Holland's Theory Applied to Medical Specialty Choice

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The present study tested the hypothesis that medical specialties classified as technique oriented or patient oriented would be distinguished by RIASEC code, with technique-oriented specialists resembling Investigative-Realistic types and patient-oriented specialists resembling Investigative-Social types. Using longitudinal data obtained from 447 college students who aspired to become physicians, the authors found that the predominant RIASEC code was the same in both groups of specialties, namely, Investigative-Social. The data suggested that most medical students could fit equally well in several different medical specialties. Thus, they should use Holland's model to explore how well their personalities can be expressed in different specialties and practice environments, not use RIASEC codes to match themselves to particular specialties.

Keywords: Career Occupational Preference System Inventory, Holland types, personality, physicians, specialty choice

Choosing a specialty is an important career development process for medical students because it often leads to at least 3 years of advanced training in the necessary residency program and charts a lifetime of engagement with a particular subset of activities that physicians perform. Because of the importance of this decision, choosing a medical specialty can be difficult for some medical students. Although these students may be committed to the occupation of physician, they may be indecisive about choosing a specialty in which to work. Physicians can choose among 27 major medical specialties and 86 subspecialties (*Directory of Graduate Medical Education Programs*, 2003). The magnitude of specialty choice problems is reflected in the large number of U.S. medical residents and practicing physicians who change specialties. Studies reveal that approximately 20% of residents (Weisman, Levine, Steinwachs, & Chase, 1980)

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and between 13% (Tardiff, Cella, Seiferth, & Perry, 1986) and 26% (Jarecky, Schwartz, Haley, & Donnelly, 1991) of physicians switched to a different specialty. A much higher rate of change of specialty (approximately 69%) was noted among physicians graduating from British medical schools (Parkhouse & Ellin, 1988). Rates of switching seem to vary across different specialties. For example, Jarecky et al. (1991) found that primary care physicians switched to controllable lifestyle specialties (i.e., radiology, pathology, dermatology, etc.) and surgeons were more stable regarding their choice of specialty.

Although medical students are older and more mature than college students, choosing a specialty entails the same difficulties (Savickas, Alexander, Osipow, & Wolf, 1985) that college students encounter in choosing a major and making the school-to-work transition. Choosing a specialty is choosing a "major" activity as a physician, and the move from medical school to residency is a school-to-work transition. Because specialty choice can be difficult and to reduce the human and institutional costs involved in changing specialties, most U.S. medical schools have formal career education and counseling programs.

Given the similarity of specialty choice to the career choices that college students must make, it is little wonder that advisors in medical schools use the same tools frequently employed in college counseling centers, including interest inventories, value surveys, decision-making workshops (*Pathway Evaluation Program for Medical Professionals: Specialty Profiles*, 1999), occupational information available through specialty boards, and workbooks (Taylor, 1993). These interventions and materials frequently are organized using Holland's typology of vocational personalities. Although Holland's RIASEC (Realistic, Investigative, Artistic, Social, Enterprising, and Conventional) model has been used infrequently to study specialty choice within the occupation of medicine, it is a popular model in medical specialty counseling. For example, the Careers in Medicine (CiM) program, sponsored by the Association of American Medical Colleges (AAMC), advocates the use of information about Holland types when selecting a medical specialty and encourages medical students to take the Self-Directed Search (SDS) (Form R, 4th ed.) (Holland, Powell, & Fritzsche, 1994). Further-more, many medical school counseling programs independent of CiM use materials associated with Holland's model.

Medical school career counselors, although appreciating the utility of Holland's model in college counseling, frequently comment that the model and the SDS are too general for use in specialty counseling. When making this evaluation, they also assert that most medical students who take the SDS receive a primary code of Investigative. Of course, this is not surprising in that physicians should be primarily classified as Investigative types who are characterized by a preference for activities that entail the observation and systematic Investigation of physical and biological phenomena. Individuals who resemble the investigative type can be described as analytic, complex, independent, intellectual, rational, and reserved. In their *Dictionary of Holland Occupational Codes*, Gottfredson and Holland (1996) gave a code of Investigative-Social-Artistic (ISA)

Table 1
RIASEC (Realistic, Investigative, Artistic, Social, Enterprising, and Conventional) Codes for Medical Specialties and Subspecialties

RIS	Emergency medicine, nuclear medicine
RSI	Orthopedics
IRE	Pathology, immunology
IRS	Anesthesiology, endocrinology, neurological surgery, neurology, obstetrics-gynecology, otorhinolaryngology/otolaryngology, pediatrics, radiology, urology
IES	Allergist
ISA	Internal medicine, family practice
ISE	Plastic surgery, psychiatry, surgery, thoracic surgery
ISR	Dermatology, ophthalmology
SEA	Preventive medicine
SIE	Physical medicine and rehabilitation
SEC	Geriatrics

Note. Compiled from the *Dictionary of Holland Occupational Codes* (Gottfredson & Holland, 1996).

to the occupation of physician in general. According to this source, the majority of physician specialties are also classified as Investigative types. (See Table 1 for a list of RIASEC codes for medical specialties and subspecialties.) In the *College Majors Finder,* Rosen, Holmberg, and Holland (1987) classified physician in most specialties with a primary code of Investigative, and yet they also assigned a primary code of Realistic to some specialties, such as orthopedics and pathology, as well as a primary code of Social to a few other specialties, such as preventive medicine and physical medicine.

