ORIGINAL RESEARCH

McGill Journal of Medicine

Perceived Risk of Pesticide Exposure among School Workers in San Carlos, Costa Rica

Alison Stacey[1] | Douglas Barraza[2] | Paniz Bolourchi[1] | Christopher Acuña-Quesada[3]

[1]School of Global Health, Faculty of Health, York University, Toronto, Ontario, Canada

[2]Program Work and Health in Central America, Central American Insitute for Studies on Toxic Substances, Universidad Nacional, Heredia, Costa Rica

[3]English as a Second Language, National Technical University at San Carlos, Costa Rica

Correspondence
Alison Stacey
Email: ali.13.2000@gmail.com

Publication Date
June 1, 2025

MJM 2025 | 22 (1) 1059
https://doi.org/10.26443/mjm.v22i1.1059

McGill Journal of Medicine

www.mjm.mcgill.ca

ABSTRACT

Background: There is increasing literature examining the effect of pesticides on people in proximity to pesticide use. However, limited information exists on how bystanders perceive the risk of pesticides to their health. This study aims to explore how school workers perceive the exposure to pesticides in a region where agriculture is the dominant economic driving force, and how these perceptions vary by sociodemographic subgroup. **Methods**: A total of 143 school workers from five districts in the San Carlos region of Costa Rica responded to the Technical Prevention Notes (NTP-578) perceived risk survey. The Mann-Whitney U test along with a Bonferroni control determined the statistical significance between subgroups. The four main sections for analysis of the results were prior knowledge on pesticide-related risks, perception of control over pesticide exposure, perception of current health risk and general knowledge of pesticide exposure. **Results**: Statistically significant differences in perceptions were seen by location, sex, age, level of education and position. Males and teachers exhibited higher levels of prior knowledge of hazards, whereas the older population, people without a university degree and administrators had higher perception of control over exposure to pesticides. **Conclusion**: School workers are knowledgeable on exposure to workplace pesticides and are aware of the severity of risk associated with pesticide exposure. In line with results from other studies, the older population and university educated people had higher perceived control over mitigating affects of pesticides. Our findings suggest that school workers could play a vital role in increasing knowledge dissemination pathways on pesticide-related harms. Further research could help in transforming school workers and bystanders into stakeholders and advocates for buffer zones.

KEYWORDS
pesticide exposure, perception of risk, school workers, reduction of rick, Costa Rica

1 | INTRODUCTION

Understanding the effects of pesticides on human and environmental health is crucial, particularly as research grows on the impact of pesticide exposure for those near their use, such as school workers in regions where agriculture is the dominant economic force. In Costa Rica, pesticides are heavily used to support the production of agricultural crops for the export market. For instance, pineapple production makes up 20% of agricultural exports, accounting for approximately 10% of agricultural land use (1) and contributing close to 2% of the country's Gross Domestic Product in 2023. (2,3) Yet methods seeking to minimize pesticide use, such as organic farming, account for only 0.04% of agricultural land in Costa Rica. (4) The impact of pineapple production on the environment is starkly evident in the case of Diazon, which Costa Rica banned in 2017 after it became the most prevalent pesticide contaminating water sources, including groundwater, wells, and springs. (6) Notwithstanding, dangerous pesticides, including Chlorpyrifos, Difenoconazole, and Bromacil, continue to be widely used in pineapple production. (5-7)

While many studies exist on the physiological effects of pesticide exposure on agricultural workers (8), there have been few studies examining the effects of pesticide exposure on surrounding communities. Bystanders are recognized as people who are near pesticide application but have no direct contact with pesticides. (12) Health effects from pesticide exposure include respiratory effects such as coughing, dizziness, and gestational symptoms. (9) Evidence has shown that pregnant women, children, and fetuses are at especially high risk of health consequences, including neurodevelopmental disorders, birth abnormalities, pre-term birth, and low birthweight. (10, 11)

