Technical Report

Screening for Cervical Cancer in Primary Care: A Draft Decision Analysis for the U.S. Preventive Services Task Force

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Structured Abstract

Importance: The US Preventive Services Task Force (USPSTF) is updating its 2018 cervical cancer screening recommendations.

Objective: To provide the USPSTF with updated model-based estimates of the benefits and harms of cervical cancer screening strategies that varied by five main attributes: (1) screening test (cytology, human papillomavirus (HPV) testing, and cytology and HPV cotesting), (2) age to start screening, (3) age to switch to primary HPV testing or cotesting if preceded by cytology, (4) rescreening interval (following a screen-negative result), and (5) age to stop screening.

Design: Comparative modeling using four microsimulation models that produce outcomes with and without cervical cancer screening in a hypothetical cohort of US 21-year-old female persons (all race) born in 2002 who begin the simulation prior to sexual initiation (e.g., age 9). Three separate base-case analyses were conducted to reflect HPV vaccination status: (1) not HPV-vaccinated; (2) fully vaccinated with either the bivalent (2vHPV) or quadrivalent (4vHPV) vaccines, providing protection against HPV-16/18; and (3) fully vaccinated with the nonavalent (9vHPV) vaccine, providing protection against HPV-16/18/31/33/45/52/58. Analyses were repeated with a single model to evaluate strategies among female persons of Black race.

Exposures: Age to start screening was evaluated at ages 21 (cytology only), 25, 30, 35 and 40 years. Age to switch from cytology to HPV testing or cotesting was evaluated at ages 25 or 30 years. The rescreening interval was evaluated at every 3 years (cytology only), 5 years or 10 years (HPV and cotesting). Age to stop screening was evaluated at 60, 65, or 70 years. Full adherence to screening initiation, rescreening interval, and follow-up for both diagnostic and pre-cancer treatment referrals was assumed. Scenario analyses included imperfect screening and follow-up adherence, alternative triage management, and the health impacts of a one-time screen at ages 35, 45, 55, and 65 years with HPV self-collection among previously unscreened female persons.

Main Outcome and Measures: Estimated lifetime benefits (life-years gained [LYG], cervical cancer cases and deaths), harms (number of screening tests, colposcopy referrals, false-positive screens), and detected CIN2 or worse for a cohort of 1,000 21-year-old female persons. Efficiency ratios were calculated to measure the harm-benefit tradeoff of screening strategies; we selected strategies that were efficient or near-efficient on both metrics of colposcopies per LYG and total tests per LYG. We repeated the efficiency analysis for each of the three separate base-case cohorts and used efficiency ratios associated with current US guidelines-based cervical cancer screening strategies in the unvaccinated population as indicative benchmarks for identifying potentially efficient strategies in the vaccinated populations.

Results: In the unvaccinated (all race) population, three US guidelines-based strategies involving HPV testing and cotesting were on the efficiency frontier for most models, while the guidelines-based strategy of 3-year cytology alone from ages 21 to 65 years was not efficient for any model. Several cotesting scenarios were also on the efficiency frontier but were on the upper, flat (less efficient) part of the frontier. Other efficient strategies involved mostly 5-year HPV testing starting at ages 25 or 30 years with a later end age of 70 years.

In the vaccinated cohorts, the models estimated that equal or greater levels of health benefit can be achieved at similar levels of efficiency with less intensive screening. In 2vHPV/4vHPV vaccinated cohorts, strategies of 5-year or 10-year HPV testing starting at age 30 to 40 years were efficient and had ratios that were comparable to current guidelines-based strategies in the unvaccinated population. In 9vHPV vaccinated cohorts, strategies identified as efficient according to the current guidelines-based benchmarks almost universally involved 10-year HPV testing with start ages of 30 to 40 years (and variable end ages).

The analysis of Black female persons using a single model estimated lower absolute benefits and harms associated with screening, compared to female persons of all races; however, strategies identified as efficient under assumptions of perfect screening adherence were nearly identical for both populations and by vaccination status. Assuming imperfect screening and follow-up adherence resulted in reduced health benefits, as well as harms, in each of the three cohorts by vaccination status. Under imperfect adherence, the gap in health benefits between female persons of Black race and female persons of all races widened, although the disproportionate impact of imperfect adherence by race was somewhat attenuated by HPV vaccination.

The base-case findings were generally stable when we assumed HPV-16/18 triaging and when HPV test sensitivity was varied. When the models were used to explore HPV self-collection for single lifetime screening of previously unscreened female persons, screening benefit was estimated to be generally greater when the screen occurred at younger ages (ages 35, 45 years) and when adherence was higher.

Limitations: Simulations assumed perfect screening adherence and fully unvaccinated or vaccinated cohorts with no herd immunity benefits. Alternative strategies or criteria to determine when to stop screening were not explored.

Conclusions: This collaborative modeling analysis suggests that routine cervical cancer screening is effective in reducing cervical cancer cases and deaths and improving life expectancy, even in fully HPV-vaccinated populations. Primary HPV-based testing strategies were found to be efficient irrespective of vaccination status. For the HPV-vaccinated populations, the models estimated that equal or greater levels of health benefit can be achieved efficiently with less intensive screening.

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Chapter 1. Introduction

Roughly 13,960 female persons* are expected to develop and 4,310 female persons are expected to die from cervical cancer in the United States in 2023,[1] despite over 60 years of widespread screening with Papanicolaou (Pap) cytology testing, and more recently testing for human papillomavirus (HPV), the causative agent of cervical cancer. Regular reviews of the most recent data, using the best available analytic tools, provide evidence on which to base screening recommendations. Described here is a decision analysis using the Cancer Intervention and Surveillance Modeling Network (CISNET) cervical cancer models to accompany a systematic evidence review describing current gaps in the expected benefits and harms of cervical cancer screening strategies in primary care.[2] The key questions for the decision analysis center around the long-term health benefits and harms of various cervical cancer screening strategies after multiple rounds of screening. For the first time, this analysis includes consideration of HPV vaccination and its impact on cervical cancer screening outcomes and efficiency.

Progress to reduce cervical cancer incidence has been uneven by race. For example, the Surveillance, Epidemiology, and End Results Program (SEER) cancer registry shows that Hispanic, non-Hispanic Black, and American Indian/Alaskan Native populations have consistently higher annual age-adjusted incidence and mortality from cervical cancer than non-Hispanic White populations.[3] For Black female persons, cervical cancer incidence in 2020 was 10% higher, and mortality was 40% higher, than the US average. Reasons for these differences are multifactorial but are fundamentally related to historic and contemporary discrimination. Among the measurable impacts of this discrimination is differences in access to cervical cancer screening and appropriate follow-up from abnormal findings.[4]

Evidence of the short-term risks of cervical precancerous lesions associated with HPV alongside the development of new technologies to improve detection of precancer and cancer have motivated updated screening recommendations. In 2012, for the first time, cervical cancer screening recommendations were consistent across several major guidelines-making organizations, including the US Preventive Services Task Force (USPSTF), which recommended routine cytology screening every 3 years starting at age 21, with an option to switch to cytology and HPV "cotesting" every 5 years starting at age 30 and ending at age 65, for those with adequate screening history and not at high risk.[5-7] In 2018, with newer evidence on – and FDA approval of – primary HPV testing among female persons ages 25 years and older, the USPSTF updated their recommendations to add an option after cytology screening every 3 years starting at age 21, to switch to primary HPV testing every 5 years between ages 30 and 65.[8] The American Cancer Society (ACS) issued updated recommendations in 2020, with a recommendation to initiate screening at age 25 years with a preferred option for 5-year primary HPV testing without preceding cytology screening.[9] Though the recommendations between the two guidelines-making organizations vary some, both reflect an important shift towards primary HPV testing.

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* Throughout this report, we use the term "female persons" to refer to individuals with a cervix, regardless of gender identity (consistent with Caughey AB, Krist AH, Wolff TA, et al. USPSTF Approach to Addressing Sex and Gender When Making Recommendations for Clinical Preventive Services. *JAMA* 2021;326(19):1953-1961).

The availability and uptake of HPV vaccination has further changed the cervical cancer landscape, as a growing number of female persons who were vaccinated starting in year 2006 – and therefore face lower cervical cancer risks – are now age-eligible for screening.[10] According to NIS-TEEN,[11] HPV vaccine completion of at least two doses among 15-year-old female persons of all races in year 2013 (i.e., those born in year 1998 and currently age 25 years) was nearly 50% (**Appendix Figure 1**); in 2017, HPV vaccine completion at age 15 years (i.e., those born in 2002 and currently age 21 years) was 58.9% for all-race and 52.8% for Black-race female persons. In 2021, HPV vaccine completion among 15-year-olds increased to 73.0% for all and Black female persons. Additionally, the share of doses that are 9vHPV (nonavalent) compared to 4vHPV (quadrivalent) or unknown has increased over time, suggesting a higher level of protection against cervical disease among rising birth cohorts (**Appendix Figure 2**).[11] For example, in 2015, the share of HPV vaccine doses that were 9vHPV was 5.7% among all-race and 2.6% among Black-race 15-year-old female persons (i.e., birth year 2000, current age 23 years), but by year 2017, the share of 9vHPV vaccine doses increased to 38.9% for all-race and 34.9% for Black-race 15-year-old female persons. In year 2021, the share of 9vHPV vaccine doses was 85.1% for all-race and 79.6% for Black-race 15-year-old female persons.[11]

Empirical evidence typically reflects only intermediate endpoints, usually over a limited number of screening rounds, as the prolonged natural history of HPV to cervical cancer is generally beyond the scope of randomized clinical trials and observational studies. Decision analyses using mathematical models that simulate the natural history of disease and extrapolate outcomes to project long-term benefits and harms with repeated screening have been recently used to accompany evidence reviews in USPSTF cancer screening recommendations.[12-15] Importantly, these models can explore what-if scenarios and the impact of alternative assumptions on the harm-benefit trade-off of screening. The model-based decision analyses that accompanied the 2018 USPSTF cervical cancer screening recommendations found that strategies involving 3-yearly cytology screening with a subsequent switch to 5-yearly primary HPV-based screening were equally or more effective and efficient than 3-yearly cytology, with or without a switch to 5-yearly cotesting.[15] The 2020 ACS recommendations for cervical cancer screening also included modeling results as part of the evidence to shift towards primary HPV-based screening in the United States.[9]

This decision analysis using the CISNET cervical cancer models accompanies the systematic review[2] and addresses the following Key Questions:

1. How does the effectiveness of cervical cancer screening strategies in reducing cervical cancer incidence and mortality vary by (1) test, (2) age to start screening, (3) age to switch to HPV primary or cotesting, if preceded by cytology, (4) rescreening interval (following a negative result), and (5) age to end screening?
2. How do the harms of different cervical cancer screening strategies in reducing cervical cancer incidence and mortality vary by (1) test, (2) age to start screening, (3) age to switch to HPV primary or cotesting, if preceded by cytology, (4) rescreening interval (following a negative result), and (5) age to end screening?
3. Which cervical cancer screening strategies are considered efficient in terms of the additional number of (1) colposcopies required per additional life-year gained, and (2) tests required per life-year gained?

Unlike the 2018 modeling report, three separate base-case analyses were conducted to reflect female persons who are expected to face differential levels of baseline cervical cancer risk depending on HPV vaccination status: (1) not HPV-vaccinated; (2) fully vaccinated with bivalent (2vHPV) or quadrivalent (4vHPV) vaccines, providing protection against HPV-16/18; and (3) fully vaccinated with the nonavalent (9vHPV) vaccine, providing protection against HPV-16/18/31/33/45/52/58.

Each of the Key Questions was reassessed using a model that reflects Black US female persons, as well as imperfect screening and follow-up adherence, to examine the impact of screening on cervical cancer disparities in the context of real-world practice. In addition, we conducted sensitivity analyses to explore the impact of alternative triage management, variation in HPV test performance, and opportunities for HPV self-collection.

Chapter 2. Methods

Overview of Models

Four decision models from the Harvard T.H. Chan School of Public Health (Harvard), Erasmus Medical Center (MISCAN-Cervix) from The Netherlands, University of Sydney/Daffodil Centre (Policy1-Cervix) from Australia, and University of Minnesota (UMN) were used for comparative modeling to address the key questions. The four modeling teams are part of the CISNET Cervical Working Group, and the Harvard and UMN teams have led the decision analysis for previous USPSTF recommendations.[5,8] Descriptions of the decision models in terms of model attributes, natural history, vaccination, and screening strategies are provided below; key similarities and differences between the models are summarized in **Table 1**. The Harvard and Policy1-Cervix models were programmed in C++, MISCAN-Cervix in Python, and UMN in Java.

Natural History Component

Overview

The four CISNET individual-based models describe the natural history of cervical cancer in an unscreened and unvaccinated population, based on the reasonably well-understood natural history pathway of HPV infection to cervical cancer. Three of the models reflect all cervical cancers, while the Harvard model reflects the natural history of squamous cell carcinomas (SCC), which accounts for over 70% of cervical cancers.[16] For all models, simulated female persons enter the model at an early age (e.g., age 9 years), in a disease-free health state and are followed over their lifetimes. Each female person undergoes transitions between health states that describe underlying true health, including HPV infection (by genotype), pre-cancer (e.g., cervical intraepithelial neoplasia or CIN, grades 1 to 3) and invasive cancer (by stage) (**Figure 1**). Transition probabilities can vary by HPV type, age or duration of infection or lesion status, and history of prior HPV infection or CIN treatment. Natural immunity is modeled as a level of protection against future type-specific HPV infection that can be applied uniformly or to a proportion of previously infected female persons. Cancer detection can occur through symptoms or screening. In all four models, individuals are subject to background mortality and hysterectomy (after which they are no longer at risk for cervical cancer), as well as excess mortality from cervical cancer by stage.

Risk of HPV Acquisition and Clearance

In all four models, risk of acquiring an HPV infection varies stochastically across individuals and by age. HPV-16 and -18 are stratified separately in all four models. The MISCAN-Cervix and UMN models pool the five other high-risk HPV types (HPV-31, -33, -45, -52, -58) targeted by the 9vHPV vaccine into a single category, whereas the Harvard and Policy1-Cervix models stratify these five high-risk types individually. All models pool the remaining high-risk HPV genotypes into a single category. HPV clearance in all models varies by HPV genotype. For the MISCAN-Cervix, Policy1-Cervix and UMN models, clearance from HPV is age-specific, while for the Harvard model, HPV clearance is a function of HPV persistence (i.e., time since infection) rather than age.

Progression and Regression of Precancer

The UMN, MISCAN-Cervix, and Policy1-Cervix models capture HPV, CIN1, CIN2, and CIN3 as separate states (noting that HPV and CIN1 are interpreted as separate states relating to productive HPV infection), whereas the Harvard model combines HPV and CIN1 into a single state (i.e., CIN1 is interpreted as a microscopic manifestation of acute HPV infection and is therefore incorporated into the HPV-infected state[17,18]). Progression from HPV to precancer and regression from precancer to HPV (or no lesion) are functions of individual or groups of HPV genotypes. Similar to HPV clearance, the models differ in how transitions between health states are defined. For example, transitions to and from CIN health states in the Harvard model are a function of infection or lesion duration, whereas in all other models, the transitions are invariant by time-in-state but may vary by a woman's age. For the Harvard and MISCAN-Cervix models, CIN lesions can develop in the absence of a high-risk HPV infection (i.e., due to low-risk HPV genotypes), while the Policy1-Cervix and UMN models assumed CIN develops due to high-risk HPV only.

Progression to Cancer

In all four models, cervical cancer can only develop if a high-risk HPV infection is present. All models allow multiple precancers within individuals (due to different HPV genotypes or genotype groups) and allow the time from precancer onset to progression to preclinical invasive cancer to vary stochastically across individuals and across precancers within individuals. Cervical cancer groupings vary by staging according to SEER (i.e., local, regional, distant) for Harvard, MISCAN-Cervix, and Policy1-Cervix, or the International Federation of Gynecology and Obstetrics (FIGO) (I to IV) for UMN; MISCAN-Cervix additionally includes a micro-invasive cancer stage. Similar to the progression and regression of HPV infections and precancer, the Harvard model captures the probability of progression to cancer as a function of the duration of the precancerous lesion, whereas in all other models, the progression to cancer is invariant by time-in-state but may vary by a woman's age. However, the MISCAN-Cervix model allows for two types of CIN3; non-progressive CIN3 has a shorter duration than progressive CIN3. In addition, for the Harvard model, CIN2 and CIN3 are modeled as non-sequential precancerous health states with distinct probabilities of progression to cancer.

Progression to Clinically-Detected Cervical Cancer

All models allow sojourn time (i.e., the time from preclinical cancer onset to cancer detection via symptoms rather than screening) to vary stochastically across individuals. Median sojourn time varies among the models from 2.3 to 5.3 years.[19]

HPV Vaccination

HPV vaccination effect is modeled as a reduction in the incidence of vaccine-type HPV infections, which is a function of model inputs on age at vaccine receipt, vaccine efficacy, and duration of vaccine protection. In addition, vaccine impact on cervical precancer and cancer burden is proportional to the cervical disease and cancers attributable to infections with specific HPV genotypes, i.e., HPV type distribution.

Screening, Diagnosis, and Treatment of Precancer

Screening is used for early detection of invasive cancer, as well as to detect the presence of high-grade precancers (CIN2 and CIN3), which may resolve spontaneously or, if screen-detected, can be treated and removed before progressing to cancer. The population-level effectiveness of screening over repeated screening rounds depends on uptake by age, interval, test characteristics, treatment efficacy, and adherence to follow-up visits. Screening assumptions in the model can vary by primary screening test, start age, stop age, interval between negative screens, triage testing following screen-positive results, uptake, and adherence to recommended follow-up. Management of screen-positive female persons can vary by age, follow-up test, time to follow-up test(s), and number of negative follow-up tests required to return to routine screening. Colposcopy and biopsy are used to diagnose precancer or cancer. Precancer treatment involves primarily loop electrosurgical excision procedure (LEEP) but may include other types, such as conization or ablation therapies.

Following successful precancer treatment, two of the models (MISCAN-Cervix and UMN) return female persons to a healthy, uninfected state, while the Harvard and Policy1-Cervix models assume that a proportion of female persons who receive treatment retain their HPV infection. Furthermore, the Policy1-Cervix model incorporates a more aggressive post-treatment natural history to capture the documented increased risk of development of new cervical precancer and cancer in female persons previously treated for precancer.[20-22]

Cancer Treatment and Survival

Preclinical cancers can progress through stages (e.g., local to regional to distant) until detection through either symptoms or screening. The likelihood of cancer detection due to symptoms rather than screening increases with increasing cancer stage. Once detected, female persons with cancer are subject to excess mortality as a function of cancer stage, age, and time since diagnosis, based on 5-year conditional relative survival estimates in SEER.[3] All models assume no excess mortality due to cervical cancer in survivors, from 15 years after initial cancer detection.

Model Calibration

A process of model calibration was undertaken to ensure fit to observed data from the US population. The models calibrate highly uncertain parameters, which include HPV incidence (by age and genotype), CIN progression and regression, and HPV natural immunity following type-specific HPV infection and clearance.

Calibration approaches varied by model. For example, for the Harvard model, baseline values for each of the uncertain parameters were randomly selected from a pre-determined plausible range, creating a unique natural history parameter set. Goodness of fit was ascertained by calculating the likelihood of model-projected outcomes from each parameter set against corresponding calibration targets. For the Harvard model, uncertainty in the natural history parameters was captured by using the 50 best-fitting parameter sets in all analyses; the base-case results were reported as the mean value across the 50 sets; sensitivity analysis employed a single top-fitting set. For the MISCAN-Cervix model, a genetic algorithm was adapted to identify a single top-fitting parameter set that fit well to the observed target data, while the UMN model used a stochastic optimization algorithm (i.e., simulated annealing) and manual fine-tuning. The Policy1-Cervix model similarly used an optimization algorithm (i.e., differential evolution method) to calibrate to the target data, identifying a best-fitting parameter set. The calibrated model parameter values used in this analysis are summarized in **Appendix Table 1**.

Sources for the calibration target data were selected on the basis of representativeness of the general US population, sampling methods, and sample size. All data were from populations prior to widespread HPV vaccination. Age- and type-specific prevalence of HPV infections was based on data from the New Mexico HPV Pap Registry (NMHPVPR), the only statewide screening registry in the United States.[23] HPV type distribution in cases of CIN and cancer (by cancer histology) were also included as calibration target data. For CIN2 and CIN3, HPV type distribution was based on data from the NMHPVPR;[24] for cancer, HPV type distribution was based on a study by the US Centers for Disease Control and Prevention (CDC) using tissue samples from US population-based cancer registries.[25] Model fit to calibration targets are displayed in **Figures 2–4**.

Model Validation

Model validation exercises were conducted to assess model fit to data not used as direct inputs or as part of the calibration process. First, age-specific cervical cancer incidence rates under an assumption of no intervention (i.e., natural history) were projected by the models and compared against cancer registry data from the 1950s and early 1960s, before cytology-based screening was widely performed (**Figure 5**).[26,27] Given the limited data from only a few states (Connecticut, New York, Hawaii) – and the potential changes in sexual behavior and other risk factors since the pre-screening era – these data were not used directly to calibrate the models but instead were used to assess predictive validity for overall underlying risk.

Next, model-projected outcomes of age-specific cervical cancer incidence and mortality rates were compared against those reported in the SEER cancer registries in recent years (i.e., 2000-2013) (**Figure 6**), under assumptions of cervical cancer screening practice patterns based on data from sites involved in the METRICS Center, a multi-site cervical cancer screening group that examines the effects of screening practice on outcomes as part of the PROSPR II consortium.[4,28-30] Screening practice patterns included estimated proportions of female persons never screened, based on data from the National Health Interview Survey (NHIS),[31] and screened at different intervals (e.g., annual, biennial) and proportions of female persons who do not comply to follow-up diagnostic testing and/or precancer treatments (see section on Imperfect Screening Adherence below for further detail).

Lastly, we simulated the protocols of empirical studies included in the EPC report[2] and compared model-estimated outcomes to the empirical outcomes. Specifically, we compared the relative risks (RRs) of colposcopy referral, CIN2+ detection, and CIN3+ detection reported in randomized controlled trials of primary HPV testing compared to cytology-based screening and, separately, cotesting to cytology-based screening (**Figure 7**).[32-37] The empirical studies varied in terms of study population, age ranges, screening history, and test performance; thus, we assumed the range of the relative performance of the HPV testing and cotesting strategies provided bounds for comparison with our model generated outcomes. **Table 2** summarizes the screening strategies modeled for the validation exercise; the model predicted RRs were calculated based on counts of colposcopy referral, CIN2+ detected, and CIN3+ detected at ages 30 and 31 years.

Screening Strategies

The primary analysis will focus on the three Key Questions assessing the comparative effectiveness and harms of different cervical cancer screening strategies. Given the high uptake of HPV vaccination among current and incoming screen-eligible female persons, three separate base-case analyses were conducted to reflect HPV vaccination status, and thereby differential levels of baseline cervical cancer risk: (1) not vaccinated; (2) fully vaccinated with either the 2vHPV or 4vHPV vaccines, providing protection against HPV-16/18; and (3) fully vaccinated with the 9vHPV vaccine, providing protection against HPV-16/18/31/33/45/52/58. Unvaccinated individuals were modelled as a population in the complete absence of HPV vaccination.

For each of the three populations stratified by vaccination status, we evaluated 73 strategies that varied by five main attributes: (1) screening test, (2) age to start screening, (3) age to switch to primary HPV testing or cotesting if preceded by cytology, (4) rescreening interval (following a screen-negative result), and (5) age to stop screening (**Table 3**). Screening tests included cytology, primary HPV testing, and cytology and HPV cotesting. Age to start screening was evaluated at ages 21 (cytology only), 25, 30, 35 and 40 years. Age to switch, from cytology to either HPV testing or cotesting or from a shorter interval to longer interval, was evaluated at ages 25, 30, 35, 40, and 45 years. The rescreening interval was evaluated at every 3 years (cytology only), 5 years or 10 years (HPV and cotesting), given the lower cervical cancer risk in the vaccinated cohorts. Age to stop screening included 60, 65, or 70 years, assuming a final negative routine screen at each end age.

Guideline-based screening strategies included: (1) cytology alone every 3 years from ages 21 to 65 years; (2) cytology alone every 3 years from age 21 years, with a switch to primary HPV testing every 5 years from ages 30 to 65 years; (3) cytology alone every 3 years from age 21 years, with a switch to cotesting every 5 years from ages 30 to 65 years; and (4) primary HPV testing every 5 years from ages 25 to 65 years.[8,9] Management of female persons with abnormal tests was based on guidelines revised in 2019 by the ASCCP (formerly known as the American Society for Colposcopy and Cervical Pathology)[38] (**Figure 8**) and included: for cytology testing, reflex HPV testing for female persons with atypical squamous cells of undetermined significance (ASC-US) and referral to colposcopy for those with more severe abnormal results; for HPV testing, cytology triage for female persons with high-risk HPV positive results with referral to colposcopy for those with ASC-US or worse and repeat HPV testing in 12 months for those with cytology-negative, HPV-positive results; for cotesting, immediate referral to colposcopy of female persons with cytology worse than ASC-US (irrespective of HPV test result) or cytology-ASC-US, HPV-positive results, and repeat cotesting in 12 months for female persons with cytology-negative, HPV-positive results with referral to colposcopy for those with HPV-positive and/or ASC-US or worse. Those with histologically-confirmed CIN2+ are then referred for excisional precancer treatment (e.g., LEEP), after which there is a series of follow-up testing prior to return to routine screening; female persons with lower-grade or no lesions from colposcopy undergo less intensive follow-up testing. The base-case analysis assumed full adherence to screening initiation, rescreening interval, and follow-up for both diagnostic and pre-cancer treatment referrals, consistent with prior analyses.

Inputs

Screening Test Characteristics

The models vary in how they incorporate screening test characteristics, but all used values that were consistent with data reported in randomized controlled trials and meta-analyses, which report the absolute and relative sensitivity and specificity of cytology, HPV testing, and cotesting. Test sensitivity and specificity values were defined at a disease threshold of CIN2 (i.e., CIN2 or worse is considered disease “positive”; less than CIN2 is considered disease “negative”) (**Table 4**).[39-49]

For cytology testing, two models (Harvard and UMN) input test characteristics directly, while for MISCAN-Cervix and Policy1-Cervix, the models are fitted either to data on the distribution of cytology test results (e.g., cytology-histology correlations) (Policy1-Cervix)[50,51] or to precancer detection rates and interval cancers among screened female persons (MISCAN-Cervix).[52] MISCAN-Cervix differentiates between lesions missed either randomly or systematically over time. For strategies involving cytology testing, we applied estimates of test sensitivity and specificity from a meta-analysis conducted by Koliopoulos et al, [39] which pooled estimates of sensitivity and specificity (ASC-US cut-off) for detection of CIN2+ based on 15 studies (sensitivity 72.9% (95% confidence interval (CI): 70.7-75.0%) and specificity 90.3% (95% CI, 90.1-90.5%)).

For HPV testing, all models directly input a test positivity matrix as a function of HPV positivity given true presence of HPV infection for a given disease health state based on RCTs and clinical studies.[41-49] We then ensured that the implied test sensitivity and specificity of HPV testing given presence and absence of CIN2+ were consistent with those reported in RCTs and meta-analyses.[40,49] Given the wide variation in absolute test characteristics across studies due to differences in protocols and populations, we elected to utilize relative sensitivity and specificity values, compared with cytology testing (positivity threshold of ASC-US or worse). Our base-case estimates were anchored on the U.S.-based ATHENA study,[40] which provided verification-bias adjusted estimates and included both HPV testing and cotesting strategies with similar follow-up algorithms as what was evaluated in the current analysis, but we explored the impact of test performance of HPV testing in sensitivity analysis.

Colposcopy/Biopsy and Precancer Treatment

There is known variation in the performance of histologic diagnosis of precancer in clinical practice in the United States.[53] In order to isolate the impacts of primary screening in our analysis, we made the simplifying assumption that colposcopy and biopsy were perfectly accurate for identifying underlying precancer status (i.e., sensitivity and specificity values were both 100%); sensitivity analysis in the 2018 USPSTF decision analysis showed that conclusions were not influenced by this assumption.[15] We assumed that the effectiveness of treatment in removing a CIN2 or CIN3 lesion (e.g., via LEEP) was 93%.[54]

Cervical Cancer Death, Non-Cervical Cancer Death, and Hysterectomy

All four models applied common inputs for relative stage-specific cervical cancer survival conditional on age at and time since diagnosis (surviving to year 1, 3, 5 and 10) from the Surveillance, Epidemiology, and End Results (SEER) program. [3] Simulated individuals faced age-specific background mortality rates reflecting the 2000 birth cohort from the Berkeley Mortality Database (data for the 2002 birth cohort not available) to capture death from all causes.[55] Finally, all models applied common age- and birth cohort-specific hysterectomy rates, based on smoothed estimates from Simms/Yuill et al.[56]

HPV Vaccination

In the vaccinated cohorts, all four models assumed complete (100%) coverage of girls at age 12 years with 100% protection against high-risk HPV genotypes targeted by either the 2vHPV/4vHPV (HPV-16/18) or 9vHPV (HPV-16/18/31/33/45/52/58) vaccines. We assumed protection was over the lifetime but did not assume any cross-protection against HPV types not targeted by the vaccines.

Outcomes

Each of the models has the capability to produce a common set of analytic outcomes associated with each strategy. These model-generated outcomes reflect both health effects and harms over the lifetime of the screening cohorts (i.e., ages 21 to 100 years): total number of tests, colposcopy referrals, detected CIN2 or worse (i.e., CIN2, CIN3, and cervical cancers), false positive cases, cervical cancer cases, cervical cancer deaths, and life-years gained (LYG) compared to no screening (from age 21 years). These measures were calculated as the cumulative number of events or time spent in the different health states of the lifetime of the cohort, which were then modified by the screening process. These measures in totality captured the benefits and harms of the strategies being considered. Analytic outcomes were presented as ranges across the 4 models, as well as the median estimate (reflecting the average of the two middle models).

Benefits

The models estimated LYG (compared to no screening) as the primary outcome for the benefits of screening in each of the base-case cohorts (unvaccinated, 2vHPV/4vHPV vaccinated, 9vHPV vaccinated). Additional measures of benefit included cervical cancer cases and deaths.

Harms

The total lifetime number of tests (i.e., including both cytology and HPV tests) and colposcopy referrals represented the primary harms and burden of cervical cancer screening. Both measures included tests or colposcopies that resulted from screening, follow-up, and surveillance. An additional measure of harm included the total number of false positive cases (i.e., colposcopies without underlying CIN2, CIN3 or cancer).

Ratio of Harms (Burden) to Benefit

Similar to a traditional incremental cost-effectiveness analysis, we calculated an efficiency ratio of incremental harms to incremental benefits of one strategy compared to the next less harmful strategy. Strategies deemed "efficient" formed an efficiency frontier with the measure of harm on the x-axis and health benefit on the y-axis; the efficiency ratio is equal to the inverse of the slope of two neighboring strategies along the frontier and represents the additional number of harms required to increase the measure of benefit by one unit. On the lower, steep end of the frontier, the ratios are lowest and more efficient; in contrast, on the upper, flat part of the frontier, the ratios are highest and less efficient, reflecting diminishing marginal returns. This ratio reflects a strategy's "value" in terms of the harm-benefit tradeoff.

Two distinct measures of efficiency that had been used in prior USPSTF decision analyses for cervical cancer screening[15,57] were selected to evaluate the harm-benefit tradeoffs associated with the screening strategies: (1) the incremental number of colposcopies per life-year gained (LYG), and (2) the incremental number of total tests per LYG. The efficiency ratios were therefore defined as the additional number of colposcopies (or tests) divided by the additional LYG of a specific strategy (strategy x) compared to the strategy associated with the next fewer colposcopies (or tests) (strategy y). For example:

$$Efficiency\ ratio = \frac{Colposcopies_{Strat\ x} - Colposcopies_{Strat\ y}}{LYG_{Strat\ x} - LYG_{Strat\ y}}$$

Strategies with a higher number of colposcopies or tests and lower LYG than an alternative strategy were strongly dominated and were thereby considered "inefficient." Additionally, strategies that provided lower LYG than another and had a higher efficiency ratio were weakly dominated and also deemed inefficient. All other strategies were considered "efficient" and formed the efficiency frontier (noting that strategies on the upper, flat part of the frontier may be less efficient and may not necessarily represent good value). In addition to efficient strategies, we also identified "near-efficient" strategies, which we defined as a strategy within 2% of the efficiency frontier (i.e., any strategy whose actual benefits were within 98% of the expected benefits, given the increase in harms and ratio of the next best strategy). For each model, we selected strategies that were efficient or near-efficient on both metrics of colposcopies per LYG and tests per LYG for further consideration since each measure of harm indicates a different valuation of burden.

We repeated the efficiency and near-efficiency calculations for each of the three separate base-case analyses for female persons who are: (1) not vaccinated; (2) fully vaccinated with 2vHPV or

4vHPV vaccines; and (3) fully vaccinated with the 9vHPV vaccine. Because there is no consensus on the appropriate harm-benefit tradeoffs using these metrics, we used efficiency ratios associated with current US guidelines-based cervical cancer screening strategies in the unvaccinated population as indicative benchmarks for identifying potentially efficient strategies in the vaccinated populations.

Scenario and Sensitivity Analyses

We evaluated alternative scenarios and uncertainty in the data, including assessing the impact of the screening strategies in a race-specific model for Black female persons, imperfect screening and follow-up adherence, triage approach using HPV-16/18 genotyping for primary HPV and cotesting, test performance for HPV testing, and the potential benefits of HPV self-collection among previously unscreened female persons.

Race-Specific Analysis

The Harvard all-race model, which was previously adapted to reflect Black female persons, captures observable differences in factors related to cancer risk (mortality, hysterectomy rates) as well as cervical cancer survival data from SEER among Black female persons.[58] Importantly, this model does not assume any differences in the natural history of HPV infection and cervical cancer by race; rather it reflects the impact of larger societal inequities on burden of cervical cancer for those of Black race, including but not limited to differences in access to screening as well as timely follow up and treatment of cervical cancer precursors.[58] We used the Harvard Black-race model to replicate the base-case analyses conducted using the all-race model for each of the three cohorts by vaccination status, and compared benefits, harms, and efficiency within the Black-race model, as well as against the Harvard all-race model.

Imperfect Screening and Follow-up Adherence

Because the analysis is intended to support national recommendations, we assumed in the base case that adherence to screening and all follow-up visits, including triage of screen-positive results, surveillance testing, colposcopy/biopsy, and precancer treatment, was 100%. However, cervical cancer screening practice in the United States is not perfect and known to be quite variable by race, geography, and health care systems, with loss to follow up at every step in the screening process.[4,59-61] Using data from health networks that are part of the PROSPR II consortium (i.e., METRICS), we assessed the impact of imperfect screening practice on our findings.[4] We assessed under-screening, timely screening, and over-screening using data on individuals continually enrolled in the METRICS cohort, regardless of vaccination status. We adjusted these data using self-reported estimates of the totally unscreened population from the 2019 National Health Interview Survey.[62] We also used data from the METRICS consortium to estimate the proportion of patients receiving follow-up to colposcopy from an indicated abnormal finding within six months. We did not have data on the rate of follow-up to excisional treatment, however we assumed the same rate as follow-up to colposcopy. We assumed that estimates of imperfect screening practice were applicable to vaccinated populations. Estimation of screening patterns was repeated specifically assessing outcomes for those of self-identified Black race, which was used in the Harvard Black-race model to assess the differential impact of imperfect screening and follow-up (**Table 5**).

HPV-16/18 Genotype Triage of High-risk HPV-Positive Results

The base-case analysis assumed that management of female persons with high-risk HPV involved triage with a cytology test to determine who is referred immediately to colposcopy versus for follow-up surveillance testing (see **Figure 8**). The ASCCP also recommends HPV genotype testing for HPV-16/18 as a triage option for both primary HPV testing and cotesting where available.[38] We therefore examined the impact of the alternative assumption that female persons who test positive for HPV-16/18 are referred directly to colposcopy and those who test positive for other high-risk HPV types undergo cytology triage (see **Appendix Figure 3**).

Test Performance of HPV Testing

We explored the lower- and upper-bound values of relative test sensitivity for HPV testing compared to cytology testing that was used in the prior 2018 USPSTF decision analysis[15], based primarily on data from the US-based ATHENA trial[40] and a meta-analysis by Arbyn et al.[49] Three models (Harvard, Policy1-Cervix, UMN) each replicated the base-case analyses using the lower-bound and upper-bound relative HPV test sensitivity values of 1.15 and 1.37, respectively, which reflect variations across HPV tests that include the Cobas HPV test (Roche), Hybrid Capture 2 (Qiagen), and PCR-based tests. Relative HPV test specificity values remained between 0.96 and 0.98, compared to cytology testing, consistent with the empirical data.

Impact of HPV Self-Collection on Unscreened Female Persons

The majority of studies evaluating adherence to HPV self-collection, including the four US-based studies, targeted female persons who were underscreened.[2] The sparse data on follow-up management and multiple rounds of screening over time among this underscreened population limited our ability to use the models to evaluate HPV self-collection as part of routine screening. In order to explore the potential health gains from HPV self-collection, we elected to conduct an analysis assuming a single lifetime screen among previously unscreened and unvaccinated female persons, occurring at either age 35, 45, 55, or 65 years to understand the range of health benefits by age. Each analysis was conducted under three assumptions of adherence to follow-up visits: (1) “perfect” adherence to colposcopy referral and precancer treatment, (2) “reduced” adherence consistent with the METRICS data for colposcopy referrals and precancer treatment (72.5% for all races, 65.3% for Black race) (**Table 5**),[4] and (3) “low” adherence using an estimate from a self-sampling study conducted in the Mississippi Delta (i.e., 28.6%).[63] We applied the relative sensitivity and specificity values of HPV self-collected samples versus clinician-collected samples based on a study by Stanczuk et al. [64] that was included in the EPC report.[2] Specifically, we assumed that the relative sensitivity and specificity of self-collected sampling versus clinician-collected sampling were 0.93(CIN2+)/0.95(CIN3+) and 0.98, respectively. The analysis was repeated using the Harvard Black-race model to identify any differential impacts by race.

Chapter 3. Results

Health Benefits and Harms

Overview of Natural History and Impact of Vaccination on Baseline Risk

In the absence of screening and HPV vaccination, estimates of lifetime risk of cervical cancer for US female persons of all races ranged from 1.1% to 2.1% across the four models (median 1.5%) and lifetime risk of cervical cancer mortality ranged from 0.51% to 0.86% (median 0.73%).

Baseline risks of cervical cancer incidence and mortality decreased considerably in populations vaccinated fully with the 2vHPV, 4vHPV, or 9vHPV vaccines. In the absence of screening, the models predicted that the lifetime risk of cervical cancer decreased by 60% to 77% (median 70%) to 0.37% to 0.65% (median 0.43%) for female persons vaccinated against HPV-16/18 infections (with either 2vHPV or 4vHPV) and by 79% to 93% (median 88%) to 0.14% to 0.34% (median 0.15%) for female persons vaccinated against HPV-16/18/31/33/45/52/58 infections (with 9vHPV). Cervical cancer mortality decreased by 58% to 77% (median 69%) to 0.20% to 0.25% (median 0.21%) for individuals vaccinated with 2vHPV or 4vHPV, and by 76% to 91% (median 88%) to 0.07% to 0.12% (median 0.09%) for individuals vaccinated with 9vHPV. Life-years gained (LYG) across the models ranged from 112 to 165 (median 127) per 1,000 21-year-old female persons fully vaccinated with 2vHPV or 4vHPV vaccines, and 145 to 198 (median 159) per 1,000 21-year-old female persons fully vaccinated with the 9vHPV vaccines, compared to no vaccination or screening.

Impact of Screening

Model-estimated outcomes of cervical cancer cases, cervical cancer deaths, LYG, total tests, colposcopies, CIN2+ detected, and false positive cases per 1,000 female persons projected under scenarios of screening are shown separately for the three base-case cohorts of female persons unvaccinated (**Tables 6-8**), vaccinated fully with the 2vHPV or 4vHPV vaccines (**Tables 9-11**), and vaccinated fully with the 9vHPV vaccine (**Tables 12-14**).

The overall gain in health benefits associated with the different screening strategies was considerable, irrespective of vaccination status, although the absolute magnitude of benefits due to screening was smaller among the vaccinated cohorts. Compared to no screening, all screening strategies resulted in reductions in cervical cancer cases and deaths, with greater benefits accruing with younger start and switch ages, shorter intervals, and later end ages. Likewise, harms of screening, including number of tests, colposcopies, and false positive results were generally greater among the more intensive strategies, although these outcomes also diminished in the vaccinated cohorts. Strategies with the lowest benefits in all models were those that involved initiating screening at age 35 or 40 years (without preceding cytology testing) and/or at 10-year interval ending at age 60 years. Strategies with the highest benefits involved those that initiate screening at either age 21 (with cytology) or age 25 years (with HPV testing or cotesting), with 5-yearly intervals ending at age 70 years. All else being equal, cotesting strategies yielded higher benefits than HPV testing strategies, although in most cases the difference was relatively small. In the unvaccinated population, the estimated health benefits in terms of LYG due to screening were generally higher in the Harvard and UMN models compared to the other models; the Harvard model also estimated greater harms in terms of number of colposcopies, while Policy1-Cervix estimated fewer harms. Absolute differences in outcomes across strategies and models tended to decrease in the vaccinated populations.

Unvaccinated Population

<u>Cancer Cases, Deaths, LYG</u>

In the unvaccinated population, across all screening strategies and all models, the lifetime number of cervical cancer cases ranged from 0.7 to 9.5 per 1,000 21-year-old female persons, and lifetime number of cervical cancer deaths ranged from 0.1 to 3.1 per 1,000 21-year-old female persons. Compared to no screening, the reductions in lifetime risk attributable to screening ranged from 50% to 96% for cases, and 62% to 98% for deaths across all strategies considered and all models (**Table 6**).

The three current USPSTF guidelines-based strategies were associated with cancer reductions ranging from 68% to 94% for cases and 77% to 96% for deaths across the models, compared to no screening; the corresponding LYG ranged from 140 to 195 per 1,000 21-year-old female persons (51 to 71 days of life gained per person, 7.4 to 18.7 cervical cancer cases averted per 1,000 21-year-old female persons), compared to no screening. Among the three USPSTF guidelines-based strategies, all models found that 3-year cytology alone from ages 21 to 65 years yielded the lowest health benefit, followed by 3-year cytology at age 21 with a switch to 5-year HPV testing at age 30 to 65 years. The highest health benefit came from the strategy involving switching to 5-year cotesting at age 30 to 65 years (although the difference between cotesting and HPV testing was much smaller than the difference between cytology and HPV testing).

Strategies that were associated with lower LYG than current guidelines-based strategies generally involved later screening start ages (e.g., 30, 35, 40 years) and/or 10-year interval, particularly when in combination with an earlier screening stop age of 60 years. Strategies that were associated with greater LYG in all models than the current USPSTF guidelines-based strategy of 3-yearly cytology alone from ages 21 to 65 years generally involved start or switch age for HPV testing or cotesting of 25 years, 5-year intervals, and/or later end age of 70 years. These more effective strategies resulted in an additional 8 to 10 LYG per 1,000 21-year-old female persons (2.8 to 3.8 days of life gained per person, 0.1 to 1.0 cervical cancer cases averted per 1,000 female persons) among strategies with screening end age of 60 years (combined with HPV testing or cotesting starting at age 25); 5 to 15 LYG per 1,000 21-year-old female persons (1.9 to 5.5 days of life gained per person, 0.7 to 1.6 cases averted per 1,000 female persons) among strategies with screening end age of 65 years; and 1.2 to 17 per 1,000 21-year-old female persons (0.4 to 6.2 days of life gained per person, 0.5 to 1.9 cases averted per 1,000 female persons) among strategies with screening end age of 70 years.

Total Tests and Colposcopies

The number of total tests over the lifetime across all strategies and models ranged from 3,327 to 26,151 tests per 1,000 female persons; US guidelines-based strategies ranged from 10,947 to 23,683 total tests per 1,000 female persons. As expected, strategies involving earlier start or switch age, more frequent intervals, and cotesting were generally associated with a greater number of total tests; end age was less influential on total number of tests (**Table 7**). For example, switching from primary HPV testing to the same strategy with cotesting resulted in at least a 52% increase in total tests (and over 100% with some strategies), and changing the start age from 30 to 25 for the same screening strategy resulted in a 16% to 23% increase in total tests. In contrast, changing the screening end age from 65 years to either 60 or 70 years for the same screening strategy resulted in no more than a 12% change in total tests.

The number of colposcopies over the lifetime across all strategies and models ranged from 114 to 1,821 per 1,000 female persons (US guidelines-based strategies ranged from 449 to 1,480 per 1,000 female persons). Strategies involving cotesting or primary HPV testing at earlier ages (ages 25, 30) and at 5-yearly intervals tended to have the highest number of colposcopies. For example, the guidelines-based 3-year cytology with a switch to 5-year cotesting at ages 30 to 65 years had 36% to 110% (median 53%) higher number of colposcopies across the models, compared to 3-year cytology testing continuously until age 65, and 13% to 70% (median 19%) higher number of colposcopies, compared to 3-year cytology at age 21 with a switch to 5-year HPV testing at ages 30 to 65 years. All else equal, start age and interval had the biggest impact on number of colposcopies; for example, colposcopies decreased by 22% to 34% when start age shifted from age 25 to 30 years, and by 23 to 37% when interval shifted from 5-year to 10-year; in contrast, the impact of end age was smaller with changes in colposcopy ranging from 2 to 11% when shifting from age 65 to either age 60 or 70 years.

CIN2+ Detected, False Positive Cases

The number of CIN2, CIN3 and cancer cases detected via screening were highest among strategies that involved earlier start or switch ages (age 21 or 25) and 5-year HPV testing or cotesting (**Table 8**). For example, all models found that a strategy of cytology starting at age 21 with a switch to 5-year cotesting at ages 25 to 65 had an additional CIN2+ detection of 9 to 47 per 1,000 21-year-old female persons, compared to the guidelines-based strategy of 3-year cytology without switching. Screening end age was less influential on CIN2+ detection; all else equal, shifting from end age of 65 years to either 60 or 70 years resulted in a change of 2 to 5 cases of CIN2+ detected per 1,000 female persons.

The number of colposcopies that did not result in CIN2+ detection was defined as false positive cases. Across the strategies and models, the proportion of colposcopies that were false positive ranged from 67% to 92% (**Table 8**). The trends in false positives cases tracked those of the number of colposcopies and CIN2+ cases detected, with cotesting strategies being associated with the highest number of false positives, and age to start/switch screening and interval having more influence than screening end age.

Population Vaccinated with 2vHPV or 4vHPV Vaccines

Cancer Cases, Deaths, LYG

In female persons fully vaccinated with 2vHPV or 4vHPV, the same screening strategies generally provided fewer absolute benefits, compared with those among unvaccinated female persons. Across all screening strategies and all models, the lifetime number of cervical cancer cases ranged from 0.2 to 1.9 per 1,000 21-year-old female persons, and lifetime number of cervical cancer deaths ranged from 0.04 to 1.0 per 1,000 21-year-old female persons; these estimates corresponded to LYG of 25 to 65 per 1,000 21-year-old female persons (9 to 24 days of life gained per person, 1.9 to 6.2 cervical cancer cases averted per 1,000 21-year-old female persons), compared to no screening in those fully vaccinated with 2vHPV or 4vHPV (**Table 9**).

Despite the lower absolute gains in health benefit from screening in those fully vaccinated with 2vHPV or 4vHPV vaccines, the *relative* reductions in cancer cases and deaths associated with screening were similar to those in the unvaccinated population, with reductions in lifetime risk of cervical cancer ranging from 50% to 96% for cases and 59% to 98% for deaths, compared to no screening in fully 2vHPV or 4vHPV vaccinated female persons across all strategies and all models. Likewise, the three current guidelines-based strategies were associated with cancer reductions ranging from 67% to 95% for cases and 72% to 97% for deaths across the models.

Total Tests, Colposcopies, CIN2+ Detected, False Positive Cases

Compared to screening in the unvaccinated population, corresponding strategies were associated with reductions in the number of lifetime total tests in the population of female persons vaccinated with 2vHPV or 4vHPV vaccines, ranging from 1% to 15% (**Table 10**). Strategies with higher reductions were those that involved HPV testing, which had lower follow-up testing (with cytology triage) given the lower prevalence of HPV due to vaccination in the population.

Likewise, number of colposcopies, CIN2+ detected, and false positive cases were reduced in those who received 2vHPV/4vHPV vaccines, compared to those who are unvaccinated (**Table 11**). For example, for the three current guidelines-based strategies, reductions in colposcopy ranged from 11% to 22% (median 19%) for 3-year cytology testing from ages 21 to 65 years, 25% to 32% (median 26%) for 3-year cytology starting at 21 with a switch to 5-year HPV testing at ages 30 to 65 years, and 17% to 28% (median 24%) for 3-year cytology starting at age 21 with a switch to 5-year cotesting at ages 30 to 65 years, among those who received 2vHPV or 4vHPV compared to those who were unvaccinated. Importantly, the yield of the colposcopies decreased in the population vaccinated against 2vHPV or 4vHPV in terms of a greater proportion of false positives among colposcopies, ranging from 75% to 94%.

Population Vaccinated with 9vHPV Vaccine

Cancer Cases, Deaths, LYG

In female persons fully vaccinated with the 9vHPV vaccine, the same screening strategies provided even fewer absolute benefits compared with those among female persons unvaccinated or vaccinated with 2vHPV or 4vHPV vaccines (**Table 12**). The lifetime number of cervical cancer cases diagnosed ranged from 0.1 to 0.8 per 1,000 21-year-old female persons, and lifetime number of cervical cancer deaths ranged from 0.02 to 0.4 per 1,000 21-year-old female persons, corresponding to LYG of 9 to 29 per 1,000 21-year-old female persons (3 to 11 days of life gained per person) compared to no screening in those vaccinated with the 9vHPV vaccine.

As with those vaccinated with the 2vHPV or 4vHPV vaccines, the relative reductions of cervical cancer cases and deaths attributable to screening compared to no screening of fully 9vHPV vaccinated female persons were similar to the unvaccinated population, ranging from 49% to 97% for cases, and 58% to 99% for deaths across all strategies considered and all models.

Total Tests, Colposcopies, CIN2+ Detected, False Positive Cases

Reductions in number of tests, colposcopies, CIN2+ detected, and false positives compared to those who are unvaccinated were even more pronounced in the population of female persons vaccinated with 9vHPV (**Tables 13-14**). For example, for the three current guidelines-based strategies, reductions in colposcopy ranged from 21% to 46% (median 33%) for 3-year cytology testing from ages 21 to 65 years, 52% to 58% (median 54%) for 3-year cytology starting at 21 with a switch to 5-year HPV testing at ages 30 to 65 years, and 37% to 52% (median 49%) for 3-year cytology starting at age 21 with a switch to 5-year cotesting at ages 30 to 65 years, among those who received 9vHPV compared to those who were unvaccinated. The yield of colposcopy decreased even further among those who received the 9vHPV vaccine, with the proportion of false positive cases among colposcopies increasing, ranging from 79% to 96% across all strategies and models.

Efficient Strategies by Vaccination Status

Unvaccinated Population

Of the 73 screening strategies evaluated in this analysis, 27 were identified in the Harvard model, 19 in the MISCAN-Cervix model, 11 in the Policy1-Cervix model, and 15 in the UMN model, as being efficient or near-efficient using both measures of colposcopies per LYG and tests per LYG (**Table 15, Figures 9-10**). Three of the current US guidelines-based strategies were identified on or near the efficiency frontier in three models (Harvard, MISCAN-Cervix, UMN): (1) 3-year cytology starting at 21 with a switch to 5-year HPV testing at ages 30 to 65; (2) 3-year cytology starting at 21 with a switch to 5-year cotesting at ages 30 to 65; and (3) 5-year HPV testing at ages 25 to 65 years. In the fourth model (Policy1-Cervix), the same three strategies were identified on or near the efficiency frontier but with screening end age at 70. When considering both efficiency metrics, the guidelines-based strategy of 3-year cytology alone from ages 21 to 65 years was not identified as efficient on any of the four models.

The strategies with the lowest number of colposcopies per LYG and tests per LYG (indicating high efficiency) tended to involve HPV testing at 10-year intervals; however, in the unvaccinated population, most of these strategies provided fewer LYG than the current guidelines-based strategies. Across the models, strategies with health benefit and (near-)efficient ratios that were similar to current recommended strategies included mostly HPV testing in 5-year intervals starting at ages 25 or 30, either with or without preceding cytology. Three models included 5-year HPV testing from age 25 but with a later end of age of 70 (MISCAN-Cervix, Policy1-Cervix, UMN), and three models included strategies involving cytology starting at age 21 with a switch to 5-year HPV at ages 25 or 30 with end ages at either 65 or 70 years (Harvard, Policy1-

Cervix, UMN). Although several cotesting scenarios were on the efficiency frontier, they were on the upper, flat part of the frontier yielding slightly higher LYG than similar HPV testing strategies, but with disproportionately greater number of colposcopies and tests, resulting in much higher harms-benefits ratios.

2vHPV/4vHPV Vaccinated Population

In general, the efficiency ratios of guidelines-based strategies tended to be higher in the 2vHPV/4vHPV vaccinated populations compared with the unvaccinated population (that is, more colposcopies or tests were required per LYG). For example, in the Harvard model, the USPSTF recommended strategy involving HPV testing requires nearly double the number of colposcopies per LYG in the 2vHPV/4vHPV vaccinated population than the unvaccinated population, and 2.4 times more tests per LYG.

When using the benchmarks associated with current screening recommendations for both colposcopies per LYG and tests per LYG from the unvaccinated cohort and considering which strategies would be similarly efficient in female persons vaccinated with 2vHPV or 4vHPV vaccines, all models generally identified strategies on the efficiency frontiers that involved 10-year screening intervals and/or later start age (**Table 16, Figures 11-12**). The only strategies with efficiency ratios that were equal to or less than those of current guidelines-based strategies in unvaccinated individuals on both efficiency metrics involved HPV testing alone; for example, the strategy of HPV testing every 10 years from ages 30 to 70 years was identified in 3 models, but otherwise the age to start, switch, and end varied across models. The strategy of 10-yearly HPV testing from ages 40 to 60 was identified as efficient (using both metrics) in all the models but had the lowest effectiveness in terms of LYG. Although strategies involving 5-year HPV testing were also identified as efficient or near-efficient strategies, they were generally associated with higher numbers of tests or colposcopies compared to 10-year HPV testing. As in the unvaccinated population, strategies involving cytology alone and cotesting were not selected using these benchmarks because they were either dominated or had much higher numbers of colposcopies and/or tests per LYG.

9vHPV Vaccinated Population

The efficiency ratios of guidelines-based strategies increased even more dramatically among female persons vaccinated with the 9vHPV vaccine, especially with respect to tests per LYG. For example, in the MISCAN-Cervix model, the number of required colposcopies per LYG associated with the guideline-based strategy of 5-year HPV testing from age 25 to 65 years was 2.3 times higher in the 2vHPV/4vHPV vaccinated population, and 2.9 times higher in the 9vHPV vaccinated population, compared to the unvaccinated population. For tests per LYG, the same strategy required 2.8 times more tests per LYG in the 2vHPV/4vHPV vaccinated population and over 6 times more tests per LYG in the 9vHPV vaccination population. Similar increases in ratios were found when using the other models.

When using the combined metrics of efficiency and efficiency ratios of the US recommended strategies in the unvaccinated population as indicators of efficiency, all identified strategies involved HPV testing alone, starting no earlier than age 30, and mostly at 10-year intervals

(**Table 17, Figures 13-14**). All models identified HPV testing every 10 years, either at ages 40 to 60 years (all models), 35 to 65 years (Harvard and MISCAN-Cervix) or 40 to 70 years (Policy1-Cervix and UMN). The strategy of 10-year HPV testing from ages 40 to 60 years was identified in all the models but had the lowest effectiveness but also the lowest efficiency ratio of all screening strategies using both metrics. One model included strategies with 5-year HPV testing at ages 30 to either 65 or 70 (MISCAN-Cervix), although these strategies were associated with relatively higher tests per LYG. Consistent with the 2vHPV/4vHPV vaccinated population, no strategies identified using the benchmarks included cytology or cotesting at any ages.

Scenario and Sensitivity Analyses

Findings by Race

Differences by Black Race Overall

We further analyzed the impact of 73 base-case screening strategies on female individuals of Black race using the Harvard model. The Harvard Black-race cervical cancer model reflects differences in "risk factors" resulting from social factors, including historic and contemporary discrimination, which manifest as differences in access to timely, appropriate care. Among these are differences in all-cause mortality which results in a lower life-expectancy among Black females compared to those of all races. For example, for a 21-year-old female person in the United States, the Harvard model projected life expectancy to be 55.7 years for Black female persons and 62.4 years for female persons of all races. We also identified important differences in hysterectomy rates. Using data from Adam et al, [65] we estimated age- and Black-race specific probability of hysterectomy, with Black individuals more likely to ever have a hysterectomy and to have hysterectomies at younger ages. As a result, once we adjusted for hysterectomy in the population, we estimated a smaller proportion of Black females to be at risk for developing cervical cancer relative to the proportion at risk among females of all races. Additionally, we incorporated SEER registry data on cervical cancer survival by stage and age at diagnosis for Black female persons, [3] which show lower survival, likely reflecting differences in the quality and timeliness of care rather than aggressiveness of disease.

Unvaccinated Population – Black Race

Cancer Cases, Deaths, LYG

The lifetime number of cervical cancer cases, deaths, and LYG were lower among Black female persons compared to all-race female persons, given the lower at-risk population, lower overall life expectancy, and worse cancer survival among Black female persons. For example, in the absence of screening, the lifetime number of cervical cancer cases was 13.1 per 1,000 21-year-old Black female persons, compared to 16.2 per 1,000 21-year-old females of all races (**Table 18**). For unvaccinated Black individuals, the lifetime number of cervical cancer cases across screening strategies ranged from 0.56 to 4.88 per 1,000 21-year-old Black female persons, and of cervical cancer deaths ranged from 0.10 to 1.11 per 1,000 21-year-old Black female persons (compared to 0.69 to 5.84 cervical cancer cases per 1,000 and 0.13 to 1.30 cervical cancer deaths per 1,000 for those of all races). The LYG were lower for each screening strategy (ranging from

99 to 160 per 1,000) for Black estimates as compared to all-race estimates (116 to 184 per 1,000). Importantly, in relative measures, the benefits of screening were very similar for Black versus all-race individuals, with a range across strategies of 63% to 96% reduction in cervical cancer cases (all race; 64% to 96%) and 74% to 98% reduction in cervical cancer deaths (all race; 74% to 98%). Current USPSTF guidelines-based strategies resulted in incidence reductions of 87% to 94% and mortality reductions of 90% to 96% for Black female persons, assuming perfect compliance to screening. Likewise, LYG reflected a similar proportional increase in the Black versus all-race models (ranging from 0.18% to 0.29% for the Black estimates versus 0.19% to 0.29% for all races).

The rank-ordering of strategies by LYG was identical to that of the all-race Harvard model and similar to that of the comparative modeling base-case findings (i.e., characteristics of strategies that are either less or more beneficial than current guidelines-based strategies remained similar). Although life expectancy improved for both groups in all screening scenarios, the life expectancy gap between Black and all-race estimates increased in all screening scenarios. Relative to the baseline gap of 6.71 years per 21-year-old female persons, the gap across screening strategies increased nominally from 6.73 to 6.74 years per person. The gap was wider for the strategies with larger health gains, as these resulted in smaller absolute gains for Black female persons.

<u>Total Tests, Colposcopies, False Positive Cases</u>

Given the lower cervical cancer burden in Black female persons (due to higher hysterectomy rates), we found that Black female persons had a lower total number of tests in all scenarios, ranging from 5.7% to 14.9% fewer tests across the strategies than all-race female persons in the Harvard model. These differences were larger in cotesting strategies (where more tests are generally performed for both groups) and in strategies with later start and stop ages (due to differences in hysterectomy and life expectancy). The total colposcopies and false positive results were also lower in Black individuals (from 5% to 13% for colposcopies and 5% to 14% for false positive results).

2vHPV/4vHPV Vaccinated Population – Black Race

<u>Cancer Cases, Deaths, LYG</u>

In the absence of screening, there was a 61% reduction in cervical cancer incidence and a 59% reduction in cervical cancer deaths from 2vHPV or 4vHPV vaccination among female persons of Black race, when compared to unvaccinated (and unscreened) female persons of Black race. The further proportional reductions in cancer burden when adding screening were similar to those in unvaccinated populations, ranging from 74% to 96% reduction in incidence and 83% to 98% reduction in mortality compared to no screening; these corresponded to LYG of 40 to 56 per 1,000 21-year-old female persons of Black race (14 to 20 days of life per Black female person, 0.20 to 1.33 cervical cancer cases averted per 1,000 21-year-old Black female persons), which were lower than LYG in the unvaccinated Black female persons (**Table 19**). As with the unvaccinated population, the absolute health gain associated with screening was smaller for those of Black race compared to those of all races.

The gap in life expectancy widened between Black and all-race female persons vaccinated with 2vHPV or 4vHPV vaccines, with and without screening, as a result of marginally fewer LYG for each averted cervical cancer case among those of Black race. For example, through 2vHPV or 4vHPV vaccination alone (without screening), LYG per 1,000 21-year-old persons was 107 years for those of Black race compared to 122 years for those of all races. With screening, although the absolute gains were smaller, the additional LYG were still higher among the all-race population (8 to 9 additional LYG per 1,000; 3 days per female persons), compared to the Black-race population.

<u>Total Tests, Colposcopies, False Positive Cases</u>

Black individuals vaccinated with 2vHPV or 4vHPV vaccines had 2% to 15% fewer total tests, 17% to 27% fewer colposcopies, and 7% to 33% fewer false positive findings than unvaccinated Black individuals. The relatively lower testing rates by race remained similar to those estimated in the unvaccinated populations, with roughly 6% to 16% fewer of each measure among female persons of Black race when compared to the corresponding all-race estimates.

9vHPV Vaccinated Population – Black Race

<u>Cancer Cases, Deaths, LYG</u>

In the absence of screening, there was an 81% reduction in cervical cancer incidence and a 78% reduction in cervical cancer deaths from 9vHPV vaccination among female persons of Black race, when compared to unvaccinated female persons of Black race. The further proportional reductions in cancer burden when adding screening ranged from 88% to 97% in lifetime cervical cancer incidence and 91% to 99% in lifetime cervical cancer mortality with screening compared to those without screening (similar to the all-race model); these corresponded to LYG of 20 to 23 per 1,000 21-year-old female persons of Black race (7 to 8 days of life per Black female person, 0.08 to 0.31 cervical cancer cases averted per 1,000 21-year-old Black female persons) (**Table 20**). Similar to unvaccinated and 2vHPV/4vHPV vaccinated female persons, the absolute health gains associated with screening in terms of both cancer cases and LYG were smaller among those of Black race compared to all races while the relative gains were similar by race.

The gap in LYG through 9vHPV vaccination alone (without screening) by race was larger than the gap in LYG through 2vHPV/4vHPV vaccination, with a total gain of 140 years per 1,000 21-year-old female persons of Black race compared to 158 years per 1,000 21-year-old female persons of all races. Adding screening strategies to 9vHPV vaccination further increased the difference in LYG by race by 6 to 7 years per 1,000 21-year-old female persons (approximately 2 days per person).

<u>Total Tests, Colposcopies, False Positive Cases</u>

The total number of tests, colposcopies, and false positive findings were further reduced relative to the same screening strategies in unvaccinated or 2vHPV/4vHPV vaccinated female persons of Black race. Among Black individuals vaccinated with 9vHPV, there were 3% to 27% fewer total tests, 28% to 64% fewer colposcopies, and 14% to 61% fewer false positive findings than for unvaccinated Black individuals. These relative reductions were similar to those estimated in the all-race model, but there were roughly 6% to 16% fewer of each measure when compared to the all-race estimates.

Efficient Strategies – Black Race

Of the 73 screening strategies evaluated by the Harvard Black-race model, 25 were identified as being efficient or near-efficient with respect to both colposcopies per LYG and tests per LYG (**Table 21, Figures 15-16**). Of current guidelines, all 3 strategies identified for female persons of all races were also identified as on or near the efficiency frontier for female persons of Black race: 5-year primary HPV testing from age 25 to age 65, 3-year cytology testing at age 21 followed by 5-year cotesting from age 30 to 65, and 3-year cytology testing at age 21 followed by 5-year HPV testing from age 30 to 65. When constraining the analysis to include only those strategies that had efficiency ratios that were equal or less than the guidelines-based strategies on both metrics of colposcopies per LYG and tests per LYG, strategies mostly involved initiating screening at ages 21 (with cytology) or 25 years with HPV testing every 5 years. Two of the same strategies were selected in both the Black-race and all-race analysis (10-year HPV testing from ages 40 to 60 years, which is less effective than current US guidelines-based strategies, and 3-year cytology at age 21 years, with a switch to 5-year HPV testing from ages 30 to 70 years), with comparable incremental harms and incremental benefits between the Black-race and all-race populations.

In the 2vHPV/4vHPV vaccinated cohort, 31 strategies were identified as being efficient or near-efficient with respect to both colposcopies per LYG and tests per LYG (**Table 22, Figures 17-18**). The rank ordering of screening strategies by effectiveness was generally similar for vaccinated versus unvaccinated Black female persons; however, the efficiency ratios for corresponding strategies were considerably larger than for unvaccinated Black persons. Similar to the findings from the all-race population, the USPSTF recommended strategy of 3-year cytology followed by 5-year HPV testing from age 30 to 65 would require twice as many colposcopies and 2.5 times the number of total tests for each additional LYG in this vaccinated population, compared to those unvaccinated.

Identifying strategies that were efficient or near-efficient for both measures of colposcopies and total tests per LYG and further restricting to strategies that are at least as efficient as current recommendations (for unvaccinated populations), we identified four efficient or near-efficient strategies which all involved 10-year screening intervals using HPV testing. Of the strategies identified by the all-race model, all but one was also identified by the Black-race model. This strategy involved 10-year HPV testing from ages 30 to 70, which was likely not identified in the Black-race model due to the diminishing marginal returns for later screening among those of Black race, as a result of both hysterectomies and competing mortality.

In the 9vHPV vaccinated cohort, 37 strategies were identified as being efficient or near-efficient with respect to both colposcopies per LYG and tests per LYG (**Table 23, Figures 19-20**). The efficiency ratios for screening strategies increased, particularly for measures of tests per LYG, compared to both 2vHPV/4vHPV vaccinated and unvaccinated Black female persons. When restricting to strategies that were efficient or near efficient for measures of both colposcopies and tests per LYG and were at least as efficient as current recommendations, six strategies were identified. These strategies were similar to those identified for the 2vHPV/4vHPV vaccinated population, and strategies all involved in primary HPV testing at 10-year intervals. All strategies identified by the all-race model were also identified by the Black race model. However, two additional and more intensive strategies were identified for female persons of Black race, both of which began screening at age 25 and were associated with a high number of tests per LYG.

Imperfect Screening and Follow-up Adherence

In the all-race models, assuming imperfect screening and follow-up adherence resulted in reduced health benefits, as well as harms, in each of the three cohorts by vaccination status (**Tables 24-32**), compared to assuming perfect adherence. Across the screening strategies, the LYG were 82% to 85% (Harvard), 56% to 74% (MISCAN-Cervix), 57% to 82% (Policy1-Cervix) and 72% to 83% (UMN) of the LYG under perfect screening (**Table 24**). Reductions in colposcopy ranged from 17 to 43% in the unvaccinated cohort (**Table 25**), 20% to 44% in the 2vHPV/4vHPV vaccinated cohort (**Table 28**), and 19% to 45% in the 9vHPV vaccinated cohort (**Table 31**).

Because of the reduced outcomes, the efficient and near-efficient strategies - identified using both metrics of colposcopies per LYG and tests per LYG, as well as efficiency ratios that were similar to current US recommended strategies in the unvaccinated cohort - included strategies that were more intensive than in the base-case analysis with perfect adherence. For example, in the unvaccinated cohort, the Harvard model identified additional 10-year HPV testing strategies with earlier start ages (i.e., 25, 30, 35 years) and all models identified additional 5-year HPV testing strategies starting earlier with or without preceding cytology testing (**Table 33, Figures 21-22**). Similarly, additional 5-year HPV testing strategies were included in all 4 models in the 2vHPV/4vHPV vaccinated cohort (**Table 34, Figures 23-24**), and 3 of 4 models (Harvard, MISCAN-Cervix, UMN) in the 9vHPV vaccinated cohort (**Table 35, Figures 25-26**).

Imperfect Screening and Follow-up Adherence in Unvaccinated Population – Black Race

In the Harvard Black-race model, we similarly found that screening was less effective across all measures when accounting for imperfect adherence (**Table 36**). For example, in the unvaccinated cohort, while the screening strategies under an assumption of perfect adherence were projected to reduce lifetime cancer incidence by 63% to 96% and cancer mortality by 74% to 98% in unvaccinated female persons of Black race, we found that the same strategies under imperfect adherence reduced lifetime incidence by 47% to 73% and mortality by 57% to 78%. With imperfect adherence, life-years gained across the screening strategies were 76% to 80% of the LYG under perfect screening.

Under perfect adherence, the models projected that across screening strategies Black female persons derived fewer LYG (due to shorter life expectancy) than female persons of all race, a difference that widened with imperfect adherence. This finding suggests that current adherence patterns in screening and follow-up have a disproportionately negative impact on Black female persons compared to female persons of all races. However, as expected with lower utilization of screening, differences in measures of resource use and screening harms also widened. Compared to those of all races and across all screening strategies, those of Black race received 9% to 18% fewer total tests, 18% to 25% fewer colposcopies, and 20% to 28% fewer false positive tests.

As both benefits and costs of screening were attenuated relative to those in the all-race model, we found substantial overlap in the strategies determined to be efficient or near-efficient by the Black and all-race models (**Table 37, Figures 27-28**). Four strategies were identified by the Black-race model that were not identified as efficient strategies in all-race individuals. These were generally more intensive strategies with screening starting at earlier ages (21 or 25).

Imperfect Screening and Follow-up Adherence in Vaccinated Populations – Black Race

The incremental benefits of screening for a Black population vaccinated with 2vHPV or 4vHPV vaccines were diminished when assuming imperfect screening and follow-up adherence, compared to perfect adherence (**Table 38**). Across the screening strategies, LYG under imperfect adherence was 78% to 81% of the LYG under perfect adherence in the Harvard model for 21-year-old female persons of Black race vaccinated with the 2vHPV, 4vHPV or 9vHPV vaccines.

The disproportionate impact of imperfect screening and follow-up patterns by race was somewhat attenuated by vaccination. For example, in the unvaccinated populations, screening with imperfect adherence was associated with an additional 75 to 128 LYG per 1,000 for female persons of all races, compared to female persons of Black race. However, among those vaccinated with the 9vHPV vaccine, imperfect adherence was associated with a smaller gap in LYG (an additional 21 to 25 LYG for female persons of all races, compared to those of Black race).

Strategies for female persons of Black race were similar to strategies identified under perfect adherence (i.e., HPV testing at either 10-year intervals or a mix of 5- and 10-year intervals) in 2vHPV and 4vHPV vaccinated cohorts, when evaluating strategies identified as efficient or near-efficient for both colposcopies and total tests per LYG performed and at least as efficient as current screening recommendations (**Table 39; Figures 29-30**). We also identified four efficient strategies for female persons of Black race vaccinated with 9vHPV (**Tables 40-41; Figures 31-32**). Importantly, screening strategies for vaccinated persons of Black race were also generally on the efficiency frontier for imperfect screening and follow-up in all-race individuals.

HPV-16/18 Genotype Triage of High-risk HPV-Positive Results

As observed in the 2018 USPSTF decision analysis, [15] when using HPV-16/18 genotype testing as the triage approach in unvaccinated female persons, the total number of colposcopies was higher than in the base case, with only slight increases in the health benefits (**Appendix Tables 2-4**). For example, for the current guidelines-based strategies, the increase in number of colposcopies ranged from 6% to 25% (median 15%) across the models for the strategy of cytology every 3 years start at age 21 with a switch to HPV testing every 5 years from ages 30 to 65 years, and 9% to 42% (median 20%) for the strategy of primary HPV testing every 5 years from ages 25 to 65 years. In contrast, when assuming perfect screening adherence, these strategies provided less than a day of life gained per person (no more than 2% increase from the base-case analysis) in all the models. Since the vaccines all target HPV-16/18 with complete efficacy over the lifetime, there were no changes in either health benefits or harms in the 2vHPV/4vHPV vaccinated and 9vHPV vaccinated cohorts compared to those for the base-case (non-genotyping) strategies.

In the unvaccinated population, the majority of strategies that were identified as efficient or near-efficient in the base-case analysis were identified when using HPV-16/18 genotype testing as the triage approach, with additional strategies identified in each model (**Appendix Table 5**). In the Harvard model, two additional strategies involving 10-year HPV testing at age 30 years (end ages 60 and 70 years) with preceding cytology starting at age 21, and 10-year HPV testing from ages 25 to 65 years without preceding cytology were identified. In Policy1-Cervix, one additional strategy of 10-year HPV testing from years 35 to 65 years was included. In MISCAN-Cervix model, two strategies involving 10-year HPV testing with preceding 5-year HPV testing were identified. In the UMN model, two additional strategies involving 5-year HPV testing from ages 25 to 65 years and from ages 30 to 70 years were included in the list of efficient or near-efficient strategies.

