- 8 Gesu GP, Marchetti F, Piccoli L, Cavallero A. Levofloxacin and ciprofloxacin *in vitro* activities against 4,003 clinical bacterial isolates collected in 24 Italian laboratories. *Antimicrobiol Agents Chemother* 2003: **47**: 816–9.
- 9 Swings J, de Vos P, van den Mooter M, Deley J. Transfer of *Pseudomonas maltophilia* Hugh 1981 to the genus *Xanthomonas* as *Xanthomonas maltophilia* (Hugh 1981) comb. nov. Int J System Bacteriol 1983; 33: 409–13.
- 10 Palleroni NJ, Bradbury JF. Stenotrophomonas, a new bacterial genus for Xanthomonas maltophilia (Hugh 1980) Swings et al. 1983. Int J System Bacteriol 1993; 43: 606–9.
- 11 Ribera A, Domenech-Sanchez A, Ruiz J, Benedi VJ, Jimenez de Anta MT, Vila J. Mutations in *gyrA* and *parC* QRDRs are not relevant for quinolone resistance in epidemiological unrelated *Stenotrophomonas maltophilia* clinical isolates. *Microbial Drug Resistance* 2002; **8**: 245–51.
- 12 Akasaka T, Tanaka M, Yamaguchi A, Sato K. Type II topoisomerase mutations in fluoroquinolone-resistant clinical strains of *Pseudomonas aeruginosa* isolated in 1998 and 1999: role of target enzyme in mechanism of fluoroquinolone resistance. *Antimicrobiol Agents Chemother* 2001; **45**: 2263–8.
- 13 Gillespie SH, Voelker LL, Ambler JE, Traini C, Dickens A. Fluoroquinolone resistance in *Streptococcus pneumoniae*: evidence that *gyrA* mutations arise at a lower rate and that mutation in *gyrA* or *parC* predisposes to further mutation. *Microbial Drug Resistance* 2003; **9**: 17–24.

Acquired immune deficiency syndrome and human immunodeficiency virus: Taiwanese medical laboratory technologists and students' attitudes, concerns and knowledge

## F-S. WU, C-W. JUAN, S-M. HUANG, Y-J. CHANG, S-L. CHOU and R. SIEBERS<sup>\*</sup>

Show Chwan Memorial Hospital, Changhua City, Taiwan and 'Wellington School of Medicine and Health Sciences, Wellington, New Zealand

The World Health Organization (WHO) estimated that in 2003 that almost 38 million people worldwide were living with human immunodeficiency virus (HIV) infection.<sup>1</sup> Medical laboratory workers are the second largest healthcare science professional group with potential exposure to HIV through the handling of biological specimens.

Previous studies from the USA, New Zealand, South Pacific and Finland have shown consistently that medical laboratory workers have many unfounded fears about HIV and acquired immune deficiency syndrome (AIDS) that impact on their work practices and in their attitudes towards AIDS patients.<sup>2-6</sup> However, it would appear that no such

Correspondence to: R. Siebers Email: rob@wnmeds.ac.nz studies have been undertaken in Asian countries where, according to WHO, prevalence of HIV is increasing more rapidly than in the Western world.

Here, the attitudes and concerns and their relationship to AIDS/HIV knowledge of medical laboratory staff and students from central Taiwan are reported.

A questionnaire was circulated to all medical laboratory staff and medical laboratory technology students from four hospitals (Pingdon Christian Hospital, Show Chwan Memorial Hospital, Changhwa Christian Hospital and Changwa Show Chwan Hospital) and three medical laboratory technology schools (Chunghwa Medical Technology College, Chungtai Medical Technology College and Chung Shan Medical University) in central Taiwan. Questionnaires were distributed in January 2004 and collected in March 2004. The purpose of the study was explained to the laboratory staff and students and ethical permission was obtained from the appropriate ethical committees.

The questionnaire had been used previously in studies of laboratory staff and nurses,<sup>3-5,7-9</sup> and was based on a statistically validated questionnaire used to determine AIDS knowledge and attitudes in UK nurses.<sup>10</sup> The questionnaire consisted of four sections. In section one, demographic data, such as age, gender, gloving practices and previous attendance at AIDS/HIV lectures, was requested. In section two, the person's responses to a variety of concerns about handling biological specimens was requested. Section three presented four statements with five possible responses, ranging from 'strongly agree' to 'strongly disagree'. Section four tested the person's knowledge of methods for destroying HIV and in which biological specimens HIV could be detected.

