chemicals used in agriculture[11].

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- Provision of free cholinesterase testing (red blood cell).
- Mailing of a laminated information brochure covering:
  - the reasons for, and importance of, notification;
  - simple and relevant clinical information for diagnosis and management of pesticide poisoning;
  - an explanation of the project;
  - advice on how to arrange cholinesterase testing.
- Mailing of relevant journal articles on pesticide poisoning.
- In parallel to the above, mailing of a supporting letter from the Regional Director of Health.
- Telephonic follow-up after the mailing to:
  - remind doctors of the goals of the project and encourage their participation;
  - ensure that the doctors had received the information package and to resend, if necessary.
- During the study period, immediate feedback from local authority health service Environmental Health Officers to doctors notifying pesticide poisoning .
- Towards the end of the study period, a personal visit by one of the investigators to doctors working in the rural areas outside of Worcester and providing an interim report on the project results.

Table I: A surveillance intervention to improve pesticide poisoning notification by rural doctors, 1994-5.

Given that organophosphate and carbamate pesticides (the main cholinesterase-inhibiting agrichemicals) are the most widely used farm chemicals, with serious potential for adverse acute health effects in the Western Cape[5,12], cholinesterase testing by rural health care providers is likely to be increasingly linked to effective surveillance activities regarding pesticides[13].

However, little is known about the awareness, skills and management practices of rural practitioners in South Africa in relation to pesticide poisoning and how this impacts on surveillance data in the country. To address this gap, an intervention study was carried out in the Worcester farming region in the Western Cape over the period 1994-1995. The study aimed to improve notification of pesticide poisoning in order to gain a more complete epidemiological profile and to inform improved prevention programmes.

Elements of the intervention targeted at local practitioners are summarised in the accompanying Table I. Provision of information aimed at encouraging pesticide poisoning notification and the provision of a free service for cholinesterase testing for all suspects formed the core of the intervention. The expectation was that the availability of free cholinesterase testing would improve accurate diagnosis and therefore improve notification. The epidemiological profile of poisonings found in the intervention area is described elsewhere[14], while this paper focuses on the impact of the intervention on the knowledge, attitudes and practices of doctors in the study areas.

Methods

The rural farming districts of the Hex River Valley and Rawsonville that fall within the jurisdiction of the Health Department of the Bree Rivier Regional Services Council (surrounding Worcester) were chosen as the intervention area and the rural farming areas around Paarl as the control. The study population included all doctors in the study areas who were potentially able to provide primary or secondary care services to victims of pesticide poisoning draining from the study areas. Included in the population were general practitioners, physicians and paediatricians in both private and public practice in Paarl (control), Worcester, De Doorns, Touws Rivier and Rawsonville (intervention).

Both intervention and control areas are intensive farming regions and have previously been shown to report a significant proportion of pesticide poisonings in the province[6]. Their geographical separation by distance and a large mountain range were expected to limit contamination in the design. Both areas have regional hospitals providing equivalent emergency and laboratory services, with similar referral networks between private and public sector doctors.

The study was conducted as a community trial with the intervention being carried out in Worcester and environs (intervention area) during 1994 to June 1995. Doctors were interviewed before (intervention area in March 1993 and control area in August 1993) and after the intervention as implemented (October 1995). Interviews were conducted telephonically by medical students using a semi-structured questionnaire. The questionnaire used for evaluation was identical in all cases, except for the baseline evaluation of doctors in the control area where five out of 40 questions used in the rest of the study were not included and nine additional questions were asked.

The sampling frame was assembled from telephonic listings in the regional telephone directory. Doctors who were no longer practising or whose speciality was not compatible with seeing cases of pesticide poisoning, were excluded (eg, radiologists, surgeons). Doctors working in casualty departments at the secondary level hospitals in the two areas were included in the sampling frame.

Data were captured and analysed on the Epi-Info version 6.01. Summary scores were calculated for correct knowledge of the notifiability of four listed and two non-listed conditions and for knowledge of symptoms of organophosphate poisoning (seven symptoms were presented as options, of which two were incorrect). Comparisons of knowledge, knowledge scores, attitudes and reported practices were made between intervention and control doctors after the intervention, paired comparisons between interventions and controls for changes in KAPs, as well as comparisons of cross-sectional shifts in KAP outcomes. Separate analyses were run excluding hospital doctors, but are only reported if the results differ substantively from results for the overall sample.

