Report from the 1st NATIONAL MEETING OF PHYSICIANS IN THE CROP-SPRAYED TOWNS

Faculty of Medical Sciences, National University of Cordoba.
August 27th and 28th 2010, University Campus, Cordoba

Coordinators: Dr. Medardo Ávila Vazquez, Prof. Dr. Carlos Nota.

Introduction

For nearly 10 years, the residents of rural and periurban areas, where agricultural activities are carried out based on the current model of agro-industrial production, have been demanding to the political authorities, the courts of justice, and also protesting before the general public, because they feel that the health of their communities is being environmentally affected, mainly through sprayings of agrochemicals used for different types of agricultural crops, but also for the handling and storage of these chemicals in populated areas, the waste disposal, as well as the collection of grains soaked with chemicals within the towns.

A reflection of these complaints and reports is included in the "Declaration of Caroya"[1] made on September 13, 2008, by a large group of organizations made up of self-organized neighbors and environmental NGOs from the Capital City of Córdoba, Oncativo, Colonia Caroya, Jesús María, Sinsacate, Alta Gracia, Cañada de Luque, Marcos Juárez, La Granja, Anisacate, Río Ceballos, and Las Peñas, among others. This text reads as follows: *That the processes of soyization, monoculture, direct sowing, intense farming … have affected our natural co-existence in the following order: Health: Reduction in the average age and height in crop-sprayed towns due to malnutrition, and a decrease of the body's natural defenses. Birth defects, mutagenesis, miscarriages, depression and suicide, disorders of the central nervous system and other neurological pathologies; disabilities, spina bifida, lupus, leukemia and other types of cancers; chloracne and other skin problems; asthma, allergies, and other respiratory and lung-related problems; male sterility and impotence; hormonal disruption and other hormonal disorders; diminished childhood development; prolonged febrile syndrome without focus; children's increased vulnerability to pollutants; anemia, multiple sclerosis, cerebral ischemia, death…*[1]

These claims and accusations were made public through the national press when it was known that the ordinary criminal justice system had recognized the complaints from neighbors in the Ituzaingó Anexo neighborhood, in the city of Córdoba, accepting the complaints from the City's Secretary of Health, due to poisoning through aerial spraying to which the population of one part of the City had been subjected, as well as being severely and environmentally attacked[2]. In January 2009, the Rural Reflection Group presented an extensive work to Mrs. President of the Nation, which contained the complaints of crop-sprayed towns throughout the country[3].

San Jorge in Santa Fe, San Nicolás in Buenos Aires, Ituzaingó neighborhood in Córdoba, and La Leonesa in Chaco, are only some of the places where the increased number of cancer cases, birth defects, reproductive and endocrine disorders, have been suffered and detected ever since systematic pesticide spraying has become commonplace. These claims from crop-sprayed towns were advocated many times by members of health teams, but responses from State Public Health areas, and the participation as well as the involvement of State Universities were very scarce and limited.

The First National Meeting of Physicians in the Crop-Sprayed Towns

In order to generate a space for analysis and academic, as well as scientific reflection on the health status of crop-sprayed towns, and to listen and support all health team members who have been denouncing and facing this problem, the Faculty of Medical Sciences from the UNC (Universidad Nacional de Córdoba, National University of Cordoba), through its two Chairs (Medicine I and Pediatrics), called the 1st Meeting.

The State University is required to scientifically study the living and working conditions, along with the health problems, social, economic and cultural issues, faced by our country's population which, on the other hand, supports the funding of State Universities by means of their taxes. With that goal in mind, physicians, other health team members, and researchers of different disciplines at a national level were called to present their experiences, data, proposals, and scientific work.

The Meeting was conducted on August 27th and 28th of this year at the University Campus of the UNC, with more than 160 participants from the provinces of Córdoba, Santa Fe, Buenos Aires, Neuquén, Santiago del Estero, Salta, Chaco, Entre Ríos, Misiones, and Catamarca, as well as from six national universities.

The Organizing Committee was composed of: Dr. Medardo Ávila Vazquez, Coordinator of the Module "Social Determinants of Health", FCM-UNC (Faculty of Medical Sciences-University of Cordoba); Dr. Ariel Depetris, Epidemiologist; Dr. Gustavo Calzolari, Physician from the Advisory Commission of Bell Ville-Cordoba; Dr. Fernando Suarez, General Practitioner working on the dispensary from the neighborhood Nuestro Hogar III; Dr. Betiana Cabrera Fasolis, Associate Professor from the Chair of Pshychosocial Medicine, UNC; and Dr. Raul Nieto, General Practitioner working on the dispensary from the neighborhood Ituzaingó Anexo.

The Academic Board was composed of: Prof. Dr. Carlos Nota, Tenured Professor of Semiotics (Medicine I), UNC; Dr. Carlos Presman, Professor of Internal Medicine, UNC; and Prof. Dr. Daniel Quiroga, Tenured Professor of Pediatrics, UNC; Dr. Ricardo Fernandez: Toxicologist, Professor of Pediatrics, UCC (Universidad Católica de Córdoba, Catholic University of Cordoba); Dr. Cecilia Marchetti, Coordinator of the Environmental Medicine Module, FCM-UNC. Coordinators of this event were Dr. Medardo Ávila Vázquez and Prof. Dr. Carlos Nota.

Reports and Testimonies

Presentations and stories of the participants matched the clinical observations of a range of diseases and health conditions on people subject to sprayings. While manifestations of acute poisoning are the daily demands of these patients, what alarms physicians the most in crop-sprayed towns are two main observations: Firstly, more newborns suffer from birth defects and there are more miscarriages than those usually occurring in their population of patients. Secondly, there is an increased detection of cancers in children and adults, and serious illnesses, such as Henoch–Schönlein purpura (HSP, also known as anaphylactoid purpura, purpura rheumatica, and Schönlein–Henoch purpura-skin disease), toxic liver disease, and neurological disorders.

The physicians stressed that they have been serving the same populations, in general, for over 25 years, but what they found in recent years was quite unusual and strictly linked to systemic sprayings of pesticides. For example, Dr. Rodolfo Páramo, a Pediatrician and Neonatologist at the public hospital of Malabrigo, a Northern city in Santa Fe, highlighted the alarm he experienced when he found 12 cases of birth defects in newborns, out of 200 births per year in 2006. This situation is analogous with the 4 cases of stillbirths due to birth defects in the small town of Rosario del Tala, in Entre Ríos, both areas characterized by massive pesticide spraying.