Test Performance of HPV Testing

The three models (Harvard, Policy1-Cervix, UMN) found that most of the strategies that were identified as efficient or near efficient in the base-case analysis were also identified when HPV test sensitivity and specificity were varied within observed ranges in empirical studies. A few slightly more intensive strategies were identified as efficient or near-efficient according to both metrics of colposcopies per LYG and tests per LYG when the test sensitivity of HPV testing was assumed to reach the lower-bound value of relative sensitivity compared to cytology (1.2). For example, for strategies that had efficiency ratios close to the current guidelines-based strategies, the Harvard model identified 5-year HPV testing from ages 25 to 70 years, and Policy1-Cervix identified two strategies involving cytology testing at age 21 with a switch to 5-year HPV testing starting at ages 25 or 30 years for the unvaccinated population (**Appendix Table 6**). In the 2vHPV/4vHPV vaccinated population, the efficient and near-efficient strategies with similar efficiency ratios as the current guidelines-based strategies in the unvaccinated population were generally the same as in the base-case analysis for each model with small changes in the ratios themselves (**Appendix Table 7**). Likewise, for the 9vHPV vaccinated cohort, the identified strategies were generally consistent with base-case findings, favoring slightly more intensive strategies in the Harvard and UMN models (**Appendix Table 8**).

When assuming an upper-bound relative sensitivity of HPV testing compared to cytology (1.37), the strategies identified as efficient or near-efficient were even more similar to those identified in the base-case analysis, with the exception that in the unvaccinated cohort, the Harvard model identified less intensive strategies involving 10-year HPV testing (versus 5-year HPV testing) (**Appendix Table 9**). In the 2vHPV/4vHPV and 9vHPV vaccinated populations, most of the same strategies were identified as in the base-case analysis with only slight variations in the efficiency ratios (**Appendix Tables 10-11**).

One-Time Screening with HPV Self-Collection

We used the models to examine the potential health benefits that may be gained with a single lifetime cervical cancer screen using HPV self-collection as an approach to recruit previously unscreened (and unvaccinated) female persons. We varied screening age and adherence to follow-up visits (i.e., colposcopy, precancer treatment) to reflect their impacts on health benefit in terms of cervical cancer cases averted, compared to no screening (**Figure 33**). Across all four models, screening benefit was generally greater when the single screen occurred at younger ages (ages 35, 45 years) and when adherence was higher; MISCAN-Cervix predicted the lowest absolute benefit, while UMN predicted the highest benefit, for each age group and adherence level.

When follow-up adherence was low (i.e., 28.6%), the models predicted a range of cancer cases averted of 0.08 to 0.39 per 1,000 female persons across the age groups (1% to 2% reduction in lifetime cancer risk, compared to no screening). Cancer cases averted increased substantially when adherence reflected rates observed in the METRICS data (72.5%) by 0.62 to 2.39 per 1,000 female persons across the age groups and models (6% to 16% reduction in lifetime cancer risk, compared to no screening). Under perfect adherence (100%), cancer cases averted increased by an additional 0.70 to 2.58 per 1,000 female persons (12% to 30% reduction in lifetime cancer risk, compared to no screening).

In the Black-race model (Harvard only), cancer cases averted from a one-time screen was lower than in the all-race model across all ages and adherence levels (**Figure 34**). Cases averted were greatest when screening occurred at age 35 years among Black female persons (10 years younger than in the all-race Harvard model). When adherence was low (28.6%), cancer cases averted ranged from 0.08 (screen age 65 years) to 0.25 (screen age 35 years) per 1,000 Black female persons. Increases in cancer cases averted associated with higher adherence to screening follow up using the METRICS data (65.3%) ranged from 0.49 (screen age 65 years) to 1.13 (screen age 35 years) per 1,000 Black female persons; under an assumption of perfect adherence, additional increases in cancer cases averted ranged from 0.83 (screen age 65 years) to 1.92 (screen age 45 years). Compared to the all-race model, cases averted in the Black-race model were 18% to 52% lower, with the highest disparity at older ages and when using the METRICS adherence data, which was differentially lower for Black female persons.[4]

Chapter 4. Discussion

This report provides evidence from a model-based decision analysis on the long-term health effects, harms, and efficiency of cervical cancer screening strategies to inform the USPSTF in updating its recommendations for cervical cancer screening in the United States. Building on the decision analysis conducted in 2018,[15] we incorporated several additions in the current analysis, including: (1) results from four established cervical cancer models that are part of the CISNET modeling consortium; (2) extending the analysis to include vaccinated cohorts and thereby a larger number of strategies that involve longer intervals and later screening ages; (3) a race-based analysis to evaluate screening outcomes in Black-race (compared to all-race) female persons; and 4) evaluating the potential impact of a single lifetime screen with HPV self-collection for previously unscreened female persons. Given the marginal benefits of some strategies, especially in the vaccinated populations, and imprecision in model outputs, we elected to be inclusive of strategies that were close to the efficiency frontier ("near-efficient") and evaluated all strategies on the basis of two efficiency metrics to reflect different measures of harm: colposcopies per LYG and tests per LYG.

In the unvaccinated population, we found that the three guidelines-based strategies involving HPV testing and cotesting were on the efficiency frontier for most models. However, other strategies were as effective and had similar or more attractive efficiency ratios in unvaccinated female persons, mostly 5-year HPV testing starting at ages 25 or 30 years and with a later end age of 70 years. The guidelines-based strategy of 3-year cytology alone from ages 21 to 65 years was not efficient for any model. Additionally, strategies involving cotesting were associated with nominal additional benefits but much higher numbers of colposcopies and tests, compared with HPV testing alone, indicating lower efficiency.

In the vaccinated cohorts, the models estimated that equal or greater levels of health benefit can be achieved at similar levels of efficiency with less intensive screening. In this population, where screen-test positivity (and thereby colposcopies) diminishes proportionally with LYG, we observed that tests played an enhanced role in reflecting screening burden (in a similar way to "number needed to screen") since tests are less sensitive to the underlying risk of the population, and thereby we used both measures of colposcopies per LYG and tests per LYG to identify efficient strategies. In 2vHPV/4vHPV vaccinated cohorts, strategies of 5-year HPV testing (without preceding cytology) and 10-year HPV testing starting at age 30 to 40 years were efficient and had ratios that were comparable to current guidelines-based strategies in the unvaccinated population. In 9vHPV vaccinated cohorts, strategies identified as efficient according to the current guidelines-based benchmarks almost universally involved 10-year HPV testing with start ages of 30 to 40 years (and variable end ages).

These base-case findings were generally stable when we assumed HPV-16/18 triaging and when HPV testing sensitivity was varied, though if screening and follow-up adherence were imperfect, we could expect to observe greater differences between strategies. Not surprisingly, the magnitude of the health benefits and harms across all screening strategies decreased under imperfect adherence resulting in similar or slightly more intensive strategies on the frontier, especially with respect to screening interval.

While there are many potential ways to deploy screening with HPV self-collection, we chose to explore one simplified use case because of the limited data on follow-up of screen-positive female persons (e.g., receipt of colposcopy and/or precancer treatment) and screening over multiple rounds. We estimated the potential health gains from a one-time screen with HPV self-collection among previously unscreened female persons at various screen ages and follow-up adherence levels. The models estimated that a one-time screening with HPV self-collection has the potential to reduce lifetime risk of cervical cancer by 25% to 30% if the screen occurs at age 35 to 45 years (12% to 15% if screening occurs at age 65 years), assuming perfect adherence to follow-up diagnosis and precancer treatment. We found that the health benefits from HPV self-collection were heavily dependent on adherence to follow-up visits for HPV-positive female person.

Several unifying themes emerged from our results, although there was variation in specific strategies selected as efficient or near-efficient across the models: (1) HPV alone was consistently identified as an efficient strategy by all models, cohorts, and metrics; start/switch age, interval, and end ages were influenced by vaccination status; (2) cytology alone was not efficient across any models or cohorts; however, we did not vary start age or screening interval in the same way we explored for HPV and cotesting; (3) cotesting tended to be the least efficient across all models and cohorts; when not dominated, these were clustered at the flat part of the efficiency frontier, indicating diminishing marginal returns with respect to LYG, and (4) overall, interval and screening start age were more influential on outcomes than screening end age.

Differences in the absolute benefits, harms, and (near-)efficient strategies among the models are likely attributable to different assumptions regarding the natural history of HPV. For example, the Harvard model assumes that the transition probabilities between health states depend upon time-in-state rather than age, with longer HPV infection persistence and precancer durations being associated with increasingly higher progression probabilities and lower regression probabilities. A time-in-state model structure that is invariant by age implies that HPV infections acquired at any point over the lifetime are equally risky. In contrast, the MISCAN-Cervix, Policy1-Cervix and UMN models apply age-specific transition probabilities that assume the risk of progression increases with age, which, at a population level, can act as a surrogate marker of time since infection. Age-specific transitions effectively result in dwell times that vary by age (i.e., are longer for female persons who acquire a new HPV infection at a younger age and shorter for those who acquire a new infection at an older age). Consequently, the Harvard model provides a shorter window of time for HPV to be detected in younger ages compared to the other models and therefore tended to favor strategies initiating HPV testing at an earlier age; likewise, the Harvard model estimated lower marginal benefits (all else equal) for ending screening at a later age given it has a comparatively longer window for detection of HPV at older ages compared to the other models. Furthermore, although total dwell times among female persons who developed cervical cancer were similar for the Harvard, UMN and Policy1-Cervix models,[19] the Harvard model's dwell time in the HPV-infected state for female persons who go on to develop cancer was twice as long as the combined HPV/CIN1 health states for Policy1-Cervix and UMN models (mean duration of 9.9 years (Harvard), 5.2 (Policy1-Cervix), 4.7 years (UMN)). This longer dwell time in the HPV state may contribute to the relatively greater HPV-based screening benefits (and higher colposcopy rates) for female persons in the Harvard model.

The models also differ in their assumptions about the sensitivity of HPV testing for detecting infections in the absence of high-grade disease, with HPV test sensitivity relatively higher in the Harvard model. This contributes to the relatively higher colposcopy numbers and also the relatively larger LYG in the Harvard model at young ages. Other HPV assays shown to improve specificity without compromising sensitivity (e.g., HPV mRNA assays) may reduce colposcopies and follow-up procedures, which would strengthen our overall findings. Other factors, such as cervical cancer burden in the absence of screening (i.e., background risk), may also contribute to differences. For example, the UMN model reflects the largest burden of cervical cancer in the absence of screening across the models, which may impact on the favored strategies and the benefits of continued screening at older ages. All models assumed that all cervical cancers result from high-risk HPV infections. While HPV-negative cancers have been observed among cervical cancer cases, it remains unclear whether these are misclassified cancers, falsely HPV-negative or truly HPV-negative.[66]

We observed that the tradeoffs between harms and benefits associated with screening strategies were generally similar for Black and all-race female persons. However, it is important to note that the primary drivers of inequities are not attributable to the differential impact of screening recommendations but rather to structural factors, including differential background mortality, hysterectomy rates, and timely access to screening and cancer treatment. Relative to all-race female persons, we found lower lifetime risk of cervical cancer incidence and mortality for Black female persons in nearly all of our scenarios. While this finding would seem to contradict the presence of a health disparity, the model results reflect (1) the higher hysterectomy rates among Black female persons, which reduce the population at risk for cervical cancer; and (2) the lower life expectancy of Black female persons. Thereby, our findings should not be taken to suggest that Black female persons are actually at lower risk of cervical cancer. In fact, given our comparison to the all-race model that includes Black race, the gap in terms of health benefit may be an underestimate of the true disparities between Black and non-Black female persons.

As in the all-race model, the Harvard model estimated that HPV vaccination provides an opportunity to undertake less intensive screening than current guidelines-based strategies among Black female persons. Furthermore, disparities related to differences in screening practice patterns for Black female persons may be attenuated in HPV-vaccinated populations. However, this attenuation of disparities assumes that the impact of HPV vaccination will be the same for Black individuals; this assumption may not be the case, whether due to differential vaccination uptake or different distribution of causal HPV types in cervical disease.[67] For example, HPV-35, which is not covered by the available HPV vaccines, is found disproportionately among Black female persons with CIN3.[68]

Although disease simulation models can be powerful tools in projecting long-term outcomes over multiple rounds of screenings and exploring different combinations of screening test modality, intervals, and ages, this analysis is subject to important limitations.

First, as with prior USPSTF decision analyses,[15,57] our analysis is based on assumptions of perfect adherence to screening intervals and follow-up of screen-positive female persons, including diagnostic colposcopy/biopsy and treatment for precancer; however, it is well-documented that screening practice is not perfect and quite variable across the United States.[29]

While we were able to leverage real-world data from the METRICS sites of the PROSPR II consortium, our imperfect adherence assumptions were based on loss-to-follow up in three large health systems, and does not necessarily generalize beyond these health systems. How loss-to-follow up might differ across testing modalities, age, and interval is uncertain – especially in HPV-vaccinated populations – but could impact the overall effectiveness and relative efficiency of the screening strategies modeled. Nonetheless, despite the more realistic representation of current screening practice, basing recommendations under assumptions of imperfect adherence can lead to inefficiencies and excess harms due to over-screening of individuals who adhere to guidelines.[69]

Second, several simplifying assumptions regarding screening were made in the models for tractability or due to a lack of data. For example, while the models attempted to simulate the multitude of pathways of follow-up management according to current recommendations, simplifications around active surveillance post-colposcopy or post-treatment were made with respect to retesting interval and number of repeat tests. Likewise, due to limited data on test performance characteristics in management and follow up, as well as in vaccinated cohorts, we assumed that the test sensitivity and specificity values for cytology and HPV testing remained constant by sub-population (i.e., for those who screened positive or received precancer treatment, based on vaccination status, and across age). As a result of these modeling simplifications, both benefit and harm outcomes may be under- or over-counted on an absolute scale; however, we expect the incremental differences between strategies to be small and therefore unlikely to change overall results or conclusions regarding the efficiency of strategies in any of the three base-case populations.

Third, although we included an extensive number of candidate strategies, there may be alternative strategies that could lead to a more attractive balance of harms and benefits; for example, we restricted our rescreening intervals to be only every 3 years for cytology, and every 5 or 10 years for HPV testing and cotesting, yet there may be combinations of screening test and ages that may make other intervals efficient. Fourth, although we included three different screening end ages (60, 65, 70 years), we did not explore alternative strategies or criteria to determine when to stop screening. Evaluating the impact of screening end age within the context of perfect adherence depends on model assumptions about the natural history of HPV in older female persons. The extent to which newly appearing HPV infections in older female persons are reactivated latent infections, and whether these reactivated infections pose a differential risk of precancer and cancer relative to newly acquired infections in younger female persons, is uncertain. However, evidence from several large cohorts suggests that HPV type and viral persistence (rather than age or reactivation status) are the primary risk determinants.[70-72] If earlier birth cohorts (i.e., those born after the 1960s) have elevated HPV prevalence in older ages relative to the cohorts used to calibrate the models or reflected in this analysis, findings may under-estimate the benefits of later screening end ages.

While the number of candidate strategies was extensive, the strategies that were included for consideration influenced the calculated efficiency ratios. For example, by including strategies for unvaccinated individuals that were less effective than current guidelines-based strategies, efficiency ratios for the guidelines-based strategies were higher (less favorable) than they would have been if those strategies were simply compared to no screening. Similarly, the efficiency ratios for less intensive strategies in vaccinated individuals would likely have been higher had even less intensive strategies been considered (for example, twice lifetime screening). Nevertheless, in general, including sufficient relevant comparator strategies is necessary to prevent underestimation of efficiency ratios, especially for strategies around the acceptability threshold because these strategies are the most policy relevant.[73]

Additionally, our race-specific analysis used a model that had been previously adapted to reflect HPV natural history in Black female persons.[58] While we were able to achieve reasonable model fit to currently observed rates of cervical cancer incidence and mortality in SEER, the data to inform the model were more limited than for all races, resulting in greater uncertainty and simplifying assumptions regarding differential underlying risk that may impact the relative benefits of the screening strategies. Although data for other racial and ethnic groups may also be limited, persistent racial disparities in US cervical cancer morbidity and mortality highlight the urgency of more efforts to generate equity-conscious evidence on screening and vaccination in order to guide care delivery interventions to improve outcomes and reduce the disparities in cervical cancer burden.

Better guidance is needed for defining efficiency ratios. Current benchmarks are somewhat arbitrary and, in the absence of evidence on society's "willingness to pay" for colposcopies and tests per LYG, should be used only as general guideposts. For this analysis, we used the efficiency ratios associated with current guidelines-based strategies in the unvaccinated population as indicators for a reasonable and acceptable harm-benefit balance, which enabled us to identify similarly efficient strategies in the vaccinated cohorts. But additional evidence on test harms, societal valuation of different harms, and racial differences in burden of harms will allow future analyses to use better evidence-driven efficiency ratios. Also, the efficiency ratios associated with the guidelines-base strategies were variable across models and sometimes found to be "near efficient" creating non-monotonic patterns in the efficiency ratios; however, this variation – and important advantage of comparative modeling – reflects structural uncertainty across the models, as well as the imprecision and marginal differences between strategies within the models (especially in the vaccinated populations where absolute screening impact is reduced). As a result, we elected to provide general characteristics of efficient strategies that were consistent across the models rather than identifying only one or two strategies that met the technical definition of "most efficient." Reassuringly, broadly similar strategies were identified as the most favorable in vaccinated individuals.

Given the increasing uptake of HPV vaccination and the increasing share of 9vHPV vaccine doses among female persons who are, or will soon be, age-eligible for cervical cancer screening in the United States, we included three base-case analyses to reflect the expected differential risks of cervical cancer by vaccination status. However, our analysis was conducted assuming known vaccination status at the individual level with vaccine completion in early adolescence, rather than assuming a mix of vaccination status that changes over time and varies by age at the population level. Although the United States does not have a universal vaccination registry to readily identify vaccination status for individuals, we elected to avoid conducting the analysis to find a "one size fits all" population-based strategy that would be optimized according to the population average but may not be optimized to specific individuals. A population-average strategy would be ever-changing over time, depending on vaccination uptake patterns in the population, and would likely disadvantage those who reside in communities with lower vaccine uptake and therefore are less likely to benefit from herd immunity.

Likewise, we modeled and evaluated strategies for unvaccinated individuals assuming no HPV vaccination in the population (i.e., no herd immunity effects). Therefore, the unvaccinated individuals in our analysis are likely less similar to younger birth cohorts who, while personally unvaccinated, become sexually active in an environment where HPV vaccination is available, effectively lowering population-level HPV risk. A nationally-representative US survey reported a 74% reduction in HPV-6/11/16/18 infections in unvaccinated sexually-active 14- to 24-year-old female persons in 2015-2018, compared to 2003-2006 (and compared to a 90% reduction in vaccinated sexually active females), showing substantial herd effects which have increased over the period from 2007 to 2018.[74] The effects were even stronger for the youngest cohorts of sexually-active female persons, aged 14 to 19 years (an 87% decrease among unvaccinated individuals and a 97% decrease among vaccinated individuals).[10] This finding of substantial herd effects is consistent with previous meta-analyses of both population-level observed data[75] and model-based estimates.[76] These data suggest that the risk of vaccine-preventable HPV types in younger birth cohorts is more comparable to their same-age vaccinated counterparts than to same-age unvaccinated counterparts from older birth cohorts. If this is the case, the identified efficient screening strategies in the unvaccinated population in our study are likely too intensive for unvaccinated female persons born in the era of HPV vaccination.

Summary

The results from our comparative modeling decision analysis suggest that routine cervical cancer screening is effective in reducing cervical cancer cases and deaths and improving life expectancy, even in HPV-vaccinated populations. Strategies involving HPV testing have the potential to provide an efficient balance of harms and benefits, irrespective of HPV vaccination status. In the unvaccinated population, strategies involving 5-year HPV testing with screening start ages of 21 (using cytology) to 30 years, including current US guidelines-based strategies, were found to be efficient. The models estimated that for the HPV-vaccinated populations, there are opportunities to increase health benefit and maintain the same harms-to-benefits balance with less intensive screening, including HPV testing every 5 or 10 years, starting at age 30 to 40 years in 2vHPV/4vHPV vaccinated female persons, and HPV testing every 10 years, starting at ages of 30 to 40 years in 9vHPV vaccinated female persons. Across all scenarios and models, when applying the two metrics of efficiency, strategies involving cytology alone or cotesting were either inefficient or had exceedingly high efficiency ratios.

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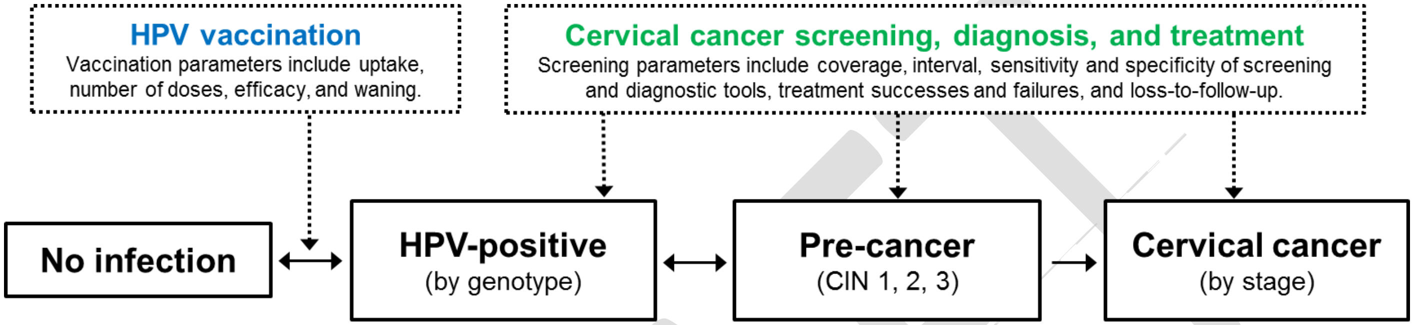
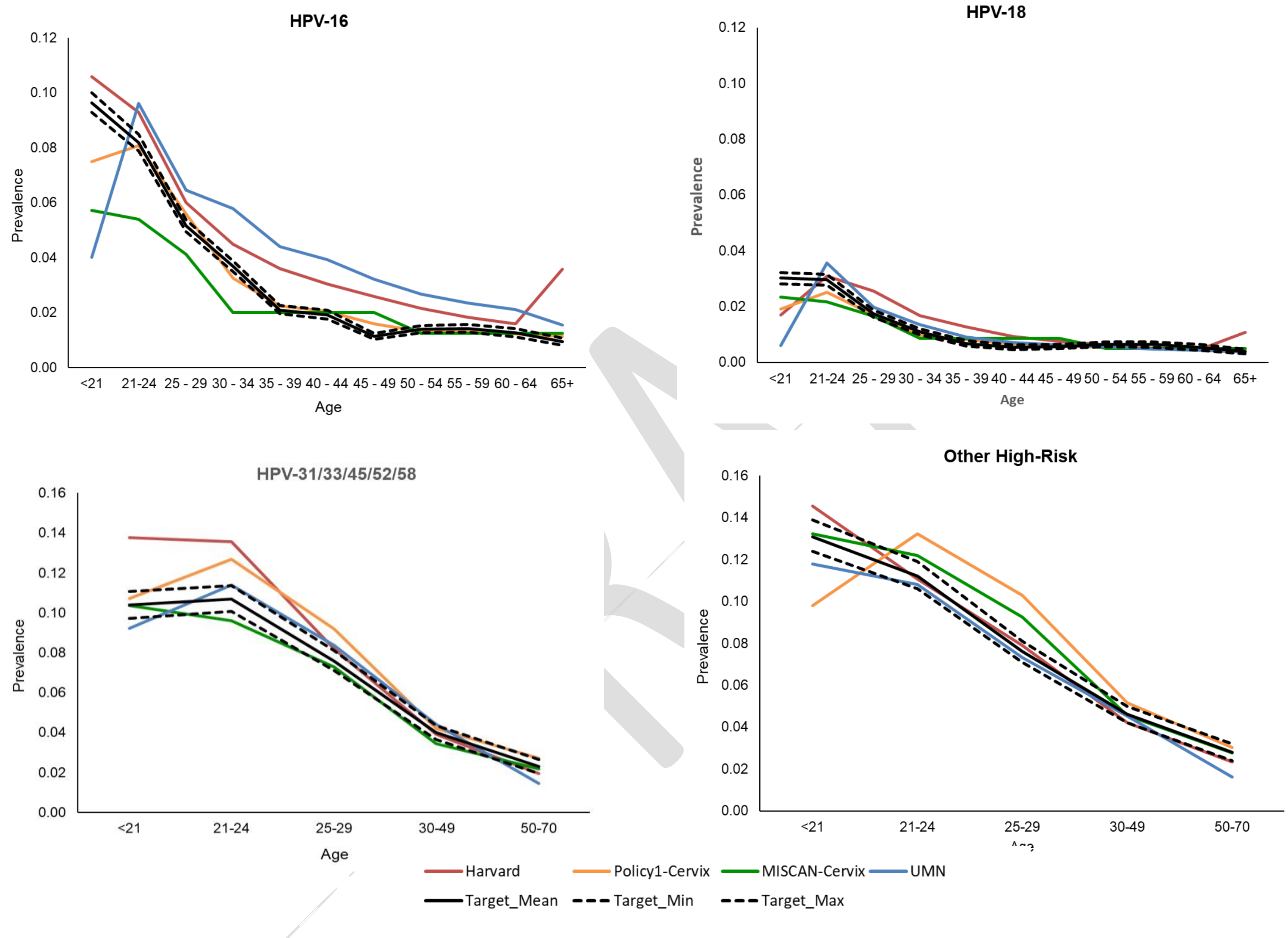
Figure 1. Model Schematic



The main health states of the model comprise HPV infection (by genotype), precancer (cervical intraepithelial neoplasia or CIN, grades 1, 2 and 3) and invasive cancer (by stage). The MISCAN-Cervix, Policy1-Cervix, and UMN models reflect all cervical cancers; the Harvard model focuses on squamous cell carcinoma, the most common histologic subtype.

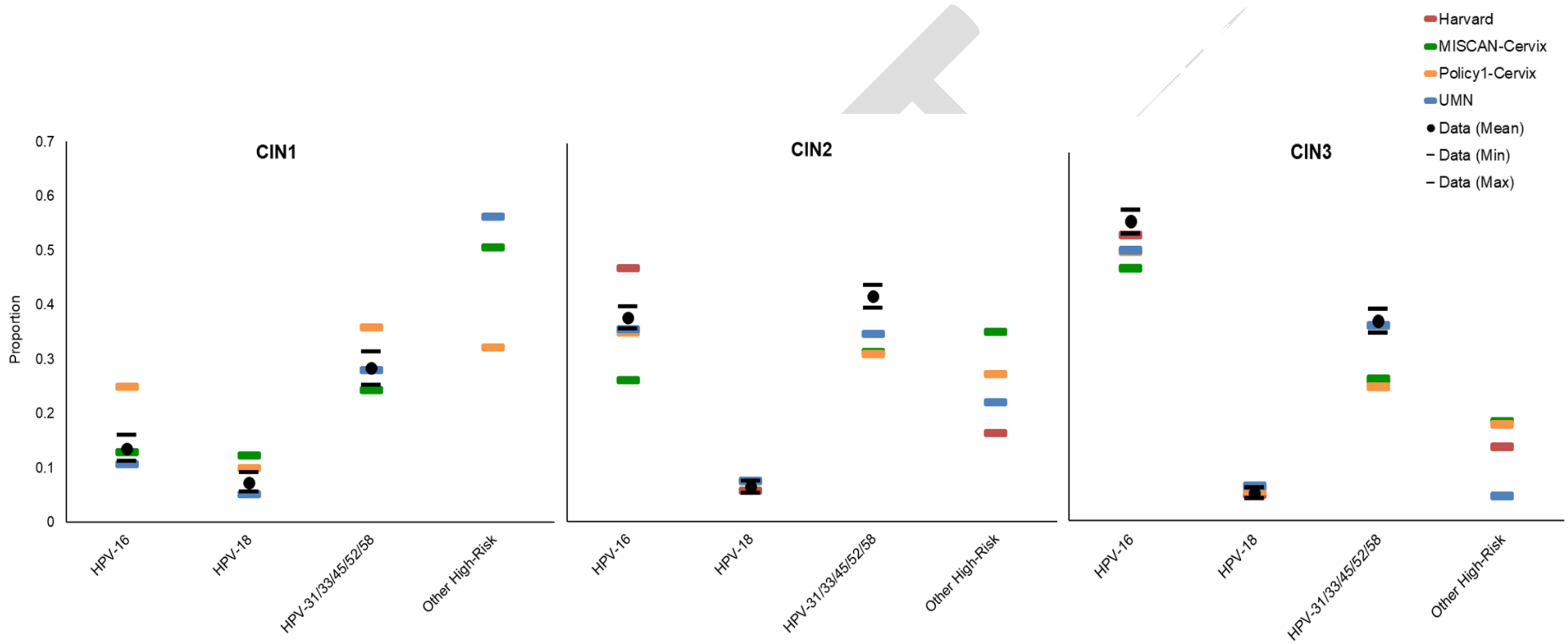
HPV vaccination is modeled as a reduction in the incidence of vaccine-type HPV infections, which is a function of model inputs on age at vaccine receipt, vaccine efficacy, and duration of vaccine protection. Screening is used for early detection of invasive cancer, as well as to detect the presence of high-grade precancers (CIN2 and CIN3), which may resolve spontaneously or, if screen-detected, can be treated and removed before progressing to cancer. The effectiveness of screening strategies depends on coverage by age, interval, test characteristics, treatment efficacy, and compliance to follow-up visits.

Figure 2. Prevalence of HPV by Age and Type



These graphs show post-calibration model fit to age- and type-specific HPV prevalence from the New Mexico HPV Pap Registry. [23]

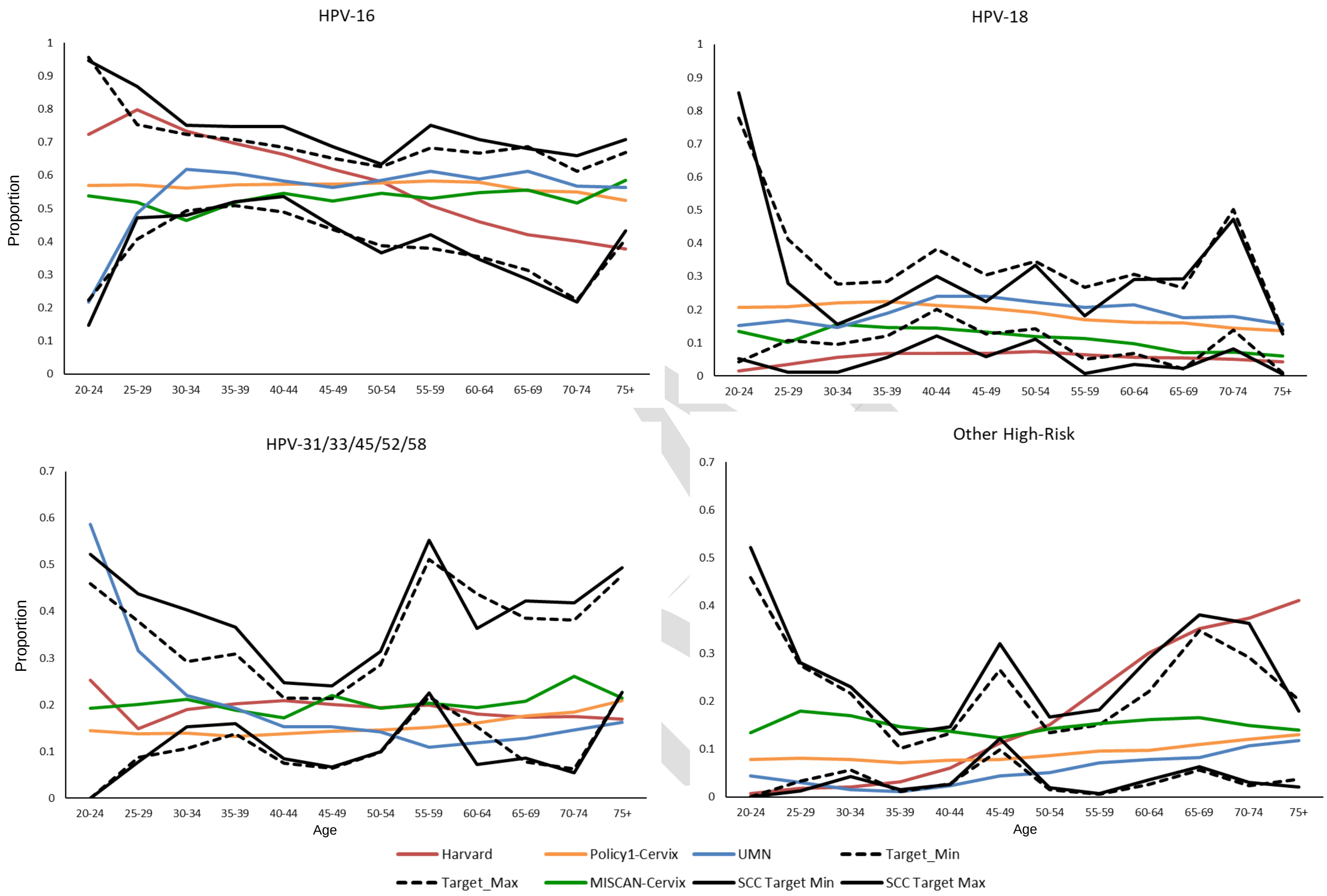
Figure 3. Type Distribution of HPV in CIN1, CIN2 and CIN3



Abbreviations: CIN, cervical intraepithelial neoplasia; HPV, human papillomavirus.

These graphs show post-calibration model fit to HPV type distribution in CIN1, CIN2 and CIN3 from the New Mexico HPV Pap Registry. [24]

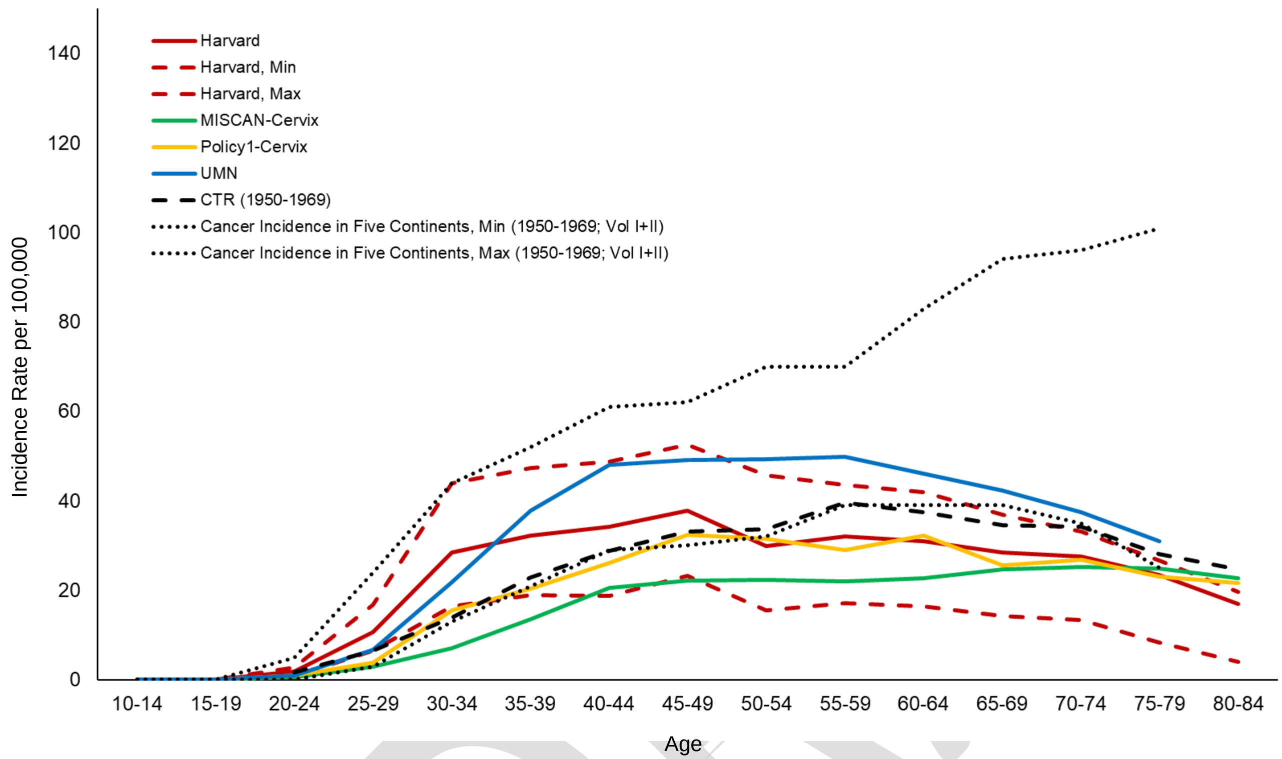
Figure 4. Type Distribution of HPV in Cancer by Age



Abbreviations: CIN, cervical intraepithelial neoplasia; HPV, human papillomavirus; SCC, squamous cell carcinoma.

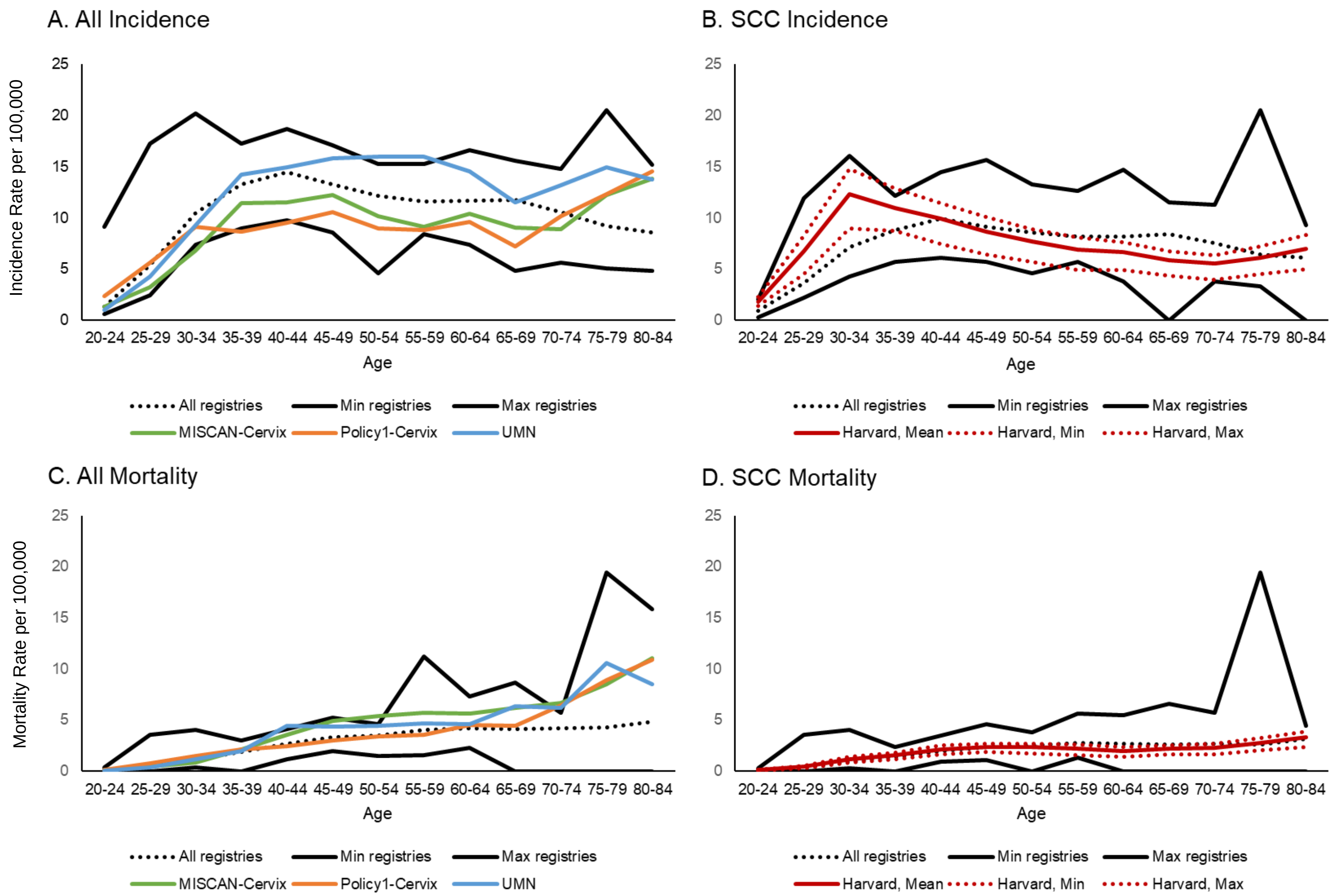
These graphs show post-calibration model fit to HPV type distribution in cancer (Harvard calibrated to SCC only) from US population-based cancer registries.[25]

Figure 5. Cervical Cancer Incidence by Age (Natural History)



This graph shows model-projected cervical cancer incidence rates under a scenario of no intervention (i.e., natural history) compared against cancer registry data from the 1950s and early 1960s, before Pap smear screening was widely available in the United States. Data were from the Connecticut Tumor Registry (CTR) and IARC Cancer Incidence in Five Continents (volumes 1 and 2), which included data from Connecticut, New York, Hawaii. [26,27] Given the limited data from only a few states – and the potential changes in sexual behavior and other risk factors since the pre-screening era, these data were not used directly to calibrate the models but instead were used to assess predictive validity for overall underlying risk.

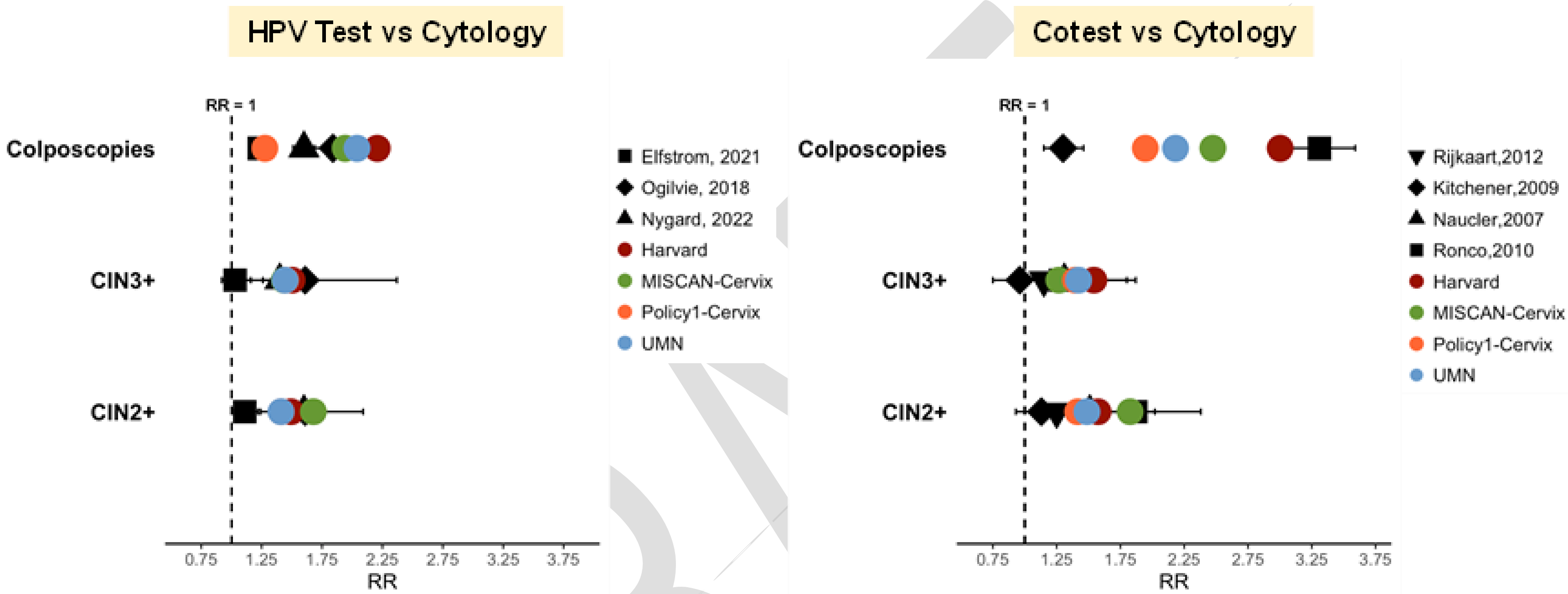
Figure 6. Cervical Cancer Incidence and Mortality by Age (With Screening)



Abbreviations: SCC, squamous cell carcinoma.

These graphs show model-projected cervical cancer incidence (All (Panel A), squamous cell carcinoma (SCC) only (Panel B) and mortality rates (All (Panel C), SCC only (Panel D) under assumptions of screening practice patterns reported in the METRICS sites, [29] compared against those reported in SEER cancer registries in recent years (i.e., 2000-2013). [3] Model projections from Harvard show the mean, minimum and maximum values across 50 good-fitting natural history parameter sets. [Note: Both incidence and mortality rates from the model were calculated using the number of female persons alive as the denominator, not adjusting for hysterectomy, to match the estimates from SEER.]

Figure 7. Model-Estimated Outcomes Compared Against Independent Empirical Studies

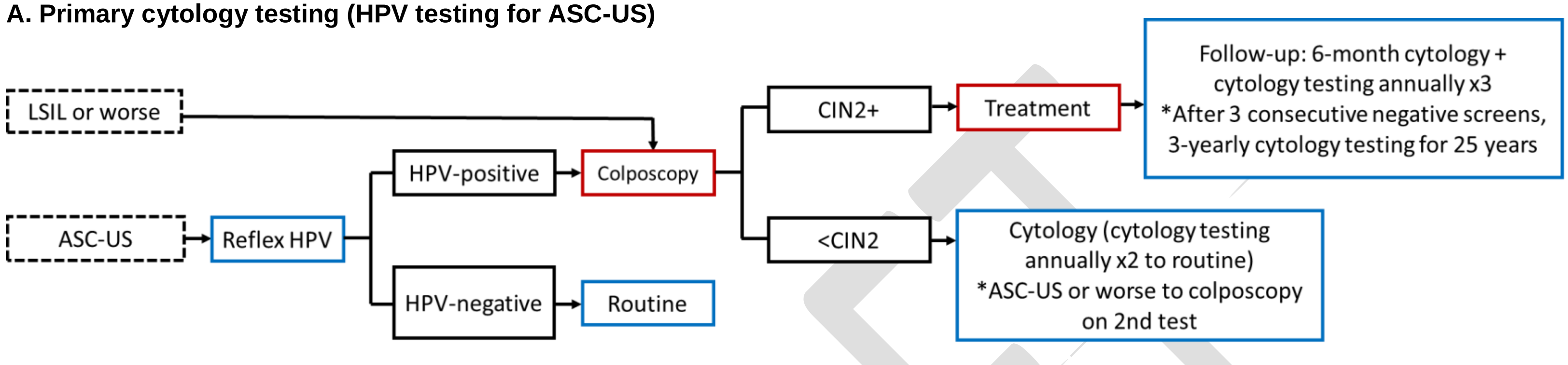


Abbreviations: CIN, cervical intraepithelial neoplasia; HPV, human papillomavirus.

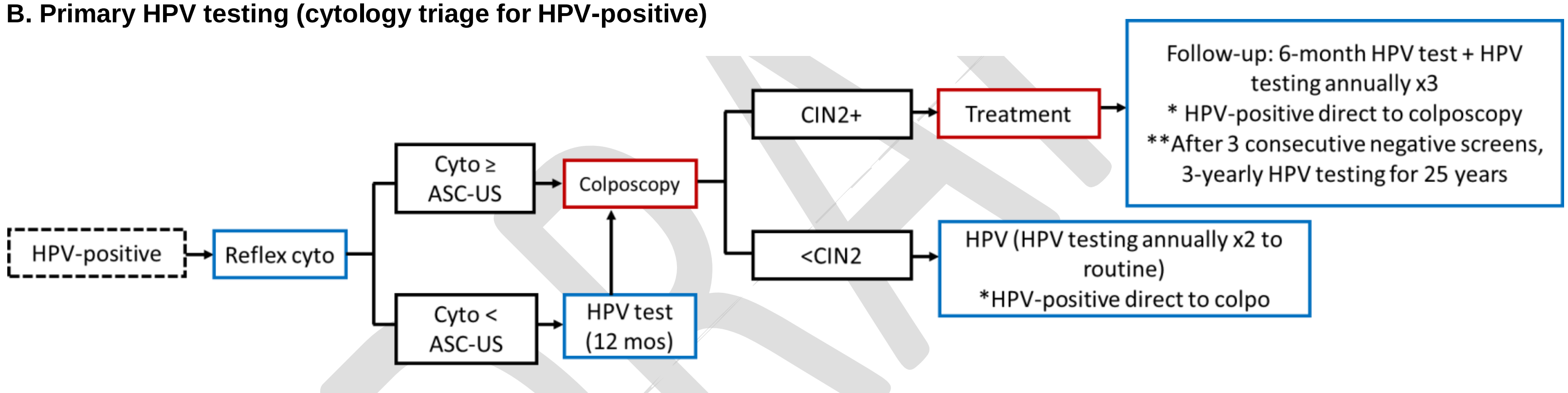
Model-estimated outcomes were compared to those reported in empirical studies summarized in the evidence synthesis.[2] Specifically, we compared the relative risks (RRs) of colposcopy referral, CIN2+ detection, and CIN3+ detection reported in randomized controlled trials of primary HPV testing compared to cytology-based screening and, separately, cotesting to cytology-based screening.[32-37,44]

Figure 8. Flow Diagrams for Management of Screen-Positive Results

A. Primary cytology testing (HPV testing for ASC-US)



B. Primary HPV testing (cytology triage for HPV-positive)



C. Primary cotesting (repeat cotesting for HPV-positive/cytology-negative)

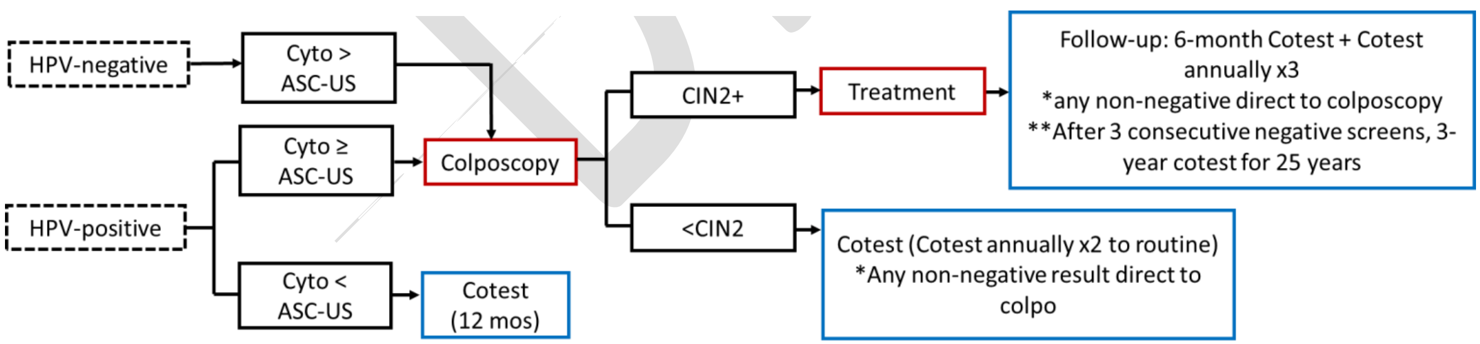


Figure 9. Colposcopies per Life-Year Gained for All Strategies Among Unvaccinated Female Persons by Model

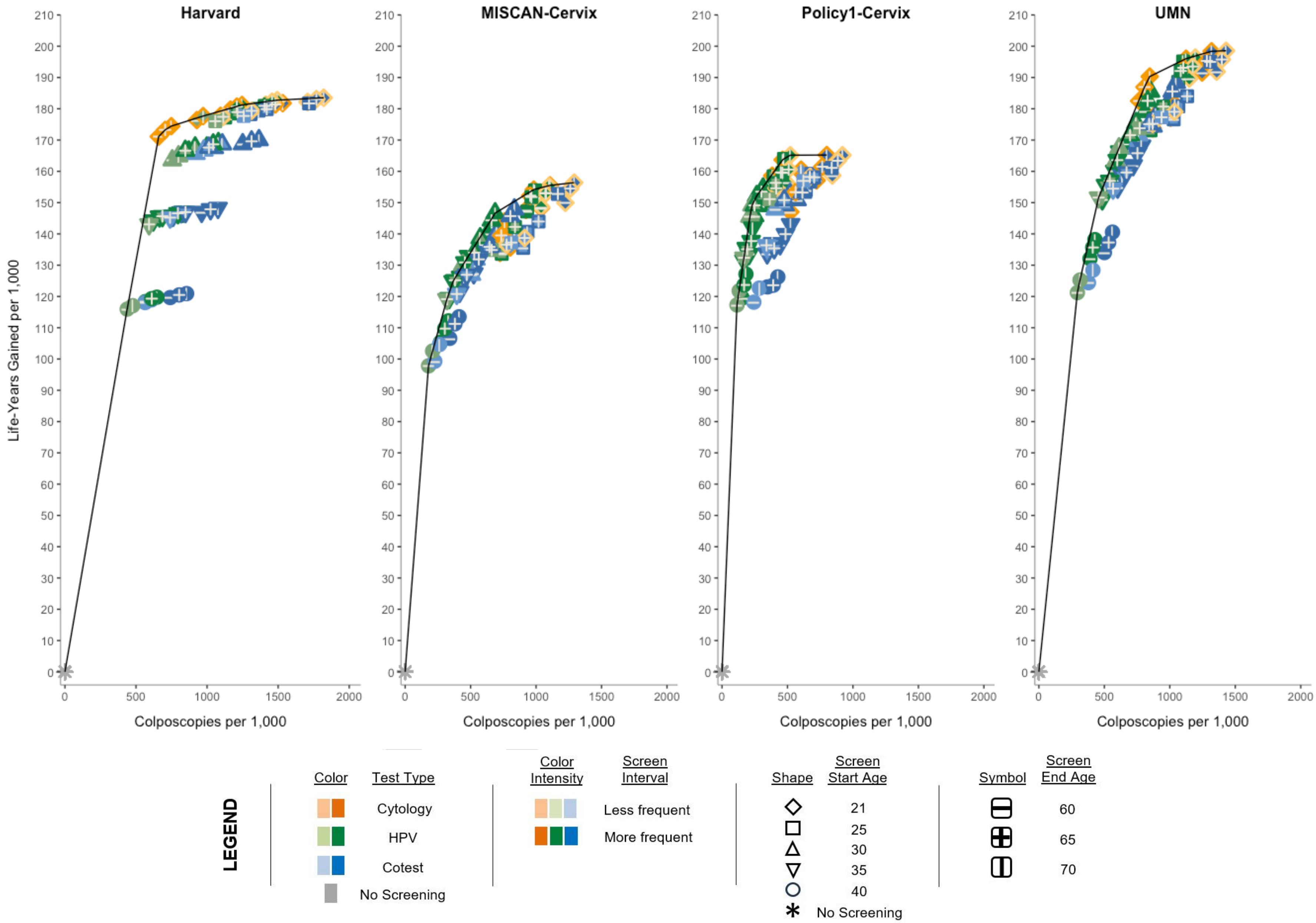


Figure 10. Tests per Life-Year Gained for All Strategies Among Unvaccinated Female Persons by Model

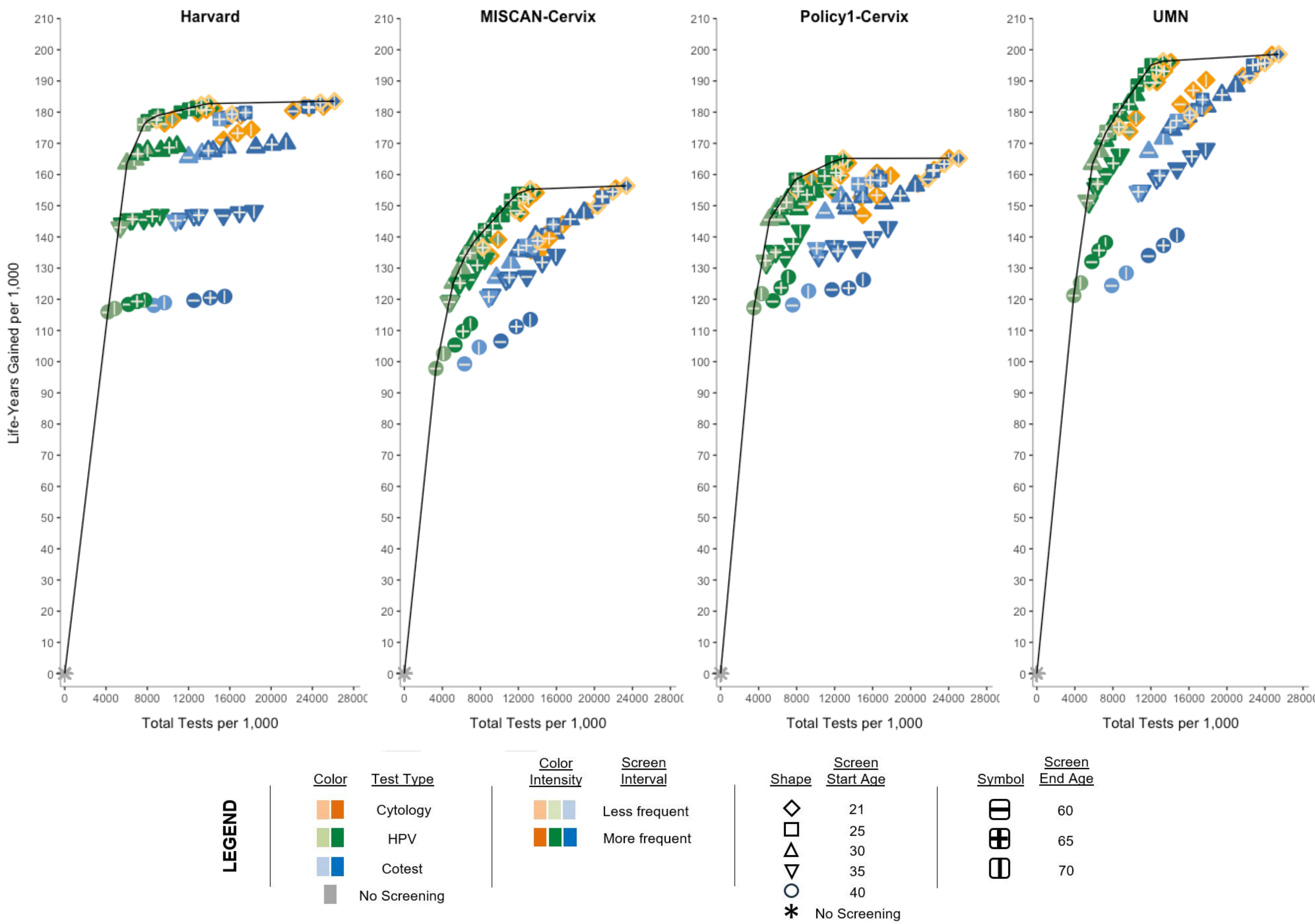


Figure 11. Colposcopies per Life-Year Gained for All Strategies Among 2vHPV or 4vHPV Vaccinated Female Persons by Model

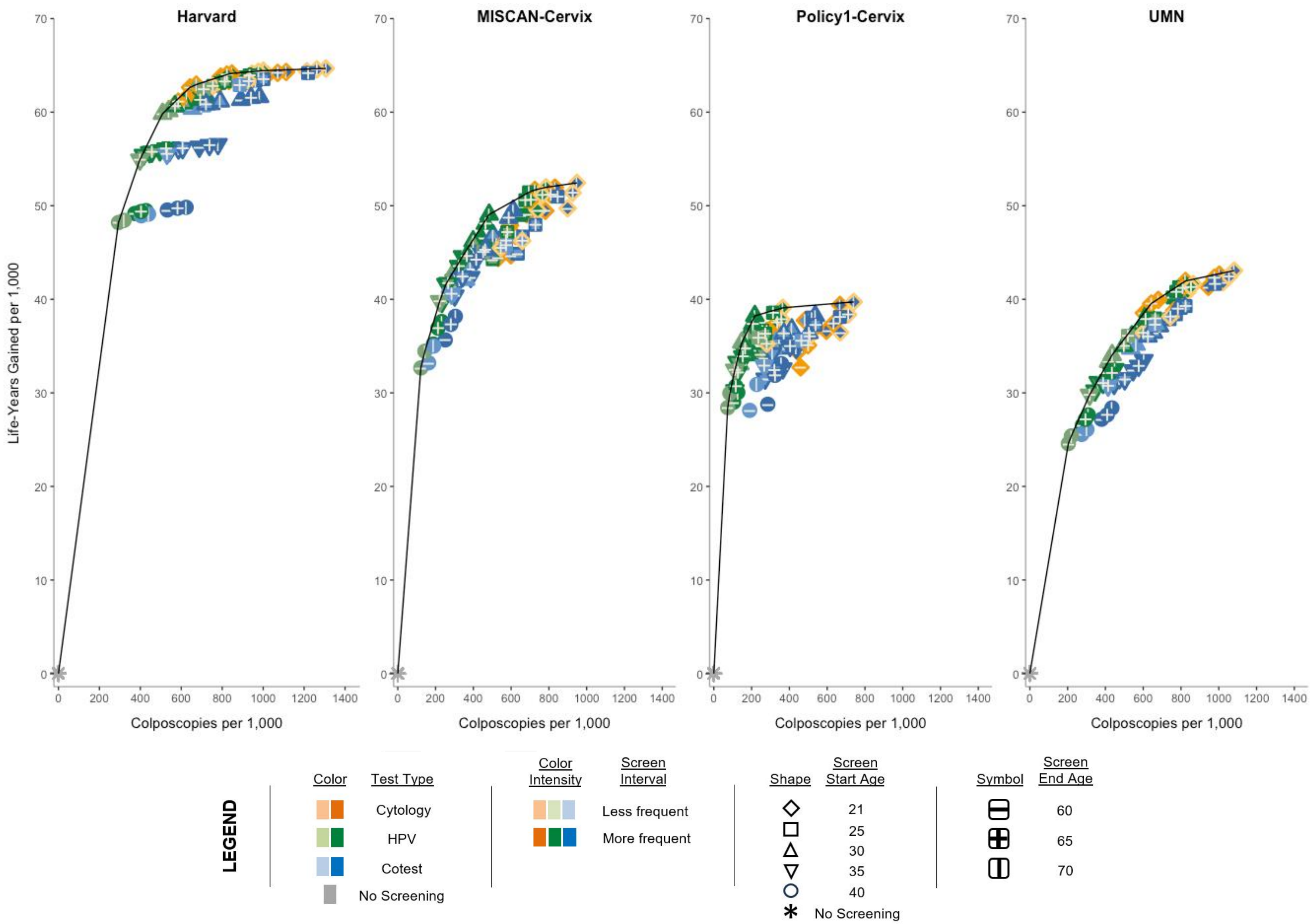


Figure 12. Tests per Life-Year Gained for All Strategies Among 2vHPV or 4vHPV Vaccinated Female Persons by Model

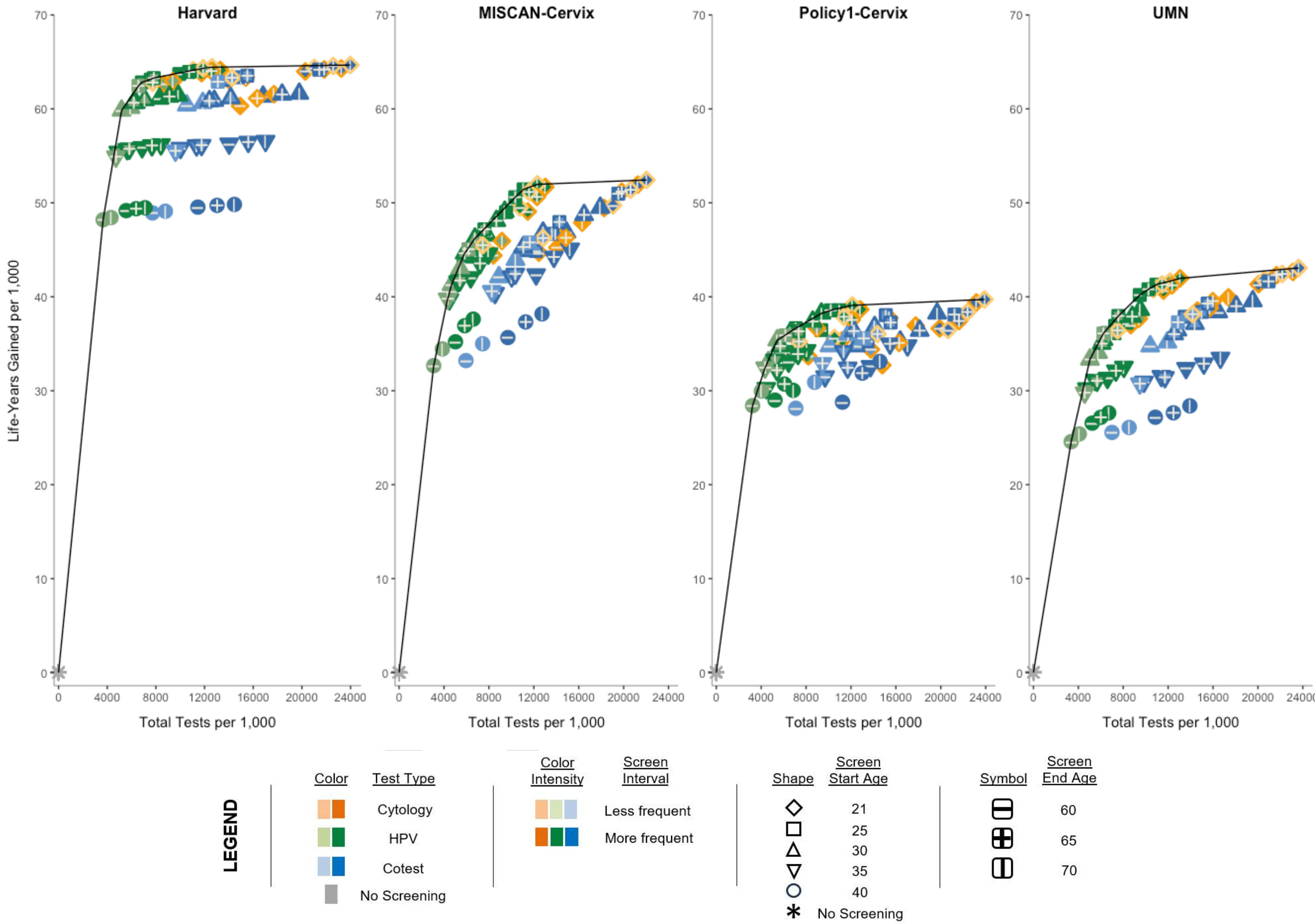


Figure 13. Colposcopies per Life-Year Gained for All Strategies Among 9vHPV Vaccinated Female Persons by Model

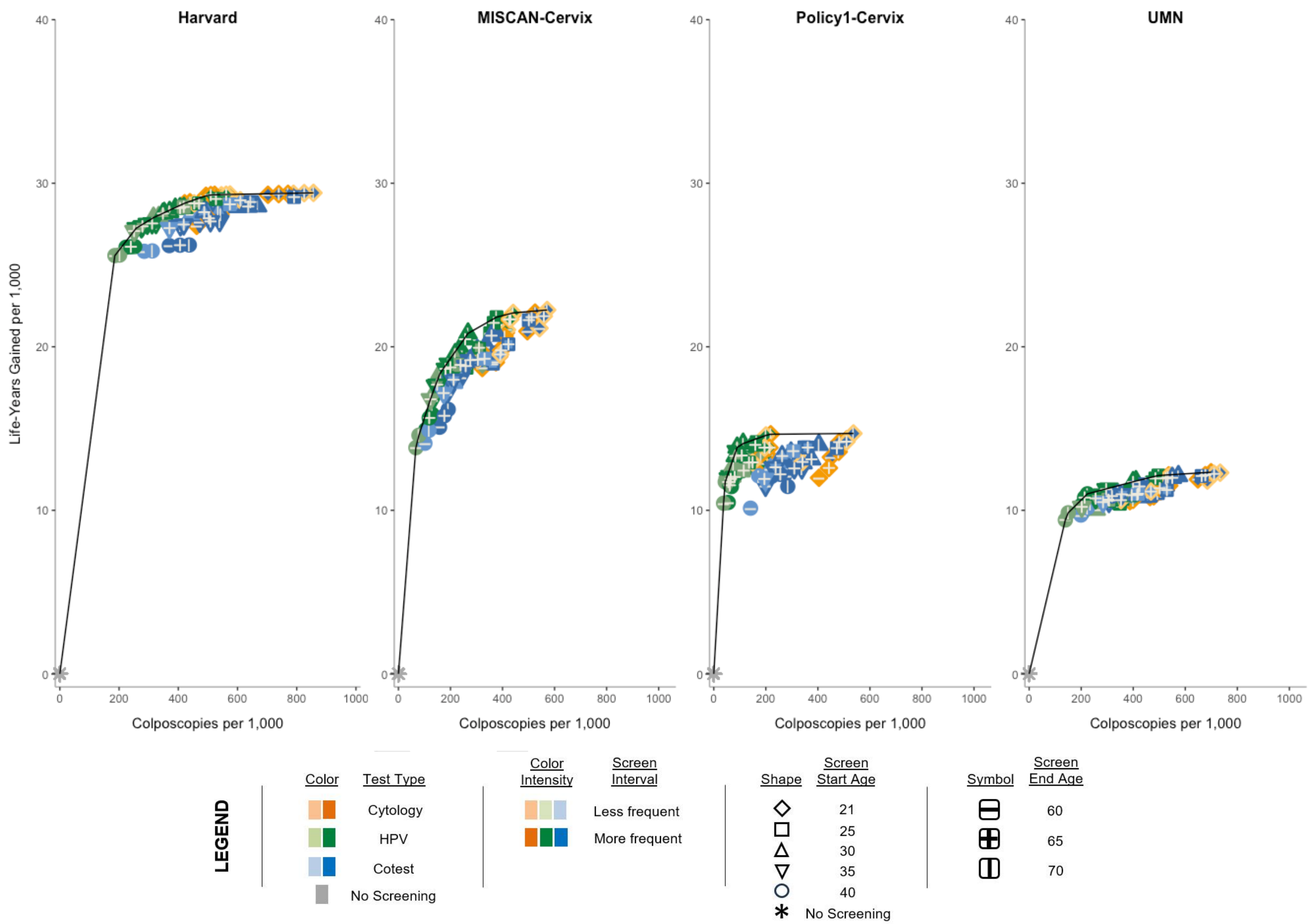


Figure 14. Tests per Life-Year Gained for All Strategies Among 9vHPV Vaccinated Female Persons by Model

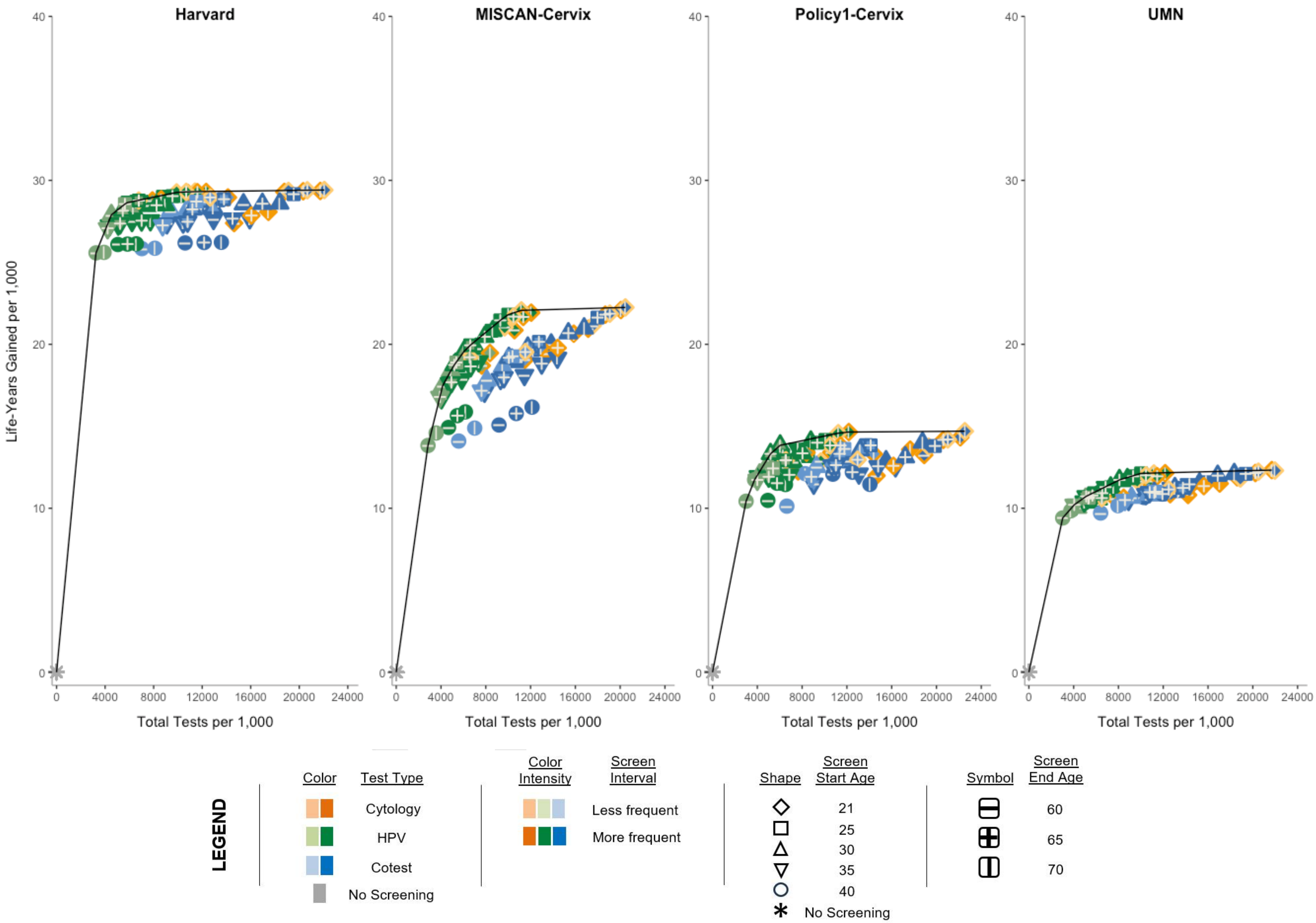


Figure 15. Colposcopies per Life-Year Gained for All Strategies Among Unvaccinated Black Female Persons in the Harvard Model

