Impact of Expected Changes in National Papanicolaou Test Volume on the Cytotechnology Labor Market

An Impending Crisis

Isam A. Eltoum, MD, MBA, and Janie Roberson, SCT(ASCP)

Key Words: Demand and supply; Total Papanicolaou test volume; Technology; Labor force

Abstract

With the new screening and treatment guidelines and the prospect of human papillomavirus vaccination for adolescents, the current total volume of Papanicolaou (Pap) tests will be significantly reduced. We used available data to assess the current supply and demand in the cytotechnology labor market and how an expected change in Pap test volume impacts this market. Cytotechnologists’ data were obtained from the American Society for Clinical Pathology (ASCP) Board of Registry and the Center for Medicare and Medicaid Services. Data for wages and vacancies were obtained from American Society for Cytotechnologists and ASCP Surveys. Cytotechnology training program data were obtained from annual reports of the Cytotechnology Programs Review Committee of American Society for Cytopathology. In the current market, the demand for cytotechnologists increases by 3.6% and the supply by 4.0% each year. At any given time, there is a vacancy rate of 3%. In the coming years, the demand will decrease remarkably with a projected total demand for cytotechnologists of 5,623 instead of 8,033 by the year 2010 and of 8,538 instead of 14,146 by the year 2026. The cytotechnology market faces an impending crisis. There is a high need for prospectively collected accurate data on demand for and supply of cytotechnologists.

For some time, changing technology and emerging screening guidelines have spurred discussion about the future job market in cytotechnology. These changes however, have never been as threatening as now, especially with the prospect of primary human papillomavirus (HPV) testing and HPV vaccination of a sector of the female population. Recently, we estimated that of the 65 million Papanicolaou (Pap) tests performed annually in the United States, 30% would not have been performed if primary HPV testing of women older than 30 years was fully adopted and more than 40% reduction would result if in addition adolescents were fully covered with HPV vaccination. How and when these changes will impact the dynamics of the future cytotechnology labor market is difficult to predict.

The essential question is one common to the business world and the health care labor market: supply vs demand. However, owing to significant fragmentation and inherent limitations of workforce data in general, determining supply and demand is fraught with difficulties. Thanks to the highly specialized nature of tasks performed by cytotechnologists and to the existence of excellent records from the American Society for Clinical Pathology (ASCP) Board of Registry (BOR), as well as other sources, it is possible to answer these questions, albeit not to an ideal level of certainty. In an attempt to resolve some of these issues, we used available data to determine the current supply and demand in the cytotechnology labor market and how an expected change in Pap test volume impacts this market. Our goal was to consolidate fragmented data to assist students, educators, cytotechnologists, policymakers, and the cytology community at large to reflect on an impending crisis in the cytotechnology labor market.
Material and Methods

Data Sources

Secondary data from a variety of sectors were used to assess the current and future cytotechnology labor markets. Data for the total number of cytotechnologists were obtained from ASCP BOR and from the Center for Medicare and Medicaid Services (CMS).5 Data for wages and vacancies were obtained from the American Society for Cytotechnologists (ASCT) and from CMS data, which show that 6,530 cytotechnologists participated in 2005 proficiency testing.10 On the other hand, ASCP BOR had registered 14,176 cytotechnologists in the period 1957-2005.12 With 6,530 currently practicing cytotechnologists, cytotechnologists who took proficiency testing in 2005, therefore, 7,646 cytotechnologists have separated from the active workforce in 48 years. This represents a separation rate of 159 (2.4% of working cytotechnologists) per year (Figure 1).

According to annual reports compiled by the CPRC/ASC, cytotechnology training programs averaged a 76% occupancy rate for the period 1996-2005, with a net loss of 91 student places or 9.1 students per year (written communication, Deborah MacIntyre, CPRC coordinator, 2006). In 2005, 44 cytotechnology schools were active. For the period 2001-2005, an average of 261 cytotechnologists passed the ASCP registry examination annually. The supply side, therefore, increases annually by 261 (4.0%), with a net growth rate of the cytotechnology workforce of 102 (1.6%) cytotechnologists per year (261 – 159).