The questionnaire was translated into Chinese and was answered by self-administration. Participation was voluntary and no personal information was collected, nor were the researchers aware of a respondent's identity. Data from the completed questionnaires were entered on to a database and analysed by Pearson's  $\chi^2$  test or by Fisher's exact test where appropriate, with statistical significance set at *P*=0.05.

Of a potential pool of 530 persons, 380 (144 students and 236 medical laboratory technologists) returned questionnaires (71.7% response rate). There was no significant difference in response rates between students and medical laboratory technologists. Respondents were predominantly female (77.1%) and 196 (51.6%) had previously attended workshops or lectures on AIDS/HIV. Over 90% always wore gloves when handling a variety of biological specimens and 62.6% treated all specimens as potentially positive for HIV. There was a significant association between use of gloves and concern about acquiring HIV/AIDS or hepatitis at work (P<0.001).

Respondents showed concern about acquiring HIV or hepatitis B in their work place (84.2% and 77.1%, respectively) and 200 responded in the affirmative as to whether or not anyone in their immediate family expressed concerns about their work in relation to AIDS/HIV. Forty-four (18.6%) medical laboratory technologists were seriously considering leaving the profession because of possible contact with AIDS or HIV-positive patients or biological samples, while 67 (28.4%) expressed uncertainty about the matter. Of the 44 seriously considering leaving the profession, 3.5% had a junior college education, 6.4% had a graduate degree and 33.4% had a postgraduate degree (P=0.002).

Nearly two-thirds of the respondents (62.6%) treated all biological specimens as potentially HIV-positive – a trend that increased with the level of qualification (P=0.001). Virtually all respondents (97.4%) agreed or strongly agreed with the statement that they had the right to be informed when AIDS or HIV-positive patients are in the hospital. Furthermore, about two-thirds (66.8%) agreed or strongly agreed with the statement that HIV testing should be mandatory for all patients. There was no association between any of the above concerns and length of work experience.

Students showed a lower mean AIDS/HIV knowledge score, while those with a postgraduate qualification showed the highest mean score. Thus, students had a mean score of 74.7% (range: 15.4–100), those with an undergraduate degree had a mean score of 83.7% (range: 38.5–100) and those with a postgraduate qualification had a mean score of 85.9% (range: 69.2–100).

There were some interesting answers to various AIDS/HIV knowledge questions. For example, 69 and 39 respondents thought that HIV could be, or has been, detected in tap water and air, respectively. Also, 11 respondents thought that HIV could not be detected in blood products, or indicated that they were unsure of the answer.

The results of this study showed that medical laboratory students and technologists have a range of concerns about AIDS/HIV and that their practical knowledge is deficient in several areas. These issues could impact on their attitudes. Thus, 44 medical laboratory technologists were seriously considering leaving the workforce because of potential contact with AIDS patients or HIV-positive biological samples.

These findings are similar to those of a previous USA study, but not of a previous New Zealand study.<sup>2,3</sup> However, in New Zealand at that time there was massive restructuring of the health sector and this may have had an impact on the number of New Zealand medical laboratory scientists who were considering leaving the profession. A similar study among Taiwanese nurses in the same district showed that 19.3% were seriously considering leaving the profession.<sup>7</sup>

Practical AIDS/HIV knowledge among medical laboratory students and technologists from Taiwan compared favourably with identical studies in New Zealand and Fiji,<sup>49</sup> where mean AIDS/HIV knowledge scores were 65.9%, 73.0% and 62.7%, respectively. A previous study among Taiwanese nurses showed a mean score of 71.6%.<sup>7</sup>

In previous studies, lack of practical AIDS/HIV knowledge has been a factor in health practitioners' unfounded fears and attitudes towards those with AIDS and HIV, and it has been suggested that better knowledge of workplace risks and protection measures will result in more positive attitudes.<sup>11</sup> Another concern is that 52.6% of respondents in the present study had relatives who express serious concerns about their work in relation to AIDS/HIV. This has been noted in other studies and 55.4% of Taiwanese nurses showed similar concerns.<sup>7</sup>

In the present study, virtually all respondents thought that their employers had an obligation to inform them of the presence of AIDS and HIV patients in the hospitals, and two-thirds wanted mandatory HIV testing of all patients. This has been noted in other studies. It must be borne in mind, however, that this completely overrides patients' rights. Also, health professionals should treat all biological specimens as potentially hazardous and observe universal precautions accordingly.

There are some limitations to the present study. For example, the characteristics of non-responders could not be determined, due to the anonymous nature of the questionnaire, and this may have introduced bias – always a concern in cross-sectional studies. However, a response rate of 71.7% was obtained, which is similar to other published studies, and thus it is reasonable to assume that the results reflect the views of the majority of medical laboratory students and technologists in central Taiwan.

