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Aerospace Nursing: Implications for Baccalaureate Nursing Education

Diane Wentworth
Illinois Wesleyan University

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AEROSPACE NURSING:
IMPLICATIONS FOR BACCALAUREATE NURSING EDUCATION

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by

Diane Wentworth

Submitted for Honors Work

In the School of Nursing

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May 2, 1969
Date

Anne W. Johnston, M.S.N.Ed.
Assistant Professor
School of Nursing
Project and Academic Advisor

May 1, 1969
Date

Forrest Frank, Ph.D.
Assistant Professor of Chemistry
Faculty Member from Another
Department

May 2, 1969
Date

Mary D. Shanks, Ed.D.
Director, School of Nursing

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I. INTRODUCTION

In his opening statement of Life Into Space, Wunder states that:

> The more intensified interest in space exploration has opened new horizons to all established scientific disciplines. Old sciences have hybridized or fused into new ones. New sciences have expanded and grown with remarkable speed.[1]

Since the end of World War Two, man's knowledge of the sciences has increased to the extent that in late 1968 men were able to orbit the moon for the first time. In July or August of 1969 the United States plans to attempt the first manned lunar landing.[2] However, this will not be the end of space adventures, but will represent the attainment of only one goal. Progress made in the direction of a lunar landing represents only one facet of the increasing knowledge in the scientific disciplines as it applies to aerospace travel. Another facet of the increasing knowledge is the planned launch of the Manned Orbiting Laboratory in the early 1970's.[3]

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[1]Charles Wunder, Life Into Space (Philadelphia: F.A. Davis Company, 1966), p. 3.

[2]"Three Final Steps to U.S. Conquest of Moon," U.S. News & World Report, January 6, 1969, p. 27.

[3]"While U.S. Eyes are on the Moon--Russia Runs Another Race in Space," U.S. News & World Report, January 6, 1969, p. 29.

Through the efforts of persons representing a wide variety of scientific disciplines, achievements have been made and are planned in space exploration. Medical personnel represent one scientific discipline which has contributed to the space program since its inception. As early as 1918, the United States Army, recognizing a need for more information about flight conditions, established the Medical Research Laboratory of Air Service. This facility has evolved into the United States Air Force School of Aerospace Medicine which has become a resource center for research, education, and clinical evaluation relating to aerospace activities.[4] Because of the complex medical problems encountered in space travel, helping man adapt to the space environment presents a challenge to medical personnel. The influence of medical knowledge is manifested in a wide range of activities related to space flights--from the design of the equipment to the medical evaluation of the crew.[5]

During Project Mercury professional nurses became actively involved in the aerospace program at Patrick Air Force Base in Florida. Between Projects Mercury and Gemini a fifty-two week formal course in aerospace nursing was designed by Major Pearl Tucker of the United States Air Force. As of December, 1968,

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[4]U.S., Department of Air Force, Aerospace Medical Division, Air Force Systems Command, School of Aerospace Medicine (Washington, D.C.: Government Printing Office, 1967), pp. 1-2.

[5]Ibid., p. 7.

seven nurses in the United States Air Force have completed this course to become qualified as aerospace nurses.[6] Although the number of opportunities for aerospace nurses are still limited, the field of aerospace nursing will advance as the field of aerospace medicine grows.

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[6] "The Stars Beckon," American Journal of Nursing, August, 1967, p. 1650.

II. STATEMENT OF THE PROBLEM

If it is desirable that the nursing profession, as a distinct discipline, keep abreast of the ever-expanding medical and paramedical scientific disciplines, then it seems feasible to attempt to determine if such education should include, in some form, an emphasis, limited or broad, on aerospace nursing. It was with this in mind that this study was undertaken.

The literature was reviewed for a definition of aerospace nursing. The United States Air Force defines space nursing as "applying nursing skills and principles to help assure the safety and well-being of the astronauts in our national space program."[7] In this study the United States Air Force definition will be used but the scope of it will be limited to pre-flight tests, in-flight conditions, and simulated flight conditions.

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[7] U.S., Department of Air Force, U.S.A.F. Recruiting Service, Fact Sheet: Aerospace Nursing (Washington, D.C.: Government Printing Office, n.d.), p. 1.

III. LIMITS OF THE PROBLEM

This study is limited to a survey of the programs of baccalaureate education with a major in nursing for students with no previous preparation in nursing,[8] and to the graduates of the United States Air Force Aerospace Nursing Course.

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[8] "Baccalaureate and Masters Degree Programs in Nursing Accredited by N.L.N. 1968-1969," Nursing Outlook, June, 1968, p. 57.

IV. PROCEDURE

The normative survey method of research was used in this study. A search of current literature revealed certain criteria which were abstracted for use in developing two questionnaires. A letter was sent to the dean of each baccalaureate nursing program in the United States as listed in Nursing Outlook, June, 1968, except Illinois Wesleyan University's Brokaw Collegiate School of Nursing.[9] A questionnaire was mailed to the faculty member of each of these programs whose dean indicated a desire to participate in this study. A second questionnaire was sent to each of the seven graduates of the United States Air Force's Aerospace Nursing Course.

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[9] Ibid.

V. REVIEW OF LITERATURE

The literature was reviewed as to the number of persons employed in the aerospace programs and their contributions to the programs and the problems inherent in, or anticipated in, space travel.