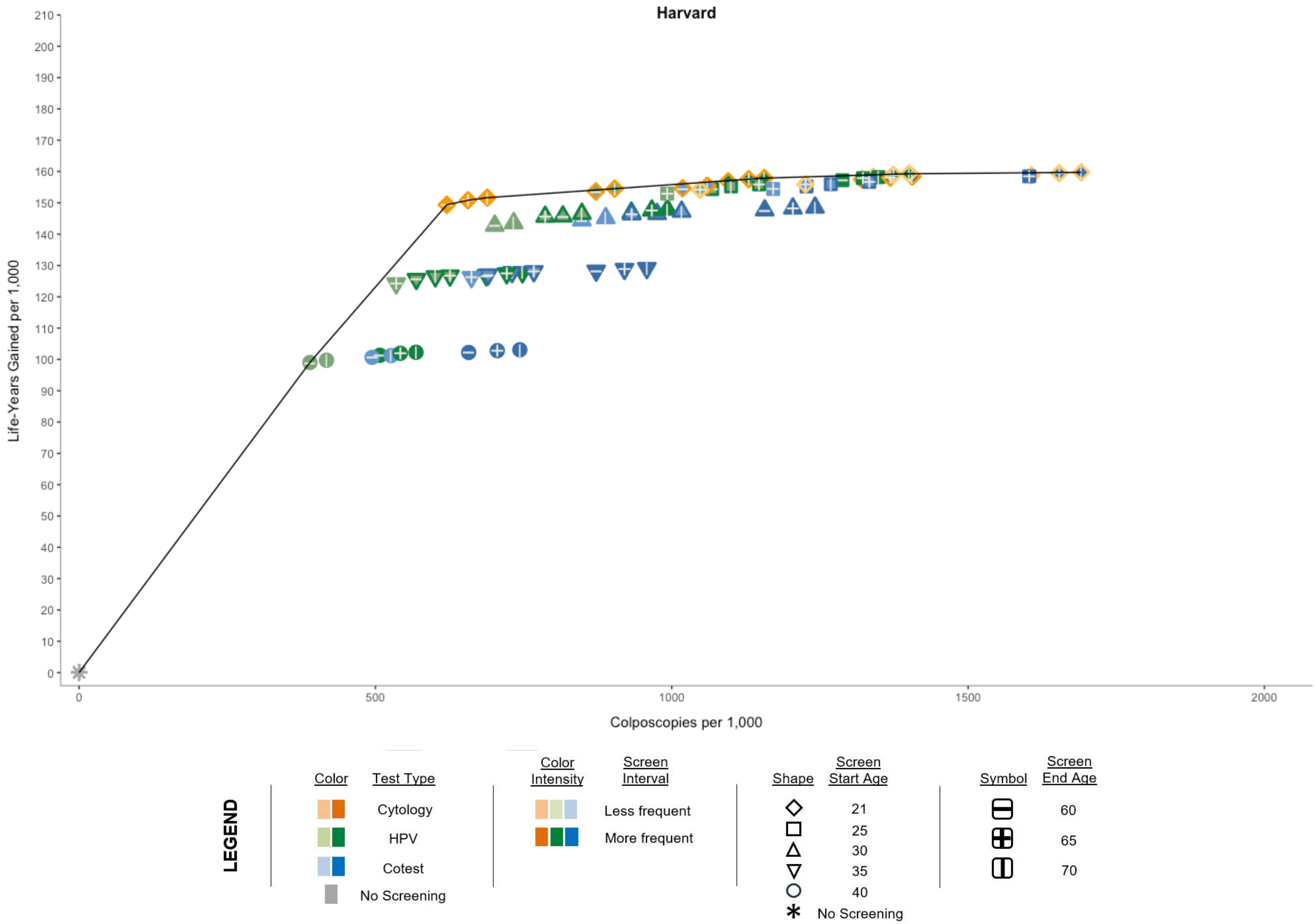


Figure 16. Tests per Life-Year Gained for All Strategies Among Unvaccinated Black Female Persons in the Harvard Model

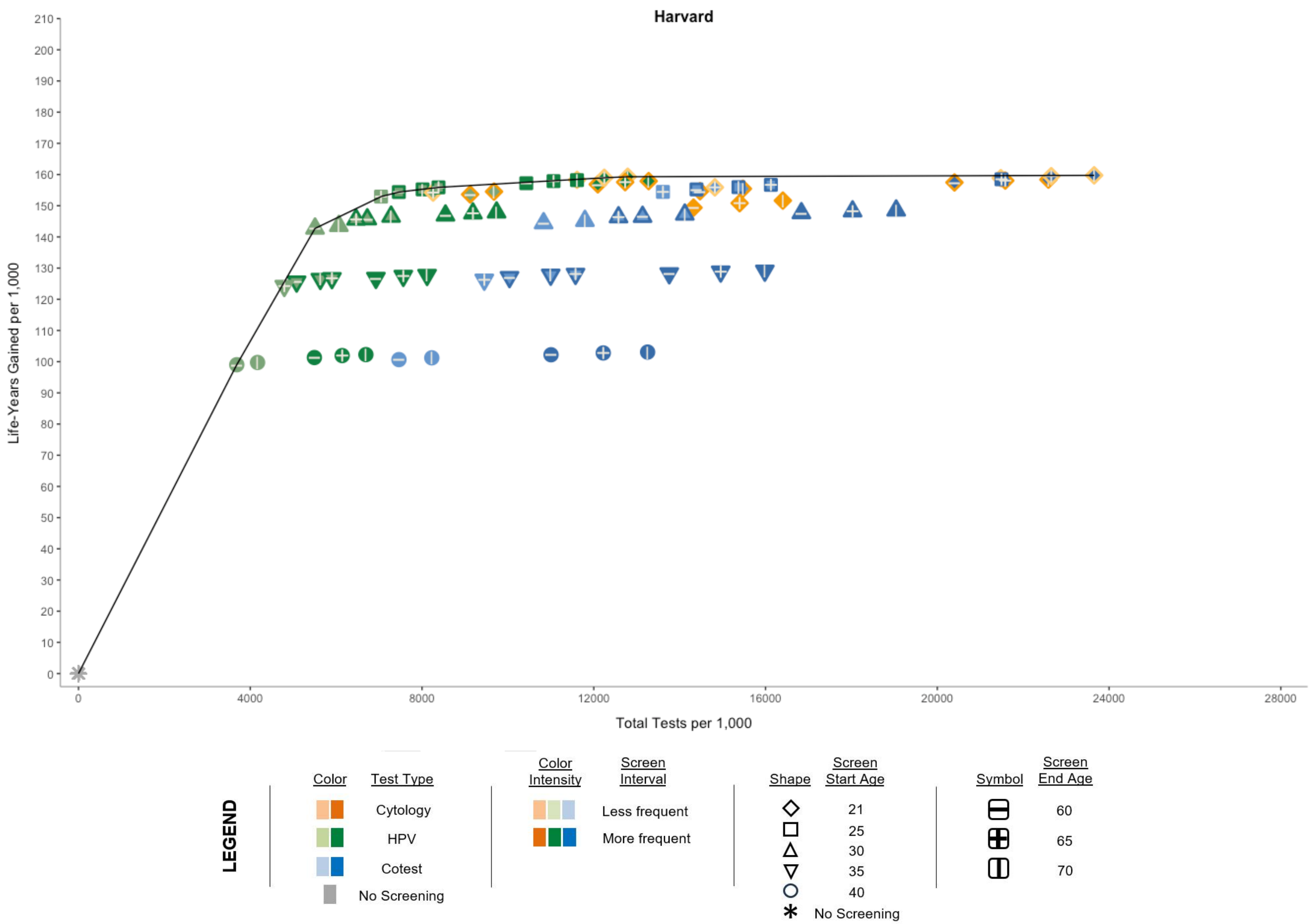


Figure 17. Colposcopies per Life-Year Gained for All Strategies Among 2vHPV or 4vHPV Vaccinated Black Female Persons in the Harvard Model

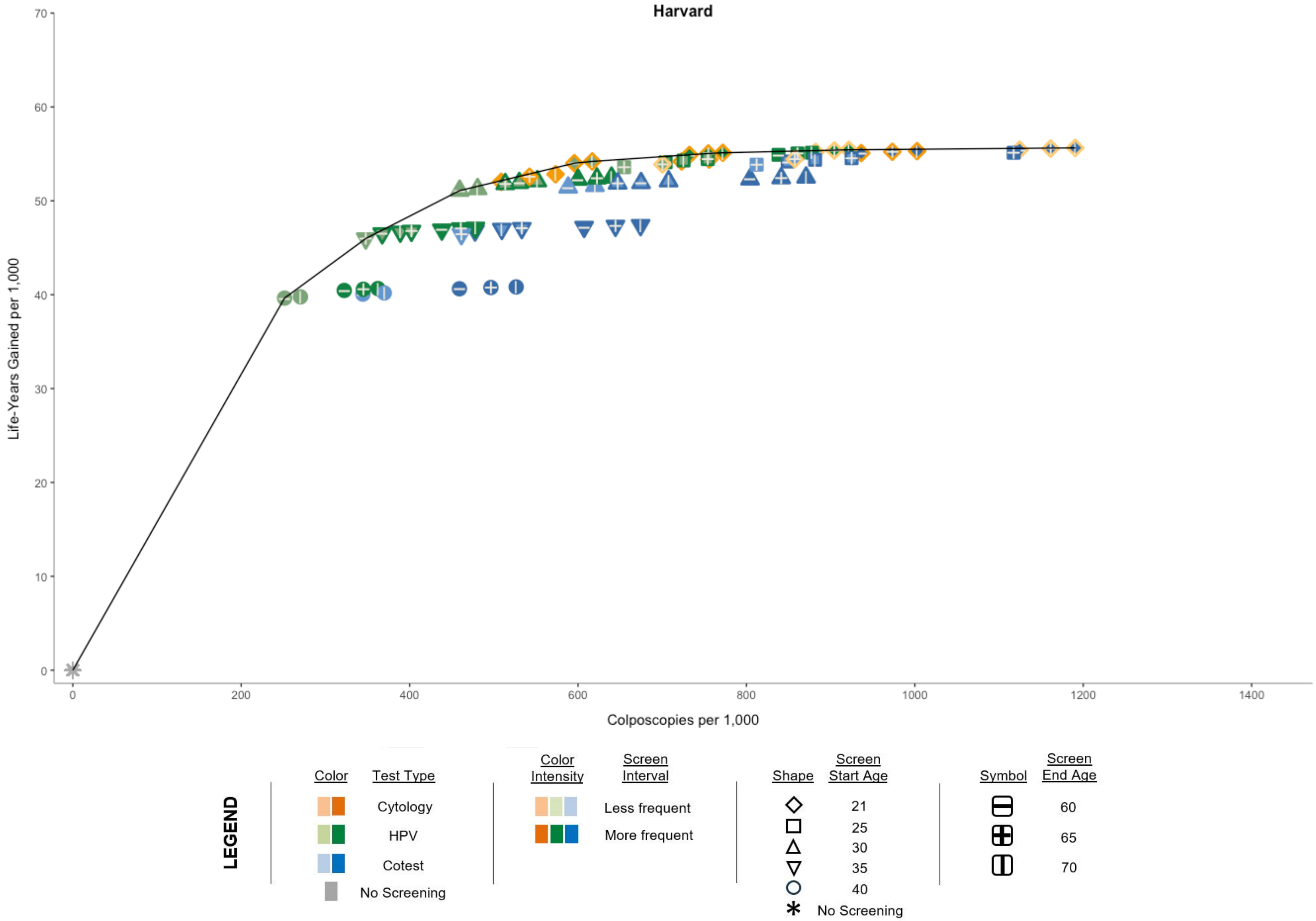


Figure 18. Tests per Life-Year Gained for All Strategies Among 2vHPV or 4vHPV Vaccinated Black Female Persons in the Harvard Model

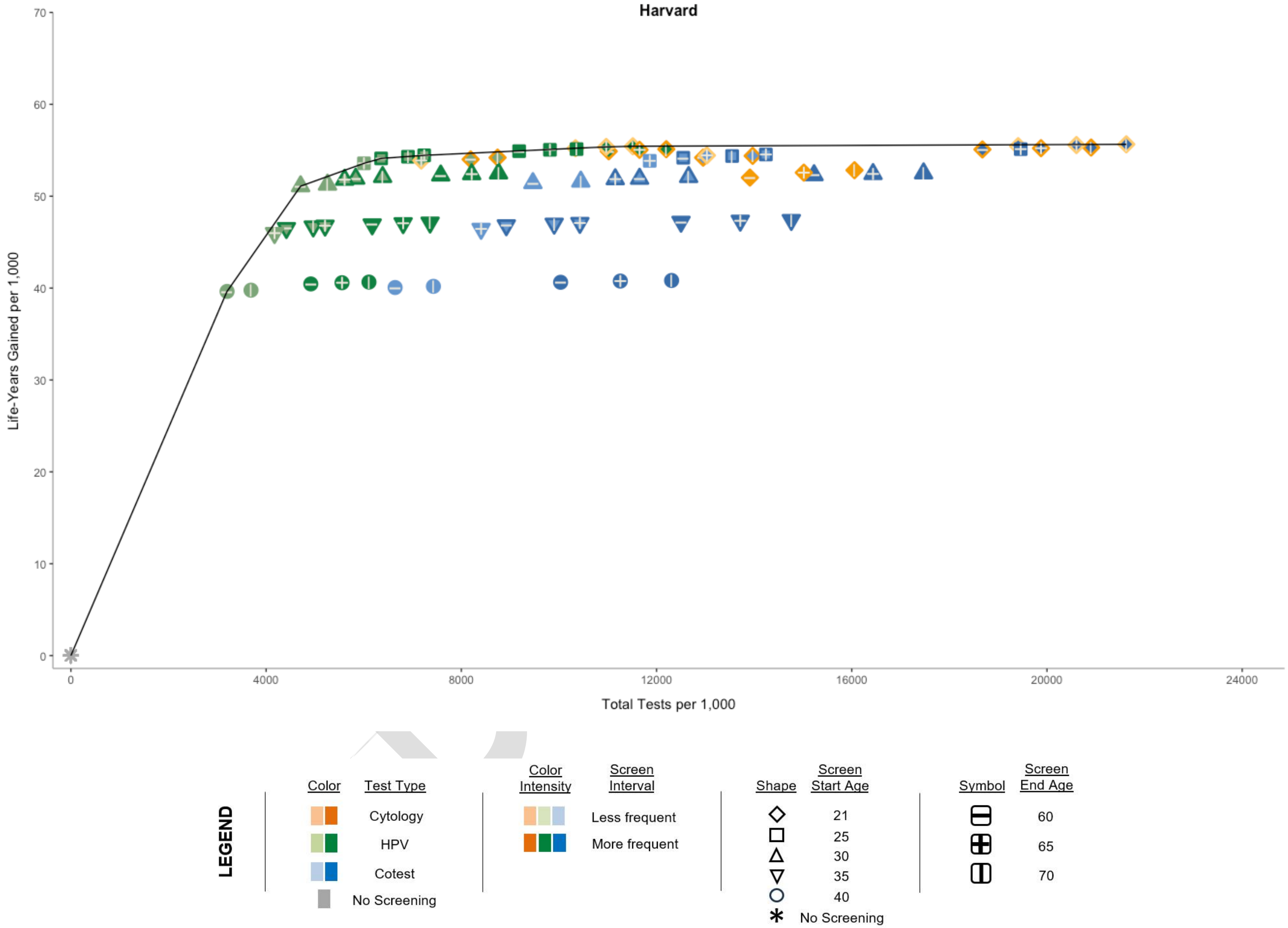


Figure 19. Colposcopies per Life-Year Gained for All Strategies Among 9vHPV Vaccinated Black Female Persons in the Harvard Model

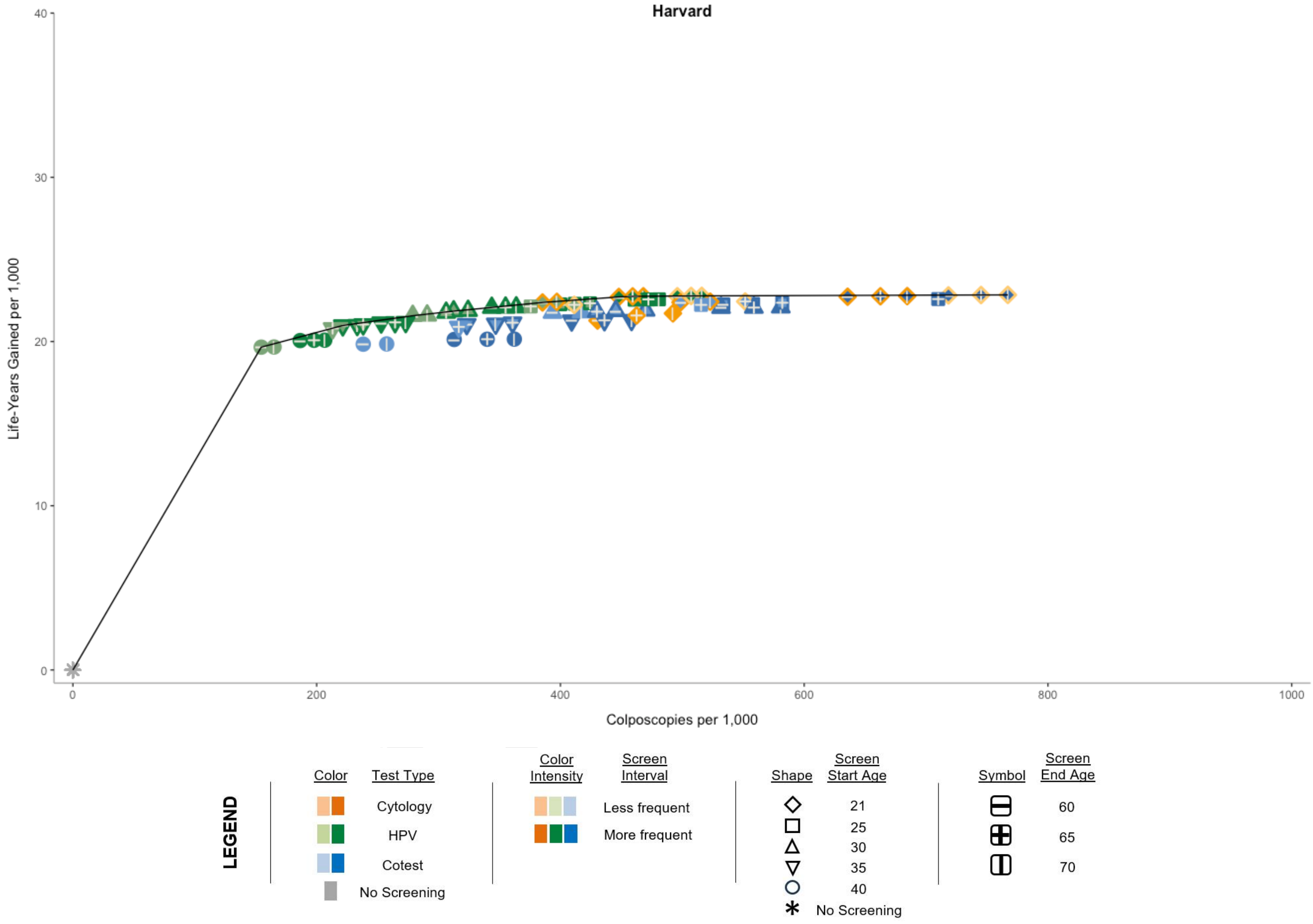


Figure 20. Tests per Life-Year Gained for All Strategies Among 9vHPV Vaccinated Black Female Persons in the Harvard Model

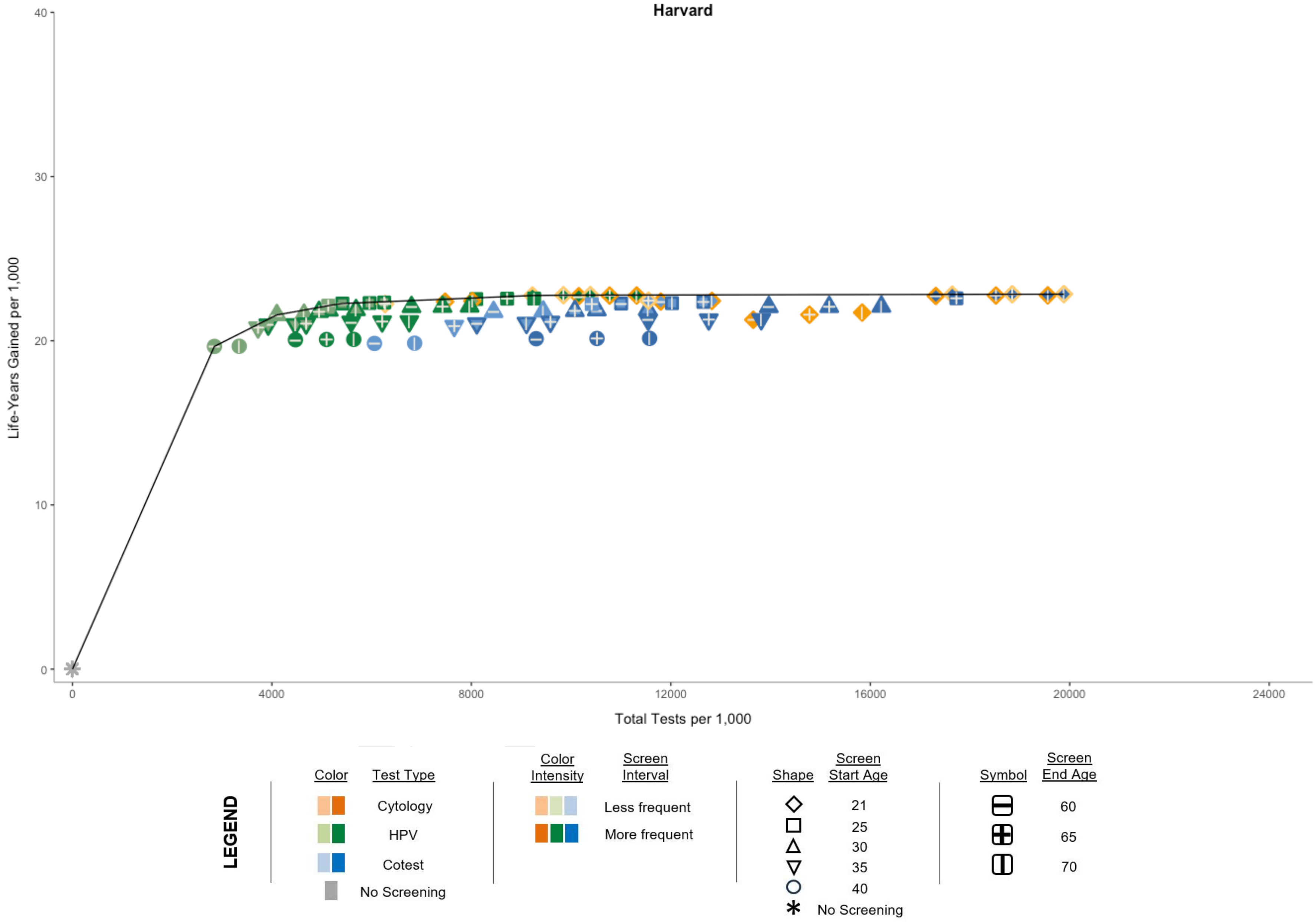


Figure 21. Colposcopies per Life-Year Gained for All Strategies Among Unvaccinated Female Persons Assuming Imperfect Screening and Follow-up Adherence by Model

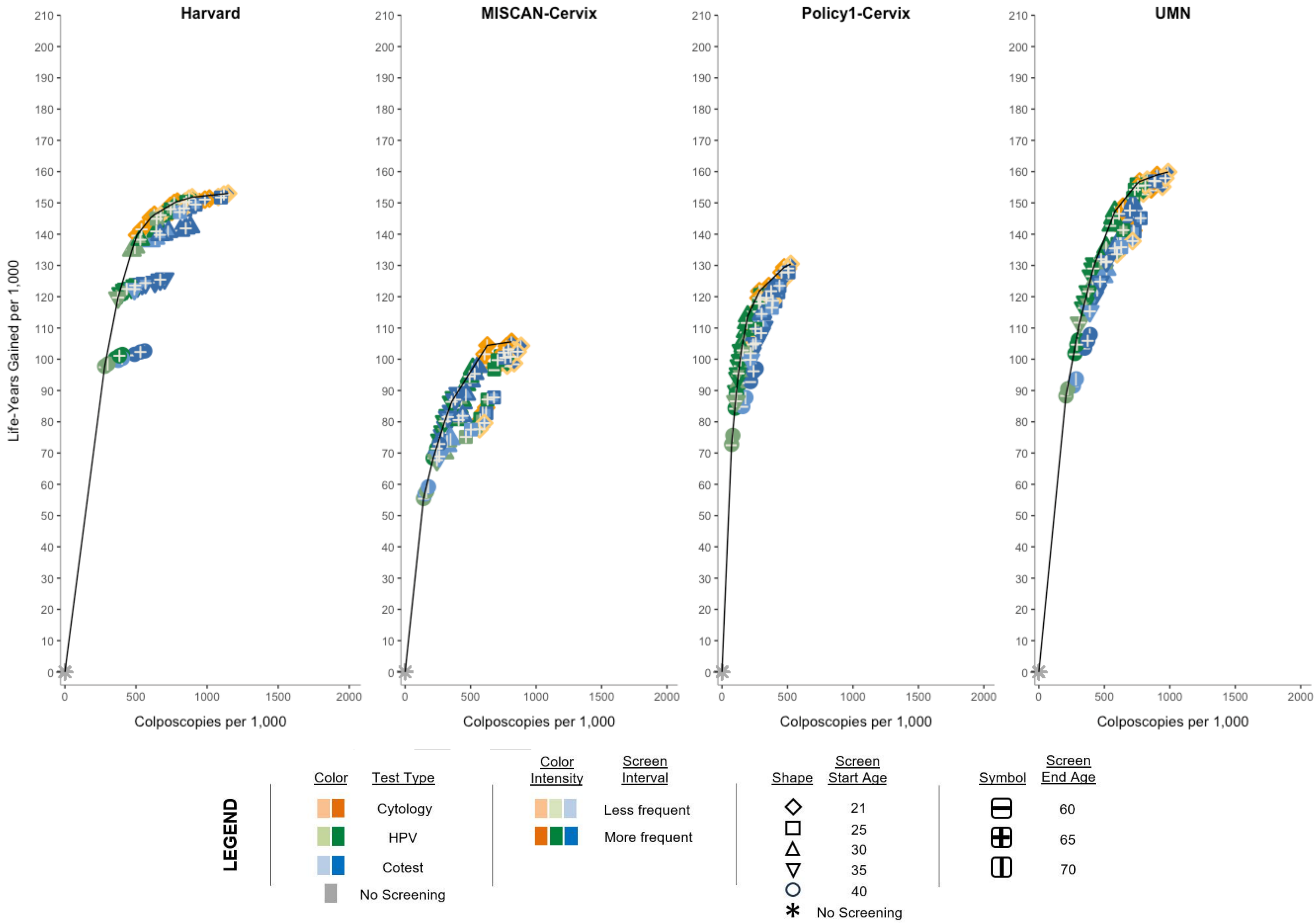


Figure 22. Tests per Life-Year Gained for All Strategies Among Unvaccinated Female Persons Assuming Imperfect Screening and Follow-up Adherence by Model

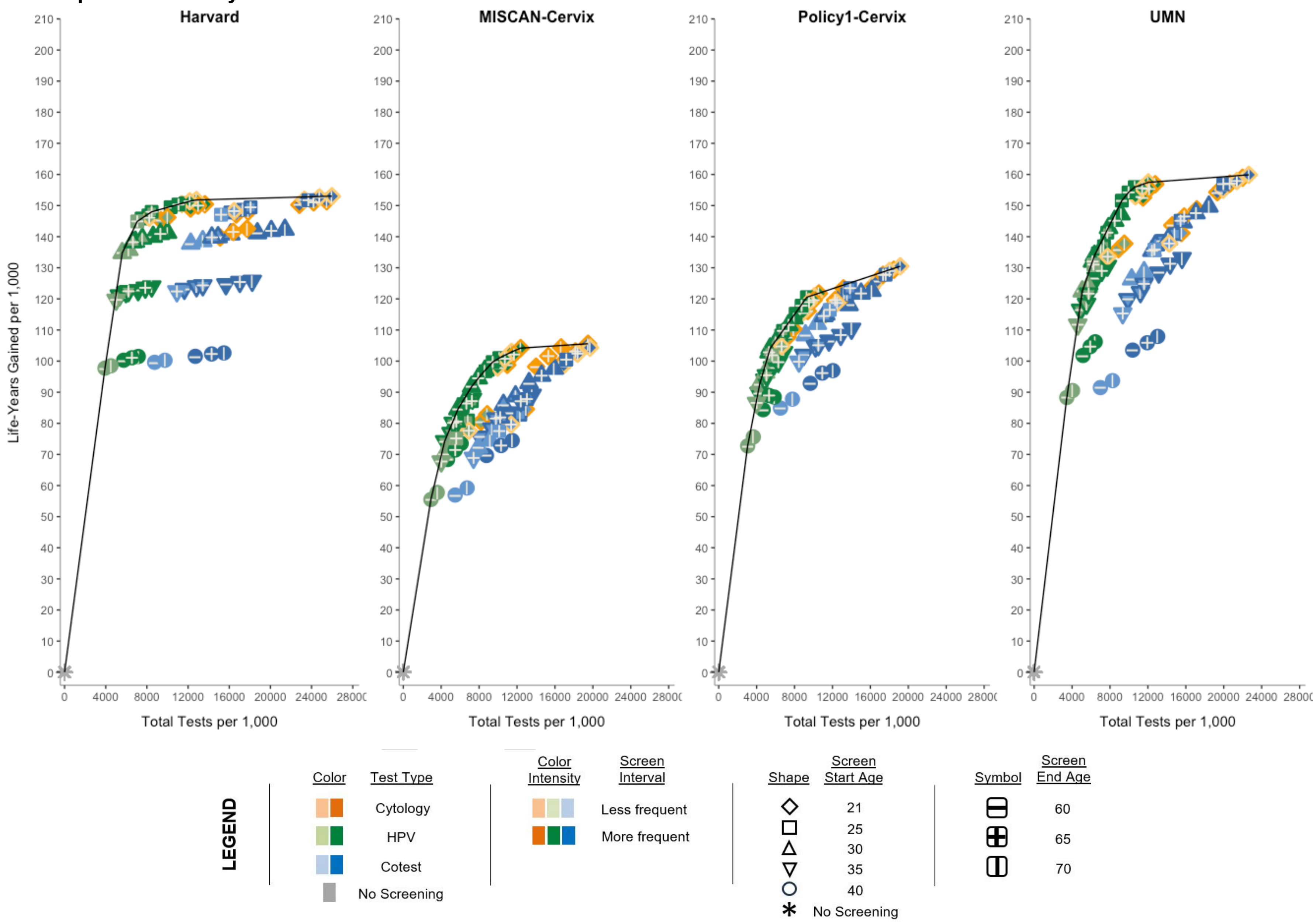


Figure 23. Colposcopies per Life-Year Gained for All Strategies Among 2vHPV or 4vHPV Vaccinated Female Persons Assuming Imperfect Screening and Follow-up Adherence by Model

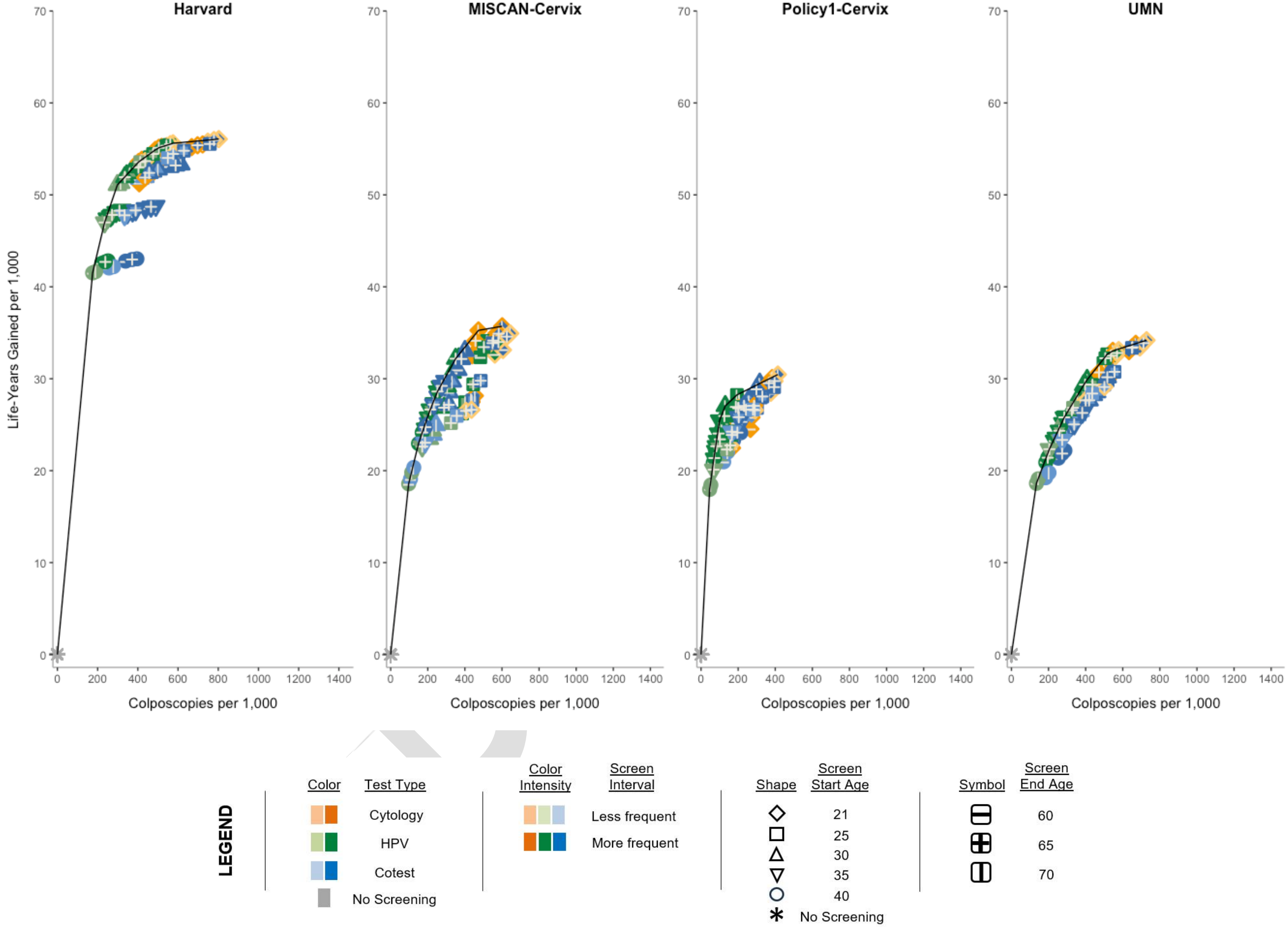


Figure 24. Tests per Life-Year Gained for All Strategies Among 2vHPV or 4vHPV Vaccinated Female Persons Assuming Imperfect Screening and Follow-up Adherence by Model

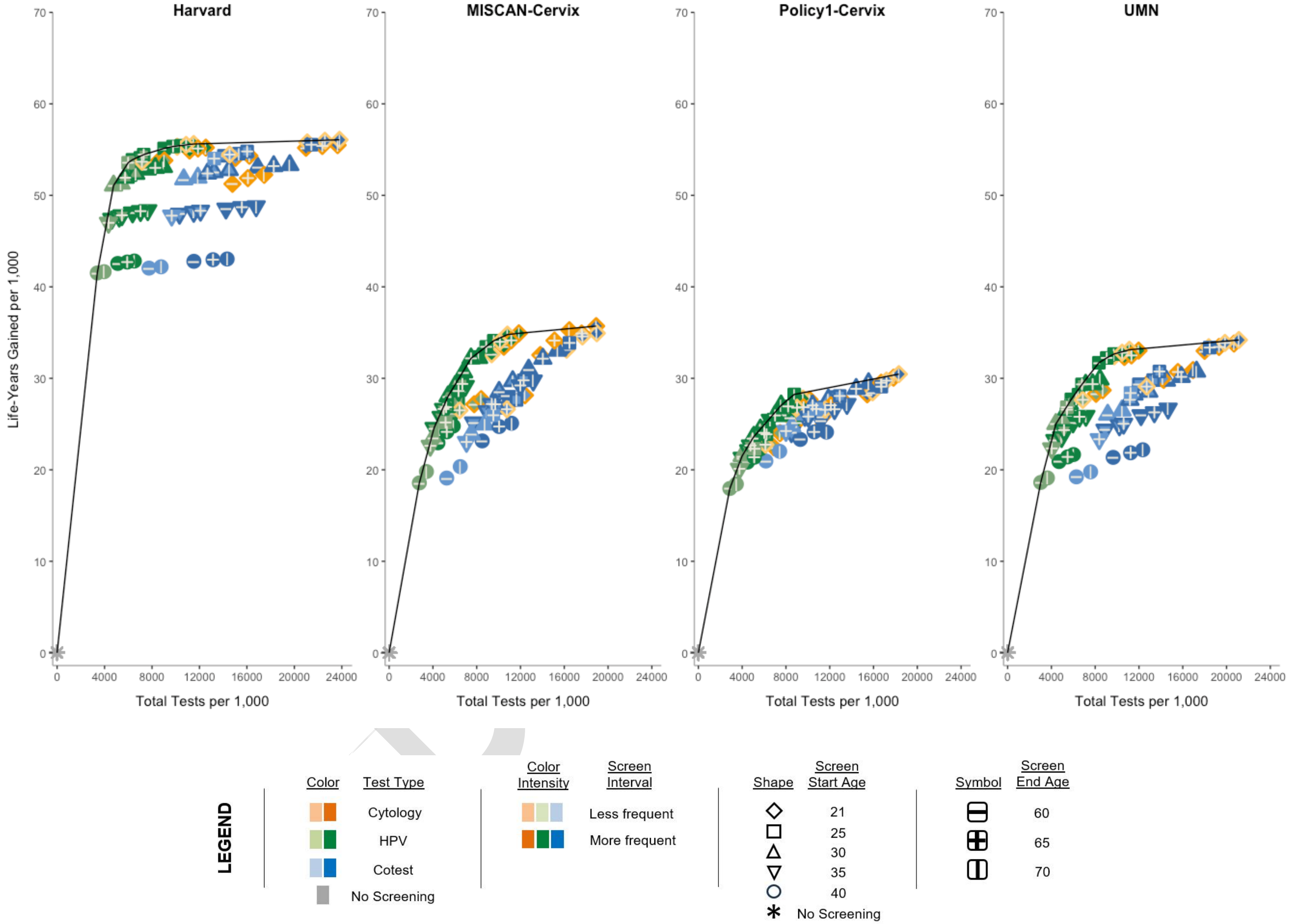


Figure 25. Colposcopies per Life-Year Gained for All Strategies Among 9vHPV Vaccinated Female Persons Assuming Imperfect Screening and Follow-up Adherence by Model

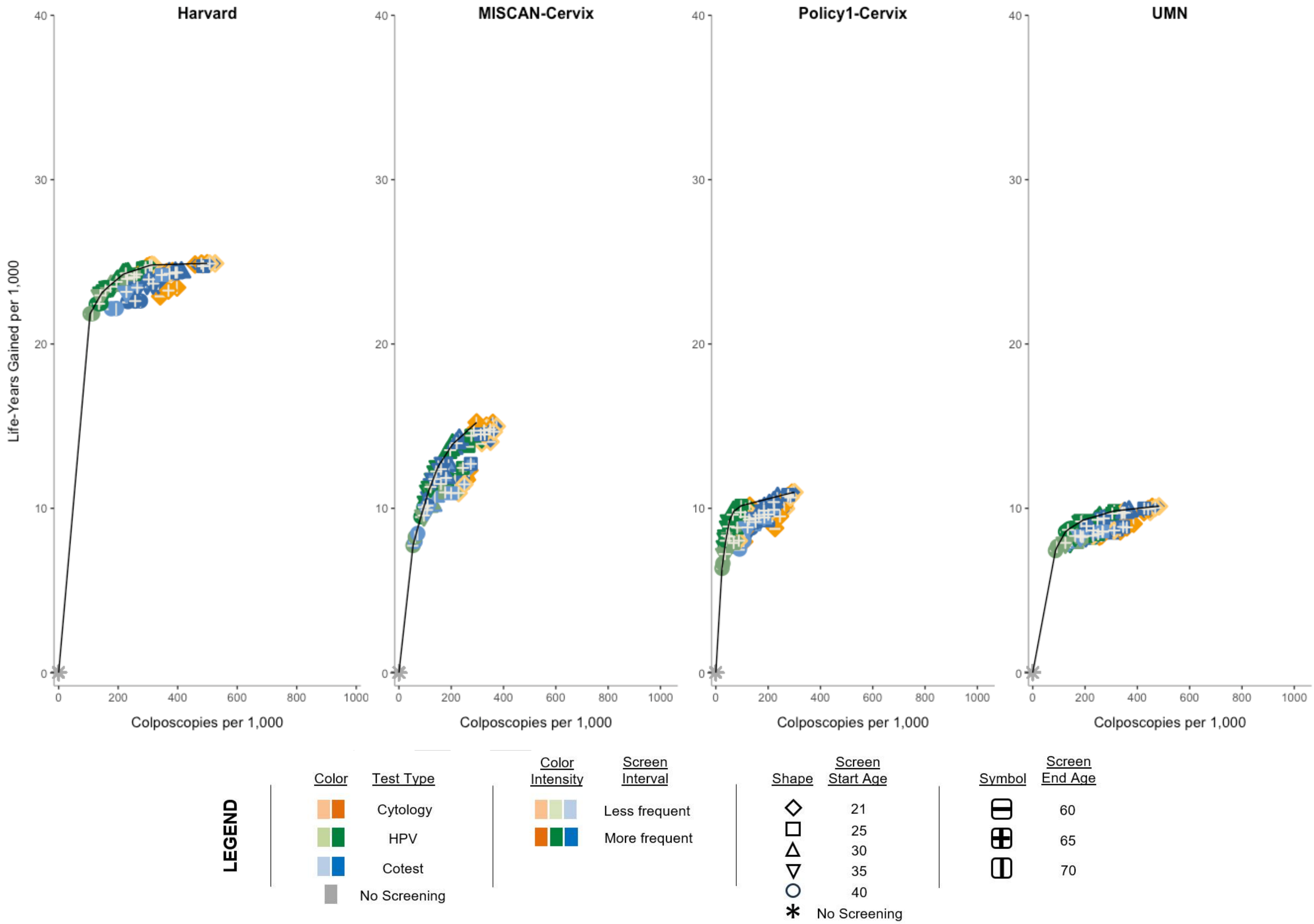


Figure 26. Tests per Life-Year Gained for All Strategies Among 9vHPV Vaccinated Female Persons Assuming Imperfect Screening and Follow-up Adherence by Model

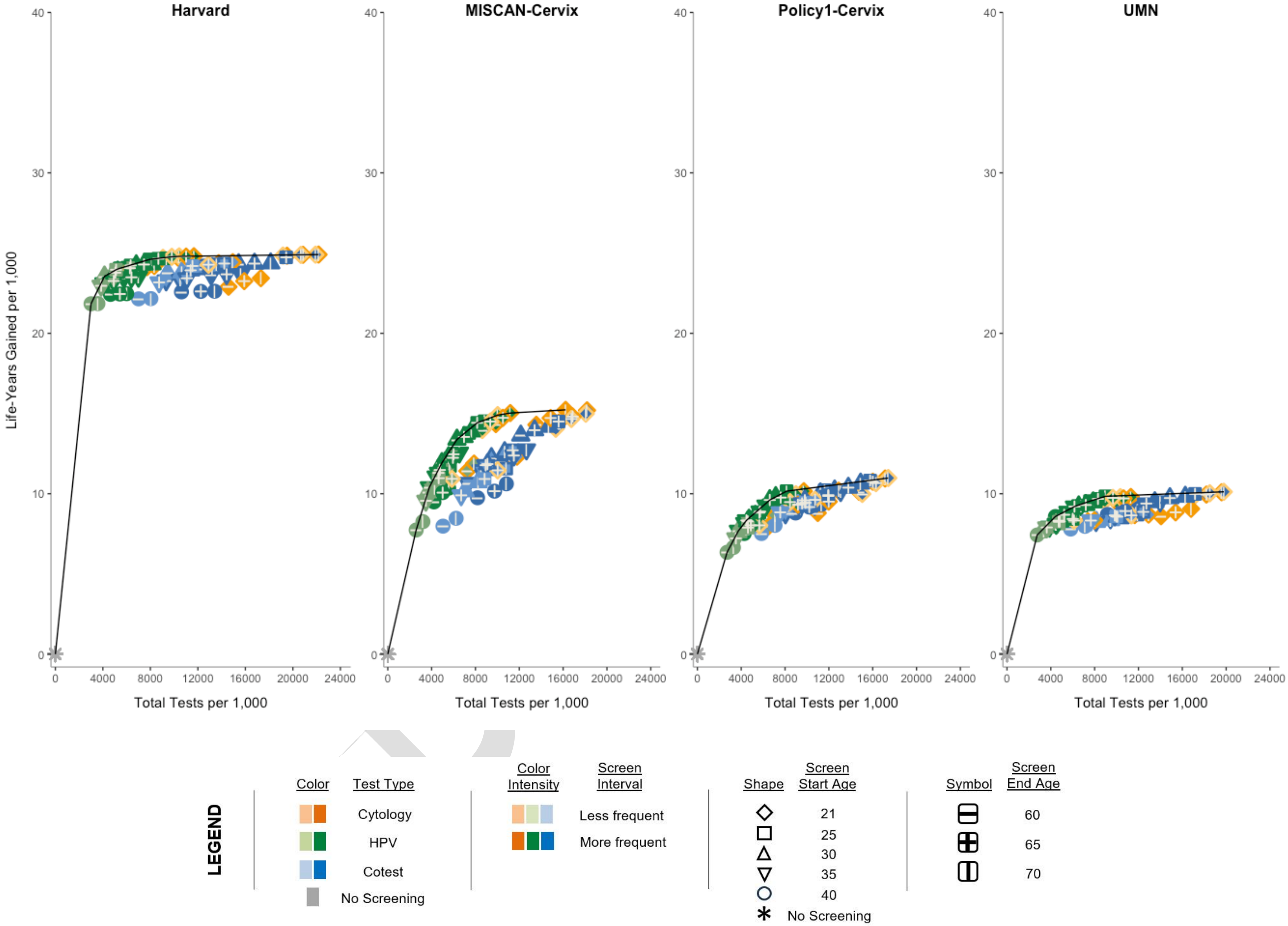


Figure 27. Colposcopies per Life-Year Gained for All Strategies Among Unvaccinated Black Female Persons Assuming Imperfect Screening and Follow-up Adherence in the Harvard Model

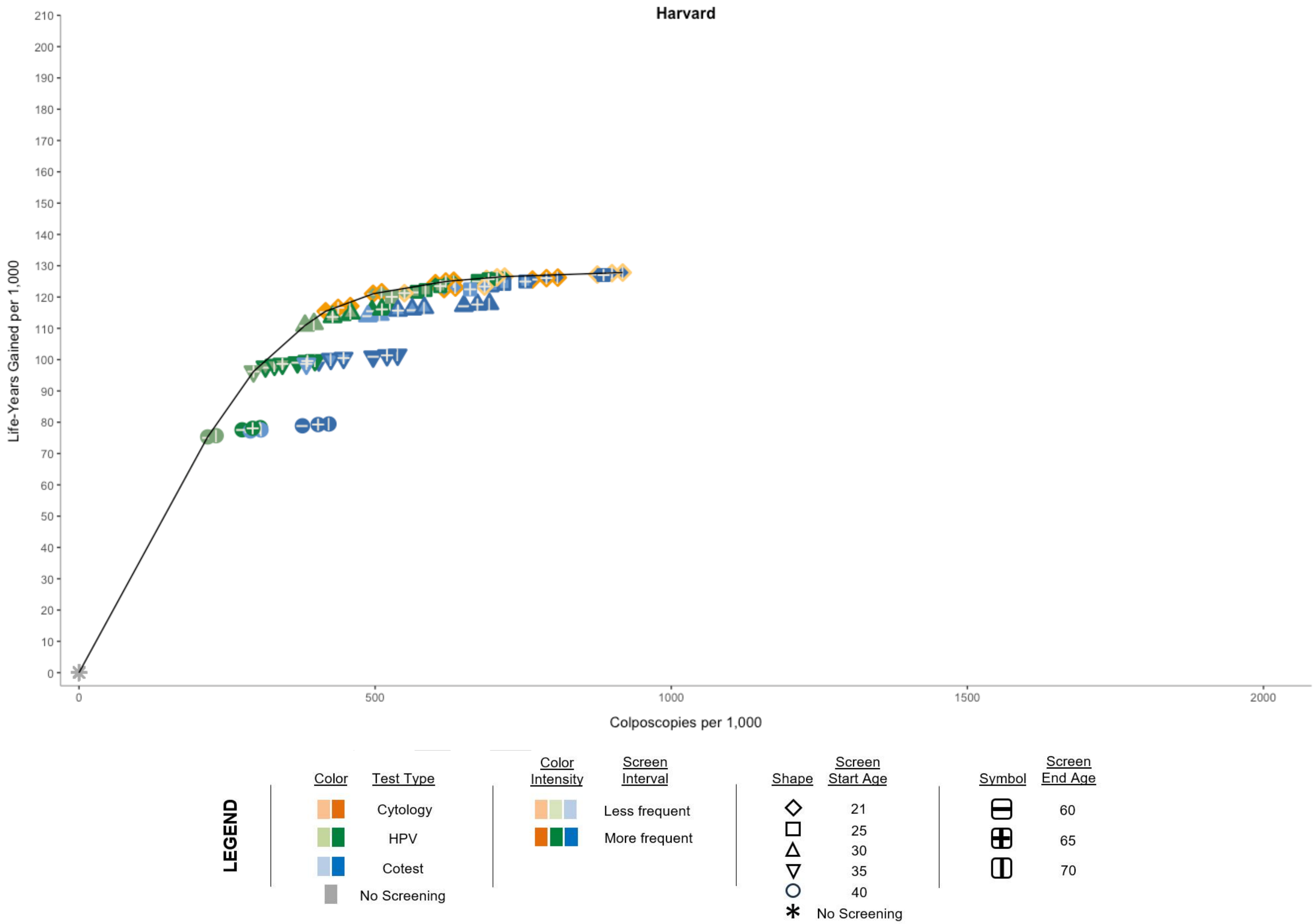


Figure 28. Tests per Life-Year Gained for All Strategies Among Unvaccinated Black Female Persons Assuming Imperfect Screening and Follow-up Adherence in the Harvard Model

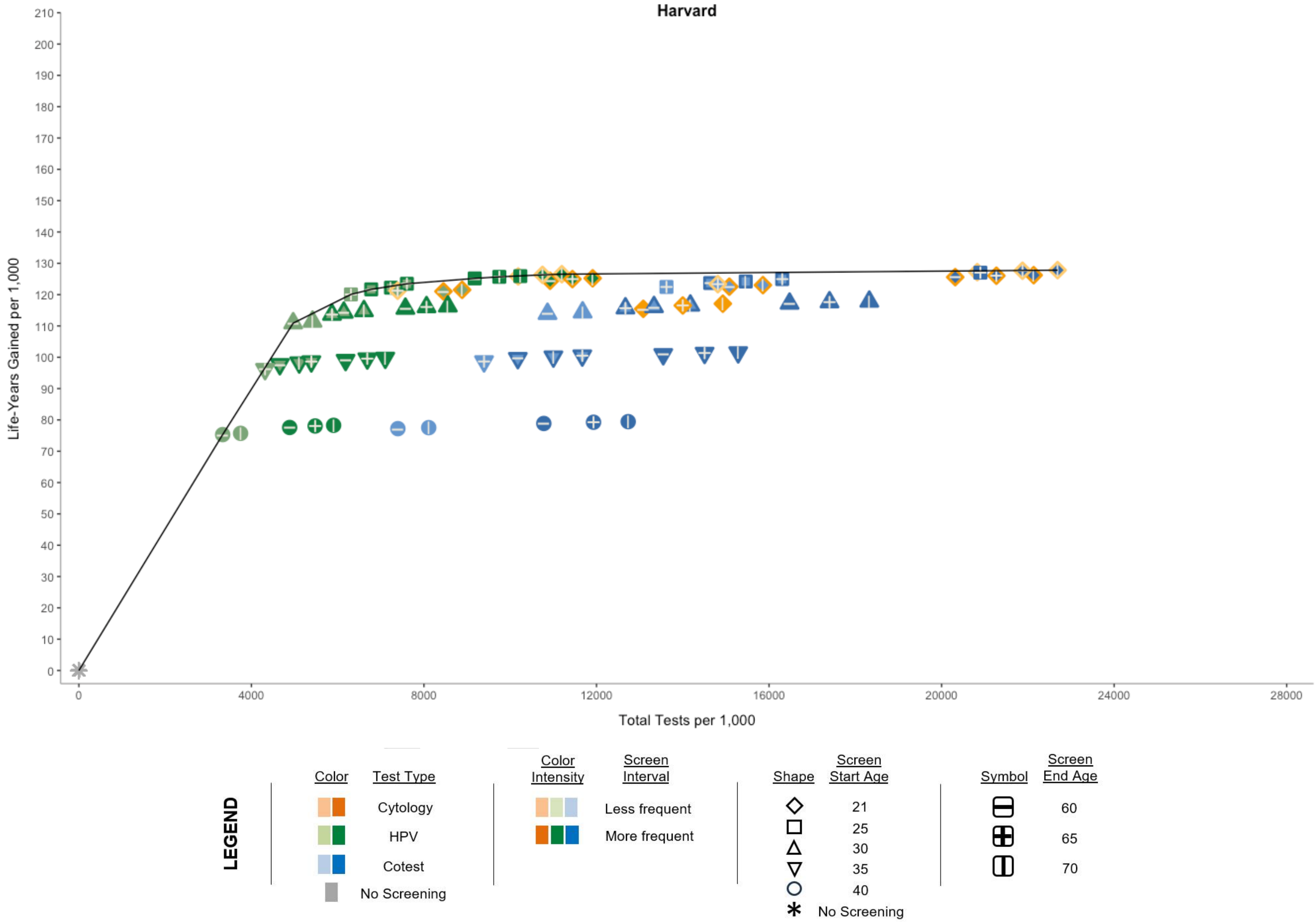


Figure 29. Colposcopies per Life-Year Gained for All Strategies Among 2vHPV or 4vHPV Vaccinated Black Female Persons Assuming Imperfect Screening and Follow-up Adherence in the Harvard Model

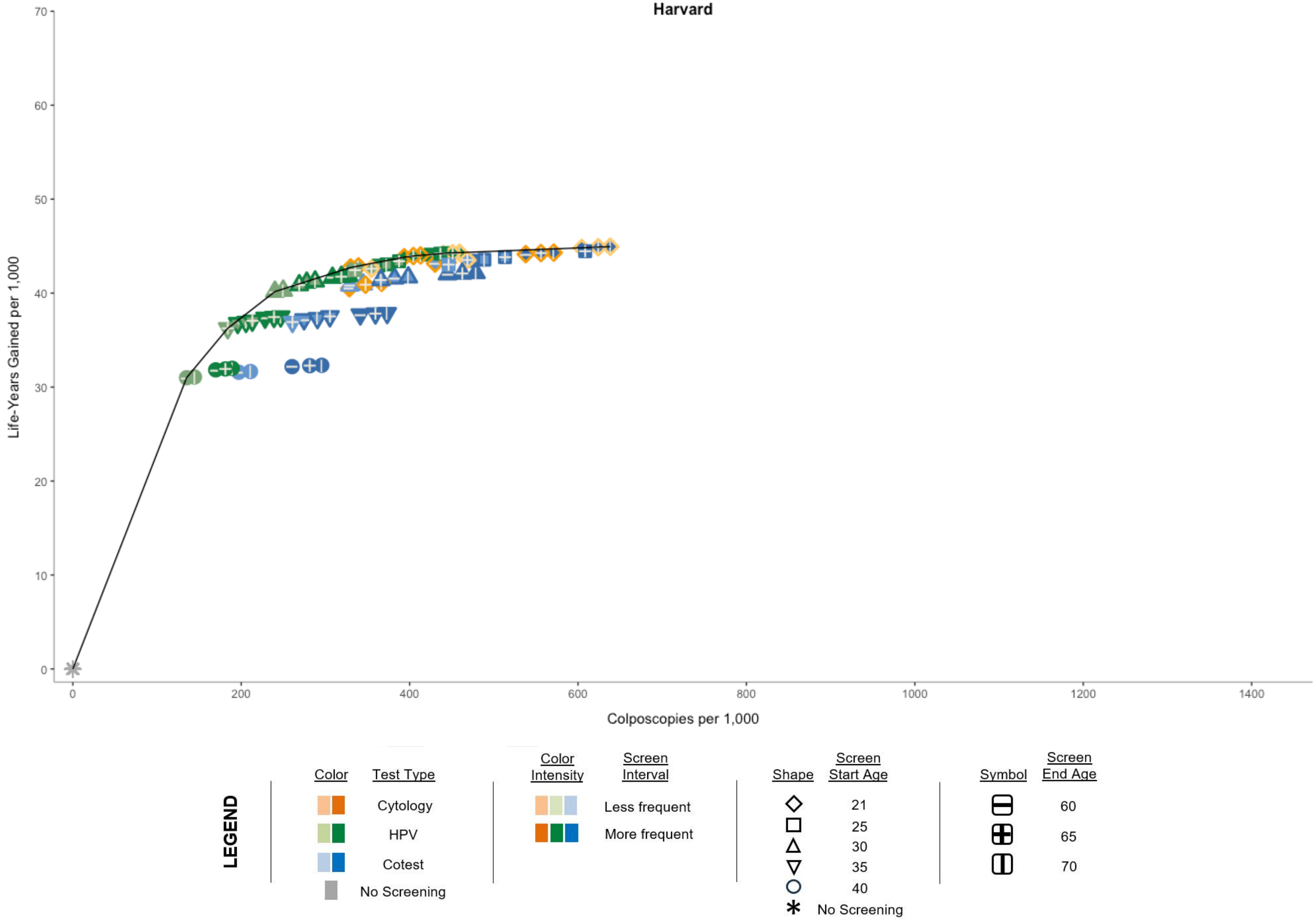


Figure 30. Tests per Life-Year Gained for All Strategies Among 2vHPV or 4vHPV Vaccinated Black Female Persons Assuming Imperfect Screening and Follow-up Adherence in the Harvard Model

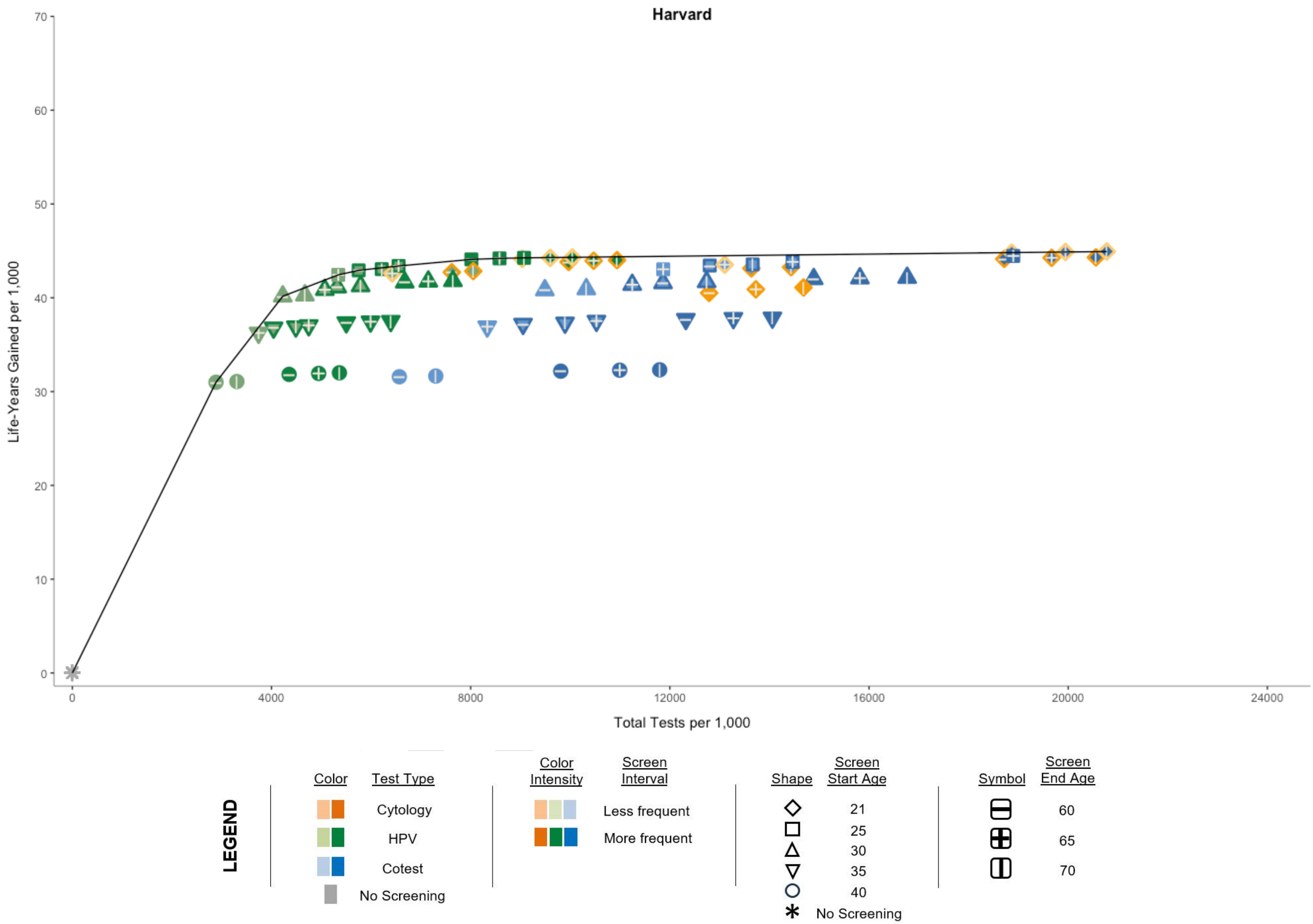


Figure 31. Colposcopies per Life-Year Gained for All Strategies Among 9vHPV Vaccinated Black Female Persons Assuming Imperfect Screening and Follow-up Adherence in the Harvard Model

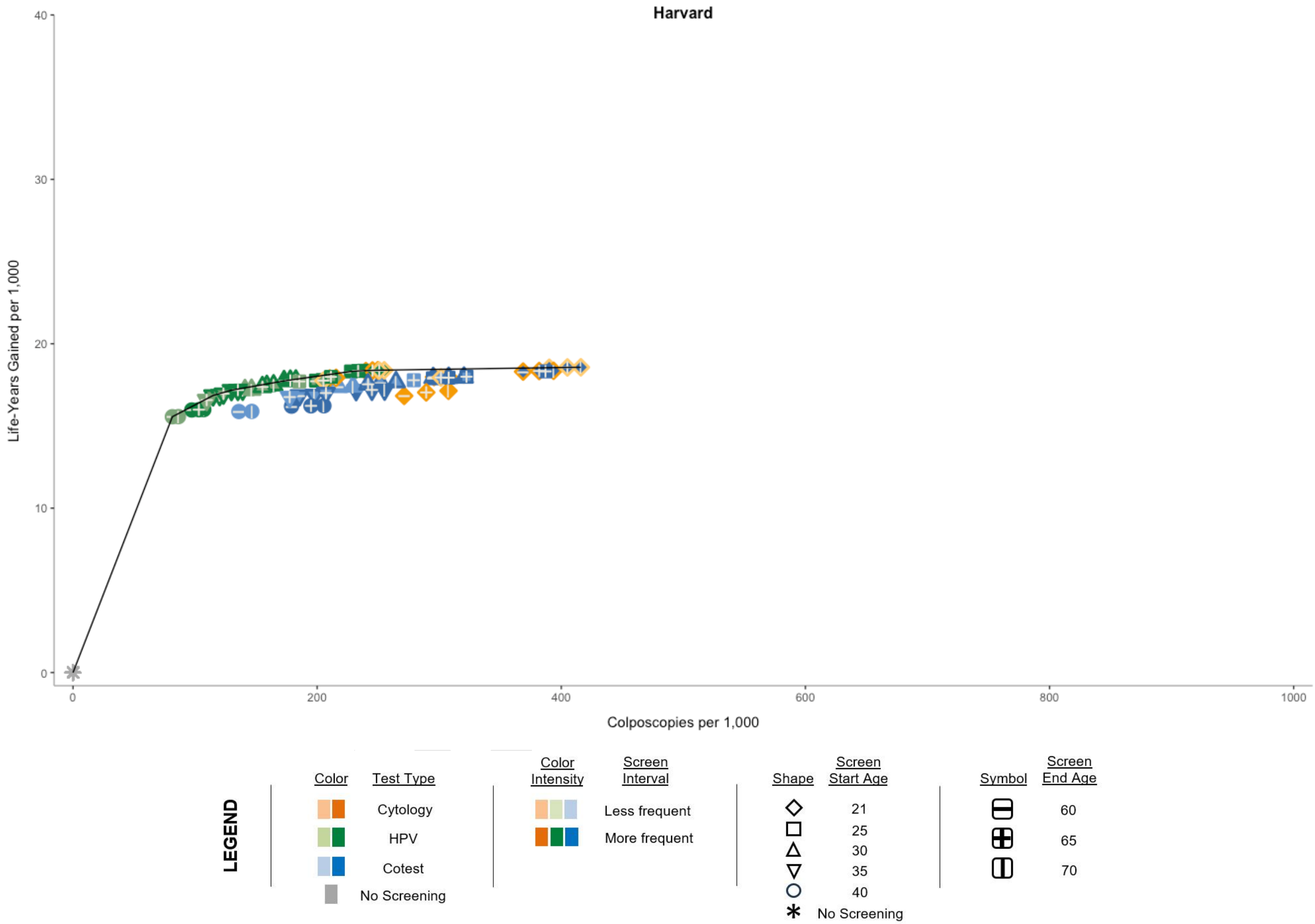


Figure 32. Tests per Life-Year Gained for All Strategies Among 9vHPV Vaccinated Black Female Persons Assuming Imperfect Screening and Follow-up Adherence in the Harvard Model

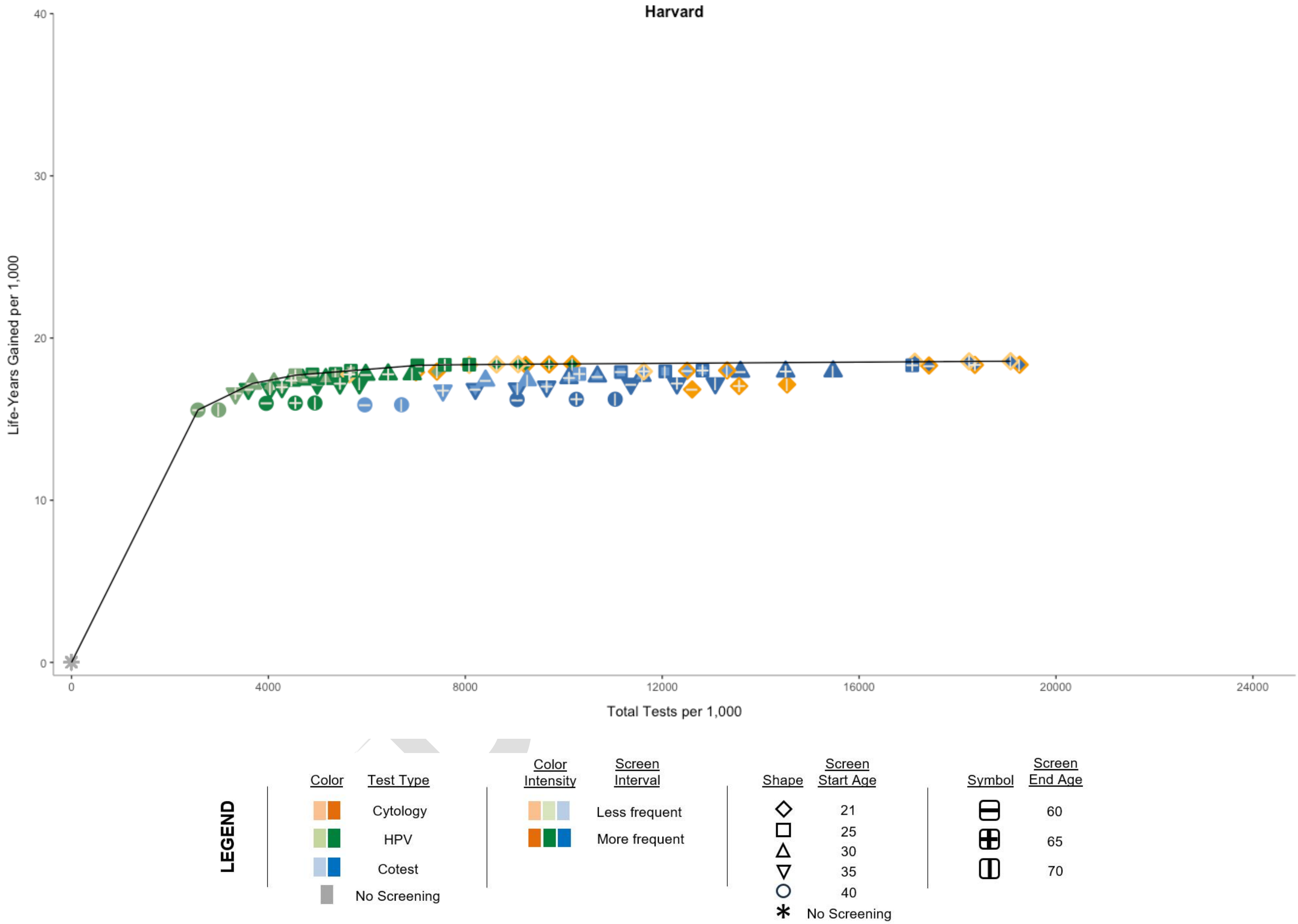


Figure 33. Cervical Cancer Cases Averted from a Single Lifetime Screen with HPV Self-Collection Among Unvaccinated Female Persons by Screen Age and Follow-Up Adherence by Model

	Cases Averted per 1,000	Additional Cases Averted per 1,000	
	28.6% Follow-Up Adherence	72.5% Follow-Up Adherence	100% Follow-Up Adherence
Harvard			
Screen Age 35	0.31	+1.78	+1.89
Screen Age 45	0.33	+1.91	+2.06
Screen Age 55	0.27	+1.61	+1.73
Screen Age 65	0.16	+1.03	+1.09
MISCAN-Cervix			
Screen Age 35	0.20	+1.20	+1.26
Screen Age 45	0.19	+1.07	+1.19
Screen Age 55	0.13	+0.80	+0.89
Screen Age 65	0.08	+0.62	+0.70
Policy1-Cervix			
Screen Age 35	0.31	+1.93	+1.95
Screen Age 45	0.35	+1.83	+2.03
Screen Age 55	0.25	+1.50	+1.52
Screen Age 65	0.23	+0.99	+1.01
UMN			
Screen Age 35	0.39	+2.39	+2.58
Screen Age 45	0.39	+2.22	+2.42
Screen Age 55	0.25	+1.93	+2.12
Screen Age 65	0.15	+1.18	+1.30

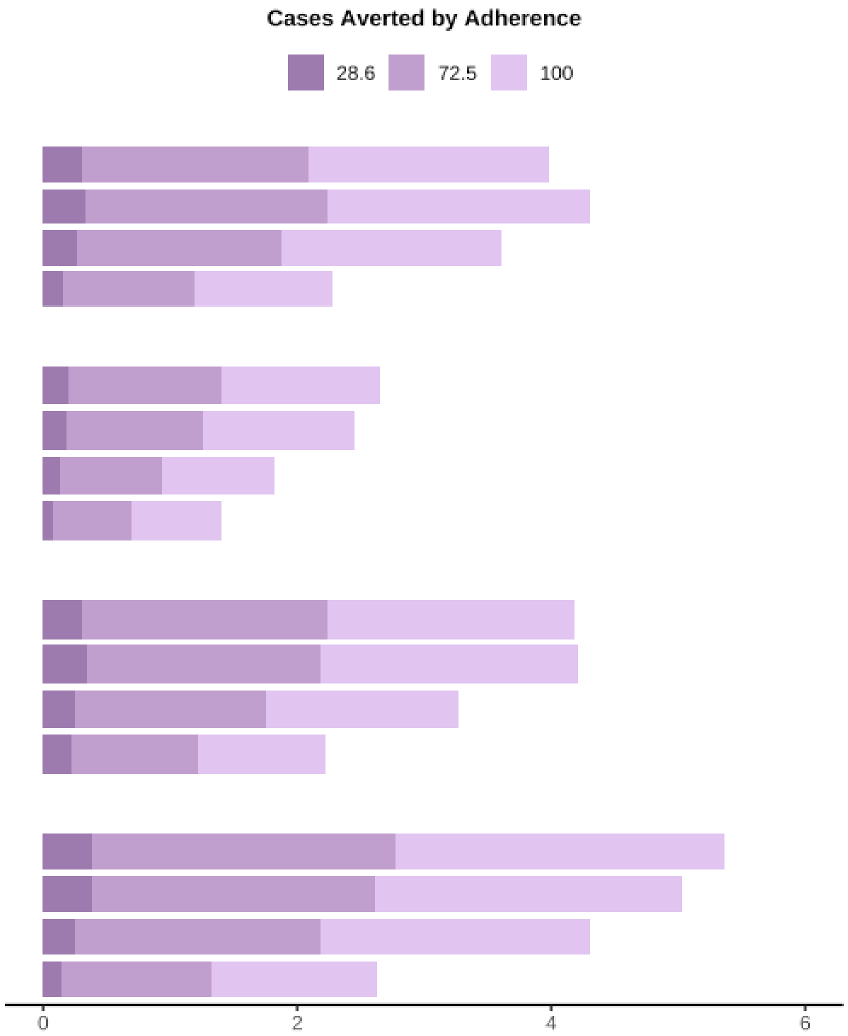


Figure 34. Cervical Cancer Cases Averted from a Single Lifetime Screen with HPV Self-Collection Among Unvaccinated Black Female Persons by Screen Age and Follow-Up Adherence in the Harvard Model

	Cases Averted per 1,000	Additional Cases Averted per 1,000	
	28.6% Follow-Up Adherence	72.5% Follow-Up Adherence	100% Follow-Up Adherence
Harvard			
Screen Age 35	0.25	+1.13	+1.90
Screen Age 45	0.24	+1.11	+1.92
Screen Age 55	0.17	+0.86	+1.47
Screen Age 65	0.08	+0.49	+0.83

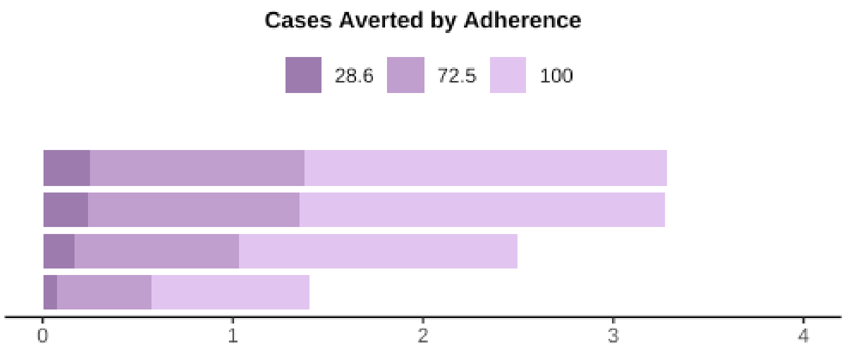


Table 1. Key Model Attribute Comparisons

	Harvard	MISCAN-Cervix	POLICY1-Cervix	UMN
Unit of analysis	Individual-based	Individual-based	Individual-based	Individual-based
Cycle length	Monthly	Continuous time	Continuous time	Monthly
HPV Transmission and Infection				
HPV types included	HPV-16, HPV-18, HPV-31, HPV-33, HPV-45, HPV-52, HPV-58, HPV other high-risk, HPV low-risk	HPV-16, HPV-18, HPV other 9v, HPV other high-risk, HPV low-risk	HPV-16, HPV-18, HPV-31, HPV-33, HPV-45, HPV-52, HPV-58, HPV other high-risk	HPV-16, HPV-18, HPV other 9v, HPV other high-risk
Natural Immunity	Reduced probability of future type-specific infection	Reduced probability of future type-specific infection	Reduced probability of future type-specific infection	Reduced probability of future type-specific infection
Cervical Carcinogenesis				
Health states included	Healthy, HPV, CIN2, CIN3, Cancer (by stage, SEER, SCC)	Healthy, HPV, CIN1, CIN2, CIN3, Cancer (by stage, SEER, all)	Healthy, HPV, CIN1, CIN2, CIN3, Cancer (by stage, SEER, all)	Healthy, HPV, CIN1, CIN2, CIN3, Cancer (by stage, FIGO, all)
Progression and regression rates	Type-specific HPV persistence	Age-specific	Age-specific	Age-specific
Model Calibration				
Calibrated parameters	HPV incidence; HPV and CIN progression probabilities by duration; HPV natural immunity; cancer progression and symptom detection	HPV incidence; HPV and CIN progression and regression; duration of CIN3 and cancer stages; cancer symptom detection; background risk in non-attenders	HPV and CIN progression and regression rates; HPV type distribution in CIN and cancer; undetected asymptomatic cancer by stage	HPV incidence; CIN progression and regression rates; cancer symptom detection
Cancer Control Interventions				
Vaccination	Yes	Yes	Yes	Yes
Screening	Yes	Yes	Yes	Yes
Diagnosis	Yes	Yes	Yes	Yes
Treatment	Yes	Yes	Yes	Yes

Abbreviations: CIN, cervical intraepithelial neoplasia; FIGO, International Federation of Gynecology and Obstetrics; HPV, Human papillomavirus; SEER, Surveillance, Epidemiology, and End Results.