Dr. Maria del Carmen Seveso, Head of Intensive Care at the Hospital 4 de Junio in Presidencia Roque Saenz Peña-Chaco, gave a devastating overview from the towns in the center of the Province of Chaco, like Napenay, Gancedo, Santa Silvina, Tres Isletas, Colonia Elisa, and Avia Terai, where there were many cases of sick patients suffering from renal failure (or kidney failure, also called renal insufficiency), as well as birth defects in children of young mothers, cancer even in very young people, miscarriages, and difficulty in becoming pregnant, respiratory problems, and acute allergies. All these were linked by the health teams to a higher level of chemical contamination in the environment, generated by the agroindustrial practice imposed in the area, which displaced many small cotton farms and destroyed the existing native forest.

The same health team found numerous cases of respiratory distress consistent with the inhalation of the herbicide Paraquat, and in addition, what caught their attention in recent years was an increase in cases of pregnancy-induced hypertension and eclampsia and preeclampsia, which they suspected could be linked to the interaction of pesticides in the etiopathogenesis of these pregnancy disorders.

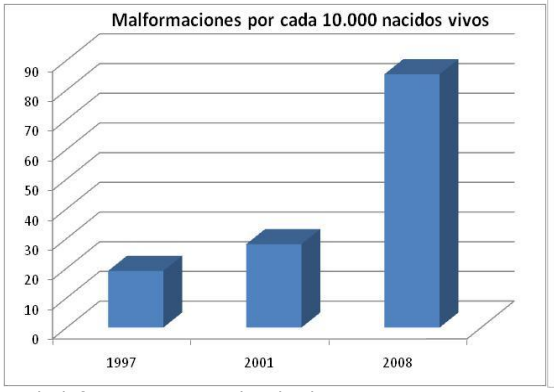
In the Province of Chaco, there have been strong complaints from residents about the presence of many people affected within a small geographic area; a situation very similar to the one occurring in the Ituzaingó Anexo neighborhood, in the City of Cordoba. As a result of the health situation in the town of La Leonesa, where a rice growing company settled to develop agro-industrial practices supported by a heavy use of pesticides, an official Commission which studied water pollutants has been established. Dr. Ana Lía Otaño, member of this Commission and National Delegate of the Ministry of Health in Chaco, presented the results of the First Report which clearly highlights an increased incidence of birth defects in newborns at the provincial level, according to data from the main public healthcare provider in the province, the Neonatal Unit at Hospital of J.C Perrando in Resistencia, Chaco (Table No. 1).

Year	**Cases registered in a year**	**Live Births**	**Incidence (Birth Defects /10,000 live births)**
1997	**46** birth defects	24,030	19.1 by 10,000
2001	**60** birth defects	21,339	28.1 by 10,000
2008	**186** birth defects	21,808	85.3 by 10,000

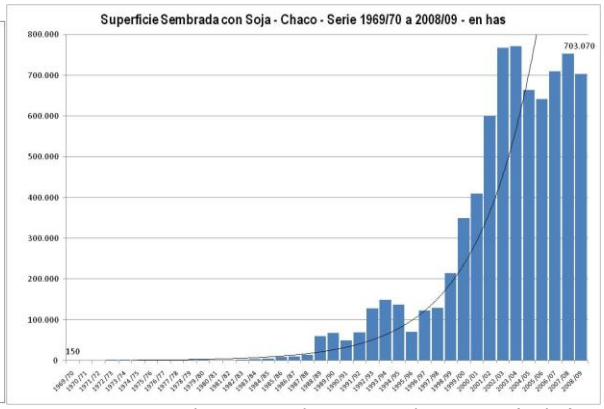
Table No. 1: Increase in congenital birth defects. Neonatal Unit, Hospital J.C. Perrando. Resistencia, Chaco.

In the Province of Chaco, it is now officially recognized what the residents have been claiming for many years: That the work activity with agrochemicals or its residential exposure (by vicinity) is linked to reproductive problems, repeated miscarriages and serious birth defects, such as the series of birth defect cases where mothers have a history of direct exposure to pesticides, which were collected by Dr. Horacio Lucero, Head of the Molecular Biology Laboratory of the Institute of Regional Medicine of the Universidad Nacional del Nordeste (National Northeastern University), who has been registering and studying them for over 10 years. His observations have been completely confirmed.

The rate of birth defects in 10,000 live births showed a significant increase in recent years, as shown in Graph No. 1.



Birth defects per 10,000 live births

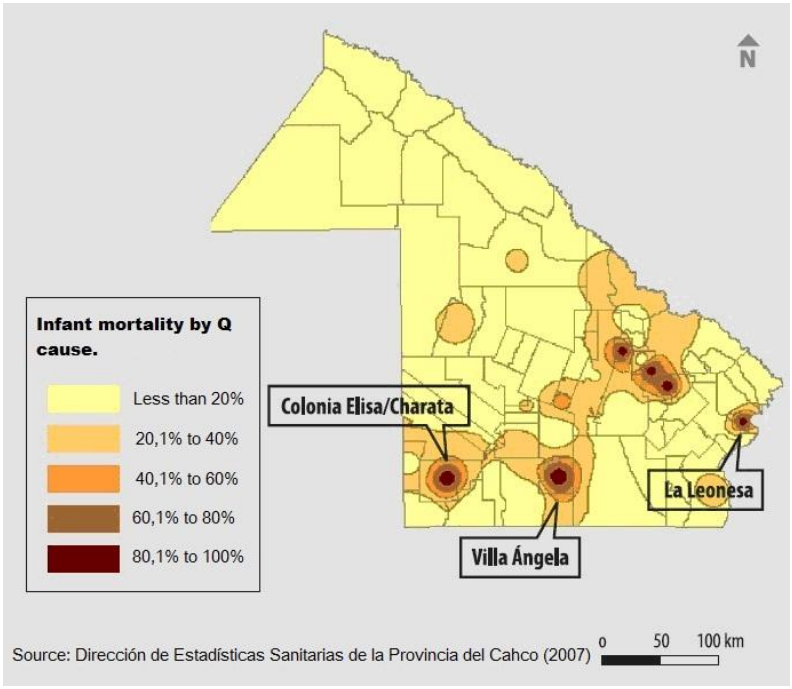


Soy-growing area, Chaco. 1969/70 to 2008/09 Series (in ha)

Graph No. 1: Number of congenital birth defects per 10,000 live births, Neonatal Unit, Hospital Perrando, Resistencia; and evolution of Soy-growing areas in the Province of Chaco

In recent years, soybean planting has been implemented in Chaco superseding other traditional activities of their regional economy. Companies making up agricultural conglomerates, which now own large extensions of public land, were established. It is noticeable how the increase of soybean planting in Chaco matches the growing number of congenital birth defects (Graph No. 1).