Multidisciplinary Approach

The number of people working on various aspects of the national space program has increased to more than three hundred thousand persons. The three major centers of activity for these people are: Manned Space Flight Center in Texas, Marshall Space Flight Center in Alabama, and Kennedy Space Center in Florida.[10] They are representatives of a wide variety of scientific disciplines. One example of a co-operative effort by these people is the School of Aerospace Medicine at Brooks Air Force Base, Texas, which has a staff of over one thousand persons. This staff includes: seventy physicians with specialized education, seventy persons with doctorate of philosophy degrees, nine dentists with specialized training, fifteen veternarians with post-doctoral

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[10]George M. Low, The Apollo Program--A Midstream Appraisal, Edwin A. Link Lecture Series (Washington, D.C.: Smithsonian Press, 1968), pp. 7-8.

education and sixty-five persons with masters' degrees.[11] At this time, emphasis is placed on a multidisciplinary approach to the complex problems encountered in space travel.

Spacecraft Sterility

One problem in helping the astronauts adapt to the spacial environment is the sterility of the spacecraft and its equipment. The full significance of this problem was recognized after contamination led to the illness of the four crew members of a simulated mission which had to be aborted after five days of experimentation.[12] After many days of experimentation, the United States Army Chemical Corps found that the vacuum inside a spacecraft is very conducive to the growth of microbes. Later in 1963, the year of the aborted mission, the National Aeronautics and Space Administration announced that all equipment leaving the earth must be sterilized.[13] Since this announcement, all equipment is cleansed with sporicidal agents and assembled in dust-free, humidity-controlled clean rooms. In addition, all landing equipment must be heated to two hundred and ninety-three degrees Fahrenheit for thirty-six hours prior to being sealed in a container for storage until the launch date. These standards are enforced by contamination officers of the manufacturers assembling the equipment and by the Special Assistant

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[11] U.S., Department of Air Force, School of Aerospace Medicine, pp. 5-6.

[12] Heather M. David, "Space Cabin Contaminant Study Spurred by Environment Tests," Technology Week, July 4, 1966, p. 22.

[13] Jonathan Eberhart, "Germs and the Space Age," Science News, April 30, 1966, pp. 312-313.

for Planetary Quarantine of the National Aeronautics and Space Administration.[14]

Sterilization of equipment leaving this planet serves the two-fold purpose of preventing illness in the astronauts due to contamination and preventing contamination of other planets due to earth-born organisms. The United States of American and the United Soviet Socialist Republic are now utilizing the same method to sterilize equipment. Both countries are studying the hazards of contamination which may exist when astronauts and cosmonauts and spacecraft return to the earth after landing on another planet. In the United States, the Public Health Service, the Department of Agriculture, and the National Academy of Science in a cooperative effort are devising evaluative tests for astronauts returning from other planets. These tests will be conducted while the space travelers are quarantined in the Lunar Receiving Laboratory.[15]

Pressure Suits

The effects of extreme pressure which is experienced during intervals of the space flight have resulted in the design of pressure suits which the astronauts wear. Major Novotny states that the pressure suit weighs twenty-five pounds. The inner layer is a slippery one which aides in donning the suit. Protection of the lungs is achieved by the second layer, a gas filled bladder which

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[14] Ibid.

[15] "New IBM Lab Will Attack Variety of Space Problems," Technology Week, January 16, 1967, p. 41.

equalizes pressure. Preventing overdistention of the bladder is the task of the third layer. The outer layer is necessary to protect all other layers. During pre-flight tests, astronauts and aerospace nurses wear the pressure suits for varying lengths of time to facilitate adjustment to the feeling of restriction.[16]

Weightlessness

Several problems during space flights are attributed to the effects of weightlessness. Eating food and evacuating the bowels are difficult in a state of weightlessness. Because even the simple action of swallowing is affected by the loss of gravity, astronauts must learn new muscle control for eating.[17]

Weightlessness affects water which in turn affects personal hygiene. In zero gravity water resembles syrup when it is in contact with the skin. The Martin Marietta Corporation has devised a shower to be used in space which counteracts this property of water. After the shower, the water would be retrieved by means of a modified water vacuum cleaner. Bacteria test patches taken after this system was used in simulated conditions indicate its effectiveness.[18]

Nutrition

Providing adequate nutrition for the astronauts has been

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[16]Dorothy R. Novotny, "Suited for Space Life," American Journal of Nursing, August, 1967, p. 1656.

[17]Ernest Planck, "Problems in Aerospace Medicine," American Association of Industrial Nurses Journal, August, 1961, p. 14.

[18]"Saturday in Space," Science Digest, February, 1968, p. 35.

another problem with which the scientific disciplines have had to study. Three to four days prior to launching a spacecraft the crew members are placed on a high protein, low residue diet to limit the bulk available for the formation of feces. During this pre-flight period, the entire diet of each astronaut is prepared separately in individual sets of pans to prevent cross contamination.[19] During flight, dehydrated food is used because it can withstand the effects of radiation, extreme heat and cold, and extreme pressure. This food which is stored in the astronaut's suit contains the maximum amount of food value with the least weight and bulk. More research is being done on this food because of the findings of Dr. Lorraine Gall of the International Business Machines (IBM) staff who has been a leader in the study of microbes found in man's intestinal tract. In a six week study which she conducted, men survived on Gemini-type food. During this time period, five new groups of intestinal bacteria appeared causing stomach gas and discomfort.[20]

Waste Disposal

Limiting the bulk available for the formation of feces aides in limiting the waste disposal problem. The School of Aerospace Medicine at Brooks Air Force Base, Texas, has been studying different waste disposal systems which could be used in the life support system. In 1968 tests were to be conducted using and activated sludge treatment plant which might prove feasible for long

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[19] U.S., Department of Air Force, Fact Sheet: Aerospace Nursing, p. 4.