In the United States of America, 7.4 million cases of acute pesticide-related illnesses were reported in school children between 1998 and 2002. (9) Similarly, a study conducted in Chile monitored urine biomarkers of school children to quantify and assess their exposure to pesticides. The authors also sought to increase knowledge about pesticides through an educational intervention for children and parents and assess participants' perception of risk through two different surveys. However, these measures failed to significantly alter the levels of organophosphates (specifically Chlorpyrifos, Diazinon, Malathion, and Parathion) found in the school children's urine, indicating that people's exposure to pesticides is firmly influenced by proximity to pesticide use and oral consumption. Systemic change is therefore needed to protect individuals from the harmful effects of pesticide exposure. (13)

In Costa Rica, there is a growing body of literature analysing the perception of risk associated with pesticide exposure. This research is imperative for understanding attitudes towards pesticides that can inform education and advocacy. Recent literature revealed that bystanders of aerial spraying of pesticides in the Limon province perceived a high magnitude of risk, indicating perceived negative health outcomes were associated with proximity to pesticide dumping. Social groups, such as ACOMUITA, an indigenous women's organization in Costa Rica, have formed to advocate for education and to oppose pesticide use. This advocacy is in response to men going sterile following intense long-term exposure to pesticides, acute health consequences related to pesticides, and effects on the environment and waterways. (14) However, the perception of pesticide use is not uniformly negative throughout Costa Rica. A study in Talamanca found that men associated pesticides with economic benefit more than fear of health hazards, as the pesticides allowed for monocropping and increased yields. (15) Thus, regional variation in perception of hazards associated with pesticides is likely.

While some studies on risk perception in Costa Rica exist, little research has been conducted on the perception of pesticide use in the northern regions where pineapple production predominates, compared to the Caribbean region, where banana and plantain crops predominate. It is significant to conduct research in both geographical areas, as the pesticide application method varies. With Bananas and Plantains aerial spraying is most common, compared to manual application using trucks or hand packs that are used for pineapples (1, 14) This paper will explore whether school workers in pineapple producing regions in Northern Costa Rica have similar perceptions and awareness of pesticide exposure risk compared to other geographic regions in Costa Rica, and how these perceptions may vary by sociodemographic subgroup.

2 | METHODS

2.1 | Survey instrument

This survey utilized quantitative methodology to conduct an exploratory study. The 'NTP-578: Perceived Risk, an Evaluative Procedure' survey, designed by Ministerio De Trabajo y Asuntos Sociales España (The Spanish Ministry of Work and Social Services), was used. (15, Appendix 1) The survey contains ten questions with a Likert scale, designed to standardize risk perception for hazards in the workplace and understand workers' priorities.

Surveys were distributed digitally between January 2020 to March 2020 to elementary and secondary school principals in the San Carlos region using random sampling methods. The counties of the San Carlos region in Alajuela Province include Pital, Ciudad Quesada, Aguas Zarcas, Venecia, and the neighboring county of Río Cuarto.

The categories of analysis were divided as follows: age was dichotomized as younger or older than 40; education was dichotomized into 'university degree' versus 'no university degree'; and position was dichotomized into teachers and administrators. Geographic regions were classified as 'agricultural settings' (Pital, Aguas Zarcas, Rio Cuarto) and 'non-agricultural settings' (Ciudad Quesada, Venecia), based on the amount of agricultural land rather than urban or rural distinctions. Survey responses were inputted and analysis was done with encoded data on Jamovi Version 2.3. (16) A Mann-Whitney U test was conducted to evaluate the significance of the difference between socio-demographic subgroups, including age, sex, level of education, position, and location. Bonferonni correction for multiple comparisons was applied, and a p-value < 0.01 was deemed to be significant.

3 | RESULTS

Table 1 displays the socio-demographic breakdown of the 143 respondents to the study; respondents were predominantly female (63.6%), with a median age of 30 (range 20-78 years).

Survey responses to questions one through nine were divided into three focus areas for analysis, and question 10 was analysed separately. Main results fall into prior knowledge of pesticide exposure and the level of perceived control of exposure and health effects. Table 2 displays the results from the Mann-Whitney U test and associated p-value for each socio-demographic group.