Results and Discussion

Current Cytotechnology Labor Force Market

The current supply is described in Table II. On the supply side of the equation, the cytotechnology job market depends on the number of available cytotechnologists. This pool of practicing cytotechnologists, like other labor markets, depends on accessions (new entrants and reemployed cytotechnologists) and separations (attrition due to death, retirement, unemployment, and other reasons)11 Figure II. Growth in this pool, therefore, depends on the net change in the number of cytotechnologists who leave the practice and the number of cytotechnologists who enter it. It is difficult to estimate the size of this pool. Best estimates were obtained from CMS data, which show that 6,530 cytotechnologists participated in 2005 proficiency testing.5 On the other hand, ASCP BOR had registered 14,176 cytotechnologists in the period 1957 to 2005.12 With 6,530 currently practicing cytotechnologists, cytotechnologists who took proficiency testing in 2005, therefore, 7,646 cytotechnologists have separated from the active workforce in 48 years. This represents a separation rate of 159 (2.4% of working cytotechnologists) per year (Figure 1).

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According to recent surveys, salaries, adjusted for inflation, are relatively flat. The 2005 ASCP data showed a 6% salary increase from the 2003 survey, which is almost identical to the inflation rate for the same period, 6.16%. Current demand is described in Table 2. The demand side of the cytotechnology labor market depends primarily on the total number of Pap tests performed annually in the United States. The total Pap test volume, in turn, depends on the total population of women eligible for screening, the proportion of this population covered by screening, the actual frequency of screening, screening guidelines, and adoption of new technologies.

Determining exactly how many Pap tests are currently performed annually in the United States is difficult and complex. Traditionally, use of Pap tests and other preventative health measures was assessed through the NHIS. Accordingly, the frequently cited number of 50 million Pap tests performed in the United States has been based on the NHIS data from the 1980s. Since then, the number of women eligible for screening has increased from 92 million in 1987 to 114 million in 2005. Based on NHIS 2000 and 2005, we recently estimated the total volume of Pap tests to be 66 and 65 million, respectively.

Estimates of the number of practicing cytotechnologists and the number of Pap tests performed per cytotechnologist offer another opportunity for determining the total volume of Pap tests performed annually. The CMS recently reported that a total of 6,530 cytotechnologists took the proficiency test in the calendar year 2005. The College of American Pathologist Q-Probes study of a large series of laboratories has shown that an individual cytotechnologist reported an average of 7,851 Pap tests a year, making the total annual volume. From the US census data, this sector of the female population increases annually by 1.2%. Without considering the recent changes in screening guidelines and given an attrition rate of the cytotechnology workforce of 2.4%, the current demand side of cytotechnology increases annually by 3.6%, ie, 237 cytotechnologists need to join the workforce each year.

The vacancy rate represents the percentage of jobs available to be filled at any given time and is one of the most important indicators of labor demand. According to the ASCP vacancy and wages data, the cytotechnologist vacancy rates are steadily decreasing from their highs in the 1990s. The current vacancy rate stands at 3%, which is not different from the estimated annual demand as calculated, 3.6%. The vacancy rate, however, has been decreasing during the last decade, and this trend will likely continue.

In labor shortages, one would typically see rising vacancies, increasing compensation levels, and low unemployment levels. The trend in the current cytotechnology labor market is decreasing vacancies, flat compensation levels, and relatively high but stable employment rates. These findings do not support a current labor shortage. Moreover, with an expected reduction in the volume of Pap tests, these trends will decrease further in the future.

### Future Cytotechnology Labor Market

In the coming few years, the demand for cytology cervical cancer screening will decrease if the new guidelines are fully adopted. First, there is accumulating evidence and mounting pressure in favor of biennial rather than annual Pap tests. Second, the US Food and Drug Administration approved primary HPV testing in conjunction with cytology screening for women 30 years or older, and the American College of Obstetricians and Gynecologists recommended triennial screening of women who have negative cytology and negative HPV test results (double negative). Third, HPV vaccination

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**Table 2**

Cytotechnology Labor Demand by the Numbers

<table>
<thead>
<tr>
<th>Description</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Estimated annual volume of Papanicolaou tests in the United States</td>
<td>65 million</td>
</tr>
<tr>
<td>Estimated annual increase in demand for cytotechnologists secondary to population growth</td>
<td>78 (1.2)</td>
</tr>
<tr>
<td>Estimated annual demand for cytotechnologists secondary to cytotechnology separation</td>
<td>159 (2.4)</td>
</tr>
<tr>
<td>Estimated annual total demand for cytotechnologists</td>
<td>237 (3.6)</td>
</tr>
<tr>
<td>Estimated total decrease in demand for cytotechnologists secondary to primary HPV screening for women older than 30 y by 2010 (%)</td>
<td>30</td>
</tr>
<tr>
<td>Estimated total decrease in demand for cytotechnologists secondary to HPV vaccine when fully implemented, approximately by 2026 (%)</td>
<td>13</td>
</tr>
</tbody>
</table>

HPV, human papillomavirus.