[20] "New IBM Lab," p. 41.

space flights. In this system microorganisms would decompose the human wastes into water, carbon dioxide, ammonia, and nutrients. These products would then be used--water and carbon dioxide would feed the algae in the system, water could be drunk by the crew members, and the algae would provide oxygen for the crew members. If this system proves to be efficient, it could be used for flights lasting for a year or more.[21]

The biological life support system just discussed may pose a problem in relation to the water supply. Dr. John T. Cookson, Jr., an environmental health engineer with the Public Health Service is studying the problem of water purification as it relates to long space journeys. Purification of waste water through a system such as the activated sludge treatment plant can concentrate the causative viruses of infectious hepatitis. Dr. Cookson is experimenting with filters which might be used to screen out these viruses.[22]

Radiation

Dr. Boris Yegorov, the Russian physician-cosmonaut, states that although the effects of weightlessness on the cardiovascular system, the central nervous system, and the fluid-electrolyte balance are as yet unknown, radiation seems to be the chief danger

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[21]Heather M. David, "Waste Treatment Plant to Improve System," Technology Week, January 9, 1967, p. 28.

[22]"Astronauts' Water Problem Could Ruin Whole Mission," Science News, November 19, 1966, p. 425.

as it may cause degeneration of body tissue at a very slow rate.[23] Recently a scanner was developed which can detect chromosomal changes due to radiation.[24] During early Gemini flights, experiments were conducted to determine the effects of radiation on organisms both from earth and space. During these flights, space organisms were collected in a package which was open in space for a total of nineteen hours. By studying these, scientists can plan more effective protection for the astronauts.[25] Russians report that they are investigating the use of the following drugs for protecting the cosmonauts from radiation: serotonin, systamine, aminothiol groups, and indolyl alkylamine groups.[26]

Research Flights

Research is being conducted at Brooks Air Force Base by medical personnel who are concerned with the health needs of the astronauts in adjusting to the environment of the spacecraft. In 1966, the National Research Council's Space Science Board of the National Academy of Sciences recommended that several space flights be planned for the purpose of medical, physiological, and behavioral research. Information collected during these flights would aide scientists in improving life support systems and collecting

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[23] "Space Doctors Advised to Stay on Earth," Science News, November 5, 1966, p. 377.

[24] Roderick Hibben, "Scanner to Examine Chromosome Changes," Aviation Week and Space Technology, December 5, 1966, p. 95.

[25] "Gemini Unit Includes Biological Panels," Aviation Week and Space Technology, June 13, 1966, p. 91.

[26] Heather M. David, "Russians Release New Biology Reports," Missiles and Rockets, April 11, 1966, p. 26.

biomedical data.[27] In response to this recommendation, the National Aeronautics and Space Administration alloted one hundred cubic feet and two hundred-fifty pounds for medical experiments on the Apollo flights. The purpose of these experiments was development of methods to collect and preserve specimens of serum, plasma, whole blood, urine, and feces for later clinical evaluation.[28] Dr. Boris Yegorov states that aerospace physicians can obtain adequate biomedical information by telemetering astronauts during flight and conducting experiments during flight.[29]

Joint Efforts

The United States of America and the United Soviet Socialist Republic have established a joint editorial board whose task is preparing and publishing research reports on space biology medicine. The first manuscript of this board published in 1968 consisted of three volumes--Volume One about life on other planets, Volume Two about man's adaptation to space, and Volume Three about life supportive and protective systems. These volumes are reviewed every three months by the National Aeronautics and Space Administration of the United States and the Academy of Sciences of the United Soviet Socialist Republic.[30] Through joint efforts such as this,

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[27]"Biomedical Space Technology Lagging," Missiles and Rockets, February 21, 1966, p. 18.

[28]"Biological Specimen Preservation During Space Flight to be Studied," Aviation Week and Space Technology, September 5, 1966, p. 69.

[29]"Space Doctors."

[30]"Space Medicine Trade Agreed on by US-USSR," Science News, March 19, 1966, p. 185.

differences between the space programs of the two nations have been found. One of the most striking differences is the number of and use of medications aboard the spacecraft. Mr. Donald Fink reports that Russians have used depressant drugs for sleep, stimulants to combat fatigue, as well as narcotics, cardiovascular medications, and anti-radiation medication.[31] In contrast to these twenty medications that the cosmonauts have access to during space flight, American astronauts have access to only four drugs--Dexedrine, APC's, Marexine, and Lomotil.[32] Mr. Fink explains this by saying that Americans hesitate to use medication to help man adapt to space flight conditions due to the inability to predict the possible side effects. The United States places more emphasis on techniques which will help astronauts adapt to the space environment without the use of medications.[33]

Bioastronautics

These problems represent a few areas which scientists have had to explore in order to help man adjust to relatively short space flights. In 1965 the National Aeronautics and Space Administration awarded a nine million dollar contract to McDonnel Aircraft Company for construction of an engine for the

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[31]Donald E. Fink, "USSR Finds Drugs Vital in Space," Aviation Week and Space Technology, October 17, 1966, p. 30.

[32]Warren C. Wetmore, "USSR Sees Gains in Manned Space Tests," Aviation Week and Space Technology, October 24, 1966, p. 30.

[33]Fink, "USSR Finds Drugs."

