

# A Midpoint Assessment of the American Cancer Society Challenge Goal to Halve the U.S. Cancer Mortality Rates Between the Years 1990 and 2015

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See related editorial on pages 217–20, this issue.

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**BACKGROUND.** The American Cancer Society has challenged the U.S. to reduce cancer mortality rates 50% over the 25 years from 1990 to 2015. The current report is an analysis and commentary on progress toward that goal through 2002, the midpoint of the challenge period.

**METHODS.** Cancer mortality rates were examined from 1990 through 2002, and projections to the Year 2015 were made. Cancer deaths that were prevented or deferred by the declining death rates were expressed as the difference between the observed and projected numbers of deaths and the numbers that would have been observed over that period had the 1990 death rates persisted.

**RESULTS.** Since 1990, cancer mortality rates have been declining in the U.S. by approximately 1% per year. Trends especially have been favorable for cancers of the breast, prostate, and colorectum and for lung cancer among men. Should this rate of decline continue over the coming decade, death rates from cancer will be approximately 23% lower in the Year 2015 than they were in 1990, and approximately 1.8 million deaths from cancer will have been prevented or deferred.

**CONCLUSIONS.** At this midpoint of the 25-year challenge period, it appears that fully reaching the goal will require substantial breakthroughs in cancer early detection and/or in cancer therapy. Between now and 2015, however, many more cancer deaths can be averted by concerted action to control tobacco and obesity, by redoubling efforts in mammography and colorectal screening, and by enacting policies to close gaps in access to cancer detection and treatment services. *Cancer* 2006;107:396–405. © 2006 American Cancer Society.

**KEYWORDS:** cancer rates, mortality, breast, prostate, lung, colorectal.

In 1996, the Board of Directors of the American Cancer Society (ACS) set an ambitious challenge goal for the U.S.: to reduce cancer death rates by 50% between 1990 and the 2015.<sup>1</sup> In 2003, the Director of the National Cancer Institute further challenged the nation to eliminate the suffering and deaths because of cancer by 2015.<sup>2</sup> Ambitious cancer objectives such as these are not unprecedented. In 1986, the National Cancer Institute set a goal to reduce cancer mortality rates by 50% between 1985 and 2000.<sup>3</sup> Although that goal was not reached, cancer mortality rates in the U.S. did begin to decline during the decade of the 1990s.<sup>4</sup> The timing of that decline was consistent with historically favorable trends in cancer

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risk factors, early detection, and treatment.<sup>5</sup> However, considerable potential remains to reduce cancer mortality further by applying the cancer-control methods we now have in hand and by discovering new methods for cancer prevention, early detection, and treatment.<sup>6</sup> In this report, we examine the trends in cancer death rates from 1990 through 2002, the approximate midpoint of the 25-year challenge period. Based on trends in cancer risk factors, early detection, and treatment, we comment on the likelihood of future trends in cancer mortality to the Year 2015.

## MATERIALS AND METHODS

This is a descriptive study of trends in both the major risk factors for cancer and in cancer mortality rates in the U.S. Data regarding the trends in prevalence of various cancer risk factors were obtained from the Behavioral Risk Factor Surveillance System and from other special surveys.<sup>7–11</sup> Cancer mortality data were obtained from the National Center for Health Statistics.<sup>7,12</sup> All mortality rates were age-adjusted to the U.S. 2000 standard population by the direct method, using 10-year age intervals.<sup>7</sup> Cancer death rates for the Years 1999 to 2002 were adjusted further to account for cancer site-specific coding changes between the International Classification of Diseases, 9th Revision (ICD-9) and the ICD-10 coding rules.<sup>13</sup> We examined age-standardized death rates from all cancers combined (ICD-9 codes 140–208, ICD-10 codes C00–C97), lung cancer (ICD-9 code 162, ICD-10 codes C33–C34), colorectal cancer (ICD-9 codes 153–154, ICD-10 codes C18–C21), breast cancer in women (ICD-9 code 174, ICD-10 code C50), prostate cancer (ICD-9 code 185, ICD-10 code C61), and all other cancer sites (apart from lung, colorectal, breast, and prostate). Age-adjusted mortality rates were examined for all sites stratified by gender, age (ages 35–54 years, ages 55–64 years, and ages 65–84 years), and race/ethnicity (African American, white, Hispanic). Mortality data for Hispanics were limited to the 39 states from which ethnic-specific mortality data were available for the entire study period.<sup>14</sup>

