Appendix I

Participants List for PulseNet Asia Pacific Workshop , February 7- 10, 2006

	Address	Name	Arrival Date	Departure Date
1	**Research Officer** ICDDR,B Tel: 880-2-8811751-60, Ext-2406 Email: lisaazmi@yahoo.com; eml@icddrb.org	Ms Ishrat Jahan Azmi	**Feb 6, 2006**	**Feb 11, 2006**
2	Senior Research Officer ICDDR, B Email: tupurislam@yahoo.com	Mohammad Aminul Islam	**Feb 6, 2006**	**Feb 11, 2006**
3	China CDC People Republic of China c/o Kan Biao	Baowei Diao	**Feb 6, 2006**	**Feb 11, 2006**
4	China CDC People Republic of China c/o Kan Biao	Dong Jin	**Feb 6, 2006**	**Feb 11, 2006**
5	**Head**, Antimicrobial Resistance Surveillance Reference Laboratory Research Institute for Tropical Medicine, Department of Health Tel: (632) 809-9763 Email: ccarlos@ritm.gov.ph	Dr. Celia C. Carlos	**Feb 6, 2006**	**Feb 11, 2006**
6	**Medical Technologist IV**, Antimicrobial Resistance Surveillance Reference Laboratory Research Institute for Tropical Medicine, Department of Health, Tel: (632) 809-9763 Email: mlagrada@ritm.gov.ph	Ms. Marietta Lagrada	**Feb 6, 2006**	**Feb 11, 2006**
7	**Science Research Specialist 2** Antimicrobial Resistance Surveillance Reference Laboratory Research Institute for Tropical Medicine, Department of Health Tel: (632) 809-9763 Email: mlimas@ritm.gov.ph	Ms. Marilyn Limas	**Feb 6, 2006**	**Feb 11, 2006**

8	**Medical Scientist**, Enteric Bacteria Laboratory, National Institute of Health, Thailand	Ms Jiraporn Sukkaew	**Feb 6, 2006**	**Feb 11, 2006**
9	**Medical Assistant level 6** Enteric Bacteria Laboratory, National Institute of Health, Thailand	Mrs. Somjai Phaisomboon	**Feb 6, 2006**	**Feb 11, 2006**
10	The reference Laboratory of Enteric Pathogens, Department of Microbiology, National Institute of Hygiene and Epidemiology (NIHE), 1 Yersin Street, Hanoi 10 000, Vietnam	Ms NGUYEN HOAI THU, BSc	**Feb 6, 2006**	**Feb 11, 2006**

Appendix II

Agenda for PulseNet Asia Pacific PFGE Workshop Hong Kong 2006

Date: February 7- 10, 2006

Venue: Public Health Laboratory Centre (PHLC), Hong Kong

February 7, 2006 (Tuesday) morning session

Time	Activities	Speakers/ Modulators	Venue
	Chairperson of the day: Dr. C. H. Ma **Chairperson of Wet Lab.: Dr. J. Terajima**		
08:30 am	Shuttle from Hotel to PHLC	Susanna Leung	
09:00 am	Reception	M. Y. Chu	Lecture Theatre
09:10 am	PulseNet Asia Pacific	Dr. K. M. Kam	Lecture Theatre
09:30 am	Principles and application of PFGE	CDC	Lecture Theatre
10:30 am	Coffee Break	Susanna Leung	1/F Foyer
10:50 am	Workshop Introduction	Dr. C. H. Ma	2/F Conference room (CR)
10:55 am	Expectation from the workshop	All participants	CR
11:05 am	Workshop Overview	Danny Cheung	CR
11:15 am	Laboratory Work Overview and Safety Issue	Cindy Luey	7F, PFGE Lab (710 Lab)
11:30 am	**Laboratory Module IA** Preparation of PFGE Agarose Plugs from seven *Salmonella* Cell Suspensions **Laboratory Module IB** Lysis of Cells in Agarose Plugs	Cindy Luey	710 Lab
01:30 pm	Lunch	Susanna Leung	1/F Foyer