This link is also strengthened when seeing the death map due to Q causes (birth defects, chromosome anomalies, and deformities) which more significantly impacts soybean areas and La Leonesa, both areas exposed to a high level of glyphosate and other pesticide usage (Map No. 1).



Map No. 1: Childhood mortality due to Q causes (Congenital birth defects)

Child cancer data presented by Dr. Otaño also record what other physicians found in their own observation - incidence rates increased significantly against preexistent levels, as shown in Table No. 2.

Year	Registered cases	Children under 15	Incidence
1985	**23 child cancer cases + 25% registered outside the province**	275,858	**10.5 per 100,000**
	TOTAL: 29		
1991	**21 child cancer cases + 25% registered outside the province**	323,788	**8.03 per 100000**
	TOTAL: 26		
2001	**32 child cancer cases + 25% registered outside the province**	354,991	**11.3 per 100,000**
	TOTAL: 40		

2007	**47 child cancer cases + 25% registered outside the province** TOTAL: **59**	376,833	**15.7 per 100,000**

Table No. 2: Incidence of child cancer at the only healthcare provider treating this pathology in the Province of Chaco: 1985 – 2007. Data provided by the the Oncology Unit of the Pediatric Hospital.

In addition, when child cancer incidence was analyzed in the town most aggressively affected by agrochemicals (La Leonesa), and then compared to nearby towns moderately fumigated (Las Palmas), and not much fumigated (Puerto Bermejo), results strengthen the connection with higher levels of exposure to pesticides, as shown in graph No. 3 because incidence was three times greater in La Leonesa.

Town	Total population 2001	Children under 15. 2001	Expected cases of child cancer per year	Registered cases	Incidence per year
La Leonesa	10,067	2,960	0.41 cases/year (1 case per 24-36 months)	1996: 1 case 1997: 1 case 2000: 1 case 2003: 2 cases 2004: 1 case 2008: 1 case 2009: 1 case	**1990 – 1999** 0.2 cases/year 1 case/60 months **2000-2009** 0.6 cases/year 1 case/20 months
Las Palmas	6,593	2,146	0.3 cases/year (1 case per 36-42 months)	1993: 1 case 1995: 1 case 2006: 1 case	**1990 – 1999** 0.2 cases per year 1 case per 120 months **2000 – 2009** 0.1 cases/year 1 case/120 months
Puerto Bermejo	1832	652	0.09 cases per year 1 case every 96 years	1995: 1 case 2008: 1 case	**1990 – 1999** 0.1 cases/year 1 case/120 months **2000 – 2009** 0.1 case/year 1 case/120 months

Table No. 3: Incidence of child cancer in three towns of the Bermejo Department, Chaco, compared with the expected incidence according to the National Record of Child Cancer.

It is important to highlight that there are few official epidemiological reports; according to what physicians themselves say, the only data they have was gathered by observation, as generally Public Health bodies have avoided checking alarming notes coming from healthcare professionals as well as people's complaints. Province of Chaco's report is almost the only report created interjurisdictionally by a public area.

Other relevant testimonial was brought by Dr. Hugo Gomez Demaio, a Pediatric Surgeon specialized in Neurosurgery in Cleveland (USA). He is the Head of the Pediatrics Unit at Hospital de Posadas, Misiones, the only public hospital in the province with pediatric surgery service. All children needing this service are referred to this hospital. The Latin American Center for Congenital Birth defects Records (ECLAM, *Centro Latinoamericano de Registro de Malformaciones Congénitas*) reports that the Province of Misiones has a 0.1 /1000 live birth rate with neural tube defects; but Dr. Demaio has recorded in his hospital a 7.2/1000 rate (70 times more), which increases yearly. His team geolocated the origin of these families with severe and invalidating deficits and all families come from highly fumigated areas. A similar scenario is observed in cases of child cancer in Misiones.

Image No. 1: Broken Mielomeningocele (MMC) in a newborn

According to Dr. Demaio, the damage to human health integrity caused by agrochemicals is not recognized to its actual size; regarding congenital birth defects, he thinks we do not know the exact dimension of the number of miscarriages.

Apart from that, it is likely that there are neurological development problems and psychological problems not being assessed. This suspicion grows in light of research performed in Colonia Alicia (Misiones) by Demaio's team. There, a neurocognitive development test was analyzed, yielding bad results in the population of children under 1 exposed to agrochemicals, compared to children in Hospital de Posadas who do not come from fumigated areas.

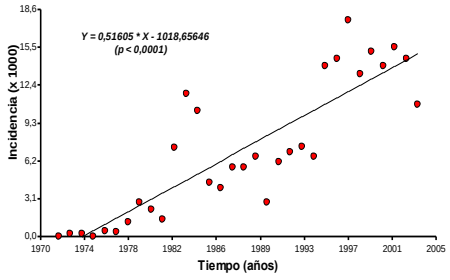
This healthcare team in Misiones suggests the iceberg model shown in Image No. 2 to interpret the health damage caused by agrochemicals.