* The percent change of demand was based on the current work force of 6,530. Data are given as number (percentage) unless otherwise indicated.
of early adolescents is a certainty.18 Last, other factors that may impact the total volume of Pap tests include changes in prevalence of hysterectomy, the possibility of using HPV alone as a method of screening, and an increase in use of liquid-based cytology and computerized screening.

**Effect of Reflex HPV Testing for Atypical Squamous Cells of Undetermined Significance on Demand**

With an atypical squamous cells of undetermined significance (ASC-US) rate of approximately 5% to 6% of the total screened population and an HPV+ rate of 43% among women with ASC-US, it is expected that approximately 1.5 million Pap tests will not need to be repeated owing to reflex HPV testing for ASC-US. To this end, despite an increase in women eligible for Pap screening, we did not detect a significant increase in the reported Pap test volume in the 2005 NHIS (65 million) compared with the 2000 NHIS (66 million).2 Because 2000 NHIS data reflect a period of use of the conventional Pap test as the sole screening method whereas 2005 NHIS data reflect a transitional period of use of liquid-based cytology and reflex HPV testing, it is possible that the observed lack of increase in the total reported Pap tests is due to a decrease in repeated Pap testing secondary to an ASC-US diagnosis.

**Effect of Primary HPV Testing and Frequency of Screening on Future Demand**

The current screening guidelines strongly argue for a decrease in screening frequency from annual to biennial or triennial screening depending on age, risk factors, history of abnormal Pap tests, and screening method. The American Cancer Society, the American College of Obstetricians and Gynecologists, and the US Preventive Services Task Forces all favor less frequent screening for women who are older than 30 years and have 3 consecutive negative Pap test results or have combined negative Pap and HPV DNA test results. If women who were 30 years or older who had negative Pap and HPV tests had been screened every 3 years as recommended by most organizations, 30% of Pap tests would not have been performed.2

**Effect of the HPV Vaccine on Future Demand**

Recently, a US government panel voted to adopt HPV vaccination of females 11 and 12 years old. The most cost-effective strategy of HPV vaccination, given the current price of the vaccine, is to delay the age of initial screening to 24 years and screen women every 2 years thereafter. If a combined policy of vaccination and HPV testing and screening are fully adopted, we expect a 43% reduction of total reported Pap tests.2

**When Might These Changes Occur?**

The effect of reflex HPV DNA testing is taking place already. For example, the recent G2 report estimated that 98% of Pap tests performed in the United States are liquid-based tests,19 which, unlike conventional Pap tests, are likely to be followed by an HPV DNA test if the diagnosis is ASC-US. On the other hand, a recent report showed that 20% of gynecologists ordered primary HPV DNA as an adjunct to cytology.20 If similar trends continue, demand will decrease 30% by 2010. Given a current annual demand of 3.6% (annual demand secondary to demographic change, 1.2%, plus annual demand secondary to cytotechnologists attrition, 2.4%), the net annual demand will be negative for the next 5 years. By 2010, demand would be 5,623 cytotechnologists if HPV testing is fully implemented, compared with 8,033 cytotechnologists if it is not implemented Figure 3.
Unlike that of primary HPV DNA testing, the effect of vaccine programs on the market will take longer to become evident. First, HPV vaccination coverage and vaccine acceptance will be gradual. Second, the most cost-effective policy will delay screening to the age of 24 years, after which subjects will be screened biennially until the age of 30 years. If we assume it takes 5 years for vaccine coverage to reach close to 100% of the target population, reduction of Pap tests will be observed 5 to 8 years later, when this cohort reaches 18 years and will continue until they reach 24 years. A further decrease in demand will occur for another 6 years as the cohort reaches 24 to 30 years. Vaccine effect, therefore, will take approximately 18 to 20 years to fully materialize and will result in an additional reduction in demand of 13% when fully adopted. By 2026, demand would be for 8,538 cytotechnologists if the vaccine policy is fully accepted and adopted, compared with 14,146 cytotechnologists if it is not (Figure 3).