February 7, 2006 (Tuesday) afternoon session

Time	Activities	Speakers/ Modulators	Venue
02:30 pm	Instrumentation of PFGE System	Dr. J. Terajima	CR
02:45 pm	Lab. experience sharing	Participants (*Country / Area*)	CR
03:30 pm	**Laboratory Module IC** Washing of Agarose Plugs After Cell Lysis	Cindy Luey	710 Lab
03:45 pm	Coffee Break (at your convenience in between plug washing steps)	Susanna Leung	1/F Foyer
4:00 pm	**Laboratory Module IC** Washing of Agarose Plugs After Cell Lysis And Keeping agarose plugs in TE for further washing in the coming day	Cindy Luey	710 Lab
4:45 pm	Q and A		710 Lab
5:00 pm	End Day 1- Shuttle back to Hotel	Susanna Leung	

February 8, 2006 (Wednesday) morning session

Time	Activities	Speakers/ Modulators	Venue
	Chairperson of the day: Mr. Danny Cheung **Chairperson of Wet Lab.: Dr. J. Terajima**		
08:30am	Shuttle from Hotel to PHLC		
09:00 am	**Laboratory Module IC (Continued)** Washing of Agarose Plugs After Cell Lysis	Cindy Luey	710 Lab
09:45 am	**Laboratory Module IIA** Restriction Digestion of DNA in Agarose Plugs with *Xba* I	Cindy Luey	710 Lab
11:00 am	Coffee Break	Susanna Leung	1/F Foyer

11:15am	Q and A		CR
11:25 am	The PulseNet Standardized PFGE protocols for *E. coli* O157:H7, *Salmonella* and *Shigella sonnei*	Cindy Luey	CR
11:55 am	PulseNet USA – How to Communicate	CDC	CR
12:25 pm	Lunch	Susanna Leung	1/F Foyer

February 8, 2006 (Wednesday) afternoon session

Time	Activities	Speakers/ Modulators	Venue
01:25pm	Report to 710 Lab for Wet Lab		
01:30 pm	**Laboratory Module IIB** Casting Agarose Gel and Loading Restricted Plug Slices on the Comb **Laboratory Module IIC** Preparation of Electrophoresis Unit for PFGE of Restriction Digests **Laboratory Module IID** Electrophoresis of Restriction Digests in PFGE Gel Q&A	Cindy Luey	710 Lab
04:00 pm	Coffee Break		1/F Foyer
04:15 pm	Lab. experience sharing	Participants *(Countries/ areas)*	CR
05:00 pm	End Day 2 - Shuttle back to Hotel	Susanna Leung	

February 9, 2006 (Thursday) morning session

Time	Activities	Speakers/ Modulators	Venue
	Chairperson of the day: Dr. Alf Chu **Chairperson of Wet Lab.: Dr. J. Terajima**		
8:30 am	Shuttle from Hotel to PHLC		

9:00 am	**Laboratory Module IIIA** Staining of PFGE Agarose Gel and Care of PFGE System after gel run	Cindy Luey	710 Lab
10:15 am	Q and A		710 Lab
10:30 am	Coffee Break	Susanna Leung	1/F Foyer
10:45 am	Quality assurance of PFGE	**CDC**	CR
11:15 am	PFGE in Japan	Dr. J. Terajima	CR
11:45 am	PulseNet Asia Pacific PIC workgroup	Danny Cheung	CR
12:15 pm	Lunch	Susanna Leung	1/F Foyer

February 9, 2006 (Thursday) afternoon session

Time	Activities	Speakers/ Modulators	Venue
01:15 pm	Overview of Gel Doc Imaging	Cindy Luey	CR
01:35 pm	**Laboratory Module IIIB** Documentation of PFGE agarose gel (2 groups of 5, 25 min per each group)	Cindy Luey	710 lab/CR
02:30 pm	PulseNet – Past, Present and Future (Extended Forum to include members of PHLC)	**CDC**	Leature Theatre
03:30 pm	Coffee Break	Susanna Leung	1/F Foyer
03:45 pm	Troubleshooting PFGE	Dr. J. Terajima (as lead person) **CDC**	CR
04:15pm	Lab. experience sharing	Participants (Countries/ areas)	CR
05:00 pm	End of Day 3 - Shuttle back to Hotel		