Trends in cancer mortality rates between 1990 and 2002 were expressed as average percent change per year, calculated as the mean of the percent declines in the 12 yearly intervals from 1990 to 2002. Then, trends between 1990 and 2002 were projected by linear extrapolation to the Year 2015 for total cancer mortality rates. The number of cancer deaths that would have been expected if the 1990 rates had remained unchanged was estimated by applying

1990 rates to subsequent observed population counts through 2002 and projected populations through 2015.<sup>15</sup> The numbers of cancer deaths prevented or deferred until an older age over this 25-year period then were expressed as the differences between the expected numbers of deaths and the deaths that were observed through 2002 as well as those that were projected to 2015.

## RESULTS

Cancer death rates declined in the U.S. between 1990 and 2002 by approximately 1% per year for all sites combined (Table 1). Declining mortality rates have been observed for all subgroups defined by gender, age, and race/ethnicity. However, declines were substantially greater for individuals ages 55 years to 64 years and for African Americans. Declines were substantially less for individuals ages 65 years to 84 years and for Hispanics. Declines have been particularly steep for breast and colorectal cancer among women and for prostate, colorectal, and lung cancer among men (Table 2, Fig. 1). Trends for all other cancer sites have declined at a much slower rate. Death rates from lung cancer among women increased from 1990 to 1998 and then stabilized through 2002. Trends for cancers of the colorectum, breast, and prostate have been tracking toward the ACS 50% reduction goal (Fig. 1).

Trends in major cancer risk factors have been mixed (Table 3). Historic downward trends in the prevalence of regular tobacco smoking among adults slowed after 1990, but there has been a continuing modest, downward trend in the number of cigarettes smoked per day by smokers, with a reduction from an average of 19.1 per day in 1990 to 16.6 per day in 2000.<sup>8</sup> Obesity trends have been adverse since 1990 among both men and women. Long-term trends in the use of hormone-replacement therapy (HRT) have not been well described to date, but there was a 38% decline in HRT sales immediately after the 2001 publication of the Women's Health Initiative trial, which showed adverse effects of HRT,<sup>9,16</sup> and other estimates place the decrease in the use of HRT at approximately 50%.<sup>10,11</sup> The use of endoscopic screening for colorectal cancer (sigmoidoscopy or colonoscopy) has increased substantially in recent years, approximately doubling since the mid-1990s, although only approximately 50% of individuals age  $\geq 50$  years report having had such examinations. Mammography use continues to increase, although the rate of increase has diminished in recent years. Long-term trends in prostate-specific antigen (PSA) screening have not been documented well, but widespread PSA

TABLE 1  
Trends in Cancer Mortality Rates in the U.S. by Gender, Age, and Race/Ethnicity, 1990 to 2002\*

Year	All individuals	Gender		Age			Race/Ethnicity		
		Male	Female	35-54 years	55-64 years	65-84 years	White	African American	Hispanic
1990	216.0	280.3	175.7	89.7	449.6	1042.2	211.6	279.6	141.1
1991	215.2	278.2	175.7	87.2	447.6	1043.6	210.9	278.0	141.0
1992	213.5	275.6	174.7	86.0	436.3	1046.3	209.5	273.8	140.7
1993	213.5	274.9	174.9	84.7	431.2	1051.9	209.4	276.0	140.5
1994	211.7	271.1	174.4	84.0	421.8	1052.0	208.0	270.5	140.3
1995	209.8	267.5	173.6	82.6	412.3	1046.8	206.2	267.7	140.1
1996	206.7	262.4	171.3	80.8	402.2	1039.1	203.3	263.3	139.9
1997	203.5	257.0	169.3	79.7	390.6	1026.5	200.0	260.2	139.6
1998	200.7	252.6	167.2	78.5	378.2	1024.2	197.7	253.9	139.4
1999	199.4	250.2	166.5	77.2	372.1	1021.4	196.7	250.8	138.4
2000	198.3	247.2	166.5	77.4	364.2	1018.2	195.9	246.8	136.5
2001	194.3	242.1	163.7	78.0	354.1	1004.8	192.6	241.5	134.7
2002	192.3	237.3	162.0	75.9	348.7	989.3	190.4	237.2	—
Average % decline per year <sup>†</sup>	1.0	1.4	0.7	1.4	2.1	0.4	0.9	1.3	0.4

\* Rates are per 100,000 population and were adjusted to the 2000 U.S. age distribution by using the direct method. Rates for the years 1999 to 2002 were adjusted further to account for the change in coding from the International Classification of Disease, 9th Revision (ICD-9) to the ICD-10 (see Anderson et al., 2001<sup>15</sup>). Data regarding Hispanics for 2002 are not yet available.