TOXIC AGROCHEMICALS
1- GENOTOXICITY (GENOME modification)
2- Learning Disorders
3- Teratogenesis
4- Carcinogenesis
5- Toxicity

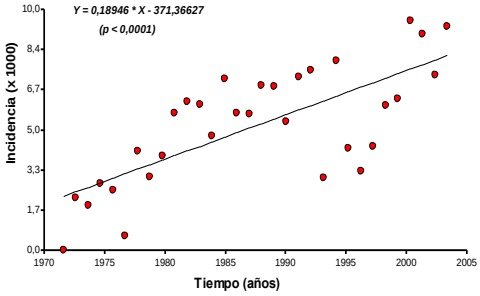
Image No. 2: The Iceberg Model showing the effects of toxic agrochemicals on human health.
MMC: Mielomeningocele

Prof. Dr. Gladys Trombotto, geneticist at the University Hospital of Maternity and Neonatology from the UNC, presented the results of her epidemiological research conducted over 111,000 live births in the Maternity Hospital of the University of Cordoba[4].

The rate of babies born with severe congenital birth defects increased between two and three times from 1971 to 2003. A first report[5], up to 1991, stated that there was an occurrence rate of 16.2% major congenital birth defects (MCM) per live birth, a rate which reached 37.1% in 2003. (See examples in graphs 3 and 4). This increment is statistically significant. Dr. Trombotto analyzed comprehensively all risk factors known for causing congenital birth defects, factors related to biological and medical antecedents and lifestyle-related conditions of mothers, and rejected all of them due to lack of statistical consistency[4] (see Graph No. 5).

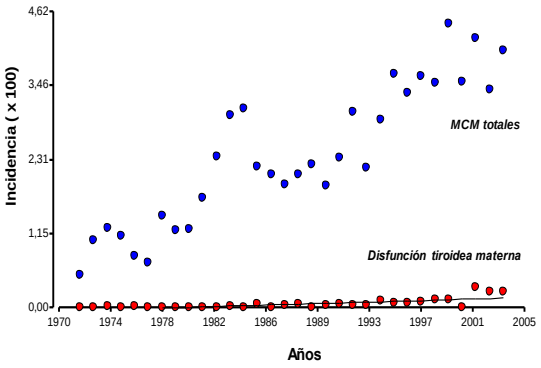


Graph No. 3: A rise in congenital heart disease



Graph No. 4: A rise in musculoskeletal defects

During the 31 years spanning this research, 111 thousand babies were born, 2,269 of which suffered major congenital birth defects. The European record of congenital birth defects, EUROCAT[6], covering 69,635 pregnancies, indicates a prevalence of 23.3% birth defects in 2004 - 2008. The Latin American research ECLAMC[7] indicates a 26.6% with over 88,000 recorded cases. The Maternity Hospital from the University of Cordoba recorded 37.1%, and an increasing trend.



Graph No. 5: Annual distribution of MCM incidence with thyroid dysfunction during pregnancy and total MCM[3]

The researcher highlights the link between agrochemicals as a risk factor; stating that the increase in sprayings matches the increase in the prevalence of birth defects. This same phenomenon is seen in Chile, Paraguay, Colombia, Spain, USA, Mexico, Philippines, Canada, and other European countries; as emphasized in all scientific literature presented for consideration[4].

Research studies from Argentine University Groups

UNL (*Universidad Nacional del Litoral*, National University of the Littoral): Dr. Maria Fernanda Simoniello, along with the team from the Toxicology, Pharmacology, and Legal

Biochemistry Chairs of the Faculty of Biochemistry and Biology from the National University of the Littoral (Santa Fe), have studied the biomarkers of cellular reaction on people directly exposed to pesticides (fumigators), or indirectly exposed (non fumigators living near crops), and have published many papers on the subject[8,9,10]. In this Meeting, she presented two investigations carried out with workers from the fruit and vegetable growing areas in Santa Fe, where the most widely used pesticides were Chlorpyrifos, Cypermethrin and Glyphosate; the first investigation was done between January and March 2007, and the second one several years later.

Among other biomarkers, they use the Comet assay (a Single Cell Gel Electrophoresis assay), a very useful tool to investigate DNA damage and its possible correlation with repair mechanisms. By using human lymphocyte, in vivo as well as in vitro, it proved to be the technique of choice to monitor damages in genetic material in a population exposed to low levels of chemical agents.

The results showed that both groups exposed to pesticides (occupational and residential) had a genetic damage rate statistically higher than the control group (not exposed to pesticides); an statistically significant difference also present in the genetic damage repair analysis.

Comet Assay	**Control (n=30)**	**Direct Exposure (n=25)**	**Indirect Exposure (n=33)**
Damage index (median±s)	*113.63±13.48*	*214.92±15.44**	*221.06±18.32**

s= standard deviation
**Statistically significant difference for the Damage index (Dunnett's test: P<0.001).*

Table No. 4: Damage index with Comet assay[7,8]

The groups were statistically compatible, and the results give biologic plausibility to the health teams' clinic observations, since individuals with less ability to eliminate genetic mutations will have more possibilities of developing cancer under this exposure. Similarly, exposed pregnant women in high vulnerability time windows will undergo spontaneous abortions or give birth to newborns with birth defects.

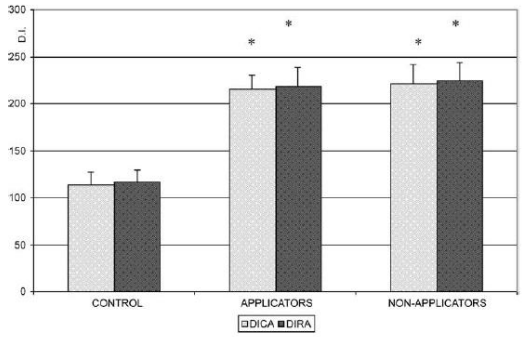


Figure 1. Damage index in exposed (applicators and non-applicators) and control subjects using Comet assay and repair assay. DICA, damage index Comet assay, * $P < 0.0001$ (ANOVA). DIRA, damage index repair assay, * $P < 0.0001$ (ANOVA)

Graph No. 6: DNA damage index using Comet assay (DICA) and Damage index repair assay (DIRA)[5]

UNRC (*Universidad Nacional de Río Cuarto,* National University of Rio Cuarto): Dr. Delia Aiassa's team from the Public Health Department of the Faculty of Agronomy and Veterinary of the UNRC and CONICET, has also been working and publishing papers about genotoxicity of Glyphosate and exposure to pesticides in general[11, 12, 13, 14, 15]. They presented their multidisciplinary work about towns in south Cordoba, and the results of genotoxicity assays using techniques of chromosome aberrations, micronucleus and Comet assay.