3.1 | Prior knowledge of pesticide risk

Questions one, three, and eight assess prior awareness of pesticide exposure in the workplace. For question one, females reported significantly less prior knowledge with a mean score of 4.73(± SD 1.68), while males had a mean score of 5.40 (± SD 1.61). Similarly, teachers had significantly higher awareness than administrators, with a mean of 5.18 (± SD 1.49) and 3.41 (± SD 2.18), respectively. Additionally, people without a university degree appeared to have a lower, but not statistically significant, awareness of pesticide harms with a mean score of 3.30 (± SD 2.21), while people with a university degree had a mean score of 5.10 (± SD 1.58), p 0.013.

Question three had a mean score of 6.15 in the total study population, indicating a high degree of fear regarding harm caused by pesticide exposure.

Question eight had no statistically significant variations across demographic subgroups. However, the average score amongst all participants was 6.15, suggesting that people believe there is a high chance that pesticides put many people in danger.

3.2 | Level of perceived control

Questions two, six, and seven asked respondents to rate their perception of control over pesticide exposure. The questions examined respondents' ability to avoid risk of

	Characteristic	Count	Total	Proportion of Total
Age	< 40	76	143	0.531
	≥ 40	67	143	0.469
Sex	Female	91	143	0.636
	Male	52	143	0.364
Civil Status	With partner	89	143	0.622
	Without partner	54	143	0.378
Education	University degree	133	143	0.930
	No university	10	143	0.070
Position	Teacher	126	143	0.881
	Administration	17	143	0.119
Children	Yes	103	143	0.720
	No	40	143	0.280
Location	Non-agricultural setting	69	143	0.483
	Agricultural setting	74	143	0.517

TABLE 1 Sociodemographic breakdown.
Socio-demographic and job characteristics of school workers in the survey (n= 143).

exposure and their ability to intervene and minimize exposure. The average score for question two among the total study population was 4.82 (± SD 5).

For question six, teachers had significantly lower mean scores than administrators, 3.89 and 5.25 (± SD 1.39), respectively. Similarly, people with a university degree had significantly lower averages than respondents without a university degree, 3.94 (± SD 2.02) and 5.60 (± SD 0.17), respectively.

Teachers had a significantly higher degree of perceived control than administrators, with a mean of 3.62 (± SD 1.90) and 4.94 (± SD 1.64), respectively. Respondents with a university degree had a significantly lower average score of 3.64 (± SD 1.87) than respondents with no university degree, with an average of 5.60 (± SD 0.58). Workers under 40 indicated a significantly lower average score of 3.36 (± SD 1.78) opposed to workers 40 and over with an average of 4.92 (±SD 1.96).

3.3 | Perception of health effects

Questions four, five, and nine asked respondents to indicate their understanding of the severity, duration, and scope of pesticides' effects on human health. No statistical significance was found between any sociodemographic groups. The average score among the study population to question four ("The likelihood you may suffer damage because of this factor" (factor = pesticide exposure))was 5.27 (± SD 1.51), with 73 people rating 6 or 7 (i.e., "very high probability").

Question five had a mean response was 5.97 (± SD 1.21), with 66 people (46.2%) responding with 7. People with a university education tended to have a lower average response than people without a university education. Respondents with a university education had an average of 5.94 (± SD 0.22), whereas those without a university degree had an average of 6.40 (± SD 0.96).

Question nine had low variations between respondents with an average response of 4.68 (± SD 1.86).

3.4 | Magnitude of risk

Question ten was scored out of 100. It asked respondents "how do you assess very serious accident and illness risk associated with the factor indicated at the beginning?" to gain a general risk perception. The average response was 82.5, with 34 respondents (24.6%) who indicated the magnitude of risk as '100', very high risk.

4 | DISCUSSION

Our study revealed medium to high levels of prior knowledge and perceived control on pesticide exposure, with significant differences based on gender, occupation, and education for some measures, and the majority of respondents expressed high concern about the health risks associated with pesticides.