Future Market Dynamics

How the cytotechnology labor market reacts to the challenges of decreasing demand is difficult to predict. Given the current annual supply of 261 (4.0%) and a negative annual demand of 159 (2.4%), the net annual growth of available workforce (surplus) will be 420 (6.4%) each year for the next 5 years. Given a current vacancy of 3% to 3.6%, this change will tip the market to labor surplus in the next 5 years. The market will react with decreased wages, unemployment, decreased supply of labor, or a combination of these. Initiatives from professional organizations and/or governmental agencies could result in further changes to stabilize the cytotechnology workforce. For labor markets in which a specialized and skilled workforce is needed and high risk is associated with poor performance, it is unlikely that the market will react with decreased wages. Instead, according to wage efficiency theory, employers will maintain high wages, and the risk of increased unemployment, therefore, remains high.

Whether the modest workforce growth rate will continue is a matter of speculation. The cytotechnologist workforce, like other workforces in the United States, is an aging one, and attrition rates may increase more rapidly than in the past. In the 2005 and 2006 ASCT Wage and Vacancy reports, 50% of cytotechnologists had been in the job more than 21 years, and retirement among the baby-boomers is a compounding factor. The lack of growth in number of training programs and student enrollment may lead to decreasing accessions to the workforce.

In this study, we assumed that demand for cytotechnologists depends solely on Pap tests. However, nongynecologic tests are equally important and are constantly changing in complexity and variety. For example, recently, the number of endoscopic fine-needle aspirations increased remarkably, whereas the number of breast fine-needle aspirations was gradually diminishing. Additional changes in nongynecologic and gynecologic tests include the ever-increasing battery of molecular tests performed out of the vial. Discussion of a second tier or advanced level of responsibility for cytotechnologists has emerged and could add incentive to those entering the profession should such a concept come to fruition.

Change in cytology laboratory technology will result in gains in daily productivity (annual capacity) as liquid-based preparations and computer-assisted screening continue to gain market share. Workload limits may be adjusted on the regulatory side (to follow manufacturer guidelines) for this. Theoretically, as many as 200 slides may be performed daily using the ThinPrep Imaging System (Cytyc, Boxborough, MA). As employers invest in new technology, the expectation of a more productive workforce will surely follow, leading to a potential worker surplus.

Challenges to cytotechnology, along with other laboratory professions, include recruitment and retention of quality staff, structural changes in cytology laboratories (consolidation), and automation. Factors that affect supply of cytotechnologists include competition for well-trained personnel and lower compensation for laboratory employment in comparison with other careers and the perception of laboratory work in general. Competition with other higher paid health care jobs (eg, nurses and physician assistants) and the loss of skilled workers into alternative careers are also threats to the workforce supply.

Conclusion

The projected decrease in the total number of Pap tests substantially impacts the demand side of the cytotechnology labor market and will offset any expected increase due to demographic changes in the screened population and to attrition by aging in the cytotechnologist labor force.

The rapidly changing environment in the Pap test market calls for an accurate and precise monitoring mechanism for total Pap tests (demand), perhaps through data obtained directly from a representative sample of all cytopathology laboratories. Accurate workforce data (supply) specific for cytotechnologists is also critical. Aggregate data for “clinical laboratory scientists” may not reflect the subtle changes in this niche market. Also, data regarding the cytotechnologist workforce such as unemployment, attrition, and not active in the labor force (Figure 1) should be collected prospectively, possibly by proficiency test providers.

The numbers we have presented herein are estimates based on available data; they do not present the true and complete picture but are our efforts to best predict the future of the cytotechnology labor market. In addition, we did not consider other scenarios such as using HPV as a primary screening test, the impact of HPV vaccine acceptance, and the potential decrease in demand for cytotechnologists if the vaccine is not fully adopted and introduced into the market.
method for all eligible women, which potentially would lead to a detrimental and substantial imbalance in this market.

From the Department of Pathology, the University of Alabama at Birmingham.

Address reprint requests to Dr Eltoum: Kracke Bldg 609, 1922 Seventh Ave S, Birmingham, AL 35233.

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