Manned Orbiting Laboratory (M.O.L.) which will be used as a space research laboratory.[34] Completion of this space station which will have six crew members is expected between 1972 and 1975.[35] Striving to solve the problems which long space flights will present is the field of bioastronautics, defined by the United States Air Force as "the application of life sciences knowledge to assure that man will function effectively in space environments."[36] The many disciplines concentrating on the field of bioastronautics include aerospace nurses, flight nurses, biochemists, health physicists, operating room technicians, flight surgeons, veterinary technologists, electronics engineers, bionuleonics technologists, sanitary industrial hygiene engineers, material specialists, and administrators.[37]

Aerospace Nurses

Aerospace nursing is a relatively new discipline in the space program. During Project Mercury two registered nurses were given practical training to fill a need for aerospace nurses.

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[34] William J. Normyle, "NASA Adapting S-4B for Space Station," Aviation Week and Space Technology, September 5, 1966, p. 34.

[35] William J. Normyle, "Post-Apollo Programs Focusing on Multipurpose Earth-Orbiter," Aviation Week and Space Technology, December 26, 1966, p. 17.

[36] U.S., Department of Air Force, U.S.A.F. Recruiting Service, Aerospace Nursing (Washington, D.C.: Government Printing Office, 1966), p. 2.

[37] Ibid.

Realizing that aerospace nurses needed more than practical training if they were to function effectively with physicians who had completed a three year course in aerospace medicine, Major Pearl Tucker of the United States Air Force initiated a fifty-two week course in aerospace nursing.[38] Space nursing as defined by the United States Air Force for this course is "applying nursing skills and principles to help assure the safety and well-being of the astronauts in our national space program."[39]

Aerospace nurses of the United States Air Force, functioning as members of the Bioastronautic Operational Support Unit (BOSU), aide in all three phases of its program--resources planning, range occupational health, and range bioastronautic support.[40] The first directorate of the Office of the Deputy of Bioastronautics, resources planning, includes the responsibility for deploying materials and support personnel for each flight. Prior to the space flight, the aerospace nurses are responsible for preparing instruments to be sent to the recovery vessels. Each ship receives a Bioastronautic Recovery Set--thirteen chests of instruments weighing approximately twelve hundred pounds--which contains routine and emergency medical supplies.[41] The resources planning division

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[38]"The Stars Beckon," p. 1650.

[39]U.S., Department of Air Force, Fact Sheet: Aerospace Nursing, p. 1.

[40]Pearl E. Tucker, Aerospace Nursing Information Sheet (Washington, D.C.: U.S. Government Printing Office, n.d.), p. 5.

[41]Ibid., p. 5.

division also includes: medical monitoring of the astronauts, operating the emergency hospital, and assisting the medical evaluation team.[42]

The second phase of the Bioastronautic Operational Support Unit is range occupational health. Aerospace nurses investigate and identify the occupational hazards for personnel assisting in missile and launch activities. For instance, Misses Goddard and Arrington report that it is the responsibility of the aerospace nurse to know the propellants and oxidizers used for power in spacecraft which are harmful to health.[43] One method employed to detect early ill effects is periodic testing of everyone associated with the launch pad for visual acuity, depth perception, color discrimination, and hearing acuity. Included in the occupational health program are Pan American range contractors and personnel of Cape Kennedy Air Force Base and Patrick Air Force Base.[44]

In range bioastronautic support, the third phase of the Bioastronautic Operational Support Unit, the aerospace nurse is concerned with:

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[42]U.S., Department of Air Force, Directorate of Bioastronautics, Aerospace Nursing Curriculum (Washington, D.C.: Government Printing Office, 1966), p. 6.

[43]Mary Goddard and Agnes Arrington, "Is Missile Nursing Different?", American Association of Industrial Nurses Journal, August, 1961, p. 10.

[44]Tucker, Information Sheet, p. 6.

> The general welfare, the medical surveillance of the astronauts to insure they are maintained in top physical condition.
>
> ....preparing the astronaut for space flight, such as providing him with the proper diet, performing the laboratory studies which certifies the physical status before launch and establish plans to meet any emergency that might arise prior to flight.
>
> ....evaluation of the physical status of the astronaut to be certain that any effect of the flight is identified and investigated.[45]

One very important facet of range bioastronautic support is obtaining biomedical data. Prior to selection as members of the space crew, candidates undergo specific tests at the Aeromedical Consultation Service at the United States Air Force School of Aerospace Medicine at Brooks Air Force Base, Texas. Three of the tests done are tilt table studies, treadmill studies, and vectorcardiography.[46] Before the space flight, physicians and aerospace nurses perform blood studies, urine tests, electrocardiogram, electroencephalogram, audiogram, X-rays, dental examination, psychiatric examination, eye, ear, nose, and throat examinations, tilt table studies, and vital signs assessment. Information is obtained in this pre-flight evaluation with which to compare data received during flight and post-flight evaluations. During flight, the body temperature, pulse, respirations, eyes, and blood pressure are continously monitored.[47] The heart is

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[45]U.S., Department of Air Force, Fact Sheet, p. 1.

[46]Carol Corrado, "Present Applications--Future Implications for Aerospace Nursing," Annual Scientific Meeting of the Aerospace Medical Association, Washington, D.C., April 10-13, 1967, p. 226.

