

# A PRELIMINARY INVESTIGATION ON THE GENERAL HEALTH AND REPRODUCTIVE STATUS OF NORTH OF VIETNAM VETERANS POTENTIALLY EXPOSED TO HERBICIDES DURING WARTIME.

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During the 2nd Indochina war, the south of Vietnam was heavily sprayed by herbicides used for military purposes. To study the potential health effects of these chemicals, in 1988 we conducted a retrospective study on veterans from the north of Vietnam who served in sprayed areas in wartime who now are demobilized and living again with their family in the north.

## 1 - METHODS

1- All the 2nd Indochina war veterans living in Viet Yen district, Ha Bac province, 40km north of Hanoi, were investigated.

2-On the basis of the records kept in the Viet Yen District Military Service we set up a list of all veterans mobilized to serve the army between 1960-1975.

3 -The research team consisted of :

- 8 physicians
- 28 medical students
- 1 statistician and 5 medical workers

The investigators were divided into 5 groups (2-3 physicians and 4-5 students each group). Each group was in charge of the investigation of 3-4 villages.

4-The investigation included :

- An interview of all veterans enlisted
- A medical examination and
- Medical care for those who were sick.

5-For this study, we have set up a somewhat arbitrary rating system for the field estimation of the herbicide exposure degree (table 4).

Taking into account that the heaviest spraying period occurs between 1966-1970, before 1966 (1960-1965) was the beginning of the spraying operations, after 1970 the exposure risk may decrease, so the numerical rating differs according to the time period the subject lived in sprayed areas.

The highest rating (3 scores per year) is given to those who served between 1966-1970. A lower rating (2 scores / year) is given to the periods before 1966 and after 1970. Only 1 score/year is given to the period after 1975 and 0 for the period before 1960 (before the spraying operations) and for non sprayed areas.

We considered 4 exposure degrees : Not exposed, lightly, moderately and heavily exposed.

We consider a subject as heavily exposed to herbicides if he lived in sprayed areas for 10 years or more from 1966-1975 and was directly sprayed on 3 times or more. According to the rating proposed above, he could receive more than 30 scores. On the basis of these calculations the heavy exposure degree is adopted to those receiving more than 30 scores. Those scored between 15 and 29 are classified as moderately exposed, between 1-14 as lightly exposed and 0 score as non exposed to herbicides.

**II-RESULTS** : See tables 1 to 10.

### III-OBSERVATIONS AND DISCUSSIONS

1-Among 1940 veterans of the 2nd Indochina war, living in Viet Yen-Ha Bac, ( table 1) - 153 (7.6%) served in the north of Viet nam. - 1465 (75.5 %) fought in the south Vietnam - 211 (10.8%) fought in Laos - 111 (5.7 %) served in the trans-Indochina strategic road (also known as the HoChiMinh trail) .

- 36 % began military service between 1966-1970.

2- In wartime, in the North Vietnam Army, there was no time limit for service. The time in the warzone in the potentially herbicide contaminated south of Vietnam was found to be:(table 2)

- less than 3 years : 23 %
- from 4-6 years : 37.7 %
- from 7-9 years : 23 %
- more than 10 years : 16 %. About 60% of the veterans fought in the south of Vietnam more than 5 years .

3- The veteran's age (up to 1988) (table 3) is similar in all groups Very few aged less than 30 (0.4 %) Most of the veterans of all groups are aged between 31-50 (83.6 %) (table 3).

4-According to our estimation of the herbicide exposure (table 4), among the veterans investigated :

- 15 % are not exposed
- 43 % are classified as lightly exposed
- 32 % moderately exposed
- 9 % heavily exposed (table 5).

5- The living standards and the habits of life were similar in all groups of veterans (table6). The living standards were estimated according to the quantity and the quality of foods the subject received daily :

From 3-6 % of the veterans are considered as having a comfortable lifestyle . 69 to 74 % have a medium or moderate living standards. From 21 to 26 % are poor .