Table 2. Screening Strategies Modeled for Validation Exercise[a]

Comparison	Pre-Switch				Post-Switch			
	Primary Test	Start Age	Interval	Triage	Switch Age	Primary Test	Interval	Triage
HPV Testing versus Cytology	CYTO	21	3	HPV for ASC-US	--	--	--	--
	CYTO	21	3	HPV for ASC-US	30	HPV	5	Cytology
Cotesting versus Cytology	CYTO	21	3	CYTO for ASC-US	--	--	--	--
	CYTO	21	3	HPV for ASC-US	30	Cotest	5	Repeat cotest in 12 mos

Abbreviations: ASC-US, atypical squamous cells of undetermined significance; CYTO, cytology; HPV, Human papillomavirus.
[a]Validation exercise involved simulating the protocols of clinical studies included in the evidence synthesis[2] and comparing model-predicted outcomes against the empirical outcomes.

Table 3. Base-Case Screening Strategies

Strategy	Screen (1) test, interval	Screen (1) start age	Screen (2) test, interval	Screen (2) start age	Screen end age(s)
CYTO-3Y, 21[a]	**Cytology, 3y**	**21**	**--**	**--**	60, **65**, 70
CYTO-3Y, 21/HPV-5Y, 30[a]	**Cytology, 3y**	**21**	**HPV, 5y**	**30**	60, **65**, 70
CYTO-3Y, 21/COTEST-5Y, 30[a]	**Cytology, 3y**	**21**	**Cotest, 5y**	**30**	60, **65**, 70
CYTO-4Y, 21/HPV-5Y, 25	Cytology, 4y	21	HPV, 5y	25	60, 65, 70
CYTO-4Y, 21/HPV-10Y, 25	Cytology, 4y	21	HPV, 10y	25	65
CYTO-3Y, 21/HPV-10Y, 30	Cytology, 3y	21	HPV, 10y	30	60, 70
HPV-5Y, 25[a]	**HPV, 5y**	**25**	**--**	**--**	60, **65**, 70
HPV-5Y, 25/HPV-10Y, 30	HPV, 5y	25	HPV, 10y	30	60, 70
HPV-5Y, 25/HPV-10Y, 35	HPV, 5y	25	HPV, 10y	35	65
HPV-5Y, 30	HPV, 5y	30	--	--	60, 65, 70
HPV-5Y, 30/HPV-10Y, 35	HPV, 5y	30	HPV, 10y	35	65
HPV-5Y, 30/HPV-10Y, 40	HPV, 5y	30	HPV, 10y	40	60, 70
HPV-5Y, 35	HPV, 5y	35	--	--	60, 65, 70
HPV-5Y, 35/HPV-10Y, 40	HPV, 5y	35	HPV, 10y	40	60, 70
HPV-5Y, 35/HPV-10Y, 45	HPV, 5y	35	HPV, 10y	45	65
HPV-5Y, 40	HPV, 5y	40	--	--	60, 65, 70
HPV-10Y, 25	HPV, 10y	25	--	--	65
HPV-10Y, 30	HPV, 10y	30	--	--	60, 70
HPV-10Y, 35	HPV, 10y	35	--	--	65
HPV-10Y, 40	HPV, 10y	40	--	--	60, 70
CYTO-4Y, 21/COTEST-5Y, 25	Cytology, 4y	21	Cotest, 5y	25	60, 65, 70
CYTO-4Y, 21/COTEST-10Y, 25	Cytology, 4y	21	Cotest, 10y	25	65
CYTO-3Y, 21/COTEST-10Y, 30	Cytology, 3y	21	Cotest, 10y	30	60, 70
COTEST-5Y, 25	Cotest, 5y	25	--	--	65
COTEST-5Y, 25/COTEST-10Y, 30	Cotest, 5y	25	Cotest, 10y	30	60, 70
COTEST-5Y, 25/COTEST-10Y, 35	Cotest, 5y	25	Cotest, 10y	35	65
COTEST-5Y, 30	Cotest, 5y	30	--	--	60, 65, 70
COTEST-5Y, 30/COTEST-10Y, 35	Cotest, 5y	30	Cotest, 10y	35	65
COTEST-5Y, 30/COTEST-10Y, 40	Cotest, 5y	30	Cotest, 10y	40	60, 70
COTEST-5Y, 35	Cotest, 5y	35	--	--	60, 65, 70
COTEST-5Y, 35/COTEST-10Y, 40	Cotest, 5y	35	Cotest, 10y	40	60, 70
COTEST-5Y, 35/COTEST-10Y, 45	Cotest, 5y	35	Cotest, 10y	45	65
COTEST-5Y, 40	Cotest, 5y	40	--	--	60, 65, 70
COTEST-10Y, 25	Cotest, 10y	25	--	--	65
COTEST-10Y, 30	Cotest, 10y	30	--	--	60, 70
COTEST-10Y, 35	Cotest, 10y	35	--	--	65
COTEST-10Y, 40	Cotest, 10y	40	--	--	60, 70

Abbreviations: CYTO, cytology; HPV, Human papillomavirus.

[a] Strategies (bolded) represent current US recommended strategies.

Table 4. Screening Test Characteristics[a]

Test Characteristic	Base-Case Value	Source	Worst-Case Value	Best-Case Value	Source
Cytology[b]					
Sensitivity	0.729	39	--	--	39,40
Specificity	0.903		--	--	
HPV[c]					
Relative sensitivity	1.240	40	1.15	1.37	40-44,49
Relative specificity	0.970		0.96	0.98	
Cotest[c]					
Relative sensitivity	1.310	40	1.20	1.42	40,49
Relative specificity	0.930		0.93	0.94	

Abbreviations: HPV, Human papillomavirus.

[a] Sensitivity (specificity) for all tests defined as probability to detect presence (absence) of cervical intraepithelial neoplasia, grade 2 or worse (CIN2+).

[b] For cytology testing, positivity threshold is atypical squamous cells of undetermined significance (ASC-US).

[c] For HPV testing and cotesting, sensitivity and specificity are relative to cytology test characteristics.

Table 5. Current Screening Practice by Race[a]

	All Race	Black Race
Screen Intervals (Recommended 3-year / 5-year / 10-year) [4,62]		
Very early (1-year / 3-year / 8-year)	9.10%	7.23%
Early (2-year / 4-year / 9-year)	10.60%	9.65%
On time (3-year / 5-year / 10-year)	41.50%	35.20%
Late (4-year / 6-year / 11-year)	12.20%	14.40%
Very late (5-year / 7-year / 12-year)	13.98%	18.80%
Never	12.60%	14.60%
Follow up to Colposcopy[4]		
Cytology and/or HPV result indicating follow-up	72.50%	65.30%
Follow up to Treatment of Precancerous Lesions[4]		
CIN2 or CIN3	72.50%	65.30%

Abbreviations: CIN, cervical intraepithelial neoplasia; HPV, Human papillomavirus.

[a] The table shows the distribution of screening intervals for all-race and Black-race female persons when adherence is imperfect under different recommended screening intervals of either 3-year, 5-year or 10-year. For example, when the recommended interval is 10-year, then a “very early” screener is assumed to screen at an 8-year interval, whereas an “early” screener screens at a 9-year interval.

Table 6. Lifetime Number of Cervical Cancer Cases, Deaths and Life-Years Gained Among Unvaccinated Female Persons for Screening Strategies by Model[a]

	Cervical Cancer Cases per 1,000					Cervical Cancer Deaths per 1,000					Life-Years Gained per 1,000				
Strategy[b]	H	M	P	U	Med[c]	H	M	P	U	Med[c]	H	M	P	U	Med*
No Screening	16.23	10.95	14.20	21.34	15.21	5.07	7.23	7.41	8.59	7.32	0	0	0	0	0
End Age 60[d]															
CYTO-3Y, 21	2.40	3.88	3.93	4.33	3.90	0.64	1.96	2.13	1.65	1.81	171	136	147	183	159
CYTO-3Y, 21/HPV-5Y, 30	1.28	2.71	2.99	3.44	2.85	0.30	1.36	1.63	1.32	1.34	180	148	155	190	168
CYTO-3Y, 21/COTEST-5Y, 30	1.18	2.64	2.61	3.24	2.62	0.27	1.32	1.40	1.25	1.29	180	148	157	192	168
CYTO-4Y, 21/HPV-5Y, 25	1.08	2.62	2.80	3.48	2.71	0.27	1.33	1.50	1.33	1.33	181	149	156	190	168
CYTO-3Y, 21/HPV-10Y, 30	1.57	3.67	3.32	5.21	3.49	0.38	1.85	1.71	1.85	1.78	176	134	151	174	162
HPV-5Y, 25	1.20	2.67	2.90	3.59	2.79	0.29	1.36	1.47	1.37	1.36	180	147	155	189	168
HPV-5Y, 25/HPV-10Y, 30	1.46	3.62	3.34	5.31	3.48	0.36	1.85	1.65	1.87	1.75	177	134	151	173	162
HPV-5Y, 30	2.35	3.07	3.15	4.39	3.11	0.47	1.52	1.45	1.57	1.49	168	140	149	179	158
HPV-5Y, 30/HPV-10Y, 40	2.50	3.55	3.45	5.45	3.50	0.51	1.79	1.60	1.89	1.69	166	134	146	171	156
HPV-5Y, 35	3.96	3.81	4.21	6.02	4.09	0.77	1.85	1.74	1.97	1.79	146	126	134	160	140
HPV-5Y, 35/HPV-10Y, 40	4.12	4.31	4.42	7.16	4.37	0.82	2.15	1.82	2.34	1.99	144	119	132	151	138
HPV-5Y, 40	5.63	4.91	5.07	8.30	5.35	1.24	2.42	2.04	2.68	2.23	118	105	120	132	119
HPV-10Y, 30	2.70	4.10	3.65	6.20	3.88	0.56	2.04	1.60	2.06	1.82	164	125	146	163	154
HPV-10Y, 40	5.84	5.47	5.41	9.52	5.65	1.30	2.74	2.12	3.10	2.43	116	98	117	121	116
CYTO-4Y, 21/COTEST-5Y, 25	0.97	2.53	2.58	3.20	2.55	0.24	1.28	1.33	1.24	1.26	182	150	159	192	170
CYTO-3Y, 21/COTEST-10Y, 30	1.43	3.57	3.03	4.84	3.30	0.34	1.78	1.55	1.73	1.64	178	136	153	177	165
COTEST-5Y, 25/COTEST-10Y, 30	1.31	3.53	2.85	4.93	3.19	0.32	1.77	1.39	1.74	1.56	178	136	154	177	166
COTEST-5Y, 30	2.23	3.00	2.97	4.06	2.99	0.43	1.47	1.34	1.45	1.40	169	141	151	182	160
COTEST-5Y, 30/COTEST-10Y, 40	2.36	3.48	3.11	5.09	3.29	0.47	1.73	1.43	1.76	1.58	167	135	149	174	158
COTEST-5Y, 35	3.85	3.72	3.94	5.81	3.90	0.73	1.81	1.61	1.91	1.71	147	127	137	162	142
COTEST-5Y, 35/COTEST-10Y, 40	3.97	4.21	4.20	6.81	4.20	0.76	2.07	1.72	2.19	1.89	146	121	134	155	140
COTEST-5Y, 40	5.52	4.83	4.96	8.09	5.24	1.20	2.37	1.92	2.62	2.14	120	107	123	134	122
COTEST-10Y, 30	2.48	4.01	3.38	5.72	3.70	0.50	1.97	1.47	1.91	1.69	166	127	148	167	157
COTEST-10Y, 40	5.63	5.38	5.24	9.23	5.51	1.22	2.67	2.09	2.97	2.38	118	99	118	124	118

End Age 65[d]															
CYTO-3Y, 21[e]	**2.07**	**3.55**	**3.23**	**3.64**	**3.39**	**0.50**	**1.68**	**1.61**	**1.32**	**1.46**	**173**	**140**	**153**	**187**	**163**
CYTO-3Y, 21/HPV-5Y, 30[e]	**1.09**	**2.13**	**2.54**	**2.88**	**2.33**	**0.22**	**0.93**	**1.29**	**1.05**	**0.99**	**181**	**152**	**160**	**193**	**170**
CYTO-3Y, 21/COTEST-5Y, 30[e]	**1.00**	**2.05**	**2.18**	**2.63**	**2.12**	**0.20**	**0.89**	**1.08**	**0.96**	**0.92**	**181**	**153**	**161**	**195**	**171**
CYTO-4Y, 21/HPV-5Y, 25	0.89	2.04	2.33	2.87	2.19	0.20	0.91	1.15	1.04	0.97	182	153	161	194	172
CYTO-4Y, 21/HPV-10Y, 25	1.33	3.20	2.84	4.75	3.02	0.31	1.49	1.32	1.63	1.41	177	137	155	175	165
HPV-5Y, 25[e]	**1.01**	**2.09**	**2.40**	**2.96**	**2.25**	**0.21**	**0.93**	**1.14**	**1.06**	**1.00**	**181**	**152**	**160**	**192**	**170**
HPV-5Y, 25/HPV-10Y, 35	1.23	2.84	2.74	4.31	2.79	0.28	1.33	1.23	1.50	1.28	179	142	156	181	168
HPV-5Y, 30	2.16	2.51	2.68	3.77	2.60	0.39	1.10	1.12	1.26	1.11	169	144	153	183	161
HPV-5Y, 30/HPV-10Y, 35	2.39	3.31	3.15	5.11	3.23	0.45	1.54	1.30	1.68	1.42	167	134	149	172	158
HPV-5Y, 35	3.78	3.23	3.77	5.42	3.77	0.69	1.42	1.48	1.70	1.45	147	131	138	164	142
HPV-5Y, 35/HPV-10Y, 45	3.90	3.73	4.00	6.32	3.95	0.73	1.71	1.58	2.01	1.65	146	125	135	157	140
HPV-5Y, 40	5.45	4.33	4.76	7.71	5.11	1.16	1.99	1.72	2.43	1.85	119	110	124	136	122
HPV-10Y, 25	1.45	3.28	2.94	4.96	3.11	0.32	1.53	1.34	1.66	1.44	176	135	151	174	162
HPV-10Y, 35	4.09	4.10	4.27	6.96	4.18	0.79	1.91	1.63	2.16	1.77	143	119	132	152	138
CYTO-4Y, 21/COTEST-5Y, 25	0.80	1.93	2.02	2.62	1.97	0.17	0.85	0.97	0.95	0.90	183	154	163	196	173
CYTO-4Y, 21/COTEST-10Y, 25	1.16	3.08	2.49	4.38	2.79	0.26	1.41	1.14	1.51	1.28	179	139	158	179	168
COTEST-5Y, 25	0.91	2.00	2.08	2.67	2.04	0.19	0.89	0.95	0.96	0.92	182	153	161	195	172
COTEST-5Y, 25/COTEST-10Y, 35	1.10	2.72	2.44	3.97	2.58	0.24	1.26	1.11	1.40	1.19	180	144	158	184	169
COTEST-5Y, 30	2.06	2.42	2.55	3.50	2.48	0.36	1.04	1.05	1.17	1.04	170	146	153	186	162
COTEST-5Y, 30/COTEST-10Y, 35	2.26	3.20	2.83	4.77	3.01	0.42	1.45	1.21	1.57	1.33	168	136	151	175	160
COTEST-5Y, 35	3.68	3.14	3.54	5.16	3.61	0.66	1.37	1.32	1.61	1.35	148	132	140	166	144
COTEST-5Y, 35/COTEST-10Y, 45	3.79	3.63	3.92	5.97	3.86	0.69	1.63	1.48	1.89	1.56	147	127	135	160	141
COTEST-5Y, 40	5.35	4.24	4.63	7.51	4.99	1.13	1.93	1.69	2.34	1.81	120	111	124	137	122
COTEST-10Y, 25	1.27	3.15	2.63	4.56	2.89	0.28	1.44	1.15	1.56	1.30	178	137	157	177	167
COTEST-10Y, 35	3.92	3.98	3.98	6.58	3.98	0.73	1.83	1.49	2.06	1.66	145	121	136	154	140
End Age 70[d]															
CYTO-3Y, 21	1.85	3.05	2.57	3.05	2.81	0.40	1.23	1.09	1.02	1.06	174	144	160	190	167
CYTO-3Y, 21/HPV-5Y, 30	0.96	1.78	1.96	2.36	1.87	0.17	0.67	0.81	0.78	0.72	181	154	164	196	172
CYTO-3Y, 21/COTEST-5Y, 30	0.90	1.69	1.70	2.08	1.69	0.15	0.62	0.70	0.68	0.65	182	156	165	198	174
CYTO-4Y, 21/HPV-5Y, 25	0.77	1.69	1.84	2.35	1.77	0.15	0.65	0.79	0.78	0.71	183	155	165	196	174
CYTO-3Y, 21/HPV-10Y, 30	1.29	3.01	2.45	4.37	2.73	0.27	1.28	0.99	1.44	1.13	178	139	159	178	168
HPV-5Y, 25	0.89	1.75	1.96	2.46	1.85	0.17	0.66	0.76	0.81	0.71	181	154	164	195	172

HPV-5Y, 25/HPV-10Y, 30	1.19	2.96	2.48	4.52	2.72	0.25	1.28	1.03	1.47	1.16	178	139	158	177	168
HPV-5Y, 30	2.04	2.16	2.40	3.22	2.28	0.34	0.83	0.91	1.01	0.87	169	147	155	185	162
HPV-5Y, 30/HPV-10Y, 40	2.23	2.89	2.79	4.64	2.84	0.39	1.23	1.07	1.46	1.15	168	139	152	175	160
HPV-5Y, 35	3.66	2.88	3.37	4.91	3.51	0.65	1.16	1.13	1.44	1.14	147	133	142	166	144
HPV-5Y, 35/HPV-10Y, 40	3.85	3.64	3.92	6.36	3.88	0.70	1.57	1.38	1.92	1.48	146	125	135	156	140
HPV-5Y, 40	5.33	3.98	4.48	7.22	4.91	1.12	1.72	1.49	2.17	1.60	120	112	127	138	124
HPV-10Y, 30	2.43	3.46	3.09	5.39	3.27	0.45	1.48	1.15	1.70	1.32	165	130	149	167	157
HPV-10Y, 40	5.61	4.81	4.92	8.77	5.26	1.20	2.19	1.69	2.72	1.94	117	103	122	125	120
CYTO-4Y, 21/COTEST-5Y, 25	0.69	1.61	1.71	2.08	1.66	0.13	0.60	0.71	0.69	0.64	184	156	165	199	174
CYTO-3Y, 21/COTEST-10Y, 30	1.18	2.92	2.27	4.01	2.59	0.23	1.21	0.89	1.31	1.05	179	141	161	181	170
COTEST-5Y, 25/COTEST-10Y, 30	1.07	2.83	2.23	4.11	2.53	0.22	1.19	0.91	1.34	1.05	179	141	159	181	169
COTEST-5Y, 30	1.95	2.06	2.16	2.96	2.11	0.32	0.78	0.81	0.91	0.79	170	148	156	188	163
COTEST-5Y, 30/COTEST-10Y, 40	2.12	2.80	2.60	4.25	2.70	0.36	1.16	0.98	1.33	1.07	169	140	153	179	161
COTEST-5Y, 35	3.57	2.80	3.27	4.63	3.42	0.62	1.11	1.05	1.37	1.08	148	134	143	168	146
COTEST-5Y, 35/COTEST-10Y, 40	3.74	3.56	3.63	5.98	3.69	0.67	1.50	1.24	1.79	1.37	147	126	137	159	142
COTEST-5Y, 40	5.25	3.90	4.32	7.00	4.78	1.09	1.66	1.49	2.08	1.57	121	114	126	141	124
COTEST-10Y, 30	2.26	3.34	2.67	4.97	3.01	0.40	1.40	0.98	1.51	1.19	167	132	153	172	160
COTEST-10Y, 40	5.45	4.71	4.73	8.43	5.09	1.15	2.09	1.59	2.58	1.84	119	105	123	128	121

Abbreviations: CYTO, cytology; HPV, Human papillomavirus; H, Harvard model; M, MISCAN-Cervix model; P, Policy1-Cervix model; U, University of Minnesota model.

[a] Outcomes calculated from age 21 to 100 years.

[b] Strategies are denoted by the screening modality, interval, age to begin screening/screening modality after switch age, interval after switch age, switch age for each end age category. For example, CYTO-3Y, 21 indicates cytology testing every 3 years starting at age 21, and CYTO-3Y, 21/HPV-5Y,30 indicates cytology testing every 3 years starting at age 21 with a switch to HPV testing every 5 years starting at age 30.

[c] Median outcome across the four models.

[d] End age indicates the age at which the final routine screen should occur, irrespective of age at last screen; exceptions include female persons who are recommended to continue screening due to prior abnormal results and/or precancer treatment.

[e] Strategies (bolded) represent current US recommended strategies.

Table 7. Lifetime Number of Total Tests and Colposcopies Among Unvaccinated Female Persons for Screening Strategies by Model[a]

	Total Tests per 1,000 [b]					Colposcopies per 1,000				
Strategy[c]	H	M	P	U	Med[d]	H	M	P	U	Med[d]
No Screening	0	0	0	0	0	0	0	0	0	0
End Age 60[e]										
CYTO-3Y, 21	15,388	14,457	14,959	15,114	15,036	660	718	522	766	689
CYTO-3Y, 21/HPV-5Y, 30	12,890	12,208	11,774	12,624	12,416	1,164	922	433	1,082	1,002
CYTO-3Y, 21/COTEST-5Y, 30	22,136	19,196	20,746	21,678	21,212	1,418	1,037	722	1,247	1,142
CYTO-4Y, 21/HPV-5Y, 25	12,412	11,645	11,267	11,823	11,734	1,412	1,038	490	1,149	1,094
CYTO-3Y, 21/HPV-10Y, 30	9,672	9,073	8,793	9,716	9,373	928	724	366	869	797
HPV-5Y, 25	11,222	10,368	10,091	10,573	10,470	1,360	932	444	1,064	998
HPV-5Y, 25/HPV-10Y, 30	8,011	7,259	7,086	7,642	7,450	1,127	738	375	853	795
HPV-5Y, 30	9,309	8,455	8,226	8,903	8,679	998	626	284	811	718
HPV-5Y, 30/HPV-10Y, 40	7,283	6,581	6,283	7,129	6,855	872	543	249	722	632
HPV-5Y, 35	7,662	6,829	6,801	7,313	7,071	750	424	207	580	502
HPV-5Y, 35/HPV-10Y, 40	5,612	4,881	4,814	5,477	5,179	621	336	168	485	410
HPV-5Y, 40	6,180	5,333	5,519	5,784	5,652	566	270	154	390	330
HPV-10Y, 30	6,029	5,158	5,145	5,857	5,508	755	410	213	589	500
HPV-10Y, 40	4,193	3,327	3,508	3,887	3,697	438	179	114	294	237
CYTO-4Y, 21/COTEST-5Y, 25	23,233	20,325	21,817	22,398	22,108	1,707	1,223	843	1,358	1,291
CYTO-3Y, 21/COTEST-10Y, 30	15,682	13,331	14,785	15,903	15,234	1,094	803	563	1,005	904
COTEST-5Y, 25/COTEST-10Y, 30	15,610	13,478	14,801	15,313	15,057	1,306	901	640	1,030	966
COTEST-5Y, 30	18,517	15,847	17,170	17,878	17,524	1,250	765	573	986	875
COTEST-5Y, 30/COTEST-10Y, 40	14,377	12,294	13,340	14,301	13,821	1,050	663	481	871	767
COTEST-5Y, 35	15,377	12,890	14,326	14,756	14,541	962	524	444	720	622
COTEST-5Y, 35/COTEST-10Y, 40	11,230	9,189	10,325	11,028	10,677	761	416	345	602	509
COTEST-5Y, 40	12,519	10,160	11,721	11,748	11,734	741	340	348	500	424
COTEST-10Y, 30	12,004	9,690	10,979	11,778	11,378	921	506	406	724	615
COTEST-10Y, 40	8,633	6,341	7,581	7,879	7,730	564	226	243	379	311
End Age 65[e]										
CYTO-3Y, 21[f]	**16,753**	**15,235**	**16,434**	**16,457**	**16,445**	**705**	**734**	**562**	**806**	**719**
CYTO-3Y, 21/HPV-5Y, 30[f]	**13,713**	**13,052**	**12,625**	**13,383**	**13,217**	**1,209**	**955**	**449**	**1,103**	**1,029**
CYTO-3Y, 21/COTEST-5Y, 30[f]	**23,683**	**20,796**	**22,470**	**23,260**	**22,865**	**1,480**	**1,075**	**765**	**1,283**	**1,179**
CYTO-4Y, 21/HPV-5Y, 25	13,233	12,486	12,132	12,584	12,535	1,457	1,071	509	1,175	1,123
CYTO-4Y, 21/HPV-10Y, 25	8,902	8,244	8,165	8,625	8,434	1,114	775	414	869	822
HPV-5Y, 25[f]	**12,043**	**11,212**	**10,947**	**11,327**	**11,269**	**1,405**	**965**	**462**	**1,083**	**1,024**
HPV-5Y, 25/HPV-10Y, 35	9,033	8,459	8,119	8,715	8,587	1,213	839	410	950	895
HPV-5Y, 30	10,134	9,304	9,090	9,662	9,483	1,043	659	301	831	745
HPV-5Y, 30/HPV-10Y, 35	7,082	6,430	6,209	7,005	6,717	847	528	248	697	612
HPV-5Y, 35	8,483	7,681	7,647	8,041	7,861	795	457	222	598	528
HPV-5Y, 35/HPV-10Y, 45	6,557	5,857	5,791	6,404	6,131	686	381	192	541	461
HPV-5Y, 40	7,011	6,184	6,363	6,542	6,452	611	303	169	411	357
HPV-10Y, 25	7,682	6,903	6,929	7,306	7,117	1,058	661	364	770	715
HPV-10Y, 35	5,381	4,720	4,720	5,285	5,002	592	319	168	456	388
CYTO-4Y, 21/COTEST-5Y, 25	24,772	21,921	23,529	23,981	23,755	1,769	1,261	885	1,397	1,329
CYTO-4Y, 21/COTEST-10Y, 25	16,206	14,013	15,747	16,071	15,909	1,313	912	671	1,035	974
COTEST-5Y, 25	23,603	20,867	22,362	22,727	22,545	1,718	1,166	838	1,309	1,238

Strategy[c]	Total Tests per 1,000 [b] H	M	P	U	Med[d]	Colposcopies per 1,000 H	M	P	U	Med[d]
COTEST-5Y, 25/COTEST-10Y, 35	17,528	15,679	16,839	17,434	17,137	1,420	1,019	704	1,132	1,076
COTEST-5Y, 30	20,075	17,458	18,902	19,479	19,190	1,313	803	614	1,020	912
COTEST-5Y, 30/COTEST-10Y, 35	13,920	12,014	13,181	14,060	13,550	1,013	644	476	843	743
COTEST-5Y, 35	16,940	14,507	16,041	16,297	16,169	1,025	562	485	753	658
COTEST-5Y, 35/COTEST-10Y, 45	12,992	11,045	12,352	12,929	12,641	848	470	399	670	570
COTEST-5Y, 40	14,098	11,781	13,480	13,326	13,403	804	380	391	533	462
COTEST-10Y, 25	14,988	12,845	14,476	14,692	14,584	1,258	810	622	937	873
COTEST-10Y, 35	10,742	8,885	10,113	10,671	10,392	739	394	340	567	480
End Age 70[e]										
CYTO-3Y, 21	18,097	16,687	17,911	17,811	17,861	748	760	603	847	754
CYTO-3Y, 21/HPV-5Y, 30	14,456	13,816	13,395	14,094	13,955	1,246	983	463	1,124	1,053
CYTO-3Y, 21/COTEST-5Y, 30	25,067	22,247	24,035	24,728	24,382	1,532	1,106	800	1,319	1,212
CYTO-4Y, 21/HPV-5Y, 25	13,973	13,249	12,898	13,295	13,272	1,493	1,098	522	1,195	1,147
CYTO-3Y, 21/HPV-10Y, 30	10,425	9,868	9,592	10,447	10,147	972	754	383	893	823
HPV-5Y, 25	12,784	11,976	11,710	12,035	12,005	1,441	992	473	1,102	1,047
HPV-5Y, 25/HPV-10Y, 30	8,759	8,054	7,894	8,373	8,214	1,171	768	394	874	821
HPV-5Y, 30	10,879	10,076	9,858	10,377	10,226	1,080	687	314	852	770
HPV-5Y, 30/HPV-10Y, 40	8,032	7,384	7,084	7,884	7,634	916	573	265	743	658
HPV-5Y, 35	9,231	8,456	8,417	8,760	8,608	832	485	235	617	551
HPV-5Y, 35/HPV-10Y, 40	6,354	5,689	5,620	6,223	5,956	666	367	186	509	438
HPV-5Y, 40	7,755	6,963	7,143	7,225	7,184	647	331	183	428	380
HPV-10Y, 30	6,775	5,962	5,943	6,601	6,281	799	440	230	612	526
HPV-10Y, 40	4,843	4,135	4,304	4,606	4,455	477	210	131	314	262
CYTO-4Y, 21/COTEST-5Y, 25	26,151	23,365	25,069	25,445	25,257	1,821	1,291	920	1,430	1,361
CYTO-3Y, 21/COTEST-10Y, 30	17,043	14,843	16,451	17,440	16,747	1,152	837	604	1,040	939
COTEST-5Y, 25/COTEST-10Y, 30	16,943	14,988	16,453	16,857	16,655	1,362	935	683	1,065	1,000
COTEST-5Y, 30	21,470	18,920	20,482	20,941	20,711	1,365	834	653	1,049	942
COTEST-5Y, 30/COTEST-10Y, 40	15,716	13,821	14,997	15,882	15,357	1,107	699	520	907	803
COTEST-5Y, 35	18,348	15,979	17,629	17,776	17,703	1,077	594	524	784	689
COTEST-5Y, 35/COTEST-10Y, 40	12,532	10,723	11,998	12,609	12,265	817	452	387	638	545
COTEST-5Y, 40	15,509	13,259	15,028	14,760	14,894	856	412	427	562	494
COTEST-10Y, 30	13,308	11,215	12,662	13,344	12,985	977	540	450	761	651
COTEST-10Y, 40	9,669	7,879	9,265	9,405	9,335	608	263	285	413	349

Abbreviations: CYTO, cytology; HPV, Human papillomavirus; H, Harvard model; M, MISCAN-Cervix model; P, Policy1-Cervix model; U, University of Minnesota model.

[a] Outcomes calculated from age 21 to 100 years.

[b] Total number of tests including cytology and HPV tests, irrespective of primary, triage or surveillance context.

[c] Strategies are denoted by the screening modality, interval, age to begin screening/screening modality after switch age, interval after switch age, switch age for each end age category. For example, CYTO-3Y, 21 indicates cytology testing every 3 years starting at age 21, and CYTO-3Y, 21/HPV-5Y,30 indicates cytology testing every 3 years starting at age 21 with a switch to HPV testing every 5 years starting at age 30.

[d] Median outcome across the four models.

[e] End age indicates the age at which the final routine screen should occur, irrespective of age at last screen; exceptions include female persons who are recommended to continue screening due to prior abnormal results and/or precancer treatment.

[f] Strategies (bolded) represent current US recommended strategies.

Table 8. Lifetime Number of CIN2+ Detected and False Positives Among Unvaccinated Female Persons for Screening Strategies by Model[a]

	CIN2+ detected per 1,000[b]					False Positives per 1,000[c]				
Strategy[d]	**H**	**M**	**P**	**U**	**Med[e]**	**H**	**M**	**P**	**U**	**Med[e]**
No Screening	0	0	0	0	0	0	0	0	0	0
End Age 60[f]										
CYTO-3Y, 21	160	77	112	245	136	499	635	411	521	510
CYTO-3Y, 21/HPV-5Y, 30	190	87	116	258	153	974	829	317	824	827
CYTO-3Y, 21/COTEST-5Y, 30	198	89	118	264	158	1,220	942	604	983	962
CYTO-4Y, 21/HPV-5Y, 25	197	91	117	254	157	1,215	941	373	895	918
CYTO-3Y, 21/HPV-10Y, 30	173	78	111	233	142	755	641	255	637	639
HPV-5Y, 25	185	79	101	233	143	1,175	848	343	831	839
HPV-5Y, 25/HPV-10Y, 30	169	69	94	206	132	958	664	281	647	655
HPV-5Y, 30	145	55	70	185	107	854	567	214	625	596
HPV-5Y, 30/HPV-10Y, 40	136	52	68	175	102	736	488	181	547	517
HPV-5Y, 35	111	39	51	142	81	640	382	155	438	410
HPV-5Y, 35/HPV-10Y, 40	102	36	49	131	76	519	298	119	353	326
HPV-5Y, 40	86	27	40	105	63	480	241	114	286	263
HPV-10Y, 30	127	44	63	157	95	628	363	150	432	397
HPV-10Y, 40	78	23	37	93	58	360	154	77	202	178
CYTO-4Y, 21/COTEST-5Y, 25	207	94	120	263	164	1,499	1,122	722	1,095	1,108
CYTO-3Y, 21/COTEST-10Y, 30	180	79	113	239	147	914	719	450	766	742
COTEST-5Y, 25/COTEST-10Y, 30	177	72	99	217	138	1,128	824	541	812	818
COTEST-5Y, 30	153	57	72	192	113	1,097	703	501	794	749
COTEST-5Y, 30/COTEST-10Y, 40	144	54	70	183	107	907	605	411	689	647
COTEST-5Y, 35	118	40	53	147	85	844	481	390	573	527
COTEST-5Y, 35/COTEST-10Y, 40	108	37	51	137	79	653	377	294	465	421
COTEST-5Y, 40	92	28	42	108	67	649	311	306	392	351
COTEST-10Y, 30	135	46	67	165	101	786	457	340	559	508
COTEST-10Y, 40	83	24	39	97	61	480	201	204	282	243
End Age 65[f]										
CYTO-3Y, 21[g]	**166**	**79**	**114**	**250**	**140**	**539**	**649**	**448**	**557**	**548**
CYTO-3Y, 21/HPV-5Y, 30[g]	**195**	**90**	**119**	**262**	**157**	**1,014**	**859**	**330**	**841**	**850**
CYTO-3Y, 21/COTEST-5Y, 30[g]	**203**	**91**	**121**	**268**	**162**	**1,277**	**977**	**645**	**1,015**	**996**
CYTO-4Y, 21/HPV-5Y, 25	203	93	120	258	161	1,254	971	389	917	944
CYTO-4Y, 21/HPV-10Y, 25	178	79	110	221	144	936	691	305	648	670
HPV-5Y, 25[g]	**191**	**81**	**103**	**236**	**147**	**1,214**	**878**	**359**	**847**	**863**
HPV-5Y, 25/HPV-10Y, 35	177	75	99	221	138	1,036	758	311	729	744
HPV-5Y, 30	150	57	73	189	111	893	598	228	642	620
HPV-5Y, 30/HPV-10Y, 35	136	51	68	173	102	710	472	180	523	498
HPV-5Y, 35	116	41	54	146	85	679	412	169	453	433
HPV-5Y, 35/HPV-10Y, 45	108	39	52	140	80	577	339	141	402	370
HPV-5Y, 40	91	29	42	109	67	519	271	127	303	287
HPV-10Y, 25	166	65	93	198	129	892	591	271	572	582
HPV-10Y, 35	102	35	50	129	76	490	282	118	327	305
CYTO-4Y, 21/COTEST-5Y, 25	212	97	123	267	168	1,556	1,157	762	1,130	1,144
CYTO-4Y, 21/COTEST-10Y, 25	186	81	114	231	150	1,127	825	557	804	815
COTEST-5Y, 25	200	84	106	246	153	1,517	1,076	731	1,063	1,069

Strategy[d]	CIN2+ detected per 1,000[b] H	M	P	U	Med[e]	False Positives per 1,000[c] H	M	P	U	Med[e]
COTEST-5Y, 25/COTEST-10Y, 35	186	79	103	232	144	1,234	934	601	901	917
COTEST-5Y, 30	158	59	74	196	116	1,155	740	540	824	782
COTEST-5Y, 30/COTEST-10Y, 35	143	54	72	181	107	870	587	404	662	624
COTEST-5Y, 35	123	43	55	151	89	902	517	430	602	559
COTEST-5Y, 35/COTEST-10Y, 45	114	40	53	146	84	734	428	345	524	476
COTEST-5Y, 40	97	30	44	112	70	707	347	347	421	384
COTEST-10Y, 25	174	68	98	208	136	1,084	737	524	729	733
COTEST-10Y, 35	107	37	52	135	80	632	355	288	432	393
End Age 70[f]										
CYTO-3Y, 21	170	81	117	254	144	578	673	486	593	586
CYTO-3Y, 21/HPV-5Y, 30	199	91	121	266	160	1,047	885	342	858	872
CYTO-3Y, 21/COTEST-5Y, 30	207	93	123	271	165	1,325	1,006	677	1,047	1,027
CYTO-4Y, 21/HPV-5Y, 25	207	95	122	261	164	1,286	996	400	934	965
CYTO-3Y, 21/HPV-10Y, 30	180	81	115	238	147	793	667	268	655	661
HPV-5Y, 25	195	82	105	240	150	1,247	904	369	862	883
HPV-5Y, 25/HPV-10Y, 30	176	72	99	212	137	995	690	295	662	676
HPV-5Y, 30	154	59	74	193	114	926	624	240	659	642
HPV-5Y, 30/HPV-10Y, 40	143	55	71	180	107	773	515	194	562	538
HPV-5Y, 35	120	43	55	150	88	712	439	180	468	453
HPV-5Y, 35/HPV-10Y, 40	109	39	52	137	80	557	325	134	372	349
HPV-5Y, 40	95	31	44	112	70	552	298	139	316	307
HPV-10Y, 30	134	47	67	163	101	665	390	162	449	419
HPV-10Y, 40	84	26	41	99	62	393	182	90	216	199
CYTO-4Y, 21/COTEST-5Y, 25	217	98	125	271	171	1,604	1,186	795	1,159	1,172
CYTO-3Y, 21/COTEST-10Y, 30	186	82	117	245	151	966	749	488	795	772
COTEST-5Y, 25/COTEST-10Y, 30	184	75	103	223	143	1,179	854	580	842	848
COTEST-5Y, 30	162	61	77	200	120	1,203	769	576	849	809
COTEST-5Y, 30/COTEST-10Y, 40	150	57	74	189	112	958	638	446	719	679
COTEST-5Y, 35	127	44	57	155	92	950	546	467	629	588
COTEST-5Y, 35/COTEST-10Y, 40	114	40	54	143	84	703	409	333	495	452
COTEST-5Y, 40	101	32	45	116	73	755	378	382	447	414
COTEST-10Y, 30	141	49	70	171	105	836	488	380	590	539
COTEST-10Y, 40	88	27	42	103	65	520	234	243	310	277

Abbreviations: CIN, cervical intraepithelial; CYTO, cytology; HPV, Human papillomavirus; H, Harvard model; M, MISCAN-Cervix model; P, Policy1-Cervix model; U, University of Minnesota model.
[a] Outcomes calculated from age 21 to 100 years.
[b] CIN2+ detected includes CIN2s, CIN3s and cervical cancers detected through screening (excludes clinically detected cancers).
[c] Total number of colposcopies that did not result in CIN2, CIN3 or cancer detection.
[d] Strategies are denoted by the screening modality, interval, age to begin screening/screening modality after switch age, interval after switch age, switch age for each end age category. For example, CYTO-3Y, 21 indicates cytology testing every 3 years starting at age 21, and CYTO-3Y, 21/HPV-5Y,30 indicates cytology testing every 3 years starting at age 21 with a switch to HPV testing every 5 years starting at age 30.
[e] Median outcome across the four models.
[f] End age indicates the age at which the final routine screen should occur, irrespective of age at last screen; exceptions include female persons who are recommended to continue screening due to prior abnormal results and/or precancer treatment.
[g] Strategies (bolded) represent current US recommended strategies.

Table 9. Lifetime Number of Cervical Cancer Cases, Deaths and Life-Years Gained Among 2vHPV or 4vHPV Vaccinated Female Persons for Screening Strategies by Model[a]

	Cervical Cancer Cases per 1,000					Cervical Cancer Deaths per 1,000					Life-Years Gained per 1,000				
Strategy[b]	**H**	**M**	**P**	**U**	**Med[c]**	**H**	**M**	**P**	**U**	**Med[c]**	**H**	**M**	**P**	**U**	**Med***
No Screening	6.45	3.74	3.69	4.83	4.28	2.14	2.47	2.01	1.99	2.08	0	0	0	0	0
End Age 60[d]															
CYTO-3Y, 21	0.87	1.36	1.45	0.92	1.14	0.24	0.69	0.83	0.41	0.55	60	45	33	39	42
CYTO-3Y, 21/HPV-5Y, 30	0.38	0.96	1.14	0.70	0.83	0.09	0.49	0.64	0.30	0.40	64	49	35	41	45
CYTO-3Y, 21/COTEST-5Y, 30	0.36	0.94	1.00	0.63	0.79	0.08	0.48	0.54	0.27	0.38	64	49	37	41	45
CYTO-4Y, 21/HPV-5Y, 25	0.33	0.95	1.13	0.70	0.82	0.08	0.48	0.62	0.29	0.39	64	50	36	41	46
CYTO-3Y, 21/HPV-10Y, 30	0.49	1.31	1.26	1.02	1.14	0.12	0.66	0.66	0.42	0.54	63	44	34	37	40
HPV-5Y, 25	0.36	0.96	1.05	0.74	0.85	0.08	0.49	0.55	0.30	0.39	64	49	36	40	44
HPV-5Y, 25/HPV-10Y, 30	0.46	1.30	1.19	1.09	1.14	0.11	0.66	0.62	0.44	0.53	63	44	34	36	40
HPV-5Y, 30	0.60	1.10	1.10	0.96	1.03	0.12	0.55	0.57	0.37	0.46	61	47	35	37	42
HPV-5Y, 30/HPV-10Y, 40	0.66	1.27	1.15	1.14	1.14	0.14	0.65	0.57	0.45	0.51	61	44	34	35	40
HPV-5Y, 35	0.99	1.33	1.18	1.29	1.23	0.19	0.66	0.55	0.51	0.53	56	42	33	31	38
HPV-5Y, 35/HPV-10Y, 40	1.05	1.51	1.33	1.48	1.41	0.21	0.76	0.60	0.56	0.58	55	40	30	30	35
HPV-5Y, 40	1.43	1.69	1.37	1.68	1.55	0.31	0.84	0.65	0.62	0.64	49	35	29	27	32
HPV-10Y, 30	0.72	1.46	1.20	1.28	1.24	0.15	0.73	0.58	0.50	0.54	60	41	33	33	37
HPV-10Y, 40	1.51	1.88	1.48	1.88	1.70	0.33	0.95	0.64	0.71	0.68	48	33	28	25	30
CYTO-4Y, 21/COTEST-5Y, 25	0.30	0.92	0.99	0.60	0.76	0.07	0.47	0.55	0.24	0.36	64	50	36	42	46
CYTO-3Y, 21/COTEST-10Y, 30	0.45	1.27	1.20	0.96	1.08	0.10	0.64	0.61	0.39	0.50	63	45	34	38	42
COTEST-5Y, 25/COTEST-10Y, 30	0.41	1.26	1.05	0.98	1.01	0.10	0.64	0.53	0.38	0.46	63	45	35	38	42
COTEST-5Y, 30	0.57	1.06	0.99	0.87	0.93	0.11	0.53	0.50	0.33	0.42	61	47	35	38	42
COTEST-5Y, 30/COTEST-10Y, 40	0.63	1.24	1.00	1.03	1.01	0.13	0.62	0.50	0.42	0.46	61	45	35	36	40
COTEST-5Y, 35	0.96	1.30	1.13	1.19	1.16	0.18	0.64	0.52	0.46	0.49	56	42	33	32	38
COTEST-5Y, 35/COTEST-10Y, 40	1.01	1.48	1.20	1.37	1.28	0.20	0.73	0.56	0.53	0.54	56	40	32	31	36
COTEST-5Y, 40	1.39	1.66	1.33	1.61	1.50	0.29	0.82	0.59	0.59	0.59	50	36	29	27	32
COTEST-10Y, 30	0.66	1.42	1.01	1.19	1.10	0.13	0.70	0.47	0.45	0.46	60	42	35	35	38
COTEST-10Y, 40	1.44	1.85	1.43	1.80	1.62	0.31	0.93	0.63	0.66	0.65	49	33	28	26	30

End Age 65[d]															
CYTO-3Y, 21[e]	**0.74**	**1.25**	**1.13**	**0.80**	**0.97**	**0.18**	**0.60**	**0.57**	**0.32**	**0.44**	**61**	**46**	**35**	**40**	**43**
CYTO-3Y, 21/HPV-5Y, 30[e]	**0.33**	**0.76**	**0.88**	**0.60**	**0.68**	**0.07**	**0.34**	**0.42**	**0.24**	**0.29**	**64**	**51**	**38**	**41**	**46**
CYTO-3Y, 21/COTEST-5Y, 30[e]	**0.31**	**0.72**	**0.84**	**0.50**	**0.61**	**0.06**	**0.32**	**0.44**	**0.20**	**0.26**	**64**	**51**	**37**	**42**	**46**
CYTO-4Y, 21/HPV-5Y, 25	0.28	0.73	0.84	0.60	0.66	0.06	0.33	0.40	0.24	0.28	64	51	38	41	46
CYTO-4Y, 21/HPV-10Y, 25	0.42	1.15	1.06	1.00	1.03	0.10	0.53	0.50	0.42	0.46	63	45	35	36	40
HPV-5Y, 25[e]	**0.31**	**0.75**	**0.83**	**0.66**	**0.70**	**0.06**	**0.34**	**0.41**	**0.25**	**0.29**	**64**	**51**	**39**	**41**	**46**
HPV-5Y, 25/HPV-10Y, 35	0.39	1.03	1.00	0.90	0.95	0.09	0.48	0.47	0.36	0.42	63	47	36	38	42
HPV-5Y, 30	0.55	0.89	0.86	0.84	0.85	0.10	0.40	0.36	0.30	0.33	61	48	37	38	43
HPV-5Y, 30/HPV-10Y, 35	0.63	1.17	1.03	1.09	1.06	0.12	0.54	0.47	0.43	0.45	61	45	35	35	40
HPV-5Y, 35	0.94	1.12	1.04	1.18	1.08	0.17	0.51	0.42	0.44	0.43	56	44	34	32	39
HPV-5Y, 35/HPV-10Y, 45	0.99	1.31	1.14	1.29	1.22	0.19	0.61	0.48	0.50	0.49	56	42	32	31	37
HPV-5Y, 40	1.38	1.48	1.21	1.56	1.43	0.29	0.68	0.49	0.56	0.52	49	37	31	27	34
HPV-10Y, 25	0.46	1.17	0.98	1.04	1.01	0.10	0.54	0.46	0.41	0.44	62	45	36	36	40
HPV-10Y, 35	1.06	1.44	1.20	1.43	1.32	0.21	0.67	0.50	0.53	0.51	55	40	32	30	36
CYTO-4Y, 21/COTEST-5Y, 25	0.25	0.71	0.76	0.50	0.61	0.05	0.32	0.39	0.19	0.26	65	51	38	42	46
CYTO-4Y, 21/COTEST-10Y, 25	0.37	1.10	0.99	0.86	0.93	0.08	0.50	0.46	0.34	0.40	63	46	36	38	42
COTEST-5Y, 25	0.28	0.72	0.77	0.55	0.64	0.06	0.32	0.38	0.20	0.26	64	51	38	42	46
COTEST-5Y, 25/COTEST-10Y, 35	0.35	0.98	0.96	0.78	0.87	0.08	0.45	0.43	0.31	0.37	64	48	37	39	44
COTEST-5Y, 30	0.53	0.85	0.84	0.75	0.80	0.09	0.37	0.39	0.26	0.32	62	49	36	39	44
COTEST-5Y, 30/COTEST-10Y, 35	0.60	1.14	0.92	0.98	0.95	0.11	0.52	0.39	0.38	0.38	61	45	36	36	40
COTEST-5Y, 35	0.92	1.08	0.91	1.09	1.00	0.16	0.48	0.38	0.41	0.39	56	44	35	33	40
COTEST-5Y, 35/COTEST-10Y, 45	0.96	1.27	1.03	1.22	1.12	0.18	0.57	0.46	0.49	0.47	56	42	32	31	37
COTEST-5Y, 40	1.35	1.45	1.11	1.49	1.40	0.28	0.67	0.44	0.54	0.49	50	37	32	28	34
COTEST-10Y, 25	0.40	1.12	0.96	0.92	0.94	0.09	0.51	0.47	0.35	0.41	63	46	36	37	42
COTEST-10Y, 35	1.00	1.40	1.14	1.32	1.23	0.19	0.64	0.47	0.49	0.48	56	41	33	31	37
End Age 70[d]															
CYTO-3Y, 21	0.65	1.06	0.97	0.67	0.82	0.15	0.44	0.44	0.26	0.35	62	48	37	40	44
CYTO-3Y, 21/HPV-5Y, 30	0.30	0.63	0.70	0.51	0.57	0.05	0.23	0.32	0.19	0.21	64	52	39	42	47
CYTO-3Y, 21/COTEST-5Y, 30	0.28	0.61	0.63	0.42	0.51	0.05	0.22	0.29	0.16	0.19	64	52	39	43	48
CYTO-4Y, 21/HPV-5Y, 25	0.25	0.60	0.69	0.51	0.56	0.05	0.23	0.31	0.20	0.21	64	52	39	42	47
CYTO-3Y, 21/HPV-10Y, 30	0.41	1.08	0.94	0.88	0.91	0.09	0.46	0.41	0.34	0.38	63	46	37	38	42
HPV-5Y, 25	0.28	0.62	0.73	0.56	0.59	0.05	0.24	0.32	0.19	0.21	64	51	39	41	46

HPV-5Y, 25/HPV-10Y, 30	0.38	1.06	0.87	0.93	0.90	0.08	0.46	0.38	0.36	0.37	63	46	37	37	42
HPV-5Y, 30	0.52	0.76	0.74	0.75	0.74	0.09	0.29	0.29	0.25	0.27	61	49	38	39	44
HPV-5Y, 30/HPV-10Y, 40	0.59	1.03	0.88	0.98	0.93	0.11	0.44	0.37	0.36	0.37	61	46	36	36	41
HPV-5Y, 35	0.91	0.99	0.93	1.09	0.96	0.16	0.40	0.34	0.39	0.37	56	45	34	33	40
HPV-5Y, 35/HPV-10Y, 40	0.98	1.27	1.12	1.30	1.20	0.18	0.55	0.41	0.47	0.44	56	42	33	31	38
HPV-5Y, 40	1.35	1.35	1.16	1.49	1.35	0.28	0.59	0.45	0.52	0.48	49	38	30	28	34
HPV-10Y, 30	0.65	1.23	0.95	1.12	1.03	0.12	0.53	0.38	0.41	0.40	60	43	35	34	39
HPV-10Y, 40	1.45	1.65	1.24	1.71	1.55	0.31	0.75	0.47	0.60	0.54	48	34	30	25	32
CYTO-4Y, 21/COTEST-5Y, 25	0.23	0.57	0.62	0.41	0.49	0.04	0.21	0.25	0.13	0.17	65	52	40	43	48
CYTO-3Y, 21/COTEST-10Y, 30	0.38	1.03	0.83	0.77	0.80	0.08	0.42	0.36	0.30	0.33	63	47	38	39	43
COTEST-5Y, 25/COTEST-10Y, 30	0.35	1.02	0.79	0.82	0.81	0.07	0.43	0.31	0.30	0.30	63	47	38	38	42
COTEST-5Y, 30	0.50	0.72	0.68	0.66	0.67	0.08	0.28	0.27	0.21	0.24	62	49	38	40	44
COTEST-5Y, 30/COTEST-10Y, 40	0.56	0.99	0.78	0.85	0.82	0.10	0.41	0.33	0.32	0.32	61	47	37	37	42
COTEST-5Y, 35	0.89	0.96	0.85	1.00	0.93	0.15	0.38	0.32	0.34	0.33	57	45	35	33	40
COTEST-5Y, 35/COTEST-10Y, 40	0.95	1.23	0.95	1.21	1.08	0.17	0.52	0.36	0.44	0.40	56	42	34	32	38
COTEST-5Y, 40	1.32	1.32	1.08	1.42	1.32	0.27	0.56	0.36	0.48	0.42	50	38	33	28	36
COTEST-10Y, 30	0.60	1.18	0.87	1.02	0.94	0.11	0.49	0.34	0.37	0.36	61	44	36	35	40
COTEST-10Y, 40	1.39	1.61	1.18	1.64	1.50	0.29	0.72	0.45	0.57	0.51	49	35	31	26	33

Abbreviations: CYTO, cytology; HPV, Human papillomavirus; H, Harvard model; M, MISCAN-Cervix model; P, Policy1-Cervix model; U, University of Minnesota model.
[a] Outcomes calculated from age 21 to 100 years.
[b] Strategies are denoted by the screening modality, interval, age to begin screening/screening modality after switch age, interval after switch age, switch age for each end age category. For example, CYTO-3Y, 21 indicates cytology testing every 3 years starting at age 21, and CYTO-3Y, 21/HPV-5Y,30 indicates cytology testing every 3 years starting at age 21 with a switch to HPV testing every 5 years starting at age 30.
[c] Median outcome across the four models.
[d] End age indicates the age at which the final routine screen should occur, irrespective of age at last screen; exceptions include female persons who are recommended to continue screening due to prior abnormal results and/or precancer treatment.
[e] Strategies (bolded) represent current US recommended strategies.

Table 10. Lifetime Number of Total Tests and Colposcopies Among 2vHPV or 4vHPV Vaccinated Female Persons for Screening Strategies by Model[a]

Strategy[c]	Total Tests per 1,000 [b] H	M	P	U	Med[d]	Colposcopies per 1,000 H	M	P	U	Med[d]
No Screening	0	0	0	0	0	0	0	0	0	0
End Age 60[e]										
CYTO-3Y, 21	14,925	14,087	14,793	14,607	14,700	542	561	460	604	552
CYTO-3Y, 21/HPV-5Y, 30	11,752	11,463	11,233	11,587	11,525	793	682	325	790	736
CYTO-3Y, 21/COTEST-5Y, 30	20,279	18,265	19,900	20,052	19,976	1,022	781	596	945	863
CYTO-4Y, 21/HPV-5Y, 25	11,073	10,763	10,529	10,695	10,729	946	741	345	835	788
CYTO-3Y, 21/HPV-10Y, 30	8,672	8,398	8,201	8,674	8,535	642	531	269	622	577
HPV-5Y, 25	9,919	9,527	9,352	9,476	9,501	904	651	301	756	704
HPV-5Y, 25/HPV-10Y, 30	6,844	6,471	6,322	6,554	6,512	756	502	247	588	545
HPV-5Y, 30	8,297	7,840	7,749	8,029	7,934	662	440	195	595	517
HPV-5Y, 30/HPV-10Y, 40	6,352	5,985	5,785	6,242	6,114	583	377	166	522	449
HPV-5Y, 35	6,866	6,379	6,443	6,594	6,519	496	299	142	418	359
HPV-5Y, 35/HPV-10Y, 40	4,907	4,478	4,458	4,760	4,619	415	234	112	345	289
HPV-5Y, 40	5,557	5,020	5,234	5,234	5,234	373	189	105	278	234
HPV-10Y, 30	5,182	4,667	4,655	5,033	4,850	508	279	137	417	348
HPV-10Y, 40	3,661	3,083	3,236	3,364	3,300	293	122	74	204	163
CYTO-4Y, 21/COTEST-5Y, 25	21,022	19,056	20,652	20,569	20,611	1,213	899	669	1,023	961
CYTO-3Y, 21/COTEST-10Y, 30	14,022	12,455	13,777	14,184	13,900	787	599	445	736	667
COTEST-5Y, 25/COTEST-10Y, 30	13,633	12,181	13,475	13,473	13,474	917	635	481	740	688
COTEST-5Y, 30	16,808	14,904	16,389	16,460	16,425	891	559	463	750	654
COTEST-5Y, 30/COTEST-10Y, 40	12,799	11,346	12,462	12,822	12,630	745	480	376	654	567
COTEST-5Y, 35	14,024	12,204	13,740	13,595	13,668	688	386	365	547	466
COTEST-5Y, 35/COTEST-10Y, 40	10,025	8,547	9,692	9,845	9,768	542	302	272	446	374
COTEST-5Y, 40	11,451	9,688	11,245	10,862	11,054	532	251	286	379	333
COTEST-10Y, 30	10,538	8,891	10,083	10,403	10,243	654	358	308	534	446
COTEST-10Y, 40	7,722	5,954	7,084	7,002	7,043	404	163	190	274	232
End Age 65[e]										
CYTO-3Y, 21[f]	**16,325**	**14,861**	**16,283**	**15,982**	**16,133**	**585**	**573**	**499**	**642**	**579**
CYTO-3Y, 21/HPV-5Y, 30[f]	**12,562**	**12,280**	**12,071**	**12,351**	**12,316**	**823**	**705**	**336**	**809**	**757**
CYTO-3Y, 21/COTEST-5Y, 30[f]	**21,837**	**19,835**	**21,623**	**21,652**	**21,638**	**1,071**	**809**	**634**	**976**	**893**
CYTO-4Y, 21/HPV-5Y, 25	11,881	11,579	11,367	11,459	11,519	976	765	357	853	809
CYTO-4Y, 21/HPV-10Y, 25	7,740	7,451	7,353	7,496	7,473	754	545	280	600	573
HPV-5Y, 25[f]	**10,728**	**10,345**	**10,195**	**10,246**	**10,295**	**934**	**675**	**313**	**775**	**725**
HPV-5Y, 25/HPV-10Y, 35	7,825	7,598	7,334	7,568	7,583	813	580	272	663	622
HPV-5Y, 30	9,109	8,662	8,590	8,801	8,732	692	464	206	612	538
HPV-5Y, 30/HPV-10Y, 35	6,179	5,837	5,697	6,087	5,962	569	365	165	497	431
HPV-5Y, 35	7,676	7,203	7,285	7,348	7,317	526	323	153	434	379
HPV-5Y, 35/HPV-10Y, 45	5,819	5,413	5,405	5,665	5,539	456	266	127	388	327
HPV-5Y, 40	6,373	5,846	6,083	6,000	6,041	403	213	116	294	253
HPV-10Y, 25	6,567	6,175	6,155	6,237	6,206	709	452	236	519	485
HPV-10Y, 35	4,716	4,325	4,353	4,566	4,460	398	222	111	316	269
CYTO-4Y, 21/COTEST-5Y, 25	22,573	20,620	22,377	22,163	22,270	1,262	926	711	1,054	990
CYTO-4Y, 21/COTEST-10Y, 25	14,259	12,820	14,362	14,186	14,222	929	659	508	744	701

Strategy[c]	Total Tests per 1,000 [b] H	M	P	U	Med[d]	Colposcopies per 1,000 H	M	P	U	Med[d]
COTEST-5Y, 25	21,432	19,528	21,216	20,950	21,083	1,220	846	668	980	913
COTEST-5Y, 25/COTEST-10Y, 35	15,514	14,280	15,530	15,522	15,518	1,001	729	538	824	776
COTEST-5Y, 30	18,374	16,480	18,120	18,071	18,096	940	587	503	784	685
COTEST-5Y, 30/COTEST-10Y, 35	12,399	11,061	12,259	12,535	12,329	720	462	370	625	544
COTEST-5Y, 35	15,595	13,790	15,476	15,181	15,328	737	415	403	576	496
COTEST-5Y, 35/COTEST-10Y, 45	11,759	10,347	11,706	11,714	11,710	606	343	320	502	423
COTEST-5Y, 40	13,031	11,277	13,008	12,469	12,738	582	281	324	409	367
COTEST-10Y, 25	13,090	11,645	13,131	12,875	12,983	885	573	463	663	618
COTEST-10Y, 35	9,605	8,253	9,459	9,481	9,470	530	284	267	414	349
End Age 70[e]										
CYTO-3Y, 21	17,706	16,310	17,766	17,373	17,540	626	595	538	680	610
CYTO-3Y, 21/HPV-5Y, 30	13,298	13,025	12,829	13,063	13,044	847	726	346	824	775
CYTO-3Y, 21/COTEST-5Y, 30	23,238	21,264	23,175	23,117	23,146	1,112	832	668	1,003	918
CYTO-4Y, 21/HPV-5Y, 25	12,615	12,319	12,123	12,170	12,245	1,001	784	365	865	825
CYTO-3Y, 21/HPV-10Y, 30	9,413	9,162	8,982	9,399	9,280	673	552	281	639	596
HPV-5Y, 25	11,463	11,088	10,962	10,955	11,025	958	694	324	790	742
HPV-5Y, 25/HPV-10Y, 30	7,583	7,234	7,096	7,280	7,257	787	523	257	608	566
HPV-5Y, 30	9,847	9,411	9,367	9,516	9,463	717	484	217	627	555
HPV-5Y, 30/HPV-10Y, 40	7,091	6,754	6,571	6,976	6,865	614	399	178	540	469
HPV-5Y, 35	8,416	7,956	8,047	8,063	8,055	550	343	163	449	396
HPV-5Y, 35/HPV-10Y, 40	5,642	5,249	5,235	5,494	5,372	446	255	123	362	309
HPV-5Y, 40	7,112	6,602	6,852	6,708	6,780	428	233	127	309	271
HPV-10Y, 30	5,917	5,437	5,432	5,761	5,599	539	300	148	436	368
HPV-10Y, 40	4,316	3,857	4,019	4,084	4,052	320	144	85	220	182
CYTO-4Y, 21/COTEST-5Y, 25	23,977	22,044	23,900	23,630	23,765	1,306	948	741	1,082	1,015
CYTO-3Y, 21/COTEST-10Y, 30	15,396	13,924	15,428	15,717	15,412	833	624	482	764	694
COTEST-5Y, 25/COTEST-10Y, 30	14,987	13,649	15,102	15,012	14,999	963	661	518	773	717
COTEST-5Y, 30	19,784	17,920	19,674	19,543	19,609	982	611	537	808	710
COTEST-5Y, 30/COTEST-10Y, 40	14,158	12,822	14,112	14,385	14,135	790	505	412	686	595
COTEST-5Y, 35	17,015	15,237	17,036	16,663	16,839	779	439	436	603	521
COTEST-5Y, 35/COTEST-10Y, 40	11,346	10,033	11,358	11,394	11,352	586	328	310	474	401
COTEST-5Y, 40	14,455	12,730	14,575	13,937	14,196	624	305	358	434	396
COTEST-10Y, 30	11,859	10,371	11,766	11,937	11,812	699	384	348	562	473
COTEST-10Y, 40	8,778	7,442	8,764	8,529	8,646	440	190	228	302	265

Abbreviations: CYTO, cytology; HPV, Human papillomavirus; H, Harvard model; M, MISCAN-Cervix model; P, Policy1-Cervix model; U, University of Minnesota model.
[a] Outcomes calculated from age 21 to 100 years.
[b] Total number of tests including cytology and HPV tests, irrespective of primary, triage or surveillance context.
[c] Strategies are denoted by the screening modality, interval, age to begin screening/screening modality after switch age, interval after switch age, switch age for each end age category. For example, CYTO-3Y, 21 indicates cytology testing every 3 years starting at age 21, and CYTO-3Y, 21/HPV-5Y,30 indicates cytology testing every 3 years starting at age 21 with a switch to HPV testing every 5 years starting at age 30.
[d] Median outcome across the four models.
[e] End age indicates the age at which the final routine screen should occur, irrespective of age at last screen; exceptions include female persons who are recommended to continue screening due to prior abnormal results and/or precancer treatment.
[f] Strategies (bolded) represent current US recommended strategies.

Table 11. Lifetime Number of CIN2+ Detected and False Positives Among 2vHPV or 4vHPV Vaccinated Female Persons for Screening Strategies by Model[a]

	CIN2+ Detected per 1,000[b]					False Positives per 1,000[c]				
Strategy[d]	H	M	P	U	Med[e]	H	M	P	U	Med[e]
No Screening	0	0	0	0	0	0	0	0	0	0
End Age 60[f]										
CYTO-3Y, 21	81	48	63	130	72	462	510	396	474	468
CYTO-3Y, 21/HPV-5Y, 30	93	54	66	137	80	701	624	259	653	638
CYTO-3Y, 21/COTEST-5Y, 30	99	56	68	142	84	924	721	529	803	762
CYTO-4Y, 21/HPV-5Y, 25	96	56	66	135	81	852	681	279	700	690
CYTO-3Y, 21/HPV-10Y, 30	85	47	61	123	73	559	481	208	499	490
HPV-5Y, 25	90	48	55	119	73	815	600	246	636	618
HPV-5Y, 25/HPV-10Y, 30	83	41	51	105	67	675	459	196	484	471
HPV-5Y, 30	71	32	37	91	54	593	405	158	503	454
HPV-5Y, 30/HPV-10Y, 40	67	30	35	87	51	517	345	131	435	390
HPV-5Y, 35	55	22	26	67	41	442	275	116	352	313
HPV-5Y, 35/HPV-10Y, 40	51	20	25	62	38	366	213	87	283	248
HPV-5Y, 40	43	15	20	46	32	331	173	85	232	203
HPV-10Y, 30	63	25	32	76	48	447	252	105	341	296
HPV-10Y, 40	39	12	18	41	29	255	109	55	163	136
CYTO-4Y, 21/COTEST-5Y, 25	104	59	68	142	86	1,111	836	601	881	858
CYTO-3Y, 21/COTEST-10Y, 30	90	48	64	128	77	699	547	381	608	577
COTEST-5Y, 25/COTEST-10Y, 30	89	44	54	113	71	831	589	427	627	608
COTEST-5Y, 30	78	34	38	97	58	815	522	425	652	587
COTEST-5Y, 30/COTEST-10Y, 40	73	32	36	93	55	673	446	339	561	503
COTEST-5Y, 35	60	24	28	70	44	630	361	338	477	419
COTEST-5Y, 35/COTEST-10Y, 40	55	21	26	66	40	488	279	246	380	330
COTEST-5Y, 40	47	16	20	48	34	486	235	265	331	298
COTEST-10Y, 30	68	27	33	83	51	588	330	274	452	391
COTEST-10Y, 40	43	13	19	43	31	363	150	171	231	201
End Age 65[f]										
CYTO-3Y, 21[g]	**84**	**48**	**64**	**131**	**74**	**501**	**521**	**434**	**511**	**506**
CYTO-3Y, 21/HPV-5Y, 30[g]	**96**	**55**	**67**	**138**	**82**	**729**	**645**	**268**	**670**	**658**
CYTO-3Y, 21/COTEST-5Y, 30[g]	**102**	**57**	**69**	**143**	**85**	**971**	**748**	**565**	**834**	**791**
CYTO-4Y, 21/HPV-5Y, 25	99	57	67	136	83	880	703	290	716	710
CYTO-4Y, 21/HPV-10Y, 25	87	47	60	113	73	669	495	220	487	491
HPV-5Y, 25[g]	**93**	**49**	**56**	**121**	**75**	**843**	**623**	**257**	**654**	**639**
HPV-5Y, 25/HPV-10Y, 35	87	45	55	112	71	728	532	218	551	541
HPV-5Y, 30	74	34	38	93	56	621	428	168	520	474
HPV-5Y, 30/HPV-10Y, 35	67	30	36	84	52	503	334	129	413	373
HPV-5Y, 35	57	24	28	68	42	470	297	126	367	332
HPV-5Y, 35/HPV-10Y, 45	54	22	26	65	40	404	243	101	322	283
HPV-5Y, 40	46	16	21	47	33	359	195	95	247	221
HPV-10Y, 25	81	38	50	97	65	631	411	186	422	416
HPV-10Y, 35	51	19	25	58	38	348	201	86	258	229
CYTO-4Y, 21/COTEST-5Y, 25	107	60	70	143	88	1,158	862	642	911	886
CYTO-4Y, 21/COTEST-10Y, 25	93	49	63	121	78	839	606	445	623	614

Strategy[d]	CIN2+ Detected per 1,000[b] H	M	P	U	Med[e]	False Positives per 1,000[c] H	M	P	U	Med[e]
COTEST-5Y, 25	101	52	60	128	80	1,121	790	608	852	821
COTEST-5Y, 25/COTEST-10Y, 35	93	48	57	120	75	910	677	481	704	691
COTEST-5Y, 30	80	36	40	98	60	862	549	463	686	617
COTEST-5Y, 30/COTEST-10Y, 35	73	31	38	90	55	650	429	332	535	482
COTEST-5Y, 35	62	25	29	72	46	677	388	375	505	446
COTEST-5Y, 35/COTEST-10Y, 45	58	23	28	69	43	550	318	293	433	376
COTEST-5Y, 40	50	17	22	49	36	533	262	302	360	331
COTEST-10Y, 25	87	41	53	105	70	801	529	410	558	543
COTEST-10Y, 35	55	20	26	63	40	477	263	240	351	307
End Age 70[f]										
CYTO-3Y, 21	86	50	66	132	76	541	541	472	548	541
CYTO-3Y, 21/HPV-5Y, 30	98	56	69	139	83	752	665	277	685	675
CYTO-3Y, 21/COTEST-5Y, 30	104	58	70	144	87	1,011	770	598	859	814
CYTO-4Y, 21/HPV-5Y, 25	101	58	68	138	84	903	722	297	727	725
CYTO-3Y, 21/HPV-10Y, 30	88	49	64	125	76	586	500	218	515	507
HPV-5Y, 25	95	50	58	121	77	866	641	265	668	655
HPV-5Y, 25/HPV-10Y, 30	86	42	53	107	70	703	478	204	501	490
HPV-5Y, 30	76	35	39	94	57	643	447	178	533	490
HPV-5Y, 30/HPV-10Y, 40	70	32	37	89	54	545	365	141	451	408
HPV-5Y, 35	59	25	29	69	44	493	317	134	380	348
HPV-5Y, 35/HPV-10Y, 40	54	21	26	64	40	393	232	97	299	265
HPV-5Y, 40	48	17	22	48	35	382	214	104	261	238
HPV-10Y, 30	66	27	34	78	50	474	272	114	357	315
HPV-10Y, 40	42	14	20	42	31	279	129	65	177	153
CYTO-4Y, 21/COTEST-5Y, 25	108	61	71	144	90	1,197	883	670	938	910
CYTO-3Y, 21/COTEST-10Y, 30	93	50	66	130	79	742	570	416	634	602
COTEST-5Y, 25/COTEST-10Y, 30	92	45	56	115	74	873	613	463	658	636
COTEST-5Y, 30	82	37	41	100	61	902	572	496	708	640
COTEST-5Y, 30/COTEST-10Y, 40	76	33	39	95	57	716	469	373	591	530
COTEST-5Y, 35	64	26	30	73	47	717	411	407	530	471
COTEST-5Y, 35/COTEST-10Y, 40	58	23	27	68	43	530	304	283	407	355
COTEST-5Y, 40	52	18	23	51	37	573	286	335	384	360
COTEST-10Y, 30	71	28	36	84	54	629	354	312	478	416
COTEST-10Y, 40	45	14	21	45	33	396	174	207	257	232

Abbreviations: CIN, cervical intraepithelial; CYTO, cytology; HPV, Human papillomavirus; H, Harvard model; M, MISCAN-Cervix model; P, Policy1-Cervix model; U, University of Minnesota model.
[a] Outcomes calculated from age 21 to 100 years.
[b] CIN2+ detected includes CIN2s, CIN3s and cervical cancers detected through screening (excludes clinically detected cancers).
[c] Total number of colposcopies that did not result in CIN2, CIN3 or cancer detection.
[d] Strategies are denoted by the screening modality, interval, age to begin screening/screening modality after switch age, interval after switch age, switch age for each end age category. For example, CYTO-3Y, 21 indicates cytology testing every 3 years starting at age 21, and CYTO-3Y, 21/HPV-5Y,30 indicates cytology testing every 3 years starting at age 21 with a switch to HPV testing every 5 years starting at age 30.
[e] Median outcome across the four models.
[f] End age indicates the age at which the final routine screen should occur, irrespective of age at last screen; exceptions include female persons who are recommended to continue screening due to prior abnormal results and/or precancer treatment.
[g] Strategies (bolded) represent current US recommended strategies.