February 10, 2006 (Friday)

Time	Activities	Speakers/ Modulators	Venue

Chairperson of the day: Dr. J. Terajima

8:30 am	Shuttle from Hotel to PHLC		
9:00 am	Overview of BioNumerics	CDC	CR
9:20 am	BioNumerics Beginning	CDC	CR
10:00 am	Coffee Break	Susanna Leung	1/F Foyer
10:15 am	Demo of TIFF analysis	CDC	CR
10:45 am	Computer analysis of PFGE gels – Practical session	CDC	CR
12:00 noon	Lunch	Susanna Leung	1/F Foyer
1:00 pm	Q and A		CR
1:15 pm	Computer analysis of PFGE gels – Practical session (continuation of the morning session)	CDC	CR
3:00 pm	Coffee Break	Susanna Leung	1/F Foyer
3:15 pm	Final Q & A, outstanding issues	Dr. K. M. Kam	CR
3:45 pm	Rapporteur session	Dr. J. Terajima	CR
	Certificate Presentation	CDC	
5:00 pm	End of Workshop – Shuttle back to Hotel	Susanna Leung	

Notes:

Chairperson of the day will lead Q and A sessions and ensure smooth running of the proceedings in conference room and lecture theatre.

Chairperson of Wet Lab. will ensure smooth running of the proceedings in PFGE Lab.

Appendix III

WORKSHOP EVALUATION CONSOLIDATION

Course name: The Third PulseNet Asia Pacific PFGE Workshop

Location: Public Health Laboratory Centre (PHLC), 382 Nam Cheong Street, Shek Kip Mei, Kowloon, Hong Kong

Dates: February 7-10, 2006

Offered by: National Institute of Infectious Diseases (NIID), Department of Bacteriology, Japan
Public Health Laboratories Centre (PHLC), Department of Health, Hong Kong
Association of Public Health Laboratories (APHL)
PulseNet Program, Foodborne and Diarrheal Diseases Branch (FDDB), Centers for Disease Control and Prevention (CDC)

Please complete this evaluation so that we can improve this workshop when it is given again.

1. What is your overall evaluation of this course?

Excellent 6 Good 4 Satisfactory_____ Unsatisfactory_____

2. Were the objectives of the course clearly defined? Yes 10 No____

3. Were the objectives of the course met? Yes 10 No____

4. Please rate the quality and usefulness of handouts.

Excellent 6 Good 4 Satisfactory_____ Unsatisfactory_____

4b. Please rate the quality and usefulness of the practices.

Excellent 7 Good 3 Satisfactory_____ Unsatisfactory_____

5. Please rate how this course will influence your ability to perform and interpret molecular subtyping of *Salmonella* serotypes, *E. coli, Shigella, Listeria, Campylobacter, Vibrio*, and other organisms in the future.

Very positively 3 Positively 7 Not much____ Not at all____

6. Would you recommend this course to others in public health laboratories? Yes 8 No 1 Not answered 1

Please explain:

No: Very good

Yes

1 There are still many countries still cannot use PFGE method to trace the outbreak and PFGE was a very useful method

2 Especially those in charge in outbreaks

3 For prevention purpose so that they can share and advocate the real situation happened in each country

7. Please rate each of the following lectures:

"Subject Matter": 1 = material was not at all pertinent; 5 = it was very pertinent

"Presentation": 1 = material was not at all clear; 5 = it was very clear

"Time Allotted": TS = lecture was too short; S = short; R = right amount of time; L = long; TL = lecture was too long