About 70 % of the veterans smoke . The exposed veterans smoke more than the non exposed ones .

12 % are classified as heavy smokers (more than 20 cigarettes/day). 68 % of the veterans don't drink alcohol. Only 0.5% is heavy drinker ( more than 1/2 liter/day, usually of rice alcohol).

After returning to the family, most of the veterans returned to farming. About 60 % used pesticides (mostly the chloro or phosphoro organic products) 1-2 times per crop, 2 crops per year, using a manual back holding sprayer.

6- We focused our attention on the health of the veterans and their reproductive problems. The veteran's health status is evaluated according to the subject's interview , their medical records and mostly from a medical examination . In this field study we was able only to make a clinical examination. We had no opportunity to use more sophisticated investigations ( X ray examination, laboratory tests...) to ascertain the diagnosis . It appears that , in comparison with the non exposed (NE) veterans , on average , the exposed (E) ones have an increased rate of : (table 8)

- respiratory diseases (asthma, bronchitis, tuberculosis...):  
7.6% (NE) / 10.5% (E)
- circulatory diseases: 0.45% (NE) / 1.8% (E)
- urinary diseases : 6.33% (NE) / 8.32% (E)
- dermal diseases : 4.9% (NE) / 5.7% (E) .

7- In regard with the veterans reproductive problems (table 9). Whereas the average age of all groups of veterans and their conjoints are similar, (table 10) , the average number of children in a non exposed veteran's family is 4.4 and in an exposed family is 3.9 .

The rate of reproductive abnormalities (abortion, stillbirth, molar pregnancies) per 100 pregnancies is 8.4% in non exposed and 13.2% in exposed veterans.

- The rate of birth defects on live births is 1.1% in non exposed and 2.32% in exposed veterans; 4.8% of non exposed and 9.16% of exposed families gave birth to malformed babies and the rate seems to increase parallelly with the exposure score of the father:
- lightly exposed 7.4%
- moderately exposed 8.9%
- heavily exposed 20.5%

#### **IV-CONCLUSION**

A preliminary investigation has been carried out on Northern vietnamese veterans of the 2nd Indochina war. Before and after the military service, they lived in the same district with a similar economic, social, healthcare conditions. They joined the North Vietnam Army between 1960-1975 and served in different warzones. Some warzones (south Vietnam, HoChiMinh trail) were heavily sprayed by herbicides, others are not or only partially sprayed (north Vietnam, Laos).

The study suggests an increased rate of respiratory, vascular urinary and dermal diseases in the veterans exposed to herbicides. But this is not statistically significant.

Especially of concern is the increased rate of abnormal pregnancies and birth defects appearing in families of veterans exposed to herbicides, and this is statistically significant. The rate of birth defect increases proportionally to the degree of exposure of the father.

Our study confirms the results of other previous studies carried by Ton duc Lang (1) and Dao ngoc Phong (2) on the increased risk of abnormal pregnancies and birth defects in family of North Vietnam veterans potentially exposed to herbicides during wartime.

#### **LITERATURE**

**1- Ton duc Lang** -Teratogenic effects of herbicides on the 1st generation. Proceeding of the International Symposium on the long term effects of Herbicides and Defoliants used in the Vietnam war. HoChiMinh city-March-1983 -Vol.3-p.88

**2- Dao ngoc Phong** - Epidemiological investigation at Thanh tri district of impact of herbicides on foetus in women whose husband fought in south Vietnam-Proceedings of the 2nd National Symposium on the long term effects of Herbicides and Defoliants used in the Vietnam war-Hanoi-1986 pp.58-71