Several empirical studies have investigated the RIASEC codes of medical students. Henry and Bardo (1987) evaluated the RIASEC code for 100 college juniors, seniors, and postgraduate students enrolled in a medical education preparatory program. Of the students, 57 were Black (27 men and 30 women) and 43 were White (26 men and 17 women). The participants as a group had a RIASEC code of Investigative-Social-Enterprising (ISE). Investigative was the primary code for 46% of the students, whereas 42% had a primary code of Social. Furthermore, 61% of the students had I, S, and A in their three-letter code, although not necessarily in that order. Antony (1998) also reported that students who aspired to become physicians resembled Investigative, Social, and Artistic types. Elam (1994) reported that medical students who resembled Artistic and Social types were more likely to choose psychiatry, students who resembled Realistic types were more likely to select surgery, and students who resembled Realistic and Enterprising types were more likely to choose radiology. In a second study, Elam (1995) reported that orthopedic surgeons included a high proportion of physicians who resemble Realistic and Social types.

A few studies have examined the RIASEC codes of practicing physicians. In a study of physicians in Israel, Meir and Yarri (1988) concluded that psychiatrists, pediatricians, and gynecologists resembled Social types; internists, orthopedists, pathologists, and ophthalmologists resembled Investigative types; and surgeons and radiologists resembled Realistic types. In an earlier study of physicians, Meir and Engel (1986) examined interests in the following three specific areas: contact with people, instruments, and sensation. These dimensions correspond to the Holland types of Social, Realistic, and Enterprising, respectively. The findings of this study suggest that Realistic persons occur more often among ophthalmologists, pathologists, and radiologists. Physicians specializing in orthopedics and other surgical specialties are more likely to have Realistic and Enterprising interests predominate. Psychiatrists and pediatricians are often Social types, whereas gynecologists are often Enterprising persons. Physicians specializing in internal medicine are more likely to be Social and Enterprising persons and less likely to be Realistic persons. Although the aforementioned studies provide information about physicians and their RIASEC codes, the results of these studies should be interpreted with caution because of small sample size and possibly unrepresentative samples.

Although not conclusive, this limited evidence does correspond to clinical judgment and anecdotal evidence suggesting that persons with different RIASEC patterns do prefer different specialties. Whereas one certainly needs Investigative skills and attitudes to master a medical school curriculum and practice medicine, working in different specialties seems to require additional skills and attitudes or reward the display of additional preferences and values. For example, Artistic traits seem useful in specialties such as psychiatry and plastic surgery; Social traits seem useful in pediatrics and family medicine; Enterprising traits seem useful in surgery and emergency medicine; Conventional traits seem useful in anesthesiology, obstetrics/gynecology, and urology; and Realistic traits seem useful in pathology, orthopedics, and sports medicine. In short, the clinical impressions of career counselors about the match between RIASEC types and medical specialties are weakly supported by the research findings. A plausible explanation for the discrepancy may be that medical specialty counselors are more attuned to identifying smaller differences within medical specialties and lose sight of the commonalities.

Given the mixed results in identifying RIASEC codes for physicians in the different medical specialties and our own experience, we wondered if it might be wiser to advise career counselors not to use RIASEC codes to direct clients' attention to medical specialties but use them only to help students make the branching decision of whether they are interested in patient-oriented or technique-oriented specialties. The choice between medical and surgical specialties is a career crossroad encountered by all medical students. More generally, they must decide between specialties that emphasize techniques versus those that emphasize communicating with patients. In other words, although RIASEC codes may

not be sufficiently precise to predict specialty, they might be robust enough to differentiate between physicians who work in primary care specialties from physicians who work in surgical and service specialties.

The hypothesis for this study rests on the assumption that physicians primarily resemble Investigative types—in skills and competencies if not interests. Then we reasoned that technique-oriented specialists would be Investigative-Realistic (IR) and patient-oriented specialists would be Investigative-Social (IS). Holland (1985b) described realistic types as asocial, frank, genuine, hardheaded, inflexible, and practical people who work with tools and manipulate things. Accordingly, we concluded that IR types resemble asocial personalities who prefer to solve problems by using their hands and tools to manipulate things. Then we reasoned that patient-oriented specialists would be Investigative-Social. Holland described Social types as cooperative, empathic, friendly, patient, and warm individuals who help, cure, and educate people as well as provide personal services. We concluded that IS types may resemble social personalities who prefer to solve problems using communication skills and are oriented to primary care specialties that offer long-term patient care (Fincher, Lewis, & Rogers, 1992), which satisfies their preference for patient contact, wish to provide continuity of care, and interest in the psychosocial aspects of patient care (Kassler, Wartman, & Silliman, 1991). Based on this rationale, we hypothesized that a RIASEC code of IR implies a preference for working in technique-oriented specialties, such as surgery, pathology, and radiology, whereas a RIASEC code of IS implies a preference for working in patient-centered specialties, such as family medicine, general internal medicine, and pediatrics.

METHOD

Participants

Participants were graduates of a combined BS/MD program who matriculated from 1995 through 1998. The BS/MD program is a 6-year curriculum that begins immediately following graduation from high school and culminates in receipt of a bachelor of science degree and a doctor of medicine degree at the same time. During their first 2 years in the combined program, students complete most of their bachelor's degree coursework. Following this accelerated curriculum, students enter medical school. Of the 447 students who entered the combined BS/MD program at our school from 1989 through 1992, 438 participated in this study and provided useable data. However, 149 of these 438 students had either withdrawn or been dismissed from the BS/MD program and therefore were not included in the study. This resulted in a sample of 289 medical students who entered residency training.