	Subject Matter	Presentation	Time Allotted
A. PulseNet Asia Pacific	1 2 3 4 5	1 2 3 4 5	TS S R L TL
	3 7	4 6	1 8 1
B. Molecular Strain-Typing of Pathogens	1 2 3 4 5 1 2 3 4 5		TS S R L TL
	1 3 6	4 6	10
B. General Information about the Workshop	NA 1 2 3 4 5	NA 1 2 3 4 5	NA TS S R L TL
	1 2 7	1 2 7	1 9
C. Safety issues and overview of Laboratory Work		1 2 3 4 5 1 2 3 4 5	TS S R L TL
		4 6	2 8 10
D. Principles and instrumentation of PFGE		1 2 3 4 5 1 2 3 4 5	TS S R L TL
		5 5	6 4 1 7 2
E. The PulseNet Standardized PFGE Protocols for,		NA 1 2 3 4 5	NA 1 2 3 4 5 NA TS S R L TL
E. colO157:H, Salmonella and *Shigella sonnei*		1 4 5 1	5 4 1 1 7 1
F. PulseNet – How to communicate		NA 1 2 3 4 5	NA 1 2 3 4 5 NA TS

S R L TL

1

2 7 1

4 5 1 9

G. PFGE in Japan 1 2 3

4 5 1 2 3 4 5 TS S R L

TL

2 3 5

2 2 6 9 1

H. PulseNet Asia Pacific PIC Workgroup NA 1 2 3 4 5

NA 1 2 3 4 5 NA TS

S R L TL

1

2 1 6 1

2 7 1 8 1

I. Delineating clusters of Foodborne Infections by PFGE 1 2 3 4 5 NA 1

2 3 4 5 TS S R L TL

The "Tenover Criteria" Revisited 2 4 4

1 2 3 4 1

7 2

J. Troubleshooting PFGE 1 2 3

4 5 1 2 3 4 5 TS S R L

TL

1 9 1 9 2 8

K. Overview of BioNumerics 1 2 3 4 5

1 2 3 4 5 TS S R L

TL

3 7

2 8 3 7

L. Demo of TIFF analysis 1 2 3

4 5 1 2 3 4 5 TS S R L

TL

2 8

1 3 6 2 8

M. Exercise 1: Analyzing a gel image/Entering text data NA 1 2 3 4 5 NA 1

2 3 4 5 TS S R L TL

1

2 7 1

2 2 5 1 3 6

N. Exercise 2: Analyzing a gel image/Bundle creation NA 1 2 3 4 5 NA

1 2 3 4 5 TS S

R L TL

1 2 7 1 2 2 5

1 3 6

O. Exercise 3: Performing comparison NA 1 2 3 4 5

NA 1 2 3 4 5 TS S

R L TL

1 1 3 5 1 2 2 5

1 3 6

NA = Not answered

8. Do you have suggestions for any topics that were not included in this course that should be included in future courses?

- Didn't find anything
- PFGE for Staphylococcus aureus (MRSA)
- No

9a. What activities did you find most helpful in the computer laboratory?

- Practical session when analyzing gel for BioNumerics
- PP presentation
- Hands-on practice
- Lecture of Troubleshooting PFGE

9b. What activities did you find least helpful in the computer laboratory?

- Didn't find anything
- No

10. Was the time allotted for each topic or practice session appropriate? Yes 8 No 1

Not answered: 1

- **Especially in the BioNumerics hands-on**

a. For which activities should more time be allowed?

- **Practical session**
- **Analysis of the gels**
- **Wet laboratory and BioNumerics analysis session**
- **Lecture**
- **For first timers: The BioNumerics: on hands-on should be one-day for the encoding and analysis**

b. For which activities should less time be allowed?

- None
- No

11. In your opinion, should we have this course again for other PulseNet participating Laboratories? Yes_10_ No____
    - To include newer participants
    - Especially for the new ones
12. Other comments about course:
    - Please include basic topics in molecular biology and elaborate more on definitions and terms frequently concerned i.e. etc., during the workshop
    - The course is very helpful for us beginners. The co-ordination are very supportive and helping us all the techniques to make the laboratory work possibly accurate
    - May be you can schedule a tour in your nice country for us participants or for your next new members
    - Thanks a lot for the hospitality