The work involved interviewing and analyzing blood samples of people from Río de los Sauces, Saira, Gigena, Marcos Juárez and Las Vertientes - in this area, 19% of women reported at least one spontaneous abortion[12]. The control group was composed of inhabitants from Río Cuarto. Statistically comparable groups were established; the results were partially published[13], and the final report of this work was presented in this Meeting, as well as in other Conventions, and it is about to be published.

Agricultural practices in this zone include, mainly, transgenic corn and soy crops. By frequency, the most widely used pesticides are: Glyphosate, Cypermethrin, 2.4D, Endosulfan, Atrazine and Chlorpyrifos, which are applied from October to March with an average of 18 times (with a range between 6 and 42 times) or spraying cycles per season[12].

Their results, as well as Simoniello's in Santa Fe, showed important differences in genotoxicity rates between exposed individuals, fumigators or not, and the members of the control group who do not live in a fumigated area. The evident genetic lesions in those groups exposed to pesticides were of a remarkably higher statistical significance, which reinforces the causal link with the exposition, and also shows a similarity with the animal testing[11, 14, 15] carried out by the same group of scientists.

Graph No. 7: Genotoxicity in Marcos Juárez and Saira shown in red (Dr. Aiassa 2010)

The Comet assay has an excellent sensitivity and specificity for DNA damage. When the cellular nucleus is subjected to electrophoresis, the broken fragments migrate out of it, showing the image of a comet, depending on the size of the DNA fragments, as well as on the quantity of the destroyed genetic material.

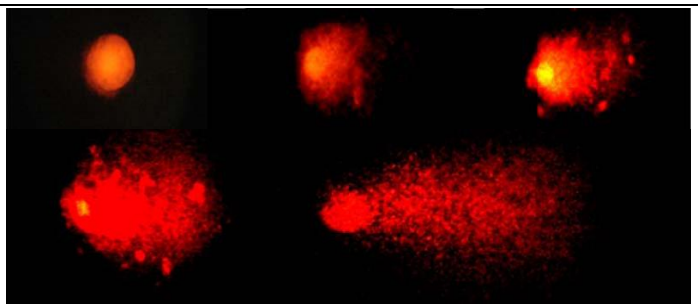
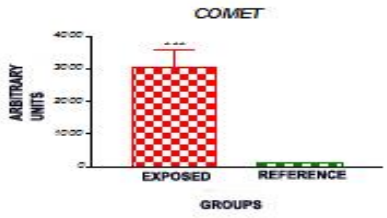


Image No. 3: Comet assay showing different levels of DNA damage in peripheral blood cells.

The damaged cell has three possibilities: 1 - That the DNA is repaired by its own systems. 2 - That the DNA is not repaired due to circumstantial or constitutional failures, triggering the process of apoptosis (programmed cell death). 3 - That the DNA is not repaired due to circumstantial or constitutional failures, and that the cell survives with mutagenic sequels. If germ cells are affected, the offspring will suffer reproductive problems or teratogenic

effects; if somatic cells are affected and mutation could not be removed, it will trigger an aberrant cell line that will likely produce a cancer.



Graph No. 8: Genotoxicity in all studied towns, comp. exposed and not exposed controls. (Dr. Aiassa 2010)

UBA (*Universidad de Buenos Aires,* Buenos Aires University): The Laboratory of Molecular Embryology of CONICET-UBA, directed by Dr. Andrés Carrasco, has also been studying Glyphosate as an embryonic development noxa on vertebrate samples with recognized compatibility with human embryonic development. There are many international reports which relate this herbicide with embryonic development damage on different experimental models[16, 17, 18, 19, 20, 21].

Carrasco's recently published[22] work, presented in this First Meeting, has shown the teratogenic effects of glyphosate by incubating and inoculating amphibian embryos and chicken embryos with very diluted doses of herbicide.

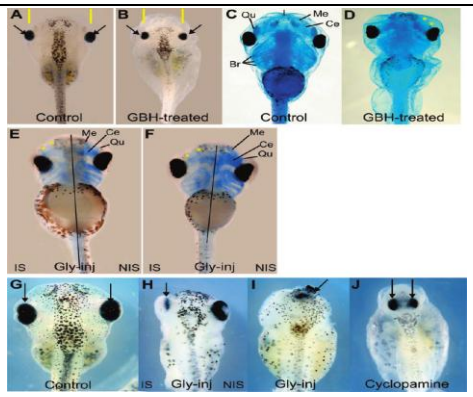


Image No. 4: Alteration of Glyfosate[22] treated embryos

The results show a reduction in the length of the embryo, alterations suggesting defects in the formation of embryonic axes, a modification in the size of the cephalic region which affects brain formation and eye reduction (see Image No. 4), alterations in the branchial arches and auditory placode, and abnormal changes in the formation mechanisms of the neural plate which could affect the brain's normal development, the closure of the neural tube, and other nervous system impairments.

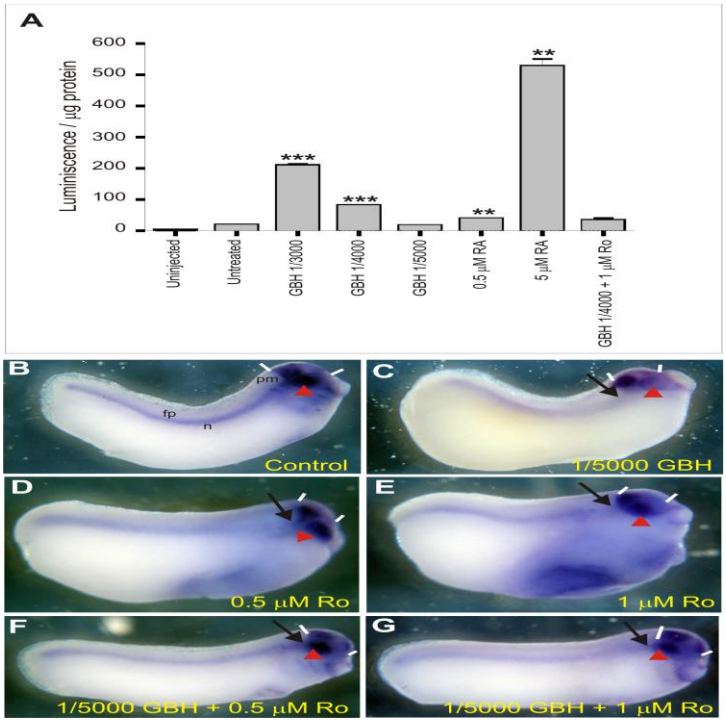


Image No. 5: Glyfosate increases retinoic acid activity

By measuring the activity of some enzymatic systems, it was discovered that Glyphosate increases the endogenous activity of retinoic acid. The manifestation of structural damages in embryos was reverted when the herbicide was simultaneously used with a retinoic acid antagonist (see Image No. 5).