<sup>†</sup> The average percent declines per year are the means of the changes across the 12 yearly intervals between 1990 and 2002.

testing began in the middle to late 1980s; PSA screening increased substantially during the 1990s; and, by 2002, the majority of U.S. men age  $\geq 50$  years reported having been tested.<sup>7,17</sup>

Declining cancer death rates since 1990 already have translated into >315,000 deaths from cancer prevented or deferred through 2002 (Table 4). Projecting the trends since 1990 linearly forward, there will be approximately 1 million cancer deaths prevented or deferred by the Year 2010 and approximately 1.8 million by the Year 2015. Increasing the rate of decline in cancer mortality from now forward at a pace sufficient to achieve the ACS 50% reduction goal could lead to >2.3 million cancer deaths being prevented or deferred by the Year 2015, compared with the numbers of deaths that would have been expected if the 1990 rates had remained unchanged.

## DISCUSSION

If the trends over the past 12 years continue into the future at the same trajectory, then the U.S. will experience an approximately 23% lower age-standardized death rate from cancer in the Year 2015 compared with the Year 1990. This is approximately 50% of the ACS 2015 challenge goal to halve the cancer death rate over this 25-year period. If this rate of decline continues into the future, then cancer death rates will be 50% lower than 1990 only after the Year 2040. Clearly, however, estimating future trends only by linear extrapolation is a crude way to foretell

future events. Indeed, we believe that many changes could speed the future rate of improvement in cancer mortality in the U.S. In the current study, we commented on the current trends in cancer mortality and risk factors, and we speculated regarding how both past and emerging events may affect future trends between now and the Year 2015.

## Lung Cancer

Tobacco is the largest single cause of death from cancer in the U.S.<sup>18</sup> Historically, tobacco use has been on the decline since the 1960s, but the downward trends in the prevalence of regular cigarette smoking slowed in the 1990s (Table 3). Lung cancer mortality began to decline among men in 1990, but rates increased among women in the 1990s. However, there likely will be a downward trend in lung cancer death rates among women in the near future because lung cancer incidence rates have begun to fall among women in recent years.<sup>4</sup> Despite the proven effectiveness of well funded tobacco-control programs, such programs have not been developed in all states, and some of the most effective programs have been cut in recent years because of state budget shortfalls. The growing disparity in tobacco use among the states could be reduced by a federal excise tax on tobacco products dedicated to funding tobacco control adequately in every state. New pharmacologic aids that soon may emerge for tobacco cessation may reduce smoking prevalence substantially. However, the long latency between tobacco

**TABLE 2**  
Trends in Cancer Mortality Rates in the U.S. by Cancer Site 1990 to 2002\*

Year	All cancer sites	Cancer site/Gender					
		Lung/Men	Lung/Women	Colorectal	Breast/Women	Prostate	All other sites
1990	216.0	91.9	37.1	24.5	33.3	38.4	101.3
1991	215.2	90.0	37.8	23.7	32.7	38.9	101.5
1992	213.5	88.1	38.8	23.4	31.6	38.9	101.0
1993	213.5	87.6	39.4	23.1	31.4	39.0	101.1
1994	211.7	85.6	39.7	22.7	30.9	38.2	100.9
1995	209.8	84.2	40.3	22.4	30.5	37.0	100.1
1996	206.7	82.6	40.4	21.7	29.5	35.7	99.3
1997	203.5	81.2	40.9	21.4	28.2	33.9	98.0
1998	200.7	79.7	41.1	21.1	27.6	32.4	96.9
1999	199.4	78.1	40.9	20.9	26.5	30.9	96.9
2000	198.3	78.2	40.9	20.8	26.6	30.0	95.6
2001	194.3	78.0	42.0	20.1	25.9	28.5	94.3
2002	192.3	76.2	41.7	19.7	25.5	27.5	92.7
Average % decline per year <sup>†</sup>	1.0	1.6	-1.0	1.8	2.2	2.7	0.7

\* Rates are per 100,000 population for all races/ethnicities and were adjusted to the 2000 U.S. age distribution by using the direct method. Rates for the years 1999 to 2002 were adjusted further to account for the change in coding from the International Classification of Disease, 9th Revision (ICD-9) to the ICD-10 (see Anderson et al., 2001<sup>13</sup>).