Table 12. Lifetime Number of Cervical Cancer Cases, Deaths and Life-Years Gained Among 9vHPV Vaccinated Female Persons for Screening Strategies by Model[a]

	Cervical Cancer Cases per 1,000					Cervical Cancer Deaths per 1,000					Life-Years Gained per 1,000				
Strategy[b]	**H**	**M**	**P**	**U**	**Med[c]**	**H**	**M**	**P**	**U**	**Med[c]**	**H**	**M**	**P**	**U**	**Med***
No Screening	3.39	1.59	1.40	1.39	1.50	1.20	1.05	0.76	0.73	0.91	0	0	0	0	0
End Age 60[d]															
CYTO-3Y, 21	0.41	0.58	0.59	0.31	0.50	0.13	0.29	0.32	0.15	0.22	27	19	12	11	16
CYTO-3Y, 21/HPV-5Y, 30	0.12	0.42	0.48	0.22	0.32	0.03	0.21	0.25	0.10	0.16	29	21	13	12	17
CYTO-3Y, 21/COTEST-5Y, 30	0.11	0.41	0.47	0.19	0.30	0.02	0.21	0.26	0.09	0.15	29	21	13	12	17
CYTO-4Y, 21/HPV-5Y, 25	0.11	0.41	0.47	0.22	0.32	0.03	0.21	0.25	0.10	0.15	29	21	13	12	17
CYTO-3Y, 21/HPV-10Y, 30	0.18	0.57	0.52	0.30	0.41	0.04	0.29	0.27	0.13	0.20	29	19	12	11	16
HPV-5Y, 25	0.14	0.42	0.43	0.22	0.32	0.03	0.21	0.24	0.10	0.15	29	21	13	12	17
HPV-5Y, 25/HPV-10Y, 30	0.18	0.57	0.50	0.31	0.40	0.04	0.28	0.25	0.14	0.19	29	19	13	10	16
HPV-5Y, 30	0.18	0.48	0.42	0.22	0.32	0.04	0.24	0.22	0.11	0.16	28	20	13	11	16
HPV-5Y, 30/HPV-10Y, 40	0.21	0.55	0.46	0.32	0.39	0.05	0.28	0.22	0.15	0.19	28	19	12	10	16
HPV-5Y, 35	0.25	0.57	0.48	0.27	0.37	0.05	0.28	0.23	0.12	0.18	28	18	12	11	15
HPV-5Y, 35/HPV-10Y, 40	0.28	0.66	0.48	0.33	0.41	0.06	0.33	0.22	0.14	0.18	27	17	12	10	14
HPV-5Y, 40	0.35	0.73	0.54	0.30	0.45	0.08	0.36	0.26	0.13	0.20	26	15	10	10	12
HPV-10Y, 30	0.23	0.63	0.51	0.33	0.42	0.05	0.32	0.24	0.15	0.19	28	17	12	10	14
HPV-10Y, 40	0.40	0.81	0.55	0.38	0.48	0.09	0.41	0.25	0.18	0.21	26	14	10	9	12
CYTO-4Y, 21/COTEST-5Y, 25	0.11	0.40	0.40	0.20	0.30	0.02	0.20	0.20	0.09	0.14	29	21	14	12	18
CYTO-3Y, 21/COTEST-10Y, 30	0.16	0.56	0.50	0.28	0.39	0.04	0.28	0.25	0.12	0.18	29	19	13	11	16
COTEST-5Y, 25/COTEST-10Y, 30	0.16	0.55	0.47	0.28	0.37	0.04	0.28	0.23	0.12	0.18	29	19	13	11	16
COTEST-5Y, 30	0.17	0.46	0.39	0.22	0.30	0.03	0.23	0.19	0.10	0.15	29	20	13	12	16
COTEST-5Y, 30/COTEST-10Y, 40	0.20	0.54	0.42	0.28	0.35	0.04	0.27	0.19	0.13	0.16	28	19	13	11	16
COTEST-5Y, 35	0.23	0.56	0.44	0.23	0.34	0.05	0.27	0.22	0.10	0.16	28	18	12	11	15
COTEST-5Y, 35/COTEST-10Y, 40	0.27	0.64	0.45	0.30	0.38	0.05	0.32	0.21	0.13	0.17	27	17	11	10	14
COTEST-5Y, 40	0.34	0.72	0.43	0.27	0.39	0.07	0.35	0.19	0.12	0.15	26	15	12	11	14
COTEST-10Y, 30	0.21	0.61	0.45	0.30	0.37	0.04	0.30	0.21	0.12	0.17	28	18	13	11	16
COTEST-10Y, 40	0.37	0.80	0.53	0.35	0.45	0.08	0.40	0.25	0.16	0.20	26	14	10	10	12

End Age 65[d]															
CYTO-3Y, 21[e]	**0.33**	**0.53**	**0.50**	**0.24**	**0.42**	**0.09**	**0.25**	**0.26**	**0.10**	**0.18**	**28**	**20**	**13**	**11**	**16**
CYTO-3Y, 21/HPV-5Y, 30[e]	**0.11**	**0.33**	**0.36**	**0.17**	**0.25**	**0.02**	**0.14**	**0.19**	**0.07**	**0.10**	**29**	**22**	**14**	**12**	**18**
CYTO-3Y, 21/COTEST-5Y, 30[e]	**0.10**	**0.31**	**0.32**	**0.13**	**0.22**	**0.02**	**0.13**	**0.18**	**0.05**	**0.09**	**29**	**22**	**14**	**12**	**18**
CYTO-4Y, 21/HPV-5Y, 25	0.10	0.32	0.35	0.16	0.24	0.02	0.14	0.17	0.07	0.10	29	22	14	12	18
CYTO-4Y, 21/HPV-10Y, 25	0.16	0.49	0.41	0.26	0.34	0.04	0.23	0.20	0.12	0.16	29	19	13	11	16
HPV-5Y, 25[e]	**0.13**	**0.33**	**0.34**	**0.16**	**0.24**	**0.03**	**0.15**	**0.16**	**0.07**	**0.11**	**29**	**21**	**14**	**12**	**18**
HPV-5Y, 25/HPV-10Y, 35	0.16	0.45	0.46	0.25	0.35	0.04	0.21	0.22	0.11	0.16	29	20	13	11	16
HPV-5Y, 30	0.17	0.38	0.35	0.18	0.26	0.03	0.17	0.18	0.07	0.12	28	20	13	12	16
HPV-5Y, 30/HPV-10Y, 35	0.21	0.51	0.41	0.26	0.34	0.04	0.23	0.17	0.11	0.14	28	19	13	11	16
HPV-5Y, 35	0.24	0.48	0.39	0.20	0.31	0.05	0.21	0.18	0.08	0.13	28	19	12	11	16
HPV-5Y, 35/HPV-10Y, 45	0.26	0.56	0.47	0.25	0.37	0.05	0.26	0.21	0.11	0.16	27	18	12	11	15
HPV-5Y, 40	0.34	0.63	0.47	0.24	0.40	0.07	0.29	0.20	0.09	0.15	26	16	12	11	14
HPV-10Y, 25	0.18	0.51	0.45	0.26	0.36	0.04	0.24	0.21	0.12	0.16	29	19	12	11	16
HPV-10Y, 35	0.29	0.61	0.46	0.30	0.38	0.06	0.28	0.19	0.12	0.16	27	17	12	10	14
CYTO-4Y, 21/COTEST-5Y, 25	0.10	0.31	0.33	0.13	0.22	0.02	0.13	0.17	0.05	0.09	29	22	14	12	18
CYTO-4Y, 21/COTEST-10Y, 25	0.14	0.47	0.43	0.23	0.33	0.03	0.22	0.20	0.09	0.15	29	20	13	11	16
COTEST-5Y, 25	0.11	0.31	0.34	0.15	0.23	0.02	0.14	0.17	0.06	0.10	29	22	14	12	18
COTEST-5Y, 25/COTEST-10Y, 35	0.15	0.43	0.37	0.22	0.30	0.03	0.20	0.17	0.09	0.13	29	20	14	11	17
COTEST-5Y, 30	0.16	0.37	0.36	0.15	0.26	0.03	0.16	0.18	0.06	0.11	29	21	13	12	17
COTEST-5Y, 30/COTEST-10Y, 35	0.19	0.49	0.37	0.24	0.30	0.04	0.22	0.16	0.10	0.13	28	19	13	11	16
COTEST-5Y, 35	0.22	0.47	0.35	0.18	0.29	0.04	0.20	0.16	0.08	0.12	28	19	13	11	16
COTEST-5Y, 35/COTEST-10Y, 45	0.25	0.54	0.40	0.23	0.32	0.05	0.24	0.17	0.10	0.14	27	18	13	11	16
COTEST-5Y, 40	0.33	0.63	0.43	0.23	0.38	0.07	0.28	0.17	0.09	0.13	26	16	12	11	14
COTEST-10Y, 25	0.16	0.49	0.37	0.24	0.31	0.04	0.22	0.16	0.10	0.13	29	19	14	11	16
COTEST-10Y, 35	0.27	0.59	0.44	0.27	0.35	0.06	0.27	0.20	0.11	0.15	27	17	12	10	14
End Age 70[d]															
CYTO-3Y, 21	0.28	0.45	0.43	0.19	0.36	0.07	0.18	0.18	0.08	0.13	28	21	14	12	18
CYTO-3Y, 21/HPV-5Y, 30	0.11	0.28	0.32	0.13	0.20	0.02	0.10	0.12	0.05	0.08	29	22	15	12	18
CYTO-3Y, 21/COTEST-5Y, 30	0.10	0.26	0.28	0.11	0.18	0.02	0.09	0.12	0.04	0.07	29	22	14	12	18
CYTO-4Y, 21/HPV-5Y, 25	0.10	0.27	0.29	0.13	0.20	0.02	0.10	0.13	0.05	0.07	29	22	15	12	18
CYTO-3Y, 21/HPV-10Y, 30	0.16	0.47	0.39	0.25	0.32	0.04	0.20	0.17	0.11	0.14	29	19	13	11	16
HPV-5Y, 25	0.12	0.27	0.30	0.13	0.20	0.02	0.10	0.14	0.05	0.08	29	22	14	12	18

HPV-5Y, 25/HPV-10Y, 30	0.16	0.46	0.37	0.25	0.31	0.04	0.20	0.17	0.11	0.14	29	19	13	11	16
HPV-5Y, 30	0.16	0.33	0.31	0.14	0.24	0.03	0.12	0.12	0.06	0.09	28	21	14	12	18
HPV-5Y, 30/HPV-10Y, 40	0.19	0.45	0.34	0.25	0.29	0.04	0.19	0.13	0.12	0.12	28	20	14	11	17
HPV-5Y, 35	0.23	0.43	0.31	0.17	0.27	0.04	0.17	0.11	0.07	0.09	28	19	14	11	16
HPV-5Y, 35/HPV-10Y, 40	0.26	0.55	0.41	0.26	0.34	0.05	0.24	0.15	0.11	0.13	27	18	12	10	15
HPV-5Y, 40	0.34	0.58	0.42	0.21	0.38	0.07	0.25	0.16	0.07	0.12	26	16	11	11	14
HPV-10Y, 30	0.21	0.53	0.38	0.26	0.32	0.05	0.22	0.15	0.11	0.13	28	18	13	11	16
HPV-10Y, 40	0.39	0.71	0.48	0.30	0.43	0.09	0.32	0.17	0.12	0.15	26	15	12	10	14
CYTO-4Y, 21/COTEST-5Y, 25	0.09	0.25	0.26	0.10	0.18	0.02	0.09	0.10	0.04	0.07	29	22	15	12	18
CYTO-3Y, 21/COTEST-10Y, 30	0.14	0.45	0.36	0.21	0.29	0.03	0.19	0.16	0.09	0.13	29	20	13	11	16
COTEST-5Y, 25/COTEST-10Y, 30	0.15	0.45	0.34	0.22	0.28	0.03	0.19	0.14	0.09	0.12	29	20	14	11	17
COTEST-5Y, 30	0.15	0.32	0.28	0.12	0.22	0.03	0.12	0.12	0.05	0.08	29	21	14	12	18
COTEST-5Y, 30/COTEST-10Y, 40	0.18	0.43	0.35	0.20	0.27	0.04	0.18	0.14	0.08	0.11	28	20	14	11	17
COTEST-5Y, 35	0.22	0.42	0.32	0.14	0.27	0.04	0.16	0.14	0.06	0.10	28	19	13	12	16
COTEST-5Y, 35/COTEST-10Y, 40	0.25	0.54	0.41	0.23	0.33	0.05	0.23	0.14	0.10	0.12	27	18	13	11	16
COTEST-5Y, 40	0.32	0.57	0.40	0.18	0.36	0.07	0.24	0.16	0.07	0.11	26	16	11	11	14
COTEST-10Y, 30	0.19	0.51	0.34	0.23	0.29	0.04	0.21	0.14	0.10	0.12	28	19	13	11	16
COTEST-10Y, 40	0.36	0.69	0.47	0.27	0.42	0.08	0.31	0.16	0.11	0.14	26	15	12	10	14

Abbreviations: CYTO, cytology; HPV, Human papillomavirus; H, Harvard model; M, MISCAN-Cervix model; P, Policy1-Cervix model; U, University of Minnesota model.
[a] Outcomes calculated from age 21 to 100 years.
[b] Strategies are denoted by the screening modality, interval, age to begin screening/screening modality after switch age, interval after switch age, switch age for each end age category. For example, CYTO-3Y, 21 indicates cytology testing every 3 years starting at age 21, and CYTO-3Y, 21/HPV-5Y,30 indicates cytology testing every 3 years starting at age 21 with a switch to HPV testing every 5 years starting at age 30.
[c] Median outcome across the four models.
[d] End age indicates the age at which the final routine screen should occur, irrespective of age at last screen; exceptions include female persons who are recommended to continue screening due to prior abnormal results and/or precancer treatment.
[e] Strategies (bolded) represent current US recommended strategies.

Table 13. Lifetime Number of Total Tests and Colposcopies Among 9vHPV Vaccinated Female Persons for Screening Strategies by Model[a]

	Total Tests per 1,000 [b]					Colposcopies per 1,000				
Strategy[c]	**H**	**M**	**P**	**U**	**Med[d]**	**H**	**M**	**P**	**U**	**Med[d]**
No Screening	0	0	0	0	0	0	0	0	0	0
End Age 60[e]										
CYTO-3Y, 21	14,634	13,652	14,649	14,218	14,426	462	387	404	464	433
CYTO-3Y, 21/HPV-5Y, 30	10,817	10,563	10,601	10,681	10,641	493	413	206	511	453
CYTO-3Y, 21/COTEST-5Y, 30	18,769	17,145	18,906	18,604	18,686	703	496	450	649	572
CYTO-4Y, 21/HPV-5Y, 25	9,892	9,683	9,670	9,680	9,681	546	417	190	521	469
CYTO-3Y, 21/HPV-10Y, 30	7,899	7,645	7,641	7,749	7,697	421	322	176	387	355
HPV-5Y, 25	8,763	8,510	8,526	8,531	8,528	511	353	153	472	412
HPV-5Y, 25/HPV-10Y, 30	5,844	5,588	5,557	5,593	5,591	441	262	121	349	305
HPV-5Y, 30	7,449	7,119	7,206	7,307	7,257	390	244	101	386	315
HPV-5Y, 30/HPV-10Y, 40	5,597	5,322	5,278	5,465	5,393	353	206	83	326	266
HPV-5Y, 35	6,216	5,863	6,041	6,070	6,055	295	168	74	282	225
HPV-5Y, 35/HPV-10Y, 40	4,360	4,045	4,100	4,216	4,158	258	130	56	223	177
HPV-5Y, 40	5,053	4,672	4,941	4,892	4,916	224	105	56	200	152
HPV-10Y, 30	4,516	4,147	4,207	4,337	4,272	316	148	69	257	203
HPV-10Y, 40	3,253	2,838	2,996	3,022	3,009	186	67	38	139	103
CYTO-4Y, 21/COTEST-5Y, 25	19,111	17,548	19,307	18,885	18,998	789	542	477	685	613
CYTO-3Y, 21/COTEST-10Y, 30	12,742	11,489	12,773	12,617	12,680	549	375	324	479	427
COTEST-5Y, 25/COTEST-10Y, 30	11,966	10,796	12,105	11,782	11,874	588	363	318	468	415
COTEST-5Y, 30	15,404	13,842	15,496	15,242	15,323	600	340	343	523	433
COTEST-5Y, 30/COTEST-10Y, 40	11,539	10,333	11,561	11,488	11,514	500	288	267	436	362
COTEST-5Y, 35	12,937	11,452	13,073	12,721	12,829	472	241	277	397	337
COTEST-5Y, 35/COTEST-10Y, 40	9,097	7,891	9,038	8,905	8,972	373	186	199	307	253
COTEST-5Y, 40	10,595	9,179	10,747	10,290	10,442	369	158	222	291	257
COTEST-10Y, 30	9,396	8,083	9,280	9,169	9,225	445	211	218	351	284
COTEST-10Y, 40	7,027	5,580	6,635	6,408	6,522	285	102	141	199	170
End Age 65[e]										
CYTO-3Y, 21[f]	**16,058**	**14,420**	**16,155**	**15,626**	**15,842**	**503**	**395**	**442**	**502**	**472**
CYTO-3Y, 21/HPV-5Y, 30[f]	**11,607**	**11,344**	**11,426**	**11,459**	**11,443**	**510**	**426**	**214**	**525**	**468**
CYTO-3Y, 21/COTEST-5Y, 30[f]	**20,325**	**18,672**	**20,610**	**20,228**	**20,276**	**739**	**512**	**482**	**677**	**594**
CYTO-4Y, 21/HPV-5Y, 25	10,682	10,464	10,486	10,456	10,475	562	430	195	532	481
CYTO-4Y, 21/HPV-10Y, 25	6,771	6,563	6,552	6,517	6,557	454	305	149	353	329
HPV-5Y, 25[f]	**9,554**	**9,293**	**9,350**	**9,311**	**9,330**	**527**	**366**	**160**	**485**	**426**
HPV-5Y, 25/HPV-10Y, 35	6,775	6,609	6,516	6,550	6,580	470	310	135	394	352
HPV-5Y, 30	8,241	7,903	8,030	8,087	8,059	406	256	108	399	328
HPV-5Y, 30/HPV-10Y, 35	5,453	5,185	5,179	5,309	5,247	348	199	83	307	253
HPV-5Y, 35	7,007	6,649	6,858	6,850	6,854	311	181	80	296	238
HPV-5Y, 35/HPV-10Y, 45	5,237	4,926	5,018	5,118	5,068	279	149	65	255	202
HPV-5Y, 40	5,846	5,459	5,760	5,673	5,716	240	118	62	213	166
HPV-10Y, 25	5,633	5,369	5,402	5,356	5,386	418	239	115	304	272
HPV-10Y, 35	4,206	3,906	4,000	4,051	4,025	251	123	56	202	163
CYTO-4Y, 21/COTEST-5Y, 25	20,663	19,074	21,014	20,501	20,582	825	559	510	711	635
CYTO-4Y, 21/COTEST-10Y, 25	12,655	11,523	12,951	12,493	12,574	610	391	341	468	430
COTEST-5Y, 25	19,542	17,977	19,861	19,370	19,456	791	501	473	663	582

Strategy[c]	Total Tests per 1,000 [b] H	M	P	U	Med[d]	Colposcopies per 1,000 H	M	P	U	Med[d]
COTEST-5Y, 25/COTEST-10Y, 35	13,797	12,744	14,120	13,761	13,779	643	423	361	529	476
COTEST-5Y, 30	16,963	15,377	17,213	16,864	16,914	636	358	376	550	463
COTEST-5Y, 30/COTEST-10Y, 35	11,196	10,062	11,345	11,198	11,197	488	276	262	415	346
COTEST-5Y, 35	14,499	12,992	14,792	14,342	14,421	509	258	309	424	367
COTEST-5Y, 35/COTEST-10Y, 45	10,798	9,619	11,019	10,792	10,795	418	212	237	356	297
COTEST-5Y, 40	12,160	10,720	12,489	11,929	12,044	406	176	256	318	287
COTEST-10Y, 25	11,521	10,382	11,777	11,309	11,415	574	331	305	418	374
COTEST-10Y, 35	8,742	7,619	8,820	8,579	8,660	370	174	195	284	239
End Age 70[e]										
CYTO-3Y, 21	17,463	15,860	17,653	17,044	17,254	543	408	480	539	509
CYTO-3Y, 21/HPV-5Y, 30	12,330	12,059	12,170	12,173	12,171	523	436	219	536	480
CYTO-3Y, 21/COTEST-5Y, 30	21,732	20,070	22,135	21,697	21,715	770	525	510	699	612
CYTO-4Y, 21/HPV-5Y, 25	11,405	11,178	11,233	11,168	11,206	575	441	200	543	492
CYTO-3Y, 21/HPV-10Y, 30	8,625	8,370	8,396	8,471	8,433	439	333	182	399	366
HPV-5Y, 25	10,277	10,008	10,090	10,025	10,058	540	377	165	497	437
HPV-5Y, 25/HPV-10Y, 30	6,571	6,313	6,308	6,316	6,315	459	273	127	359	316
HPV-5Y, 30	8,966	8,622	8,780	8,800	8,790	419	267	113	410	339
HPV-5Y, 30/HPV-10Y, 40	6,324	6,049	6,039	6,192	6,121	371	218	90	339	278
HPV-5Y, 35	7,733	7,369	7,614	7,568	7,591	325	192	86	307	249
HPV-5Y, 35/HPV-10Y, 40	5,083	4,775	4,855	4,943	4,899	276	142	62	235	188
HPV-5Y, 40	6,571	6,182	6,512	6,390	6,451	253	129	68	224	177
HPV-10Y, 30	5,240	4,876	4,968	5,064	5,016	334	160	75	271	216
HPV-10Y, 40	3,912	3,568	3,756	3,747	3,751	202	79	44	150	114
CYTO-4Y, 21/COTEST-5Y, 25	22,068	20,468	22,533	21,976	22,022	857	572	537	734	653
CYTO-3Y, 21/COTEST-10Y, 30	14,123	12,908	14,400	14,159	14,141	584	390	357	505	447
COTEST-5Y, 25/COTEST-10Y, 30	13,336	12,215	13,716	13,317	13,326	623	378	348	495	436
COTEST-5Y, 30	18,378	16,782	18,755	18,343	18,360	668	372	404	574	489
COTEST-5Y, 30/COTEST-10Y, 40	12,911	11,755	13,174	13,042	12,976	535	303	297	464	384
COTEST-5Y, 35	15,919	14,401	16,341	15,838	15,878	540	273	339	449	394
COTEST-5Y, 35/COTEST-10Y, 40	10,432	9,320	10,671	10,454	10,443	407	201	229	334	281
COTEST-5Y, 40	13,582	12,135	14,051	13,416	13,499	437	191	284	342	313
COTEST-10Y, 30	10,730	9,508	10,898	10,703	10,716	479	226	247	374	311
COTEST-10Y, 40	8,105	7,011	8,282	7,961	8,033	312	117	172	225	198

Abbreviations: CYTO, cytology; HPV, Human papillomavirus; H, Harvard model; M, MISCAN-Cervix model; P, Policy1-Cervix model; U, University of Minnesota model.
[a] Outcomes calculated from age 21 to 100 years.
[b] Total number of tests including cytology and HPV tests, irrespective of primary, triage or surveillance context
[c] Strategies are denoted by the screening modality, interval, age to begin screening/screening modality after switch age, interval after switch age, switch age for each end age category. For example, CYTO-3Y, 21 indicates cytology testing every 3 years starting at age 21, and CYTO-3Y, 21/HPV-5Y,30 indicates cytology testing every 3 years starting at age 21 with a switch to HPV testing every 5 years starting at age 30.
[d] Median outcome across the four models.
[e] End age indicates the age at which the final routine screen should occur, irrespective of age at last screen; exceptions include female persons who are recommended to continue screening due to prior abnormal results and/or precancer treatment.
[f] Strategies (bolded) represent current US recommended strategies.

Table 14. Lifetime Number of CIN2+ Detected and False Positives Among 9vHPV Vaccinated Female Persons for Screening Strategies by Model[a]

Strategy[d]	CIN2+ detected per 1,000[b] H	CIN2+ detected per 1,000[b] M	CIN2+ detected per 1,000[b] P	CIN2+ detected per 1,000[b] U	CIN2+ detected per 1,000[b] Med[e]	False Positives per 1,000[c] H	False Positives per 1,000[c] M	False Positives per 1,000[c] P	False Positives per 1,000[c] U	False Positives per 1,000[c] Med[e]
No Screening	0	0	0	0	0	0	0	0	0	0
End Age 60[f]										
CYTO-3Y, 21	38	25	29	39	34	424	360	375	425	399
CYTO-3Y, 21/HPV-5Y, 30	40	28	30	42	35	453	383	176	469	418
CYTO-3Y, 21/COTEST-5Y, 30	45	29	32	44	38	658	464	418	605	534
CYTO-4Y, 21/HPV-5Y, 25	40	28	30	41	35	506	387	159	480	434
CYTO-3Y, 21/HPV-10Y, 30	38	24	28	36	32	384	296	147	351	324
HPV-5Y, 25	38	23	26	35	30	473	328	127	437	382
HPV-5Y, 25/HPV-10Y, 30	35	20	23	29	26	406	241	98	319	280
HPV-5Y, 30	32	16	17	27	22	358	227	84	360	292
HPV-5Y, 30/HPV-10Y, 40	31	14	16	24	20	321	191	68	301	246
HPV-5Y, 35	26	11	12	20	16	269	157	62	262	209
HPV-5Y, 35/HPV-10Y, 40	25	9	11	18	14	233	120	45	205	163
HPV-5Y, 40	22	7	9	14	12	202	98	46	185	141
HPV-10Y, 30	30	12	14	21	18	286	136	54	237	186
HPV-10Y, 40	21	6	8	12	10	165	61	30	127	94
CYTO-4Y, 21/COTEST-5Y, 25	46	31	32	44	38	743	509	445	641	575
CYTO-3Y, 21/COTEST-10Y, 30	41	25	29	38	34	508	348	296	440	394
COTEST-5Y, 25/COTEST-10Y, 30	40	22	25	32	29	548	340	293	435	387
COTEST-5Y, 30	38	17	18	29	23	562	321	325	494	410
COTEST-5Y, 30/COTEST-10Y, 40	36	16	17	27	22	465	271	250	410	340
COTEST-5Y, 35	31	12	12	22	17	442	228	265	375	320
COTEST-5Y, 35/COTEST-10Y, 40	29	10	11	19	15	345	175	187	287	237
COTEST-5Y, 40	25	8	9	15	12	344	150	213	275	244
COTEST-10Y, 30	34	13	15	23	19	412	197	202	327	265
COTEST-10Y, 40	23	6	8	13	11	262	95	133	186	159
End Age 65[f]										
CYTO-3Y, 21[g]	**40**	**26**	**30**	**40**	**35**	**463**	**367**	**413**	**463**	**438**
CYTO-3Y, 21/HPV-5Y, 30[g]	**41**	**29**	**31**	**43**	**36**	**469**	**395**	**183**	**483**	**432**
CYTO-3Y, 21/COTEST-5Y, 30[g]	**46**	**30**	**32**	**44**	**38**	**693**	**479**	**450**	**633**	**556**
CYTO-4Y, 21/HPV-5Y, 25	41	29	31	42	36	521	399	164	491	445
CYTO-4Y, 21/HPV-10Y, 25	37	23	27	33	30	417	280	122	320	300
HPV-5Y, 25[g]	**38**	**24**	**26**	**35**	**31**	**489**	**340**	**133**	**450**	**395**
HPV-5Y, 25/HPV-10Y, 35	37	22	25	31	28	433	286	110	363	324
HPV-5Y, 30	33	16	17	27	22	373	239	90	372	306
HPV-5Y, 30/HPV-10Y, 35	31	14	16	23	20	317	184	67	284	234
HPV-5Y, 35	27	11	12	20	16	284	169	68	275	222
HPV-5Y, 35/HPV-10Y, 45	26	10	12	19	15	253	138	53	236	187
HPV-5Y, 40	23	8	9	15	12	217	110	52	198	154

Strategy[d]	CIN2+ detected per 1,000[b]					False Positives per 1,000[c]				
	H	M	P	U	Med[e]	H	M	P	U	Med[e]
HPV-10Y, 25	35	18	22	27	25	384	219	93	278	248
HPV-10Y, 35	25	9	11	16	14	225	113	44	186	149
CYTO-4Y, 21/COTEST-5Y, 25	47	31	32	44	38	778	525	478	666	596
CYTO-4Y, 21/COTEST-10Y, 25	42	25	29	36	32	568	364	312	432	398
COTEST-5Y, 25	45	27	27	38	33	746	473	446	625	549
COTEST-5Y, 25/COTEST-10Y, 35	42	24	26	35	30	601	397	335	495	446
COTEST-5Y, 30	39	18	18	30	24	598	338	357	521	439
COTEST-5Y, 30/COTEST-10Y, 35	35	16	17	26	21	452	259	245	389	324
COTEST-5Y, 35	32	12	13	22	18	477	245	296	402	349
COTEST-5Y, 35/COTEST-10Y, 45	30	11	12	21	17	388	200	225	335	280
COTEST-5Y, 40	26	8	10	16	13	380	167	245	302	274
COTEST-10Y, 25	39	20	24	30	27	535	309	281	388	349
COTEST-10Y, 35	28	10	12	18	15	342	163	183	266	224
End Age 70[f]										
CYTO-3Y, 21	41	26	31	40	36	502	380	449	498	474
CYTO-3Y, 21/HPV-5Y, 30	42	29	32	43	37	481	405	187	494	443
CYTO-3Y, 21/COTEST-5Y, 30	47	31	32	45	39	724	492	478	654	573
CYTO-4Y, 21/HPV-5Y, 25	41	29	32	42	36	533	410	169	501	455
CYTO-3Y, 21/HPV-10Y, 30	39	25	29	37	33	400	306	152	362	334
HPV-5Y, 25	39	24	27	36	31	501	351	138	461	406
HPV-5Y, 25/HPV-10Y, 30	37	20	24	30	27	422	252	103	329	291
HPV-5Y, 30	34	17	18	28	23	385	249	95	383	316
HPV-5Y, 30/HPV-10Y, 40	32	15	17	25	21	338	202	73	314	258
HPV-5Y, 35	28	12	13	21	17	297	179	73	286	233
HPV-5Y, 35/HPV-10Y, 40	26	10	12	18	15	249	131	50	216	174
HPV-5Y, 40	23	8	10	15	13	229	121	57	209	165
HPV-10Y, 30	31	13	15	22	19	303	147	60	249	198
HPV-10Y, 40	22	6	9	13	11	180	72	35	138	105
CYTO-4Y, 21/COTEST-5Y, 25	48	32	33	45	39	808	537	504	689	613
CYTO-3Y, 21/COTEST-10Y, 30	43	26	30	39	35	541	361	326	466	414
COTEST-5Y, 25/COTEST-10Y, 30	41	23	26	33	29	582	354	323	462	408
COTEST-5Y, 30	39	18	19	30	24	628	352	385	544	464
COTEST-5Y, 30/COTEST-10Y, 40	37	17	17	27	22	498	285	279	437	361
COTEST-5Y, 35	32	13	14	23	18	508	259	325	426	376
COTEST-5Y, 35/COTEST-10Y, 40	30	11	12	20	16	377	189	216	314	265
COTEST-5Y, 40	27	9	11	16	14	410	182	274	325	299
COTEST-10Y, 30	35	14	16	24	20	444	212	231	350	291
COTEST-10Y, 40	24	7	9	14	11	288	110	163	211	187

Abbreviations: CIN, cervical intraepithelial; CYTO, cytology; HPV, Human papillomavirus; H, Harvard model; M, MISCAN-Cervix model; P, Policy1-Cervix model; U, University of Minnesota model.
[a] Outcomes calculated from age 21 to 100 years.
[b] CIN2+ detected includes CIN2s, CIN3s and cervical cancers detected through screening (excludes clinically detected cancers).
[c] Total number of colposcopies that did not result in CIN2, CIN3 or cancer detection.

Strategy[d]	CIN2+ detected per 1,000[b]					False Positives per 1,000[c]				
	H	M	P	U	Med[e]	H	M	P	U	Med[e]

[d] Strategies are denoted by the screening modality, interval, age to begin screening/screening modality after switch age, interval after switch age, switch age for each end age category. For example, CYTO-3Y, 21 indicates cytology testing every 3 years starting at age 21, and CYTO-3Y, 21/HPV-5Y,30 indicates cytology testing every 3 years starting at age 21 with a switch to HPV testing every 5 years starting at age 30.
[e] Median outcome across the four models.
[f] End age indicates the age at which the final routine screen should occur, irrespective of age at last screen; exceptions include female persons who are recommended to continue screening due to prior abnormal results and/or precancer treatment.
[g] Strategies (bolded) represent current US recommended strategies.

Table 15. Efficient and Near-Efficient Cervical Cancer Screening Strategies Among Unvaccinated Female Persons by Model[a]

Strategy	Incremental Colposcopies per LYG				Incremental Total Tests per LYG			
	H	M	P	U	H	M	P	U
HPV-10Y, 40, 60	4	2	1	2	36	34	30	32
HPV-10Y, 35, 65	Dom	7	Dom	5	Dom	65	Dom	46
HPV-5Y, 35/HPV-10Y, 40, 60	Dom	55*	Dom	Dom	Dom	520*	Dom	Dom
HPV-10Y, 30, 60	Dom	Dom	4	11*	Dom	Dom	58	49
HPV-10Y, 30, 70	Dom	14	5	10	Dom	170*	222*	186*
HPV-5Y, 30/HPV-10Y, 35, 65	Dom	22*	10*	Dom	Dom	146	297*	Dom
HPV-5Y, 30/HPV-10Y, 40, 70	Dom	15*	12	Dom	Dom	206	293*	Dom
CYTO-3Y, 21/HPV-10Y, 30, 60	93*	Dom	Dom	Dom	5,552*	Dom	Dom	Dom
CYTO-3Y, 21/HPV-10Y, 30, 70	70	Dom	18*	Dom	5,071*	Dom	9,435*	Dom
HPV-5Y, 30, 60	Dom	19*	Dom	Dom	Dom	818*	Dom	Dom
HPV-5Y, 30, 65	Dom	15*	Dom	Dom	Dom	338*	Dom	Dom
HPV-10Y, 25, 65	197*	Dom	Dom	Dom	133	Dom	Dom	Dom
HPV-5Y, 30, 70	Dom	15	Dom	Dom	Dom	337*	Dom	Dom
CYTO-4Y, 21/HPV-10Y, 25, 65	123*	Dom	Dom	Dom	3,826*	Dom	Dom	Dom
HPV-5Y, 25/HPV-10Y, 30, 60	138*	Dom	Dom	Dom	281	Dom	Dom	Dom
CYTO-3Y, 21/HPV-5Y, 30, 60	94*	Dom	Dom	Dom	4,900*	Dom	Dom	Dom
HPV-5Y, 25/HPV-10Y, 30, 70	244*	Dom	20*	Dom	579	Dom	213	Dom
CYTO-3Y, 21/HPV-5Y, 30, 65[c]	**78***	**48***	**Dom**	**92***	**2,663***	**4,279***	**Dom**	**2,016***
HPV-5Y, 25/HPV-10Y, 35, 65	191*	Dom	Dom	Dom	615	Dom	Dom	Dom
CYTO-3Y, 21/HPV-5Y, 30, 70	77	39	17	49	2,376*	8,003*	1,052*	2,367*
CYTO-4Y, 21/COTEST-10Y, 25, 65	205*	Dom	Dom	Dom	17,824*	Dom	Dom	Dom
HPV-5Y, 25, 60	169*	Dom	Dom	Dom	2,133*	Dom	Dom	Dom
COTEST-5Y, 25/COTEST-10Y, 30, 70	225*	Dom	Dom	Dom	16,868*	Dom	Dom	Dom
HPV-5Y, 25, 65[c]	**133***	**54***	**Dom**	**134***	**1,509***	**291**	**Dom**	**229**
CYTO-4Y, 21/HPV-5Y, 25, 60	2,031*	Dom	Dom	Dom	1,429*	Dom	Dom	Dom
CYTO-3Y, 21/COTEST-5Y, 30, 60	159*	Dom	Dom	Dom	8,506*	Dom	Dom	Dom
COTEST-5Y, 25/COTEST-10Y, 35, 65	203*	Dom	Dom	Dom	8,999*	Dom	Dom	Dom
HPV-5Y, 25, 70	949*	42*	32	53*	1,507*	355	688	231
CYTO-4Y, 21/HPV-5Y, 25, 65	206*	61*	Dom	102*	1,269	1,099*	Dom	873*
CYTO-3Y, 21/COTEST-5Y, 30, 65[c]	**1,631***	**60***	**Dom**	**87***	**6,039***	**7,373***	**Dom**	**70,160***
CYTO-4Y, 21/HPV-5Y, 25, 70	161	102*	41	203*	1,464	936	1,015	1,033
CYTO-3Y, 21/COTEST-5Y, 30, 70	496*	92	4,643	82	5,607*	40,902*	185,624	5,660*
CYTO-4Y, 21/COTEST-5Y, 25, 60	484*	Dom	Dom	Dom	4,389*	Dom	Dom	Dom
COTEST-5Y, 25, 65	963*	Dom	Dom	99*	5,255*	Dom	Dom	3,918*
CYTO-4Y, 21/COTEST-5Y, 25, 65	828*	870*	Dom	101*	32,458*	18,082*	Dom	19,268*
CYTO-4Y, 21/COTEST-5Y, 25, 70	427	208	Dom	654	15,892	9,114	Dom	5,548

Abbreviations: CYTO, cytology; HPV, Human papillomavirus; LYG, life-years gained; H, Harvard model; M, MISCAN-Cervix model; P, Policy1-Cervix model; U, University of Minnesota model.

[a] Near-efficient (i.e., within 2% of the efficiency frontier) are indicated by *. Strategies are ordered by increasing colposcopies in the Harvard model. Ratios were calculated against the next-less effective, non-dominated strategy within each model. Ratios in grey font indicate strategies that had lower LYG than the guidelines-based strategy of 3-yearly cytology from ages 21 to 65 years in each model. Yellow highlighted ratios indicate strategies that were most efficient on both metrics among the current guidelines-based strategies and whose efficiency ratios served as benchmarks for efficiency in the vaccinated populations in each model. Strategies that were dominated by both efficiency metrics in all 4 models are not shown.

[b] Strategies are denoted by the screening modality, interval, age to begin screening/screening modality after switch age, interval after switch age, switch age for each end age category. For example, HPV-10Y, 40, 60 indicates HPV testing every 10 years starting at age 40 years and ending at age 60 years, and HPV-5Y, 35/HPV-10Y, 40, 60 indicates HPV testing every 5 years starting at age 35 years with a switch to HPV testing every 10 years starting at age 40 years and ending at age 60 years.

[c] Strategies (bolded) represent current US recommended strategies.

Table 16. Efficient and Near-Efficient Cervical Cancer Screening Strategies Among 2vHPV or 4vHPV Vaccinated Female Persons by Model[a]

	Incremental Colposcopies per LYG				Incremental Total Tests per LYG			
Strategy	H	M	P	U	H	M	P	U
HPV-10Y, 40, 60	6	4	3	8	76	94	114	137
HPV-10Y, 35, 65	Dom	15	10	Dom	Dom	174	277	Dom
HPV-5Y, 35/HPV-10Y, 40, 60	Dom	17*	Dom	Dom	Dom	198*	Dom	Dom
HPV-10Y, 30, 60	22	Dom	Dom	28*	131	Dom	Dom	191
HPV-10Y, 30, 70	105*	33*	13	Dom	2,547*	445*	369	Dom
HPV-5Y, 30/HPV-10Y, 35, 65	74*	562*	Dom	Dom	1,215*	347	Dom	Dom
HPV-5Y, 30/HPV-10Y, 40, 70	Dom	34*	40*	Dom	Dom	580	1,540*	Dom
CYTO-3Y, 21/HPV-10Y, 30, 60	48	Dom	Dom	Dom	10,826*	Dom	Dom	Dom
CYTO-3Y, 21/HPV-10Y, 30, 70	101	Dom	Dom	Dom	20,888*	Dom	Dom	Dom
HPV-5Y, 30, 65	Dom	35*	29*	Dom	Dom	1,015*	2,103*	Dom
HPV-10Y, 25, 65	77*	Dom	Dom	41*	530	Dom	Dom	435
HPV-5Y, 30, 70	Dom	31	24	Dom	Dom	932*	1,446	Dom
CYTO-4Y, 21/HPV-10Y, 25, 65	740*	Dom	Dom	Dom	3,396*	Dom	Dom	Dom
HPV-5Y, 25/HPV-10Y, 30, 60	636*	Dom	Dom	Dom	742	Dom	Dom	Dom
HPV-5Y, 25/HPV-10Y, 30, 70	652*	Dom	Dom	Dom	2,486*	Dom	Dom	Dom
CYTO-3Y, 21/HPV-5Y, 30, 60	140*	Dom	Dom	Dom	7,564*	Dom	Dom	Dom
HPV-5Y, 25/HPV-10Y, 35, 65	418*	Dom	Dom	Dom	2,142	Dom	Dom	Dom
CYTO-3Y, 21/HPV-5Y, 30, 65[c]	**139**	**Dom**	**Dom**	**99***	**6,399***	**Dom**	**Dom**	**5,013***
CYTO-3Y, 21/COTEST-10Y, 30, 70	406*	Dom	Dom	Dom	128,790*	Dom	Dom	Dom
CYTO-3Y, 21/HPV-5Y, 30, 70	207	126	299*	75	138,218*	7,751*	26,346*	3,147
HPV-5Y, 25, 60	300*	Dom	Dom	Dom	4,835*	Dom	Dom	Dom
CYTO-4Y, 21/COTEST-10Y, 25, 65	690*	Dom	Dom	Dom	174,128*	Dom	Dom	Dom
HPV-5Y, 25, 65[c]	**264***	**124***	**291***	**105***	**4,451***	**818**	**2,509**	**1,262**
CYTO-4Y, 21/HPV-5Y, 25, 60	1,204*	Dom	Dom	Dom	3,853	Dom	Dom	Dom
HPV-5Y, 25, 70	6,041*	89	313*	84*	4,770*	884	76,791*	1,447
COTEST-5Y, 25/COTEST-10Y, 30, 70	686*	Dom	Dom	Dom	81,851*	Dom	Dom	Dom
CYTO-4Y, 21/HPV-5Y, 25, 65	712*	135*	Dom	119*	4,094	2,243*	Dom	25,199*
CYTO-4Y, 21/HPV-5Y, 25, 70	521	209	172	106*	6,470	2,324	3,639	3,574*
COTEST-5Y, 25/COTEST-10Y, 35, 65	559*	Dom	Dom	Dom	30,463*	Dom	Dom	Dom
CYTO-3Y, 21/COTEST-5Y, 30, 60	334*	Dom	Dom	Dom	17,545*	Dom	Dom	Dom
CYTO-3Y, 21/COTEST-5Y, 30, 65[c]	**3,607***	**Dom**	**Dom**	**448***	**137,919***	**Dom**	**Dom**	**25,261***
CYTO-3Y, 21/COTEST-5Y, 30, 70	1,657*	425*	977*	263*	69,121*	20,353*	35,650*	14,785*
CYTO-4Y, 21/COTEST-5Y, 25, 60	1,589*	Dom	Dom	Dom	187,012*	Dom	Dom	Dom
COTEST-5Y, 25, 65	10,582	Dom	Dom	Dom	202,006*	Dom	Dom	Dom
CYTO-4Y, 21/COTEST-5Y, 25, 65	1,895*	190*	Dom	490*	72,237*	13,006*	Dom	19,361*
CYTO-4Y, 21/COTEST-5Y, 25, 70	1,294	349	597	232	48,207	20,691	18,693	9,520

Abbreviations: CYTO, cytology; HPV, Human papillomavirus; LYG, life-years gained; H, Harvard model; M, MISCAN-Cervix model; P, Policy1-Cervix model; U, University of Minnesota model.

[a] Near-efficient (i.e., within 2% of the efficiency frontier) are indicated by *. Strategies are ordered by increasing colposcopies in the Harvard model. Ratios were calculated against the next-less effective, non-dominated strategy within each model. Yellow highlighted ratios indicate strategies with efficiency ratios that were equal to or less than those from the current guidelines-based strategies in the unvaccinated population on both efficiency metrics of colposcopies per LYG and tests per LYG in each model. The efficiency ratios used as benchmarks in each model were: 78-133 colposcopies per LYG and 1,509-2,663 tests per LYG in the Harvard model; 48-54 colposcopies per LYG and 291-4,279 tests per LYG in the MISCAN-Cervix model; 17-32 colposcopies per LYG and 688-1,052 tests per LYG in the Policy1-Cervix model; 92 to 134 colposcopies per LYG and 229-2,016 tests per LYG in the UMN model (see **Table 15**). Strategies that were dominated by both efficiency metrics in all 4 models are not shown.

[b] Strategies are denoted by the screening modality, interval, age to begin screening/screening modality after switch age, interval after switch age, switch age for each end age category. For example, HPV-10Y, 40, 60 indicates HPV testing every 10 years starting at age 40 years and ending at age 60 years, and HPV-5Y, 35/HPV-10Y, 40, 60 indicates HPV testing every 5 years starting at age 35 years with a switch to HPV testing every 10 years starting at age 40 years and ending at age 60 years.

[c] Strategies (bolded) represent current US recommended strategies.

Table 17. Efficient and Near-Efficient Cervical Cancer Screening Strategies Among 9vHPV Vaccinated Female Persons by Model[a]

	Incremental Colposcopies per LYG				Incremental Total Tests per LYG			
Strategy	**H**	**M**	**P**	**U**	**H**	**M**	**P**	**U**
HPV-10Y, 40, 60	7	5	4	15	127	205	287	321
HPV-10Y, 40, 70	Dom	Dom	5	25	Dom	Dom	580	1,647*
HPV-5Y, 40, 65	Dom	Dom	Dom	68*	Dom	Dom	Dom	11,091*
HPV-10Y, 35, 65	43*	20	Dom	Dom	637*	361*	Dom	Dom
HPV-5Y, 40, 70	Dom	Dom	Dom	64	Dom	Dom	Dom	4,543*
HPV-5Y, 35/HPV-10Y, 40, 60	43	Dom	Dom	Dom	663*	Dom	Dom	Dom
HPV-5Y, 35, 65	Dom	Dom	Dom	256*	Dom	Dom	Dom	3,092*
HPV-10Y, 30, 60	91	Dom	Dom	Dom	546	Dom	Dom	Dom
HPV-10Y, 30, 70	376*	24	Dom	Dom	15,313*	801	Dom	Dom
HPV-5Y, 30/HPV-10Y, 35, 65	126*	Dom	25*	Dom	3,697*	Dom	901	Dom
HPV-5Y, 30/HPV-10Y, 40, 60	122*	Dom	Dom	Dom	3,619*	Dom	Dom	Dom
HPV-5Y, 30/HPV-10Y, 40, 70	152*	49*	22	Dom	5,051*	1,054	1,655	Dom
HPV-5Y, 30, 60	132*	Dom	Dom	Dom	5,277*	Dom	Dom	Dom
HPV-5Y, 30, 65	152*	46*	Dom	243*	6,314*	2,488*	Dom	2,969
HPV-10Y, 25, 65	154*	Dom	Dom	Dom	1,685	Dom	Dom	Dom
HPV-5Y, 30, 70	Dom	44	96	239	Dom	2,287*	11,419*	11,877*
CYTO-3Y, 21/HPV-10Y, 30, 60	119	Dom	Dom	Dom	15,260*	Dom	Dom	Dom
CYTO-3Y, 21/HPV-10Y, 30, 70	283*	Dom	Dom	Dom	14,053*	Dom	Dom	Dom
HPV-5Y, 25/HPV-10Y, 30, 60	166*	Dom	Dom	Dom	2,422	Dom	Dom	Dom
CYTO-4Y, 21/HPV-10Y, 25, 65	157*	Dom	Dom	Dom	7,412*	Dom	Dom	Dom
HPV-5Y, 25/HPV-10Y, 30, 70	176*	Dom	Dom	Dom	12,436*	Dom	Dom	Dom
HPV-5Y, 25/HPV-10Y, 35, 65	176*	Dom	Dom	Dom	7,581*	Dom	Dom	Dom
CYTO-3Y, 21/HPV-5Y, 30, 60	159	Dom	Dom	Dom	8,451*	Dom	Dom	Dom
CYTO-3Y, 21/HPV-5Y, 30, 65[c]	**350**	**186***	**Dom**	**719***	**122,603***	**9,765***	**Dom**	**15,327***
HPV-5Y, 25, 60	401*	Dom	Dom	Dom	8,157*	Dom	Dom	Dom
CYTO-3Y, 21/HPV-5Y, 30, 70	799	495*	261	3,965*	79,972*	17,086*	13,384	214,733*
HPV-5Y, 25, 65[c]	**404***	**154***	**Dom**	**468***	**9,361***	**1,766**	**Dom**	**5,561***
HPV-5Y, 25, 70	430*	111	579*	254	10,798*	2,042	12,276*	4,845
CYTO-4Y, 21/HPV-5Y, 25, 60	1,625*	Dom	Dom	Dom	6,524	Dom	Dom	Dom
CYTO-3Y, 21/COTEST-10Y, 30, 60	1,073*	Dom	Dom	Dom	27,209*	Dom	Dom	Dom
CYTO-4Y, 21/HPV-5Y, 25, 65	14,690*	187*	Dom	555*	23,847	5,089*	Dom	8,460*
CYTO-4Y, 21/HPV-5Y, 25, 70	2,958*	247	175	403*	48,461	4,498	7,019	7,900*
CYTO-3Y, 21/COTEST-10Y, 30, 70	907*	Dom	Dom	Dom	26,394*	Dom	Dom	Dom
CYTO-4Y, 21/COTEST-10Y, 25, 65	1,046*	Dom	Dom	Dom	21,648*	Dom	Dom	Dom
COTEST-5Y, 25/COTEST-10Y, 30, 70	32,155*	Dom	Dom	Dom	53,177*	Dom	Dom	Dom
COTEST-5Y, 25/COTEST-10Y, 35, 65	2,986*	Dom	Dom	Dom	38,079*	Dom	Dom	Dom
COTEST-5Y, 30, 70	Dom	Dom	Dom	527*	Dom	Dom	Dom	27,718*
CYTO-3Y, 21/COTEST-5Y, 30, 60	300,918*	Dom	Dom	Dom	285,576*	Dom	Dom	Dom
CYTO-3Y, 21/COTEST-5Y, 30, 65[c]	**5,160***	**247***	**Dom**	**9,011***	**365,680***	**26,797***	**Dom**	**510,136***
CYTO-3Y, 21/COTEST-5Y, 30, 70	4,244*	4,206*	Dom	1,012	253,033*	444,590*	Dom	58,361

Strategy	Incremental Colposcopies per LYG				Incremental Total Tests per LYG			
	H	M	P	U	H	M	P	U
CYTO-4Y, 21/COTEST-5Y, 25, 60	4,458*	Dom	Dom	Dom	182,573*	Dom	Dom	Dom
COTEST-5Y, 25, 65	976*	Dom	Dom	815*	26,696*	Dom	Dom	30,492*
CYTO-4Y, 21/COTEST-5Y, 25, 65	2,992*	3,030*	Dom	Dom	110,792*	151,098*	Dom	Dom
CYTO-4Y, 21/COTEST-5Y, 25, 70	2,869	725	6,362	Dom	107,953	51,612	207,264	Dom

Abbreviations: CYTO, cytology; HPV, Human papillomavirus; LYG, life-years gained; H, Harvard model; M, MISCAN-Cervix model; P, Policy1-Cervix model; U, University of Minnesota model.
[a] Near-efficient (i.e., within 2% of the efficiency frontier) are indicated by *. Strategies are ordered by increasing colposcopies in the Harvard model. Ratios were calculated against the next-less effective, non-dominated strategy within each model. Yellow highlighted ratios indicate strategies with efficiency ratios that were equal to or less than those from the current guidelines-based strategies in the unvaccinated population on both efficiency metrics of colposcopies per LYG and tests per LYG in each model. The efficiency ratios used as benchmarks in each model were: 78-133 colposcopies per LYG and 1,509-2,663 tests per LYG in the Harvard model; 48-54 colposcopies per LYG and 291-4,279 tests per LYG in the MISCAN-Cervix model; 17-32 colposcopies per LYG and 688-1,052 tests per LYG in the Policy1-Cervix model; 92-134 colposcopies per LYG and 229-2,016 tests per LYG in the UMN model (see **Table 15**). Strategies that were dominated by both efficiency metrics in all 4 models are not shown.
[b] Strategies are denoted by the screening modality, interval, age to begin screening/screening modality after switch age, interval after switch age, switch age for each end age category. For example, HPV-10Y, 40, 60 indicates HPV testing every 10 years starting at age 40 years and ending at age 60 years, and HPV-5Y, 35/HPV-10Y, 40, 60 indicates HPV testing every 5 years starting at age 35 years with a switch to HPV testing every 10 years starting at age 40 years and ending at age 60 years.
[c] Strategies (bolded) represent current US recommended strategies.

Table 18. Lifetime Outcomes Among Unvaccinated Black Female Persons for Screening Strategies in the Harvard Model[a]

	Outcomes per 1,000						
Strategy[e]	CC Cases	CC Deaths	Life-Years Gained	Total Tests[b]	Colpos	CIN2 + detected[c]	False Positives[d]
No Screening	13.09	4.22	0.00	0	0	0	0
End Age 60[f]							
CYTO-3Y, 21	1.88	0.51	149.38	14,322	621	153	468
CYTO-3Y, 21/HPV-5Y, 30	0.98	0.23	156.86	12,093	1,095	183	912
CYTO-3Y, 21/COTEST-5Y, 30	0.92	0.21	157.46	20,400	1,321	189	1,132
CYTO-4Y, 21/HPV-5Y, 25	0.81	0.21	158.30	11,611	1,340	190	1,150
CYTO-3Y, 21/HPV-10Y, 30	1.26	0.31	153.63	9,120	872	166	706
HPV-5Y, 25	0.92	0.22	157.21	10,428	1,288	178	1,110
HPV-5Y, 25/HPV-10Y, 30	1.16	0.30	154.38	7,460	1,068	162	906
HPV-5Y, 30	1.86	0.35	146.91	8,546	932	139	793
HPV-5Y, 30/HPV-10Y, 40	1.99	0.39	145.69	6,725	816	131	685
HPV-5Y, 35	3.25	0.61	126.82	6,926	687	106	582
HPV-5Y, 35/HPV-10Y, 40	3.39	0.65	125.64	5,080	569	97	472
HPV-5Y, 40	4.70	1.05	101.33	5,493	507	81	427
HPV-10Y, 30	2.19	0.45	142.71	5,508	701	122	579
HPV-10Y, 40	4.88	1.11	99.02	3,686	390	72	317
CYTO-4Y, 21/COTEST-5Y, 25	0.74	0.19	158.84	21,479	1,607	198	1,408
CYTO-3Y, 21/COTEST-10Y, 30	1.15	0.28	154.66	14,474	1,018	172	847
COTEST-5Y, 25/COTEST-10Y, 30	1.04	0.26	155.24	14,392	1,227	169	1,058
COTEST-5Y, 30	1.77	0.33	147.65	16,835	1,157	146	1,011
COTEST-5Y, 30/COTEST-10Y, 40	1.90	0.37	146.48	13,136	975	137	838
COTEST-5Y, 35	3.16	0.57	128.30	13,757	872	110	762
COTEST-5Y, 35/COTEST-10Y, 40	3.28	0.60	127.09	10,038	690	101	589
COTEST-5Y, 40	4.61	1.02	102.22	11,005	657	84	573
COTEST-10Y, 30	2.02	0.40	144.43	10,832	848	128	720
COTEST-10Y, 40	4.72	1.05	100.66	7,463	494	76	418
End Age 65[f]							
CYTO-3Y, 21[g]	**1.66**	**0.40**	**150.83**	**15,396**	**656**	**157**	**499**
CYTO-3Y, 21/HPV-5Y, 30[g]	**0.86**	**0.17**	**157.56**	**12,731**	**1,130**	**187**	**943**
CYTO-3Y, 21/COTEST-5Y, 30[g]	**0.81**	**0.15**	**158.06**	**21,582**	**1,369**	**193**	**1,176**
CYTO-4Y, 21/HPV-5Y, 25	0.69	0.15	158.96	12,245	1,374	194	1,180
CYTO-4Y, 21/HPV-10Y, 25	1.09	0.26	154.21	8,258	1,048	170	878
HPV-5Y, 25[g]	**0.80**	**0.16**	**157.89**	**11,063**	**1,322**	**183**	**1,140**
HPV-5Y, 25/HPV-10Y, 35	0.99	0.23	155.89	8,384	1,147	170	977
HPV-5Y, 30	1.74	0.29	147.57	9,186	966	143	823
HPV-5Y, 30/HPV-10Y, 35	1.94	0.35	145.60	6,465	786	130	656
HPV-5Y, 35	3.14	0.55	127.47	7,564	722	110	612
HPV-5Y, 35/HPV-10Y, 45	3.24	0.58	126.75	5,902	626	103	523
HPV-5Y, 40	4.58	0.99	101.96	6,141	542	85	457
HPV-10Y, 25	1.19	0.26	152.93	7,046	992	158	835
HPV-10Y, 35	3.42	0.64	124.25	4,793	535	96	439
CYTO-4Y, 21/COTEST-5Y, 25	0.63	0.13	159.46	22,653	1,654	202	1,452
CYTO-4Y, 21/COTEST-10Y, 25	0.95	0.21	155.89	14,820	1,226	177	1,049
COTEST-5Y, 25	0.71	0.14	158.47	21,494	1,603	191	1,412
COTEST-5Y, 25/COTEST-10Y, 35	0.88	0.20	156.69	16,124	1,333	177	1,156
COTEST-5Y, 30	1.66	0.28	148.24	18,027	1,204	150	1,055
COTEST-5Y, 30/COTEST-10Y, 35	1.85	0.33	146.35	12,576	932	136	796

Strategy[e]	CC Cases	CC Deaths	Life-Years Gained	Total Tests[b]	Colpos	CIN2 + detected[c]	False Positives[d]
	Outcomes per 1,000						
COTEST-5Y, 35	3.05	0.52	128.85	14,956	920	114	806
COTEST-5Y, 35/COTEST-10Y, 45	3.15	0.55	128.11	11,575	767	107	660
COTEST-5Y, 40	4.51	0.97	102.80	12,221	706	88	617
COTEST-10Y, 25	1.06	0.23	154.43	13,611	1,171	165	1,006
COTEST-10Y, 35	3.27	0.59	126.25	9,450	662	100	562
End Age 70[f]							
CYTO-3Y, 21	1.52	0.33	151.65	16,403	689	161	528
CYTO-3Y, 21/HPV-5Y, 30	0.79	0.13	157.89	13,278	1,156	190	966
CYTO-3Y, 21/COTEST-5Y, 30	0.74	0.12	158.38	22,588	1,406	196	1,210
CYTO-4Y, 21/HPV-5Y, 25	0.62	0.11	159.29	12,790	1,400	197	1,203
CYTO-3Y, 21/HPV-10Y, 30	1.09	0.23	154.53	9,677	904	171	733
HPV-5Y, 25	0.73	0.13	158.21	11,609	1,349	186	1,163
HPV-5Y, 25/HPV-10Y, 30	0.99	0.21	155.24	8,014	1,100	167	933
HPV-5Y, 30	1.67	0.26	147.88	9,736	993	146	846
HPV-5Y, 30/HPV-10Y, 40	1.83	0.31	146.53	7,280	848	136	712
HPV-5Y, 35	3.07	0.52	127.77	8,118	748	113	635
HPV-5Y, 35/HPV-10Y, 40	3.23	0.57	126.49	5,632	601	102	499
HPV-5Y, 40	4.51	0.96	102.27	6,693	569	88	481
HPV-10Y, 30	2.02	0.36	143.56	6,063	733	127	606
HPV-10Y, 40	4.74	1.03	99.75	4,170	417	77	341
CYTO-4Y, 21/COTEST-5Y, 25	0.56	0.10	159.75	23,653	1,691	205	1,486
CYTO-3Y, 21/COTEST-10Y, 30	1.00	0.20	155.45	15,473	1,060	176	884
COTEST-5Y, 25/COTEST-10Y, 30	0.89	0.19	155.96	15,369	1,268	174	1,094
COTEST-5Y, 30	1.60	0.24	148.51	19,042	1,242	153	1,089
COTEST-5Y, 30/COTEST-10Y, 40	1.76	0.29	147.20	14,119	1,017	142	875
COTEST-5Y, 35	2.99	0.49	129.13	15,984	958	117	841
COTEST-5Y, 35/COTEST-10Y, 40	3.14	0.53	127.84	10,997	731	106	625
COTEST-5Y, 40	4.44	0.94	103.08	13,254	744	91	652
COTEST-10Y, 30	1.88	0.33	145.18	11,793	889	133	756
COTEST-10Y, 40	4.61	1.00	101.23	8,227	527	80	447

Abbreviations: CC, Cervical cancer; CIN, cervical intraepithelial; Colpos, colposcopies; CYTO, cytology; HPV, Human papillomavirus.
[a] Outcomes calculated from age 21 to 100 years.
[b] Total number of tests including cytology and HPV tests, irrespective of primary, triage or surveillance context.
[c] CIN2+ detected includes CIN2s, CIN3s and cervical cancers detected through screening (excludes clinically detected cancers).
[d] Total number of colposcopies that did not result in CIN2, CIN3 or cancer detection.
[e] Strategies are denoted by the screening modality, interval, age to begin screening/screening modality after switch age, interval after switch age, switch age for each end age category. For example, CYTO-3Y, 21 indicates cytology testing every 3 years starting at age 21, and CYTO-3Y, 21/HPV-5Y,30 indicates cytology testing every 3 years starting at age 21 with a switch to HPV testing every 5 years starting at age 30.
[f] End age indicates the age at which the final routine screen should occur, irrespective of age at last screen; exceptions include female persons who are recommended to continue screening due to prior abnormal results and/or precancer treatment.
[g] Strategies (bolded) represent current US recommended strategies.

Table 19. Lifetime Outcomes Among 2vHPV or 4vHPV Vaccinated Black Female Persons for Screening Strategies in the Harvard Model[a]

	Outcomes per 1,000						
Strategy[e]	**CC Cases**	**CC Deaths**	**Life-Years Gained**	**Total Tests[b]**	**Colpos**	**CIN2 + detected[c]**	**False Positives[d]**
No Screening	5.07	1.73	0.00	0	0	0	0
End Age 60[f]							
CYTO-3Y, 21	0.66	0.18	52.03	13,913	509	77	432
CYTO-3Y, 21/HPV-5Y, 30	0.31	0.07	54.89	11,021	732	90	643
CYTO-3Y, 21/COTEST-5Y, 30	0.30	0.06	55.09	18,677	936	94	842
CYTO-4Y, 21/HPV-5Y, 25	0.25	0.06	55.22	10,339	882	92	790
CYTO-3Y, 21/HPV-10Y, 30	0.39	0.09	54.01	8,191	596	82	513
HPV-5Y, 25	0.29	0.06	54.90	9,185	838	86	753
HPV-5Y, 25/HPV-10Y, 30	0.36	0.09	54.11	6,357	704	78	626
HPV-5Y, 30	0.52	0.09	52.27	7,578	600	66	534
HPV-5Y, 30/HPV-10Y, 40	0.56	0.11	51.92	5,836	530	63	468
HPV-5Y, 35	0.88	0.16	46.92	6,174	438	50	389
HPV-5Y, 35/HPV-10Y, 40	0.93	0.18	46.52	4,416	367	46	321
HPV-5Y, 40	1.26	0.28	40.45	4,916	322	38	284
HPV-10Y, 30	0.62	0.12	51.09	4,706	459	58	401
HPV-10Y, 40	1.33	0.30	39.64	3,200	251	35	217
CYTO-4Y, 21/COTEST-5Y, 25	0.24	0.05	55.45	19,409	1,124	99	1,026
CYTO-3Y, 21/COTEST-10Y, 30	0.37	0.08	54.20	12,954	723	86	637
COTEST-5Y, 25/COTEST-10Y, 30	0.33	0.08	54.19	12,548	849	84	765
COTEST-5Y, 30	0.50	0.09	52.30	15,228	804	71	733
COTEST-5Y, 30/COTEST-10Y, 40	0.54	0.11	51.91	11,652	675	67	608
COTEST-5Y, 35	0.85	0.15	47.21	12,502	607	53	554
COTEST-5Y, 35/COTEST-10Y, 40	0.90	0.17	46.83	8,922	478	49	429
COTEST-5Y, 40	1.23	0.27	40.63	10,034	459	41	418
COTEST-10Y, 30	0.57	0.11	51.43	9,467	588	63	526
COTEST-10Y, 40	1.27	0.28	40.06	6,643	344	37	308
End Age 65[f]							
CYTO-3Y, 21[g]	**0.58**	**0.14**	**52.57**	**15,018**	**542**	**79**	**463**
CYTO-3Y, 21/HPV-5Y, 30[g]	**0.28**	**0.05**	**55.04**	**11,652**	**755**	**91**	**663**
CYTO-3Y, 21/COTEST-5Y, 30[g]	**0.27**	**0.05**	**55.22**	**19,878**	**973**	**96**	**878**
CYTO-4Y, 21/HPV-5Y, 25	0.23	0.05	55.36	10,969	904	94	810
CYTO-4Y, 21/HPV-10Y, 25	0.35	0.08	53.88	7,179	700	83	618
HPV-5Y, 25[g]	**0.26**	**0.05**	**55.05**	**9,815**	**861**	**87**	**773**
HPV-5Y, 25/HPV-10Y, 35	0.32	0.07	54.45	7,239	754	82	672
HPV-5Y, 30	0.49	0.08	52.40	8,212	622	68	555
HPV-5Y, 30/HPV-10Y, 35	0.55	0.10	51.80	5,608	514	62	451
HPV-5Y, 35	0.86	0.15	47.05	6,808	461	52	409
HPV-5Y, 35/HPV-10Y, 45	0.89	0.17	46.79	5,208	402	49	354
HPV-5Y, 40	1.23	0.26	40.58	5,555	345	40	305
HPV-10Y, 25	0.38	0.08	53.58	6,005	655	76	579
HPV-10Y, 35	0.96	0.18	45.98	4,173	348	46	302
CYTO-4Y, 21/COTEST-5Y, 25	0.21	0.04	55.57	20,603	1,161	100	1,061
CYTO-4Y, 21/COTEST-10Y, 25	0.31	0.07	54.44	13,032	857	88	770
COTEST-5Y, 25	0.23	0.04	55.12	19,462	1,117	94	1,024
COTEST-5Y, 25/COTEST-10Y, 35	0.28	0.06	54.54	14,240	925	88	837
COTEST-5Y, 30	0.47	0.08	52.42	16,436	841	73	769
COTEST-5Y, 30/COTEST-10Y, 35	0.53	0.10	51.86	11,154	647	66	581

Strategy[e]	CC Cases	CC Deaths	Life-Years Gained	Total Tests[b]	Colpos	CIN2 + detected[c]	False Positives[d]
	Outcomes per 1,000						
COTEST-5Y, 35	0.83	0.14	47.33	13,716	644	55	590
COTEST-5Y, 35/COTEST-10Y, 45	0.86	0.15	47.08	10,429	533	51	482
COTEST-5Y, 40	1.21	0.26	40.76	11,258	497	42	454
COTEST-10Y, 25	0.34	0.07	53.85	11,861	812	81	731
COTEST-10Y, 35	0.90	0.17	46.44	8,405	462	48	413
End Age 70[f]							
CYTO-3Y, 21	0.53	0.12	52.83	16,056	573	81	493
CYTO-3Y, 21/HPV-5Y, 30	0.26	0.04	55.12	12,200	772	93	679
CYTO-3Y, 21/COTEST-5Y, 30	0.25	0.04	55.30	20,905	1,003	97	906
CYTO-4Y, 21/HPV-5Y, 25	0.21	0.04	55.44	11,514	922	95	826
CYTO-3Y, 21/HPV-10Y, 30	0.35	0.07	54.20	8,743	617	84	532
HPV-5Y, 25	0.24	0.04	55.13	10,362	878	89	789
HPV-5Y, 25/HPV-10Y, 30	0.32	0.07	54.30	6,907	725	81	645
HPV-5Y, 30	0.47	0.07	52.49	8,762	640	69	571
HPV-5Y, 30/HPV-10Y, 40	0.52	0.09	52.10	6,387	552	65	487
HPV-5Y, 35	0.84	0.14	47.12	7,360	478	53	425
HPV-5Y, 35/HPV-10Y, 40	0.89	0.16	46.70	4,966	389	48	341
HPV-5Y, 40	1.22	0.26	40.65	6,108	362	41	321
HPV-10Y, 30	0.58	0.11	51.27	5,257	481	61	420
HPV-10Y, 40	1.29	0.28	39.77	3,691	270	37	234
CYTO-4Y, 21/COTEST-5Y, 25	0.20	0.03	55.65	21,626	1,191	102	1,089
CYTO-3Y, 21/COTEST-10Y, 30	0.33	0.07	54.39	13,969	756	88	668
COTEST-5Y, 25/COTEST-10Y, 30	0.29	0.06	54.37	13,548	882	86	796
COTEST-5Y, 30	0.46	0.07	52.50	17,472	871	74	797
COTEST-5Y, 30/COTEST-10Y, 40	0.51	0.09	52.10	12,658	708	69	639
COTEST-5Y, 35	0.82	0.14	47.40	14,762	674	56	618
COTEST-5Y, 35/COTEST-10Y, 40	0.87	0.15	47.00	9,903	510	51	459
COTEST-5Y, 40	1.19	0.25	40.83	12,308	527	44	483
COTEST-10Y, 30	0.54	0.10	51.60	10,448	620	65	556
COTEST-10Y, 40	1.25	0.27	40.19	7,428	370	39	331

Abbreviations: CC, Cervical cancer; CIN, cervical intraepithelial; Colpos, colposcopies; CYTO, cytology; HPV, Human papillomavirus.
[a] Outcomes calculated from age 21 to 100 years.
[b] Total number of tests including cytology and HPV tests, irrespective of primary, triage or surveillance context.
[c] CIN2+ detected includes CIN2s, CIN3s and cervical cancers detected through screening (excludes clinically detected cancers).
[d] Total number of colposcopies that did not result in CIN2, CIN3 or cancer detection.
[e] Strategies are denoted by the screening modality, interval, age to begin screening/screening modality after switch age, interval after switch age, switch age for each end age category. For example, CYTO-3Y, 21 indicates cytology testing every 3 years starting at age 21, and CYTO-3Y, 21/HPV-5Y,30 indicates cytology testing every 3 years starting at age 21 with a switch to HPV testing every 5 years starting at age 30.
[f] End age indicates the age at which the final routine screen should occur, irrespective of age at last screen; exceptions include female persons who are recommended to continue screening due to prior abnormal results and/or precancer treatment.
[g] Strategies (bolded) represent current US recommended strategies.