Measures

The Career Occupational Preference System Inventory (COPS) (Knapp & Knapp, 1982) was used to measure vocational interests because its items consist of job activities. Respondents answer like or dislike for 168 job activities. The items are scored in the following eight occupational clusters: Science, Technology, Service, Arts, Communication, Clerical, Business, and Outdoor. Interest scores are obtained for five of eight of the occupational clusters at two levels, Professional and Skilled. The occupational cluster called Technology also includes a third level, Consumer Economics. The remaining three clusters are undifferentiated by level. Profiles are developed that compare examinees in each of the 14 occupational interest clusters, including the cluster covering physician: Professional, Science (Knapp, Knapp, & Knapp-Lee, 1990). Validity studies have shown that more than 60% of high school students entered jobs or educational programs consistent with their COPS interest area (Knapp et al., 1990). A median test-retest reliability of .90, stability estimates of interest scores of .63, and construct validities ranging from .61 to .78 have been reported (Knapp et al., 1990).

Procedures

The participants completed the COPS during the orientation program at the beginning of the first year in the BS/MD program. COPS scores were converted to the six RIASEC scores using formulas developed by J. M. Schuerger (personal communication, May 22, 2001). The formulas weighted different combinations of raw scores on COPS scales to yield a *T* score for each Holland code (see Appendix). Participants were grouped according to the medical specialty they entered upon graduating from medical school. To determine RIASEC codes for these specialties, mean scores for the groups on COPS scales were calculated and then the profile of mean scores was converted to a RIASEC code. For each individual, the three highest RIASEC scores were rank-ordered from highest to lowest. Individuals who showed ties involving the first, second, and third highest scores were analyzed separately (n = 48) because the hypothesis pertained to individuals with a clear first letter code. Participants whose residency was listed as transitional (n = 25) or preliminary (n = 22) were also analyzed separately. Physicians who entered the specialties of dermatology (n = 2), radiology (n = 3), pathology (n = 1), and physical medicine and rehabilitation (n = 2) were excluded from the study because the sample sizes were small. This left seven specialty areas and a total N of 186 participants, of whom 97 (52%) were women and 89 (48%) were men. Breakdown by ethnicity showed 90 (48%) Asians or Pacific Islanders, 87 (47%) Caucasians, 8 (4%) African Americans, and 1 (1%) Hispanic. Of the seven specialties entered by participants, five were patient oriented: family practice (n = 54), internal medicine (n = 66), obstetrics and gynecology (n = 15), pediatrics (n = 16), and psychiatry (n = 11). The remaining two specialties were technique oriented: surgery (n = 15) and emergency medicine (n = 9).

For participants who had Investigative as their first code and Realistic or Social as their second code (n = 88), a chi-square was calculated to test the hypothesis that the second most frequent RIASEC code would be Realistic for physicians specializing in technique-oriented specialties and social for physicians specializing in patient-oriented specialties.

Validity and Reliability of the Predicted Holland Codes

To better understand the formula used to convert COPS scales to Holland codes, it should be realized that the predicted Holland codes are composites of scores from the COPS inventory. Evidence for the conceptual validity of these composites as representatives of Holland codes is of three kinds: (a) conceptual similarity at the item level between Holland variables and the relevant scales from COPS, (b) factor analysis results when the COPS variables are factored with the Holland variables, and (c) correlations between the COPS scales and directly measured Holland variables.

An example may serve to illustrate the first point. Items from Holland's (1985a) Vocational Preference Inventory (VPI) that measure the Enterprising variable include jobs such as buyer, salesperson, manager, and promoter. The relevant scales from the COPS inventory are Professional Business and Skilled Business. Instead of the names of jobs, items on these scales consist of various job activities, including such business-related functions as directing, supervising, selling, meeting with important persons, and so on. In other words, the activities listed in the COPS scales are directly relevant to jobs listed in the VPI Enterprising scale. In a similar manner, all the Holland codes are well represented by relevant activities on the COPS scales.

The second point is made from a factor analysis using proprietary data from the files of Dr. James Schuerger. In this analysis of 79 participants from a private practice sample, the Holland codes and COPS scales were factored together and yielded six factors. The resulting patterns of loadings almost exactly replicated the patterns of variables making up the predicted Holland codes. For example, the factor identified as Investigative had four loadings over .50: Enterprising from the Holland code, and Professional Science, Skilled Science, and Professional Technology from the COPS. Holland codes in this analysis were measured by the Strong Interest Inventory (Hansen & Campbell, 1985).

The third point, correlations among Holland codes and COPS scales, is made using the same data and result in correlations between Holland codes and predicted Holland codes ranging from a low of .52 for Conventional to a high of .80 for Investigative, with an average correlation of .70. In every instance, the relevant correlation was the highest in its row and column. These correlations are verified using data from the COPS manual (Knapp & Knapp, 1984). In these data, the Holland codes were measured by Holland's VPI in two separate samples. In a sample of 213 college students, the highest correlations of each Holland code were with relevant COPS scales, as reflected in the predictive

equations used in this study. For example, the Holland code Artistic was most highly correlated with Communication and Professional Arts on the COPS and with Skilled Arts at a slightly lower level. A similar confirmation was reported in a sample of 57 adult women, closely but not exactly repeating the patterns of the predictive equations.

As stated earlier, the predicted Holland codes are composites made up of selected COPS scales. The reliability of composite variables, according to Guilford (1954) and Nunnally (1967), is directly related to the reliability of the component parts and the correlations among them. If the intercorrelations are zero, the reliability of the composite is the simple average of the reliabilities of the components. If the intercorrelations are positive, the reliability of the composite is higher than the average of reliabilities of the component parts. For the predicted Holland codes, the average reliability of the relevant COPS scales is .88, and the intercorrelations are positive. When calculated according to formulae provided by Nunnally, the reliabilities of the composites ranged from .92 to .95.