In addition, questionnaires can generate biased and preconceived answers. However, in a New Zealand followup study using a qualitative focus group designed to overcome these problems, it was shown that nurses' perceived lack of AIDS/HIV knowledge and lack of work experience impacted on their attitudes towards AIDS and HIV patients.<sup>12</sup>

In conclusion, the present study showed that medical laboratory students and technologists from central Taiwan have many concerns about, and unrealistic attitudes towards, AIDS/HIV; findings that are similar to those from studies of medical laboratory workers in the Western world. These unfounded concerns and attitudes are likely to be related to deficiencies in practical AIDS/HIV knowledge.

Thus, there is a strong indication for effective and ongoing educational programmes targeted at specific health professional focus groups to alleviate many of those concerns and to modify attitudes. Previous studies of health professionals have shown that such programmes provide positive benefits.<sup>13,14</sup> It is the task of the medical laboratory profession to reduce the unfounded fear of AIDS/HIV among members of the profession, their immediate families and, most importantly, those with AIDS or HIV. □

## References

- 1 UNAIDS. 2004 report on the global AIDS epidemic. www.who.int/hiv/facts/en/ (accessed 21 October 2004).
- 2 Gauch RR, Feeney KB, Brown JW. Fear of AIDS and attrition among medical technologists. *Am J Public Health* 1990; **80**: 1264–5.
- 3 Siebers RWL, MacKenzie R, Lynch M, Humble MW. Attitudes and concerns amongst laboratory staff regarding handling of HIV-positive biological specimens. *N Z Med J* 1992; **105**: 217–8.
- 4 Siebers RWL, Lynch M, Singh KP. Relationship between AIDS/HIV knowledge and attitudes, concerns and practices of medical laboratory technologists in Fiji. N Z J Med Lab Sci 1995; 49: 19–21.
- 5 Siebers RW, Lynch M. HIV and AIDS knowledge among medical laboratory technologists in the Pacific. *Pac Health Dialog* 1998; 5: 22–5.
- 6 Liikanen EL, Aavarinne H. Laboratory technologists' attitudes towards AIDS and AIDS patients. *Scand J Caring Sci* 1997; **11**: 212–6.
- 7 Juan CW, Siebers R, Wu FF, Wu CJ, Chang YJ, Chao C. The attitudes, concerns, gloving practices and knowledge of nurses in a Taiwanese hospital regarding AIDS and HIV. *Int J Nurs Pract* 2004; **10**: 32–8.

- 8 van Wissen KA, Siebers RW. Nurses' attitudes and concerns pertaining to HIV and AIDS. J Adv Nurs 1993; 18: 912–7.
- 9 Siebers RW, Lynch M, Kendrick C, Watts C. AIDS/HIV knowledge of medical laboratory science students at Massey and Otago Universities. N Z J Med Lab Sci 1994; 48: 174–7.
- 10 Robbins I, Cooper A, Bender MP. The relationship between knowledge, attitudes and degree of contact with AIDS and HIV. J Adv Nurs 1992; 17: 198–203.
- 11 Yeh SM, Yuan HS, Ko YC. Factors related to the willingness of nurses to care for AID patients in Taiwan. *Kaohsiung J Med Sci* 1990; **6**: 422–7.
- 12 van Wissen K, Woodman K. Nurses' attitudes and concerns to HIV/AIDS. A focus group approach. J Adv Nurs 1995; **20**: 1141–7.
- 13 Armstrong-Esther C, Hewitt WE. The effect of education on nurses' perception of AIDS. J Adv Nurs 1990; 15: 638–51.
- 14 Gallop RM, Taerk G, Lancee WJ, Coates RA, Fanning M. A randomized trial of group interventions for hospital staff caring for patients with AIDS. *AIDS Care* 1992; 4: 177–85.

## Sequencing and analysis of the 16S rDNA of thermophilic *Campylobacter lari* and their reliability for molecular discrimination

## N. MITSUHASHI, M. MATSUDA, O. MURAYAMA, B. C. MILLAR<sup>\*</sup> and J. E. MOORE<sup>\*</sup>

Laboratory of Molecular Biology, School of Environmental Health Sciences, Azabu University, Fuchinobe 1-17-71, Sagamihara 229-8501, Japan; and 'Department of Bacteriology, Northern Ireland Public Health Laboratory, Belfast City Hospital, Belfast BT9 7AD, Northern Ireland, UK

In 1980, a new thermophilic *Campylobacter* organism, referred to as nalidixic acid (NAL)-resistant thermophilic *Campylobacter* (NARTC), which is urease-negative, was first described by Skirrow and Benjamin.<sup>1</sup> Although Benjamin *et al.*<sup>2</sup> first proposed the name *C. laridis* for the NARTC, it was later revised to *C. lari.*<sup>3</sup> Thereafter, *C. lari* organisms have been isolated from various elements of the natural environment, including from wild birds and animals, and also recovered from humans.