<sup>†</sup> The average percent declines per year are the means of the changes across the 12 yearly intervals between 1990 and 2002.

cessation and reduced lung cancer risk means that only those reductions in tobacco use that can be achieved in the next few years will have a substantial impact on lung cancer mortality by the Year 2015. Tobacco reduction needs to continue as a high-priority, long-term objective, however, because new investments in tobacco control will yield important cancer reductions beyond 2015.

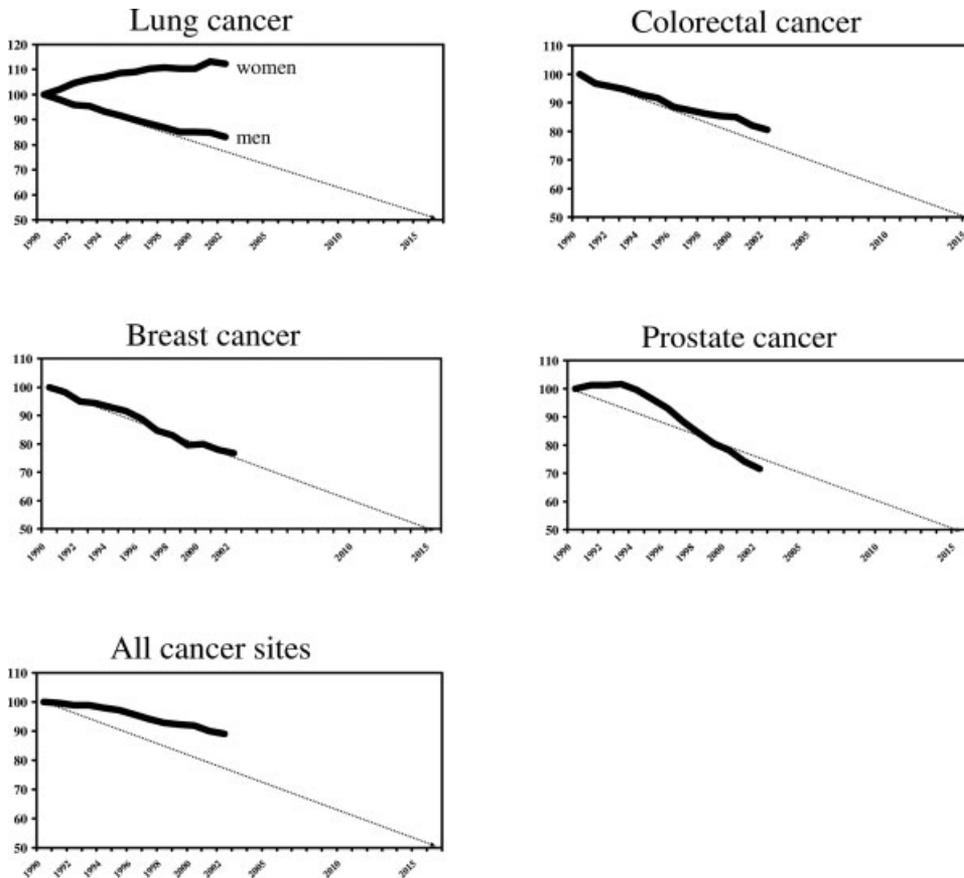
Treatment for advanced lung cancer continues to be largely ineffective, although there have been advances in recent years. New developments in targeted therapies for lung cancer may have substantial effects on overall cancer mortality, because lung cancer accounts for approximately 25% of all cancer deaths. If ongoing trials of selenium supplementation for lung cancer risk reduction show positive results, then selenium supplements also could have a favorable impact on lung cancer rates before 2015.