RESULTS

Means and standard deviations on the 14 COPS scales for the total group and by sex are available from the senior author. The values derived from the conversion of COPS total group means to RIASEC codes were: R (49.34), I (62.14), A (45.36), S (55.99), E (45.29), and C (48.62). These values suggest a summary code of ISR or ISRC for physicians. The difference in values for R and C was negligible, and both were substantially lower than the second letter of S. When the scale scores were converted to RIASEC codes, the first letter of the RIASEC codes for the 186 participants were as follows: 109 (59%) Investigative, 46 (25%) Social, 14 (7%) Realistic, 9 (5%) Artistic, 6 (3%) Conventional, and 2 (1%) Enterprising (see Figure 1). The 186 participants included 155 (83%) physicians who had Investigative as either their highest or second highest code. The combinations that had the highest numbers were 59 Investigative-Social, 33 Social-Investigative, and 29 Investigative-Realistic. For those who had Investigative as their highest code, their second codes were 59 Social, 29 Realistic, 8 Enterprising, 8 Artistic, and 4 Conventional.

Means and standard deviations for the COPS scores by specialty are available from the senior author. High scores on the Science Professional scale characterize all groups of physicians. Emergency medicine physicians earned the lowest mean score on this scale, and pediatricians earned the highest, but differences among the specialties were not statistically significant. Only one of the 14 COPS scales showed a statistically significant difference between the medical specialty groups: Arts Skilled, $F(6, 185) = 2.48$, $p < .05$. A Tukey multiple comparison indicated that psychiatrists scored significantly higher than surgeons on this scale.

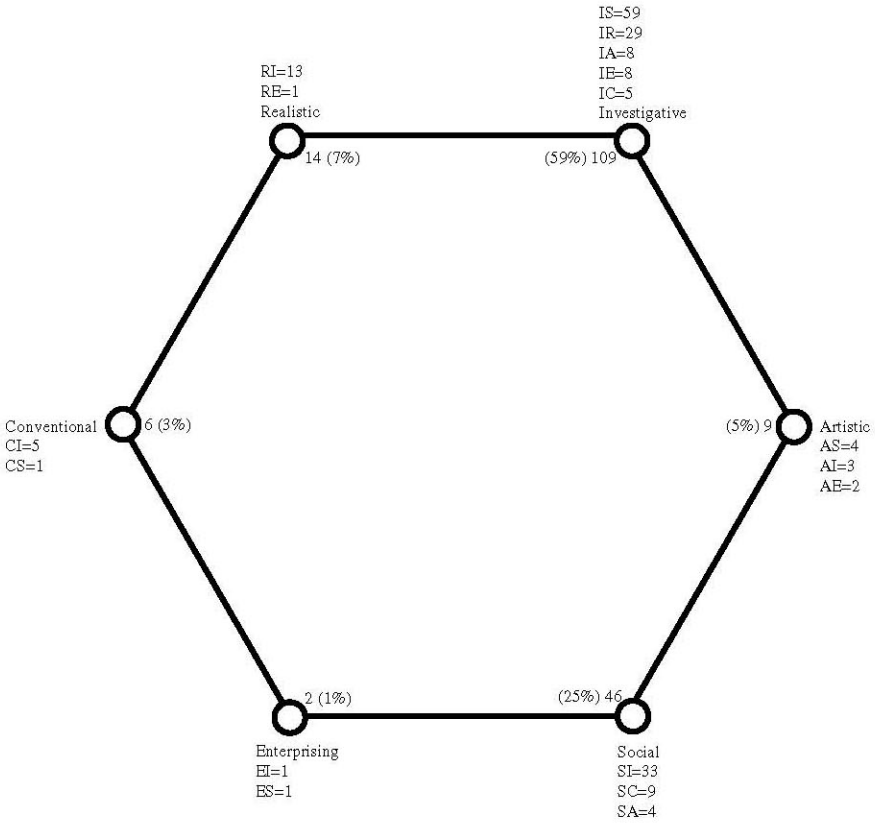

Figure 1. RIASEC codes for physicians (N = 186).

Family Practitioners

The values derived from the conversion of COPS group means to RIASEC codes were: R (48.26), I (61.45), A (44.24), S (56.79), E (45.53), and C (48.93) (see Table 2). These values suggest a summary code of ISCR for family practitioners. The difference in values for R and C was negligible. Among the 54 family practitioners, the first letter of their codes were 30 (56%) Investigative, 18 (33%) Social, 3 (6%) Conventional, 2 (4%) Artistic, 1 (1%) Realistic, and 0 Enterprising. Of those with Investigative primary codes, 18 (60%) had a second code of Social, whereas 12 (66%) of those with Social primary codes had Investigative as their second code. All 3 of the family practitioners with a Conventional primary code had Investigative as their second code. Of the family practitioners with Artistic primary codes, 1 had a second code of Social and the other had a second code of Enterprising. The remaining family practitioner displayed a Realistic-Investigative code.