An atypical group of urease-positive thermophilic campylobacters (UPTC) was first isolated from the natural environment in England in 1985.<sup>4</sup> Subsequently, this organism has been reported in four patients in France.<sup>5,6</sup> After the existence of these organisms had been confirmed, isolated UPTC were reported in Northern Ireland,<sup>7-10</sup> The Netherlands<sup>11</sup> and Japan.<sup>12,13</sup>

To discriminate these organisms, Megraud *et al.* first identified three human clinical isolates of UPTC as *C. lari* by means of a hybridisation dot-blot assay, as well as by biochemical characterisation, and they described their

finding as a variant of *C. lari.*<sup>5</sup> Owen *et al.*<sup>14</sup> suggested that UPTC (n=8) and NAL-sensitive *Campylobacter* (NASC, n=4) strains belonged within *C. lari*, possibly as biovars based on the numerical analysis of high-resolution polyacrylamide gel electrophoresis (PAGE) of proteins combined with computerised analysis of the profiles.

In 1991, Vandamme et al.<sup>15</sup> described a true C. lari species of a representative UPTC strain (CCUG18267) and two urease-negative (UN) C. lari strains (CCUG23947  $^{\scriptscriptstyle \rm T}$  and CCUG12774) by means of hybridisation studies employing DNA-23S rRNA and DNA-DNA. In 1995, Alderton et al.<sup>16</sup> reported a classification analysis based on the 16S rRNA sequence of an organism formerly described as strain RMIT32A<sup>T</sup> and a group of similar bacteria (a new C. hyoilei species), two strains of UPTC CCUG18267 and UN C. lari CCUG23947<sup>T</sup> (EMBL/GenBank, accession numbers, L14631 and L04316). Although, the 16S rRNA sequences showed 99.2% similarity between these two strains, many internal unidentified bases have been detected in the sequences of the nearly full-length 16S rDNA from both the strains. When Wesley et al.<sup>17</sup> performed an analysis of the Arcobacter-specific and A. butzleri-specific 16S rRNA-based DNA probes, the 16S rRNA sequences from the two C. lari strains (CCUG18267 and CCUG23947<sup>T</sup>) were also employed.

In studies of *C. lari*, based on 16S rDNA sequence information, the 16S rDNA sequences containing internal unidentified bases have been used. However, sequencing and comparison of 16S rDNA have resulted in the identification and discrimination of many bacterial taxa.

The present study aims to determine and employ the sequences of nearly full-length 16S rDNA, which do not contain internal unidentified bases, from over 10 *C. lari* isolates from various countries and sources, and to evaluate the reliability of 16S rRNA sequence data for molecular discrimination of *C. lari*, including UPTC and UN *C. lari*.

The 15 isolates of UPTC and UN *C. lari* used to clone, sequence, analyse and compare the 16S rDNA in the present study are shown in Table 1. The 12 isolates of UPTC were isolated from the natural environment, including from seagulls and humans in England, France, Northern Ireland and Japan. The remaining three isolates of UN *C. lari* were isolated from a seagull and two humans in Northern Ireland and Japan.

Polymerase chain reaction (PCR) amplification using a primer pair of fD1 and rD1,<sup>18</sup> TA cloning and sequencing of the 16S rDNA from UPTC and UN *C. lari* isolates were carried out using procedures described previously.<sup>19</sup> The fD1 and rD1 sequences correspond to the nucleotude position (np) 8 through to 27 and np 1492 through to 1510 of the 16S rDNA of *Escherichia coli*, respectively.<sup>20,21</sup> These sequences corresponding to the PCR primers were excluded from the sequences of the nearly full-length 16S rDNA (approximate 1400 bp) and further similarity analysis. In the present study, multiple TA-cloned PCR products were sequenced for accuracy.

The DNA sequences of the nearly full-length 16S rDNA of all UPTC and UN *C. lari* isolates determined in the present study (Table 1) were compared with those of the other thermophilic campylobacters (i.e., UPTC CCUG18267 and *C. lari* CCUG23947<sup>T</sup>, LMG7607, LMG11251, LMG11760, LMG14338, *C. jejuni* CCUG11284, *C. jejuni* doylei CCUG24567, *C. coli* CCUG11283, *C. hyoilei* RMIT32A and

Correspondence to: Dr Motoo Matsuda Email: matsuda@azabu-u. ac.jp