Name (Optional):_____ Date:_____

Title: Analysis of *Salmonella enterica* Serotype Typhi Pulsed-Field Gel Electrophoresis Patterns in Different Regions in Vietnam

Phung Dac Cam[1], Nguyen Thi Phong Lan[1], Bui Thu Hien[1], Oralak Serichantalergs[2], Carl Mason[2] and Haruo Watanabe[3]
[1]National Institute of Hygiene and Epidemiology (NIHE), Hanoi, Vietnam
[2]Armed Forces Research Institute of Medical Sciences (AFRIMS), Bangkok, Thailand
3 National Institute of Infectious Diseases, Tokyo, Japan

Summary

Background Typhoid fever caused by *Salmonella enterica* serovar Typhi is a burden disease in developing world where sanitation remains poor. In Vietnam, typhoid fever is not only highly endemic but also emerging drug resistance among *S.enterica* serotype Typhi. **Objectives** The present study was aimed at to extend the genetic diversity to more recent isolations of serovar Typhi strains from Vietnam with respect to antimicrobial patterns and PFGE profiles. **Methodology** A total of 98 *Salmonella enterica* serovar Typhi strains have obtained from patients with typhoid fever in six different provinces of Vietnam from 1998 to 2005. All strains were identified by standard biochemical tests and serotyping. The antimicrobial susceptibility of those strains was determined by the agar diffusion method on Mueller Hinton agar (Oxoid) to the following thirteen antimicrobial agents (Oxoid). Pulsed-field gel electrophoresis (PFGE) was performed as PulseNet USA protocol using XbaI to analysis of genomic DNA from both antimicrobial agent-sensitive and multidrug-resistant serovar Typhi. **Results** Among 98 isolates, 18 different PFGE patterns were found and 62/98 had similar PFGE patterns. The strains from the same geographic region did not often

have similar PFGE patterns. In addition, relative patterns were observed within year of isolation. Of the 98 *Salmonella* serotype Typhi, only 10 strains (10%) were fully susceptible to azithromycin, ciprofloxacin, colistin, gentamicin, kanamycin and neomycin, whereas another 90% were resistant to at least one type of the 7 commonly available drug including nalidixic acid, ampicillin, chloramphenicol, streptomycin, sulfisoxazole, sulfamethoxazole, and tetracycline. 24/97 strains (25%) were resistant to 7 antimicrobial drugs and had the same PFGE pattern, and 58/97 strains were resistant to 3 antimicrobial drugs and 38/58 had similar PFGE patterns. **Conclusion** The multidrug resistant (MDR) isolates had a similar PFGE patterns may suggest that the MDR pattern has recently emerged in Vietnam, where patients often getting abused or misused antimicrobial treatments. The wide spreading MDR strains of *Salmonella enterica* serovar. Typhi is more important than that of those seen in non- drug resistant isolates.

Introduction

Typhoid fever is systemic febrile illness caused by *Salmonella enterica* serotype Typhi. It is worldwide health problem, especially in developing countries with their poor sanitation and contaminated food. Estimates from World Health Organization suggest that the 16.6 milions new infection of typhoid fever and 600,000 deaths each year (Edelman and Levine). In Vietnam, typhoid fever is highly endemic, with reported annually incidence rates in 1995 to 1998 ranging from 27 to 42 per 100,000. Recently, the number of cases decreased (5000 cases in whole country in 2004) but emerging drug resistance among *S.enterica* serotype Typhi in Vietnam has greatly complicated the treatment of typhoid fever. Effective epidemiological surveillance is needed to monitor the presence and spread of the disease, to select appropriated antimicrobial agents to which the organism has so far remained susceptible. For

serovar Typhi, the primary tools are serotyping and phage typing. However, these methods lack discrimination and are often complemented by the more sensitive and discriminative molecular techniques (Arbeit R.D. 1999). Macrorestriction fingerprinting based on profile patterns obtained by digestion of genomic DNA followed by pulsed-field gel electropheresis (PFGE) is one of the most common technique used to perform comparative chromosomal DNA analysis of serovar Typhi ((Hampton et al.;Sulakvelidze et al.;Tassios et al.;Threlfall et al.;Threlfall et al.). For most serotypes and phage types, PFGE has proved both discriminatory and highly reproducible.
There are several studies in Vietnam (Le et al.;Wain et al.) have used PFGE, bacteriophage typing, ribotyping, and plasmid fingerprinting to described a variety of different serovar Typhi clones in sporadic or endemic and epidemic typhoid cases.