Results

Response rates in the study varied widely. In the intervention area, the response rate at baseline (1993) was 92% (n=50) while at the follow up it was 73% (n=40). In the control area, response rate at baseline (1993) was 53% (n=34) while at the follow up it was 71% (n=48). There was considerable flux of doctors in the samples, with only 39% of the intervention doctors (n=46 at baseline) and 56% of the control doctors (n=18) being contactable at follow up. This was partly due to doctors moving in and out of the area, or doctors being away at the time of the survey and having locums running the practices. Full-time hospital staff comprised a larger proportion of the sample in the intervention area (22% at baseline and 31% post intervention) than in the control are (17% at baseline and 6% post intervention). The difference in proportion of hospital doctors between areas was statistically significant (Chi-Squared = 5.15; p = 0.02) although the difference from baseline to post-intervention was not.

Compliance with the intervention was measured indirectly by asking about aspects of the intervention. Of the 29 Worcester respondents in 1995, 55% reported receiving continuing medical education materials in the past year, while the equivalent for Paarl doctors was 12%. Reported easy availability of cholinesterase testing increased from 50% to 83% among intervention doctors, while that for the control area went up from 6% to 35%.

Table II summarises findings for knowledge, attitude and practice among doctors in the control and intervention areas. Improved awareness of the notifiability of pesticide poisoning was found in 1995 for the intervention area as compared to the control (OR=4.14; 95% CI=0.89-21.85). This difference was more striking when full-time hospital staff were excluded from analysis. All 20 doctors in full-time or part-time private practice reported awareness of the notifiability of pesticide poisoning in the intervention area compared to 21 of the 32 private practitioners in the control area (Fisher's exact p=0.002).

	Baseline		Post Intervention	
	W 93 (n=46)	P 93 (n=18)	W 95 (n=29)	P 95 (n=34)
KNOWLEDGE				
% who know that pesticide poisoning was notifiable	76.1	77.8	89.7	67.6
ATTITUDE				
% reporting that PP* should be notifiable	89.7	n/a	91.2	91.4
% reporting that they NEVER get feedback on notifications	75.6 (n=45)	92.6 (n=14)	88.9 (n=27)	91.3 (n=23)
% reporting that lack of feedback influenced their notification practice	57.8 (n=45)	15.4 (n=13)	32.0 (n=25)	45.0 (n=20)
PRACTICE				
% reporting ever diagnosing PP	82.6	50.0	96.6	79.4
% reporting ever requesting a cholinesterase test	59.1	11.1	72.4	32.3
% who reported notifying all PPs they saw (n=those who saw any PPs)	45.5 (n=22)	50.0 (n=6)	44.4 (n=18)	25.0 (n=16)

*W - Worcester • P - Paarl • *PP - pesticide poisoning*
n/a - question not asked in 1993 survey

Table II: Knowledge, attitude and practice of doctors regarding pesticides and notifiability of pesticide poisoning.

	Baseline		Post Intervention	
	W 93	P 93	W 95	P 95
Ignorance of notifiability	9	5	4	5
Paperwork	5	1	3	1
Difficulty contacting the local authority	1	0	1	1
No notification forms	2	0	2	3
Patient was referred on	3	0	5	2
Diagnosis mild/uncertain	0	0	0	2
Lack of feedback	3	0	0	2
Didn't make primary diagnosis	1	0	0	1
Forgot	2	1	0	0

Table III: Reasons for failure to notify pesticide poisoning.

There was also a non-significant improvement in awareness of the notifiability of pesticide poisoning from pre-intervention to post-intervention in the intervention are (OR=2.72; 95% CI 0.60-13.97), which, again, was significant when excluding hospital doctors (Fisher's exact p=0.009). This improvement was not the case for the control area, where the reported awareness in fact decreased slightly from 1993 to 1995 (Table II).

Overall knowledge of the notifiability of other conditions was no different between groups or between study periods. Knowledge related to other aspects of pesticides showed no obvious effect from the intervention. In particular, there were no significant differences for knowledge score for symptoms of organophosphate poisoning, either as an overall index or for individual symptoms.

In both groups at baseline and post-intervention, there was a high percentage who reported a lack of feedback following notification (at least 75%). Even though there was a slight increase in reporting of lack of feedback in the intervention area, there was a decline for doctors in the intervention area reporting that a lack of feedback influenced their propensity to notify - from 57.8% in 1993 to 32.0% in 1995 (p=0.04).

