A survey of nurse anesthesia educational programs: A look at the trend toward graduate education

CATHERINE E. MERZ, CRNA
Monroeville, Pennsylvania

The specialty of nurse anesthesia is growing and changing rapidly. The author presents a look at the trend toward graduate education and the influences behind the change based on a national survey of anesthesia educational programs.

Anesthesia has been delivered by nurses since the last decade of the 19th century. Nurses were originally trained by surgeons, but in 1909 the first training program directed by nurse anesthetists was established in Portland, Oregon.¹

Today, there are three entry levels into anesthesia nursing education: the certificate program, the baccalaureate program, and the master’s program. * Some certificate programs offer optional baccalaureate and optional master’s degree frameworks as well. The programs average 24 months in length. Some 67% of the programs are known to offer a monthly stipend, and more than 50% charge either tuition, a registration fee, or both.² All graduates are eligible to take the national certification examination. Currently, the literature offers little information comparing the types of programs. Therefore, nurses considering an extended role in anesthesia nursing have little information to allow them to decide which program best suits their objectives.

In September of 1982, the American Association of Nurse Anesthetists presented data obtained from a survey of anesthesia programs that indicated a trend in nurse anesthesia education toward master’s degree programs.³ The certificate programs that have become affiliated with a university system offer a wide variety of degrees in conjunction with their clinical training. These include medicine, education, nursing, and allied health.

Most of the nurse anesthesia programs have existed within a hospital system for years and the decision to affiliate with a university is a major one affecting faculty, students, and the institution. The faculty must meet certain educational criteria to retain their positions. The program typically will have to be restructured and be accepted by various educational and medical accrediting bodies (National League for Nursing and the Council on Accreditation of Nurse Anesthesia Programs/Schools, for example). The amount of classroom training is generally increased and is often more difficult. This is added to already stringent clinical requirements. Tuition is increased substantially beyond the cost of certificate programs. The classroom requirements limit the amount of time the student spends in the clinical area, especially the first year. Thus, the hospitals have fewer students available to provide service.

The purpose of this survey is to provide nurses with some information on the current and future status of nurse anesthesia programs. Know-

*By 1987, the requirement for entrance into a school of nurse anesthesia is a BSN or BS degree, in addition to academic preparation as a registered nurse. Thus, the emphasis is that nurse anesthesia education should be at the post-baccalaureate level.
ing the reasons programs are being restructured as they are will help nurses make the best choice among the alternative programs. Nurses enter the field of anesthesia with different goals. Young nurses are more likely to desire the chance to continue their education in a college setting. Older nurses or nurses who were educated in a diploma school can currently still specialize in anesthesia by entering a certificate program.

A prospective student may decide to pursue the emotional and financial investment of a graduate education upon learning that 39% of the nurse anesthesia programs will be offering a graduate degree by 1988. Also, an awareness of the forces behind the trend may provide the student with the encouragement to await acceptance to a graduate program, given that at the time of this survey they constitute only 19% of the available programs. (Table I.) Similarly, program directors and university administrators will benefit by knowing the factors which have influenced other institutions to move in this direction.

Background

A review of the literature reveals very little information on the recent changes in nurse anesthesia education. The trend toward master's preparation of nurse anesthetists is supported in the literature mainly by association with the change in nursing education and the education of women in general.

Nurse anesthetists were the initial nurse practitioners, yet from their historical beginnings were indoctrinated that they were practicing a medical specialty. As a result, in the early years they lost touch with nursing in the organized sense. It is the author's contention that since nurse anesthetists and nursing were not communicating, nurse anesthetists were left behind in the trend to move nursing education to the university setting and specialty nursing to become a function of graduate education.

In 1982, according to the AANA, there were 27 programs granting master's degrees. According to an unpublished report, an additional 36 schools have future plans to change their program framework to the graduate level. Educators are appealing for professionalism in the area of research, politics, education, management, and leadership, the foundations of which require advanced degrees. In 1977, Garde wrote that, "The leaders of recognized nurse anesthesia educational programs should make positive efforts in structuring their anesthesia programs into an academic framework. It would be distressing if this clinical specialty, with practice based on physiology and pharmacology, does not produce graduates with a science degree."