Treatment of early-stage lung cancer is much more effective, but only a small proportion of lung cancers currently are detected at early stages; therefore, effective lung cancer screening methods are needed. The effectiveness of annual chest X-rays in reducing lung cancer mortality is now being examined as part of the Prostate, Lung, Colorectal, Ovary (PLCO) trial, an ongoing comparison of chest X-rays, sigmoidoscopies, PSA tests, and ovarian screening tests (vs. no screenings) among >154,000 individuals.<sup>19</sup> The effectiveness of computed tomography (CT) scanning of the lung fields is being examined in

the National Lung Screening Trial (NLST), a randomized controlled study among approximately 50,000 smokers and former smokers that is comparing lung cancer mortality outcomes from annual CT scans versus chest X-rays.<sup>20</sup> Neither the PLCO trial nor the NLST is likely to produce results until after 2008, however, so even if one or both of these trials show lung cancer mortality reductions from screening, most of the benefits from widespread implementation of radiologic screening programs would not be apparent until after 2015. However, it is clear that down-staging of lung cancer at diagnosis is possible with CT screening. On this basis alone, some CT screening is now being done outside the context of the NLST. If CT screening does reduce mortality, then the small amount of lung screening now being done in the U.S. will yield some mortality reductions before 2015. Considering all factors, it is likely that, between now and the Year 2015, the downward trends in mortality from lung cancer will continue at approximately the same rate for men and soon will begin to become apparent for women. Among both genders, then, we will likely experience an overall steeper decline from lung cancer in the coming decade than over the past decade.

### Colorectal Cancer

Colorectal cancer mortality rates have been declining steadily for many years, even before 1990.<sup>18</sup> It has been demonstrated that several lifestyle factors affect the risk of colorectal cancer, including obe-



**FIGURE 1.** U.S. cancer mortality trends for are illustrated selected cancer sites from 1990 to 2015. An asterisk indicates mortality per 100,000 population per year, age adjusted to the U.S. 2000 standard population, expressed as a percentage of the 1990 rate. The solid line shows the observed mortality rates, and the dotted line is the line drawn between the 1990 mortality rate and the 2015 rate that would be 50% lower than the 1990 rate (i.e., the decline consistent with the American Cancer Society challenge goal).

sity, HRT, and nonsteroidal antiinflammatory drugs (NSAIDs).<sup>6,16,21</sup> Being overweight increases the risk; however, paradoxically, the declining trend in death rates from colorectal cancer has persisted despite the obesity epidemic.<sup>22,23</sup> It is likely that, without the obesity epidemic, the colorectal cancer mortality decline would have been even steeper; therefore, the pace of colorectal mortality reduction may be increased if the obesity epidemic can be stopped, then reversed.

It is known that both HRT and NSAIDs reduce colorectal cancer risk, but these drugs are not recommended for this purpose, because they also have adverse side effects.<sup>16,21</sup> The use of both HRT and NSAIDs was on the increase during the 1990s, then their use suddenly changed. HRT use dropped after the 2001 publication of an overall adverse effect of HRT in the Womens' Health Initiative (WHI) trial.<sup>9-11,16</sup> The sudden drop in HRT use will have an adverse effect on future colorectal cancer trends among women, because both the WHI trial and other observational studies have shown that HRT use reduces risk of colorectal cancer risk.<sup>16</sup> Recent findings of adverse effects of selective cyclooxygenase 2 inhibitors on cardiovascular disease risk<sup>24</sup> likely will result

in substantial declines in the use of these NSAIDs, which will have an adverse affect on future trends in colorectal cancer.

Treatment for colorectal cancer is improving,<sup>25</sup> but the single most effective strategy to prevent deaths from colorectal cancer may be the prevention of colorectal cancer by the identification and removal of colorectal polyps.<sup>26</sup> Rates of endoscopic screening of the colorectum (sigmoidoscopy or colonoscopy) have increased in the past 10 years; however, only approximately 50% of adults ages  $\geq 50$  years in the U.S. report ever having had an endoscopic examination.<sup>7</sup> However, Medicare included coverage for all recommended colorectal screening methods in 2001,<sup>27</sup> and recent national publicity has increased substantially the public interest in screening.<sup>28</sup> There is a high potential to reduce future death rates from colorectal cancer by accelerating the pace of increased endoscopic screening, which also could offset the adverse effect of changes in HRT and NSAID use in the coming years. The emergence of CT colography (virtual colonoscopy) as an option in screening in the future also may serve to increase screening rates. Overall, there is a high likelihood that the rate of decline in deaths from color-