Table 1  
 NUMBER OF INVESTIGATIONS - REPARTITION IN WARZONES  
 AND ENROLMENT DATE

ENROLMENT DATE	NORTH VIETNAM		SOUTH VIETNAM		LAOS		HOCHIMINH TRAIL		TOTAL	%
	Number	%	Number	%	Nber	%	Number	%		
Before 1960	28	18.3	114	7.8	15	17.1	15	13.5	172	88.9
1961-1965	44	28.8	338	23.1	95	145.0	45	40.5	522	26.9
1966-1970	36	23.5	561	38.3	67	131.8	36	32.1	700	36.1
1971-1975	44	28.8	444	30.3	32	115.2	15	13.5	535	27.8
After 1975	1	0.7	8	0.5	2	0.9	0	0.0	11	0.6
TOTAL	153	7.8	1465	75.5	211	110.8	111	5.7	1940	100%

Table 2

SEJOURN TIME IN THE WARZONE

Sejourn time! in warzone !	North VN !		South VN !		Laos		HCM trail !		Total!	%
	Nber!	%	Nber!	%	Nber!	%	Nber!	%		
1 year	0	0.0	6	0.4	0	0.0	0	0.0	6	
2 years	11	7.2	17	11.7	43	20.1	7	6.3	232	23.0
3 -	10	6.5	174	11.9	14	6.6	11	9.9	209	
4 -	18	11.8	173	11.8	30	14.2	20	18.0	241	
5 -	18	11.8	208	11.2	37	17.5	15	13.5	278	37.7
6 -	17	11.1	167	11.1	18	8.5	11	9.9	213	
7 -	8	5.2	150	10.2	12	5.7	3	2.7	173	
8 -	12	7.8	107	7.3	21	10.0	17	15.3	157	23.0
9 -	12	7.8	81	5.7	11	5.2	10	9.0	117	
10 -	9	5.9	71	5.1	8	3.8	5	1.5	96	
Over 10 years!	38	21.8	151	10.3	17	8.1	12	10.8	218	16.2
Total	153	100	1459	100	211	100	111	100	1940	100

Table 3

AGE (UNTIL 1988) AND WARZONE

Age	North VN		South VN		Laos		HCM trail		TOTAL	%
	Nber:	%	Nber:	%	Nber:	%	Nber:	%		
< 30 y	0	0	5	0.3	2	1.0			7	0.4
31-35	32	20.9	336	22.9	14	6.6	5	4.5	387	19.9
36-40	23	15.0	337	23	37	17.5	24	21.6	421	21.7
41-45	22	14.3	309	21.0	53	25.1	35	31.5	419	21.5
46-50	34	22.2	266	18.1	70	33.1	28	25.2	398	20.5
51-55	24	15.6	149	10.1	22	10.4	8	7.2	203	10.4
56-60	10	6.5	45	3.0	12	5.6	9	8.1	76	3.9
> 60	8	5.2	18	1.2	1	0.4	2	1.8	29	1.4
Total	153	100	1465	100	211	100	111	100	1940	100

Table 4

ESTIMATION OF THE HERBICIDE EXPOSURE DEGREE

Basis for the estimation :

- the warzone
- sejour time in the warzone
- number of direct contacts with herbicides

NORTH VIETNAM	:	0 score/ year
LAOS (non sprayed areas )	:	0 - / year
SOUTH VIETNAM AND HOCHIMINH TRAIL	:	(sprayed areas)
- before 1960	:	0 score/ year
- between 1961-1965	:	2 -
- - 1966-1970	:	3 -
- - 1971-1975	:	2 -
- after 1976	:	1 -
DIRECT EXPOSURE	:	3 scores each time
<u>TOTAL OF SCORES :</u>		

- No exposure : 0 score
- lightly exposed : from 1 to 14 scores
- moderately exposed: - 15 - 29 -
- heavily exposed : more than 30 scores