Table 2
Means and Standard Deviations for RIASEC Codes by Specialty

	Physicians (N = 186)		Family Medicine (n = 54)		Internal Medicine (n = 66)		Pediatrics (n = 16)		Psychiatry (n = 11)		Obstetrics and Gynecology (n = 15)		Surgery (n = 9)		Emergency Medicine (n = 15)	
RIASEC Codes	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Realistic	49.34	10.11	48.26	8.18	49.59	10.80	46.78	8.52	54.22	15.98	47.02	10.78	50.24	9.06	54.93	8.23
Investigative	62.14	7.85	61.45	6.83	62.27	8.66	61.41	5.35	63.86	7.71	62.83	8.86	63.37	9.06	61.21	9.15
Artistic	45.36	11.98	44.24	11.24	45.33	12.62	48.51	13.16	51.36	13.16	43.22	12.01	41.44	11.71	49.51	4.73
Social	55.99	9.62	56.79	8.63	56.14	10.11	58.80	8.79	55.45	14.17	53.39	7.81	52.50	10.52	56.02	8.00
Enterprising	45.29	10.11	45.53	9.80	45.75	10.57	43.13	10.47	43.99	11.64	45.64	8.77	44.82	9.56	46.15	11.57
Conventional	48.62	11.43	48.93	11.40	48.87	11.07	49.94	13.46	49.71	12.70	45.91	10.18	45.30	13.71	51.36	7.97

Internists

The values derived from the conversion of COPS group means to RIASEC codes were: R (49.59), I (62.27), A (45.33), S (56.14), E (45.75), and C (48.87). These values suggest a summary code of ISRC for internists. The difference between values for R and C was negligible. Among the 66 internists, the primary codes were 37 (56%) Investigative, 16 (24%) Social, 7 (11%) Realistic, 3 (4%) Artistic, 2 (3%) Conventional, and 1 (2%) Enterprising. Of the internists, 20 had code patterns of Investigative-Social, whereas 10 had code patterns of Social-Investigative. Of the 7 who showed a primary code of Realistic, 6 had code patterns of Realistic-Investigative, and 1 had a code pattern of Realistic-Enterprising. Of those with Social as their primary code, 10 had Investigative as a second letter code, 3 had Conventional, and 3 had Artistic. The 1 who had Enterprising as the primary code had a second code of Social. Of the 2 who had primary codes of Conventional, 1 had a second code of Investigative and the other had a second code of Social. For the 3 who had Artistic as their primary code, 2 had a second code of Social and the third had a second code of Investigative.

Pediatricians

The values derived from the conversion of COPS group means to RIASEC codes were: R (46.78), I (61.41), A (48.51), S (58.80), E (43.13), and C (49.94). These values suggest a summary code of ISC for pediatricians. Among the 16 pediatricians, there were 9 (56%) with Investigative as their primary code, of which 3 displayed Social as their second code and 3 displayed Realistic as their second code. There were 6 (38%) pediatricians who had Social as a primary code, of which 5 (83%) had Investigative as the second code and 1 (6%) had Conventional as the second code. One pediatrician had a Conventional-Investigative pattern. None of the pediatricians had a primary code of Artistic, Realistic, or Enterprising.

Psychiatrists

The values derived from the conversion of COPS group means to RIASEC codes were: R (54.22), I (63.86), A (51.36), S (55.45), E (43.99), and C (49.71). These values suggest a summary code of ISR or IRS for psychiatrists. The difference in values for R and S was negligible. Among the 11 psychiatrists, 5 (46%) had Investigative as their primary code, with 2 showing a second code of Realistic, 2 showing a second code of Social, and 1 showing a second code of Artistic. The 3 (27%) psychiatrists who displayed a primary code of Realistic had Investigative as their second code. In addition, 1 psychiatrist (9%) had an Artistic-Social pattern, 1 (9%) had an Artistic-Investigative pattern, and 1 (9%) had a

Social-Investigative pattern. None of the psychiatrists had a primary code of Enterprising or Conventional.

Obstetricians and Gynecologists

The values derived from the conversion of COPS group means to RIASEC codes were: R (47.02), I (62.83), A (43.22), S (53.39), E (45.64), and C (45.91). These values suggest a summary code of ISR for obstetricians and gynecologists. Among the 15 physicians who specialized in obstetrics and gynecology, 11 (72%) showed a primary code of Investigative, with 7 having a second code of Social, 2 having a second code of Enterprising, and 2 showing a second code of Realistic. Among the remaining 4 obstetricians and gynecologists, 1 (7%) each had primary codes of Conventional, Realistic, Social, and Artistic, and all 4 of these had Investigative as their second code. No obstetricians and gynecologists had Enterprising as a primary code.

Surgeons

The values derived from the conversion of COPS group means to RIASEC codes were: R (50.24), I (63.37), A (41.44), S (52.50), E (44.82), and C (45.30). These values suggest a summary code of ISR for surgeons. Among the 15 physicians who specialized in surgery, 11 (72%) showed a primary code of Investigative, with 5 having a second code of Realistic, 5 having a second code of Social, and 1 having a second code of Enterprising. Of the 4 remaining surgeons, 2 (14%) had Social-Investigative codes, 1 (7%) had an Artistic-Enterprising code, and 1 (7%) had a Conventional-Investigative code. None of the surgeons had Realistic or Enterprising as a primary code.

Emergency Medicine

The values derived from the conversion of COPS group means to RIASEC codes were: R (54.93), I (61.21), A (49.51), S (56.02), E (46.15), and C (51.36). These values suggest a summary code of ISR for emergency medicine physicians. Among the 9 physicians who specialized in emergency medicine, 5 (60%) had a primary code of Investigative with 4 having a second code of Social and 1 having a second code of Realistic. Of the remaining emergency medicine physicians, 2 (20%) showed a Social-Investigative pattern, 1 (10%) showed an Enterprising-Investigative pattern, and 1 (10%) showed a Realistic-Investigative pattern.

Preliminary and Transitional

The values derived from the conversion of COPS group means to RIASEC codes were: for the transitional group R (49.43), I (60.75), A (39.87), S (50.59), E (40.59), and C (43.37); and for the preliminary group R (54.63), I (66.29), A (42.69), S (54.34), E (47.04), and C (47.42). These values suggest a summary code of ISR for individuals who enter preliminary or transitional specialties. The difference in values for R and S was negligible. *Transitional* refers to a 1-year broad-based program between medical school and residency. It is often taken by individuals who cannot decide on a residency/specialty (G. V. Richard, personal communication, May 8, 2002). *Preliminary* is a 1-year position designed for individuals seeking 1 or 2 years of broad clinical experience prerequisite to entering a specialty (D. D. Gibson, personal communication, May 8, 2002) and may be required by some residency programs before beginning a permanent residency (G. V. Richard, personal communication, May 8, 2002).