As a conclusion, the authors claim that the direct effect of glyphosate over the initial mechanisms of morphogenesis in vertebrate embryos raises concerns about the clinical outcomes observed in the offspring of populations exposed to Glyphosate in the agricultural fields[22]; and which were attested by the doctors from fumigated towns present in this National Meeting.

Analysis of scientific literature

Over the last years, there has been an increase in the quality and quantity of epidemiological-related papers that link exposure to pesticides with harm to human health.

Congenital Birth Defects and Agrochemicals

Winchester[23] carried out an epidemiological-ecological study establishing a relation between the quantity of agrochemicals (Atrazine herbicide, nitrates, and other pesticides) measured in surface water, and congenital birth defect rates detected over a population of 3,011,000 births in the United States, between 1996 and 2002. Births were grouped by the months in which the child was conceived, taking the date of the last menstruation period (LMP) to assess the embryonic period (that of highest vulnerability). The authors saw the presence of pesticides on surface water as an important indicator of the levels of human exposure to pesticides.

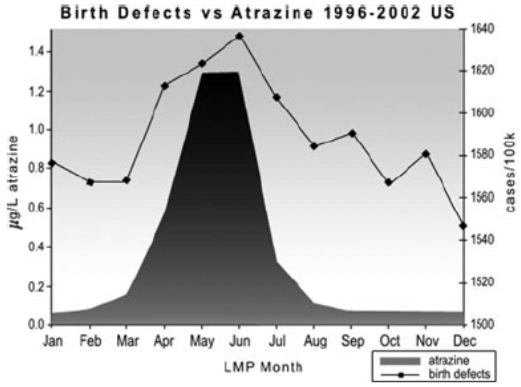


Figure 1 The United States birth defect rates by month of LMP versus atrazine concentrations.

Graph No. 9: Rate of birth defects by month of LPM and Atrazine in surface waters[23]

Results: The seasonal pattern (spring) showing an increase of pesticides in water coincided with a higher rate of various congenital birth defects in infants whose mothers' LMP was during spring months, a correlation that is statistically significant[23].

Another epidemiological-ecological study carried out by **Dr. Schreinemachers[24]**, at the US Environmental Protection Agency (EPA), used data from official demographic sources, and compared incidences of infants born with congenital birth defects (1995-97) in counties with high production of wheat that use significant quantities of 2.4D herbicide, against another rural population from neighboring counties with less wheat production and less pesticide consumption. It compared fumigated populations against non-fumigated populations in rural areas.

A significant increase in congenital birth defects linked to the population with higher exposure to 2.4D was found, and when LMP occurred in spring the impact was 5 times higher.

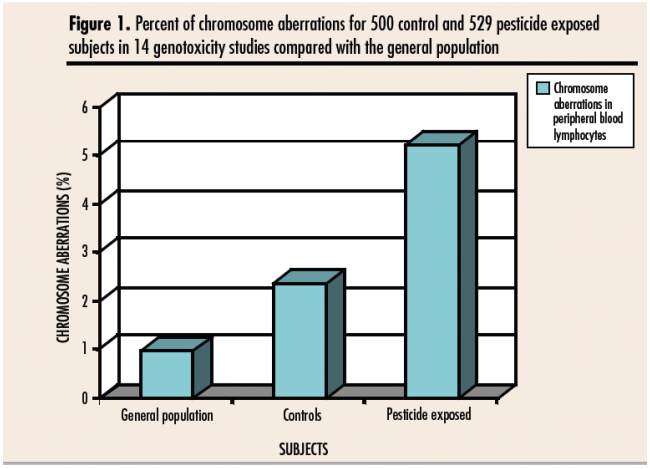
McMaster University in Canada, where the field currently known as Evidence-Based Medicine (EBM) was developed, started a systematic revision carried out by **Dr. Sanborn[25]** that analyzes pesticides and birth defects. After selecting works on population by a methodological quality qualification, rated from 1 to 7, 50 studies from 9 countries were chosen, scoring 4.83 on average.

The studies consistently showed an increase in risk for defects at birth due to exposure to pesticides in mothers. The specific defects included were limb reduction, urogenital anomalies, CNS defects, orofacial clefts, heart conditions, and ocular defects. The overall rate for any birth defect also increased with parents exposed to pesticides. Pesticides were identified in two studies, specifically Glyphosate and Pyridil by-products.

7 out of 10 studies analyzing prematurity, intrauterine growth delay, and low weight at birth in relation to pesticide exposure, showed a positive association.

9 out of 11 studies showed a positive association between exposure to pesticides and miscarriage, fetal death, stillbirth, and neonatal death; and critical windows to the moment of exposure with early or late abortions. A study (the Philippines) showed that the danger of aborting the fetus was 6 (six) times higher in rural workers using powerful pesticides, compared against those workers using integrated techniques in pest handling (minimized use of pesticides).

Genotoxicity: The results from the 14 studies of genotoxicity are shown in Graph No. 10, with a difference over twice as much larger in favor of those exposed.



Graph No. 10: Percentage of chromosome aberrations in 529 pesticide exposed subjects, compared to 500 simultaneous control subjects, and percentage of estimated chromosome aberrations estimated in the general population[25].

In clinical practice, these chromosome aberrations may appear as spontaneous abortions, birth defects, spermatic anomalies, or they can foster cancer development.

The most striking characteristic of the results in this systematic revision is the consistency in the evidence demonstrating that exposure to pesticides increases the risk for congenital birth defects, reproductive disorders, and genotoxicity (as well as neurotoxicity).