In 1980, Hegyvary and Prow agreed with Garde and have interpreted the accreditation standards to state that, "The practice of anesthesia is based on knowledge from a wide scope of sciences, and that practice is characterized by continual questioning of assumptions and techniques and validating new techniques and knowledge." Questioning and validation imply the need for research by nurse anesthetists. Research courses are incorporated into the graduate framework and many programs require the completion of a research project.

Matejski stated in 1981 that, "As graduates of a program become known for their work, quality and research, more students with a similar potential are attracted to the school. As more of the school's graduates move into positions of leadership, financial support from alumni increases, providing more autonomy for the profession and its schools."

As a result of data obtained from a survey done in 1977, the Educational Committee of the American Association of Nurse Anesthetists expressed concern about the role of hospitals in financially supporting health care education, particularly in light of the emphasis placed on cost containment. "It is conceivable that hospital-based nurse anesthesia educational programs will have increasing difficulty in acquiring needed funds for future operation." Matejski pointed out that "when an organization becomes dependent on a limited source of funds, the contributors can exercise considerable influence on the expenditures of those funds."

Torres agreed, stating that, "Nursing programs are often viewed by nursing administration as creating as undue economic burden on the institution." Financial considerations may be playing a dominant role in the rate at which certificate programs are affiliating with universities.

In addition, students entering educational programs today are, as a whole, a highly sophisticated group and are taking responsibility for their own professional growth. The National League for Nursing reported that as of October 1980, a total of 441 BSN schools had registered nurses enrolled, and that 32,671 nurses were enrolled during the 1979-1980 academic year to obtain a higher degree in nursing. Norris reported that in 1980, 10% of women returning to college had the ultimate goal of obtaining a doctorate, over 36% a master's de-
Table I
Survey of nurse anesthesia educational programs

If your program presently grants a certificate or a baccalaureate degree and you do not have plans to change the program's framework to a master's framework by 1988, please check this box [ ] and answer the first three questions only.

If your program presently grants a master's degree, or you foresee the framework changing to the master's level by 1988, please complete the questionnaire.

1. What year was your program founded? ________________________________

2. How many students do you accept each year? ________________________

3. In what area of the country is your school located? NE SE NW SW MW

To what degree were the following factors influential in your decision to change your program to a master's level framework?

Please indicate your rating of each item by circling the appropriate number: 0 = no influence, 3 = very influential, and d/k = don't know.

<table>
<thead>
<tr>
<th>Factors</th>
<th>Ratings</th>
</tr>
</thead>
<tbody>
<tr>
<td>4. The program will/did benefit financially as a result of affiliation with a university system</td>
<td>0 1 2 3 d/k</td>
</tr>
<tr>
<td>5. A large number of applicants have college degrees</td>
<td>0 1 2 3 d/k</td>
</tr>
<tr>
<td>6. Affiliation will provide an educational ladder for nurses choosing anesthesia as a specialty</td>
<td>0 1 2 3 d/k</td>
</tr>
<tr>
<td>7. A desire to broaden the scope and depth of the course work offered</td>
<td>0 1 2 3 d/k</td>
</tr>
<tr>
<td>8. The increase in other nursing specialties at the master's level</td>
<td>0 1 2 3 d/k</td>
</tr>
<tr>
<td>9. A desire to have the specialty of nurse anesthesia more widely recognized and accepted professionally</td>
<td>0 1 2 3 d/k</td>
</tr>
<tr>
<td>10. Discussions with other program directors</td>
<td>0 1 2 3 d/k</td>
</tr>
<tr>
<td>11. Affiliation did/will bring more assurance to the program's future</td>
<td>0 1 2 3 d/k</td>
</tr>
<tr>
<td>12. Encouragement from anesthesiologists</td>
<td>0 1 2 3 d/k</td>
</tr>
<tr>
<td>13. Encouragement from the hospital's board of directors for other than financial reasons</td>
<td>0 1 2 3 d/k</td>
</tr>
<tr>
<td>14. Encouragement from the Council on Accreditation of Nurse Anesthesia Programs/Schools</td>
<td>0 1 2 3 d/k</td>
</tr>
<tr>
<td>15. Encouragement from surgeons at your affiliated hospitals</td>
<td>0 1 2 3 d/k</td>
</tr>
<tr>
<td>16. Encouragement from certificate program graduates</td>
<td>0 1 2 3 d/k</td>
</tr>
<tr>
<td>17. Encouragement from master's program graduates</td>
<td>0 1 2 3 d/k</td>
</tr>
</tbody>
</table>

Please circle the appropriate response.