Table 20. Lifetime Outcomes Among 9vHPV Vaccinated Black Female Persons for Screening Strategies in the Harvard Model[a]

	Outcomes per 1,000						
Strategy[e]	CC Cases	CC Deaths	Life-Years Gained	Total Tests[b]	Colpos	CIN2 + detected[c]	False Positives[d]
No Screening	2.50	0.92	0.00	0	0	0	0
End Age 60[f]							
CYTO-3Y, 21	0.28	0.09	21.28	13,653	430	35	395
CYTO-3Y, 21/HPV-5Y, 30	0.09	0.02	22.71	10,154	448	38	410
CYTO-3Y, 21/COTEST-5Y, 30	0.09	0.02	22.73	17,313	636	41	594
CYTO-4Y, 21/HPV-5Y, 25	0.08	0.02	22.76	9,226	496	37	459
CYTO-3Y, 21/HPV-10Y, 30	0.13	0.03	22.38	7,474	385	36	349
HPV-5Y, 25	0.10	0.02	22.54	8,097	461	34	427
HPV-5Y, 25/HPV-10Y, 30	0.13	0.03	22.27	5,414	400	32	368
HPV-5Y, 30	0.13	0.03	22.06	6,800	344	29	315
HPV-5Y, 30/HPV-10Y, 40	0.16	0.03	21.85	5,141	312	28	284
HPV-5Y, 35	0.19	0.04	21.15	5,589	253	23	230
HPV-5Y, 35/HPV-10Y, 40	0.22	0.05	20.98	3,926	221	22	199
HPV-5Y, 40	0.27	0.06	20.06	4,472	186	19	168
HPV-10Y, 30	0.18	0.04	21.57	4,099	279	27	252
HPV-10Y, 40	0.31	0.07	19.66	2,847	155	18	137
CYTO-4Y, 21/COTEST-5Y, 25	0.08	0.02	22.81	17,643	718	42	676
CYTO-3Y, 21/COTEST-10Y, 30	0.12	0.03	22.38	11,798	499	38	460
COTEST-5Y, 25/COTEST-10Y, 30	0.12	0.03	22.27	11,004	534	37	497
COTEST-5Y, 30	0.13	0.02	22.06	13,965	532	33	499
COTEST-5Y, 30/COTEST-10Y, 40	0.15	0.03	21.87	10,517	445	32	414
COTEST-5Y, 35	0.18	0.04	21.27	11,546	409	26	384
COTEST-5Y, 35/COTEST-10Y, 40	0.21	0.04	21.05	8,110	323	24	299
COTEST-5Y, 40	0.26	0.05	20.12	9,300	313	21	292
COTEST-10Y, 30	0.16	0.03	21.76	8,446	394	30	364
COTEST-10Y, 40	0.29	0.07	19.84	6,057	238	19	219
End Age 65[f]							
CYTO-3Y, 21[g]	**0.23**	**0.06**	**21.59**	**14,780**	**463**	**36**	**427**
CYTO-3Y, 21/HPV-5Y, 30[g]	**0.08**	**0.02**	**22.75**	**10,774**	**459**	**39**	**421**
CYTO-3Y, 21/COTEST-5Y, 30[g]	**0.08**	**0.01**	**22.76**	**18,520**	**663**	**42**	**620**
CYTO-4Y, 21/HPV-5Y, 25	0.08	0.02	22.77	9,845	507	38	470
CYTO-4Y, 21/HPV-10Y, 25	0.12	0.03	22.23	6,268	411	34	377
HPV-5Y, 25[g]	**0.10**	**0.02**	**22.56**	**8,717**	**472**	**35**	**437**
HPV-5Y, 25/HPV-10Y, 35	0.12	0.03	22.33	6,251	424	33	391
HPV-5Y, 30	0.13	0.02	22.08	7,421	355	29	326
HPV-5Y, 30/HPV-10Y, 35	0.16	0.03	21.76	4,945	306	28	278
HPV-5Y, 35	0.19	0.04	21.17	6,211	264	24	241
HPV-5Y, 35/HPV-10Y, 45	0.21	0.05	21.04	4,686	238	23	215
HPV-5Y, 40	0.27	0.06	20.07	5,096	198	19	178
HPV-10Y, 25	0.14	0.03	22.13	5,130	376	31	344
HPV-10Y, 35	0.24	0.05	20.80	3,722	213	22	191
CYTO-4Y, 21/COTEST-5Y, 25	0.08	0.01	22.83	18,846	745	43	702
CYTO-4Y, 21/COTEST-10Y, 25	0.11	0.02	22.44	11,551	552	38	514
COTEST-5Y, 25	0.09	0.02	22.59	17,727	710	40	670
COTEST-5Y, 25/COTEST-10Y, 35	0.12	0.03	22.36	12,652	582	38	544
COTEST-5Y, 30	0.12	0.02	22.07	15,177	559	33	525
COTEST-5Y, 30/COTEST-10Y, 35	0.15	0.03	21.82	10,075	430	31	399
COTEST-5Y, 35	0.18	0.03	21.29	12,761	436	26	410
COTEST-5Y, 35/COTEST-10Y, 45	0.20	0.04	21.15	9,586	361	25	336

Strategy[e]	CC Cases	CC Deaths	Life-Years Gained	Total Tests[b]	Colpos	CIN2 + detected[c]	False Positives[d]
	Outcomes per 1,000						
COTEST-5Y, 40	0.26	0.05	20.14	10,519	340	21	319
COTEST-10Y, 25	0.12	0.03	22.23	10,414	515	35	480
COTEST-10Y, 35	0.22	0.05	20.89	7,657	317	24	292
End Age 70[f]							
CYTO-3Y, 21	0.21	0.05	21.71	15,837	492	37	456
CYTO-3Y, 21/HPV-5Y, 30	0.08	0.01	22.76	11,315	468	39	429
CYTO-3Y, 21/COTEST-5Y, 30	0.08	0.01	22.77	19,560	685	42	642
CYTO-4Y, 21/HPV-5Y, 25	0.08	0.02	22.78	10,387	516	38	478
CYTO-3Y, 21/HPV-10Y, 30	0.12	0.03	22.42	8,019	397	37	360
HPV-5Y, 25	0.10	0.02	22.57	9,260	481	35	446
HPV-5Y, 25/HPV-10Y, 30	0.13	0.03	22.30	5,959	412	33	379
HPV-5Y, 30	0.13	0.02	22.09	7,965	364	30	334
HPV-5Y, 30/HPV-10Y, 40	0.15	0.03	21.88	5,687	324	29	295
HPV-5Y, 35	0.19	0.04	21.18	6,756	273	24	249
HPV-5Y, 35/HPV-10Y, 40	0.22	0.05	21.00	4,470	233	23	210
HPV-5Y, 40	0.27	0.06	20.08	5,641	207	20	187
HPV-10Y, 30	0.17	0.04	21.59	4,644	291	27	263
HPV-10Y, 40	0.31	0.07	19.67	3,345	165	19	146
CYTO-4Y, 21/COTEST-5Y, 25	0.08	0.01	22.84	19,884	767	43	724
CYTO-3Y, 21/COTEST-10Y, 30	0.11	0.02	22.42	12,824	523	39	484
COTEST-5Y, 25/COTEST-10Y, 30	0.12	0.03	22.29	12,024	558	37	521
COTEST-5Y, 30	0.12	0.02	22.09	16,223	581	34	547
COTEST-5Y, 30/COTEST-10Y, 40	0.14	0.03	21.89	11,538	470	32	438
COTEST-5Y, 35	0.18	0.03	21.30	13,814	458	27	432
COTEST-5Y, 35/COTEST-10Y, 40	0.20	0.04	21.08	9,106	347	25	322
COTEST-5Y, 40	0.25	0.05	20.15	11,574	362	22	341
COTEST-10Y, 30	0.15	0.03	21.79	9,441	417	31	387
COTEST-10Y, 40	0.28	0.06	19.85	6,863	257	20	237

Abbreviations: CC, Cervical cancer; CIN, cervical intraepithelial; Colpos, colposcopies; CYTO, cytology; HPV, Human papillomavirus.
[a] Outcomes calculated from age 21 to 100 years.
[b] Total number of tests including cytology and HPV tests, irrespective of primary, triage or surveillance context.
[c] CIN2+ detected includes CIN2s, CIN3s and cervical cancers detected through screening (excludes clinically detected cancers).
[d] Total number of colposcopies that did not result in CIN2, CIN3 or cancer detection.
[e] Strategies are denoted by the screening modality, interval, age to begin screening/screening modality after switch age, interval after switch age, switch age for each end age category. For example, CYTO-3Y, 21 indicates cytology testing every 3 years starting at age 21, and CYTO-3Y, 21/HPV-5Y,30 indicates cytology testing every 3 years starting at age 21 with a switch to HPV testing every 5 years starting at age 30.
[f] End age indicates the age at which the final routine screen should occur, irrespective of age at last screen; exceptions include female persons who are recommended to continue screening due to prior abnormal results and/or precancer treatment.
[g] Strategies (bolded) represent current US recommended strategies.

Table 21. Efficient and Near-Efficient Cervical Cancer Screening Strategies Among Unvaccinated Black Female Persons in the Harvard Model[a]

Strategy[b]	Incremental Colposcopies per LYG	Incremental Total Tests per LYG
HPV-10Y, 40, 60	4	37
CYTO-3Y, 21/HPV-10Y, 30, 60	92*	2,928*
CYTO-3Y, 21/HPV-10Y, 30, 70	75	14,913*
HPV-10Y, 25, 65	237*	151
CYTO-4Y, 21/HPV-10Y, 25, 65	140*	941*
HPV-5Y, 25/HPV-10Y, 30, 60	139*	285
CYTO-3Y, 21/HPV-5Y, 30, 60	82*	3,803*
HPV-5Y, 25/HPV-10Y, 30, 70	275*	643*
CYTO-3Y, 21/HPV-5Y, 30, 65[c]	**75**	**2,604***
HPV-5Y, 25/HPV-10Y, 35, 65	179*	613
CYTO-3Y, 21/HPV-5Y, 30, 70	79	2,443*
HPV-5Y, 25, 60	143*	1,541*
CYTO-3Y, 21/COTEST-5Y, 30, 60	142*	7,627*
HPV-5Y, 25, 65[c]	**587***	**1,341***
COTEST-5Y, 25/COTEST-10Y, 35, 65	199*	9,672*
CYTO-4Y, 21/HPV-5Y, 25, 60	448*	1,337*
HPV-5Y, 25, 70	612*	1,391*
CYTO-3Y, 21/COTEST-5Y, 30, 65[c]	**1,264***	**6,077***
CYTO-4Y, 21/HPV-5Y, 25, 65	204*	1,258
CYTO-4Y, 21/HPV-5Y, 25, 70	175	1,641
CYTO-3Y, 21/COTEST-5Y, 30, 70	515*	5,708*
COTEST-5Y, 25, 65	770*	5,073*
CYTO-4Y, 21/COTEST-5Y, 25, 60	477*	4,441*
CYTO-4Y, 21/COTEST-5Y, 25, 65	1,450*	56,346*
CYTO-4Y, 21/COTEST-5Y, 25, 70	637	23,791

Abbreviations: CYTO, cytology; HPV, Human papillomavirus; LYG, life-years gained
[a] Near-efficient (i.e., within 2% of the efficiency frontier) are indicated by *. Strategies are ordered by increasing colposcopies. Ratios were calculated against the next-less effective, non-dominated strategy. Ratios in grey font indicate strategies that had lower LYG than the guidelines-based strategy of 3-yearly cytology from ages 21 to 65 years in the Harvard model. Yellow highlighted ratios indicate strategies that were most efficient on both metrics among the current guidelines-based strategies and whose efficiency ratios served as benchmarks for efficiency in the vaccinated populations. Strategies that were dominated by both efficiency metrics are not shown.
[b] Strategies are denoted by the screening modality, interval, age to begin screening/screening modality after switch age, interval after switch age, switch age for each end age category. For example, HPV-10Y, 40, 60 indicates HPV testing every 10 years starting at age 40 years and ending at age 60 years, and HPV-5Y, 35/HPV-10Y, 40, 60 indicates HPV testing every 5 years starting at age 35 years with a switch to HPV testing every 10 years starting at age 40 years and ending at age 60 years.
[c] Strategies (bolded) represent current US recommended strategies.

Table 22. Efficient and Near-Efficient Cervical Cancer Screening Strategies Among 2vHPV or 4vHPV Vaccinated Black Female Persons in the Harvard Model[a]

Strategy[b]	Incremental Colposcopies per LYG	Incremental Total Tests per LYG
HPV-10Y, 40, 60	6	81
HPV-10Y, 30, 60	22	132
HPV-10Y, 30, 70	121*	3,130*
HPV-5Y, 30/HPV-10Y, 35, 65	76*	1,273*
CYTO-3Y, 21/HPV-10Y, 30, 60	47	5,078*
CYTO-3Y, 21/HPV-10Y, 30, 70	112	27,151*
HPV-10Y, 25, 65	78*	522
CYTO-4Y, 21/HPV-10Y, 25, 65	86*	3,855*
HPV-5Y, 25/HPV-10Y, 30, 60	1,061*	661
HPV-5Y, 25/HPV-10Y, 30, 70	1,123*	2,987*
CYTO-3Y, 21/HPV-5Y, 30, 60	167*	8,530*
HPV-5Y, 25/HPV-10Y, 35, 65	556*	2,636
CYTO-3Y, 21/HPV-5Y, 30, 65[c]	**163**	**7,374***
CYTO-3Y, 21/COTEST-10Y, 30, 70	717*	27,051*
CYTO-3Y, 21/HPV-5Y, 30, 70	228	7,362*
HPV-5Y, 25, 60	314*	4,260*
CYTO-4Y, 21/COTEST-10Y, 25, 65	993*	20,223*
HPV-5Y, 25, 65[c]	**20,867***	**4,269***
HPV-5Y, 25, 70	14,924*	4,587*
COTEST-5Y, 25/COTEST-10Y, 30, 70	1,524*	27,500*
CYTO-4Y, 21/HPV-5Y, 25, 60	1,091*	4,001
CYTO-4Y, 21/HPV-5Y, 25, 65	545*	4,431
CYTO-4Y, 21/HPV-5Y, 25, 70	475	7,554
COTEST-5Y, 25/COTEST-10Y, 35, 65	907*	75,471*
CYTO-3Y, 21/COTEST-5Y, 30, 60	4,128*	17,804*
CYTO-3Y, 21/COTEST-5Y, 30, 65[c]	**1,931***	**2,957,692***
CYTO-3Y, 21/COTEST-5Y, 30, 70	1,298*	137,556*
COTEST-5Y, 25, 65	93,784*	18,040*
CYTO-4Y, 21/COTEST-5Y, 25, 60	19,744*	768,353*
CYTO-4Y, 21/COTEST-5Y, 25, 65	1,808*	68,566*
CYTO-4Y, 21/COTEST-5Y, 25, 70	1,273	47,851

Abbreviations: CYTO, cytology; HPV, Human papillomavirus; LYG, life-years gained.
[a] Near-efficient (i.e., within 2% of the efficiency frontier) are indicated by *. Strategies are ordered by increasing colposcopies. Ratios were calculated against the next-less effective, non-dominated strategy. Yellow highlighted ratios indicate strategies with efficiency ratios that were equal to or less than those from the current guidelines-based strategies in the unvaccinated population on both efficiency metrics of colposcopies per LYG and tests per LYG in the Harvard model. The efficiency ratios used as benchmarks were: 75-587 colposcopies per LYG and 1,341-2,604 tests per LYG (see **Table 21**). Strategies that were dominated by both efficiency metrics are not shown.
[b] Strategies are denoted by the screening modality, interval, age to begin screening/screening modality after switch age, interval after switch age, switch age for each end age category. For example, HPV-10Y, 40, 60 indicates HPV testing every 10 years starting at age 40 years and ending at age 60 years, and HPV-5Y, 35/HPV-10Y, 40, 60 indicates HPV testing every 5 years starting at age 35 years with a switch to HPV testing every 10 years starting at age 40 years and ending at age 60 years.
[c] Strategies (bolded) represent current US recommended strategies.

Table 23. Efficient and Near-Efficient Cervical Cancer Screening Strategies Among 9vHPV Vaccinated Black Female Persons in the Harvard Model[a]

Strategy[b]	Incremental Colposcopies per LYG	Incremental Total Tests per LYG
HPV-10Y, 40, 60	8	145
HPV-10Y, 35, 65	51*	765*
HPV-5Y, 35/HPV-10Y, 40, 60	51	818*
HPV-10Y, 30, 60	96	654
HPV-10Y, 30, 70	539*	24,809*
HPV-5Y, 30/HPV-10Y, 35, 65	143*	4,422*
HPV-5Y, 30/HPV-10Y, 40, 60	121	3,753*
HPV-5Y, 30/HPV-10Y, 40, 70	404*	5,173*
HPV-5Y, 30, 60	146*	5,490*
HPV-5Y, 30, 65	187*	6,572*
HPV-10Y, 25, 65	221*	1,831
CYTO-3Y, 21/HPV-10Y, 30, 60	138	18,357*
CYTO-3Y, 21/HPV-10Y, 30, 70	314*	17,391*
HPV-5Y, 25/HPV-10Y, 30, 60	210*	2,143
CYTO-4Y, 21/HPV-10Y, 25, 65	257*	11,429*
HPV-5Y, 25/HPV-10Y, 30, 70	221*	17,494*
HPV-5Y, 25/HPV-10Y, 35, 65	233*	13,674*
CYTO-3Y, 21/HPV-5Y, 30, 60	186	10,563*
CYTO-3Y, 21/HPV-5Y, 30, 65[c]	**330**	**11,094***
HPV-5Y, 25, 60	467*	9,788*
CYTO-3Y, 21/HPV-5Y, 30, 70	1,333	12,052*
HPV-5Y, 25, 65[c]	**472***	**11,153***
HPV-5Y, 25, 70	499*	12,665*
CYTO-4Y, 21/HPV-5Y, 25, 60	38,497*	7,773
CYTO-3Y, 21/COTEST-10Y, 30, 60	18,949*	54,011*
CYTO-4Y, 21/HPV-5Y, 25, 65	2,183*	35,940
CYTO-4Y, 21/HPV-5Y, 25, 70	1,997	89,741
CYTO-3Y, 21/COTEST-10Y, 30, 70	2,968*	46,724*
CYTO-4Y, 21/COTEST-10Y, 25, 65	2,752*	35,545*
COTEST-5Y, 25/COTEST-10Y, 35, 65	524*	75,051*
CYTO-3Y, 21/COTEST-5Y, 30, 60	15,861*	25,835*
CYTO-3Y, 21/COTEST-5Y, 30, 65[c]	**34,900***	**26,803***
CYTO-3Y, 21/COTEST-5Y, 30, 70	22,132*	1,140,810*
COTEST-5Y, 25, 65	1,565*	38,519*
CYTO-4Y, 21/COTEST-5Y, 25, 60	7,051*	252,773*
CYTO-4Y, 21/COTEST-5Y, 25, 65	4,494*	165,869*
CYTO-4Y, 21/COTEST-5Y, 25, 70	4,180	158,070

Abbreviations: CYTO, cytology; HPV, Human papillomavirus; LYG, life-years gained.

[a] Near-efficient (i.e., within 2% of the efficiency frontier) are indicated by *. Strategies are ordered by increasing colposcopies. Ratios were calculated against the next-less effective, non-dominated strategy. Yellow highlighted ratios indicate strategies with efficiency ratios that were equal to or less than those from the current guidelines-based strategies in the unvaccinated population on both efficiency metrics of colposcopies per LYG and tests per LYG in the Harvard model.

The efficiency ratios used as benchmarks were: 75-587 colposcopies per LYG and 1,341-2,604 tests per LYG (see **Table 21**). Strategies that were dominated by both efficiency metrics are not shown.
[b] Strategies are denoted by the screening modality, interval, age to begin screening/screening modality after switch age, interval after switch age, switch age for each end age category. For example, HPV-10Y, 40, 60 indicates HPV testing every 10 years starting at age 40 years and ending at age 60 years, and HPV-5Y, 35/HPV-10Y, 40, 60 indicates HPV testing every 5 years starting at age 35 years with a switch to HPV testing every 10 years starting at age 40 years and ending at age 60 years.
[c] Strategies (bolded) represent current US recommended strategies.

Table 24. Lifetime Number of Cervical Cancer Cases, Deaths and Life-Years Gained Among Unvaccinated Female Persons Assuming Imperfect Screening and Follow-up Adherence by Model[a]

	Cervical Cancer Cases per 1,000					Cervical Cancer Deaths per 1,000					Life-Years Gained per 1,000				
Strategy[b]	**H**	**M**	**P**	**U**	**Med[c]**	**H**	**M**	**P**	**U**	**Med[c]**	**H**	**M**	**P**	**U**	**Med***
No Screening	16.47	10.97	14.20	21.37	15.33	5.23	7.23	7.41	8.58	7.32	0	0	0	0	0
End Age 60[d]															
CYTO-3Y, 21	5.10	6.26	6.34	8.31	6.30	1.42	3.39	3.06	3.06	3.06	140	98	115	144	128
CYTO-3Y, 21/HPV-5Y, 30	4.00	5.95	6.07	7.17	6.01	1.09	3.27	2.92	2.64	2.78	149	99	116	153	132
CYTO-3Y, 21/COTEST-5Y, 30	3.88	5.89	5.40	6.96	5.65	1.04	3.23	2.57	2.57	2.57	150	100	124	154	137
CYTO-4Y, 21/HPV-5Y, 25	3.85	5.96	6.07	7.14	6.02	1.06	3.29	2.91	2.64	2.77	150	98	116	153	133
CYTO-3Y, 21/HPV-10Y, 30	4.36	6.96	6.80	8.92	6.88	1.18	3.98	3.26	3.23	3.25	145	80	108	136	122
HPV-5Y, 25	3.93	6.05	6.12	7.27	6.09	1.07	3.32	2.88	2.67	2.78	149	97	115	152	132
HPV-5Y, 25/HPV-10Y, 30	4.26	7.04	6.87	9.04	6.95	1.17	4.03	3.27	3.27	3.27	146	78	105	135	120
HPV-5Y, 30	4.82	6.29	6.49	8.06	6.39	1.20	3.43	2.96	2.85	2.91	140	92	109	143	124
HPV-5Y, 30/HPV-10Y, 40	5.01	6.73	6.87	9.08	6.80	1.26	3.79	3.17	3.23	3.20	138	85	104	134	119
HPV-5Y, 35	6.06	6.75	7.27	9.45	7.01	1.45	3.69	3.15	3.22	3.19	123	82	98	127	110
HPV-5Y, 35/HPV-10Y, 40	6.23	7.24	7.80	10.61	7.52	1.51	4.08	3.48	3.66	3.57	121	74	90	116	103
HPV-5Y, 40	7.42	7.43	8.20	11.34	7.81	1.86	4.07	3.50	3.89	3.69	100	68	84	102	92
HPV-10Y, 30	5.22	7.44	7.66	10.11	7.55	1.33	4.25	3.53	3.54	3.54	135	70	93	122	108
HPV-10Y, 40	7.64	8.14	9.03	12.75	8.58	1.93	4.65	4.01	4.44	4.23	98	56	73	88	80
CYTO-4Y, 21/COTEST-5Y, 25	3.70	5.94	5.22	6.93	5.58	1.01	3.26	2.48	2.58	2.53	152	99	126	155	139
CYTO-3Y, 21/COTEST-10Y, 30	4.16	6.93	5.88	8.61	6.41	1.12	3.93	2.78	3.11	2.94	147	82	118	139	128
COTEST-5Y, 25/COTEST-10Y, 30	4.04	6.97	5.68	8.65	6.33	1.10	3.95	2.71	3.13	2.92	148	80	119	139	129
COTEST-5Y, 30	4.67	6.23	5.60	7.82	5.91	1.17	3.39	2.54	2.79	2.67	141	93	118	145	130
COTEST-5Y, 30/COTEST-10Y, 40	4.81	6.66	5.86	8.78	6.26	1.21	3.73	2.70	3.12	2.91	140	86	115	137	126
COTEST-5Y, 35	5.88	6.67	6.45	9.24	6.56	1.40	3.63	2.78	3.16	2.97	125	83	107	128	116
COTEST-5Y, 35/COTEST-10Y, 40	6.05	7.17	6.76	10.25	6.96	1.44	4.02	2.96	3.52	3.24	123	76	102	120	111
COTEST-5Y, 40	7.27	7.36	7.39	11.18	7.38	1.81	4.02	3.10	3.82	3.46	102	70	93	104	98
COTEST-10Y, 30	4.97	7.37	6.39	9.75	6.88	1.25	4.17	2.88	3.41	3.14	138	72	108	126	117
COTEST-10Y, 40	7.40	8.08	8.01	12.46	8.05	1.85	4.59	3.44	4.31	3.88	100	57	85	91	88
End Age 65[d]															
CYTO-3Y, 21[e]	**4.83**	**5.92**	**5.93**	**7.81**	**5.93**	**1.30**	**3.07**	**2.76**	**2.82**	**2.79**	**142**	**102**	**120**	**146**	**131**

	Cervical Cancer Cases per 1,000					Cervical Cancer Deaths per 1,000					Life-Years Gained per 1,000				
Strategy[b]	**H**	**M**	**P**	**U**	**Med[c]**	**H**	**M**	**P**	**U**	**Med[c]**	**H**	**M**	**P**	**U**	**Med***
CYTO-3Y, 21/HPV-5Y, 30[e]	**3.83**	**5.60**	**5.77**	**6.75**	**5.69**	**1.01**	**2.98**	**2.65**	**2.42**	**2.54**	**150**	**102**	**120**	**155**	**135**
CYTO-3Y, 21/COTEST-5Y, 30[e]	**3.72**	**5.55**	**5.04**	**6.53**	**5.29**	**0.97**	**2.92**	**2.26**	**2.36**	**2.31**	**151**	**103**	**128**	**157**	**140**
CYTO-4Y, 21/HPV-5Y, 25	3.68	5.64	5.77	6.71	5.71	0.99	3.00	2.65	2.42	2.53	151	101	119	156	135
CYTO-4Y, 21/HPV-10Y, 25	4.17	6.95	6.86	8.91	6.91	1.12	3.89	3.17	3.20	3.18	146	78	105	134	120
HPV-5Y, 25[e]	**3.76**	**5.70**	**5.81**	**6.83**	**5.76**	**1.00**	**3.01**	**2.64**	**2.44**	**2.54**	**150**	**100**	**118**	**154**	**134**
HPV-5Y, 25/HPV-10Y, 35	4.01	6.44	6.45	8.23	6.45	1.08	3.59	3.00	2.99	3.00	148	87	110	141	126
HPV-5Y, 30	4.66	5.95	6.19	7.62	6.07	1.13	3.14	2.70	2.64	2.67	141	94	112	145	126
HPV-5Y, 30/HPV-10Y, 35	4.93	6.79	6.90	9.07	6.84	1.22	3.77	3.08	3.20	3.14	138	81	103	132	118
HPV-5Y, 35	5.90	6.37	7.01	9.04	6.69	1.39	3.35	2.95	3.03	2.99	124	86	100	129	112
HPV-5Y, 35/HPV-10Y, 45	6.04	6.83	7.37	9.88	7.10	1.43	3.70	3.19	3.39	3.29	122	80	95	122	108
HPV-5Y, 40	7.26	7.08	7.85	10.87	7.55	1.80	3.77	3.22	3.65	3.43	101	71	89	105	95
HPV-10Y, 25	4.26	7.05	7.01	9.13	7.03	1.13	3.95	3.18	3.25	3.21	145	75	102	131	116
HPV-10Y, 35	6.26	7.42	8.12	10.77	7.77	1.50	4.13	3.50	3.72	3.61	120	68	87	112	100
CYTO-4Y, 21/COTEST-5Y, 25	3.55	5.57	4.87	6.44	5.22	0.95	2.93	2.22	2.35	2.29	153	102	129	158	141
CYTO-4Y, 21/COTEST-10Y, 25	3.96	6.88	5.64	8.50	6.26	1.06	3.81	2.55	3.04	2.80	148	80	119	138	128
COTEST-5Y, 25	3.62	5.65	4.89	6.54	5.27	0.96	2.98	2.21	2.36	2.29	152	100	128	157	140
COTEST-5Y, 25/COTEST-10Y, 35	3.86	6.41	5.30	7.87	5.85	1.04	3.56	2.40	2.86	2.63	149	88	123	145	134
COTEST-5Y, 30	4.52	5.91	5.32	7.36	5.62	1.11	3.11	2.29	2.56	2.42	142	95	122	148	132
COTEST-5Y, 30/COTEST-10Y, 35	4.77	6.73	5.82	8.74	6.27	1.17	3.71	2.59	3.07	2.83	140	82	114	135	124
COTEST-5Y, 35	5.74	6.33	6.24	8.80	6.29	1.34	3.31	2.58	2.94	2.76	125	87	108	131	116
COTEST-5Y, 35/COTEST-10Y, 45	5.88	6.75	6.39	9.59	6.57	1.38	3.64	2.70	3.26	2.98	124	82	105	125	114
COTEST-5Y, 40	7.12	7.03	7.11	10.71	7.12	1.75	3.72	2.87	3.61	3.24	102	73	96	106	99
COTEST-10Y, 25	4.04	6.98	5.79	8.67	6.38	1.07	3.87	2.60	3.07	2.83	147	78	116	136	126
COTEST-10Y, 35	6.03	7.37	6.89	10.43	7.13	1.42	4.08	2.91	3.58	3.24	122	69	100	115	108
End Age 70[d]															
CYTO-3Y, 21	4.64	5.65	5.60	7.38	5.63	1.22	2.78	2.45	2.61	2.53	143	104	123	149	133
CYTO-3Y, 21/HPV-5Y, 30	3.72	5.37	5.47	6.37	5.42	0.97	2.73	2.43	2.25	2.34	150	104	122	157	136
CYTO-3Y, 21/COTEST-5Y, 30	3.63	5.31	4.74	6.14	5.02	0.94	2.68	2.06	2.17	2.11	151	106	129	159	140
CYTO-4Y, 21/HPV-5Y, 25	3.58	5.41	5.52	6.32	5.46	0.95	2.76	2.44	2.23	2.34	152	103	121	157	136
CYTO-3Y, 21/HPV-10Y, 30	4.13	6.65	6.39	8.46	6.52	1.09	3.63	2.92	3.01	2.96	146	83	110	138	124

Strategy[b]	Cervical Cancer Cases per 1,000					Cervical Cancer Deaths per 1,000					Life-Years Gained per 1,000				
	H	M	P	U	Med[c]	H	M	P	U	Med[c]	H	M	P	U	Med*
HPV-5Y, 25	3.65	5.51	5.55	6.45	5.53	0.96	2.81	2.41	2.27	2.34	151	101	121	156	136
HPV-5Y, 25/HPV-10Y, 30	4.03	6.71	6.47	8.51	6.59	1.08	3.67	2.94	3.03	2.98	147	81	108	137	122
HPV-5Y, 30	4.55	5.74	5.96	7.25	5.85	1.09	2.91	2.52	2.46	2.49	141	97	114	147	128
HPV-5Y, 30/HPV-10Y, 40	4.78	6.42	6.52	8.59	6.47	1.17	3.45	2.87	3.00	2.94	139	87	106	136	121
HPV-5Y, 35	5.79	6.17	6.79	8.71	6.48	1.35	3.15	2.73	2.86	2.80	124	88	103	131	114
HPV-5Y, 35/HPV-10Y, 40	6.02	6.91	7.45	10.08	7.18	1.42	3.72	3.14	3.43	3.28	122	77	94	118	106
HPV-5Y, 40	7.16	6.88	7.70	10.53	7.43	1.76	3.55	3.10	3.49	3.29	102	74	88	106	95
HPV-10Y, 30	5.01	7.10	7.25	9.64	7.18	1.24	3.86	3.17	3.33	3.25	136	74	96	124	110
HPV-10Y, 40	7.47	7.83	8.66	12.20	8.25	1.86	4.31	3.68	4.19	3.94	98	58	76	91	84
CYTO-4Y, 21/COTEST-5Y, 25	3.46	5.35	4.64	6.06	4.99	0.92	2.71	2.02	2.16	2.09	153	104	130	160	142
CYTO-3Y, 21/COTEST-10Y, 30	3.96	6.59	5.41	8.09	6.00	1.03	3.57	2.39	2.88	2.63	148	85	121	141	131
COTEST-5Y, 25/COTEST-10Y, 30	3.84	6.66	5.30	8.11	5.98	1.02	3.61	2.34	2.88	2.61	149	83	121	141	131
COTEST-5Y, 30	4.42	5.68	5.15	6.99	5.41	1.07	2.87	2.13	2.37	2.25	142	98	123	150	132
COTEST-5Y, 30/COTEST-10Y, 40	4.61	6.37	5.46	8.23	5.91	1.13	3.39	2.32	2.87	2.60	141	89	119	139	129
COTEST-5Y, 35	5.65	6.11	5.96	8.44	6.04	1.30	3.08	2.37	2.76	2.57	126	89	110	133	118
COTEST-5Y, 35/COTEST-10Y, 40	5.87	6.86	6.41	9.74	6.64	1.37	3.67	2.66	3.28	2.97	124	78	105	122	114
COTEST-5Y, 40	7.03	6.82	6.89	10.34	6.96	1.71	3.50	2.71	3.41	3.06	103	74	97	108	100
COTEST-10Y, 30	4.79	7.08	5.94	9.20	6.51	1.18	3.82	2.52	3.16	2.84	139	74	112	129	120
COTEST-10Y, 40	7.26	7.78	7.56	11.92	7.67	1.79	4.25	3.09	4.06	3.57	100	59	88	94	91

Abbreviations: CYTO, cytology; HPV, Human papillomavirus; H, Harvard model; M, MISCAN-Cervix model; P, Policy1-Cervix model; U, University of Minnesota model.
[a] Outcomes calculated from age 21 to 100 years.
[b] Strategies are denoted by the screening modality, interval, age to begin screening/screening modality after switch age, interval after switch age, switch age for each end age category. For example, CYTO-3Y, 21 indicates cytology testing every 3 years starting at age 21, and CYTO-3Y, 21/HPV-5Y,30 indicates cytology testing every 3 years starting at age 21 with a switch to HPV testing every 5 years starting at age 30.
[c] Median outcome across the four models.
[d] End age indicates the age at which the final routine screen should occur, irrespective of age at last screen; exceptions include female persons who are recommended to continue screening due to prior abnormal results and/or precancer treatment.
[e] Strategies (bolded) represent current US recommended strategies.

Table 25. Lifetime Number of Total Tests and Colposcopies Among Unvaccinated Female Persons Assuming Imperfect Screening and Follow-up Adherence by Model[a]

	Total Tests per 1,000 [b]					Colposcopies per 1,000				
Strategy[c]	**H**	**M**	**P**	**U**	**Med[d]**	**H**	**M**	**P**	**U**	**Med[d]**
No Screening	0	0	0	0	0	0	0	0	0	0
End Age 60[e]										
CYTO-3Y, 21	15,119	14,012	11,282	14,566	14,289	507	584	319	585	545
CYTO-3Y, 21/HPV-5Y, 30	12,238	10,971	9,382	11,484	11,228	741	728	269	743	735
CYTO-3Y, 21/COTEST-5Y, 30	22,817	16,823	16,063	19,320	18,071	947	761	431	858	810
CYTO-4Y, 21/HPV-5Y, 25	11,390	9,945	8,902	10,685	10,315	846	779	285	797	788
CYTO-3Y, 21/HPV-10Y, 30	9,360	8,200	7,280	8,901	8,550	604	573	235	606	588
HPV-5Y, 25	10,300	8,664	8,115	9,249	8,957	826	680	274	720	700
HPV-5Y, 25/HPV-10Y, 30	7,482	6,166	6,001	6,719	6,443	692	551	239	585	568
HPV-5Y, 30	8,607	7,207	6,742	7,852	7,529	616	468	180	554	511
HPV-5Y, 30/HPV-10Y, 40	6,881	5,770	5,428	6,368	6,069	547	410	162	500	455
HPV-5Y, 35	7,148	5,964	5,671	6,552	6,258	468	330	133	402	366
HPV-5Y, 35/HPV-10Y, 40	5,323	4,371	4,261	4,906	4,638	396	266	113	343	304
HPV-5Y, 40	5,744	4,670	4,689	5,153	4,921	356	214	100	276	245
HPV-10Y, 30	5,602	4,315	4,329	5,076	4,702	471	301	134	399	350
HPV-10Y, 40	3,924	2,917	3,054	3,442	3,248	280	141	74	207	174
CYTO-4Y, 21/COTEST-5Y, 25	23,296	16,930	16,741	19,933	18,431	1,079	832	482	944	888
CYTO-3Y, 21/COTEST-10Y, 30	16,682	11,685	12,034	14,266	13,150	751	594	353	700	647
COTEST-5Y, 25/COTEST-10Y, 30	16,109	11,102	12,350	13,531	12,940	847	596	408	709	653
COTEST-5Y, 30	18,734	13,268	13,744	15,708	14,726	813	504	352	675	589
COTEST-5Y, 30/COTEST-10Y, 40	14,914	10,569	11,287	12,785	12,036	694	442	308	607	524
COTEST-5Y, 35	15,678	11,079	11,625	13,149	12,387	633	355	276	497	426
COTEST-5Y, 35/COTEST-10Y, 40	11,639	8,078	8,978	9,894	9,436	510	287	228	423	355
COTEST-5Y, 40	12,705	8,774	9,660	10,390	10,025	490	231	218	349	290
COTEST-10Y, 30	12,257	7,922	9,154	10,286	9,720	604	324	258	495	409
COTEST-10Y, 40	8,751	5,472	6,514	6,986	6,750	375	152	158	264	211
End Age 65[e]										
CYTO-3Y, 21[f]	**16,391**	**15,299**	**12,266**	**15,826**	**15,563**	**539**	**606**	**339**	**613**	**572**
CYTO-3Y, 21/HPV-5Y, 30[f]	**12,966**	**11,674**	**10,008**	**12,126**	**11,900**	**769**	**752**	**279**	**757**	**755**
CYTO-3Y, 21/COTEST-5Y, 30[f]	**24,195**	**18,153**	**17,333**	**20,630**	**19,392**	**985**	**788**	**455**	**881**	**834**
CYTO-4Y, 21/HPV-5Y, 25	12,153	10,714	9,527	11,386	11,050	874	806	294	813	809
CYTO-4Y, 21/HPV-10Y, 25	8,227	6,913	6,632	7,762	7,337	672	568	237	597	583
HPV-5Y, 25[f]	**11,065**	**9,433**	**8,744**	**9,954**	**9,693**	**854**	**707**	**283**	**732**	**719**
HPV-5Y, 25/HPV-10Y, 35	8,461	7,236	6,780	7,715	7,476	744	629	255	645	637
HPV-5Y, 30	9,305	7,904	7,368	8,488	8,196	643	492	189	566	529
HPV-5Y, 30/HPV-10Y, 35	6,639	5,599	5,309	6,160	5,880	530	409	159	475	442
HPV-5Y, 35	7,843	6,657	6,287	7,134	6,895	495	355	142	415	385
HPV-5Y, 35/HPV-10Y, 45	6,207	5,270	5,028	5,751	5,511	435	302	126	378	340
HPV-5Y, 40	6,543	5,484	5,309	5,913	5,698	383	241	109	291	266
HPV-10Y, 25	7,064	5,588	5,634	6,257	5,946	645	464	219	511	487
HPV-10Y, 35	5,007	4,012	3,998	4,597	4,304	373	243	107	311	277
CYTO-4Y, 21/COTEST-5Y, 25	24,754	18,385	18,010	21,382	19,883	1,118	860	505	966	913
CYTO-4Y, 21/COTEST-10Y, 25	16,471	11,379	12,477	14,246	13,361	838	605	388	716	660

Strategy[c]	Total Tests per 1,000 [b]					Colposcopies per 1,000				
	H	M	P	U	Med[d]	H	M	P	U	Med[d]
COTEST-5Y, 25	23,683	17,201	17,605	19,961	18,783	1,098	764	508	888	826
COTEST-5Y, 25/COTEST-10Y, 35	18,072	13,043	13,854	15,443	14,649	919	679	439	778	728
COTEST-5Y, 30	20,083	14,588	15,014	17,067	16,040	850	531	375	696	613
COTEST-5Y, 30/COTEST-10Y, 35	14,310	10,222	11,084	12,430	11,757	668	439	303	580	510
COTEST-5Y, 35	17,032	12,388	12,875	14,346	13,611	670	382	299	518	450
COTEST-5Y, 35/COTEST-10Y, 45	13,430	9,774	10,509	11,594	11,051	566	326	258	467	397
COTEST-5Y, 40	14,288	10,315	10,924	11,937	11,431	531	261	241	373	317
COTEST-10Y, 25	15,209	10,119	11,713	12,696	12,205	808	502	381	629	566
COTEST-10Y, 35	10,912	7,410	8,467	9,339	8,903	489	260	216	389	325
End Age 70[e]										
CYTO-3Y, 21	17,726	16,649	13,162	17,165	16,907	571	628	357	642	600
CYTO-3Y, 21/HPV-5Y, 30	13,636	12,382	10,565	12,773	12,577	791	776	285	770	773
CYTO-3Y, 21/COTEST-5Y, 30	25,465	19,491	18,478	21,981	20,736	1,017	813	475	903	858
CYTO-4Y, 21/HPV-5Y, 25	12,804	11,411	10,086	12,040	11,726	895	829	301	828	828
CYTO-3Y, 21/HPV-10Y, 30	9,990	8,861	7,879	9,513	9,187	629	595	244	621	608
HPV-5Y, 25	11,760	10,132	9,304	10,616	10,374	877	730	290	746	738
HPV-5Y, 25/HPV-10Y, 30	8,145	6,825	6,594	7,368	7,097	717	574	248	600	587
HPV-5Y, 30	9,999	8,612	7,928	9,151	8,881	665	516	196	580	548
HPV-5Y, 30/HPV-10Y, 40	7,553	6,445	6,033	7,041	6,743	572	434	171	514	474
HPV-5Y, 35	8,469	7,294	6,839	7,722	7,508	516	376	149	426	401
HPV-5Y, 35/HPV-10Y, 40	5,961	5,044	4,867	5,529	5,287	421	290	122	357	324
HPV-5Y, 40	7,164	6,107	5,856	6,445	6,276	405	263	116	302	282
HPV-10Y, 30	6,239	4,977	4,936	5,694	5,336	496	323	143	413	368
HPV-10Y, 40	4,502	3,588	3,655	4,049	3,852	303	164	83	221	193
CYTO-4Y, 21/COTEST-5Y, 25	25,974	19,701	19,150	22,649	21,175	1,148	885	525	988	937
CYTO-3Y, 21/COTEST-10Y, 30	17,843	12,936	13,243	15,537	14,390	784	619	375	722	670
COTEST-5Y, 25/COTEST-10Y, 30	17,325	12,349	13,551	14,832	14,191	881	621	431	731	676
COTEST-5Y, 30	21,412	15,927	16,155	18,433	17,294	883	556	395	718	637
COTEST-5Y, 30/COTEST-10Y, 40	16,152	11,843	12,519	14,141	13,330	729	467	331	629	548
COTEST-5Y, 35	18,234	13,590	14,012	15,602	14,807	701	405	319	538	472
COTEST-5Y, 35/COTEST-10Y, 40	12,821	9,350	10,213	11,216	10,714	543	312	251	446	379
COTEST-5Y, 40	15,485	11,492	12,047	13,036	12,542	562	285	261	392	338
COTEST-10Y, 30	13,429	9,172	10,408	11,601	11,005	637	349	281	518	433
COTEST-10Y, 40	9,758	6,738	7,778	8,273	8,026	404	178	182	286	234

Abbreviations: CYTO, cytology; HPV, Human papillomavirus; H, Harvard model; M, MISCAN-Cervix model; P, Policy1-Cervix model; U, University of Minnesota model.
[a] Outcomes calculated from age 21 to 100 years.
[b] Total number of tests including cytology and HPV tests, irrespective of primary, triage or surveillance context.
[c] Strategies are denoted by the screening modality, interval, age to begin screening/screening modality after switch age, interval after switch age, switch age for each end age category. For example, CYTO-3Y, 21 indicates cytology testing every 3 years starting at age 21, and CYTO-3Y, 21/HPV-5Y,30 indicates cytology testing every 3 years starting at age 21 with a switch to HPV testing every 5 years starting at age 30.
[d] Median outcome across the four models.
[e] End age indicates the age at which the final routine screen should occur, irrespective of age at last screen; exceptions include female persons who are recommended to continue screening due to prior abnormal results and/or precancer treatment.
[f] Strategies (bolded) represent current US recommended strategies.

Table 26. Lifetime Number of CIN2+ Detected and False Positives Among Unvaccinated Female Persons Assuming Imperfect Screening and Follow-up Adherence by Model[a]

	CIN2+ detected per 1,000[b]					False Positives per 1,000[c]				
Strategy[d]	**H**	**M**	**P**	**U**	**Med[e]**	**H**	**M**	**P**	**U**	**Med[e]**
No Screening	0	0	0	0	0	0	0	0	0	0
End Age 60[f]										
CYTO-3Y, 21	112	46	69	232	91	354	361	224	353	353
CYTO-3Y, 21/HPV-5Y, 30	132	49	70	249	101	559	461	173	494	477
CYTO-3Y, 21/COTEST-5Y, 30	138	50	74	256	106	757	484	329	602	543
CYTO-4Y, 21/HPV-5Y, 25	135	49	68	250	101	660	499	192	547	523
CYTO-3Y, 21/HPV-10Y, 30	121	42	66	221	93	437	358	145	385	372
HPV-5Y, 25	128	41	60	227	94	649	437	192	493	465
HPV-5Y, 25/HPV-10Y, 30	118	36	55	199	86	530	351	164	386	368
HPV-5Y, 30	103	30	43	182	73	475	298	121	371	335
HPV-5Y, 30/HPV-10Y, 40	98	28	41	172	69	413	259	106	328	294
HPV-5Y, 35	81	23	33	141	57	358	209	88	261	235
HPV-5Y, 35/HPV-10Y, 40	75	20	31	129	53	293	166	72	214	190
HPV-5Y, 40	64	16	26	104	45	268	133	65	172	153
HPV-10Y, 30	91	23	36	149	64	346	188	85	251	219
HPV-10Y, 40	58	13	22	89	40	200	85	44	118	101
CYTO-4Y, 21/COTEST-5Y, 25	142	50	74	261	108	883	535	380	683	609
CYTO-3Y, 21/COTEST-10Y, 30	127	43	71	229	99	577	372	256	470	421
COTEST-5Y, 25/COTEST-10Y, 30	125	37	65	212	95	675	382	320	497	440
COTEST-5Y, 30	109	31	49	191	79	663	323	285	484	403
COTEST-5Y, 30/COTEST-10Y, 40	103	29	48	180	76	552	281	243	426	354
COTEST-5Y, 35	85	23	37	147	61	516	226	225	350	288
COTEST-5Y, 35/COTEST-10Y, 40	79	21	35	136	57	401	180	180	287	234
COTEST-5Y, 40	68	17	30	108	49	397	145	178	241	209
COTEST-10Y, 30	97	23	44	158	70	470	204	198	336	270
COTEST-10Y, 40	62	13	27	93	44	290	93	122	171	147
End Age 65[f]										
CYTO-3Y, 21[g]	**115**	**47**	**71**	**237**	**93**	**380**	**375**	**242**	**376**	**376**
CYTO-3Y, 21/HPV-5Y, 30[g]	**136**	**51**	**72**	**253**	**104**	**581**	**477**	**180**	**504**	**490**
CYTO-3Y, 21/COTEST-5Y, 30[g]	**142**	**51**	**76**	**260**	**109**	**790**	**501**	**351**	**621**	**561**
CYTO-4Y, 21/HPV-5Y, 25	139	50	69	254	104	683	516	199	558	537
CYTO-4Y, 21/HPV-10Y, 25	122	40	61	210	92	504	358	154	387	372
HPV-5Y, 25[g]	**132**	**43**	**61**	**231**	**97**	**672**	**454**	**199**	**501**	**478**
HPV-5Y, 25/HPV-10Y, 35	123	39	58	214	91	574	402	176	431	417
HPV-5Y, 30	106	32	45	187	76	496	314	128	380	347
HPV-5Y, 30/HPV-10Y, 35	98	28	41	168	69	396	259	103	307	283
HPV-5Y, 35	84	24	35	145	59	379	225	95	270	247
HPV-5Y, 35/HPV-10Y, 45	80	22	33	138	56	326	189	82	240	215
HPV-5Y, 40	67	18	28	108	48	291	151	71	182	167
HPV-10Y, 25	115	32	51	185	83	487	293	149	326	310
HPV-10Y, 35	75	19	29	123	52	271	151	67	188	170
CYTO-4Y, 21/COTEST-5Y, 25	146	52	75	265	111	917	553	401	701	627
CYTO-4Y, 21/COTEST-10Y, 25	129	41	69	222	99	660	383	294	493	438

Strategy[d]	CIN2+ detected per 1,000[b] H	M	P	U	Med[e]	False Positives per 1,000[c] H	M	P	U	Med[e]
COTEST-5Y, 25	140	44	69	243	105	906	493	413	646	570
COTEST-5Y, 25/COTEST-10Y, 35	130	41	67	226	99	740	436	347	551	494
COTEST-5Y, 30	112	33	51	195	82	695	340	306	501	421
COTEST-5Y, 30/COTEST-10Y, 35	103	29	48	177	75	527	279	237	403	341
COTEST-5Y, 35	89	25	39	151	64	548	244	246	367	306
COTEST-5Y, 35/COTEST-10Y, 45	84	23	38	144	61	451	206	207	323	265
COTEST-5Y, 40	71	18	31	112	51	434	165	199	261	230
COTEST-10Y, 25	122	33	61	197	92	640	319	297	431	375
COTEST-10Y, 35	79	19	35	129	57	381	163	169	260	214
End Age 70[f]										
CYTO-3Y, 21	119	49	72	241	96	408	389	258	401	395
CYTO-3Y, 21/HPV-5Y, 30	139	52	73	257	106	599	492	186	513	502
CYTO-3Y, 21/COTEST-5Y, 30	144	53	77	264	111	818	518	369	639	578
CYTO-4Y, 21/HPV-5Y, 25	141	51	70	258	106	700	531	205	570	550
CYTO-3Y, 21/HPV-10Y, 30	126	44	68	227	97	456	372	151	394	383
HPV-5Y, 25	135	44	63	235	99	691	469	205	511	490
HPV-5Y, 25/HPV-10Y, 30	122	37	57	205	90	549	365	170	394	380
HPV-5Y, 30	109	33	46	190	78	515	330	133	390	360
HPV-5Y, 30/HPV-10Y, 40	102	30	43	177	73	432	274	112	337	306
HPV-5Y, 35	87	25	36	148	61	397	239	100	278	259
HPV-5Y, 35/HPV-10Y, 40	80	22	32	135	56	312	181	78	223	202
HPV-5Y, 40	70	19	29	112	50	309	165	77	190	177
HPV-10Y, 30	96	25	38	154	67	365	201	91	258	230
HPV-10Y, 40	62	15	24	94	43	218	100	51	126	113
CYTO-4Y, 21/COTEST-5Y, 25	148	53	77	269	113	944	570	420	719	644
CYTO-3Y, 21/COTEST-10Y, 30	131	45	73	235	102	604	388	275	487	437
COTEST-5Y, 25/COTEST-10Y, 30	129	39	67	218	98	703	397	339	513	455
COTEST-5Y, 30	115	34	52	199	83	725	357	324	519	438
COTEST-5Y, 30/COTEST-10Y, 40	107	31	50	186	79	581	297	263	443	370
COTEST-5Y, 35	91	26	40	154	66	575	259	264	383	324
COTEST-5Y, 35/COTEST-10Y, 40	83	23	38	141	60	429	196	200	305	252
COTEST-5Y, 40	74	20	32	116	53	461	181	217	276	246
COTEST-10Y, 30	101	25	46	164	73	498	219	219	354	286
COTEST-10Y, 40	65	15	29	99	47	314	109	143	187	165

Abbreviations: CIN, cervical intraepithelial; CYTO, cytology; HPV, Human papillomavirus; H, Harvard model; M, MISCAN-Cervix model; P, Policy1-Cervix model; U, University of Minnesota model.
[a] Outcomes calculated from age 21 to 100 years.
[b] CIN2+ detected includes CIN2s, CIN3s and cervical cancers detected through screening (excludes clinically detected cancers).
[c] Total number of colposcopies that did not result in CIN2, CIN3 or cancer detection.
[d] Strategies are denoted by the screening modality, interval, age to begin screening/screening modality after switch age, interval after switch age, switch age for each end age category. For example, CYTO-3Y, 21 indicates cytology testing every 3 years starting at age 21, and CYTO-3Y, 21/HPV-5Y,30 indicates cytology testing every 3 years starting at age 21 with a switch to HPV testing every 5 years starting at age 30.
[e] Median outcome across the four models.
[f] End age indicates the age at which the final routine screen should occur, irrespective of age at last screen; exceptions include female persons who are recommended to continue screening due to prior abnormal results and/or precancer treatment.
[g] Strategies (bolded) represent current US recommended strategies.

Table 27. Lifetime Number of Cervical Cancer Cases, Deaths and Life-Years Gained Among 2vHPV or 4vHPV Vaccinated Female Persons Assuming Imperfect Screening and Follow-up Adherence by Model[a]

	Cervical Cancer Cases per 1,000					Cervical Cancer Deaths per 1,000					Life-Years Gained per 1,000				
Strategy[b]	**H**	**M**	**P**	**U**	**Med[c]**	**H**	**M**	**P**	**U**	**Med[c]**	**H**	**M**	**P**	**U**	**Med***
No Screening	6.69	3.79	3.69	4.83	4.31	2.24	2.50	2.01	1.99	2.13	0	0	0	0	0
End Age 60[d]															
CYTO-3Y, 21	1.91	2.21	2.06	1.81	1.98	0.56	1.21	1.05	0.76	0.90	51	33	25	30	32
CYTO-3Y, 21/HPV-5Y, 30	1.46	2.08	1.93	1.54	1.73	0.42	1.15	0.99	0.62	0.80	55	33	25	32	32
CYTO-3Y, 21/COTEST-5Y, 30	1.43	2.06	1.70	1.46	1.58	0.40	1.14	0.84	0.59	0.71	55	34	28	33	34
CYTO-4Y, 21/HPV-5Y, 25	1.42	2.09	1.92	1.52	1.72	0.41	1.17	0.97	0.61	0.79	55	33	26	32	32
CYTO-3Y, 21/HPV-10Y, 30	1.58	2.42	2.19	1.87	2.03	0.45	1.39	1.11	0.76	0.94	54	27	22	28	28
HPV-5Y, 25	1.43	2.12	1.86	1.57	1.71	0.41	1.17	0.92	0.63	0.78	55	32	26	32	32
HPV-5Y, 25/HPV-10Y, 30	1.54	2.46	2.09	1.91	2.00	0.44	1.42	1.04	0.78	0.91	54	26	23	28	27
HPV-5Y, 30	1.64	2.20	1.89	1.72	1.81	0.44	1.21	0.91	0.68	0.79	53	31	25	29	30
HPV-5Y, 30/HPV-10Y, 40	1.71	2.35	2.02	1.92	1.97	0.46	1.35	0.99	0.77	0.88	52	28	24	27	28
HPV-5Y, 35	1.97	2.35	2.00	1.99	1.99	0.50	1.30	0.94	0.77	0.85	48	27	23	25	26
HPV-5Y, 35/HPV-10Y, 40	2.04	2.52	2.16	2.21	2.19	0.53	1.43	1.03	0.86	0.95	47	25	21	23	24
HPV-5Y, 40	2.33	2.56	2.14	2.31	2.32	0.60	1.42	0.99	0.88	0.94	43	23	21	21	22
HPV-10Y, 30	1.78	2.59	2.16	2.12	2.14	0.48	1.49	1.04	0.83	0.94	51	23	22	25	24
HPV-10Y, 40	2.42	2.81	2.38	2.56	2.49	0.63	1.62	1.12	0.99	1.05	42	19	18	19	19
CYTO-4Y, 21/COTEST-5Y, 25	1.37	2.08	1.67	1.44	1.55	0.40	1.15	0.82	0.58	0.70	56	33	28	33	33
CYTO-3Y, 21/COTEST-10Y, 30	1.53	2.42	1.86	1.77	1.82	0.43	1.38	0.93	0.72	0.83	54	27	26	30	28
COTEST-5Y, 25/COTEST-10Y, 30	1.48	2.45	1.78	1.78	1.78	0.43	1.40	0.87	0.72	0.80	54	27	27	29	28
COTEST-5Y, 30	1.61	2.18	1.67	1.66	1.66	0.43	1.20	0.80	0.66	0.73	53	31	27	30	30
COTEST-5Y, 30/COTEST-10Y, 40	1.67	2.33	1.74	1.83	1.78	0.45	1.32	0.85	0.74	0.79	53	29	26	28	28
COTEST-5Y, 35	1.91	2.33	1.79	1.94	1.92	0.49	1.27	0.82	0.74	0.78	49	28	25	26	27
COTEST-5Y, 35/COTEST-10Y, 40	1.98	2.49	1.88	2.10	2.04	0.51	1.41	0.89	0.81	0.85	48	25	24	24	24

	Cervical Cancer Cases per 1,000					Cervical Cancer Deaths per 1,000					Life-Years Gained per 1,000				
Strategy[b]	**H**	**M**	**P**	**U**	**Med[c]**	**H**	**M**	**P**	**U**	**Med[c]**	**H**	**M**	**P**	**U**	**Med***
COTEST-5Y, 40	2.28	2.56	1.94	2.26	2.27	0.59	1.41	0.88	0.86	0.87	43	23	23	21	23
COTEST-10Y, 30	1.71	2.56	1.85	2.01	1.93	0.46	1.47	0.89	0.79	0.84	52	24	25	26	26
COTEST-10Y, 40	2.34	2.79	2.10	2.48	2.41	0.61	1.59	0.97	0.96	0.97	42	19	21	19	20
End Age 65[d]															
CYTO-3Y, 21[e]	**1.80**	**2.07**	**1.86**	**1.68**	**1.83**	**0.52**	**1.08**	**0.89**	**0.67**	**0.78**	**52**	**34**	**27**	**31**	**32**
CYTO-3Y, 21/HPV-5Y, 30[e]	**1.41**	**1.96**	**1.79**	**1.45**	**1.62**	**0.40**	**1.05**	**0.86**	**0.58**	**0.72**	**55**	**34**	**27**	**32**	**33**
CYTO-3Y, 21/COTEST-5Y, 30[e]	**1.38**	**1.92**	**1.54**	**1.38**	**1.46**	**0.39**	**1.02**	**0.73**	**0.54**	**0.64**	**55**	**35**	**30**	**33**	**34**
CYTO-4Y, 21/HPV-5Y, 25	1.37	1.96	1.80	1.44	1.62	0.39	1.05	0.85	0.57	0.71	56	34	27	33	34
CYTO-4Y, 21/HPV-10Y, 25	1.54	2.39	2.11	1.87	1.99	0.44	1.33	1.01	0.75	0.88	54	26	23	28	27
HPV-5Y, 25[e]	**1.38**	**1.99**	**1.75**	**1.49**	**1.62**	**0.39**	**1.06**	**0.83**	**0.59**	**0.71**	**55**	**33**	**27**	**32**	**32**
HPV-5Y, 25/HPV-10Y, 35	1.47	2.26	1.97	1.76	1.86	0.42	1.26	0.96	0.71	0.83	54	29	24	29	29
HPV-5Y, 30	1.60	2.05	1.78	1.65	1.71	0.42	1.08	0.82	0.65	0.74	53	32	26	29	30
HPV-5Y, 30/HPV-10Y, 35	1.70	2.37	1.98	1.93	1.96	0.45	1.33	0.94	0.76	0.85	52	27	23	27	27
HPV-5Y, 35	1.93	2.22	1.93	1.92	1.93	0.49	1.18	0.86	0.72	0.79	48	29	24	26	28
HPV-5Y, 35/HPV-10Y, 45	1.98	2.38	2.01	2.06	2.04	0.51	1.30	0.94	0.79	0.86	48	27	23	24	26
HPV-5Y, 40	2.29	2.43	2.04	2.22	2.25	0.59	1.30	0.92	0.84	0.88	43	24	21	21	22
HPV-10Y, 25	1.54	2.46	2.08	1.94	2.01	0.44	1.38	1.01	0.76	0.88	54	25	22	27	26
HPV-10Y, 35	2.05	2.58	2.19	2.25	2.22	0.53	1.44	1.03	0.85	0.94	47	23	20	22	22
CYTO-4Y, 21/COTEST-5Y, 25	1.34	1.94	1.53	1.36	1.44	0.38	1.02	0.72	0.53	0.62	56	35	30	34	34
CYTO-4Y, 21/COTEST-10Y, 25	1.47	2.40	1.73	1.75	1.74	0.41	1.33	0.82	0.70	0.76	54	27	27	29	28
COTEST-5Y, 25	1.35	1.97	1.53	1.40	1.47	0.38	1.04	0.72	0.54	0.63	56	34	29	33	34
COTEST-5Y, 25/COTEST-10Y, 35	1.43	2.23	1.65	1.63	1.64	0.41	1.24	0.78	0.66	0.72	55	30	28	31	30
COTEST-5Y, 30	1.57	2.05	1.52	1.58	1.58	0.42	1.09	0.69	0.62	0.65	53	32	29	30	31
COTEST-5Y, 30/COTEST-10Y, 35	1.66	2.36	1.68	1.82	1.75	0.44	1.31	0.78	0.72	0.75	52	27	27	28	28
COTEST-5Y, 35	1.88	2.19	1.66	1.86	1.87	0.48	1.15	0.73	0.70	0.72	49	29	27	26	28

	Cervical Cancer Cases per 1,000					Cervical Cancer Deaths per 1,000					Life-Years Gained per 1,000				
Strategy[b]	**H**	**M**	**P**	**U**	**Med[c]**	**H**	**M**	**P**	**U**	**Med[c]**	**H**	**M**	**P**	**U**	**Med***
COTEST-5Y, 35/COTEST-10Y, 45	1.93	2.35	1.75	1.97	1.95	0.49	1.28	0.78	0.76	0.77	48	27	26	25	26
COTEST-5Y, 40	2.25	2.40	1.83	2.17	2.21	0.58	1.28	0.79	0.81	0.80	43	25	24	22	24
COTEST-10Y, 25	1.48	2.42	1.74	1.79	1.77	0.42	1.35	0.81	0.72	0.76	54	26	27	28	28
COTEST-10Y, 35	1.98	2.55	1.85	2.14	2.06	0.50	1.41	0.83	0.82	0.82	48	23	24	23	24
End Age 70[d]															
CYTO-3Y, 21	1.72	1.96	1.73	1.59	1.73	0.48	0.98	0.79	0.63	0.71	52	35	28	31	33
CYTO-3Y, 21/HPV-5Y, 30	1.38	1.88	1.69	1.38	1.54	0.39	0.97	0.78	0.53	0.66	55	35	28	33	34
CYTO-3Y, 21/COTEST-5Y, 30	1.36	1.86	1.44	1.30	1.40	0.38	0.94	0.65	0.50	0.58	55	36	30	34	35
CYTO-4Y, 21/HPV-5Y, 25	1.35	1.89	1.70	1.37	1.53	0.38	0.97	0.76	0.53	0.65	56	35	28	33	34
CYTO-3Y, 21/HPV-10Y, 30	1.52	2.32	1.99	1.76	1.87	0.43	1.27	0.95	0.70	0.82	54	28	24	29	28
HPV-5Y, 25	1.35	1.90	1.64	1.42	1.53	0.38	0.98	0.73	0.54	0.63	55	34	28	33	34
HPV-5Y, 25/HPV-10Y, 30	1.48	2.34	1.95	1.80	1.87	0.42	1.28	0.91	0.71	0.81	54	27	24	28	28
HPV-5Y, 30	1.57	2.00	1.68	1.58	1.63	0.41	1.03	0.74	0.60	0.67	53	32	27	30	31
HPV-5Y, 30/HPV-10Y, 40	1.65	2.23	1.89	1.81	1.85	0.44	1.21	0.87	0.70	0.79	52	29	24	28	28
HPV-5Y, 35	1.90	2.14	1.78	1.85	1.88	0.48	1.11	0.75	0.69	0.72	48	29	25	26	28
HPV-5Y, 35/HPV-10Y, 40	1.98	2.38	2.01	2.10	2.05	0.51	1.30	0.92	0.79	0.86	48	26	22	24	25
HPV-5Y, 40	2.26	2.36	1.96	2.16	2.21	0.58	1.23	0.84	0.80	0.82	43	25	22	22	24
HPV-10Y, 30	1.73	2.46	2.03	2.01	2.02	0.46	1.35	0.95	0.77	0.86	51	24	22	25	24
HPV-10Y, 40	2.38	2.69	2.24	2.45	2.42	0.62	1.48	1.01	0.92	0.97	42	20	18	19	20
CYTO-4Y, 21/COTEST-5Y, 25	1.31	1.86	1.42	1.28	1.36	0.37	0.96	0.63	0.49	0.56	56	35	30	34	34
CYTO-3Y, 21/COTEST-10Y, 30	1.47	2.30	1.68	1.64	1.66	0.41	1.25	0.77	0.65	0.71	54	28	27	30	29
COTEST-5Y, 25/COTEST-10Y, 30	1.43	2.32	1.60	1.67	1.63	0.40	1.26	0.73	0.65	0.69	55	28	28	30	29
COTEST-5Y, 30	1.54	1.96	1.43	1.50	1.52	0.41	1.00	0.62	0.57	0.59	53	33	29	31	32
COTEST-5Y, 30/COTEST-10Y, 40	1.61	2.21	1.58	1.71	1.66	0.43	1.19	0.71	0.67	0.69	53	30	28	29	30
COTEST-5Y, 35	1.85	2.12	1.58	1.77	1.81	0.47	1.08	0.66	0.66	0.66	49	30	27	27	28

	Cervical Cancer Cases per 1,000					Cervical Cancer Deaths per 1,000					Life-Years Gained per 1,000				
Strategy[b]	**H**	**M**	**P**	**U**	**Med[c]**	**H**	**M**	**P**	**U**	**Med[c]**	**H**	**M**	**P**	**U**	**Med***
COTEST-5Y, 35/COTEST-10Y, 40	1.93	2.37	1.71	1.99	1.96	0.49	1.27	0.74	0.74	0.74	48	26	26	25	26
COTEST-5Y, 40	2.22	2.35	1.76	2.10	2.16	0.57	1.22	0.74	0.77	0.76	43	25	24	22	24
COTEST-10Y, 30	1.66	2.46	1.70	1.89	1.80	0.44	1.34	0.76	0.73	0.74	52	25	26	26	26
COTEST-10Y, 40	2.31	2.67	1.93	2.36	2.33	0.60	1.45	0.84	0.89	0.86	42	20	22	20	21

Abbreviations: CYTO, cytology; HPV, Human papillomavirus; H, Harvard model; M, MISCAN-Cervix model; P, Policy1-Cervix model; U, University of Minnesota model.

[a] Outcomes calculated from age 21 to 100 years.

[b] Strategies are denoted by the screening modality, interval, age to begin screening/screening modality after switch age, interval after switch age, switch age for each end age category. For example, CYTO-3Y, 21 indicates cytology testing every 3 years starting at age 21, and CYTO-3Y, 21/HPV-5Y,30 indicates cytology testing every 3 years starting at age 21 with a switch to HPV testing every 5 years starting at age 30.

[c] Median outcome across the four models.

[d] End age indicates the age at which the final routine screen should occur, irrespective of age at last screen; exceptions include female persons who are recommended to continue screening due to prior abnormal results and/or precancer treatment.

[e] Strategies (bolded) represent current US recommended strategies.