**TABLE 3**  
Trends in Major Cancer Risk Factors and Cancer Screening in the U.S. by Gender, 1990 to 2002\*

Year	Risk factors (%)			HRT (millions) <sup>§</sup>	Screening (%)		
	Smoking <sup>†</sup>		Obesity <sup>‡</sup>		Colorectal endoscopy <sup>  </sup>	Mammograms (women) <sup>¶</sup>	PSA (men) <sup>**</sup>
	Men	Women					
1990	24.9	21.3	11.6			58.3	
1991	25.1	21.3	12.6			62.2	
1992	24.2	21.0	12.6			63.1	
1993	24.0	21.1	13.7		24	66.5	
1994	23.9	21.6	14.4			66.6	
1995	24.8	20.9	15.8	10	29.4	68.6	
1996	25.5	21.9	16.8			69.2	
1997	25.4	21.1	16.6	13	32.7	70.3	
1998	25.3	20.9	18.3			72.3	
1999	24.2	20.8	19.7	15	33.7	72.8	
2000	24.4	21.2	20.1			76.1	
2001	25.4	21.2	21.0	15	46.3		56.7
2002	25.7	20.8	22.1		48.1	75.9	53.7

HRT indicates hormone-replacement therapy; PSA, prostate-specific antigen.

\* Risk factor prevalences are expressed as percent of the population (see U.S. Department of Health and Human Services, Centers for Disease Control and Prevention<sup>7</sup>).

<sup>†</sup> Smoking is the percent of adults age ≥18 years who currently are regular smokers.

<sup>‡</sup> Obesity is the percent of the adult population with a body mass index ≥30 kg/m<sup>2</sup>.

<sup>§</sup> HRT is the estimates of sales to women, in millions of women receiving prescriptions. That number in 2003 was 10 million (38% lower than the 2001 number; see Hersh et al., 2004<sup>8</sup>).

<sup>||</sup> Colorectal endoscopy is the percent of adults age ≥50 years who have had a lower gastrointestinal endoscopic examination (sigmoidoscopy or colonoscopy) in the previous 5 years.

<sup>¶</sup> Mammograms is the percent of women age ≥40 years who have had a mammogram in the past 2 years.

\*\* PSA is the percent of men age ≥50 years who report having a PSA test in the last year.

ectal cancer will be steeper in the coming decade than was observed in the last decade.

### Breast Cancer

Breast cancer remains the second leading cause of cancer mortality in women.<sup>18</sup> The average decline in breast cancer death rates of approximately 2.2% per year since 1990 is likely the combined result of earlier diagnosis (especially by mammography) and better treatment (especially the use of antiestrogen therapies). Although there has been debate regarding the relative importance of screening versus treatment in reducing breast cancer mortality rates, it is clear that early diagnosis and effective treatments work synergistically to improve breast cancer outcomes.<sup>29</sup> The declining rates of mortality from breast cancer followed the increasing trends in screening mammography in the U.S. during the 1980s.<sup>5,6</sup> However, the rate of increase in screening mammography use has diminished over the past several years, and economic forces in the health care system present future challenges. An increasing proportion of Americans either have no health insurance at all, or they have plans that feature high deductibles and high copays for clinical preventive services, such as mammography. In the meantime, screening capacity is

decreasing in the U.S.<sup>30</sup> Until >90% of American women age >40 years are receiving annual mammograms, the potential remains unrealized for a much more substantial reduction in breast cancer mortality.

It is important to note that these favorable trends have been seen in an era in which there were unfavorable trends in both HRT use and obesity, 2 major risk factors for breast cancer.<sup>9,16,22,23</sup> The sudden reduction in HRT use after publication of the WHI trial results in 2001<sup>9-11</sup> should help to reduce breast cancer incidence and mortality in the future. The dramatic increase in obesity in the past decade, however, will result in increased incidence of postmenopausal breast cancer in years to come. First stopping and then reversing the obesity epidemic will produce important reductions in future breast cancer rates.<sup>22</sup>

Progress in breast cancer treatment also is continuing, especially in the development and application of hormone-targeted therapies. Recent findings of a substantial benefit of trastuzumab as adjuvant therapy for women with HER-2 positive breast cancer is an example of the remarkable ongoing progress in breast cancer therapy.<sup>31</sup> Between now and 2015, aromatase inhibitors most likely will replace or shorten

**TABLE 4**  
**The Number of Observed Deaths from Cancer in the U.S. from 1990 through 2002, the Number of Deaths that Would Have Been Observed if 1990 Death Rates had Persisted through 2002, and the Number of Deaths Expected through 2015 under Alternative Scenarios**