18. What was/is the major factor that affected your choice of affiliation?
   a. philosophy of the program
   b. geographical location
   c. financial situation
   d. other (please indicate) ________________________________

19. The school that you did/will select for affiliation is/was?
   a. school of nursing
   b. allied health
   c. school of medicine
   d. school of education
   e. other (please indicate) ________________________________

(Table I continued on next page.)
gree, and 35% a bachelor's degree. Over 65% of these women stated that facilitation of personal growth and a desire for further education were reasons for returning to college.\textsuperscript{1}

Job satisfaction also plays a role in nurses continuing their basic education. Today's nurse, regardless of specialty, is acutely aware that nursing is changing. "Nurses' roles are no longer as circumscribed as they were . . . nor as clearly delineated . . . as they seemed to be seven or eight years ago. The roles are extended and expanded."\textsuperscript{10} As the role of the nurse anesthetist expands, respect and acceptance as a contributing team member are important.\textsuperscript{12} "In our status conscious society . . . to compete and work as a peer with persons from the same or other disciplines, a professional is expected to achieve certain educational standards."\textsuperscript{13}

Thus, the literature has indicated that there are four basic reasons associated with the changing trend in nurse anesthesia education: (1) that the union with a university would be financially advantageous to the program; (2) that prospective students are seeking higher level educational programs because their basic education is college level; (3) that the specialty of nurse anesthesia would benefit through recognition and acceptance by other professionals; and (4) that affiliation with or transfer to a university would help to secure the future of the program.

The current survey

To accomplish this current survey, a questionnaire (Table I) was selected as a means of providing information to support the four reasons listed above. Fourteen statements were listed, eight of which were derived directly from the four reasons described in the literature, and the remaining six statements were included to determine the influence of peer advice. The director of each school offering a master's degree and those planning to offer one were asked to rate the statements on a scale from zero (no influence) to three (very influential). Seven multiple-choice questions were included to elicit data on the choice of school for affiliation as well as changes that may be associated with this new framework. The director was also asked the date the transfer occurred or is expected to occur. Space was provided for additional comments.

Table I

Survey of nurse anesthesia educational programs (continued)

20. If you had the opportunity to re-evaluate the choice of affiliation would you make the same choice?
   a. yes
   b. no
   c. don't know

21. If not, what school would you choose?
   a. school of nursing
   b. allied health
   c. school of medicine
   d. school of education
   e. other (please indicate)

22. Did affiliation with a university change the amount of control you had over the program's direction?
   a. increased
   b. decreased
   c. no change
   d. don't know

23. Was the amount of monthly stipend changed as a result of affiliation?
   a. increased
   b. decreased
   c. no change
   d. don't know

24. As a result of affiliation with a university, has/do you expect the class enrollment to change?
   a. increase
   b. decrease
   c. stay the same

25. What year did/will you affiliate with a university?

26. Additional comments welcome

October/1984
Names and addresses of the accredited schools and directors were obtained from the December, 1982 issue of the *AANA Journal*. A letter of introduction and explanation accompanied the survey, asking directors of graduate programs, as well as those intending to change their program's framework to the master's level by 1988 to answer the entire questionnaire.

The directors of certificate and baccalaureate programs who did not foresee this change occurring were asked to identify themselves in the survey and to answer only three questions: the location of the school, the enrollment figure, and the year the school was founded. This data was used to compare schools that offer/or will offer a Master's degree with the remaining programs. Each questionnaire was coded to indicate the current degree offered. The categorization of available programs as well as those who answered the questionnaire are shown in Table II.

The questionnaire was mailed with an enclosed self-addressed envelope to 145 nurse anesthesia programs, both civilian and military. Reliability and validity of the questionnaire was sought by having experts in the field of nurse anesthesia as well as one graduate program director review the questionnaire for clarity and understanding of the application of the instrument. Feedback was also obtained from experts in the field of research and education.

Each statement was summed and the number of responses for each rating reported. The number of directors who rated statement one very influential (3) was compared to directors who rated statement one non-influential (0), etc. Stacked-bar graphs were used to display the ratings, dividing the responses according to the current type of program framework offered. Responses from the multiple choice questions were also displayed in stacked-bar graphs, a select number of which are published here.