Table 5

FIELD ESTIMATION OF THE EXPOSURE DEGREE

	North VN	South VN	Laos	HCM trail	Total	%
: Not exposed	: 152	: 45	: 87	: 9	: 293	: 15.1
: Lightly exp.		: 731	: 68	: 42	: 844	: 43.5
: Moderately exp:	1	: 511	: 47	: 38	: 627	: 32.3
: Heavily exp. :		: 145	: 9	: 22	: 176	: 9.0

TABLE 6

## ACTUAL LIVING STANDARDS AND HABITS OF LIFE

*****											
		Non		Exposed veterans							
		Exposed		Lightly	Moderately	Heavily	Total				
*****											
		T.tal	Rate %	T.tal	Rate %	T.tal	Rate %	T.tal	Rate %	T.tal	Rate %
*****											
LIVING STANDARDS OF THE FAMILY											
* Comfortable:	18	6.06	26	3.08	22	3.51	7	3.98	55	3.34	
* Medium	216	72.73	614	72.75	470	74.96	123	69.89	1207	73.3	
* Poor	63	21.21	204	24.17	135	21.53	46	26.14	385	23.4	
* Total	297	100	844	100	627	100	176	100	1647	100	
SMOKING											
* No smoker	109	36.7	222	26.3	165	26.32	43	24.43	430	26.1	
* Smoker *	188	63.3	622	73.7	462	73.68	133	75.57	1217	73.9	
* + Lightly	71	23.91	198	23.46	132	21.05	31	17.61	361	21.9	
* + Moderate	84	28.28	321	38.03	257	40.99	70	39.77	648	39.3	
* + Heavy	33	11.11	103	12.2	73	11.64	32	18.18	208	12.6	
* Total	297	100	844	100	627	100	176	100	1647	100	
ALCOHOL CONSUMPTION											
* No drinker	210	70.71	572	67.77	428	68.26	122	69.32	1122	68.1	
* Drinker**	87	29.29	272	32.23	199	31.74	54	30.68	525	31.9	
* + Lightly	74	24.92	228	27.01	170	27.11	34	19.32	432	26.2	
* + Moderate	11	3.70	41	4.86	26	4.15	19	10.80	86	5.22	
* + Heavy	2	0.67	3	0.36	3	0.48	1	0.57	7	0.43	
* Total	297	100	844	100	627	100	176	100	1647	100	
CONTACT WITH OTHER CHEMICALS											
* Yes	189	63.64	537	63.63	344	54.86	100	56.82	981	59.6	
* No	108	36.36	307	36.37	283	45.14	76	43.18	666	40.4	
* Total	297	100	844	100	627	100	176	100	1647	100	
*****											
* Smoker:						** Drinker :					
+ Light	< 10	cigarettes/day				+ Light	< 100	ml/day			
+ Moderate	10 - 20	-				+ Moderate	100-500	-			
+ Heavy	> 20	-				+ Heavy	>500	ml/day			

TABLE 7

## WAR INJURIES - MALARIA

		Non exposed		Exposed veterans				Total		
		T.tal	Rate %	T.tal	Rate %	T.tal	Rate %	T.tal	Rate %	
WAR INJURIES										
Yes	:	70	:23.57	: 351	:41.59	: 345	:55.02	: 119	:67.61	* 815 :49.5 *
No	:	227	:76.43	: 493	:58.41	: 282	:44.98	: 57	:32.39	* 832 :50.5 *
Total	:	297	: 100	: 844	: 100	: 627	: 100	: 176	: 100	* 1647 : 100 *
MALARIA INFECTION										
Yes	:	170	:57.24	: 720	:85.31	: 569	:90.75	: 170	:96.59	* 1459 :88.6 *
No	:	127	:42.76	: 124	:14.69	: 58	: 9.25	: 6	: 3.41	* 188 :11.4 *
Total	:	297	: 100	: 844	: 100	: 627	: 100	: 176	: 100	* 1647 : 100 *

TABLE 8

ILLNESS AND EXPOSURE TO HERBICIDES  
( % )