The proportion of doctors that reported diagnosing PP in the preceding year increased slightly in both groups (OR for intervention area 1.79; 95% CI 0.63-5.14; OR for control area 1.80; 95% CI 0.50-7.31) and the number of doctors ever reporting the diagnosis of pesticide poisoning increased in the intervention area (OR=5.89; 95% CI 0.66-135.17). Moreover, the mean number of poisonings reported in the past year increased in both groups (from 2.6 to 4.6 in the intervention area, p=0.11; from 0.6 to 2.4 in the control, p=0.19) although these difference were not statistically significant.

Doctors' perceptions of the usual circumstances surrounding pesticide poisoning appeared to shift substantially in the intervention area. Comparisons post to pre-baseline showed that doctors identified more intentional (21% vs 9%) and domestic accidents (59% vs 33%), and fewer occupational (58% vs 21%) causes (Chi-Squared = 10.0; p<0.05).

The percentage of these doctors who confirmed notifying their cases remained the same in the intervention area at just under 50% and dropped in the control area where the numbers were very small. The reasons given for not notifying pesticide poisoning are summarised in Table III.

Discussion

The most important finding from this study related to improved awareness of the notifiability of pesticide poisoning in the intervention group, both when compared with the control post-intervention, and when compared to baseline awareness before the intervention, particularly when restricting analysis to doctors outside of full-time hospital practice. The intervention appears to have an effect specific to pesticide awareness because awareness did not improve in the control area, nor did median scores for knowledge of other notifiable conditions (for example, measles) increase in the intervention area. Moreover, these findings were made from an already relatively high baseline level of awareness in the intervention area (76.1%), supporting our contention that there was probably a real effect from the intervention. In contrast, none of the other measures of knowledge (knowledge of types of hazardous pesticides used and symptoms and treatment of OP poisoning) appeared to benefit from the intervention. It is possible that such information requires more targeted types of continuing education for rural practitioners[15,16].

Of concern is the high number of doctors reporting a lack of feedback following notification in both areas, but particularly where this was reported in the study area after intervention. Rapid and timeous feedback to doctors was seen as an important subtext to the intervention yet this failed to appear as an important determinant of practitioner in the survey. This may have been due to real difficulties in establishing feedback to notifying practitioners or due to differing perceptions amongst notifiers and environmental health officers as to what constitutes appropriate feedback. An analogous situation exists regarding the follow up of pesticide poisoning, where difference of opinion exist[2,17] as to whether the mere writing up of the investigation report constitutes a sufficient or adequate public health response to a pesticide poisoning.

Despite this, it was apparent that doctors in the intervention area were less likely to report that poor feedback was instrumental in their reasons for not notifying, perhaps suggesting that at a functional level, feedback had improved in the study area. The use of qualitative study designs might better answer this important health services research question.

In the question asked only in the Paarl survey in 1993, respondents were adamant that the responsibility for prevention of pesticide poisoning lay mainly with farmers (14 out of 18 respondents). Only one identified doctors as having any responsibility for prevention, while in four cases, nurses were identified, and in seven cases other government departments, such as Labour or Agriculture. This finding provides an insight into the possible lack of orientation of rural (predominantly general) practitioners towards primary prevention of pesticide poisoning.

Doctors in the intervention area appeared to shift their perceptions of the usual circumstances of pesticide poisoning. The pattern they reported in 1995 appears to approximate more closely the patterns found on review of notification in the region than either the baseline patterns in the intervention area or at both cross-sections in the control area. It may well reflect that doctors were more closely aware of the real circumstances operating in the area. However, it should be borne in mind that mild cases (or chronic cases) did not appear to be picked up in this study, and their inclusion might substantially alter the apparent patterns of circumstances surrounding pesticide-related morbidity.

While the proportion of doctors reporting having made the diagnosis of pesticide poisoning increased after the intervention, it occurred in both intervention and control areas, as did the proportion reporting ever requesting cholinesterase testing. This may be due to a number of factors, including possible greater usage of pesticides with greater morbidity impacts in the region, greater generic awareness amongst rural practitioners (for example, as a result of greater coverage of pesticide hazards in the South African medical literature - see, for example references 2, 3, 6, 12, 13, 17, 18) or due to a "Hawthorne effect" where practitioners are made more aware simply as a result of the survey and therefore tend to have a higher index of suspicion. In either of the latter two cases, these would be desirable results, although we have no evidence to support or disprove these explanations.

However, there was no increase in the proportion reporting that they notified all the poisonings they saw, despite the presence of increased awareness reported by doctors in the intervention area. This is a disappointing finding, given the objectives of the intervention. While lack of feedback and "forgetfulness" were not reported as reasons for failure to notify in the intervention area in 1995 (Table III), there were a number of other reasons that are cause for concern: unavailability of forms (n=2), difficulty in reaching the local authority (n=1) and excessive paperwork (n=3). Moreover, five doctors reported that because they referred the patient to a hospital, they did not notify. This was explicitly identified as the motivation to make cholinesterase tests available to GPs to encourage them to notify immediately, and reflects a partial failure of the intervention.