Table 28. Lifetime Number of Total Tests and Colposcopies Among 2vHPV or 4vHPV Vaccinated Female Persons Assuming Imperfect Screening and Follow-up Adherence by Model[a]

	Total Tests per 1,000 [b]					Colposcopies per 1,000				
Strategy[c]	**H**	**M**	**P**	**U**	**Med[d]**	**H**	**M**	**P**	**U**	**Med[d]**
No Screening	0	0	0	0	0	0	0	0	0	0
End Age 60[e]										
CYTO-3Y, 21	14,782	13,811	11,112	14,261	14,036	407	440	266	447	424
CYTO-3Y, 21/HPV-5Y, 30	11,167	10,479	8,985	10,669	10,574	487	536	194	527	507
CYTO-3Y, 21/COTEST-5Y, 30	20,981	16,286	15,423	17,995	17,140	668	563	344	634	598
CYTO-4Y, 21/HPV-5Y, 25	10,120	9,363	8,395	9,745	9,554	544	562	195	559	551
CYTO-3Y, 21/HPV-10Y, 30	8,427	7,770	6,874	8,078	7,924	404	419	167	419	411
HPV-5Y, 25	9,019	8,115	7,583	8,337	8,226	524	483	181	496	490
HPV-5Y, 25/HPV-10Y, 30	6,348	5,668	5,453	5,818	5,743	443	385	154	390	388
HPV-5Y, 30	7,599	6,802	6,385	7,130	6,966	386	332	118	389	359
HPV-5Y, 30/HPV-10Y, 40	5,955	5,386	5,066	5,634	5,510	345	289	105	347	317
HPV-5Y, 35	6,361	5,674	5,408	5,972	5,823	292	235	88	277	256
HPV-5Y, 35/HPV-10Y, 40	4,609	4,103	4,002	4,318	4,210	248	188	72	232	210
HPV-5Y, 40	5,113	4,459	4,485	4,698	4,591	221	150	66	185	168
HPV-10Y, 30	4,760	4,012	4,000	4,409	4,211	298	209	84	269	239
HPV-10Y, 40	3,387	2,761	2,875	3,026	2,951	175	97	46	135	116
CYTO-4Y, 21/COTEST-5Y, 25	21,088	16,217	15,916	18,374	17,295	748	605	376	692	649
CYTO-3Y, 21/COTEST-10Y, 30	15,034	11,185	11,323	12,885	12,104	527	436	272	502	469
COTEST-5Y, 25/COTEST-10Y, 30	14,060	10,412	11,389	11,987	11,688	576	423	302	500	462
COTEST-5Y, 30	16,911	12,749	13,149	14,507	13,828	559	362	278	499	430
COTEST-5Y, 30/COTEST-10Y, 40	13,235	10,047	10,651	11,542	11,096	474	315	237	442	379
COTEST-5Y, 35	14,234	10,717	11,175	12,187	11,681	437	256	221	365	310
COTEST-5Y, 35/COTEST-10Y, 40	10,320	7,715	8,502	8,898	8,700	347	204	177	303	253
COTEST-5Y, 40	11,531	8,502	9,311	9,644	9,477	339	165	175	253	214
COTEST-10Y, 30	10,677	7,504	8,530	9,144	8,837	410	228	193	353	291
COTEST-10Y, 40	7,745	5,259	6,166	6,281	6,223	257	107	122	184	153
End Age 65[e]										
CYTO-3Y, 21[f]	**16,085**	**15,107**	**12,103**	**15,557**	**15,332**	**436**	**457**	**286**	**472**	**447**
CYTO-3Y, 21/HPV-5Y, 30[f]	**11,873**	**11,158**	**9,609**	**11,311**	**11,234**	**504**	**553**	**201**	**536**	**520**
CYTO-3Y, 21/COTEST-5Y, 30[f]	**22,355**	**17,585**	**16,697**	**19,312**	**18,449**	**697**	**582**	**365**	**652**	**617**
CYTO-4Y, 21/HPV-5Y, 25	10,875	10,116	9,016	10,460	10,288	561	581	201	569	565
CYTO-4Y, 21/HPV-10Y, 25	7,148	6,432	6,126	6,868	6,650	437	406	157	400	403
HPV-5Y, 25[f]	**9,773**	**8,868**	**8,199**	**9,054**	**8,961**	**542**	**503**	**187**	**506**	**504**
HPV-5Y, 25/HPV-10Y, 35	7,300	6,687	6,228	6,793	6,740	476	445	166	437	441
HPV-5Y, 30	8,275	7,478	7,005	7,765	7,621	403	350	125	397	374
HPV-5Y, 30/HPV-10Y, 35	5,735	5,211	4,947	5,417	5,314	335	288	102	325	307
HPV-5Y, 35	7,031	6,335	6,018	6,560	6,448	308	252	95	285	269
HPV-5Y, 35/HPV-10Y, 45	5,463	4,971	4,758	5,152	5,061	272	214	82	258	236
HPV-5Y, 40	5,910	5,264	5,102	5,479	5,372	238	170	72	196	183
HPV-10Y, 25	5,988	5,156	5,121	5,411	5,283	412	325	140	332	328
HPV-10Y, 35	4,334	3,761	3,753	4,028	3,894	235	170	68	204	187
CYTO-4Y, 21/COTEST-5Y, 25	22,573	17,657	17,182	19,855	18,756	779	626	396	712	669

Strategy[c]	Total Tests per 1,000 [b] H	M	P	U	Med[d]	Colposcopies per 1,000 H	M	P	U	Med[d]
CYTO-4Y, 21/COTEST-10Y, 25	14,539	10,754	11,579	12,705	12,142	576	436	290	501	468
COTEST-5Y, 25	21,437	16,474	16,716	18,462	17,589	758	549	394	650	599
COTEST-5Y, 25/COTEST-10Y, 35	16,018	12,289	12,914	13,868	13,391	629	486	330	556	521
COTEST-5Y, 30	18,261	14,041	14,414	15,866	15,140	588	381	298	517	449
COTEST-5Y, 30/COTEST-10Y, 35	12,675	9,693	10,438	11,175	10,806	456	314	232	419	366
COTEST-5Y, 35	15,575	11,983	12,438	13,405	12,921	466	275	242	382	328
COTEST-5Y, 35/COTEST-10Y, 45	12,088	9,376	10,037	10,596	10,317	389	232	203	338	285
COTEST-5Y, 40	13,144	10,048	10,578	11,235	10,906	372	187	196	273	235
COTEST-10Y, 25	13,242	9,520	10,777	11,230	11,003	549	356	280	435	396
COTEST-10Y, 35	9,661	7,070	8,003	8,373	8,188	334	185	167	273	229
End Age 70[e]										
CYTO-3Y, 21	17,461	16,467	13,003	16,942	16,705	467	473	303	500	470
CYTO-3Y, 21/HPV-5Y, 30	12,537	11,851	10,162	11,968	11,909	519	570	206	547	533
CYTO-3Y, 21/COTEST-5Y, 30	23,648	18,914	17,829	20,683	19,799	722	601	383	670	636
CYTO-4Y, 21/HPV-5Y, 25	11,515	10,803	9,566	11,123	10,963	575	598	207	578	577
CYTO-3Y, 21/HPV-10Y, 30	9,045	8,409	7,463	8,688	8,549	420	435	174	430	425
HPV-5Y, 25	10,468	9,559	8,757	9,727	9,643	557	519	193	516	518
HPV-5Y, 25/HPV-10Y, 30	7,013	6,307	6,038	6,474	6,391	460	402	160	401	401
HPV-5Y, 30	8,963	8,173	7,556	8,436	8,305	418	367	131	408	388
HPV-5Y, 30/HPV-10Y, 40	6,626	6,035	5,659	6,300	6,168	361	305	111	356	331
HPV-5Y, 35	7,642	6,952	6,572	7,150	7,051	322	268	100	294	281
HPV-5Y, 35/HPV-10Y, 40	5,237	4,751	4,597	4,934	4,842	264	204	79	242	223
HPV-5Y, 40	6,513	5,860	5,648	6,020	5,940	252	185	77	204	195
HPV-10Y, 30	5,388	4,653	4,593	5,023	4,838	315	225	91	279	252
HPV-10Y, 40	3,965	3,407	3,470	3,636	3,553	190	114	53	144	129
CYTO-4Y, 21/COTEST-5Y, 25	23,805	18,974	18,317	21,128	20,051	803	645	414	728	686
CYTO-3Y, 21/COTEST-10Y, 30	16,211	12,411	12,525	14,146	13,336	552	454	291	519	487
COTEST-5Y, 25/COTEST-10Y, 30	15,318	11,636	12,586	13,295	12,940	603	440	322	519	479
COTEST-5Y, 30	19,614	15,372	15,550	17,260	16,405	614	400	316	535	468
COTEST-5Y, 30/COTEST-10Y, 40	14,509	11,289	11,872	12,896	12,384	501	333	257	460	396
COTEST-5Y, 35	16,781	13,164	13,574	14,663	14,118	490	292	260	397	344
COTEST-5Y, 35/COTEST-10Y, 40	11,519	8,957	9,734	10,213	9,974	374	222	197	321	271
COTEST-5Y, 40	14,335	11,188	11,705	12,350	12,027	396	204	214	288	251
COTEST-10Y, 30	11,868	8,731	9,778	10,448	10,113	436	246	214	370	308
COTEST-10Y, 40	8,768	6,497	7,429	7,583	7,506	279	125	143	203	173

Abbreviations: CYTO, cytology; HPV, Human papillomavirus; H, Harvard model; M, MISCAN-Cervix model; P, Policy1-Cervix model; U, University of Minnesota model.
[a] Outcomes calculated from age 21 to 100 years.
[b] Total number of tests including cytology and HPV tests, irrespective of primary, triage or surveillance context.
[c] Strategies are denoted by the screening modality, interval, age to begin screening/screening modality after switch age, interval after switch age, switch age for each end age category. For example, CYTO-3Y, 21 indicates cytology testing every 3 years starting at age 21, and CYTO-3Y, 21/HPV-5Y,30 indicates cytology testing every 3 years starting at age 21 with a switch to HPV testing every 5 years starting at age 30.
[d] Median outcome across the four models.
[e] End age indicates the age at which the final routine screen should occur, irrespective of age at last screen; exceptions include female persons who are recommended to continue screening due to prior abnormal results and/or precancer treatment.
[f] Strategies (bolded) represent current US recommended strategies.

Table 29. Lifetime Number of CIN2+ Detected and False Positives Among 2vHPV or 4vHPV Vaccinated Female Persons Assuming Imperfect Screening and Follow-up Adherence by Model[a]

	CIN2+ detected per 1,000[b]					False Positives per 1,000[c]				
Strategy[d]	**H**	**M**	**P**	**U**	**Med[e]**	**H**	**M**	**P**	**U**	**Med[e]**
No Screening	0	0	0	0	0	0	0	0	0	0
End Age 60[f]										
CYTO-3Y, 21	56	27	37	119	46	330	282	216	328	305
CYTO-3Y, 21/HPV-5Y, 30	65	29	37	128	51	398	348	143	399	373
CYTO-3Y, 21/COTEST-5Y, 30	68	30	40	134	54	574	367	290	500	434
CYTO-4Y, 21/HPV-5Y, 25	65	29	35	128	50	454	368	146	430	399
CYTO-3Y, 21/HPV-10Y, 30	60	25	34	113	47	321	269	120	306	288
HPV-5Y, 25	61	24	31	113	46	440	318	139	383	350
HPV-5Y, 25/HPV-10Y, 30	57	20	28	98	42	365	252	115	292	272
HPV-5Y, 30	49	17	21	87	35	319	218	89	302	260
HPV-5Y, 30/HPV-10Y, 40	47	16	20	83	33	280	188	77	264	226
HPV-5Y, 35	38	12	16	64	27	239	154	66	213	183
HPV-5Y, 35/HPV-10Y, 40	36	11	14	59	25	198	122	53	173	147
HPV-5Y, 40	31	8	12	45	22	178	98	49	141	119
HPV-10Y, 30	44	12	17	70	31	238	135	60	200	167
HPV-10Y, 40	28	6	10	38	19	136	62	32	97	79
CYTO-4Y, 21/COTEST-5Y, 25	70	30	39	137	55	651	398	322	555	477
CYTO-3Y, 21/COTEST-10Y, 30	63	26	37	120	50	440	281	221	382	332
COTEST-5Y, 25/COTEST-10Y, 30	61	21	33	108	47	492	277	256	393	335
COTEST-5Y, 30	53	18	25	94	39	486	238	244	405	324
COTEST-5Y, 30/COTEST-10Y, 40	50	16	24	90	37	404	206	205	352	279
COTEST-5Y, 35	41	13	18	68	30	380	168	196	297	246
COTEST-5Y, 35/COTEST-10Y, 40	39	11	17	64	28	294	132	153	240	196
COTEST-5Y, 40	33	9	14	47	24	294	108	156	206	181
COTEST-10Y, 30	47	13	21	77	34	345	148	164	276	220
COTEST-10Y, 40	31	7	12	41	22	215	69	105	143	124
End Age 65[f]										
CYTO-3Y, 21[g]	**58**	**28**	**38**	**120**	**48**	**357**	**293**	**234**	**352**	**322**
CYTO-3Y, 21/HPV-5Y, 30[g]	**66**	**30**	**38**	**129**	**52**	**413**	**360**	**149**	**407**	**384**
CYTO-3Y, 21/COTEST-5Y, 30[g]	**70**	**31**	**41**	**135**	**55**	**601**	**380**	**309**	**517**	**448**
CYTO-4Y, 21/HPV-5Y, 25	67	30	36	130	52	470	381	151	439	410
CYTO-4Y, 21/HPV-10Y, 25	59	23	31	105	45	355	263	115	295	279
HPV-5Y, 25[g]	**63**	**25**	**32**	**114**	**47**	**456**	**331**	**144**	**392**	**361**
HPV-5Y, 25/HPV-10Y, 35	59	23	30	106	45	394	292	125	331	311
HPV-5Y, 30	50	18	22	88	36	334	230	95	309	269
HPV-5Y, 30/HPV-10Y, 35	47	15	20	80	33	271	188	74	246	217
HPV-5Y, 35	40	13	17	65	28	253	166	71	220	193
HPV-5Y, 35/HPV-10Y, 45	38	12	16	63	27	220	139	60	195	167
HPV-5Y, 40	32	9	13	46	23	194	111	54	150	131
HPV-10Y, 25	55	18	26	88	41	336	211	104	244	227
HPV-10Y, 35	36	10	14	54	25	186	110	49	150	130
CYTO-4Y, 21/COTEST-5Y, 25	72	31	40	138	56	680	412	341	573	493

Strategy[d]	CIN2+ detected per 1,000[b] H	M	P	U	Med[e]	False Positives per 1,000[c] H	M	P	U	Med[e]
CYTO-4Y, 21/COTEST-10Y, 25	63	24	36	114	50	489	283	241	387	335
COTEST-5Y, 25	68	26	37	123	52	665	362	343	527	445
COTEST-5Y, 25/COTEST-10Y, 35	64	24	35	115	50	541	319	282	440	380
COTEST-5Y, 30	54	18	25	95	40	513	251	263	422	343
COTEST-5Y, 30/COTEST-10Y, 35	50	16	24	87	37	387	205	199	332	269
COTEST-5Y, 35	43	13	19	69	31	407	181	216	312	264
COTEST-5Y, 35/COTEST-10Y, 45	40	12	18	67	29	333	152	178	271	225
COTEST-5Y, 40	35	9	15	48	25	324	123	175	225	200
COTEST-10Y, 25	59	19	32	98	45	467	233	236	337	287
COTEST-10Y, 35	38	10	17	59	28	282	120	143	214	179
End Age 70[f]										
CYTO-3Y, 21	59	29	39	122	49	385	304	250	378	341
CYTO-3Y, 21/HPV-5Y, 30	67	31	39	130	53	426	371	153	417	394
CYTO-3Y, 21/COTEST-5Y, 30	71	31	41	136	56	624	393	326	534	463
CYTO-4Y, 21/HPV-5Y, 25	68	30	37	131	53	481	392	156	447	420
CYTO-3Y, 21/HPV-10Y, 30	62	26	36	115	49	335	280	125	315	297
HPV-5Y, 25	64	25	33	115	48	468	342	149	401	371
HPV-5Y, 25/HPV-10Y, 30	59	21	29	100	44	379	262	120	301	282
HPV-5Y, 30	52	18	23	90	37	347	241	99	318	280
HPV-5Y, 30/HPV-10Y, 40	49	17	21	85	35	295	199	81	271	235
HPV-5Y, 35	41	13	18	66	29	265	176	76	228	202
HPV-5Y, 35/HPV-10Y, 40	38	12	16	61	27	212	132	58	181	156
HPV-5Y, 40	34	10	14	47	24	206	121	58	157	139
HPV-10Y, 30	46	13	19	72	32	252	145	65	207	176
HPV-10Y, 40	30	7	11	40	21	149	73	37	104	88
CYTO-4Y, 21/COTEST-5Y, 25	73	31	41	139	57	702	424	358	589	507
CYTO-3Y, 21/COTEST-10Y, 30	65	26	38	121	52	463	293	238	398	346
COTEST-5Y, 25/COTEST-10Y, 30	63	22	35	110	49	516	288	274	409	349
COTEST-5Y, 30	56	19	26	96	41	537	264	280	439	360
COTEST-5Y, 30/COTEST-10Y, 40	52	17	25	92	39	429	218	223	368	295
COTEST-5Y, 35	44	14	20	71	32	429	193	232	326	279
COTEST-5Y, 35/COTEST-10Y, 40	40	12	18	66	29	318	144	172	255	213
COTEST-5Y, 40	36	10	16	49	26	346	134	192	239	216
COTEST-10Y, 30	49	14	22	79	36	368	159	183	291	237
COTEST-10Y, 40	32	8	14	43	23	235	80	124	160	142

Abbreviations: CYTO, cytology; HPV, Human papillomavirus; CIN, cervical intraepithelial; H, Harvard model; M, MISCAN-Cervix model; P, Policy1-Cervix model; U, University of Minnesota model.
[a] Outcomes calculated from age 21 to 100 years.
[b] CIN2+ detected includes CIN2s, CIN3s and cervical cancers detected through screening (excludes clinically detected cancers).
[c] Total number of colposcopies that did not result in CIN2, CIN3 or cancer detection.
[d] Strategies are denoted by the screening modality, interval, age to begin screening/screening modality after switch age, interval after switch age, switch age for each end age category. For example, CYTO-3Y, 21 indicates cytology testing every 3 years starting at age 21, and CYTO-3Y, 21/HPV-5Y,30 indicates cytology testing every 3 years starting at age 21 with a switch to HPV testing every 5 years starting at age 30.
[e] Median outcome across the four models.
[f] End age indicates the age at which the final routine screen should occur, irrespective of age at last screen; exceptions include female persons who are recommended to continue screening due to prior abnormal results and/or precancer treatment.
[g] Strategies (bolded) represent current US recommended strategies.

Table 30. Lifetime Number of Cervical Cancer Cases, Deaths and Life-Years Gained Among 9vHPV Vaccinated Female Persons Assuming Imperfect Screening and Follow-up Adherence by Model[a]

	Cervical Cancer Cases per 1,000					Cervical Cancer Deaths per 1,000					Life-Years Gained per 1,000				
Strategy[b]	**H**	**M**	**P**	**U**	**Med[c]**	**H**	**M**	**P**	**U**	**Med[c]**	**H**	**M**	**P**	**U**	**Med***
No Screening	3.53	1.60	1.40	1.38	1.50	1.26	1.07	0.76	0.73	0.92	0	0	0	0	0
End Age 60[d]															
CYTO-3Y, 21	0.91	0.93	0.82	0.53	0.87	0.30	0.51	0.42	0.27	0.36	23	14	9	9	12
CYTO-3Y, 21/HPV-5Y, 30	0.65	0.88	0.78	0.44	0.72	0.21	0.50	0.40	0.21	0.30	25	14	9	9	12
CYTO-3Y, 21/COTEST-5Y, 30	0.64	0.87	0.67	0.42	0.66	0.20	0.49	0.34	0.20	0.27	25	14	10	10	12
CYTO-4Y, 21/HPV-5Y, 25	0.65	0.90	0.79	0.43	0.72	0.21	0.51	0.40	0.21	0.30	25	14	9	10	12
CYTO-3Y, 21/HPV-10Y, 30	0.73	1.03	0.89	0.53	0.81	0.23	0.61	0.44	0.26	0.35	24	11	8	8	10
HPV-5Y, 25	0.66	0.90	0.76	0.44	0.71	0.21	0.51	0.39	0.21	0.30	25	14	9	10	12
HPV-5Y, 25/HPV-10Y, 30	0.72	1.05	0.84	0.54	0.78	0.22	0.61	0.42	0.26	0.34	24	11	8	8	10
HPV-5Y, 30	0.68	0.93	0.75	0.45	0.72	0.21	0.52	0.36	0.22	0.29	24	13	9	9	11
HPV-5Y, 30/HPV-10Y, 40	0.73	1.00	0.80	0.53	0.76	0.22	0.58	0.39	0.26	0.33	24	12	8	8	10
HPV-5Y, 35	0.74	1.00	0.78	0.47	0.76	0.22	0.56	0.38	0.23	0.30	23	12	8	9	10
HPV-5Y, 35/HPV-10Y, 40	0.79	1.07	0.84	0.55	0.81	0.24	0.62	0.41	0.27	0.34	23	10	8	8	9
HPV-5Y, 40	0.81	1.10	0.82	0.50	0.82	0.24	0.63	0.39	0.23	0.32	22	9	8	9	9
HPV-10Y, 30	0.75	1.10	0.86	0.56	0.81	0.23	0.64	0.43	0.27	0.35	24	10	8	8	9
HPV-10Y, 40	0.88	1.19	0.93	0.59	0.90	0.26	0.71	0.45	0.28	0.36	22	8	6	7	8
CYTO-4Y, 21/COTEST-5Y, 25	0.63	0.88	0.68	0.42	0.65	0.20	0.50	0.34	0.20	0.27	25	14	10	10	12
CYTO-3Y, 21/COTEST-10Y, 30	0.69	1.02	0.76	0.50	0.73	0.22	0.60	0.38	0.24	0.31	24	12	9	9	10
COTEST-5Y, 25/COTEST-10Y, 30	0.70	1.03	0.73	0.51	0.72	0.22	0.60	0.36	0.25	0.30	24	12	9	9	10
COTEST-5Y, 30	0.68	0.92	0.65	0.43	0.67	0.20	0.51	0.32	0.21	0.26	24	14	10	9	12
COTEST-5Y, 30/COTEST-10Y, 40	0.72	0.99	0.69	0.49	0.71	0.22	0.57	0.34	0.24	0.29	24	12	10	9	11
COTEST-5Y, 35	0.72	0.99	0.69	0.45	0.70	0.22	0.55	0.33	0.21	0.27	24	12	9	9	10
COTEST-5Y, 35/COTEST-10Y, 40	0.76	1.07	0.74	0.52	0.75	0.23	0.62	0.36	0.26	0.31	23	11	9	8	10

	Cervical Cancer Cases per 1,000					Cervical Cancer Deaths per 1,000					Life-Years Gained per 1,000				
Strategy[b]	**H**	**M**	**P**	**U**	**Med[c]**	**H**	**M**	**P**	**U**	**Med[c]**	**H**	**M**	**P**	**U**	**Med***
COTEST-5Y, 40	0.80	1.09	0.73	0.48	0.76	0.23	0.62	0.33	0.23	0.28	23	10	9	9	10
COTEST-10Y, 30	0.73	1.09	0.74	0.53	0.74	0.22	0.64	0.36	0.26	0.31	24	10	9	8	10
COTEST-10Y, 40	0.84	1.18	0.81	0.56	0.83	0.25	0.69	0.38	0.27	0.33	22	8	8	8	8
End Age 65[d]															
CYTO-3Y, 21[e]	**0.84**	**0.87**	**0.75**	**0.49**	**0.80**	**0.27**	**0.47**	**0.37**	**0.24**	**0.32**	**23**	**15**	**10**	**9**	**12**
CYTO-3Y, 21/HPV-5Y, 30[e]	**0.64**	**0.83**	**0.74**	**0.40**	**0.69**	**0.20**	**0.45**	**0.35**	**0.18**	**0.28**	**25**	**15**	**9**	**10**	**12**
CYTO-3Y, 21/COTEST-5Y, 30[e]	**0.63**	**0.82**	**0.62**	**0.37**	**0.63**	**0.20**	**0.45**	**0.29**	**0.17**	**0.24**	**25**	**15**	**11**	**10**	**13**
CYTO-4Y, 21/HPV-5Y, 25	0.64	0.84	0.73	0.39	0.68	0.20	0.46	0.35	0.18	0.28	25	14	9	10	12
CYTO-4Y, 21/HPV-10Y, 25	0.71	1.04	0.85	0.51	0.78	0.22	0.60	0.41	0.24	0.33	24	11	8	8	10
HPV-5Y, 25[e]	**0.65**	**0.85**	**0.71**	**0.40**	**0.68**	**0.20**	**0.46**	**0.34**	**0.19**	**0.27**	**25**	**14**	**10**	**10**	**12**
HPV-5Y, 25/HPV-10Y, 35	0.69	0.96	0.77	0.50	0.73	0.22	0.55	0.38	0.24	0.31	24	12	9	8	10
HPV-5Y, 30	0.67	0.88	0.70	0.42	0.69	0.20	0.48	0.33	0.20	0.27	24	14	10	9	12
HPV-5Y, 30/HPV-10Y, 35	0.73	1.01	0.78	0.51	0.75	0.22	0.58	0.38	0.24	0.31	24	11	8	8	10
HPV-5Y, 35	0.73	0.94	0.72	0.43	0.73	0.22	0.52	0.33	0.20	0.28	23	12	9	9	10
HPV-5Y, 35/HPV-10Y, 45	0.77	1.01	0.79	0.49	0.78	0.23	0.57	0.37	0.24	0.30	23	11	8	8	10
HPV-5Y, 40	0.81	1.04	0.80	0.46	0.80	0.24	0.57	0.36	0.21	0.30	22	10	8	9	10
HPV-10Y, 25	0.71	1.03	0.84	0.51	0.78	0.22	0.59	0.41	0.24	0.33	24	11	8	8	10
HPV-10Y, 35	0.80	1.10	0.86	0.54	0.83	0.24	0.63	0.40	0.25	0.33	23	10	7	8	9
CYTO-4Y, 21/COTEST-5Y, 25	0.62	0.84	0.62	0.37	0.62	0.20	0.45	0.29	0.17	0.24	25	15	11	10	13
CYTO-4Y, 21/COTEST-10Y, 25	0.68	1.02	0.69	0.47	0.68	0.21	0.58	0.33	0.23	0.28	24	11	10	9	10
COTEST-5Y, 25	0.63	0.84	0.60	0.37	0.62	0.20	0.46	0.29	0.17	0.24	25	14	11	10	12
COTEST-5Y, 25/COTEST-10Y, 35	0.68	0.95	0.66	0.46	0.67	0.21	0.54	0.32	0.22	0.27	24	13	10	9	12
COTEST-5Y, 30	0.67	0.86	0.61	0.39	0.64	0.20	0.47	0.28	0.18	0.24	24	14	10	10	12
COTEST-5Y, 30/COTEST-10Y, 35	0.71	0.99	0.68	0.47	0.69	0.21	0.56	0.32	0.23	0.27	24	12	10	9	11
COTEST-5Y, 35	0.71	0.93	0.64	0.41	0.67	0.21	0.51	0.28	0.19	0.25	24	12	10	9	11

	Cervical Cancer Cases per 1,000					Cervical Cancer Deaths per 1,000					Life-Years Gained per 1,000				
Strategy[b]	**H**	**M**	**P**	**U**	**Med[c]**	**H**	**M**	**P**	**U**	**Med[c]**	**H**	**M**	**P**	**U**	**Med***
COTEST-5Y, 35/COTEST-10Y, 45	0.74	1.00	0.67	0.46	0.71	0.22	0.55	0.30	0.22	0.26	23	12	9	9	10
COTEST-5Y, 40	0.79	1.03	0.69	0.44	0.74	0.23	0.57	0.30	0.20	0.26	23	10	9	9	10
COTEST-10Y, 25	0.70	1.04	0.71	0.47	0.70	0.21	0.59	0.33	0.23	0.28	24	11	9	9	10
COTEST-10Y, 35	0.76	1.08	0.74	0.49	0.75	0.23	0.62	0.33	0.23	0.28	23	10	9	8	10
End Age 70[d]															
CYTO-3Y, 21	0.80	0.83	0.70	0.44	0.75	0.25	0.42	0.31	0.21	0.28	23	15	10	9	12
CYTO-3Y, 21/HPV-5Y, 30	0.63	0.80	0.67	0.37	0.65	0.20	0.42	0.30	0.17	0.25	25	15	10	10	12
CYTO-3Y, 21/COTEST-5Y, 30	0.63	0.79	0.59	0.35	0.61	0.19	0.41	0.26	0.16	0.23	25	15	11	10	13
CYTO-4Y, 21/HPV-5Y, 25	0.63	0.81	0.67	0.37	0.65	0.20	0.42	0.32	0.18	0.26	25	15	10	10	12
CYTO-3Y, 21/HPV-10Y, 30	0.71	0.98	0.80	0.49	0.75	0.22	0.56	0.37	0.24	0.31	24	12	9	8	10
HPV-5Y, 25	0.64	0.81	0.66	0.37	0.65	0.20	0.43	0.30	0.17	0.25	25	15	10	10	12
HPV-5Y, 25/HPV-10Y, 30	0.70	1.00	0.80	0.49	0.75	0.22	0.56	0.38	0.24	0.31	24	12	8	8	10
HPV-5Y, 30	0.67	0.85	0.67	0.39	0.67	0.20	0.45	0.30	0.18	0.25	24	14	10	9	12
HPV-5Y, 30/HPV-10Y, 40	0.72	0.95	0.75	0.48	0.73	0.22	0.53	0.35	0.23	0.29	24	12	9	8	10
HPV-5Y, 35	0.73	0.91	0.70	0.41	0.71	0.22	0.48	0.30	0.19	0.26	24	13	9	9	11
HPV-5Y, 35/HPV-10Y, 40	0.78	1.02	0.79	0.50	0.78	0.23	0.57	0.36	0.24	0.30	23	11	8	8	10
HPV-5Y, 40	0.80	1.01	0.76	0.44	0.78	0.23	0.54	0.33	0.20	0.28	22	10	8	9	10
HPV-10Y, 30	0.74	1.05	0.81	0.51	0.77	0.23	0.59	0.38	0.24	0.31	24	10	8	8	9
HPV-10Y, 40	0.87	1.15	0.86	0.55	0.87	0.26	0.65	0.40	0.25	0.33	22	8	7	8	8
CYTO-4Y, 21/COTEST-5Y, 25	0.62	0.81	0.56	0.35	0.59	0.19	0.42	0.26	0.16	0.23	25	15	11	10	13
CYTO-3Y, 21/COTEST-10Y, 30	0.68	0.98	0.68	0.46	0.68	0.21	0.54	0.31	0.22	0.26	24	12	10	9	11
COTEST-5Y, 25/COTEST-10Y, 30	0.68	0.99	0.65	0.46	0.66	0.21	0.56	0.29	0.22	0.26	24	12	10	9	11
COTEST-5Y, 30	0.66	0.83	0.57	0.36	0.62	0.20	0.43	0.25	0.17	0.23	24	14	11	10	12
COTEST-5Y, 30/COTEST-10Y, 40	0.70	0.95	0.62	0.44	0.66	0.21	0.52	0.28	0.22	0.25	24	13	10	9	12
COTEST-5Y, 35	0.70	0.90	0.60	0.38	0.65	0.21	0.47	0.26	0.18	0.23	24	13	10	10	12

	Cervical Cancer Cases per 1,000					Cervical Cancer Deaths per 1,000					Life-Years Gained per 1,000				
Strategy[b]	**H**	**M**	**P**	**U**	**Med[c]**	**H**	**M**	**P**	**U**	**Med[c]**	**H**	**M**	**P**	**U**	**Med***
COTEST-5Y, 35/COTEST-10Y, 40	0.75	1.01	0.67	0.46	0.71	0.22	0.55	0.30	0.22	0.26	23	11	9	8	10
COTEST-5Y, 40	0.79	1.01	0.68	0.41	0.73	0.23	0.53	0.28	0.19	0.26	23	11	9	9	10
COTEST-10Y, 30	0.72	1.04	0.67	0.48	0.70	0.22	0.58	0.30	0.23	0.27	24	11	9	8	10
COTEST-10Y, 40	0.84	1.14	0.74	0.51	0.79	0.25	0.64	0.33	0.24	0.29	22	8	8	8	8

Abbreviations: CYTO, cytology; HPV, Human papillomavirus; H, Harvard model; M, MISCAN-Cervix model; P, Policy1-Cervix model; U, University of Minnesota model.
[a] Outcomes calculated from age 21 to 100 years.
[b] Strategies are denoted by the screening modality, interval, age to begin screening/screening modality after switch age, interval after switch age, switch age for each end age category. For example, CYTO-3Y, 21 indicates cytology testing every 3 years starting at age 21, and CYTO-3Y, 21/HPV-5Y,30 indicates cytology testing every 3 years starting at age 21 with a switch to HPV testing every 5 years starting at age 30.
[c] Median outcome across the four models.
[d] End age indicates the age at which the final routine screen should occur, irrespective of age at last screen; exceptions include female persons who are recommended to continue screening due to prior abnormal results and/or precancer treatment.
[e] Strategies (bolded) represent current US recommended strategies.

Table 31. Lifetime Number of Total Tests and Colposcopies Among 9vHPV Vaccinated Female Persons Assuming Imperfect Screening and Follow-up Adherence by Model[a]

	Total Tests per 1,000 [b]					Colposcopies per 1,000				
Strategy[c]	H	M	P	U	Med[d]	H	M	P	U	Med[d]
No Screening	0	0	0	0	0	0	0	0	0	0
End Age 60[e]										
CYTO-3Y, 21	14,581	13,555	10,990	14,059	13,807	341	276	227	335	305
CYTO-3Y, 21/HPV-5Y, 30	10,331	9,861	8,573	9,990	9,926	297	315	124	331	306
CYTO-3Y, 21/COTEST-5Y, 30	19,506	15,611	14,759	16,866	16,238	459	337	259	425	381
CYTO-4Y, 21/HPV-5Y, 25	9,061	8,622	7,852	8,939	8,780	304	317	108	337	310
CYTO-3Y, 21/HPV-10Y, 30	7,725	7,263	6,502	7,382	7,322	258	246	108	255	250
HPV-5Y, 25	7,935	7,425	6,998	7,572	7,498	283	266	91	295	275
HPV-5Y, 25/HPV-10Y, 30	5,409	5,068	4,915	5,052	5,060	245	208	75	221	214
HPV-5Y, 30	6,810	6,312	6,007	6,548	6,430	217	186	61	240	202
HPV-5Y, 30/HPV-10Y, 40	5,250	4,934	4,706	5,018	4,976	198	161	53	207	179
HPV-5Y, 35	5,770	5,333	5,120	5,559	5,446	166	133	46	177	149
HPV-5Y, 35/HPV-10Y, 40	4,090	3,796	3,745	3,882	3,839	146	105	37	143	124
HPV-5Y, 40	4,640	4,211	4,273	4,419	4,346	126	84	35	125	105
HPV-10Y, 30	4,136	3,669	3,698	3,873	3,786	176	114	42	159	137
HPV-10Y, 40	3,004	2,590	2,709	2,759	2,734	106	54	23	87	70
CYTO-4Y, 21/COTEST-5Y, 25	19,164	15,326	15,048	16,982	16,154	485	350	268	449	400
CYTO-3Y, 21/COTEST-10Y, 30	13,752	10,602	10,671	11,658	11,164	363	260	199	319	290
COTEST-5Y, 25/COTEST-10Y, 30	12,266	9,616	10,443	10,593	10,518	362	235	200	305	270
COTEST-5Y, 30	15,432	12,138	12,525	13,491	13,008	372	209	205	336	272
COTEST-5Y, 30/COTEST-10Y, 40	11,904	9,458	10,022	10,451	10,237	313	181	169	286	233
COTEST-5Y, 35	13,116	10,309	10,707	11,476	11,092	297	150	167	256	211
COTEST-5Y, 35/COTEST-10Y, 40	9,329	7,318	8,038	8,130	8,084	235	118	129	203	166
COTEST-5Y, 40	10,618	8,193	8,963	9,168	9,065	233	96	135	187	161
COTEST-10Y, 30	9,453	7,048	7,970	8,161	8,065	272	129	136	225	180
COTEST-10Y, 40	7,005	5,037	5,849	5,812	5,830	177	62	90	130	110
End Age 65[e]										
CYTO-3Y, 21[f]	**15,905**	**14,858**	**11,982**	**15,386**	**15,122**	**369**	**286**	**245**	**360**	**323**
CYTO-3Y, 21/HPV-5Y, 30[f]	**11,009**	**10,507**	**9,175**	**10,640**	**10,573**	**306**	**325**	**127**	**339**	**316**
CYTO-3Y, 21/COTEST-5Y, 30[f]	**20,856**	**16,871**	**16,010**	**18,196**	**17,533**	**480**	**349**	**276**	**441**	**395**
CYTO-4Y, 21/HPV-5Y, 25	9,804	9,353	8,452	9,666	9,510	313	328	112	345	320
CYTO-4Y, 21/HPV-10Y, 25	6,278	5,853	5,653	6,118	5,986	254	228	88	231	229
HPV-5Y, 25[f]	**8,674**	**8,155**	**7,600**	**8,305**	**8,230**	**292**	**277**	**95**	**304**	**285**
HPV-5Y, 25/HPV-10Y, 35	6,337	6,010	5,656	6,001	6,005	262	245	82	250	247
HPV-5Y, 30	7,461	6,955	6,607	7,190	7,073	226	196	65	248	211
HPV-5Y, 30/HPV-10Y, 35	5,050	4,754	4,591	4,806	4,780	195	161	51	192	177
HPV-5Y, 35	6,405	5,946	5,719	6,160	6,053	174	142	49	185	158
HPV-5Y, 35/HPV-10Y, 45	4,915	4,626	4,478	4,717	4,672	158	121	42	162	139
HPV-5Y, 40	5,430	5,006	4,876	5,218	5,112	136	95	38	135	115
HPV-10Y, 25	5,112	4,642	4,615	4,731	4,686	230	177	68	186	182
HPV-10Y, 35	3,853	3,476	3,511	3,631	3,571	140	95	34	125	110
CYTO-4Y, 21/COTEST-5Y, 25	20,666	16,752	16,297	18,509	17,630	508	363	285	468	416

Strategy[c]	Total Tests per 1,000 [b] H	M	P	U	Med[d]	Colposcopies per 1,000 H	M	P	U	Med[d]
CYTO-4Y, 21/COTEST-10Y, 25	12,899	10,026	10,740	11,356	11,048	372	250	200	311	281
COTEST-5Y, 25	19,434	15,588	15,761	17,160	16,461	486	313	277	426	370
COTEST-5Y, 25/COTEST-10Y, 35	14,220	11,400	11,950	12,443	12,197	398	275	223	345	310
COTEST-5Y, 30	16,767	13,395	13,775	14,868	14,322	392	221	221	352	287
COTEST-5Y, 30/COTEST-10Y, 35	11,386	9,097	9,805	10,077	9,941	303	180	165	268	224
COTEST-5Y, 35	14,420	11,505	11,950	12,718	12,334	317	161	184	272	228
COTEST-5Y, 35/COTEST-10Y, 45	11,070	8,934	9,558	9,836	9,697	264	135	151	232	191
COTEST-5Y, 40	12,249	9,745	10,209	10,789	10,499	257	109	152	206	179
COTEST-10Y, 25	11,539	8,834	9,869	9,977	9,923	346	199	185	266	233
COTEST-10Y, 35	8,733	6,698	7,561	7,654	7,608	228	107	121	182	152
End Age 70[e]										
CYTO-3Y, 21	17,305	16,227	12,886	16,800	16,514	398	297	262	386	341
CYTO-3Y, 21/HPV-5Y, 30	11,664	11,180	9,714	11,303	11,242	313	335	130	347	324
CYTO-3Y, 21/COTEST-5Y, 30	22,166	18,183	17,132	19,582	18,883	499	359	291	457	408
CYTO-4Y, 21/HPV-5Y, 25	10,428	10,027	8,991	10,342	10,185	320	337	114	353	328
CYTO-3Y, 21/HPV-10Y, 30	8,333	7,874	7,075	7,987	7,931	267	255	112	263	259
HPV-5Y, 25	9,366	8,831	8,142	8,987	8,909	299	287	97	312	293
HPV-5Y, 25/HPV-10Y, 30	6,076	5,680	5,482	5,718	5,699	255	217	79	229	223
HPV-5Y, 30	8,138	7,628	7,149	7,865	7,746	233	205	68	256	219
HPV-5Y, 30/HPV-10Y, 40	5,920	5,551	5,283	5,684	5,617	207	170	56	214	189
HPV-5Y, 35	6,999	6,534	6,258	6,748	6,641	181	151	52	192	166
HPV-5Y, 35/HPV-10Y, 40	4,707	4,413	4,323	4,495	4,454	155	114	40	149	132
HPV-5Y, 40	6,006	5,559	5,411	5,763	5,661	142	104	41	141	123
HPV-10Y, 30	4,751	4,281	4,275	4,485	4,383	185	123	46	166	145
HPV-10Y, 40	3,583	3,205	3,287	3,373	3,330	114	63	27	94	78
CYTO-4Y, 21/COTEST-5Y, 25	21,903	18,069	17,420	19,785	18,927	526	374	301	482	428
CYTO-3Y, 21/COTEST-10Y, 30	14,938	11,796	11,854	12,920	12,387	383	270	215	335	302
COTEST-5Y, 25/COTEST-10Y, 30	13,567	10,810	11,621	11,910	11,766	383	245	216	321	283
COTEST-5Y, 30	18,132	14,707	14,895	16,272	15,584	413	231	236	368	302
COTEST-5Y, 30/COTEST-10Y, 40	13,209	10,663	11,225	11,802	11,514	334	191	186	302	247
COTEST-5Y, 35	15,618	12,654	13,076	13,977	13,527	335	170	199	286	243
COTEST-5Y, 35/COTEST-10Y, 40	10,537	8,521	9,254	9,442	9,348	255	128	146	218	182
COTEST-5Y, 40	13,413	10,824	11,327	11,914	11,620	275	119	167	219	193
COTEST-10Y, 30	10,655	8,243	9,188	9,464	9,326	291	139	153	240	196
COTEST-10Y, 40	8,044	6,238	7,087	7,117	7,102	194	72	107	145	126

Abbreviations: CYTO, cytology; HPV, Human papillomavirus; H, Harvard model; M, MISCAN-Cervix model; P, Policy1-Cervix model; U, University of Minnesota model.
[a] Outcomes calculated from age 21 to 100 years.
[b] Total number of tests including cytology and HPV tests, irrespective of primary, triage or surveillance context.
[c] Strategies are denoted by the screening modality, interval, age to begin screening/screening modality after switch age, interval after switch age, switch age for each end age category. For example, CYTO-3Y, 21 indicates cytology testing every 3 years starting at age 21, and CYTO-3Y, 21/HPV-5Y,30 indicates cytology testing every 3 years starting at age 21 with a switch to HPV testing every 5 years starting at age 30.
[d] Median outcome across the four models.
[e] End age indicates the age at which the final routine screen should occur, irrespective of age at last screen; exceptions include female persons who are recommended to continue screening due to prior abnormal results and/or precancer treatment.
[f] Strategies (bolded) represent current US recommended strategies.

Table 32. Lifetime Number of CIN2+ Detected and False Positives Among 9vHPV Vaccinated Female Persons Assuming Imperfect Screening and Follow-up Adherence by Model[a]

	CIN2+ detected per 1,000[b]					False Positives per 1,000[c]				
Strategy[d]	**H**	**M**	**P**	**U**	**Med[e]**	**H**	**M**	**P**	**U**	**Med[e]**
No Screening	0	0	0	0	0	0	0	0	0	0
End Age 60[f]										
CYTO-3Y, 21	26	14	17	35	21	305	180	204	300	252
CYTO-3Y, 21/HPV-5Y, 30	29	15	17	38	23	258	208	101	293	233
CYTO-3Y, 21/COTEST-5Y, 30	31	16	18	40	25	415	223	234	385	310
CYTO-4Y, 21/HPV-5Y, 25	28	14	16	38	22	266	210	86	300	238
CYTO-3Y, 21/HPV-10Y, 30	27	13	15	32	21	221	161	87	223	191
HPV-5Y, 25	26	12	14	32	20	247	177	72	263	212
HPV-5Y, 25/HPV-10Y, 30	25	10	12	26	18	212	137	58	195	166
HPV-5Y, 30	23	8	10	24	16	186	124	48	216	155
HPV-5Y, 30/HPV-10Y, 40	22	7	9	22	15	168	107	41	185	137
HPV-5Y, 35	19	6	7	18	13	140	88	36	159	114
HPV-5Y, 35/HPV-10Y, 40	18	5	6	16	11	121	70	28	127	95
HPV-5Y, 40	16	4	6	13	9	104	56	27	112	80
HPV-10Y, 30	21	6	8	18	13	147	75	32	141	108
HPV-10Y, 40	15	3	4	11	8	84	35	17	76	56
CYTO-4Y, 21/COTEST-5Y, 25	31	15	18	41	25	441	233	244	408	326
CYTO-3Y, 21/COTEST-10Y, 30	29	13	17	35	23	323	170	176	284	230
COTEST-5Y, 25/COTEST-10Y, 30	28	11	15	30	21	323	156	180	276	228
COTEST-5Y, 30	26	9	11	27	18	336	140	189	309	249
COTEST-5Y, 30/COTEST-10Y, 40	25	8	10	25	18	279	120	155	261	208
COTEST-5Y, 35	21	6	8	20	14	268	100	156	236	196
COTEST-5Y, 35/COTEST-10Y, 40	20	5	8	18	13	207	78	119	185	152
COTEST-5Y, 40	18	4	6	15	10	209	64	127	172	149
COTEST-10Y, 30	23	6	9	21	15	239	85	123	204	163
COTEST-10Y, 40	17	3	5	12	9	154	41	83	118	100
End Age 65[f]										
CYTO-3Y, 21[g]	**27**	**15**	**17**	**35**	**22**	**331**	**187**	**222**	**324**	**273**
CYTO-3Y, 21/HPV-5Y, 30[g]	**29**	**15**	**17**	**38**	**23**	**266**	**215**	**103**	**301**	**240**
CYTO-3Y, 21/COTEST-5Y, 30[g]	**32**	**16**	**18**	**40**	**25**	**436**	**231**	**250**	**401**	**326**
CYTO-4Y, 21/HPV-5Y, 25	28	15	16	38	22	274	218	89	307	246
CYTO-4Y, 21/HPV-10Y, 25	26	11	14	30	20	218	150	69	201	175
HPV-5Y, 25[g]	**26**	**12**	**14**	**32**	**20**	**256**	**184**	**75**	**272**	**220**
HPV-5Y, 25/HPV-10Y, 35	25	11	13	29	19	227	162	63	221	192
HPV-5Y, 30	23	8	10	25	17	194	131	51	223	162
HPV-5Y, 30/HPV-10Y, 35	22	7	9	21	15	164	106	39	171	135
HPV-5Y, 35	19	6	7	19	13	148	95	39	166	121
HPV-5Y, 35/HPV-10Y, 45	19	6	7	18	12	132	80	32	144	106
HPV-5Y, 40	17	4	6	14	10	113	63	30	121	88
HPV-10Y, 25	24	9	11	24	18	197	116	52	163	140
HPV-10Y, 35	18	5	6	15	10	115	63	26	110	86
CYTO-4Y, 21/COTEST-5Y, 25	32	16	18	41	25	463	241	260	427	344
CYTO-4Y, 21/COTEST-10Y, 25	29	12	16	33	22	333	165	178	278	228

Strategy[d]	CIN2+ detected per 1,000[b]					False Positives per 1,000[c]				
	H	M	P	U	Med[e]	H	M	P	U	Med[e]
COTEST-5Y, 25	30	13	17	36	24	444	209	254	391	322
COTEST-5Y, 25/COTEST-10Y, 35	29	12	16	32	22	358	183	201	313	257
COTEST-5Y, 30	26	9	11	27	19	356	148	206	324	265
COTEST-5Y, 30/COTEST-10Y, 35	25	8	11	24	17	269	120	150	244	197
COTEST-5Y, 35	21	7	9	21	15	288	108	172	251	211
COTEST-5Y, 35/COTEST-10Y, 45	21	6	8	20	14	236	90	140	213	176
COTEST-5Y, 40	18	5	7	15	11	232	73	143	190	167
COTEST-10Y, 25	27	9	14	27	20	309	132	166	240	203
COTEST-10Y, 35	20	5	7	17	12	200	71	111	165	138
End Age 70[f]										
CYTO-3Y, 21	28	15	18	36	23	359	195	238	350	294
CYTO-3Y, 21/HPV-5Y, 30	30	16	17	38	24	272	221	106	309	247
CYTO-3Y, 21/COTEST-5Y, 30	32	16	19	41	25	455	238	265	416	341
CYTO-4Y, 21/HPV-5Y, 25	29	15	17	38	23	280	224	91	315	252
CYTO-3Y, 21/HPV-10Y, 30	28	13	16	33	22	229	166	90	230	198
HPV-5Y, 25	27	12	15	32	21	262	191	77	279	227
HPV-5Y, 25/HPV-10Y, 30	25	10	13	27	19	220	143	61	202	173
HPV-5Y, 30	24	9	10	25	17	201	137	53	230	169
HPV-5Y, 30/HPV-10Y, 40	23	8	9	23	16	176	112	43	191	144
HPV-5Y, 35	20	6	8	19	14	154	101	41	173	127
HPV-5Y, 35/HPV-10Y, 40	19	5	7	17	12	129	75	30	133	102
HPV-5Y, 40	17	4	6	14	10	119	69	32	127	94
HPV-10Y, 30	22	6	8	19	14	155	81	34	147	114
HPV-10Y, 40	16	3	5	11	8	92	41	20	83	62
CYTO-4Y, 21/COTEST-5Y, 25	32	16	18	42	25	481	249	275	441	358
CYTO-3Y, 21/COTEST-10Y, 30	30	14	17	35	24	341	177	191	300	246
COTEST-5Y, 25/COTEST-10Y, 30	29	11	16	31	22	343	162	195	291	243
COTEST-5Y, 30	27	9	12	28	19	376	154	220	340	280
COTEST-5Y, 30/COTEST-10Y, 40	25	9	11	26	18	299	127	170	276	223
COTEST-5Y, 35	22	7	9	21	15	305	114	187	265	226
COTEST-5Y, 35/COTEST-10Y, 40	21	6	8	19	13	226	85	134	199	167
COTEST-5Y, 40	19	5	7	15	11	249	80	158	203	180
COTEST-10Y, 30	24	7	10	22	16	258	92	139	218	179
COTEST-10Y, 40	17	4	6	13	9	170	47	99	132	116

Abbreviations: CIN, cervical intraepithelial; CYTO, cytology; HPV, Human papillomavirus; H, Harvard model; M, MISCAN-Cervix model; P, Policy1-Cervix model; U, University of Minnesota model.
[a] Outcomes calculated from age 21 to 100 years.
[b] CIN2+ detected includes CIN2s, CIN3s and cervical cancers detected through screening (excludes clinically detected cancers).
[c] Total number of colposcopies that did not result in CIN2, CIN3 or cancer detection.
[d] Strategies are denoted by the screening modality, interval, age to begin screening/screening modality after switch age, interval after switch age, switch age for each end age category. For example, CYTO-3Y, 21 indicates cytology testing every 3 years starting at age 21, and CYTO-3Y, 21/HPV-5Y,30 indicates cytology testing every 3 years starting at age 21 with a switch to HPV testing every 5 years starting at age 30.
[e] Median outcome across the four models.
[f] End age indicates the age at which the final routine screen should occur, irrespective of age at last screen; exceptions include female persons who are recommended to continue screening due to prior abnormal results and/or precancer treatment.
[g] Strategies (bolded) represent current US recommended strategies.

Table 33. Efficient and Near-Efficient Cervical Cancer Screening Strategies Among Unvaccinated Female Persons Assuming Imperfect Screening and Follow-up Adherence by Model[a]

	Incremental Colposcopies per LYG				Incremental Total Tests per LYG			
Strategy	**H**	**M**	**P**	**U**	**H**	**M**	**P**	**U**
HPV-10Y, 40, 60	3	3	1	2	40	53	42	39
HPV-10Y, 35, 65	4	Dom	2*	4	49*	Dom	68*	49*
HPV-5Y, 35/HPV-10Y, 40, 60	Dom	9*	5*	Dom	Dom	78	71*	Dom
HPV-5Y, 35/HPV-10Y, 45, 65	Dom	7	Dom	Dom	Dom	151*	Dom	Dom
HPV-10Y, 30, 60	6	Dom	Dom	Dom	45	Dom	Dom	Dom
HPV-5Y, 30/HPV-10Y, 40, 60	Dom	Dom	11*	Dom	Dom	Dom	96	Dom
CYTO-3Y, 21, 70	Dom	15	44*	Dom	Dom	17,069	1,363*	Dom
HPV-5Y, 30/HPV-10Y, 40, 70	Dom	Dom	7*	Dom	Dom	Dom	288*	Dom
HPV-5Y, 30, 60	Dom	Dom	5*	10*	Dom	Dom	280*	167*
HPV-5Y, 30, 65	Dom	18*	5*	10*	Dom	259	258*	189*
HPV-10Y, 25, 65	27*	Dom	Dom	Dom	144	Dom	Dom	Dom
HPV-5Y, 30, 70	Dom	15*	4	Dom	Dom	282	259*	Dom
CYTO-4Y, 21/HPV-10Y, 25, 65	84*	Dom	Dom	Dom	3,111*	Dom	Dom	Dom
HPV-5Y, 25/HPV-10Y, 30, 60	154*	Dom	Dom	Dom	447	Dom	Dom	Dom
HPV-5Y, 25/HPV-10Y, 30, 70	141*	Dom	Dom	Dom	679*	Dom	Dom	Dom
CYTO-3Y, 21/HPV-5Y, 30, 60	39*	Dom	Dom	Dom	3,544*	Dom	Dom	Dom
HPV-5Y, 25/HPV-10Y, 35, 65	65*	Dom	Dom	Dom	459	Dom	Dom	Dom
CYTO-3Y, 21/HPV-5Y, 30, 65[c]	**37**	**Dom**	**14***	**22***	**2,261***	**Dom**	**296***	**1,975***
CYTO-3Y, 21/HPV-5Y, 30, 70	49	25*	11	26	2,114*	790	1,059*	2,370*
HPV-5Y, 25, 60	60*	Dom	Dom	32*	1,232*	Dom	Dom	163
CYTO-4Y, 21/HPV-5Y, 25, 60	1,334*	Dom	Dom	Dom	1,177*	Dom	Dom	Dom
HPV-5Y, 25, 65[c]	**237***	**Dom**	**Dom**	**22***	**1,106***	**Dom**	**Dom**	**267**
CYTO-4Y, 21/HPV-5Y, 25, 65	87*	Dom	Dom	28*	1,085	Dom	Dom	1,038*
HPV-5Y, 25, 70	268*	Dom	14*	19	1,191*	Dom	236	385
CYTO-4Y, 21/HPV-5Y, 25, 70	76	Dom	15*	97*	1,556	Dom	3,006*	943
COTEST-5Y, 25/COTEST-10Y, 35, 65	90*	Dom	Dom	Dom	6,595*	Dom	Dom	Dom
CYTO-3Y, 21/COTEST-5Y, 30, 60	649*	Dom	Dom	Dom	6,330*	Dom	Dom	Dom
CYTO-3Y, 21/COTEST-5Y, 30, 65[c]	**314***	**Dom**	**28***	**620***	**5,133***	**Dom**	**1,117***	**9,188***
CYTO-3Y, 21/COTEST-5Y, 30, 70	234*	160	25	64	1,097,890*	5,042	1,040*	6,763*
CYTO-4Y, 21/COTEST-5Y, 25, 60	2,344*	Dom	Dom	Dom	133,892*	Dom	Dom	Dom
COTEST-5Y, 25, 65	238*	Dom	37*	2,378*	34,437*	Dom	1,151*	9,734*
CYTO-4Y, 21/COTEST-5Y, 25, 65	258*	Dom	30*	189*	13,836*	Dom	1,034*	21,231*
CYTO-4Y, 21/COTEST-5Y, 25, 70	209	Dom	45	88	10,854	Dom	992	4,366

Abbreviations: CYTO, cytology; HPV, Human papillomavirus; LYG, life-years gained; H, Harvard model; M, MISCAN-Cervix model; P, Policy1-Cervix model; U, University of Minnesota model.
[a] Near-efficient (i.e., within 2% of the efficiency frontier) are indicated by *. Strategies are ordered by increasing colposcopies in the Harvard model. Ratios were calculated against the next-less effective, non-dominated strategy within each model. Ratios in grey font indicate strategies that had lower LYG than the guidelines-based strategy of 3-yearly cytology from ages 21 to 65 years in each model. Yellow highlighted ratios indicate strategies with efficiency ratios that were equal to or less than those from the current guidelines-based strategies in the unvaccinated population on both efficiency metrics of colposcopies per LYG and tests per LYG in each model, assuming perfect adherence. The efficiency ratios used as benchmarks in each

Strategy	Incremental Colposcopies per LYG				Incremental Total Tests per LYG			
	H	M	P	U	H	M	P	U

model were: 78-133 colposcopies per LYG and 1,509-2,663 tests per LYG in the Harvard model; 48-54 colposcopies per LYG and 291-4,279 tests per LYG in the MISCAN-Cervix model; 17-32 colposcopies per LYG and 688-1,052 tests per LYG in the Policy1-Cervix model; 92-134 colposcopies per LYG and 229-2,016 tests per LYG in the UMN model (see **Table 15**). Strategies that were dominated by both efficiency metrics in all 4 models are not shown.

[b] Strategies are denoted by the screening modality, interval, age to begin screening/screening modality after switch age, interval after switch age, switch age for each end age category. For example, HPV-10Y, 40, 60 indicates HPV testing every 10 years starting at age 40 years and ending at age 60 years, and HPV-5Y, 35/HPV-10Y, 40, 60 indicates HPV testing every 5 years starting at age 35 years with a switch to HPV testing every 10 years starting at age 40 years and ending at age 60 years.

[c] Strategies (bolded) represent current US recommended strategies.

Table 34. Efficient and Near-Efficient Cervical Cancer Screening Strategies Among 2vHPV or 4vHPV Vaccinated Female Persons Assuming Imperfect Screening and Follow-up Adherence by Model[a]

	Incremental Colposcopies per LYG				Incremental Total Tests per LYG			
Strategy	**H**	**M**	**P**	**U**	**H**	**M**	**P**	**U**
HPV-10Y, 40, 60	4	5	3	7	82	149	160	163
HPV-5Y, 35/HPV-10Y, 45, 65	Dom	17	9*	Dom	Dom	417*	665*	Dom
HPV-10Y, 30, 60	16	Dom	Dom	24*	144	Dom	Dom	216
HPV-5Y, 35, 70	Dom	Dom	7	Dom	Dom	Dom	818*	Dom
HPV-5Y, 30, 60	Dom	Dom	Dom	30	Dom	Dom	Dom	815*
HPV-5Y, 30, 65	Dom	27	Dom	Dom	Dom	505	Dom	Dom
HPV-10Y, 25, 65	46*	Dom	Dom	45*	494	Dom	Dom	547*
HPV-5Y, 30, 70	Dom	344*	19	Dom	Dom	13,892*	728	Dom
CYTO-4Y, 21/HPV-10Y, 25, 65	321*	Dom	Dom	Dom	10,086*	Dom	Dom	Dom
HPV-5Y, 25/HPV-10Y, 30, 60	126*	Dom	Dom	Dom	1,112	Dom	Dom	Dom
HPV-5Y, 25/HPV-10Y, 30, 70	107*	Dom	Dom	Dom	3,114*	Dom	Dom	Dom
CYTO-3Y, 21, 70	Dom	40	Dom	Dom	Dom	13,577*	Dom	Dom
HPV-5Y, 25/HPV-10Y, 35, 65	82*	Dom	Dom	Dom	1,685	Dom	Dom	Dom
CYTO-3Y, 21/HPV-5Y, 30, 60	63	Dom	Dom	49*	8,769*	Dom	Dom	16,152*
CYTO-3Y, 21/HPV-5Y, 30, 65[c]	**77**	**Dom**	**Dom**	**49***	**6,868***	**Dom**	**Dom**	**8,360***
CYTO-3Y, 21/HPV-5Y, 30, 70	142	80*	Dom	83	40,777*	7,486	Dom	6,056*
HPV-5Y, 25, 60	1,449*	Dom	Dom	48*	2,529	Dom	Dom	654
HPV-5Y, 25, 65[c]	**193***	**Dom**	**Dom**	**42***	**3,590**	**Dom**	**Dom**	**1,353**
CYTO-4Y, 21/HPV-5Y, 25, 60	279*	Dom	Dom	Dom	6,242*	Dom	Dom	Dom
HPV-5Y, 25, 70	179*	Dom	52	39	7,710*	Dom	1,001	1,566
CYTO-4Y, 21/HPV-5Y, 25, 65	145*	Dom	Dom	380*	6,409	Dom	Dom	5,235*
CYTO-4Y, 21/HPV-5Y, 25, 70	143	Dom	Dom	352*	6,515	Dom	Dom	3,036
COTEST-5Y, 30, 70	Dom	Dom	99	Dom	Dom	Dom	5,479*	Dom
COTEST-5Y, 25/COTEST-10Y, 35, 65	184*	Dom	Dom	Dom	24,984*	Dom	Dom	Dom
CYTO-3Y, 21/COTEST-5Y, 30, 60	2,073*	Dom	Dom	Dom	183,613*	Dom	Dom	Dom
CYTO-3Y, 21/COTEST-5Y, 30, 65[c]	**1,009***	**Dom**	**1,225***	**263***	**236,739***	**Dom**	**6,204***	**26,416***
CYTO-3Y, 21/COTEST-5Y, 30, 70	756*	284	113*	161*	95,333*	8,941	4,957*	14,059*
CYTO-4Y, 21/COTEST-5Y, 25, 60	997*	Dom	Dom	394*	55,158*	Dom	Dom	25,896*
COTEST-5Y, 25, 65	748*	Dom	Dom	312*	420,388*	Dom	Dom	30,578*
CYTO-4Y, 21/COTEST-5Y, 25, 65	579*	Dom	296*	196*	31,434*	Dom	5,580*	11,642*
CYTO-4Y, 21/COTEST-5Y, 25, 70	498	Dom	100	157	26,889	Dom	4,306	9,350

Abbreviations: CYTO, cytology; HPV, Human papillomavirus; LYG, life-years gained; H, Harvard model; M, MISCAN-Cervix model; P, Policy1-Cervix model; U, University of Minnesota model.

[a] Near-efficient (i.e., within 2% of the efficiency frontier) are indicated by *. Strategies are ordered by increasing colposcopies in the Harvard model. Ratios were calculated against the next-less effective, non-dominated strategy within each model. Yellow highlighted ratios indicate strategies with efficiency ratios that were equal to or less than those from the current guidelines-based strategies in the unvaccinated population on both efficiency metrics of colposcopies per LYG and tests per LYG in each model, assuming perfect adherence. The efficiency ratios used as benchmarks in each model were: 78-133 colposcopies per LYG and 1,509-2,663 tests per LYG in the Harvard model; 48-54 colposcopies per LYG and 291-4,279 tests per LYG in the MISCAN-Cervix model; 17-32 colposcopies per LYG and 688-1,052 tests per LYG in the Policy1-Cervix model; 92-134 colposcopies per LYG and 229-2,016 tests per LYG in the UMN model (see **Table 15**). Strategies that were dominated by both efficiency metrics in all 4 models are not shown.

[b] Strategies are denoted by the screening modality, interval, age to begin screening/screening modality after switch age, interval after switch age, switch age for each end age category. For example, HPV-10Y, 40, 60 indicates HPV testing every 10 years starting at age 40 years and ending at age 60 years, and HPV-5Y, 35/HPV-10Y, 40, 60 indicates HPV testing every 5 years starting at age 35 years with a switch to HPV testing every 10 years starting at age 40 years and ending at age 60 years.
[c] Strategies (bolded) represent current US recommended strategies.

Table 35. Efficient and Near-Efficient Cervical Cancer Screening Strategies Among 9vHPV Vaccinated Female Persons Assuming Imperfect Screening and Follow-up Adherence by Model[a]

	Incremental Colposcopies per LYG				Incremental Total Tests per LYG			
Strategy	**H**	**M**	**P**	**U**	**H**	**M**	**P**	**U**
HPV-10Y, 40, 60	5	7	4	12	138	335	427	371
HPV-5Y, 40, 60	Dom	Dom	Dom	35	Dom	Dom	Dom	1,443
HPV-5Y, 40, 65	Dom	Dom	Dom	87*	Dom	Dom	Dom	7,269*
HPV-10Y, 35, 65	31	Dom	Dom	Dom	760*	Dom	Dom	Dom
HPV-5Y, 35/HPV-10Y, 40, 60	33	23*	Dom	Dom	849*	453	Dom	Dom
HPV-5Y, 35/HPV-10Y, 40, 70	Dom	19	14*	Dom	Dom	920*	1,204*	Dom
HPV-5Y, 35/HPV-10Y, 45, 65	Dom	28*	13*	Dom	Dom	922*	1,127	Dom
HPV-5Y, 35, 65	Dom	Dom	Dom	101*	Dom	Dom	Dom	2,809
HPV-10Y, 30, 60	125*	Dom	Dom	Dom	664	Dom	Dom	Dom
HPV-5Y, 35, 70	Dom	Dom	12	99	Dom	Dom	1,934*	7,353*
HPV-10Y, 30, 70	172*	Dom	Dom	Dom	20,200*	Dom	Dom	Dom
HPV-5Y, 30/HPV-10Y, 35, 65	91*	Dom	Dom	Dom	3,912*	Dom	Dom	Dom
HPV-5Y, 30/HPV-10Y, 40, 60	82*	Dom	Dom	Dom	3,615*	Dom	Dom	Dom
HPV-5Y, 30/HPV-10Y, 40, 70	95*	Dom	Dom	Dom	5,043*	Dom	Dom	Dom
HPV-5Y, 30, 60	66	43*	Dom	Dom	7,000*	944	Dom	Dom
HPV-5Y, 30, 65	203*	46*	36*	Dom	8,501*	4,022*	1,676	Dom
HPV-10Y, 25, 65	130*	Dom	Dom	Dom	2,347	Dom	Dom	Dom
HPV-5Y, 30, 70	266*	41	28	334*	10,511*	2,581*	2,850*	6,315*
HPV-5Y, 25/HPV-10Y, 30, 60	136*	Dom	Dom	Dom	3,500	Dom	Dom	Dom
CYTO-4Y, 21/HPV-10Y, 25, 65	148*	Dom	Dom	Dom	57,090*	Dom	Dom	Dom
HPV-5Y, 25/HPV-10Y, 30, 70	141*	Dom	Dom	Dom	14,468*	Dom	Dom	Dom
CYTO-3Y, 21/HPV-10Y, 30, 60	140*	Dom	Dom	Dom	29,871*	Dom	Dom	Dom
HPV-5Y, 25/HPV-10Y, 35, 65	126*	Dom	Dom	Dom	5,094*	Dom	Dom	Dom
CYTO-3Y, 21/HPV-10Y, 30, 70	139*	Dom	Dom	Dom	19,506*	Dom	Dom	Dom
HPV-5Y, 25, 60	184*	Dom	Dom	Dom	4,538	Dom	Dom	Dom
HPV-5Y, 25, 65[c]	**186***	**Dom**	**Dom**	**280***	**16,668***	**Dom**	**Dom**	**5,236***
CYTO-3Y, 21/HPV-5Y, 30, 60	171*	Dom	Dom	Dom	113,400*	Dom	Dom	Dom
HPV-5Y, 25, 70	192*	Dom	83	214	20,265*	Dom	2,790	4,719
CYTO-4Y, 21/HPV-5Y, 25, 60	190*	Dom	Dom	Dom	11,289	Dom	Dom	Dom
CYTO-3Y, 21/HPV-5Y, 30, 65[c]	**166**	**Dom**	**Dom**	**343***	**88,609***	**Dom**	**Dom**	**18,046***
CYTO-4Y, 21/HPV-5Y, 25, 65	184*	Dom	Dom	333*	11,643	Dom	Dom	10,473*
CYTO-3Y, 21/HPV-5Y, 30, 70	311	Dom	172*	298*	131,795*	Dom	5,649*	14,351*
CYTO-4Y, 21/HPV-5Y, 25, 70	995*	Dom	Dom	316*	22,682	Dom	Dom	11,082*
CYTO-3Y, 21/COTEST-10Y, 30, 60	1,188*	Dom	Dom	Dom	25,824*	Dom	Dom	Dom
CYTO-3Y, 21/COTEST-10Y, 30, 70	894*	Dom	Dom	Dom	24,726*	Dom	Dom	Dom
CYTO-3Y, 21, 70	Dom	69	Dom	Dom	Dom	25,237	Dom	Dom
COTEST-5Y, 30, 70	Dom	Dom	289*	Dom	Dom	Dom	14,070*	Dom
CYTO-3Y, 21/COTEST-5Y, 30, 60	4,514*	Dom	Dom	Dom	218,274*	Dom	Dom	Dom

Strategy	Incremental Colposcopies per LYG				Incremental Total Tests per LYG			
	H	M	P	U	H	M	P	U
CYTO-3Y, 21/COTEST-5Y, 30, 65[c]	**1,868***	**Dom**	**302***	**1,177***	**105,822***	**Dom**	**13,336***	**83,710***
CYTO-4Y, 21/COTEST-5Y, 25, 60	4,097*	Dom	Dom	Dom	170,607*	Dom	Dom	Dom
COTEST-5Y, 25, 65	552*	Dom	272*	764*	347,484*	Dom	11,545*	54,484*
CYTO-3Y, 21/COTEST-5Y, 30, 70	1,770	Dom	245	580	102,620	Dom	11,380*	42,379*
CYTO-4Y, 21/COTEST-5Y, 25, 65	Dom	Dom	Dom	823*	Dom	Dom	Dom	50,111*
CYTO-4Y, 21/COTEST-5Y, 25, 70	Dom	Dom	319	857	Dom	Dom	11,315	38,563

Abbreviations: CYTO, cytology; HPV, Human papillomavirus; LYG, life-years gained; H, Harvard model; M, MISCAN-Cervix model; P, Policy1-Cervix model; U, University of Minnesota model.

[a] Near-efficient (i.e., within 2% of the efficiency frontier) are indicated by *. Strategies are ordered by increasing colposcopies in the Harvard model. Ratios were calculated against the next-less effective, non-dominated strategy within each model. Yellow highlighted ratios indicate strategies with efficiency ratios that were equal to or less than those from the current guidelines-based strategies in the unvaccinated population on both efficiency metrics of colposcopies per LYG and tests per LYG in each model, assuming perfect adherence. The efficiency ratios used as benchmarks in each model were: 78-133 colposcopies per LYG and 1,509-2,663 tests per LYG in the Harvard model; 48-54 colposcopies per LYG and 291-4,279 tests per LYG in the MISCAN-Cervix model; 17-32 colposcopies per LYG and 688-1,052 tests per LYG in the Policy1-Cervix model; 92-134 colposcopies per LYG and 229-2,016 tests per LYG in the UMN model (see **Table 15**). Strategies that were dominated by both efficiency metrics in all 4 models are not shown.

[b] Strategies are denoted by the screening modality, interval, age to begin screening/screening modality after switch age, interval after switch age, switch age for each end age category. For example, HPV-10Y, 40, 60 indicates HPV testing every 10 years starting at age 40 years and ending at age 60 years, and HPV-5Y, 35/HPV-10Y, 40, 60 indicates HPV testing every 5 years starting at age 35 years with a switch to HPV testing every 10 years starting at age 40 years and ending at age 60 years.

[c] Strategies (bolded) represent current US recommended strategies.

Table 36. Lifetime Outcomes Among Unvaccinated Black Female Persons Assuming Imperfect Screening and Follow-up Adherence in the Harvard Model[a]

	Outcomes per 1,000						
Strategy[e]	**CC Cases**	**CC Deaths**	**Life-Years Gained**	**Total Tests[b]**	**Colpos**	**CIN2 + detected[c]**	**False Positives[d]**
No Screening	13.09	4.22	0.00	0	0	0	0
End Age 60[f]							
CYTO-3Y, 21	4.72	1.32	115.47	13,084	416	140	276
CYTO-3Y, 21/HPV-5Y, 30	3.83	1.03	124.43	10,923	602	167	435
CYTO-3Y, 21/COTEST-5Y, 30	3.73	0.99	125.59	20,316	766	174	592
CYTO-4Y, 21/HPV-5Y, 25	3.69	1.01	125.80	10,185	688	171	517
CYTO-3Y, 21/HPV-10Y, 30	4.13	1.11	121.04	8,452	497	153	343
HPV-5Y, 25	3.76	1.02	125.18	9,177	673	163	511
HPV-5Y, 25/HPV-10Y, 30	4.06	1.11	121.68	6,777	570	150	421
HPV-5Y, 30	4.58	1.14	115.55	7,570	495	129	366
HPV-5Y, 30/HPV-10Y, 40	4.73	1.18	114.29	6,142	444	122	321
HPV-5Y, 35	5.65	1.36	99.08	6,184	369	99	270
HPV-5Y, 35/HPV-10Y, 40	5.80	1.40	97.75	4,659	315	92	222
HPV-5Y, 40	6.80	1.76	77.59	4,887	275	77	198
HPV-10Y, 30	4.93	1.25	110.90	4,969	382	114	268
HPV-10Y, 40	7.00	1.82	75.32	3,334	217	70	147
CYTO-4Y, 21/COTEST-5Y, 25	3.57	0.96	127.18	20,826	875	180	695
CYTO-3Y, 21/COTEST-10Y, 30	3.98	1.07	122.54	15,079	616	160	456
COTEST-5Y, 25/COTEST-10Y, 30	3.87	1.05	123.70	14,636	698	158	540
COTEST-5Y, 30	4.45	1.10	117.17	16,476	650	136	513
COTEST-5Y, 30/COTEST-10Y, 40	4.57	1.13	116.09	13,333	563	130	433
COTEST-5Y, 35	5.51	1.31	100.93	13,547	497	105	392
COTEST-5Y, 35/COTEST-10Y, 40	5.66	1.35	99.69	10,176	405	98	307
COTEST-5Y, 40	6.68	1.72	78.87	10,778	377	82	296
COTEST-10Y, 30	4.73	1.18	113.91	10,864	488	121	366
COTEST-10Y, 40	6.81	1.75	77.22	7,395	289	75	215
End Age 65[f]							
CYTO-3Y, 21[g]	**4.57**	**1.24**	**116.53**	**14,000**	**438**	**144**	**294**
CYTO-3Y, 21/HPV-5Y, 30[g]	**3.74**	**0.98**	**124.96**	**11,441**	**619**	**170**	**449**
CYTO-3Y, 21/COTEST-5Y, 30[g]	**3.66**	**0.95**	**126.04**	**21,270**	**789**	**177**	**612**
CYTO-4Y, 21/HPV-5Y, 25	3.61	0.96	126.32	10,748	706	174	532
CYTO-4Y, 21/HPV-10Y, 25	4.02	1.08	121.24	7,390	550	154	396
HPV-5Y, 25[g]	**3.68**	**0.97**	**125.68**	**9,747**	**692**	**166**	**525**
HPV-5Y, 25/HPV-10Y, 35	3.89	1.04	123.47	7,605	610	156	454
HPV-5Y, 30	4.49	1.10	116.06	8,060	511	132	379
HPV-5Y, 30/HPV-10Y, 35	4.73	1.17	113.63	5,868	428	121	307
HPV-5Y, 35	5.56	1.32	99.57	6,686	386	102	283
HPV-5Y, 35/HPV-10Y, 45	5.67	1.36	98.64	5,389	344	97	246
HPV-5Y, 40	6.72	1.72	78.06	5,478	293	81	213
HPV-10Y, 25	4.12	1.09	120.07	6,307	528	145	383
HPV-10Y, 35	5.88	1.42	96.19	4,316	295	91	204
CYTO-4Y, 21/COTEST-5Y, 25	3.49	0.92	127.62	21,876	900	184	716
CYTO-4Y, 21/COTEST-10Y, 25	3.85	1.03	123.35	14,813	685	163	522
COTEST-5Y, 25	3.56	0.93	127.02	20,899	886	176	710
COTEST-5Y, 25/COTEST-10Y, 35	3.75	1.01	124.95	16,305	754	165	589
COTEST-5Y, 30	4.37	1.05	117.61	17,401	673	140	533
COTEST-5Y, 30/COTEST-10Y, 35	4.58	1.12	115.68	12,671	539	128	410

Strategy[e]	CC Cases	CC Deaths	Life-Years Gained	Total Tests[b]	Colpos	CIN2 + detected[c]	False Positives[d]
	Outcomes per 1,000						
COTEST-5Y, 35	5.44	1.27	101.36	14,506	520	108	412
COTEST-5Y, 35/COTEST-10Y, 45	5.54	1.31	100.51	11,670	447	103	344
COTEST-5Y, 40	6.60	1.68	79.26	11,931	404	85	319
COTEST-10Y, 25	3.92	1.04	122.45	13,621	660	153	507
COTEST-10Y, 35	5.69	1.35	98.66	9,393	384	96	288
End Age 70[f]							
CYTO-3Y, 21	4.47	1.19	117.10	14,929	458	147	311
CYTO-3Y, 21/HPV-5Y, 30	3.69	0.95	125.22	11,911	633	173	460
CYTO-3Y, 21/COTEST-5Y, 30	3.62	0.93	126.22	22,135	808	180	629
CYTO-4Y, 21/HPV-5Y, 25	3.57	0.94	126.53	11,196	719	177	542
CYTO-3Y, 21/HPV-10Y, 30	4.03	1.05	121.53	8,885	511	157	354
HPV-5Y, 25	3.63	0.95	125.91	10,234	705	169	536
HPV-5Y, 25/HPV-10Y, 30	3.95	1.05	122.22	7,235	585	154	432
HPV-5Y, 30	4.44	1.07	116.28	8,554	526	135	391
HPV-5Y, 30/HPV-10Y, 40	4.63	1.13	114.80	6,609	459	126	332
HPV-5Y, 35	5.51	1.29	99.78	7,103	398	105	293
HPV-5Y, 35/HPV-10Y, 40	5.69	1.35	98.29	5,109	330	96	234
HPV-5Y, 40	6.67	1.70	78.28	5,906	306	83	223
HPV-10Y, 30	4.82	1.20	111.43	5,417	397	118	279
HPV-10Y, 40	6.92	1.78	75.72	3,750	232	74	158
CYTO-4Y, 21/COTEST-5Y, 25	3.45	0.90	127.82	22,689	918	186	732
CYTO-3Y, 21/COTEST-10Y, 30	3.89	1.02	123.04	15,858	636	164	472
COTEST-5Y, 25/COTEST-10Y, 30	3.78	1.00	124.19	15,459	718	162	556
COTEST-5Y, 30	4.33	1.03	117.82	18,324	693	142	551
COTEST-5Y, 30/COTEST-10Y, 40	4.48	1.08	116.56	14,175	583	133	450
COTEST-5Y, 35	5.39	1.25	101.53	15,285	538	111	427
COTEST-5Y, 35/COTEST-10Y, 40	5.57	1.30	100.18	11,001	425	101	324
COTEST-5Y, 40	6.56	1.66	79.45	12,735	422	87	335
COTEST-10Y, 30	4.64	1.13	114.38	11,678	508	125	383
COTEST-10Y, 40	6.74	1.72	77.54	8,110	307	78	230

Abbreviations: CC, Cervical cancer; CIN, cervical intraepithelial; Colpos, colposcopies; CYTO, cytology; HPV, Human papillomavirus.
[a] Outcomes calculated from age 21 to 100 years.
[b] Total number of tests including cytology and HPV tests, irrespective of primary, triage or surveillance context.
[c] CIN2+ detected includes CIN2s, CIN3s and cervical cancers detected through screening (excludes clinically detected cancers).
[d] Total number of colposcopies that did not result in CIN2, CIN3 or cancer detection.
[e] Strategies are denoted by the screening modality, interval, age to begin screening/screening modality after switch age, interval after switch age, switch age for each end age category. For example, CYTO-3Y, 21 indicates cytology testing every 3 years starting at age 21, and CYTO-3Y, 21/HPV-5Y,30 indicates cytology testing every 3 years starting at age 21 with a switch to HPV testing every 5 years starting at age 30.
[f] End age indicates the age at which the final routine screen should occur, irrespective of age at last screen; exceptions include female persons who are recommended to continue screening due to prior abnormal results and/or precancer treatment.
[g] Strategies (bolded) represent current US recommended strategies.