Purpose of study

The present study was aimed at to extend the genetic diversity to more recent isolations of serovar Typhi strains from Vietnam with respect to antimicrobial patterns and PFGE profiles.

Materials and Methods

Bacterial strains.

A total of 98 *Salmonella enterica* serotype Typhi strains have obtained from patients with typhoid fever in Vietnam between from 1998 to 2005. The Laboratory of Enteric Infections of the National Institute of Hygiene and Epidemiology have collected suspected *Salmonella* typhi cultures from different provincial hospital laboratories as primary cultures of blood samples from patients with clinical symptoms suggesting *Salmonella* typhi infection. At the Laboratory of Enteric Infections, the isolates were identified by standard biochemical methods and serotyping.

Antimicrobial susceptibility testing.

The antimicrobial susceptibility of the strains were determined by the agar difusion methods (National Commitee for Clinical Laboratory Standards.1997. Performance standards for antimicrobial disk susceptibility tests - approved standard) on Muller-Hinton agar (Oxoid) to the following 13 antimicrobial agents (Oxoid): Ampicillin (Am-10), Azithromycin (AZM-15), Ciprofloxacin (Cip-5),

Chloramphenicol (C-30), Colistin (CL-10), Gentamycin (Gm-10), Kanamycin (K-30), Nalidixic acid (NA-30), Neomycin (N-30), Streptomycin (S-10), Sulfisoxazole (G-25), Tetracyclin (Te-30), and Trimethoprim/Sulfamethoxazole (SXT).

PFGE.

PFGE was performed for all strains as Pulse Net USA protocol: One-Day (24-28 h) Standardized Laboratory Protocol for Moloecular Subtyping of *Escherichia coli* O157:H7, non-typhoidal *Salmonella* serotypes, and *Shigella sonnei* by Pulsed Field Gel Electrophoresis (PFGE).

Calculation of similarity indices. The BioNumerics software version 3.0 (Applied Maths, Kontrijk, Belgium) was used for calculating the Disc similarity indices (tolerance 1.0%, unweighted pair group method using arithmetic indices) in the cluster analysis.

Statistical method.

$P<0.05$ indicated statistical significance.

Results and discussions

1. PFGE pattern associated *Salmonella enterica* source.

Antimicrobial susceptibility testing and PFGE of total 98 serovar typhi isolates has been done from typhoid fever patients in 6 province including Hanoi, Thanh hoa, Ho Chi Minh city, An giang, Tien giang and Dong thap between 1999 and 2005. The isolates obtained included 3 isolates from Hanoi city, 9 isolates from An giang , 6 isolates from Dong thap, 36 isolates from Thanh hoa, 15 isolates from Ho Chi Minh city, and 29 isolates from Tien giang provinces.

Among 98 isolates obtained from 6 provinces, 18 unrelated PFGE patterns were identified (Fig.1), 63% of isolates had similar PFGE patterns with 90% genetic similarity.

Three strains from patients in Hanoi had similar PFGE patterns (90% genetic similarity), nine strains from An

giang had the same PFGE patterns at similarity level of 91%, and six strains from Dong thap had similar PFGE patterns (96% genetic similarity). Likewise, 10 different PFGE patterns were found in 36 strains in Thanh Hoa, and 15 strains, 4 different PFGE patterns were found in 15 strains in Ho Chi Minh city, and 8 different PFGE patterns were found in 29 strains in Tien Giang.

Subtyping by PFGE with the restriction enzyme XbaI showed that strains from the same geographic region did not often have similar PFGE patterns, and pattern clustering was apparently in all of 6 provinces. Multiple PFGE patterns also observed for *Salmonella enterica* serovar. Typhi strains isolated from many part of the world: Taiwan, Malaysia and Thailand (H.Y Tsen *at all* 1998).