Our results report females having significantly less prior knowledge of pesticide use than their male counterparts. This was consistent with findings from a study done in Talamanca, Costa Rica. (14) While the study in Talamanca was directed at farm workers, it found that women had little to no relevant knowledge, as their sole knowledge transfer source was their husbands, who had work training or information from other farmers regarding the harms of pesticide exposure. (14)

Regarding gender differences in perceptions of risks associated with pesticide use, two previous surveys in Limon province and in Washington State found that female respondents reported higher severity of risks than their male counterparts. (14, 17) Our study's findings were consistent with these reports; females reported a higher severity of risk than their male counterparts. Explanations for this gender-based variation may include differences in gender roles, where female roles more often comprise caretaking of family and community. (14, 17) Familial pressures may lead to increased fear about factors outside of perceived control, such as environmental exposures, and expectations to be concerned for family or community wellbeing. (14, 17) This also causes pressure to stay in agricultural communities, due to stress linked to job security, shelter, and financial barriers. (18-20) If further research is conducted in the San Carlos region, it is recommended that the effects of pesticide use and exposure on gender roles be further examined.

The survey done in the Limon Province of Costa Rica also found that older respondents perceived a higher risk of harm associated with pesticide use compared to their younger counterparts. (14) Our study did not find a statistically significant difference in perceived harm or prior knowledge of pesticide exposures. However, other Spanish research on environmental risk perception found that younger generations were more likely to recognize the severity of environmental hazards, including pesticide exposure. (19)

In line with this, our study found the older population (over 40) had a significantly higher perception of their level of control over mitigating a 'risk situation'. Some authors posit that populations with higher levels of knowledge are overconfident, have a higher perception of control over the hazard, and therefore fear the hazard less. (19) However, overconfidence in control of pesticide hazards is not in line with expert knowledge on routes of pesticide exposure. In fact, drift exposure (through inhalation), proximity to pesticide use, and oral pathways (through food consumption) outweigh individual choice when it comes to control over pesticide exposure. A study in Chile found no significant difference in urine metabolites after an educational intervention on exposure pathways. (13) Indeed, external factors such as job security, shelter, and food availability can force people to have continued exposure. (19,20)

The survey done in Talamanca also found that people closer to agricultural settings had more knowledge on pesticides and their associated risks than people in non-agricultural settings. (14) However, in our study, no significant differences were seen between respondents from agricultural and non-agricultural settings. This may be a result of different application techniques used between Talamanca, where Ariel spraying is predominant, and more visible to bystanders than manual spraying application techniques used on Pineapple crops. Nevertheless, while the findings were not statistically significant, people in agricultural settings appeared to report a lower level of knowledge on the effects of pesticide use than respondents in non-agricultural settings. More research into knowledge transfer pathways would be beneficial to understand the content and sources of information about pesticides in these settings.

	Perceived Risk											
	Question		Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	GR
Sociodemographic Characteristic	Total Population	Mean	4.97	4.82	6.15	5.27	5.97	4.06	3.77	6.15	4.68	82.5
Age	< 40	Mean	4.84	5.00	6.09	5.21	6.04	3.92	3.36	6.11	4.92	79.9
	≥ 40	Mean	5.12	4.61	6.23	5.34	5.90	4.21	4.24	6.21	4.40	85.5
		p	0.119	0.357	0.700	0.745	0.561	0.377	**0.008***	0.619	0.164	0.141
Sex	Female	Mean	4.73	4.80	6.31	5.31	6.07	4.16	3.74	6.21	4.71	83.5
	Male	Mean	5.40	4.85	5.88	5.21	5.81	3.88	3.84	6.06	4.62	80.8
		p	**0.009***	0.696	0.195	0.948	0.219	0.474	0.716	0.375	0.616	0.150
Education	University Degree	Mean	5.10	4.84	6.16	5.28	5.94	3.94	3.64	6.17	4.71	81.8
	No University Degree	Mean	3.30	4.50	6.11	5.20	6.40	5.60	5.60	6.00	4.30	93.8
		p	0.013	0.579	0.996	0.791	0.248	0.013	**0.002***	0.268	0.498	0.051
Position	Teacher	Mean	5.18	4.84	6.18	5.30	5.91	3.89	3.62	6.17	4.72	81.7
	Administration	Mean	3.41	4.65	5.94	5.12	6.41	5.24	4.94	6.00	4.35	89.0
		p	**0.002***	0.739	0.624	0.719	0.129	0.011	**0.007***	0.220	0.420	0.352
Location	Agricultural Setting	Mean	4.80	5.01	6.19	5.25	5.96	3.81	3.65	6.06	4.43	81.0
	Non-Agricultural Setting	Mean	5.14	4.64	6.12	5.30	5.99	4.29	3.89	6.24	4.90	83.9
		p	0.133	0.200	0.404	0.652	0.542	0.169	0.371	0.219	0.120	0.761

TABLE 2 Description of mean response values to NTP 578 perception of risk survey.
Mann-Whitney U test values and statistical significance results to NTP-578 perception of risk survey (n=143).