Year	No. of deaths observed	No. of deaths expected with 1990 rates unchanged	Difference	Cumulative difference
1990	505,322	505,322	0	0
1991	514,657	515,719	1062	1062
1992	520,578	524,883	4305	5367
1993	529,904	533,801	3897	9264
1994	534,310	541,966	7656	16,920
1995	538,455	550,552	12,097	29,017
1996	539,533	559,160	19,627	48,644
1997	539,577	567,791	28,214	76,858
1998	541,532	577,194	35,662	112,520
1999	549,838	585,835	35,997	148,517
2000	553,091	598,755	45,664	194,181
2001	553,768	610,054	56,286	250,467
2002	557,271	622,056	64,785	315,252
2010 (with 23% mortality reduction by 2015)			123,315	1,110,684
2015 (with 23% mortality reduction by 2015)			136,552	1,778,310
2015 (with 50% mortality reduction by 2015, projected from 2002 rates)			296,852	2,350,629

the duration of tamoxifen therapy as breast cancer treatment for postmenopausal women.<sup>32</sup> Aromatase inhibitors also substantially reduce the incidence of second primary cancers in the contralateral breast. Because estrogen is the likely mechanism of effects of obesity on breast cancer growth, the wider use of aromatase inhibitors may serve to offset the adverse effects of obesity on breast cancer mortality. By 2008, findings from the Study of Tamoxifen and Raloxifene (STAR) trial likely will be known.<sup>33</sup> If it is found that Raloxifene is equivalent to tamoxifen for breast cancer prevention and has a more favorable overall risk profile, then the wider use of raloxifene by postmenopausal women may have an important impact on breast cancer incidence and mortality rates before 2015. Considering all of these competing factors, it is likely that, in the coming decade the downward trends in mortality from breast cancer will continue at a rate similar to that observed in the past decade.

### Prostate Cancer

Prostate cancer is the second most common cause of cancer death in men, and African-American men are at significantly greater risk of dying from prostate cancer than white men.<sup>18</sup> The reasons for the approximately 2.7% per year downward trend in prostate cancer mortality since 1990 are uncertain, but this era closely followed the introduction of PSA

screening in the U.S. and the advent of more effective treatments.<sup>34</sup> Although indirect evidence suggests that there will be mortality benefits from PSA screening, to our knowledge no trials have been completed to date demonstrating the size of the mortality benefit from PSA screening; therefore, it is not possible to know how much of this favorable trend has been because of early diagnosis, how much has been because of improvements in treatment, or how much may have been caused by other spurious factors, such as changes in the way the cause of death is listed on death certificates.<sup>35</sup> In the coming years, clear results of a benefit to mortality from either the PLCO trial in the U.S.<sup>19</sup> or the European PSA trial<sup>36</sup> will help to specify screening recommendations better. However, because these results may not be known for several years to come, and because there well may be a long latency between PSA screening and a mortality benefit, changes in screening rates resulting from these trials may not have a substantial effect on death rates from prostate cancer before the Year 2015.

Chemoprevention research in prostate cancer may have an impact on prostate cancer by 2015. The Prostate Cancer Prevention Trial provided an important proof of principle that antiandrogen therapies can reduce prostate cancer risk.<sup>37</sup> Although the benefits of finasteride for prevention were not demonstrated clearly from that trial,<sup>38,39</sup> other agents that

interfere with androgen effects on prostate cancer growth may prove to be useful for chemoprevention in the future. In addition, if the ongoing factorial Selenium and Vitamin E Trial in >30,000 men in the U.S.<sup>40</sup> indicates as rapid a benefit from 1 or both of those nutritional supplements on prostate cancer risk as was observed in earlier trials,<sup>41,42</sup> then nutritional supplementation and/or antiandrogen chemoprevention may produce a favorable impact on prostate cancer mortality before 2015. In the interim, treatment for patients with advanced prostate cancer continues to improve.<sup>43</sup>