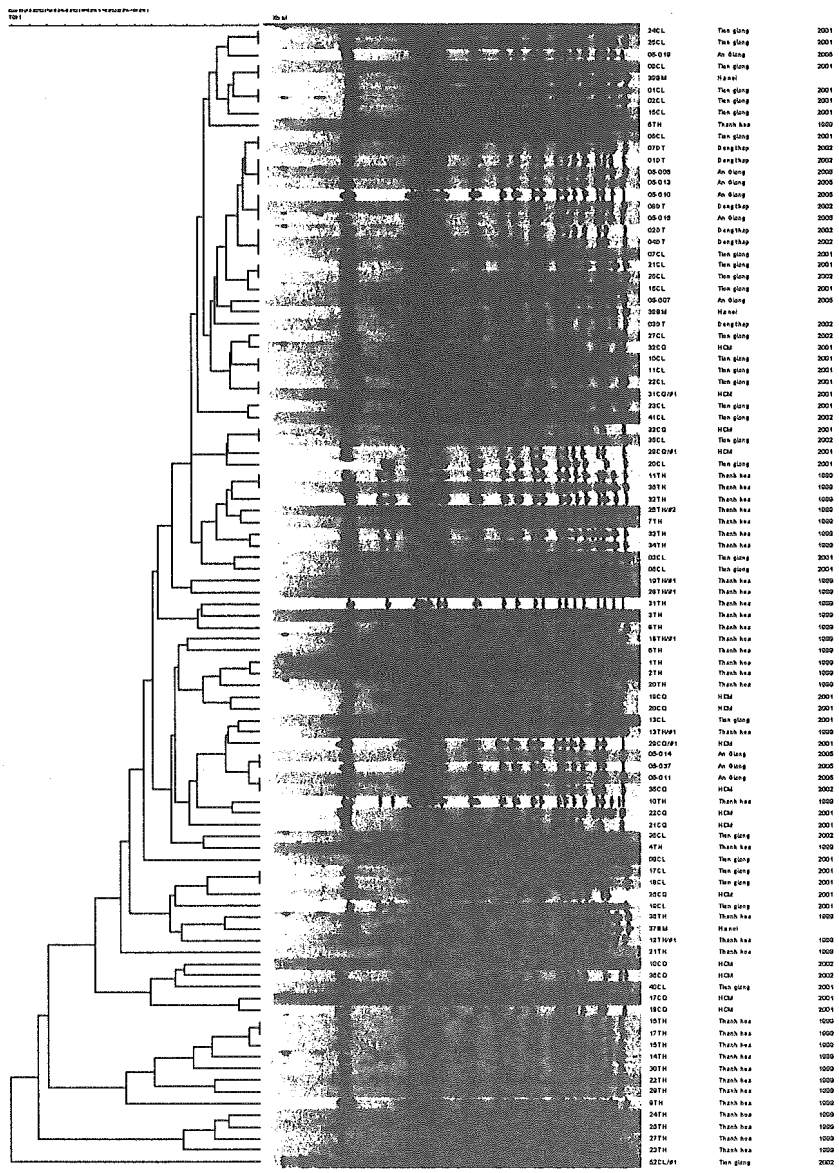

Fig.1. *Salmonella enterica* serotype Typhi PFGE patterns.

2. Multidrug resistant cases

Resistance to multidrug (MDR) is common among *Salmonella enterica* serovar. Typhi in Vietnam, however, a limited number of other studies have investigated on the genetic relatedness of multidrug resistant isolates has been reported.

A total of 98 *Salmonella enterica* serovar. Typhi tested, only 10% of them were fully susceptible to azithromycin, ciprofloxacin, colistin, gentamicin, kanamycin and neomycin, whereas another 90% were resistant to at least one type of the 7 commonly available drugs including nalidixic acid, ampicillin, chloramphenicol, streptomycin, sulfisoxazole, sulfamethoxazole, and tetracycline. Our results suggest that MDR is common among clinical isolates of *Salmonella enterica* serovar. Typhi. A similar results for this strains was observed in few other studies, mainly conducted in Vietnam (Philippa *at all.* 1999; AH Le *at all.* 2004).