* $p < 0.01$.

Q1. To what extent are you aware of the risk associated with this factor? (To what extent do you know harm it can cause, and the possibilities of suffering these risks?)
Q2. To what extent do you consider that those responsible for prevention in your company are aware of the risk associated with this factor?
Q3. To what degree do you fear the harm that may result from this factor?
Q4. The likelihood that you may suffer damage (small or large, soon or in the long run) because of this factor is:
Q5. In the event of a risk situation, the severity of the damage that this factor can cause is:
Q6. To what extent can you avoid that this factor originates a risk situation?
Q7. In the event of a risk situation, to what extent can you intervene to control (to avoid or reduce) the risk that this factor can cause?
Q8. To what extent is it a factor that can put into risk many people at once?
Q9. In case of exposure to the risk factor, when do the most harmful consequences of this source of risk appear?
GR. How do you assess very serious accident and illness risk associated with pesticides?

Overall, the responses to the NTP-578 study revealed some discrepancies between respondents and expert knowledge. However, some responses in Table 1 to general knowledge, such as severity, duration, and number of people affected by pesticides (Questions: 4,5, and 9) are in line with expert knowledge. Discontinuities in knowledge come from the perception of control in preventing and mitigating pesticide exposure. Most significantly, this study has revealed that school workers in San Carlos are aware of and fear the effects of pesticide exposure at work. In rating the level of fear of harm from pesticides, respondents had an average score of 6.5 out of 7, with a median answer of 7, indicating a high degree of fear. These results highlight the need to address these fears, such as by ongoing testing of pesticide exposure within school zones and communities.

This study has some limitations. Though we utilized a random sampling method in five targeted locations of the San Carlos Region to optimize randomization, the sample size was small, and thus may not fully reflect the sociodemographic distribution of school workers in this region. In addition, the surveys were distributed in early 2020 at the onset of the COVID-19 pandemic. As a result, it is possible that concerns about the COVID-19 pandemic and its associated health implications may have been more pressing than concerns about pesticide-related harms, resulting in a reduced number of possible survey responses as well as potential devaluing of perceived hazards.

Overall, further research on pesticide use and exposure levels in the San Carlos region is recommended. Firstly, quantifying the exposure to pesticides and the proximity of pesticide use to school zones is crucial to getting an accurate picture of exposure in the San Carlos region. Additionally, further research should be done to examine whether the most common pesticide exposure pathways in the region, such as drift and oral exposure, can be minimized through the implementation of buffer zones between pesticide users and communities. Secondly, it is vital to better understand the knowledge transfer pathways on pesticide-related risks to ensure safe dissemination of accurate information. Further research elucidates ways through which gender roles potentially affect knowledge dissemination through the community. Many populations in this study indicated a high level of perceived control or ability to avoid exposure to pesticides, which is not in line with expert knowledge. We believe that by optimizing knowledge accuracy and level, school workers in San Carlos can become important stakeholders in advocating for pesticide buffer zones and other mitigation strategies, once common exposure pathways have been identified. While previous studies have shown that educational intervention alone has little effect on pesticide exposure routes, advocacy groups similar to those in Talamanca help disseminate accurate knowledge, educational interventions, and political pressure to reduce overall exposure to pesticides. As school workers play a pivotal role in the community, we believe they have the ability to keep communities aware of hazards such as pesticides they are being exposed too.