**Results**

The response rate of the survey was 68% (99

<table>
<thead>
<tr>
<th>Table II</th>
</tr>
</thead>
<tbody>
<tr>
<td>General information on surveyed schools</td>
</tr>
</tbody>
</table>

Number of schools surveyed = 145  
Number of responses = 99  
Number of unusable responses = 18

Schools changing their programs (total number = 39)

<table>
<thead>
<tr>
<th>Year established</th>
<th>Location</th>
<th>Type of program</th>
<th>Enrollment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before 1940:</td>
<td>NE: 15</td>
<td>Certif: 13</td>
<td>0-5: 4</td>
</tr>
<tr>
<td>1940-1950:</td>
<td>SE: 7</td>
<td>BS: 7</td>
<td>6-10: 19</td>
</tr>
<tr>
<td>Since 1980:</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Schools not changing their programs (total number = 42)

<table>
<thead>
<tr>
<th>Year established</th>
<th>Location</th>
<th>Type of program</th>
<th>Enrollment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before 1940:</td>
<td>NE: 20</td>
<td>Certif: 35</td>
<td>0-5: 13</td>
</tr>
<tr>
<td>1940-1950:</td>
<td>SE: 11</td>
<td>BS: 6</td>
<td>6-10: 25</td>
</tr>
<tr>
<td>1951-1960:</td>
<td>NW: 0</td>
<td>Op BS: 1</td>
<td>11-15: 3</td>
</tr>
<tr>
<td>1961-1970:</td>
<td>SW: 2</td>
<td></td>
<td>Over 15: 1</td>
</tr>
<tr>
<td>1971-1980:</td>
<td>MW: 9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Since 1980:</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Total number of schools of each type surveyed:

| Certificate program | 79 |
| Optional bachelor's degree | 11 |
| Bachelor's degree | 27 |
| Optional master's degree | 8  |
| Master's degree | 19 |
| Unknown | 1 |

Journal of the American Association of Nurse Anesthetists
out of 145). Of the 99 directors who responded, 17 of their programs currently offer a master’s degree and 22 more directors indicated that they intend for their programs to offer a master’s degree by 1988. (Figure 1.) Less than one-half of the respondents had no plans to offer a graduate program by 1988.

Of the four reasons derived from the literature for the trend toward master’s education, two were strongly supported by the survey. An increase in professional recognition and acceptance was strongly supported by positive ratings of statements 8 and 9. (Figures 2-3.) The influence of discussions with other program directors was rated neutrally. The concept that graduate programs would be more attractive to the applicants, was strongly supported by statements 5 and 6. (Figures 4-5.)

The trend in nursing education toward baccalaureate programs as a minimum requirement has increased the number of nurses with a college degree. The American Association of Nurse Anesthetists had recommended a college degree as a minimum entry requirement for anesthesia school, as had the Council on Accreditation of Nurse Anesthesia Educational Programs/Schools. Nurses returning for education in a specialty area are therefore more likely to desire continuing within the university system.

Several directors made comments that “since anesthesia is a nursing specialty, it should be
taught at a graduate level." Another current MS program director wrote that "nurse anesthesia education is taught at a graduate level; therefore, graduates should receive the degree they duly deserve." This director also stated that the university setting would provide an academic milieu for research inquiry, fostering anesthesia research and thereby promoting recognition by society of the nurse anesthesia profession.

The issue of program improvement was well supported by the responses to statement 7. Affiliation with a university allows the directors access to the university faculty, laboratories, and equipment which should ultimately broaden and improve the course structure. (Figure 6.)

The responses were rather neutral to the issue of a university affiliation increasing the security of the program's future. However, there is apparently minimal financial advantage to an affiliation, as 77% of the respondents rated statement 4 as having no influence on their decision, while only 13% rated this statement as having some influence. One director wrote that enrollment would have to increase now that affiliation with a graduate school had occurred so that the program would be profitable for the university.

The two directors who stated that financial benefit was very influential also felt strongly (rated 3) that affiliation would bring more assurance of their program's future. Another director wrote that a review of programs in the surrounding area revealed that graduates are taking positions at "any salary" and that it is rare to be offered a differential for the master's degree. In this director's view, there was no economic advantage to the graduate degree, thus the school's baccalaureate program was being maintained.

Two directors (from the 42% of the schools not changing their framework) said that their schools were closing due to expanding anesthesia residency programs. One was a certificate program and one offered a baccalaureate degree.