There were 47 individuals who were categorized as preliminary or transitional. As with the other specialty groups, individuals in the preliminary or transitional group who showed ties between the highest and second highest score or between the second highest and third highest scores were not included ($n = 11$). The remaining 36 included 19 individuals in the preliminary group and 17 individuals in the transitional group. In the preliminary group, 10 individuals eventually entered the following specialties: surgery ($n = 6$), internal medicine ($n = 2$), family practice ($n = 1$), and emergency medicine ($n = 1$). The surgeons had a variety of RIASEC code patterns, including ICR, RIS, IRS, IEA, and ISR. Internists had code patterns of IES and IRS, the family practitioner had a code pattern of IAE, and the emergency medicine physician had a code pattern of IRS. In the transitional group, 7 individuals eventually entered internal medicine ($n = 4$), surgery ($n = 2$), and emergency medicine ($n = 1$). The internists in this group had a variety of RIASEC code patterns including SCI, CSE, ISR, and RIS. The surgeons showed patterns of IRS and IRA, and the emergency medicine physician had a code pattern of SIA.

Investigative-Realistic and Social-Investigative were frequently occurring code patterns for individuals who specialized in emergency medicine regardless of whether they first completed a preliminary or transitional year. Investigative was also the primary code for the individual who eventually entered family practice. Of the individuals who eventually became surgeons, 8 had Investigative as their primary code, and 1 had Realistic as the primary code. The majority of those with a primary code of Investigative had Realistic as the second code, and the remaining ones had second codes of either Social, Enterprising, or Conventional. Individuals with a primary code of Investigative comprised one half of those who became internists, with the other 3 having Social, Conventional, or Realistic as their primary code.

Ties Between Holland Scores

A total of 43 individuals were analyzed separately because they had ties within the first 3 RIASEC scores. Of these individuals, 5 had ties between the highest and second highest score, 19 had ties between the second highest and third highest, and 18 had ties between the third and fourth highest scores. One individual had a tie between the first, second, and third highest scores. Tie scores between the first and second highest scores involved a variety of specialties. Of the 5, 1 family practitioner had first and second RIASEC codes of either Realistic or Social, 1 internist had either Realistic or Investigative, 1 obstetrician/gynecologist had either Social or Conventional, 1 pediatrician had either Social or Investigative, and 1 surgeon had either Artistic or Social. Of the 19 individuals with ties between second and third highest scores, 14 had a first code of Investigative, including 6 family practitioners, 5 internists, 2 psychiatrists, and 1 obstetrician/gynecologist. The ties between second and third letter codes involved various combinations of the remaining Holland codes of Social, Artistic, Enterprising, Realistic, and Conventional. The 1 individual with a tie between the first, second, and third highest code involving the letters R, I, and S was an internist. Of the 18 individuals with ties between third and fourth highest scores, 14 had a first code of Investigative, including 10 internists, 2 family practitioners, and 2 surgeons.

Hypothesis Test

A chi-square was performed to test the hypothesis that the most frequent second letter of the RIASEC code would be Realistic for physicians specializing in technique-oriented specialties and Social for physicians specializing in patient-oriented specialties. Only physicians who had first letter codes of Investigative ($n = 88$) and who had second letter codes of Realistic ($n = 29$) or Social ($n = 59$) were included. Of these 88, 73 were in patient-oriented specialties and 15 were in technique-oriented specialties. For patient-oriented specialists, 23 (31.5%) participants had a second letter code of Realistic and 50 (68.5%) had second letter code of Social. For technique-oriented specialists, 6 (40%) had a second letter code of Realistic and 9 (60%) a second letter code of Social. The results of the chi-square were not statistically significant, $\chi^2 = .406$, $df = 1$, $p = .524$. The results revealed that the second most frequent second letter of the RIASEC code was social for both patient-oriented and technique-oriented specialists. These results however should be interpreted with caution given the small sample size for the technique-oriented specialists. Furthermore, one of the cells had an expected frequency of less than 5 and thus violates one of the assumptions of chi-square.

Given that the aforementioned analysis only allowed us to use the portion of our sample that had Investigative as their first letter code followed by Realistic or Social as the second letter code, we conducted further analysis using the entire sample of 186. We separated the entire sample into two groups, patient oriented

Table 3
Means and Standard Deviations for RIASEC Codes
by Patient-Oriented and Technique-Oriented Specialties

	Patient Oriented (n = 162)		Technique Oriented (n = 24)		Total (N = 186)	
RIASEC Codes	*M*	*SD*	*M*	*SD*	*M*	*SD*
Realistic	48.95	10.24	52.00	8.88	49.34	10.11
Investigative	62.07	7.70	62.56	8.96	62.14	7.84
Artistic	45.50	12.23	44.47	10.35	45.36	11.98
Social	56.32	9.61	53.82	9.62	56.00	9.62
Enterprising	45.29	10.13	45.32	10.13	45.29	10.11
Conventional	48.80	11.36	47.58	12.06	48.62	11.43

(n = 162) and technique oriented (n = 24), and compared means and standard deviations to determine if physicians who chose technique-oriented specialties had higher Realistic scores and lower Social scores compared to physicians who chose patient-oriented specialties. Results indicate that physicians who chose patient-oriented specialties and physicians who chose technique-oriented specialties both have higher Social scores than Realistic scores (see Table 3). However, the magnitude of difference between Realistic and Social scores is larger for patient-oriented specialists than technique oriented. Aside from their first letter code of Investigative, physicians who chose patient-oriented specialties have a predominant second letter code of Social followed by Realistic. For technique-oriented physicians, the second letter code of Realistic or Social may be interchangeable. The large difference in sample size for the two groups is problematic, and these findings should be interpreted with caution.