Of 98 isolates, 24 strains (25%) were resistant to all 7 commonly available antimicrobial drugs, and 58 strains (59%) were resistant to 3 antimicrobial drugs which traditionally been used for treatment of typhoid fever in Vietnam such as streptomycin, sulfamethoxazole, and tetracycline.

24 strains resisted to 7 drugs had the similar PFGE patterns (Fig.2). All of them originated from South of Vietnam, except 1 from Hanoi. Likewise, 58 strains resisted to 3 drugs exhibited the same PFGE patterns (Fig.3). The 58 MDR strains were mainly originated from Northern and Southern parts of Vietnam.

The results of this study indicates that there was no correlation between the sources of serovar Typhi resistance to the antimicrobial agents tested.

The MDR isolates had a similar PFGE patterns may suggest that the MDR pattern has recently emerged in Vietnam, where patients often getting unnecessary or inappropriate antimicrobial treatments.

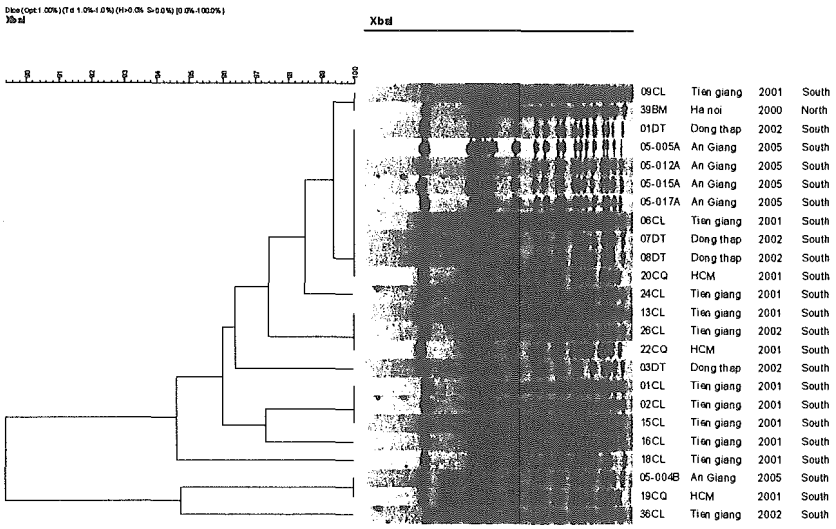

Fig.2. 24 MDR to 7 types of drug

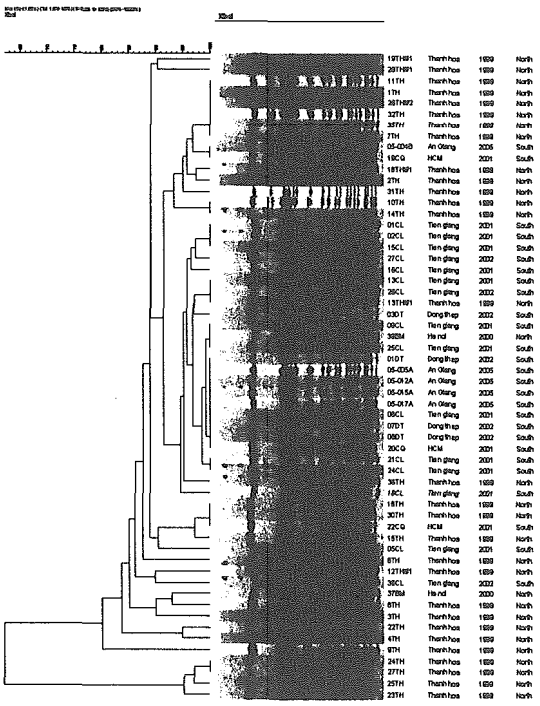

Fig.3. 58 MDR to 3 types of drug