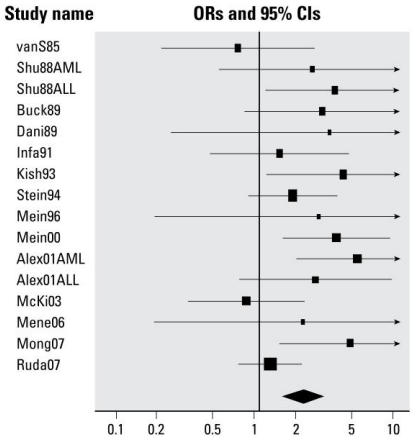
Limitations: The main limitation of the studies on the toxic effect of pesticides consists in their not being able to wholly demonstrate the cause-effect relationship. The subjects under study cannot be deliberately exposed to hazardous poisons in a randomized controlled test (RCT); the evidence provided by well constructed clinical and epidemiological observation studies, such as those analyzed herein, **presents the highest level of evidence that we can ethically obtain**[25].

Conclusion: This systematic revision provides clear evidence that exposure to pesticides increases the risk of health problems, and it is therefore necessary to advance further toward public restrictions to the use of pesticides[25].

Cancer and agrochemicals

Widge[26], at the University of Ottawa, has recently published a meta-analysis and a systematic revision analyzing childhood leukemia and the exposure to pesticides in both parents. Leukemia is the main cancer in children. 31 studies were included, either cohort or control cases, with good methodological quality, over 1,775 identified works. No statistically significant association was found between occupational exposure to pesticide in the father of children with leukemia .

Childhood leukemia was associated with **pregnant mothers' occupational exposure** to pesticides, OR = 2.09, IC 95%, 1.51 to 2.88 (over twice as much more probabilities to develop leukemia than in the control group).



Graph No. 11: Childhood leukemia meta-analysis in relation to pregnant mothers' occupational exposure to pesticides[26]

The risk of childhood leukemia was also high in the cases of pregnant mothers' exposed to insecticides, OR = 2.72, IC 95%, 1.47 to 5.04, and herbicides: OR = 3.62, IC 95%, 01.28 to 10.03. Conclusion: The epidemiological and biological evidence presented suggests that pregnant mothers should avoid exposure to pesticides. This study also provides another tool for preventing cancer in children[26].

Infante-Rivard[27], updating a revision on childhood cancer and pesticides, and after analyzing a significant number of population-based studies, concluded that there is a certain association between exposure to pesticides and childhood cancer. Their data, analyzed using Hill's causality criteria, show that the ratio is repeated over many studies, thus providing consistency to the causal association, and that other works detect a biological gradient of exposure that also re-enforces the association; that biological plausibility is present; that the specific ratio with certain type of pesticide in particular and a type of oncological disease was not demonstrated because cancer development probably depends on the presence of many factors, such as genetic predisposition and others, that have to come together at a given moment to cause the disease.

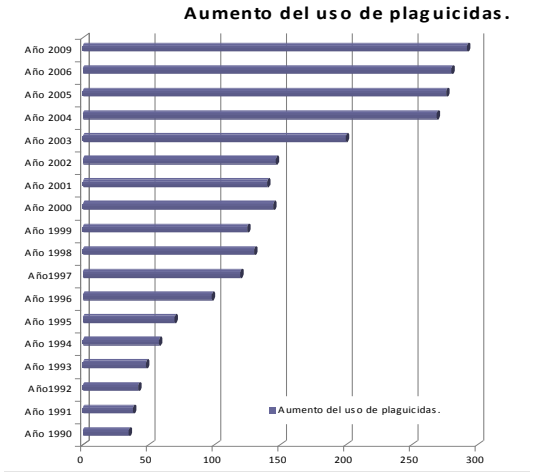
Dr. Sanborn[28] at McMaster University has also published a systematic revision about cancer and the use of pesticides. She found a strong and consistent link between lymphoma non-Hodgkin, leukemia in children, brain tumors, and prostate cancer in adults, and exposure to pesticides; moreover, a stronger link was found when exposures were longer and higher (doses/response). The study concluded that her results support attempts at reducing exposure to pesticides as a measure to prevent cancer[28].

As it can be seen from this group of selected relevant articles, and from the information found in the best works carried out with research methods ethically acceptable, today we can rely on sufficient evidence to state that exposure to pesticides increases the risk of affecting human health, and that clinical observations made by health teams in fumigated populations demonstrate the link between the use of agrochemicals in those environments and health related problems.

The Magnitude of the Problem

It is crucial to acknowledge the fact that, together with the increase in cancer and birth defect cases in the mentioned areas, the use of pesticides also increased exponentially since the

introduction of transgenic crops. This type of crop requires the use of more and more pesticides. In 1990, 35 million liters were used during the crop year. In 1996, the introduction of transgenic biotechnology accelerated the use of pesticides to the extent that 98 million liters were used, and in 2000, it increased to 145 million liters. Last year 292 million liters were used, and this year we will be spraying the fields with over 300 million liters of herbicides, insecticides, acaricides, defoliants and other poisonous substances (see Graph No. 12). 200 million liters of Glyphosate, a commonly used pesticide, may be sprayed this year. Nearly 4 million liters per year of Endosulfan, a poisonous insecticide, are sprayed each year.

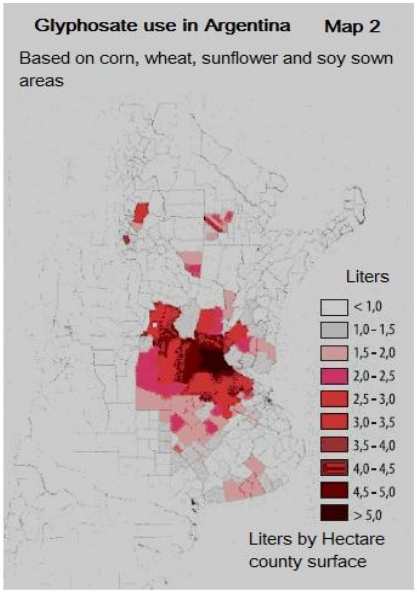


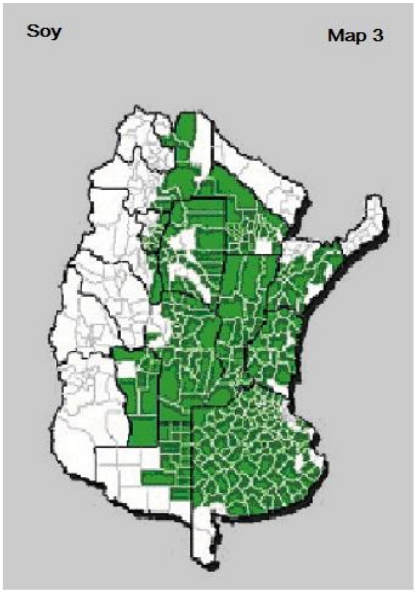
Increase in pesticide usage.