REFERENCES

1. Alvarado AG. Sustainable pineapple production in Costa Rica. Esri; 2021. Available from: storymaps.arcgis.com/stories/2c3b2463594e48c88b143e14b8d1b025

2. Canapep. Exportación de piña en 2023 (Pineapple exports in 2023). Available from: https://canapep.com/estadisticas/

3. Del Moral-Arroyo M. 20 años buscando la excelencia en la producción de piña de Costa Rica (20 years searching for excellence in Costa Rican pineapple production). Available from: https://www.freshplaza.es/article/9534858/20-anos-buscando-la-excelencia-en-la-produccion-de-pina-de-costa-rica/

4. Willer H, Lernoud J, editors. The world of organic agriculture: Statistics & emerging trends 2017. Frick and Bonn: Research Institute of Organic Agriculture FiBL and IFOAM - Organics International; 2017.

5. Jiménez K, Solano K, Scholz C, Redondo-López S, Mena F. Early toxic effects in a Central American native fish (Parachromis dovii) exposed to chlorpyrifos and difenoconazole. Environ Toxicol Chem. 2021;40(7):1940–9. Available from: http://dx.doi.org/10.1002/etc.5048

6. Valverde BE, Chaves L. The banning of bromacil in Costa Rica. Weed Sci. 2020;68(3):240–5. Available from: http://dx.doi.org/10.1017/wsc.2020.13

7. Shrestha S, Kamel F, Umbach DM, Freeman LEB, Koutros S, Alavanja M, et al. High pesticide exposure events and olfactory impairment among U.S. farmers. Environ Health Perspect. 2019;127(1):17005. Available from:

http://dx.doi.org/10.1289/EHP3713

8. Mena F, González-Ortegón E, Solano K, Araújo CVM. The effect of the insecticide diazinon on the osmoregulation and the avoidance response of the white leg shrimp (Penaeus vannamei) is salinity dependent. Ecotoxicol Environ Saf. 2020;206:111364. Available from: http://dx.doi.org/10.1016/j.ecoenv.2020.111364

9. Alarcon WA, Calvert GM, Blondell JM, Mehler LN, Sievert J, Propeck M, et al. Acute illnesses associated with pesticide exposure at schools. JAMA. 2005;294(4):455–65. Available from: http://dx.doi.org/10.1001/jama.294.4.455

10. Shelton JF, Geraghty EM, Tancredi DJ, Delwiche LD, Schmidt RJ, Ritz B, et al. Neurodevelopmental disorders and prenatal residential proximity to agricultural pesticides: the CHARGE study. Environ Health Perspect. 2014;122(10):1103–9. Available from: http://dx.doi.org/10.1289/ehp.1307044

11. Larsen AE, Gaines SD, Deschênes O. Agricultural pesticide use and adverse birth outcomes in the San Joaquin Valley of California. Nat Commun. 2017;8(1). Available from: http://dx.doi.org/10.1038/s41467-017-00349-2

12. European Food Safety Authority (EFSA). Guidance on the assessment of exposure of operators, workers, residents and bystanders in risk assessment for plant protection products, 2014. Parma, Italy: European Food Safety Authority; 2014. Available from: efsa.onlinelibrary.wiley.com/doi/pdf/10.2903/j.efsa.2014.3874

13. Muñoz-Quezada MT, Lucero B, Bradman A, Steenland K, Zúñiga L, Calafat AM, et al. An educational intervention on the risk perception of pesticides exposure and organophosphate metabolites urinary concentrations in rural school children in Maule Region, Chile. Environ Res. 2019;176:108554. Available from: http://dx.doi.org/10.1016/j.envres.2019.108554

14. Barraza D, Jansen K, van Wendel de Joode B, Wesseling C. Pesticide use in banana and plantain production and risk perception among local actors in Talamanca, Costa Rica. Environ Res. 2011;111(5):708–17. Available from: http://dx.doi.org/10.1016/j.envres.2011.02.009

15. Vidal P, Solé Gómez M. Riesgo percibido: un procedimiento de evaluación. Ministerio de Trabajo y Asuntos Sociales España. NTP. 2001;578.