### Other Cancers

Although mortality rates have been declining by approximately 2% per year from the 4 most common causes of cancer death (lung, colorectal, breast, and prostate), much less progress has been made in the other 50% of all adult cancers in the U.S. Favorable trends in tobacco use and nutrition and general progress in cancer treatments have affected some cancers beneficially, such as cancers of the head and neck, stomach, and bladder.<sup>6</sup> Stopping and then reversing the obesity epidemic may have favorable effects on obesity-related cancers, which have been increasing, such as adenocarcinoma of the esophagus and renal cancer.<sup>22</sup> For many of the other cancers, however, such as cancers of the pancreas, brain, and ovary and the hematopoietic malignancies, risk factors are poorly understood, and there are no effective early-detection methods. For these cancers, current hope for improvement needs to be from the development of better methods for early cancer detection, such as what might emerge from proteomics, and from the development of better treatments. Proteomic patterns in blood that may detect cancers at early stages could be coupled with sensitive imaging methods to lead to highly effective approaches for earlier cancer detection. There is also a high potential for immediate impact from new discoveries in targeted cancer therapies, because many of these agents may be useful to control cancer growth in many organ sites.<sup>44</sup>

### Age Factors

The less favorable trend in cancer mortality among the elderly is likely the combined effect of the tendency for the elderly to forego both cancer screening and more aggressive treatment<sup>45,46</sup> as well as the phenomenon of the compression of mortality into older ages because of cancer treatments that do not cure cancer but only slow its growth. Some of the decisions to forego effective therapies are reasonable choices because of the comorbid conditions that

many elderly patients experience. However, the benefits of screening and treatment can be underestimated in the elderly, because life expectancy often is underestimated both by the elderly and by health care providers. The average life expectancy of an individual age 65 years in the U.S. is now nearly 20 years.<sup>47</sup> Because many of the newer targeted approaches to cancer therapy are based on a strategy to control cancer growth rather than to eradicate malignancy, this will delay more cancer deaths into older ages, thereby serving to increase death rates from cancer in older ages. Therefore, we should expect this force to diminish the progress in cancer mortality among the elderly in years to come.

### Socioeconomic Factors

There appear to be interacting economic, social, and biologic reasons for disparities by race and ethnicity in U.S. cancer mortality.<sup>18</sup> African Americans experienced a steeper decline in cancer death rates between 1990 and 2002 than did white Americans, but a wide disparity continued to persist (25% higher age-adjusted death rates for African Americans than for white Americans in 2002). If the current trends continue, then the U.S. racial disparity in cancer mortality will not be eliminated until many decades beyond the Year 2010, which is the year currently targeted by national objectives.<sup>48</sup>

Racial and ethnic minorities are more likely to live in poverty (24% of African Americans and 27% of Hispanics live in poverty compared with only 8% of non-Hispanic whites).<sup>49</sup> Cancer mortality is higher in areas with high poverty rates, regardless of race/ethnicity.<sup>50</sup> Poverty, therefore, is an important factor in cancer disparities by race and ethnicity in the U.S. There are many opportunities to close the socioeconomic gaps in cancer in the U.S., including increasing efforts to reduce the socioeconomic gaps in tobacco use and obesity, increasing the reach of current programs for providing cancer screening, and enacting national policies to assure that all cancer patients have access to fully effective therapies.<sup>6,51</sup>

In summary, we recently have experienced over a decade of early progress in the war on cancer. Over the first half of the 25-year ACS challenge period, cancer death rates have been declining at about 2% per year for the 4 most common cancer sites (breast, prostate, colorectal, and lung cancer). These are the cancers for which we have known interventions for prevention, early detection, or treatment. For all other cancer sites, progress has been substantially less. For all cancer sites, there has been an approximately 1% decline in death rates each year since 1990. This trend would produce only an approxi-

mately 23% lower age-adjusted mortality rate in 2015 than was experienced in 1990. Hence, the ACS challenge goal to reduce cancer mortality rates by half over this 25-year period may be only half met. Fully achieving the objective of halving the cancer death rate by 2015 will require major new breakthroughs in cancer early detection and therapy.

It is important to remember that these predictions are only best guesses based on past events. It seems that progress is persistent, however, and there are many possible breakthroughs on the horizon. Preliminary mortality data from 2003 indicate a continuing rate of decline in cancer mortality.<sup>52</sup> Just how much steeper the future downward slope in cancer death rates can be will depend on the extent to which policy makers and the American public can join together to create systems and incentives to reduce several behavioral risk factors for cancer (especially tobacco use and obesity), to facilitate early cancer detection (especially for colorectal cancer), and to assure that state-of-the-art treatment is available for all Americans who are affected by cancer.

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