Graph No. 12: Evolution of pesticide usage per year in millions of liters/kg (Rap-Al)

Each year the amount of Glyphosate per hectare repeatedly sprayed on the same plot of land has increased. This is probably because weeds have become resistant. In 1996, the sprayings started at less than 2 liters per hectare, whereas today some areas are sprayed with 10 liters per hectare, and almost 20 liters per hectare in other areas.

These poisonous substances are sprayed over extensive territories.



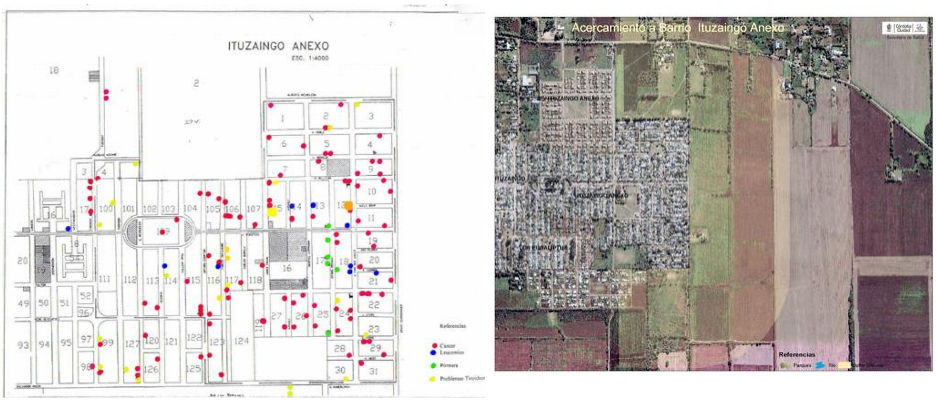


Maps No. 2 and No. 3: Glyphosate and Soy. Estimated geographical dispersion. 2010. MSAL y SAGPyA

Transgenic crops subject to systematic sprayings cover 22 million hectares located in the provinces of Buenos Aires, Santa Fe, Córdoba, Entre Ríos, Santiago del Estero, San Luis, Chaco, Salta, Jujuy, Tucumán, La Pampa and Corrientes. According to geographers from the UNC, at least 12 million people live in towns surrounded by crops that may be found in these vast territories, and that figure does not include the population from large cities in each of these provinces.

Twelve million Argentineans are directly sprayed. This means that a sufficient amount of those 300 million liters of agrotoxics are sprayed on houses, schools, parks, water sources, sports fields, and work areas. In other words, on their lives. This population is treated by physicians working in the crop-sprayed towns, where we notice an alarming increase of cancer, birth defects and reproductive disorders which cannot be concealed anymore.

This undisputed reality is revealed, for example, in the geo-reference made in 2005 by the mothers in Córdoba's Ituzaingó neighborhood and its local government primary care team about the cases in this neighborhood where, among other pollutants, agrochemicals played a relevant role.



Graph No. 14. Red: Cancer in general. Blue: Leukemia. Green: Purpura. Yellow: Hypothyroidism. A geographic gradient is observed as we approach the area to the right: the crop-sprayed area.

Proposals

The first recommendation is for the public and society to listen, recognize and acknowledge what health and science experts state - toxic pesticides are poisonous, and they are making us sick. The diseases that we are exposed to everyday are not random, and they are caused by the spraying of these pesticides.

Due to the seriousness of the problem presented here, and in view of the **precautionary principle**, we believe that measures must be taken in order to guarantee a healthy and clean environment for the people in the crop-sprayed areas, our patients. It is urgent that we make progress in restricting the use of pesticides, since crop-sprayed towns of Argentina are poisoned massively during at least 6 months each year, and three times per month.

Sprayings carried out by airplanes or helicopters have shown to generate a "drift" of poisonous substances spreading uncontrollably. In fact, in its Directive 128/09, the European Parliament banned pesticides throughout its territories, and established that the regulations from every member country must be adapted in that regard, since pesticide sprayings in France were detected in Iceland a few days later.

Taking into consideration Argentina's widespread use of agrochemicals and the fragile health status observed in people who live in the crop-sprayed towns, we believe that it is essential to immediately ban all aerial sprayings of pesticides throughout the country.

Also, sprayings on land must be carried out far away from highly populated towns and cities. Even though its drift is lower, these chemicals can still be found in neighborhoods near to fields. Therefore, it is essential that crops are sprayed from a distance of no less than 1000 meters from the limits of urban areas - towns and cities – and respecting all specific regulations.

We believe that in addition to stop sprayings in populated areas, it is necessary to ban the use of pesticides of Ia and Ib toxicological type. They are real chemical weapons.

We question the current agro-industrial and transgenic production model. There are other options for agro-ecological production that the State University should promote and develop. It is necessary to research, select, and agree to production systems that allow for social and cultural integration, defending and reproducing our environment's ecological conditions.

State universities and their Faculties of Medical Sciences should commit more to research and training of their professionals[29] so that they recognize and respond proactively and therapeutically to these types of conditions and environmentally related diseases.

Cordoba, August 28, 2010

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Next Meeting

It will be held during March-April of 2011 at the Faculty of Medical Sciences of the Universidad Nacional de Rosario (National University of Rosario).
The **Red Universitaria de Ambiente y Salud** (University Network of Environment and Health) has thus been established. All those interested are welcomed to visit the web site and join the forum at: www.reduas.com.ar

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