16. The Jamovi Project. Jamovi (Version 2.3). 2022. Available from: https://www.jamovi.org

17. Lehrer N, Sneegas G. Beyond polarization: using Q methodology to explore stakeholders' views on pesticide use, and related risks for agricultural workers, in Washington State's tree fruit industry. Agric Human Values. 2018;35(1):131–47. Available from: http://dx.doi.org/10.1007/s10460-017-9810-z

18. Barraza D, Jansen K, Wesseling C, van Wendel de Joode B. Pesticide risk perceptions among bystanders of aerial spraying on bananas in Costa Rica. Environ Res. 2020;189:109877. Available from: http://dx.doi.org/10.1016/j.envres.2020.109877

19. Subiza-Pérez M, Santa Marina L, Irizar A, Gallastegi M, Anabitarte A, Urbieta N, et al. Who feels a greater environmental risk? Women, younger adults and pro-environmentally friendly people express higher concerns about a set of environmental exposures. Environ Res. 2020;181:108918. Available from: http://dx.doi.org/10.1016/j.envres.2019.108918

20. McCright AM, Xiao C. Gender and environmental concern: Insights from recent work and for future research. Soc Nat Resour. 2014;27(10):1109–13. Available from: http://dx.doi.org/10.1080/08941920.2014.918235

21. Calliera M, Luzzani G, Sacchettini G, Capri E. Residents perceptions of non-dietary pesticide exposure risk. Knowledge gaps and challenges for targeted awareness-raising material in Italy. Sci Total Environ. 2019;685:775–85. Available from: http://dx.doi.org/10.1016/j.scitotenv.2019.06.223

APPENDIX A

| ESTUDIO: RIESGO PERCIBIDO DE USO DE PLAGUICIDAS

Esta investigación tiene como objetivo estudiar los riesgos percibidos del uso de plaguicidas entre docentes y otros miembros del personal de centros educativos en San Carlos y Río Cuarto. Esta encuesta no debería demorar más de cinco minutos en completarse. Si acepta participar en este estudio, se le pedirá que responda las preguntas de la encuesta en la parte de abajo y posterior de esta página lo mejor que pueda. No ponga su nombre en la encuesta, ya que toda la información que proporcione será anónima y confidencial. No hay riesgos o beneficios previsibles para usted como participante. Tiene la oportunidad de hacer preguntas y retirarse de la investigación en cualquier momento, incluso después de haber aceptado participar inicialmente. Negarse a participar o retirarse del estudio, tal como lo entendemos, no creará ningún problema para ninguna de las partes.

¿Tiene usted alguna pregunta?, Si la tuviese en algún momento mientras completa la encuesta, informe a uno de los investigadores.

| ENCUESTA SOBRE USO DE PLAGUICIDAS

Edad: ____________________ **Sexo:** □ Masculino □ Femenino **Estado Civil:** ____________________
Hijos: ____________________ **Pueblo:** ____________________ **Posición de Trabajo:** ____________________
Nivel de Educación: □ Primaria completa □ Primaria incompleta □ Secundaria completa
□ Secundaria incompleta □ Bachillerato □ Licenciatura □ Maestría

A continuación, evalúe los siguientes aspectos relacionados con el uso de plaguicidas utilizando una escala de 1 a 7, siendo 1 el más bajo y 7 el más alto.

Recuerde que en cada caso debe rodear el número que mejor represente su evaluación.

1. ¿En qué medida conoce los riesgos asociados con el uso de plaguicidas (en qué medida sabe cuáles son los daños que puede causarle o la posibilidad de experimentar estos daños, etc.)?

NIVEL DE CONOCIMIENTO MUY BAJO 1 2 3 4 5 6 7 NIVEL DE CONOCIMIENTO MUY ALTO

2. ¿Hasta qué punto cree que los responsables del uso de plaguicidas conocen el grado de riesgo asociado con él?

NIVEL DE CONOCIMIENTO MUY BAJO 1 2 3 4 5 6 7 NIVEL DE CONOCIMIENTO MUY ALTO

3. ¿Hasta qué punto tiene miedo del daño que puede derivarse del uso de plaguicidas?

GRADO MUY BAJO 1 2 3 4 5 6 7 GRADO MUY ALTO

4. ¿Cuál cree que es la posibilidad de que personalmente experimente un daño (pequeño o grande, inmediato o posterior) como resultado del uso de plaguicidas?