A literature review indicated university affiliation to be financially advantageous for diploma nursing programs that are becoming baccalaureate programs. The difference may be that once a diploma program becomes a degree granting program, the diploma school no longer exists; the university has full control. However, most hospital-based nurse anesthesia programs have merged with a university, sharing control as well as the financial burdens and assets.

The directors' ratings of statements 12, 14, 15, 16, and 17 indicated that advice from peers and other professionals was not very influential toward their decision to change to a graduate program. Encouragement of program directors by the Council on Accreditation to seek affiliation with a university is based on recommendations once several factors are taken into consideration: availability of a university, stability of the program, enrollment, and present curriculum, for example. The low rating on encouragement from anesthesiologists and surgeons may reflect their lack of knowledge about nurse anesthesia training and the levels of programs that are available. Also, they may be more likely to encourage individual anesthetists or nurses to pursue higher level education rather than encouraging directors to change their program's framework. Advice from master's program
graduates may have been rated negatively due to the low number of anesthetists who have graduate degrees.

Present program framework

The responses were separated according to the current type of program framework offered to see if any of the directors felt stronger about a certain statement or issue. Each of the ratings were tallied according to the type of school framework currently offered. There was not a large variance among the responses of certificate program directors and master’s program directors, etc., in how they rated each factor. The percentage of responses seemed to be associated with the number of each type of program available (Table II).

The number of responses per locale was consistent with the number of schools located in each area. The largest number of responses came from the Northeast, which is where the majority of the nurse anesthesia schools are located. (Table II.)

Most anesthesia schools enroll between 6-10 students per year. If the director listed a range, the higher figure was used. Enrollment figures did not vary considerably between the schools that are changing and those that are not. The only exception was with the classes of 15 or more students which are almost exclusively from schools that are changing to a graduate framework. This may be indicative of the universities requiring more students to make the affiliation economically feasible. (Table II.)

Affiliation

Interestingly, philosophy of the program and geographical location were split evenly among the directors as the major influence in their choice of schools for affiliation. Some additional reasons behind their choices of schools included: the only option available; a willingness on the part of the degree granting institution; and trends in the profession. A total of 47% of the directors who stated that philosophy of the program was highly influential in their decision toward the school chosen for affiliation also chose the school of nursing.

Almost the same percentage of directors who chose the school of nursing for affiliation chose some other option not listed in the survey (36% vs. 31%). (Figure 7.) Some of the other schools chosen for affiliation included health education, health science, engineering, pharmacy, physiology, and biology. Two directors established a separate university division for anesthesia. One director commented that a nursing affiliation could not be considered (even though the program had wanted such an affiliation) because the nurse anesthesia faculty had advanced degrees in fields other than nursing. Another director said that the nursing school refused to accept nurse anesthesia as a nursing specialty, and as a result, the program affiliated with allied health.

Only two directors replied that if given the opportunity to re-evaluate they would not make the same choice of school for affiliation. Both were directors of master’s programs, one offering a degree in allied health, the other in education. Both indicated they would choose the school of medicine. The great variability in choice of schools is viewed by the author as perhaps being indicative of the uncertainty frequently voiced by nurse anesthetists as to whether or not they still “belong to nursing.”

A total of 46% of the directors surveyed felt that the affiliation or anticipated affiliation with a graduate school would not change the amount of control they had over the program’s direction. Since there is no indication which schools have merged (share control) and which have totally transferred to a university, it is difficult to determine the significance of the response. One might suppose that if a certificate program was transferred to a university system, the “director’s” position would be taken over by the dean; whereas a merger with a university would allow for sharing control and direction of the program.

Almost 50% of the schools anticipated no change in the stipend allowance; no one anticipated an increase. Perhaps this substantiates the responses of the directors who felt that there was no financial benefit incurred with affiliation.
Disqualified responses

Eighteen of the directors answered the questionnaire incorrectly and therefore their responses were not considered. Eight rated the statements as if they were related to their affiliation as a baccalaureate program. Question 25 (what year did/will you affiliate with a university?) was answered with a date previous to 1982, yet the schools were currently listed as offering a baccalaureate degree. Four directors answered the questionnaire as if planning to change to a graduate program yet indicated no date. These four questionnaires were eliminated because the survey was intended to reflect the motivations of program directors of those programs currently offering a master’s degree by 1988. Three currently listed master’s program directors answered incorrectly. One director did not complete the survey, and two answered as if not planning to change (checked the box and the three demographic questions only). Two directors checked the box as if not planning to change, and then answered the questionnaire also. Another asked that the survey be re-directed to another source.