One possible adverse result of the study was the finding that the percentage of doctors reporting that the minimum criteria for notification included biochemical confirmation actually increased in the intervention area from 17.4% to 34.5%. This may be an undesirable outcome as it discourages GPs from notifying where cholinesterase testing is not freely available, particularly given the fact that pesticide poisoning may be notified on clinical grounds alone.

In summary, this study has suggested that intervention with rural practitioners at relatively low inputs, may achieve a limited improvement in awareness of pesticide poisoning as a notifiable condition, improvement in feedback to practitioners following notification, a clearer awareness of typical circumstances surrounding pesticide poisoning in the region and, possibly, an increased index of diagnostic suspicion amongst rural practitioners. The practitioner-orientated continuous education materials developed in this study may, therefore, be useful in other parts of the country. However, no improvements were demonstrated for attitudes, or practices related specifically to notification, and some key impediments to notification appear not to have been influenced by the intervention. Greater attention ought to be directed to the load of paperwork and to the failure to notify as a result of referring patients to hospitals. It appears that the free cholinesterase testing service is not substantially used and did not improve notification practices.

The development of a district health system for South Africa is going to challenge health planners to develop mechanisms to achieve greater cooperation between primary care practitioners in private sector and public health services, particularly in rural areas. Based on this study, public health managers might want to consider carefully the value of expending scarce resources on improving the notification rates of rural doctors. Perhaps, more limited and achievable objectives in relation to practitioner behaviours, such as simply raising awareness or diagnostic indices of suspicion, would be preferable, and other methods to improve passive or active surveillance could be pursued. Moreover, the limited orientation of rural practitioners towards prevention appears to be an issue in this study, and warrants further exploration.

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References

1. World Health Organisation. *Informal Consultation on Planning Strategy for the Prevention of Pesticide Poisoning.* Geneva, 1990.
2. Department of Health. *Pesticidal Poisoning in South Africa, 1980-1994.* Epidemiological Comments 1995;22(5):112-138.
3. London L, Myers JE. *Critical issues in Agrichemical Safety in South Africa.* Am J Ind Med 1995;27(1):1-14.
4. Coetzee GJ. *The Epidemiology of Pesticide Mortality in the Western Cape.* Department of Community Health, University of Cape Town, 1981.
5. Emanual K. *Poisoned pay: Farmworkers and the South African Pesticide Industry.* Group for Environmental Monitoring and The Pesticide Trust, Johannesburg, 1992.
6. London L, Ehrlich R, Rafudien S, Krige F, Vurgarellis P. *Notification of pesticide poisoning in the Western Cape 1987-1991.* SA Med J 1994;84:269-272.
7. Davies JE. *A global need - farm work safety.* Am J Ind Med 1988;13:725-729.
8. Coye MJ, Fenske R. *Agricultural workers.* In: Occupational Health. Recognising and Preventing work-related disease. Ed: BS Levy. Little Brown and Co, Boston, 1988.
9. Hartye J. *Physicians as the weak link in Agricultural Health services: Defining the agenda for action.* Am J Ind Med 1990;18:421-425.
10. Department of Manpower. Occupational Health and Safety Act. Act 85/93. Government Gazette 337; Number 14918. Government Printers, Pretoria 1993.
11. Department of Manpower. Hazardous Chemical Substances Regulations.
12. London L, Myers JE. *General Patterns of Agrichemical Usage in the Southern Region of South Africa.* SA J Sci 1995;91:509-514.
13. London L. *Biological Monitoring of workers exposed to organophosphate pesticides: Guidelines for field application.* Occupational Health Southern Africa. July/August 1995;1(4):13-17.
14. Bailie R, London L. *Enhanced surveillance for pesticide poisoning in the Western Cape* (accompanying paper).
15. Naidoo N. *The future of rural practice - the political perspective.* S Fam Pr 1995;16:459-464.
16. Hill PV. *Procedural skills in rural practice - a practice profile.* S Fam Pr 1995;16:674-677.
17. London L. *Pesticidal poisoning in South Africa, 1980-1994.* Epidemiological Comments 1995;22(10):228-229.
18. London L. *Agrichemical safety practices on farms in the Western Cape.* SA Med J 1994;84:273-278.