MUY BAJA POSIBILIDAD 1 2 3 4 5 6 7 MUY ALTA POSIBILIDAD

5. En el caso de que ocurra un riesgo, la gravedad del daño que puede causar el uso de plaguicidas es de:

GRAVEDAD MUY BAJA 1 2 3 4 5 6 7 GRAVEDAD MUY ALTA

6. ¿En qué medida puede evitar que los plaguicidas provoquen un riesgo?

EN MUY BAJO GRADO 1 2 3 4 5 6 7 EN MUY ALTO GRADO

7. En caso de que ocurra un riesgo, ¿en qué medida puede intervenir para controlar (evitar o reducir) el daño que puede causarle el uso de plaguicidas?

POSIBILIDAD DE CONTROL MUY BAJA 1 2 3 4 5 6 7 POSIBILIDAD DE CONTROL MUY ALTA

8. ¿En qué medida es el uso de plaguicidas un factor que puede dañar a un gran número de personas a la vez?

GRADO MUY BAJO 1 2 3 4 5 6 7 GRADO MUY ALTO

9. En caso de exposición, ¿cuándo experimenta las consecuencias más perjudiciales del uso de plaguicidas?

INMEDIATAMENTE 1 2 3 4 5 6 7 MUY LARGO PLAZO

10. ¿Cómo califica el riesgo de accidente o enfermedad muy grave asociada con el uso de plaguicidas en general?

Tenga en cuenta que los accidentes o enfermedades muy graves son aquellos que implican una pérdida irreversible de la salud (muerte, pérdida de extremidades y / o habilidades funcionales, enfermedades crónicas que acortan severamente la vida o reducen drásticamente la calidad de vida) ya sea de inmediato o en el medio / largo término.
Califique la magnitud de este riesgo marcando con un círculo el punto en la escala que mejor refleje su opinión, tenga en cuenta que 0 representa un riesgo muy bajo o cero y 100 un riesgo muy alto o extremo.

MUY BAJO 0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100 MUY ALTO

APPENDIX B

DIMENSIONAL ASSESSMENT OF PERCEIVED RISK (DAPR-W)

On a scale from 1 to 7, you must assess nine aspects related to the factor. Remember that in each case you must circle the number that best represents your assessment.

Q1. To what extent are you aware of the risk associated with this factor? (To what extent do you know the harm it can cause, the possibilities you have of suffering these risks?)

Very low level of knowledge 1 2 3 4 5 6 7 Very high level of knowledge

Q2. To what extent do you consider that those responsible for prevention in your company are aware of the risk associated with this factor?

Very low level of knowledge 1 2 3 4 5 6 7 Very high level of knowledge

Q3. To what degree do you fear the harm that may result from this factor?

A low degree 1 2 3 4 5 6 7 A high degree

Q4. The likelihood that you may suffer damage (small or large, soon or in the long run) because of this factor is?

Low possibility 1 2 3 4 5 6 7 High possibility

Q5. In the event of a risk situation, the severity of the damage that this factor can cause is?

Low severity 1 2 3 4 5 6 7 High severity

Q6. To what extent can you avoid that this factor originates a risk situation?

At a low degree 1 2 3 4 5 6 7 At a high degree

Q7. In the event of a risk situation, to what extent can you intervene to control (avoid or reduce) the risk that this factor can cause?

Very low possibility of control 1 2 3 4 5 6 7 Very high possibility of control

Q8. To what extent is it a factor that can put many people at risk at once?

Zero degree 1 2 3 4 5 6 7 Very high degree

Q9. In case of exposure to the risk factor, when do the most harmful consequences appear?

Immediately 1 2 3 4 5 6 7 Very long term

How do you assess very serious accident and illness risk associated with the factor indicated at the beginning(*)? Keep in mind that very serious accidents or illnesses are those that entail irreversible health loss (e.g., death, loss of body parts and/or functional capacities, chronic diseases that may shorten life severely or drastically reduce life quality) either immediately or in the long term. Assess the magnitude of this risk by writing a cross (x) on the number that best reflects your opinion. Zero represents very low risk or no risk at all and 100 represents extreme or very high risk.

Very low 0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100 Very high