DISCUSSION

The findings of this study show that when they were college freshman, our sample of physicians had a RIASEC code of ISR and that 83% of the participants had Investigative as their primary or secondary code. When a second letter code is considered, most of the participants resembled Social types. Of the 186 students, 89 (48%) had a combination of Investigative-Social or Social-Investigative for their first and second letter RIASEC code. These findings suggest that approximately half of the physicians who enter family practice, obstetrics/gynecology, pediatrics, surgery, and internal medicine share a combination of traits that characterize them as warm, cooperative, and friendly as well as curious, rational, and reserved. Although based on a single study, this conclusion suggests the possibility that for use in occupational information material, the occupation of physician

be assigned the code of Investigative-Social-Realistic and that medical specialties not be coded differently. This speculation is tempered however by the fact that the data in this study concerned people who eventually ended up in certain specialties, not about the specialties themselves. If a large enough sample of positions in the medical specialties were analyzed, the specialties might turn out to have different codes. And if large representative samples of actual incumbents were tested, they might prove to have different typical person codes as well. Caution should be used when interpreting and generalizing the findings of this study because participants were essentially college freshman enrolled in an accelerated medical degree program (i.e., BS/MD program) and thus may not be representative of medical students who began medical school after receiving a college degree.

When physicians classified as patient-oriented versus technique-oriented specialists were examined by their second letter codes of either R or S, we found that the majority of patient-oriented specialists had second codes of Social. However, for technique-oriented specialists, there are more secondary codes of Social than Realistic. It appears that patient-oriented specialties attract more people with more Social than Realistic interests but that technique-oriented specialties attract a relatively equal mix of people with both Social and Realistic interests. This finding fails to support our hypothesis.

A post hoc inspection of the data suggests that patient-oriented versus technique-oriented specialists might be distinguished not by differences in the content of the second letter in their RIASEC code but distance between their highest and second highest scores. Surgeons had twice the distance between their first and second letters than did internists, family physicians, and emergency medicine physicians. The only other group that showed this degree of distance was the group of physicians who entered a preliminary or transitional year; many of these physicians entered surgery or a specialty that required more extensive training and scholarship. Further studies of RIASEC types among medical specialties should determine if profile shape interacts with profile content to predict specialty choice. In particular, we now hypothesize that well-defined Investigative types are relatively more likely to enter technique-oriented and service specialties, especially those that require extensive training, whereas well-defined Investigative-Social types (where these two scores are the two highest and both are distant from the third score) are more likely to enter patient-oriented specialties.

In addition, it would be interesting to conduct a follow-up study with the individuals who entered patient-oriented specialties who had Realistic as their secondary code and with individuals who entered technique-oriented specialties who had Social as their secondary code. This type of follow-up might clarify why individuals with social interests choose technique-oriented specialties and why individuals with Realistic interests choose patient-oriented specialties. It is possible that these individuals practice medicine in an environment that provides a good fit for them given their RIASEC type. It would also be interesting to inquire

about their job satisfaction to determine if their choice of specialty and practice environment are actually a good fit for these physicians.

A limitation on the results of this study arises from its longitudinal design. Entering college students were assessed and assigned RIASEC types, which were then used to study medical specialties that they entered 6 or more years later. A strength of this design is that career counselors use assessments the same way, namely, they test students in college and try to predict occupational choices years later. However, a weakness of this design may be that RIASEC codes were assigned to medical specialties using prospective data. Results might differ when using a cross-sectional design to assess the RIASEC types of physicians currently employed in different specialties because training during college and medical school might lead to increased interest in investigative and social tasks (Mallinkcrodt, Gelso, & Royalty, 1990). The students in this study underwent 6 years of training prior to entering a medical specialty. For those individuals for whom RIASEC codes did not appear to provide a good fit, it is possible that their interests in other areas may have developed during their training years. For example, three of the premedical students who entered psychiatry were Investigative-Realistic types. Typically, psychiatrists have been categorized as Social types (Holland, 1973; Meir & Engel, 1986), and thus it is possible that these individuals developed Social interests based on their training. Although Social was not one of the first or second letters making up their RIASEC code when evaluated as a premedical student, it is possible that a Social interest developed during medical school, especially during their clinical training. It would be interesting to once again obtain RIASEC codes for these individuals to see if personality and interests have remained stable over time or if a shift has occurred, possibly as a result of their medical school training.

Specific recommendations for future studies may also include in-depth analyses of specific medical specialists, such as psychiatrists to see how those who resemble Investigative-Realistic types differ from those who resemble Investigative-Social types in their daily practice of psychiatric medicine. A second study may involve interviewing the physicians who did not have Investigative as their first letter code to better understand their choice of medicine as a career. Although our study focused on RIASEC codes, future studies should include other variables that may influence career choice of physicians, such as values and lifestyle factors.