[47]U.S., Department of Air Force, Fact Sheet, p. 1.

monitored by an electrocardiogram, the blood pressure by a microphone placed under the blood pressure cuff, and respirations by a thermister placed at the tip of his nose.[48]

At this time the Aerospace Nursing Course offered by the United States Air Force is a fifty-two week course taught at Patrick Air Force Base in Florida. Students are selected on the basis of the following qualifications:

> Limited to regular or career reserve USAF Nurse Corps
> Not exceed age 35
> Baccalaureate degree
> Minimum five (5) years active duty
> Completed flight nurse course
> Physically qualified for flying duty
> At least two (2) years assured active duty upon completion of course
> Students will be equally divided in primary AFSC's 9735 (operating room) and 9754 (general duty).[49]

During the Aerospace Nursing Course, students study at the Burn Center of Brooke Army General Hospital, the National Aeronautics and Space Administration Manned Spacecraft Center, the John Fitzgerald Kennedy Space Center, the Wilford Hall United States Air Force Hospital, the United States Air Force School of Aerospace Medicine, and the Patrick Air Force Base.[50] Students are also required to attend the annual Aerospace Medical Association Convention.[51]

Supervisors of this course have published its curriculum

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[48]Nancy J. Barron, "A Ride in the Human Centrifuge," American Journal of Nursing, August, 1967, p. 1653.

[49]Tucker, Information Sheet, p. 11.

[50]U.S., Department of Air Force, Aerospace Nursing, p. 17.

[51]U.S., Department of Air Force, Aerospace Nursing Curriculum, p. 5.

It states that the methods used for teaching this course include: lecture, demonstration, discussion, seminar, practical application, field trips, and observation. Student reports, performance, and conference periods are the evaluative techniques used. In addition each student is required to write a paper for publication or presentation on a facet of aerospace nursing. Units of study for this course as stated in the Aerospace Nursing Curriculum are: orientation and overview, bioastronautics, physiological indoctrination, contractor medical support, medical planning for disaster casulty control, School of Aerospace Medicine, Wilford Hall United States Air Force Hospital, National Aeronautics and Space Administration, educational visits, Aerospace Medical Association Annual Meeting, operational bioastronautics, and administration.[52]

At the present time, there are seven graduates of the Aerospace Nursing Course. When Major Tucker formalized this course, she planned to add a masters' degree in public health as a qualification and to expand the residency period to three years.[53] Neither of these goals is a reality yet, but aerospace nurses anticipate an expansion of this program and their responsibilities. Four areas in which aerospace nurses will become more active participants are: helping develop better evaluative techniques for selection of crew members, participating in research to determine man's tolerance to the hazards of the space environment, assisting in monitoring biomedical data, and providing baseline data of the

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[52]U.S., Department of Air Force, Aerospace Nursing, pp. 6-7.

[53]"The Stars Beckon," p. 1652.

female to that of the male. One of these aerospace nurses may be the first female astronaut.[54]

Aerospace nurses have shown an interest in applying their knowledge to the advancement of nursing care. One area of interest is an orbiting hospital. In an article entitled "Weightless Ward," Captain Doris Piper, a graduate of the United States Air Force Aerospace Nursing Course, describes a hospital in a weightless environment.[55] Decubitus ulcers, enemas, and infusions as known here on earth would be impossible in a space environment due to the absence of gravity. Even meals would need to be served in a different method as food will not stay on a spoon in a weightless ward.[56]

Problems presented by the human crew members of space flights are being solved through the efforts of many scientific disciplines, including aerspace nurses. However as space flights become longer and more complicated new solutions may have to be found for these problems which are:

> (1) the reaction of living material to ahostile environment, (2) the protection or preparation of a living material so that it will be better able to survive this harsh environment, (3) the logistics of supplies adequate to aide life in resisting this environment, and (4) the selection of individuals best able to tolerate a new environment. A fifth problem is the contact with and the study of new forms of life, should they exist beyond our atmosphere.[57]

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[54]Corrado, p. 227.

[55]Doris A. Piper, "Weightless Ward," American Journal of Nursing, November, 1968, pp. 2360-2361.

[56]Lucile Slattery and Mary Goddard, "On the Edge of Space," American Journal of Nursing, June, 1961, p. 44.

[57]Wunder, p. 7.

VI. PRESENTATION OF DATA

Data for this study was collected through the use of two questionnaires. A letter was directed to the deans of the forty-five National League of Nursing accredited baccalaureate nursing schools for students with no previous education in nursing.[58] Thirty responses were received of which fifteen indicated a willingness to participate in this study and designated a faculty member to whom further correspondence regarding the study should be directed. A questionnaire (Appendix A) was sent to the designated faculty member of each of these fifteen schools. All fifteen questionnaires were completed and returned.

A similar letter and questionnaire (Appendix B) was sent to the seven graduates of the United States Air Force Aerospace Nursing Course. One hundred percent of the questionnaires were completed and returned.

Results from the questionnaires are presented in table form for each question. Tables I through XII are results from the questionnaires sent to faculty members and Tables XIII through XX are results from the questionnaires sent to the aerospace nurses.

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[58] "Baccalaureate and Masters Degree," p. 57.

Questionnaire to Baccalaureate

Nursing Schools

TABLE I

What is the enrollment of your school of nursing at this time?

Number of Students	Number of Schools
50-100	1
101-150	7
151-200	4
over 200	3
Total	15

As indicated in Table I, seven of the fifteen respondents represented schools with enrollments of 101-150 students. The three schools with enrollments of over two hundred students had enrollments of two hundred and eighty-four, three hundred and forty-one, and four hundred and twenty-one.

TABLE II

How many students are in each class?