Diseases	Non exposed veterans		Exposed veterans in total		Statistic value between non exp. and exp.group		Exposed veterans		
	T.tal	Rate %	T.tal	Rate %	X <sup>2</sup>	P value	Rate %	Rate %	Rate %
*Respiratory	17	: 7.69	139	:10.51	1.38	> 0.05	10.9	: 10.5	: 9.3
*Circulatory	1	: 0.45	24	: 1.81	2.16	> 0.05	2.4	: 1.5	: 0.6
*Gastro-intesti	83	:37.56	465	:35.17			33.7	: 35.1	:40.7
*Urinary	14	: 6.3	110	: 8.32	0.87	> 0.05	9.9	: 7.4	: 5.2
*Dermal	11	: 4.97	76	: 5.75	0.19	> 0.05	7.2	: 4.7	: 3.5
*Osteo-articula	33	:14.93	138	:10.44			9.6	: 11.7	: 9.9
*Neuro-psychiat	45	:20.36	247	:18.68			17.3	: 19.6	:20.9
* Others	17	: 7.69	123	: 9.3			9	: 9.5	: 9.9
*Total*	221	: 100	1322	: 100			100	: 100	: 100

\* : Total all diseases  
\*\* : Percentage between diseases and total of diseases



Table 9  
REPRODUCTIVE PROBLEMS AND EXPOSURE TO HERBICIDES

:Reproductive status	Exposed veterans				: Total
	: veterans	:Lightly	:Moderately	:Heavily	
: n = 293	: n = 844	: n = 627	: n = 176		
:No. of pregnancies	: 1407	: 3642	: 3044	: 810	: 7496
:No. of live births	: 1289	: 3217	: 2584	: 706	: 6507
:Mean children/family	: 4.4	: 3.8	: 4.1	: 4	: ME 3.9
:N.abnorm.pregnancies	: 118	: 425	: 460	: 104	: 989
:Rate Abn.pregn/Preg(%)	: 8.4	: 11.7	: 15.1	: 12.8	: ME 13.2
: Relative risk*	:	: 1.39	: 1.80	: 1.52	:
: Chi square	:	: 9.31	: 30.35	: 9.13	:
: P value	:	: <0.01	: < 0.001	: < 0.01	:
:Confidence interval**	:	: 0.55 - 29.06	: 0.84 - 43.78	: 0.63 - 34.08	:
:Nber birth defects	: 14	: 60	: 56	: 36	: 151
:Rate birth def/birth(%)	: 1.1	: 1.9	: 2.2	: 5.1	: ME 2.32
: Relative risk*	:	: 1.73	: 2.00	: 4.64	:
: Chi square	:	: 3.36	: 5.48	: 28.28	:
: P value	:	: > 0.05	: > 0.05	: < 0.001	:
:Confidence interval**	:	: 0.6 - 47.28	: 0.87 - 62.55	: 12.36 - 958.04	:
:Nber birth defects	: 14	: 60	: 56	: 36	: 151
:Rate birth def/family(%)	: 4.8	: 7.1	: 8.9	: 20.5	: ME 9.2
: Relative risk*	:	: 1.48	: 1.85	: 4.27	:
: Chi square	:	: 1.72	: 4.27	: 22.22	: 7.65
: P value	:	: > 0.05	: > 0.05	: < 0.001	: < 0.05
:Confidence interval**	:	: 0.51 - 38.31	: 0.74 - 54.9	: 8.28 - 617.29	:

\* : Relative risk between non exposed and exposed groups  
 \*\* : 95 % confidence interval  
 ME : Mean exposed

TABLE 10  
AVERAGE AGE OF THE VETERANS AND THEIR CONJOINT ( WIFE )

* Herbicide exposure degree	: Average age of the husband (veteran)	: Average age of the wife
* Non exposed	: 44	: 41
* Lightly exposed	: 40	: 37
* Moderately exposed	: 45	: 41
* Heavily exposed	: 46	: 41