Given the similarities in personality and interests among physicians in different medical specialties, it is important to emphasize that each physician could probably pursue a successful and satisfying career in several specialties. The idea that there is one particular specialty that fits each individual medical student appears invalid. Most medical students will find that they fit several specialties equally well. Early in their training, they should be disabused of the idea that there is one perfect specialty choice for each person. Instead, they should be helped to understand how they could use different specialties to construct satisfying and successful careers. This conclusion still leaves medical educators and career counselors with the challenge of guiding students to explore specialties

and make viable and suitable choices. It also should make them wary about how they use Holland's model of personality types in specialty decision making. Rather than using RIASEC types to match medical students to specialties, the types should be used to help students explore how their personalities can be expressed congruently in at least two or three different specialties. In the end, a specialty should enable physicians to implement their self-concepts in meaningful work tasks.

Appendix
Equations for Holland *T* Scores From COPS Raw Scores

Realistic = (Technology Professional + 3 × Technology Skilled + Outdoor – Communication – 49)/34 × 10 + 50

Investigative = (Science Skilled + Technology Professional + 2 × Science Professional – 56.5)/27 × 10 + 50

Artistic = (Communication + Arts Professional + Arts Skilled – 61)/18 × 10 + 50

Social = (Service Skilled + Service Professional – 35)/12 × 10 + 50

Enterprising = (Business Professional + Business Skilled – 31)/13 × 10 + 50

Conventional = (2 × Clerical + Consumer Economics + Service Skilled – 52)/22 × 10 + 50

REFERENCES

Antony, J. S. (1998). Personality-career fit and freshman medical career aspirations: A test of Holland's theory. *Research in Higher Education, 39*, 679-697.

Directory of graduate medical education programs. (2003). Washington, DC: American Medical Association.

Elam, C. L. (1994). Application of Holland's theory of vocational personalities and work environments to medical student specialty selection. *Journal of Career Development, 21*, 37-48.

Elam, C. L. (1995). Primary care specialty selection: Application of a vocational behavior theory. *Family Medicine, 27*, 249-254.

Fincher, R. M. E., Lewis, L. A., & Rogers, L. Q. (1992). Classification model that predicts medical student choices of primary care or non-primary care specialties. *Academic Medicine, 67*, 324-327.

Gottfredson, G. D., & Holland, J. L. (1996). *Dictionary of Holland occupational codes.* Odessa, FL: Psychological Assessment Resources.

Guilford, J. P. (1954). *Psychometric methods.* New York: McGraw-Hill.

Hansen, J. C., & Campbell, D. P. (1985). *Manual for the SVIB-SCII* (4th ed.). Stanford, CA: Stanford University Press.

Henry, P., & Bardo, H. R. (1987). Expressed occupational choice of nontraditional premedical students as measured by the Self-Directed Search: An investigation of Holland's theory. *Psychological Reports, 60*, 575-581.

Holland, J. L. (1973). *Making vocational choices: A theory of careers*. Englewood Cliffs, NJ: Prentice Hall.

Holland, J. L. (1985a). *Manual for the Vocational Preference Inventory*. Odessa, FL: Psychological Assessment Resources.

Holland, J. L. (1985b). *The Self-Directed Search: Professional manual–1985 edition*. Odessa, FL: Psychological Assessment Resources.

Holland, J. L., Powell, A. B., & Fritzsche, B. A. (1994). *The Self-Directed Search professional user's guide* (4th ed.). Odessa, FL: Psychological Assessment Resources.

Jarecky, R. K., Schwartz, R. W., Haley, J., & Donnelly, M. B. (1991). Stability of medical specialty selection at the University of Kentucky. *Academic Medicine, 66*, 77-82.

Kassler, W. J., Wartman, S. A., & Silliman, R. A. (1991). Why medical students choose primary care careers. *Academic Medicine, 66*, 41-43.

Knapp, R. R., & Knapp, L. (1982). *Career Occupational Preference System Interest Inventory*. San Diego, CA: EdITS.

Knapp, R. R., & Knapp, L. (1984). *Manual: COPS Interest Inventory*. San Diego: EdITS.

Knapp, R. R., Knapp, L., & Knapp-Lee, L. (1990). *COPSystem technical manual*. San Diego, CA: EdITS.

Mallinkcrodt, B., Gelso, C. J., & Royalty, G. M. (1990). Impact of the research training environment and counseling psychology student's Holland personality type on interests in research. *Professional Psychology: Research and Practice, 21*, 26-32.

Meir, E. I., & Engel, K. (1986). Interests and specialty choice in medicine. *Social Science in Medicine, 23*, 527-530.

Meir, E. I., & Yarri, Y. (1988). The relationship between congruent specialty choice within occupations and satisfaction. *Journal of Vocational Behavior, 33*, 99-117.

Nunnally, J. C. (1967). *Psychometric theory*. New York: McGraw-Hill.

Parkhouse, J., & Ellin, D. J. (1988). Reasons for doctors' career choice and change of choice. *Medical Education, 296*, 1651-1653.

Pathway evaluation program for medical professionals: Specialty profiles. (1999). Research Park Triangle, NC: Glaxo-Wellcome, Inc.

Rosen, D., Holmberg, K., & Holland, J. L. (1987). *The college majors finder*. Odessa, FL: Psychological Assessment Resources.

Savickas, M. L., Alexander, D. E., Osipow, S. H., & Wolf, F. M. (1985). Measuring specialty indecision among career decided students. *Journal of Vocational Behavior, 27*, 356-367.

Tardiff, K., Cella, D., Seiferth, C., & Perry, S. (1986). Selection and change of specialties by medical school graduates. *Journal of Medical Education, 61*, 790-796.

Taylor, A. D. (1993). *How to choose a medical specialty* (2nd ed.). Philadelphia: W. B. Saunders.

Weisman, C. S., Levine, D. M., Steinwachs, D. M., & Chase, G. A. (1980). Male and female physician career patterns: Specialty choices and graduate training. *Academic Medicine, 55*, 813-825.