Student Classes	Number of Students					
	0-25	25-50	50-75	75-100	over 100	No Answer
Freshman	1	6	4	1	2	1
Sophomore	2	8	3	1	1	
Junior	4	8	2	1	0	
Senior	4	7	3	1	0	

Table II indicates the sizes of the student classes in the schools which participated in this study. Twenty-five to fifty students was the most common size for each of the four classes. The university giving no answer to the number of students in the freshman class stated that students do not enter the school of nursing until the beginning of their sophomore year.

TABLE III

Are students now given information about aerospace nursing as a career opportunity?

	Number	Percentage
Yes	9	60
No	6	40
Total	15	100

Responses to the third question are tabulated in Table III. Several respondents answering yes stated that a very limited amount of information is presented about aerospace nursing as a career opportunity. Two of these respondents further qualified their answer by adding that this information is presented to their students by personnel from the military services.

As Table IV indicates, the majority of schools participating in this study do not plan to include material on aerospace nursing in the curriculum of the classes between the years of 1969 and 1973. Of those planning to include material on aerospace nursing, one more plans to do so in 1972 and 1973 than in 1969, 1970, and 1971. Of the eighteen not indicating either a positive or negative

response, several indicated that the curriculum for the years being considered was not yet finalized. Percentages in this table are based on the total possible answers which was seventy-five.

TABLE IV

Do you plan to include material on aerospace nursing in your curriculum for the class of:

Year	Yes		No	
	Number	Percentage	Number	Percentage
1969	2	2 2/3	12	16
1970	2	2 2/3	11	15
1971	2	2 2/3	8	11
1972	3	4	7	9
1973	3	4	7	9
Total	12	16	45	60

Twice as many respondents indicated that their school had no course into which an introduction to aerospace nursing could be included as indicated that their schools did have a course into which this material could be incorporated.

In conjunction with Table V, Table VI indicates that four different answers were received to this question. Two respondents would or do incorporate this material into a freshman level course and two respondents would or do incorporate this material into a senior level course.

TABLE V

Do you have a course into which an introduction to aerospace nursing might or will be incorporated?

	Number	Percentage
Yes	4	26
No	8	54
No Answer	3	20
Total	15	100

TABLE VI

If the answer to #5 is yes, please specify the course and the level at which it is offered:

Course	Level
Trends in Nursing	Senior
Medical-Surgical Nursing or Nursing Seminar	Senior
Nursing and Health Sciences	Freshman
Course title not Identified	Freshman

TABLE VII

What content do you think should be included in more depth than is now offered to facilitate learning in the area of aerospace medicine?

Indicate by rank order of preference, i.e. 1, 2, 3, etc.

Content	Rank order of preference								
	1	2	3	4	5	6	7	8	9
Bioastronautics	0	4	2	0	1	1	0	0	0
Biology	1	00	0	1	1	2	1	0	0
Chemistry	1	1	1	0	2	1	1	0	0
Flight Physiology	6	2	0	2	0	0	0	0	0
Physics	1	2	1	2	1	1	1	0	0
Psychology	0	1	3	1	3	1	1	0	0
Public Health	0	0	0	0	00	1	1	1	4
Radiation	0	0	2	4	1	0	0	2	0
Nutrition	0	0	1	0	0	0	1	3	2
Other	1	0	0	0	0	0	0	0	0
No Answer	5	5	5	6	6	8	9	9	9

Table VII indicates a disparity in identifying content needed in greater depth. However, flight physiology is designated by the most respondents as the area needing most emphasis. The respondent who ranked "other" first wrote in physiological psychology as the area needing more in depth study.

TABLE VIII

Indicate by rank order of preference, i.e. 1, 2, 3, etc., the persons qualified to present his material to students.

	Rank order of preference						
	1	2	3	4	5	6	7
Aerospace Nurse	4	1	2	1	0	1	0
Biologist	0	0	0	0	2	1	2
Nursing Instructor	2	3	2	0	1	0	0
Nursing Scientist	3	3	0	0	0	0	0
Physician	0	0	0	0	0	2	3
Physicist	0	1	1	4	0	1	0
Physiologist	1	2	1	0	2	0	0
Other	1	0	0	0	0	0	0
No Answer	4	5	7	10	10	10	10

Persons with education in nursing, i.e. aerospace nurses, nursing instructors, and nursing scientists, are indicated by more respondents as the persons more qualified to present this material than are other persons. One respondent clarified her answer by stating that a person from the nursing profession would need special education in this area before presenting material to students. Another respondent stated that this would need to be a team effort with representatives of many disciplines.

TABLE IX

Do you think that discussions on aerospace nursing would be suitable material for a senior seminar or a senior colloquiem in a baccalaureate nursing program?

	Number	Percentage
Yes	14	93
No	1	7
Total	15	100

Fourteen of the fifteen respondents felt that discussions on aerospace nursing would be suitable material for a senior seminar or senior colloquium in a baccalaureate nursing program as seen in Table IX.

TABLE X

Have any of the nursing majors in your school of nursing indicated an interest in having content on aerospace nursing included in their educational program?

	Number	Percentage
Yes	2	14
No	13	86
Total	15	100

TABLE XI

Have any of the faculty members indicated an interest in incorporating aerospace nursing into their curriculum?

	Number	Percentage
Yes	3	20
No	12	80
Total	15	100

Tables X and XI indicate that neither a majority of students nor a majority of faculty members have indicated an interest in incorporating aerospace nursing into their curriculum.

TABLE XII

Do you think content on aerospace nursing would be an advantageous addition to a baccalaureate nursing program?

	Number	Percentage
Yes	6	43
No	8	57
Total	14	100

Table XII indicates that responses to this question were almost evenly distributed. One respondent did not answer this question.