The limitations of this survey included the inability to control the response rate, as well as the choice to use a questionnaire rather than a telephone or personal interview due to financial and practical considerations.

Several directors answered the multiple choice questions on the back of the survey with more than one answer. All of their responses were included in the summation. Thus, several of the totals are greater than 39 (the number of directors who answered the entire survey). Many directors answered question 23 as “no stipend offered.” These responses were summed as “no change.” Also, several directors gave two dates for affiliation, one for offering an optional master’s, and one for a generic master’s. The date given for the affiliation offering an optional master’s was used.

Conclusions

The field of nurse anesthesia is growing and changing rapidly. The growth in graduate affiliations is steady, with a continued growth projected over the next five years. It is obvious from the responses that nurses want to see their career choice respected and to be accepted by their peers. More nursing students are choosing college for their basic preparation (as do most other disciplines) and seek graduate education for specialization. Since anesthesia is a nursing specialty, it seems graduate education in nursing is an appropriate choice. However, the specialty of nurse anesthesia demands an extensive background in science and pharmacology; thus the affiliations with other colleges. An alternative would be the addition of special courses to the anesthesia student’s nursing curriculum.

Graduate education is attractive because it offers a broader curriculum (courses in education, research, and administration, for example), and an opportunity to continue with post-doctorate work. The nursing profession is attempting to unify educational preparation and anesthesia nursing may ultimately be a graduate specialty.

Today, nurses have many considerations to make before choosing the avenue of specialization in anesthesia. Surveys can help to provide information to these students as well as to administrators so that responsible decisions can be made.

One area for further study and expansion is the actual mechanism of the affiliation or merger that is occurring between the anesthesia programs and the universities. The manner in which the affiliation occurs affects the school financially, it affects the director’s position and his or her control over the program. It also affects the students, because when a hospital program has merged with a university, the student has two hierarchies with which to deal.

Another area for further study is the stipend allowance. Most certificate programs continue to offer a cash stipend, however, more of the collegiate programs which charge a much larger tuition are discontinuing it. One of the arguments against the stipend for anesthesia students is that the other nursing disciplines do not receive an allowance during their practicum. Now that more anesthesia programs are based at universities, comparisons are being made among the various specialties.

An additional survey of those directors who do not foresee affiliating with a university may provide some insight into the future of nurse anesthesia education. Perhaps determining the benefits and/or disadvantages of having multiple colleges (education, medicine, nursing, etc.) offering degrees in “anesthesia” also would be helpful to directors of potential graduate programs. In addition, a comparison of graduates from the various types of programs available (such as their certification examination scores, job placement, etc.) may be helpful to prospective students of anesthesia.

REFERENCES

(2) Council on Accreditation of Nurse Anesthesia Educational Programs/Schools, List of Recognized Educational Programs/
AANA Journal Course

Test Yourself Answers
(Questions appeared on page 561.)

1. Hepatitis B is a very prevalent infection affecting between 5-10% of adult Americans. Between 0.5-1.0% of American adults are carriers of the virus. They are capable of transmitting the disease to others through tears, saliva, semen, vaginal secretions or blood products.

2. The U.S. Department of Health and Human Services, Centers for Disease Control (CDC) recommends vaccination for technicians, nurses and physicians working in emergency rooms, clinical laboratories and operating rooms. Working conditions in these areas generally place individuals who have not had hepatitis B at high risk because of direct contact with carriers and their secretions and body fluids.

3. Heptavax-B has produced adequate antibody levels in 95% of the immunocompetent adults in one study. The antibody levels are likely to remain adequate for 5 years. Following this, a booster dose can be given to increase antibody titer again.

4. "Cleaned and disinfected" lensed instruments have been identified as the source of nosocomial infections with pulmonary tuberculosis, herpetic pneumonia and bacterial sepsis. Steam and heat sterilization is the most effective method of inactivating viruses. Effective chemical sterilization with 2% gluteraldehyde requires immersion for 10 hours.

5. Hospital acquired pneumonias account for only 15% of all nosocomial infections. However, these pneumonias produce the greatest number of deaths, even more than those caused by urinary tract, surgical wound infections or bacteremia. It is estimated that 100,000 Americans die annually as a result of hospital-acquired infections.