Questionnaire to Aerospace Nurses

A questionnaire (Appendix B) was sent to the seven graduates of the Air Force Aerospace Nursing Course. The results of the responses received from all seven women are presented in Tables XIII through XX.

TABLE XIII

Was content on aerospace nursing included as part of your formal education in a school of nursing?

	Number	Percentage
Yes	0	0
No	7	100
Total	7	100

None of the aerospace nurses received content on aerospace nursing in a school of nursing. No answers were received to question two of the questionnaire since a pre-requisite to it was an affirmative answer to question one. Apparently the authordid not have the sophistication necessary to formulate questions three and four in such a way as to elicit meaningful responses. Therefore, the data received was tabulated as shown in Appendixes C and D.

The majority of respondents gave an affirmative answer to question five as shown in Table XIV. The respondent who answered no to this question qualified it by saying that

this was suitable material for a student at the master's level of study.

TABLE XIV

Do you think that an introduction to aerospace nursing should be included in a baccalaureate nursing program?

	Number	Percentage
Yes	6	86
No	1	14
Total	7	100

TABLE XV

If your answer to #5 is yes, what would you suggest as time allotment for presenting material?

	Number	Percentage
1-16 hours	3	60
17-32 hours	1	20
33-48 hours	1	20
Other	0	0
Total	5	100

Two respondents did not answer this question. As Table XV shows, the time allotment of 1-16 hours was indicated most often as a suitable time allotment for presentation of content on aerospace nursing.

Aerospace nurse respondents, like faculty member respondents, indicated persons with nursing background, i.e., aerospace nurses, nursing instructors, and nursing scientists, as the persons most qualified to present material on aerospace nursing to the students.

The two persons who were written in as persons qualified to present this material were an aerospace medical doctor, ranked number one, and an Air Force Nurse recruiter, ranked number four. Several respondents stated that whoever presents the material should have a background in the field of aerospace medicine.

TABLE XVI

Indicate by rank order of preference, i.e. 1, 2, 3, etc. the persons qualified to present this material to students:

	Rank order of preference						
	1	2	3	4	5	6	7
Aerospace Nurse	4	1					
Biologist				1			
Nursing Instructor		3					1
Nursing Scientist			2			1	
Physician					1		
Physicist			1				
Physiologist		1					
Other	1			1			
No Answer	2	2	4	5	6	6	6

As Table XVII indicates, bioastronautics and flight physiology have been the most help to the respondents. Occupational health, ranked number three, and mathematics, ranked number six, were written in as other areas which have been helpful.

TABLE XVII

Indicate by rank order of preference, i.e. 1, 2, 3, etc., the areas of instruction which have been most helpful in your preparation as an aerospace nurse.

	Rank order of preference								
	1	2	3	4	5	6	7	8	9
Bioastronautics	3	1							
Biology				1	1				
Chemistry			1			1	1		
Flight Physiology	1	2	2						
Physics		1	1	1					
Psychology				1	1				
Public Health						1		1	
Radiation					1		1	1	
Nutrition							1	1	1
Other			1			1			
No Answer	3	3	2	4	4	4	4	4	6

As Tables XVIII and XIX show, all respondents indicated aerospace nursing is a suitable topic for a senior seminar or

senior colloquium in a baccalaureate nursing program. All seven respondents also agreed that information about aerospace nursing as a career opportunity should be presented to students.

TABLE XVIII

Do you think that discussions on aerospace nursing would be suitable material for a senior seminar or senior colloquium in a baccalaureate nursing program?

	Number	Percentage
Yes	7	100
No	0	0
Total	7	100

TABLE XIX

Do you think students in baccalaureate nursing programs should be given information about aerospace nursing as a career opportunity?

	Number	Percentage
Yes	7	100
No	0	0
Total	7	100

Six of the seven respondents indicated that content on aerospace nursing would be an advantageous addition to a baccalaureate school of nursing.

TABLE XX

Do you think content on aerospace nursing would be an advantageous addition to a baccalaureate program in nursing?

	Number	Percentage
Yes	6	86
No	1	14
Total	7	100

VII. SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

This study was undertaken to determine if nursing education on the baccalaureate level should include in some form an emphasis on aerospace nursing. An overwhelming majority of respondents to both questionnaires indicated that discussions on aerospace nursing would be suitable material for a senior seminar or senior colloquium in a baccalaureate nursing program. (See Tables IX & XVIII) Neither a large number of students nor faculty members have indicated an interest in incorporating aerospace nursing into the curriculum. (Tables X & XI) In tables VIII and XVI responses indicate persons with nursing background are most qualified to present material to students on aerospace nursing.

From the data collected in this study, the author concludes that discussions on aerospace nursing are recognized as suitable material for a senior seminar or senior colloquium. The person presenting this material should be someone with a nursing backbround. The author also concludes that there has been little interest shown by faculty or students in studying this area of nursing at the baccalaureate level. This may be partly due to the fact that the field of aerospace nursing and the literature on aerospace nursing are, as yet, limited.

In light of the results of this study, the author would recommend that:

1. A more detailed study be undertaken to determine what material on aerospace nursing might be presented to students on the baccalaureate level.
2. Baccalaureate programs include a discussion of aerospace nursing in a senior seminar or senior colloquium conducted by persons who are prepared in this specialized field.
3. A follow-up study be conducted of the schools planning to include material on aerospace nursing between the years of 1969 and 1973.
4. Additional study be done on incorporating the principles of aerospace nursing into all courses.
5. Additional articles be written and published concerning the field of aerospace nursing.

APPENDIX A

RESEARCH PROJECT--AEROSPACE NURSING

DIANE WENTWORTH, ILLINOIS WESLEYAN UNIVERSITY, NURSING MAJOR

PLEASE CIRCLE YOUR ANSWER AND RETURN QUESTIONNAIRE BY FEBRUARY 1, 1969.

1. What is the enrollment of your school of nursing at this time? _____

2. How many students are in each class?

Freshman _____

Sophomore _____

Junior _____

Senior _____

3. Are students now given information about aerospace nursing as a career opportunity? Yes No

4. Do you plan to include material on aerospace nursing in your curriculum for the class of:

1969 Yes No

1970 Yes No

1971 Yes No

1972 Yes No

1973 Yes No

5. Do you have a course into which an introduction to aerospace nursing might be or will be incorporated? Yes No

6. If the answer to #5 is yes, please specify the course and the level at which it is offered: _____

7. What content do you think should be included in more depth than is now offered to facilitate learning in the area of aerospace nursing?

Indicate by rank order of preference, i.e. 1, 2, 3, etc.

Bioastronautics	___	Psychology	___
Biology	___	Public Health	___
Chemistry	___	Radiation	___
Flight physiology	___	Nutrition	___
Physics	___	Other	___

If other, please specify:_____

8. Indicate by rank order of preference, i.e. 1, 2, 3, etc., the persons qualified to present this material to students.

Aerospace nurse	___	Physician	___
Biologist	___	Physicist	___
Nursing instructor (M.S.N.)	___	Physiologist	___
		Other	___
Nursing scientist (doctoral preparation)	___		

If other, please specify:_____

9. Do you think that discussions on aerospace nursing would be suitable material for a senior seminar or senior colloquium in a baccalaureate nursing program? Yes No

10. Have any of the nursing majors in your school of nursing indicated an interest in having content on aerospace nursing included in their educational program? Yes No

11. Have any of the faculty members indicated an interest in incorporating aerospace nursing into their curriculum? Yes No

12. Do you think content on aerospace nursing would be an advantageous addition to a baccalaureate nursing program? Yes No

APPENDIX B

RESEARCH PROJECT--AEROSPACE NURSING

DIANE WENTWORTH, ILLINOIS WESLEYAN UNIVERSITY, NURSING MAJOR

PLEASE CIRCLE YOUR ANSWER AND RETURN QUESTIONNAIRE BY JANUARY 23, 1969.

1. Was content on aerospace nursing included as part of your formal education in a school of nursing? Yes No

2. If your answer to #1 is yes, what amount of time was allotted to the theory of aerospace nursing?
   1-16 hours
   17-32 hours
   33-48 hours
   other

   If other, please specify:_____

3. In the formal Aerospace Nursing Course, what amount of time was allotted to the theory of aerospace nursing?
   1-16 hours
   17-32 hours
   33-48 hours
   other

   If other, please specify:_____

4. In the formal Aerospace Nursing Course, what amount of time was allotted to the application of theory of aerospace nursing?

1-16 hours
17-32 hours
33-48 hours
other

If other, please specify:_____

5. Do you think that an introduction to aerospace nursing should be included in a baccalaureate nursing program? Yes No

6. If the answer to #5 is yes, what would you suggest as time allotment for presenting material?

1-16 hours
17-32 hours
33-48 hours
other

If other, please specify:_____

7. Indicate by rank order of preference, i.e. 1, 2, 3, etc., the persons qualified to present this material to students.

Aerospace nurse	___	Physician	___
Biologist	___	Physicist	___
Nursing instructor (M.S.N.)	___	Physiologist	___
Nursing scientist (doctoral preparation)	___	Other	___

If other, please specify:_____

8. Indicate by rank order of preference, i.e. 1, 2, 3, etc., the areas of instruction which have been most helpful in your preparation as an aerospace nurse.

Bioastronautics	___	Psychology	___
Biology	___	Public health	___
Chemistry	___	Radiation	___
Flight physiology	___	Nutrition	___
Physics	___	Other	___

If other, please specify:_____

9. Do you think that discussions on aerospace nursing would be suitable material for a senior seminar or senior colloquium in a baccalaureate nursing program? Yes No

10. Do you think students in baccalaureate nursing programs should be given information about aerospace nursing as a career opportunity? Yes No

11. Do you think content on aerospace nursing would be an advantageous addition to a baccalaureate program in nursing? Yes No

APPENDIX C

In the formal Aerospace Nursing Course, what amount of time was allotted to the theory of aerospace nursing?

Responses	Number of hours		
Occupational health	402	388	200
Bioastronautics	411	206	80
Research	160	90	40
Theory	50%		
No Answer	2		

This indicates the responses which were written in as answers to the third question of the questionnaire sent to the aerospace nurses. Each answer received is shown since no two answers were the same. Through further investigation it was found thatthe amount of time spent in each area does vary from class to class. One factor influencing this, as stated by one of the respondents, is the number of space flights launched during the year of study.

APPENDIX D

In the formal Aerospace Nursing course, what amount of time was allotted to the application of theory of aerospace nursing?

Responses	Amount of time	
Occupational health preceptorship	5 weeks	4 weeks
BOSU in ICU & OR	4 weeks	4 weeks
Operational bioastronautics	217 hours	
Varies from class to class	1	
No answer	2	

Responses shown in this chart are those which were written in as answers to question four on the questionnaire sent to aerospace nurses. Each answer received is shown. As mentioned in connection with responses to question three, the time spent in each area varies with each group of students.

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