Table 37. Efficient and Near-Efficient Cervical Cancer Screening Strategies Among Unvaccinated Black Female Persons Assuming Imperfect Screening and Follow-up Adherence in the Harvard Model[a]

Strategy[b]	Incremental Colposcopies per LYG	Incremental Total Tests per LYG
HPV-10Y, 40, 60	3	44
HPV-10Y, 35, 65	4	47*
HPV-10Y, 30, 60	6	46
HPV-10Y, 25, 65	24*	146
CYTO-4Y, 21/HPV-10Y, 25, 65	263*	920*
HPV-5Y, 25/HPV-10Y, 30, 60	395*	292
HPV-5Y, 25/HPV-10Y, 30, 70	107*	846*
CYTO-3Y, 21/HPV-5Y, 30, 60	31	3,461*
HPV-5Y, 25/HPV-10Y, 35, 65	51*	462
CYTO-3Y, 21/HPV-5Y, 30, 65[c]	**33**	**2,573***
CYTO-3Y, 21/HPV-5Y, 30, 70	52	67,819*
HPV-5Y, 25, 60	248*	920
CYTO-4Y, 21/HPV-5Y, 25, 60	95*	3,484*
HPV-5Y, 25, 65[c]	**128***	**1,142**
HPV-5Y, 25, 70	105*	2,110*
CYTO-4Y, 21/HPV-5Y, 25, 65	67*	1,571
CYTO-4Y, 21/HPV-5Y, 25, 70	66	2,110
COTEST-5Y, 25/COTEST-10Y, 35, 65	289*	5,863*
CYTO-3Y, 21/COTEST-5Y, 30, 60	364*	27,462*
CYTO-3Y, 21/COTEST-5Y, 30, 65[c]	**192***	**32,255***
CYTO-3Y, 21/COTEST-5Y, 30, 70	176*	22,955*
CYTO-4Y, 21/COTEST-5Y, 25, 60	240*	14,743*
COTEST-5Y, 25, 65	340*	19,747*
CYTO-4Y, 21/COTEST-5Y, 25, 65	165*	9,747*
CYTO-4Y, 21/COTEST-5Y, 25, 70	154	8,892

Abbreviations: CYTO, cytology; HPV, Human papillomavirus; LYG, life-years gained.
[a] Near-efficient (i.e., within 2% of the efficiency frontier) are indicated by *. Strategies are ordered by increasing colposcopies. Ratios were calculated against the next-less effective, non-dominated strategy. Ratios in grey font indicate strategies that had lower LYG than the guidelines-based strategy of 3-yearly cytology from ages 21 to 65 years in the Harvard model. Yellow highlighted ratios indicate strategies with efficiency ratios that were equal to or less than those from the current guidelines-based strategies in the unvaccinated population on both efficiency metrics of colposcopies per LYG and tests per LYG in the Harvard model. assuming perfect adherence. The efficiency ratios used as benchmarks were: 75-587 colposcopies per LYG and 1,341-2,604 tests per LYG (see **Table 21**). Strategies that were dominated by both efficiency metrics are not shown.
[b] Strategies are denoted by the screening modality, interval, age to begin screening/screening modality after switch age, interval after switch age, switch age for each end age category. For example, HPV-10Y, 40, 60 indicates HPV testing every 10 years starting at age 40 years and ending at age 60 years, and HPV-5Y, 35/HPV-10Y, 40, 60 indicates HPV testing every 5 years starting at age 35 years with a switch to HPV testing every 10 years starting at age 40 years and ending at age 60 years.
[c] Strategies (bolded) represent current US recommended strategies.

Table 38. Lifetime Outcomes Among 2vHPV or 4vHPV Vaccinated Black Female Persons Assuming Imperfect Screening and Follow-up Adherence in the Harvard Model[a]

	Outcomes per 1,000						
Strategy[e]	**CC Cases**	**CC Deaths**	**Life-Years Gained**	**Total Tests[b]**	**Colpos**	**CIN2 + detected[c]**	**False Positives[d]**
No Screening	5.07	1.73	0.00	0	0	0	0
End Age 60[f]							
CYTO-3Y, 21	1.68	0.51	40.52	12,788	328	71	258
CYTO-3Y, 21/HPV-5Y, 30	1.35	0.39	43.82	9,968	393	81	312
CYTO-3Y, 21/COTEST-5Y, 30	1.32	0.38	44.15	18,716	538	86	452
CYTO-4Y, 21/HPV-5Y, 25	1.31	0.38	44.14	9,038	440	82	357
CYTO-3Y, 21/HPV-10Y, 30	1.46	0.42	42.73	7,622	330	75	254
HPV-5Y, 25	1.32	0.38	44.09	8,013	425	78	347
HPV-5Y, 25/HPV-10Y, 30	1.43	0.41	42.93	5,750	363	72	291
HPV-5Y, 30	1.51	0.41	41.65	6,675	308	61	247
HPV-5Y, 30/HPV-10Y, 40	1.58	0.43	41.13	5,319	278	59	219
HPV-5Y, 35	1.80	0.47	37.37	5,502	228	47	181
HPV-5Y, 35/HPV-10Y, 40	1.86	0.49	36.80	4,042	196	45	151
HPV-5Y, 40	2.11	0.57	31.83	4,353	170	38	132
HPV-10Y, 30	1.64	0.45	40.16	4,226	240	55	185
HPV-10Y, 40	2.19	0.59	31.00	2,886	135	35	100
CYTO-4Y, 21/COTEST-5Y, 25	1.27	0.36	44.81	18,865	604	89	515
CYTO-3Y, 21/COTEST-10Y, 30	1.41	0.40	43.14	13,638	430	80	350
COTEST-5Y, 25/COTEST-10Y, 30	1.37	0.40	43.44	12,802	473	78	395
COTEST-5Y, 30	1.49	0.40	42.01	14,890	445	67	379
COTEST-5Y, 30/COTEST-10Y, 40	1.54	0.41	41.57	11,863	382	63	319
COTEST-5Y, 35	1.75	0.45	37.72	12,321	341	51	290
COTEST-5Y, 35/COTEST-10Y, 40	1.81	0.47	37.20	9,052	275	48	227
COTEST-5Y, 40	2.07	0.56	32.18	9,809	260	40	220
COTEST-10Y, 30	1.58	0.43	40.82	9,490	329	60	270
COTEST-10Y, 40	2.13	0.58	31.58	6,567	197	37	160
End Age 65[f]							
CYTO-3Y, 21[g]	**1.62**	**0.48**	**40.90**	**13,727**	**348**	**72**	**275**
CYTO-3Y, 21/HPV-5Y, 30[g]	**1.32**	**0.38**	**43.95**	**10,470**	**404**	**83**	**321**
CYTO-3Y, 21/COTEST-5Y, 30[g]	**1.30**	**0.36**	**44.26**	**19,668**	**556**	**88**	**468**
CYTO-4Y, 21/HPV-5Y, 25	1.29	0.37	44.25	9,599	451	84	367
CYTO-4Y, 21/HPV-10Y, 25	1.43	0.41	42.60	6,424	355	75	280
HPV-5Y, 25[g]	**1.30**	**0.37**	**44.20**	**8,579**	**436**	**79**	**357**
HPV-5Y, 25/HPV-10Y, 35	1.38	0.40	43.39	6,553	387	75	312
HPV-5Y, 30	1.49	0.40	41.75	7,149	319	63	256
HPV-5Y, 30/HPV-10Y, 35	1.58	0.43	40.85	5,070	269	58	210
HPV-5Y, 35	1.78	0.46	37.45	5,988	239	49	190
HPV-5Y, 35/HPV-10Y, 45	1.82	0.47	37.05	4,747	213	47	166
HPV-5Y, 40	2.09	0.56	31.93	4,947	181	39	142
HPV-10Y, 25	1.44	0.41	42.44	5,340	335	70	266
HPV-10Y, 35	1.90	0.49	36.26	3,741	184	44	140
CYTO-4Y, 21/COTEST-5Y, 25	1.25	0.35	44.88	19,946	624	90	533
CYTO-4Y, 21/COTEST-10Y, 25	1.36	0.39	43.53	13,103	469	80	388
COTEST-5Y, 25	1.27	0.36	44.46	18,897	609	86	522
COTEST-5Y, 25/COTEST-10Y, 35	1.34	0.38	43.83	14,466	513	81	432
COTEST-5Y, 30	1.47	0.39	42.09	15,816	463	68	395
COTEST-5Y, 30/COTEST-10Y, 35	1.54	0.41	41.40	11,244	366	63	303

Strategy[e]	CC Cases	CC Deaths	Life-Years Gained	Total Tests[b]	Colpos	CIN2 + detected[c]	False Positives[d]
	Outcomes per 1,000						
COTEST-5Y, 35	1.73	0.44	37.82	13,276	359	53	307
COTEST-5Y, 35/COTEST-10Y, 45	1.77	0.46	37.52	10,526	305	50	255
COTEST-5Y, 40	2.05	0.55	32.28	10,993	281	42	240
COTEST-10Y, 25	1.39	0.39	43.04	11,866	446	75	371
COTEST-10Y, 35	1.82	0.47	36.92	8,333	261	47	214
End Age 70[f]							
CYTO-3Y, 21	1.59	0.46	41.10	14,685	367	74	293
CYTO-3Y, 21/HPV-5Y, 30	1.31	0.37	44.01	10,939	413	84	329
CYTO-3Y, 21/COTEST-5Y, 30	1.29	0.36	44.31	20,557	571	89	482
CYTO-4Y, 21/HPV-5Y, 25	1.28	0.36	44.30	10,044	459	85	374
CYTO-3Y, 21/HPV-10Y, 30	1.43	0.40	42.85	8,052	339	77	262
HPV-5Y, 25	1.29	0.36	44.26	9,072	445	81	365
HPV-5Y, 25/HPV-10Y, 30	1.41	0.40	43.06	6,214	373	74	299
HPV-5Y, 30	1.48	0.39	41.80	7,644	328	64	264
HPV-5Y, 30/HPV-10Y, 40	1.55	0.41	41.26	5,790	288	61	227
HPV-5Y, 35	1.77	0.45	37.51	6,395	247	50	197
HPV-5Y, 35/HPV-10Y, 40	1.84	0.48	36.92	4,489	206	46	159
HPV-5Y, 40	2.08	0.55	32.00	5,363	189	40	149
HPV-10Y, 30	1.62	0.44	40.27	4,671	250	57	193
HPV-10Y, 40	2.17	0.58	31.07	3,305	144	36	108
CYTO-4Y, 21/COTEST-5Y, 25	1.24	0.35	44.94	20,775	638	91	547
CYTO-3Y, 21/COTEST-10Y, 30	1.38	0.39	43.27	14,435	445	82	364
COTEST-5Y, 25/COTEST-10Y, 30	1.35	0.38	43.56	13,663	489	80	409
COTEST-5Y, 30	1.46	0.38	42.15	16,765	479	69	410
COTEST-5Y, 30/COTEST-10Y, 40	1.52	0.40	41.69	12,739	398	65	333
COTEST-5Y, 35	1.72	0.44	37.86	14,060	373	54	320
COTEST-5Y, 35/COTEST-10Y, 40	1.78	0.46	37.33	9,895	291	50	241
COTEST-5Y, 40	2.04	0.54	32.32	11,796	296	43	253
COTEST-10Y, 30	1.56	0.42	40.93	10,322	345	61	284
COTEST-10Y, 40	2.11	0.57	31.66	7,299	211	39	173

Abbreviations: CC, Cervical cancer; CIN, cervical intraepithelial; Colpos, colposcopies; CYTO, cytology; HPV, Human papillomavirus.
[a] Outcomes calculated from age 21 to 100 years.
[b] Total number of tests including cytology and HPV tests, irrespective of primary, triage or surveillance context.
[c] CIN2+ detected includes CIN2s, CIN3s and cervical cancers detected through screening (excludes clinically detected cancers).
[d] Total number of colposcopies that did not result in CIN2, CIN3 or cancer detection.
[e] Strategies are denoted by the screening modality, interval, age to begin screening/screening modality after switch age, interval after switch age, switch age for each end age category. For example, CYTO-3Y, 21 indicates cytology testing every 3 years starting at age 21, and CYTO-3Y, 21/HPV-5Y,30 indicates cytology testing every 3 years starting at age 21 with a switch to HPV testing every 5 years starting at age 30.
[f] End age indicates the age at which the final routine screen should occur, irrespective of age at last screen; exceptions include female persons who are recommended to continue screening due to prior abnormal results and/or precancer treatment.
[g] Strategies (bolded) represent current US recommended strategies.

Table 39. Efficient and Near-Efficient Cervical Cancer Screening Strategies Among 2vHPV or 4vHPV Vaccinated Black Female Persons Assuming Imperfect Screening and Follow-up Adherence in the Harvard Model[a]

Strategy[b]	Incremental Colposcopies per LYG	Incremental Total Tests per LYG
HPV-10Y, 40, 60	4	93
HPV-10Y, 35, 65	9	163*
HPV-10Y, 30, 60	14	146
HPV-10Y, 30, 70	91*	4,108*
HPV-10Y, 25, 65	42*	489
CYTO-4Y, 21/HPV-10Y, 25, 65	47*	6,997*
HPV-5Y, 25/HPV-10Y, 30, 60	164*	847
HPV-5Y, 25/HPV-10Y, 30, 70	129*	3,592*
HPV-5Y, 25/HPV-10Y, 35, 65	86*	1,725
CYTO-3Y, 21/HPV-5Y, 30, 60	58	7,969*
CYTO-3Y, 21/HPV-5Y, 30, 65[c]	**86**	**7,041***
CYTO-3Y, 21/HPV-5Y, 30, 70	129*	7,046*
HPV-5Y, 25, 60	139*	2,080
HPV-5Y, 25, 65[c]	**126**	**5,248**
CYTO-4Y, 21/HPV-5Y, 25, 60	183*	21,299*
HPV-5Y, 25, 70	151	8,510
CYTO-4Y, 21/HPV-5Y, 25, 65	298*	20,683*
CYTO-4Y, 21/HPV-5Y, 25, 70	391*	27,068*
COTEST-5Y, 25/COTEST-10Y, 35, 65	10,185*	17,970*
CYTO-3Y, 21/COTEST-5Y, 30, 60	666*	196,296*
CYTO-3Y, 21/COTEST-5Y, 30, 65[c]	**22,080***	**2,112,042***
CYTO-3Y, 21/COTEST-5Y, 30, 70	2,469*	225,113*
CYTO-4Y, 21/COTEST-5Y, 25, 60	292*	17,944*
COTEST-5Y, 25, 65	803*	48,335*
CYTO-4Y, 21/COTEST-5Y, 25, 65	286*	17,413*
CYTO-4Y, 21/COTEST-5Y, 25, 70	283	17,148

Abbreviations: CYTO, cytology; HPV, Human papillomavirus; LYG, life-years gained.
[a] Near-efficient (i.e., within 2% of the efficiency frontier) are indicated by *. Strategies are ordered by increasing colposcopies. Ratios were calculated against the next-less effective, non-dominated strategy. Yellow highlighted ratios indicate strategies with efficiency ratios that were equal to or less than those from the current guidelines-based strategies in the unvaccinated population on both efficiency metrics of colposcopies per LYG and tests per LYG in the Harvard model. assuming perfect adherence. The efficiency ratios used as benchmarks were: 75-587 colposcopies per LYG and 1,341-2,604 tests per LYG (see **Table 21**). Strategies that were dominated by both efficiency metrics are not shown.
[b] Strategies are denoted by the screening modality, interval, age to begin screening/screening modality after switch age, interval after switch age, switch age for each end age category. For example, HPV-10Y, 40, 60 indicates HPV testing every 10 years starting at age 40 years and ending at age 60 years, and HPV-5Y, 35/HPV-10Y, 40, 60 indicates HPV testing every 5 years starting at age 35 years with a switch to HPV testing every 10 years starting at age 40 years and ending at age 60 years.
[c] Strategies (bolded) represent current US recommended strategies.

Table 40. Lifetime Outcomes Among 9vHPV Vaccinated Black Female Persons Assuming Imperfect Screening and Follow-up Adherence in the Harvard Model[a]

	Outcomes per 1,000						
Strategy[e]	**CC Cases**	**CC Deaths**	**Life-Years Gained**	**Total Tests[b]**	**Colpos**	**CIN2 + detected[c]**	**False Positives[d]**
No Screening	2.50	0.92	0.00	0	0	0	0
End Age 60[f]							
CYTO-3Y, 21	0.74	0.25	16.83	12,609	271	33	238
CYTO-3Y, 21/HPV-5Y, 30	0.57	0.19	18.34	9,225	240	36	204
CYTO-3Y, 21/COTEST-5Y, 30	0.56	0.19	18.31	17,420	369	40	329
CYTO-4Y, 21/HPV-5Y, 25	0.57	0.19	18.34	8,080	245	35	210
CYTO-3Y, 21/HPV-10Y, 30	0.63	0.20	17.89	6,997	210	34	176
HPV-5Y, 25	0.58	0.19	18.32	7,026	228	33	195
HPV-5Y, 25/HPV-10Y, 30	0.63	0.20	17.76	4,894	199	31	168
HPV-5Y, 30	0.60	0.19	17.74	5,978	173	29	144
HPV-5Y, 30/HPV-10Y, 40	0.64	0.20	17.44	4,693	159	28	131
HPV-5Y, 35	0.65	0.20	17.17	4,991	130	24	106
HPV-5Y, 35/HPV-10Y, 40	0.69	0.21	16.85	3,594	115	23	92
HPV-5Y, 40	0.72	0.22	15.97	3,955	97	20	77
HPV-10Y, 30	0.66	0.21	17.19	3,675	141	27	114
HPV-10Y, 40	0.77	0.24	15.56	2,568	81	19	62
CYTO-4Y, 21/COTEST-5Y, 25	0.56	0.18	18.54	17,132	390	40	350
CYTO-3Y, 21/COTEST-10Y, 30	0.60	0.20	17.98	12,507	296	37	258
COTEST-5Y, 25/COTEST-10Y, 30	0.61	0.20	17.90	11,161	295	36	259
COTEST-5Y, 30	0.59	0.19	17.92	13,590	295	32	263
COTEST-5Y, 30/COTEST-10Y, 40	0.63	0.20	17.64	10,683	252	31	220
COTEST-5Y, 35	0.63	0.20	17.17	11,366	232	27	205
COTEST-5Y, 35/COTEST-10Y, 40	0.66	0.21	16.86	8,204	186	25	160
COTEST-5Y, 40	0.70	0.22	16.21	9,053	179	22	157
COTEST-10Y, 30	0.64	0.20	17.38	8,411	217	30	188
COTEST-10Y, 40	0.74	0.23	15.88	5,959	136	21	115
End Age 65[f]							
CYTO-3Y, 21[g]	**0.71**	**0.23**	**17.04**	**13,562**	**289**	**34**	**255**
CYTO-3Y, 21/HPV-5Y, 30[g]	**0.57**	**0.18**	**18.37**	**9,704**	**245**	**37**	**209**
CYTO-3Y, 21/COTEST-5Y, 30[g]	**0.56**	**0.18**	**18.34**	**18,352**	**382**	**40**	**342**
CYTO-4Y, 21/HPV-5Y, 25	0.57	0.18	18.37	8,636	251	36	215
CYTO-4Y, 21/HPV-10Y, 25	0.62	0.20	17.76	5,644	205	33	172
HPV-5Y, 25[g]	**0.57**	**0.18**	**18.34**	**7,585**	**234**	**34**	**200**
HPV-5Y, 25/HPV-10Y, 35	0.62	0.20	17.98	5,675	211	32	179
HPV-5Y, 30	0.60	0.19	17.76	6,432	178	29	149
HPV-5Y, 30/HPV-10Y, 35	0.65	0.21	17.37	4,465	155	28	127
HPV-5Y, 35	0.65	0.20	17.19	5,453	135	24	111
HPV-5Y, 35/HPV-10Y, 45	0.68	0.21	16.96	4,275	123	24	100
HPV-5Y, 40	0.72	0.22	15.99	4,546	103	21	82
HPV-10Y, 25	0.63	0.20	17.71	4,547	185	30	155
HPV-10Y, 35	0.71	0.22	16.58	3,330	110	23	87
CYTO-4Y, 21/COTEST-5Y, 25	0.55	0.18	18.56	18,235	405	41	364
CYTO-4Y, 21/COTEST-10Y, 25	0.60	0.19	17.95	11,627	301	37	265
COTEST-5Y, 25	0.56	0.18	18.32	17,080	387	39	348
COTEST-5Y, 25/COTEST-10Y, 35	0.60	0.19	18.00	12,820	322	37	285
COTEST-5Y, 30	0.59	0.18	17.94	14,508	308	33	275
COTEST-5Y, 30/COTEST-10Y, 35	0.63	0.20	17.53	10,106	242	31	210

Strategy[e]	CC Cases	CC Deaths	Life-Years Gained	Total Tests[b]	Colpos	CIN2 + detected[c]	False Positives[d]
	Outcomes per 1,000						
COTEST-5Y, 35	0.63	0.20	17.19	12,299	245	27	218
COTEST-5Y, 35/COTEST-10Y, 45	0.65	0.20	17.00	9,653	207	26	181
COTEST-5Y, 40	0.70	0.21	16.22	10,256	195	23	172
COTEST-10Y, 25	0.61	0.20	17.78	10,316	279	34	245
COTEST-10Y, 35	0.67	0.21	16.76	7,546	178	25	153
End Age 70[f]							
CYTO-3Y, 21	0.69	0.22	17.14	14,537	308	35	273
CYTO-3Y, 21/HPV-5Y, 30	0.56	0.18	18.39	10,171	250	37	213
CYTO-3Y, 21/COTEST-5Y, 30	0.55	0.18	18.35	19,261	394	41	353
CYTO-4Y, 21/HPV-5Y, 25	0.56	0.18	18.39	9,075	255	36	219
CYTO-3Y, 21/HPV-10Y, 30	0.62	0.20	17.93	7,423	216	35	180
HPV-5Y, 25	0.57	0.18	18.36	8,081	238	34	204
HPV-5Y, 25/HPV-10Y, 30	0.62	0.20	17.79	5,364	204	32	173
HPV-5Y, 30	0.60	0.19	17.77	6,922	183	30	153
HPV-5Y, 30/HPV-10Y, 40	0.64	0.20	17.48	5,165	164	29	136
HPV-5Y, 35	0.65	0.20	17.19	5,848	139	25	114
HPV-5Y, 35/HPV-10Y, 40	0.69	0.21	16.87	4,036	120	24	97
HPV-5Y, 40	0.72	0.22	16.00	4,945	107	21	86
HPV-10Y, 30	0.66	0.21	17.21	4,114	146	27	119
HPV-10Y, 40	0.77	0.24	15.57	2,989	86	20	67
CYTO-4Y, 21/COTEST-5Y, 25	0.55	0.17	18.57	19,077	416	41	375
CYTO-3Y, 21/COTEST-10Y, 30	0.59	0.19	18.00	13,319	307	38	269
COTEST-5Y, 25/COTEST-10Y, 30	0.60	0.19	17.94	12,062	308	36	271
COTEST-5Y, 30	0.59	0.18	17.95	15,473	320	33	287
COTEST-5Y, 30/COTEST-10Y, 40	0.62	0.19	17.67	11,587	265	32	233
COTEST-5Y, 35	0.62	0.20	17.20	13,079	255	27	228
COTEST-5Y, 35/COTEST-10Y, 40	0.66	0.21	16.88	9,059	198	26	172
COTEST-5Y, 40	0.69	0.21	16.23	11,045	206	23	183
COTEST-10Y, 30	0.64	0.20	17.40	9,258	229	30	199
COTEST-10Y, 40	0.74	0.23	15.89	6,706	146	21	125

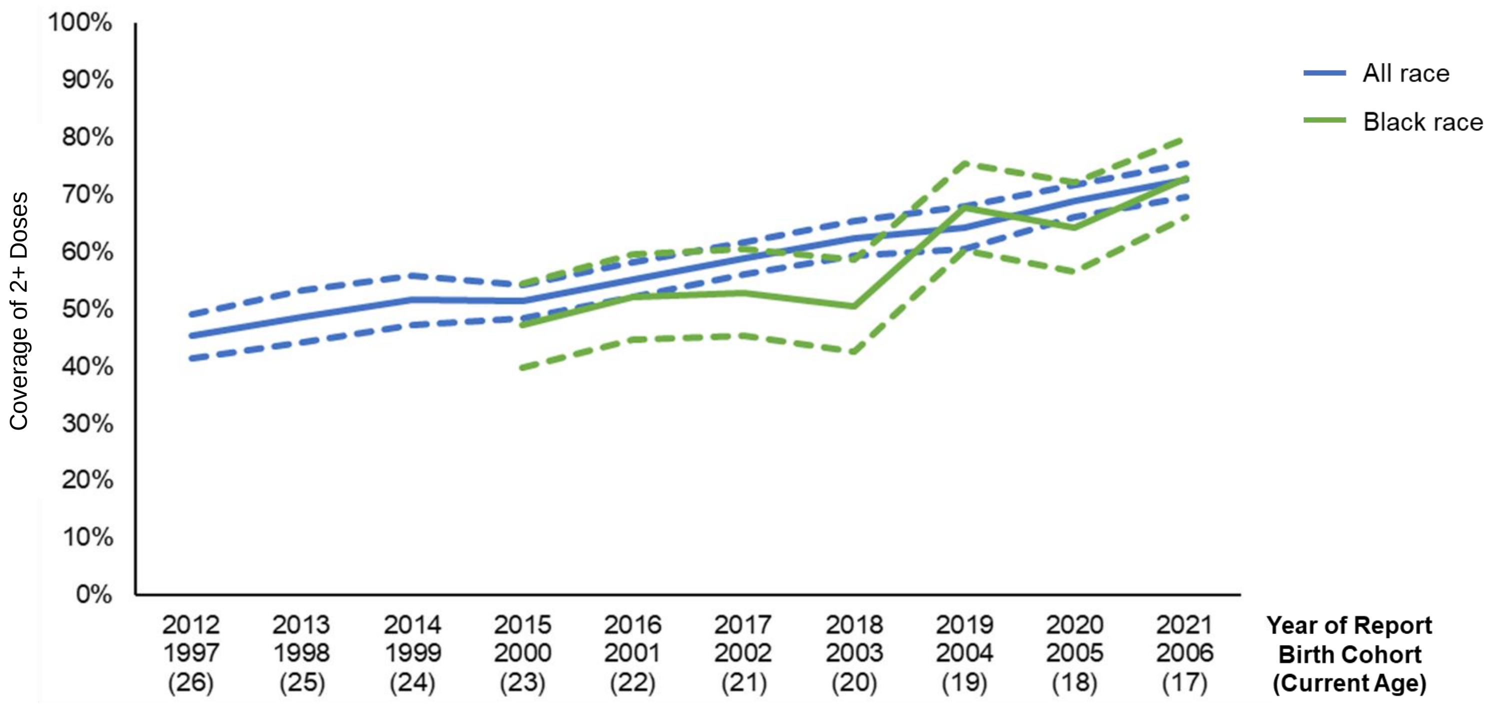
Abbreviations: CC, Cervical cancer; CIN, cervical intraepithelial; Colpos, colposcopies; CYTO, cytology; HPV, Human papillomavirus.
[a] Outcomes calculated from age 21 to 100 years.
[b] Total number of tests including cytology and HPV tests, irrespective of primary, triage or surveillance context.
[c] CIN2+ detected includes CIN2s, CIN3s and cervical cancers detected through screening (excludes clinically detected cancers).
[d] Total number of colposcopies that did not result in CIN2, CIN3 or cancer detection.
[e] Strategies are denoted by the screening modality, interval, age to begin screening/screening modality after switch age, interval after switch age, switch age for each end age category. For example, CYTO-3Y, 21 indicates cytology testing every 3 years starting at age 21, and CYTO-3Y, 21/HPV-5Y,30 indicates cytology testing every 3 years starting at age 21 with a switch to HPV testing every 5 years starting at age 30.
[f] End age indicates the age at which the final routine screen should occur, irrespective of age at last screen; exceptions include female persons who are recommended to continue screening due to prior abnormal results and/or precancer treatment.
[g] Strategies (bolded) represent current US recommended strategies.

Table 41. Efficient and Near-Efficient Cervical Cancer Screening Strategies Among 9vHPV Vaccinated Black Female Persons Assuming Imperfect Screening and Follow-up Adherence in the Harvard Model[a]

Strategy[b]	Incremental Colposcopies per LYG	Incremental Total Tests per LYG
HPV-10Y, 40, 60	5	165
HPV-10Y, 35, 65	28*	751*
HPV-5Y, 35/HPV-10Y, 40, 60	26	793*
HPV-10Y, 30, 60	597*	678
HPV-10Y, 30, 70	472*	26,821*
HPV-5Y, 30/HPV-10Y, 35, 65	128*	4,397*
HPV-5Y, 30/HPV-10Y, 40, 60	107*	4,046*
HPV-5Y, 30, 60	76	43,869*
HPV-10Y, 25, 65	104*	1,699
HPV-5Y, 25/HPV-10Y, 30, 60	1,481*	6,915*
HPV-5Y, 25/HPV-10Y, 30, 70	583*	9,417*
CYTO-4Y, 21/HPV-10Y, 25, 65	1,709*	21,304*
HPV-5Y, 25/HPV-10Y, 35, 65	156*	4,054
HPV-5Y, 25, 60	95	4,083
HPV-5Y, 25, 65[c]	**202**	**19,300**
HPV-5Y, 25, 70	303	34,145
CYTO-3Y, 21/HPV-5Y, 30, 60	561*	101,153*
CYTO-4Y, 21/HPV-5Y, 25, 60	635*	38,278*
CYTO-3Y, 21/HPV-5Y, 30, 65[c]	**516***	**113,861***
CYTO-3Y, 21/HPV-5Y, 30, 70	382	236,462*
CYTO-4Y, 21/HPV-5Y, 25, 65	1,153*	49,783*
CYTO-4Y, 21/HPV-5Y, 25, 70	651*	38,123
CYTO-3Y, 21/COTEST-5Y, 30, 60	345*	36,448*
CYTO-3Y, 21/COTEST-5Y, 30, 65[c]	**6,225***	**457,307***
COTEST-5Y, 25, 65	51,674*	3,260,600*
CYTO-4Y, 21/COTEST-5Y, 25, 60	944*	52,516*
CYTO-4Y, 21/COTEST-5Y, 25, 65	908	52,140
CYTO-4Y, 21/COTEST-5Y, 25, 70	1,686	128,998

Abbreviations: CYTO, cytology; HPV, Human papillomavirus; LYG, life-years gained.
[a] Near-efficient (i.e., within 2% of the efficiency frontier) are indicated by *. Strategies are ordered by increasing colposcopies. Ratios were calculated against the next-less effective, non-dominated strategy. Yellow highlighted ratios indicate strategies with efficiency ratios that were equal to or less than those from the current guidelines-based strategies in the unvaccinated population on both efficiency metrics of colposcopies per LYG and tests per LYG in the Harvard model. assuming perfect adherence. The efficiency ratios used as benchmarks were: 75-587 colposcopies per LYG and 1,341-2,604 tests per LYG (see **Table 21**). Strategies that were dominated by both efficiency metrics are not shown.
[b] Strategies are denoted by the screening modality, interval, age to begin screening/screening modality after switch age, interval after switch age, switch age for each end age category. For example, HPV-10Y, 40, 60 indicates HPV testing every 10 years starting at age 40 years and ending at age 60 years, and HPV-5Y, 35/HPV-10Y, 40, 60 indicates HPV testing every 5 years starting at age 35 years with a switch to HPV testing every 10 years starting at age 40 years and ending at age 60 years.
[c] Strategies (bolded) represent current US recommended strategies.

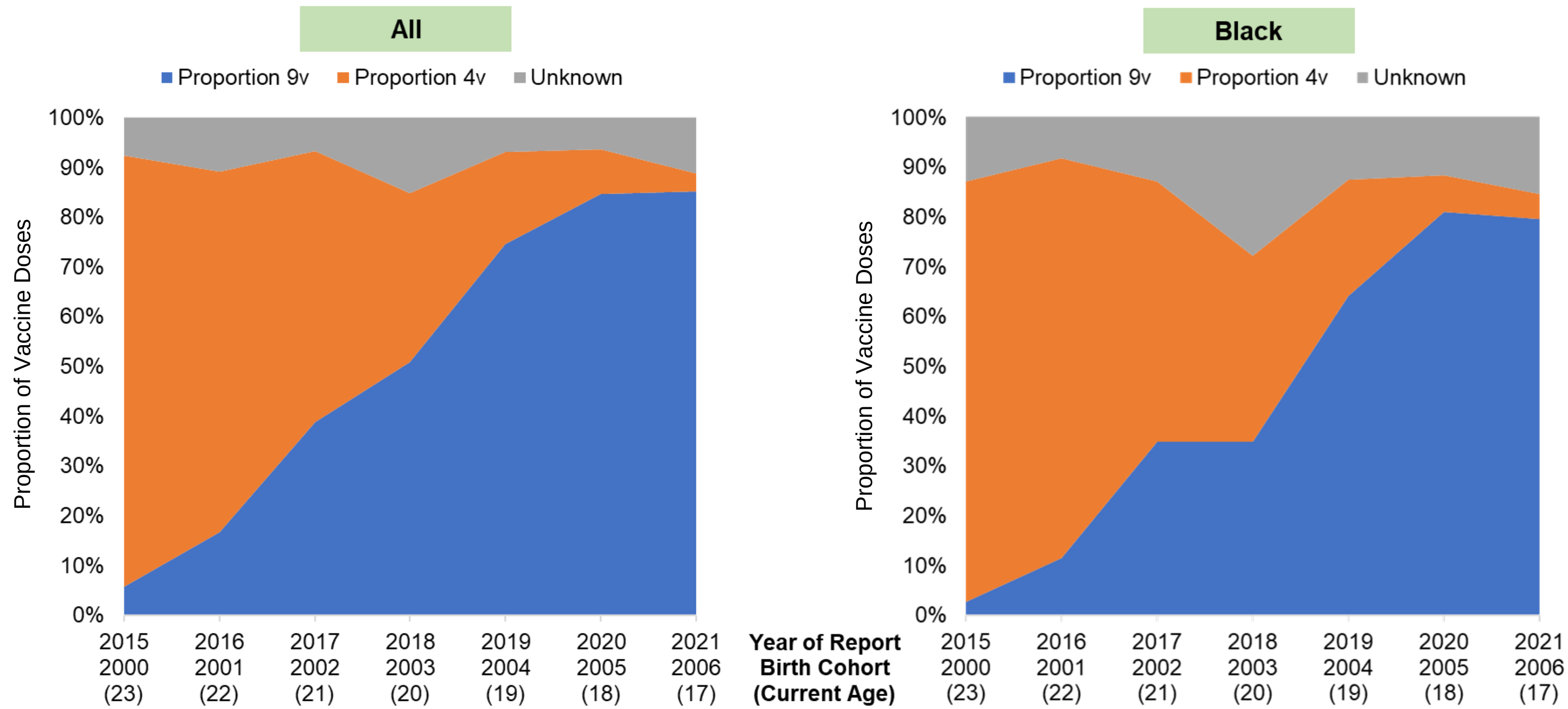
Appendix Figure 1. HPV Vaccine Completion (2 or More Doses) Among Female Persons Aged 15 Years, by Year of Report, Birth Cohort and Current Age



HPV vaccine completion of at least two doses among 15-year-old female persons of all races in year 2013 (i.e., those born in year 1998 and currently age 25 years) was nearly 50%; in 2017, HPV vaccine completion at age 15 years (i.e., those born in 2002 and current age 21 years) was 58.9% for all-race and 52.8% for Black-race female persons. In 2021, 2-dose HPV vaccine uptake among 15-year-olds increased to 73.0% for all and Black female persons.

Source: National Immunization Survey-Teen (NIS-TEEN). 2012-2021. National Center for Health Statistics. Available from: https://www.cdc.gov/vaccines/imz-managers/nis/datasets-teen.html.

Appendix Figure 2. Share of HPV Vaccine Doses Among Female Persons Aged 15 Years, by Year of Report, Birth Cohort and Current Age

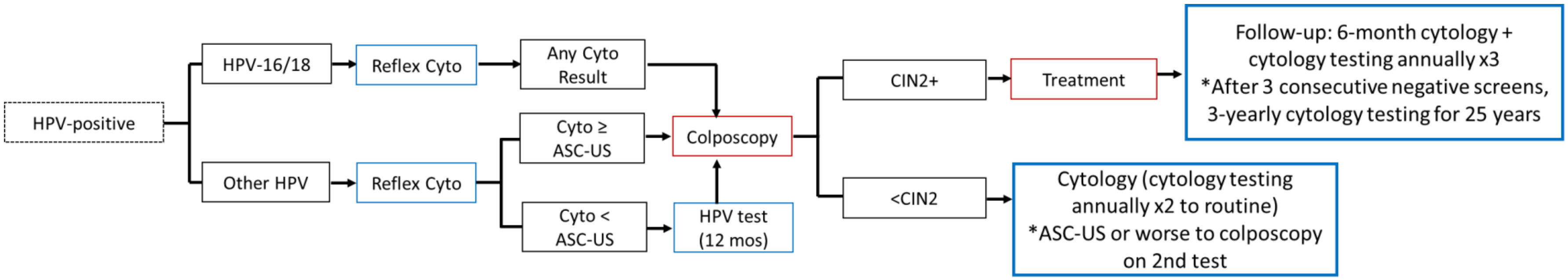


The share of doses that are 9vHPV (nonavalent) compared to 4vHPV (quadrivalent) or unknown has increased over time, suggesting a higher level of protection against cervical disease among younger birth cohorts. For example, in 2015, the share of HPV vaccine doses that were 9vHPV was 5.7% among all-race and 2.6% among Black-race 15-year-old female persons (i.e., birth year 2000, current age 23 years), but by year 2017, the share of 9vHPV vaccine doses increased to 38.9% for all-race and 34.9% for Black-race 15-year-old female persons. In year 2021, the share of 9vHPV vaccine doses was 85.1% for all-race and 79.6% for Black-race 15-year-old female persons.

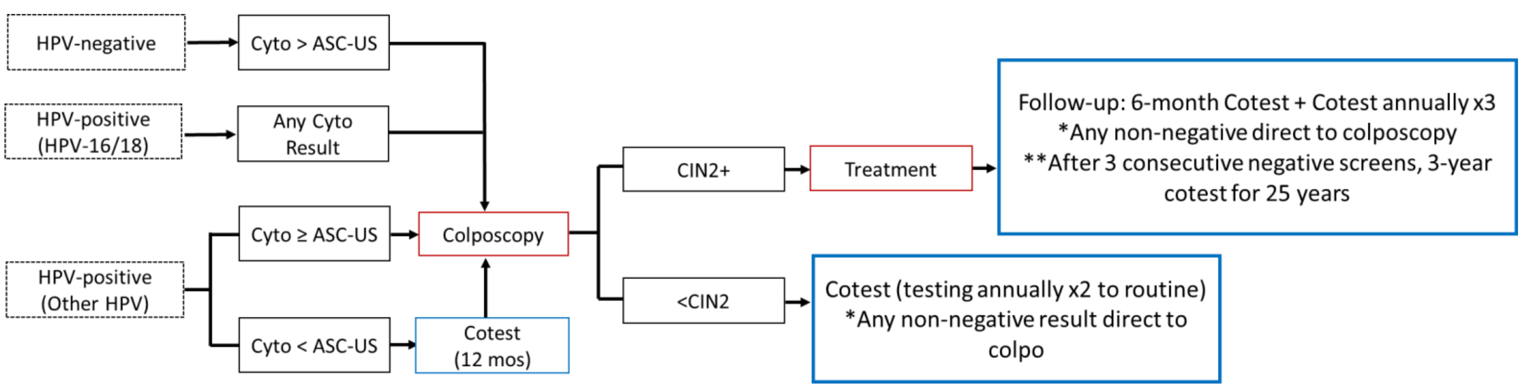
Source: National Immunization Survey-Teen (NIS-TEEN). 2012-2021. National Center for Health Statistics. Available from: https://www.cdc.gov/vaccines/imz-managers/nis/datasets-teen.html.

Appendix Figure 3. Flow Diagrams for Management of Screen-Positive Results: HPV-16/18 Genotype Triage

Primary HPV testing



Primary cotesting



Appendix Table 1A. Natural History Model Parameters, Post-Calibration: Harvard Model

Model parameter	Range of values for 50 best-fitting sets[a]
HPV 16 incidence (monthly)	
Age <20 years	0.00002-0.00876
Age 20-24 years	0.00154-0.00483
Age 25-29 years	0.00133-0.00336
Age 30-34 years	0.00124-0.00302
Age 35-39 years	0.00120-0.00278
Age 40-44 years	0.00113-0.00265
Age 45-49 years	0.00103-0.00252
Age 50-54 years	0.00093-0.00228
Age 55-59 years	0.00084-0.00206
Age 60+ years	0.00037-0.00203
HPV 18 incidence (monthly)	
Age <20 years	0.00001-0.00327
Age 20-24 years	0.00113-0.00311
Age 25-29 years	0.00062-0.00265
Age 30-34 years	0.00051-0.00154
Age 35-39 years	0.00040-0.00127
Age 40-44 years	0.00034-0.00101
Age 45-49 years	0.00031-0.00086
Age 50-54 years	0.00028-0.00078
Age 55-59 years	0.00025-0.00071
Age 60+ years	0.00011-0.00070
HPV 31 incidence (monthly)	
Age <20 years	0.00001-0.00493
Age 20-24 years	0.00118-0.00471
Age 25-29 years	0.00078-0.00278
Age 30-34 years	0.00055-0.00190
Age 35-39 years	0.00044-0.00131
Age 40-44 years	0.00043-0.00115
Age 45-49 years	0.00039-0.00113
Age 50-54 years	0.00036-0.00102
Age 55-59 years	0.00032-0.00092
Age 60+ years	0.00014-0.00091
HPV 33 incidence (monthly)	
Age <20 years	0.00001-0.00299
Age 20-24 years	0.00041-0.00262
Age 25-29 years	0.00025-0.00137
Age 30-34 years	0.00018-0.00084
Age 35-39 years	0.00016-0.00067
Age 40-44 years	0.00015-0.00060
Age 45-49 years	0.00013-0.00054
Age 50-54 years	0.00012-0.00049
Age 55-59 years	0.00011-0.00044
Age 60+ years	0.00005-0.00043
HPV 45 incidence (monthly)	
Age <20 years	0.00001-0.00210
Age 20-24 years	0.00042-0.00168
Age 25-29 years	0.00032-0.00078
Age 30-34 years	0.00028-0.00064

Model parameter	Range of values for 50 best-fitting sets[a]
Age 35-39 years	0.00023-0.00055
Age 40-44 years	0.00019-0.00045
Age 45-49 years	0.00017-0.00036
Age 50-54 years	0.00014-0.00031
Age 55-59 years	0.00013-0.00028
Age 60+ years	0.00006-0.00027
HPV 52 incidence (monthly)	
Age <20 years	0.00001-0.00593
Age 20-24 years	0.00034-0.00400
Age 25-29 years	0.00023-0.00127
Age 30-34 years	0.00021-0.00087
Age 35-39 years	0.00020-0.00083
Age 40-44 years	0.00019-0.00078
Age 45-49 years	0.00019-0.00081
Age 50-54 years	0.00017-0.00074
Age 55-59 years	0.00016-0.00067
Age 60+ years	0.00001-0.00066
HPV 58 incidence (monthly)	
Age <20 years	0.00001-0.00253
Age 20-24 years	0.00060-0.00234
Age 25-29 years	0.00047-0.00117
Age 30-34 years	0.00040-0.00096
Age 35-39 years	0.00034-0.00083
Age 40-44 years	0.00028-0.00068
Age 45-49 years	0.00025-0.00056
Age 50-54 years	0.00022-0.00051
Age 55-59 years	0.00020-0.00046
Age 60+ years	0.00005-0.00045
Other carcinogenic incidence (monthly)	
Age <20 years	0.00003-0.02940
Age 20-24 years	0.00956-0.02738
Age 25-29 years	0.00636-0.02024
Age 30-34 years	0.00466-0.01309
Age 35-39 years	0.00392-0.00976
Age 40-44 years	0.00344-0.00857
Age 45-49 years	0.00319-0.00767
Age 50-54 years	0.00289-0.00702
Age 55-59 years	0.00261-0.00636
Age 60+ years	0.00115-0.00624
Non-carcinogenic incidence (monthly)	
Age <20 years	0.00001-0.03654
Age 20-24 years	0.00269-0.02046
Age 25-29 years	0.00211-0.01953
Age 30-34 years	0.00187-0.01486
Age 35-39 years	0.00170-0.01206
Age 40-44 years	0.00147-0.01095
Age 45-49 years	0.00103-0.00900
Age 50-54 years	0.00077-0.00639
Age 55-59 years	0.00056-0.00479
Age 60+ years	0.00026-0.00447

Model parameter	Range of values for 50 best-fitting sets[a]
Natural immunity [b]	0.559-0.833
HPV 16 clearance (monthly)[c]	
Year 1	0.04189
Year 2	0.04075
Year 3	0.0339
Year 4	0.03189
Year 5+	0.01985
HPV 18 clearance (monthly)[c]	
Year 1	0.07334
Year 2	0.06324
Year 3	0.0536
Year 4	0.02062
Year 5+	0.02062
HPV 31 clearance (monthly)[c]	
Year 1	0.06345
Year 2	0.03383
Year 3	0.03383
Year 4	0.03383
Year 5+	0.03383
HPV 33 clearance (monthly)[c]	
Year 1	0.08345
Year 2	0.04496
Year 3	0.03616
Year 4	0.03616
Year 5+	0.03616
HPV 45 clearance (monthly)[c]	
Year 1	0.07852
Year 2	0.04258
Year 3	0.04168
Year 4	0.03013
Year 5+	0.01507
HPV 52 clearance (monthly)[c]	
Year 1	0.063
Year 2	0.0444
Year 3	0.0444
Year 4	0.03933
Year 5+	0.03933
HPV 58 clearance (monthly)[c]	
Year 1	0.06557
Year 2	0.05443
Year 3	0.05397
Year 4	0.03332
Year 5+	0.01666
Other carcinogenic clearance (monthly)[c]	
Year 1	0.08077
Year 2	0.06663
Year 3	0.05397
Year 4	0.04923
Year 5+	0.00509

Non-carcinogenic clearance (monthly)[c]	
Year 1	0.05189
Year 2	0.05001
Year 3	0.03465
Year 4	0.03465
Year 5+	0.02861
HPV 16 progression to CIN2 (monthly)[c]	
Year 1	0.00171
Year 2	0.00242
Year 3	0.00258
Year 4	0.00552
Year 5	0.015
Years 6-10	0.01519-0.04339
Years 11+	0.01682-0.07444
HPV 16 progression to CIN3 (monthly)[c]	
Year 1	0.00057
Year 2	0.00081
Year 3	0.00086
Year 4	0.00184
Year 5	0.00502
Years 6-10	0.00509-0.01453
Years 11+	0.00563-0.02493
HPV 18 progression to CIN2 (monthly)[c]	
Year 1	0.00004
Year 2	0.00019
Year 3	0.00019
Year 4	0.00773
Year 5	0.00773
Years 6-10	0.00783-0.02237
Years 11+	0.00867-0.03838
HPV 18 progression to CIN3 (monthly)[c]	
Year 1	0.00001
Year 2	0.00005
Year 3	0.00005
Year 4	0.00194
Year 5	0.00194
Years 6-10	0.00196-0.00561
Years 11+	0.00217-0.00962
HPV 31 progression to CIN2 (monthly)[c]	
Year 1	0.00026
Year 2	0.00278
Year 3	0.00309
Year 4	0.00693
Year 5	0.00693
Years 6-10	0.00702-0.02005
Years 11+	0.00777-0.03440
HPV 31 progression to CIN3 (monthly)[c]	
Year 1	0.00007
Year 2	0.0007
Year 3	0.00077
Year 4	0.00174
Year 5	0.00174

Years 6-10	0.00176-0.00503
Years 11+	0.00195-0.00862
HPV 33 progression to CIN2 (monthly)[c]	
Year 1	0.00072
Year 2	0.00072
Year 3	0.00494
Year 4	0.00494
Year 5	0.00494
Years 6-10	0.00500-0.01429
Years 11+	0.00554-0.02451
HPV 33 progression to CIN3 (monthly)[c]	
Year 1	0.00018
Year 2	0.00018
Year 3	0.00124
Year 4	0.00124
Year 5	0.00124
Years 6-10	0.00125-0.00358
Years 11+	0.00139-0.00614
HPV 45 progression to CIN2 (monthly)[c]	
Year 1	0
Year 2	0
Year 3	0.00226
Year 4	0.00533
Year 5	0.00533
Years 6-10	0.00540-0.01543
Years 11+	0.00598-0.02647
HPV 45 progression to CIN3 (monthly)[c]	
Year 1	0
Year 2	0
Year 3	0.00056
Year 4	0.00134
Year 5	0.00134
Years 6-10	0.00135-0.00386
Years 11+	0.00150-0.00663
HPV 52 progression to CIN2 (monthly)[c]	
Year 1	0.00088
Year 2	0.00168
Year 3	0.00168
Year 4	0.00198
Year 5	0.00568
Years 6-10	0.00575-0.01643
Years 11+	0.00637-0.02818
HPV 52 progression to CIN3 (monthly)[c]	
Year 1	0.00022
Year 2	0.00042
Year 3	0.00042
Year 4	0.00049
Year 5	0.00142
Years 6-10	0.00144-0.00412
Years 11+	0.00160-0.00706
HPV 58 progression to CIN2 (monthly)[c]	
Year 1	0.00059

Year 2	0.00247
Year 3	0.00247
Year 4	0.00462
Year 5	0.01025
Years 6-10	0.01038-0.02964
Years 11+	0.01149-0.05085
HPV 58 progression to CIN3 (monthly)[c]	
Year 1	0.00015
Year 2	0.00062
Year 3	0.00062
Year 4	0.00116
Year 5	0.00257
Years 6-10	0.00260-0.00744
Years 11+	0.00288-0.01276
Other carcinogenic HPV progression to CIN2 (monthly)[c]	
Year 1	0.00013
Year 2	0.00037
Year 3	0.00196
Year 4	0.00196
Year 5	0.00196
Years 6-10	0.00199-0.00567
Years 11+	0.00220-0.00973
Other carcinogenic HPV progression to CIN3 (monthly)[c]	
Year 1	0.00003
Year 2	0.00009
Year 3	0.00049
Year 4	0.00049
Year 5	0.00049
Years 6-10	0.00050-0.00142
Years 11+	0.00055-0.00243
Non-carcinogenic HPV progression to CIN2 (monthly)[c]	
Year 1	0.00021
Year 2	0.00029
Year 3	0.00031
Year 4	0.00066
Year 5	0.00066
Years 6-10	0.00067-0.00192
Years 11+	0.00074-0.00329
Non-carcinogenic HPV progression to CIN3 (monthly)[c]	
Year 1	0.00002
Year 2	0.00003
Year 3	0.00003
Year 4	0.00007
Year 5	0.00007
Years 6-10	0.00007-0.00021
Years 11+	0.00008-0.00037
Regression of CIN2 related to HPV 16 (monthly)[d]	
Years 1-5	0.045
Years 6-10	0.036
Years 11-20	0.027
Years 21-30	0.0018
Years 31-40	0.0009

Years 41+	0.00045
Regression of CIN2 related to other HR HPV (monthly)[d]	
Years 1-5	0.05
Years 6-10	0.04
Years 11-20	0.03
Years 21-30	0.002
Years 31-40	0.001
Years 41+	0.0005
Regression of CIN3 related to HPV 16 (monthly)[d]	
Years 1-5	0.0225
Years 6-10	0.018
Years 11-20	0.0135
Years 21-30	0.0009
Years 31-40	0.00045
Years 41+	0.00023
Regression of CIN3 related to other HR HPV (monthly)[d]	
Years 1-5	0.025
Years 6-10	0.02
Years 11-20	0.015
Years 21-30	0.001
Years 31-40	0.0005
Years 41+	0.00025
Progression of CIN2 to invasive cancer related to HPV 16 (monthly)[e]	
Years 1-5	0.00003-0.00004
Years 6-10	0.00004-0.00005
Years 11-20	0.00086-0.00111
Years 21-29	0.00251-0.00325
Years 30-34	0.00503-0.00649
Years 35-39	0.00545-0.00704
Years 40-44	0.01174-0.01515
Years 45-49	0.01257-0.01624
Years 50+	0.07527-0.09720
Progression of CIN2 to invasive cancer related to HPV 18 (monthly)[e]	
Years 1-5	0.00003-0.00004
Years 6-10	0.00004-0.00005
Years 11-20	0.00086-0.00111
Years 21-29	0.00251-0.00326
Years 30-34	0.00502-0.00651
Years 35-39	0.00543-0.00706
Years 40-44	0.01170-0.01520
Years 45-49	0.01254-0.01628
Years 50+	0.07506-0.09748
Progression of CIN2 to invasive cancer related to HPV 33 (monthly)[e]	
Years 1-5	0.00003-0.00004
Years 6-10	0.00004-0.00005
Years 11-20	0.00086-0.00111
Years 21-29	0.00252-0.00325
Years 30-34	0.00505-0.00650
Years 35-39	0.00547-0.00705
Years 40-44	0.01178-0.01518
Years 45-49	0.01262-0.01626
Years 50+	0.07556-0.09735

Progression of CIN2 to invasive cancer related to HPV 31/45/52/58 (monthly)[e]	
Years 1-5	0.00002
Years 6-10	0.00002
Years 11-20	0.00057
Years 21-29	0.00167
Years 30-34	0.00334
Years 35-39	0.00362
Years 40-44	0.0078
Years 45-49	0.00835
Years 50+	0.05
Progression of CIN2 to invasive cancer related to other HR HPV (monthly)[e]	
Years 1-5	0
Years 6-10	0
Years 11-20	0.00006-0.00011
Years 21-29	0.00017-0.00033
Years 30-34	0.00034-0.00066
Years 35-39	0.00037-0.00071
Years 40-44	0.00079-0.00153
Years 45-49	0.00085-0.00164
Years 50+	0.00085-0.00164
Progression of CIN3 to invasive cancer related to HPV 16 (monthly)[e]	
Years 1-5	0.00017-0.00021
Years 6-10	0.00018-0.00023
Years 11-20	0.00432-0.00556
Years 21-29	0.01262-0.01625
Years 30-34	0.02524-0.03250
Years 35-39	0.02735-0.03520
Years 40-44	0.05890-0.07583
Years 45-49	0.06311-0.08124
Years 50+	0.07556-0.09727
Progression of CIN3 to invasive cancer related to HPV 18 (monthly)[e]	
Years 1-5	0.00017-0.00021
Years 6-10	0.00018-0.00023
Years 11-20	0.00431-0.00556
Years 21-29	0.01262-0.01625
Years 30-34	0.02523-0.03250
Years 35-39	0.02733-0.03521
Years 40-44	0.05887-0.07584
Years 45-49	0.06308-0.08126
Years 50+	0.07552-0.09730
Progression of CIN3 to invasive cancer related to HPV 33 (monthly)[e]	
Years 1-5	0.00016-0.00021
Years 6-10	0.00018-0.00023
Years 11-20	0.00429-0.00549
Years 21-29	0.01254-0.01606
Years 30-34	0.02507-0.03211
Years 35-39	0.02716-0.03479
Years 40-44	0.05851-0.07493
Years 45-49	0.06269-0.08028
Years 50+	0.07506-0.09612

Progression of CIN3 to invasive cancer related to HPV 31/45/52/58 (monthly)[e]	
Years 1-5	0.00011
Years 6-10	0.00012
Years 11-20	0.00286
Years 21-29	0.00835
Years 30-34	0.0167
Years 35-39	0.0181
Years 40-44	0.03898
Years 45-49	0.04176
Years 50+	0.05
Progression of CIN3 to invasive cancer related to other HR HPV (monthly)[e]	
Years 1-5	0.00001-0.00002
Years 6-10	0.00001-0.00002
Years 11-20	0.00029-0.00057
Years 21-29	0.00085-0.00165
Years 30-34	0.00170-0.00331
Years 35-39	0.00184-0.00358
Years 40-44	0.00397-0.00772
Years 45-49	0.00425-0.00827
Years 50+	0.00425-0.00827
Progression of invasive cancer stages (monthly)	
Local to regional	0.02
Regional to distant	0.025
Invasive cancer mortality (monthly)[f]	
Local	
Year 1	0.00151
Years 2-3	0.00187
Years 4-5	0.00104
Years 6-10	0.00083
Years 11-15	0.00071
Regional	
Year 1	0.01189
Years 2-3	0.01188
Years 4-5	0.00353
Years 6-10	0.0024
Years 11-15	0.00181
Distant	
Year 1	0.05546
Years 2-3	0.03245
Years 4-5	0.00859
Years 6-10	0.00413
Years 11-15	0.00413
Probability of symptom detection (monthly)	
Local	0.0174
Regional	0.0735
Distant	0.1746

Abbreviations: CIN2, cervical intraepithelial neoplasia grade 2; CIN3, cervical intraepithelial neoplasia grade 3; HPV, human papillomavirus; HR, high-risk.
[a] Values represent the range of probabilities across the 50 top-fitting sets; parameters without a range of values were held constant across the 50 top-fitting sets.
[b] Natural immunity represents the percentage reduction in risk of subsequent, type-specific infection after a woman has cleared a carcinogenic infection with the same type. Risk reduction is assumed to be constant across age, time, and genotype.

[c] HPV clearance and progression probabilities are a function of time since infection (i.e., persistence).
[d] Precancer regression probabilities decrease by time since lesion onset and are constant across carcinogenic HPV types. Given limited data, we assumed that the monthly CIN3 regression probability is 50% of CIN2 regression; 50% regress to type-specific HPV-infected health states and 50% regress to the Normal health state.
[e] Precancer progression probabilities increase by time since lesion onset and are constant across carcinogenic HPV types. CIN2 progression is set at 20% of CIN3 progression (for carcinogenic types only).
[f] In addition to time since diagnosis, cancer mortality was adjusted for age at diagnosis by applying stage-specific multipliers to the baseline probabilities that ranged from 0.49 to 3.28 for local cancer; 0.62 to 1.60 for regional cancer; and 0.71 to 2.99 for distant cancer.

Appendix Table 1B. Transition Probabilities by HPV Genotype and Age: MISCAN-Cervix Model

HPV Type	Age	Regression		Probability	Progression		Probability
		From	To	(ever[a])	From	To	(ever[a])
HPV 16	15	HPV 16	Cleared	0.920	HPV 16	CIN 1	0.08
HPV 16	25	HPV 16	Cleared	0.941	HPV 16	CIN 1	0.059
HPV 16	35	HPV 16	Cleared	0.833	HPV 16	CIN 1	0.167
HPV 16	50	HPV 16	Cleared	0.912	HPV 16	CIN 1	0.088
HPV 16	75	HPV 16	Cleared	0.982	HPV 16	CIN 1	0.018
HPV 18	15	HPV 18	Cleared	0.790	HPV 18	CIN 1	0.21
HPV 18	25	HPV 18	Cleared	0.845	HPV 18	CIN 1	0.155
HPV 18	35	HPV 18	Cleared	0.562	HPV 18	CIN 1	0.438
HPV 18	50	HPV 18	Cleared	0.768	HPV 18	CIN 1	0.232
HPV 18	75	HPV 18	Cleared	0.952	HPV 18	CIN 1	0.048
HPV 9V	15	HPV 9V	Cleared	0.920	HPV 9V	CIN 1	0.08
HPV 9V	25	HPV 9V	Cleared	0.941	HPV 9V	CIN 1	0.059
HPV 9V	35	HPV 9V	Cleared	0.833	HPV 9V	CIN 1	0.167
HPV 9V	50	HPV 9V	Cleared	0.911	HPV 9V	CIN 1	0.089
HPV 9V	75	HPV 9V	Cleared	0.982	HPV 9V	CIN 1	0.018
HPVOHR	15	HPVOHR	Cleared	0.859	HPVOHR	CIN 1	0.141
HPVOHR	25	HPVOHR	Cleared	0.897	HPVOHR	CIN 1	0.103
HPVOHR	35	HPVOHR	Cleared	0.707	HPVOHR	CIN 1	0.293
HPVOHR	50	HPVOHR	Cleared	0.845	HPVOHR	CIN 1	0.155
HPVOHR	75	HPVOHR	Cleared	0.968	HPVOHR	CIN 1	0.032
HPV 16	20	CIN 1	Cleared	0.439	CIN 1	CIN 2	0.561
HPV 16	35	CIN 1	Cleared	0.807	CIN 1	CIN 2	0.193
HPV 16	50	CIN 1	Cleared	0.777	CIN 1	CIN 2	0.223
HPV 16	65	CIN 1	Cleared	0.708	CIN 1	CIN 2	0.292
HPV 18	20	CIN 1	Cleared	0.833	CIN 1	CIN 2	0.167
HPV 18	35	CIN 1	Cleared	0.943	CIN 1	CIN 2	0.057
HPV 18	50	CIN 1	Cleared	0.934	CIN 1	CIN 2	0.066
HPV 18	65	CIN 1	Cleared	0.913	CIN 1	CIN 2	0.087
HPV 9V	20	CIN 1	Cleared	0.643	CIN 1	CIN 2	0.357
HPV 9V	35	CIN 1	Cleared	0.877	CIN 1	CIN 2	0.123
HPV 9V	50	CIN 1	Cleared	0.858	CIN 1	CIN 2	0.142
HPV 9V	65	CIN 1	Cleared	0.814	CIN 1	CIN 2	0.186
HPVOHR	20	CIN 1	Cleared	0.813	CIN 1	CIN 2	0.187
HPVOHR	35	CIN 1	Cleared	0.936	CIN 1	CIN 2	0.064
HPVOHR	50	CIN 1	Cleared	0.926	CIN 1	CIN 2	0.074
HPVOHR	65	CIN 1	Cleared	0.902	CIN 1	CIN 2	0.098
NoHPV	20	CIN 1	Cleared	0.961	CIN 1	CIN 2	0.039
NoHPV	35	CIN 1	Cleared	0.987	CIN 1	CIN 2	0.013
NoHPV	50	CIN 1	Cleared	0.985	CIN 1	CIN 2	0.015
NoHPV	65	CIN 1	Cleared	0.980	CIN 1	CIN 2	0.02
HPV 16	20	CIN 2	Cleared	0.735	CIN 2	CIN 3	0.265
HPV 16	35	CIN 2	Cleared	0.229	CIN 2	CIN 3	0.771
HPV 16	50	CIN 2	Cleared	0.426	CIN 2	CIN 3	0.574
HPV 16	65	CIN 2	Cleared	0.000	CIN 2	CIN 3	1
HPV 18	20	CIN 2	Cleared	0.903	CIN 2	CIN 3	0.097
HPV 18	35	CIN 2	Cleared	0.718	CIN 2	CIN 3	0.282
HPV 18	50	CIN 2	Cleared	0.790	CIN 2	CIN 3	0.21
HPV 18	65	CIN 2	Cleared	0.619	CIN 2	CIN 3	0.381

HPV Type	Age	Regression		Probability	Progression		Probability
		From	To	(ever[a])	From	To	(ever[a])
HPV 9V	20	CIN 2	Cleared	0.866	CIN 2	CIN 3	0.134
HPV 9V	35	CIN 2	Cleared	0.611	CIN 2	CIN 3	0.389
HPV 9V	50	CIN 2	Cleared	0.711	CIN 2	CIN 3	0.289
HPV 9V	65	CIN 2	Cleared	0.474	CIN 2	CIN 3	0.526
HPVOHR	20	CIN 2	Cleared	0.915	CIN 2	CIN 3	0.085
HPVOHR	35	CIN 2	Cleared	0.754	CIN 2	CIN 3	0.246
HPVOHR	50	CIN 2	Cleared	0.817	CIN 2	CIN 3	0.183
HPVOHR	65	CIN 2	Cleared	0.667	CIN 2	CIN 3	0.333
NoHPV	20	CIN 2	Cleared	0.922	CIN 2	CIN 3	0.078
NoHPV	35	CIN 2	Cleared	0.774	CIN 2	CIN 3	0.226
NoHPV	50	CIN 2	Cleared	0.832	CIN 2	CIN 3	0.168
NoHPV	65	CIN 2	Cleared	0.694	CIN 2	CIN 3	0.306
HPV 16	20	CIN 3	Cleared	0.966	CIN 3	CC	0.034
HPV 16	35	CIN 3	Cleared	0.727	CIN 3	CC	0.273
HPV 16	50	CIN 3	Cleared	0.387	CIN 3	CC	0.613
HPV 16	65	CIN 3	Cleared	0.079	CIN 3	CC	0.921
HPV 18	20	CIN 3	Cleared	0.914	CIN 3	CC	0.086
HPV 18	35	CIN 3	Cleared	0.303	CIN 3	CC	0.697
HPV 18	50	CIN 3	Cleared	0.000	CIN 3	CC	1
HPV 18	65	CIN 3	Cleared	0.000	CIN 3	CC	1
HPV 9V	20	CIN 3	Cleared	0.980	CIN 3	CC	0.98
HPV 9V	35	CIN 3	Cleared	0.840	CIN 3	CC	0.84
HPV 9V	50	CIN 3	Cleared	0.641	CIN 3	CC	0.641
HPV 9V	65	CIN 3	Cleared	0.460	CIN 3	CC	0.46
HPVOHR	20	CIN 3	Cleared	0.979	CIN 3	CC	0.021
HPVOHR	35	CIN 3	Cleared	0.830	CIN 3	CC	0.17
HPVOHR	50	CIN 3	Cleared	0.619	CIN 3	CC	0.381
HPVOHR	65	CIN 3	Cleared	0.428	CIN 3	CC	0.572
No HPV	20	CIN 3	Cleared	1.000	CIN 3	CC	0.000[b]
No HPV	35	CIN 3	Cleared	1.000	CIN 3	CC	0.000[b]
No HPV	50	CIN 3	Cleared	1.000	CIN 3	CC	0.000[b]
No HPV	65	CIN 3	Cleared	1.000	CIN 3	CC	0.000[b]

Abbreviations: CC, cervical cancer; CIN, cervical intraepithelial neoplasia; HPV, human papillomavirus; HPV 9V, HPV-31/33/45/52/58; HPVOHR, other high-risk HPV-35/39/51/56/59/66/68.
[a] Values represent the total probability of moving from one health state to another, unless a women undergoes a hysterectomy or dies before this transition; the probabilities are assumed to be independent of the transition duration.
[b] CIN 3 lesions can never transition to cervical cancer without an HPV infection.

Appendix Table 1C. Natural History Model Parameters, Post-Calibration: Policy1-Cervix Model

Model parameter	Range of values across ages and treatment status[a]
HPV 16 incidence (annual)	
Age <20 years	0-0.061
Age 20-24 years	0.040-0.043
Age 25-29 years	0.004-0.008
Age 30-34 years	0.003-0.007
Age 35-39 years	0.003-0.004
Age 40-44 years	0.004-0.005
Age 45-49 years	0.001-0.002
Age 50-54 years	0.002-0.003
Age 55-59 years	0.002
Age 60+ years	0-0.002
HPV 18 incidence (annual)	
Age <20 years	0-0.017
Age 20-24 years	0.011-0.017
Age 25-29 years	0.001-0.002
Age 30-34 years	0.002-0.004
Age 35-39 years	0.002-0.003
Age 40-44 years	0.002
Age 45-49 years	0.002
Age 50-54 years	0.002
Age 55-59 years	0.001-0.002
Age 60+ years	0-0.001
HPV 31 incidence (annual)	
Age <20 years	0-0.044
Age 20-24 years	0.040-0.047
Age 25-29 years	0.011-0.012
Age 30-34 years	0.010-0.013
Age 35-39 years	0.006-0.009
Age 40-44 years	0.004-0.005
Age 45-49 years	0.004
Age 50-54 years	0.003-0.004
Age 55-59 years	0.003
Age 60+ years	0-0.003
HPV 33 incidence (annual)	
Age <20 years	0-0.015
Age 20-24 years	0.008
Age 25-29 years	0.003-0.004
Age 30-34 years	0.003-0.004
Age 35-39 years	0.002-0.003
Age 40-44 years	0.001-0.002
Age 45-49 years	0.001
Age 50-54 years	0.001

Age 55-59 years	0.001
Age 60+ years	0-0.001
HPV 45 incidence (annual)	
Age <20 years	0-0.025
Age 20-24 years	0.020-0.024
Age 25-29 years	0.005-0.006
Age 30-34 years	0.007-0.009
Age 35-39 years	0.004-0.006
Age 40-44 years	0.003-0.004
Age 45-49 years	0.002-0.003
Age 50-54 years	0.003
Age 55-59 years	0.003
Age 60+ years	0-0.002
HPV 52 incidence (annual)	
Age <20 years	0-0.044
Age 20-24 years	0.040-0.047
Age 25-29 years	0.013-0.016
Age 30-34 years	0.010-0.012
Age 35-39 years	0.006-0.009
Age 40-44 years	0.004-0.005
Age 45-49 years	0.004
Age 50-54 years	0.003-0.004
Age 55-59 years	0.003
Age 60+ years	0-0.003
HPV 58 incidence (annual)	
Age <20 years	0-0.037
Age 20-24 years	0.028-0.024
Age 25-29 years	0.005-0.006
Age 30-34 years	0.006-0.008
Age 35-39 years	0.003-0.005
Age 40-44 years	0.003
Age 45-49 years	0.002
Age 50-54 years	0.002-0.003
Age 55-59 years	0.002
Age 60+ years	0.002
Other carcinogenic incidence (annual)	
Age <20 years	0-0.177
Age 20-24 years	0.176-0.207
Age 25-29 years	0.067-0.08-
Age 30-34 years	0.048-0.065
Age 35-39 years	0.028-0.043
Age 40-44 years	0.034-0.043
Age 45-49 years	0.028-0.032
Age 50-54 years	0.017-0.018
Age 55-59 years	0.014-0.016
Age 60+ years	0-0.013
HPV 16 clearance and progression (annual)	
HPV progression to CIN1	0.079-0.219

HPV progression to CIN2	0.006-0.070
HPV regression to uninfected	0.189-0.592
CIN1 progression to CIN2	0.029-0.059
CIN1 progression to CIN3	0.027-0.044
CIN1 regression to HPV	0.018-0.024
CIN1 regression to uninfected	0.141-0.186
CIN2 progression to CIN3	0.100-0.333
CIN2 regression to CIN1	0.074-0.097
CIN2 regression to HPV	0.021-0.028
CIN2 regression to uninfected	0.196-0.258
CIN3 progression to invasive cancer	0.003-0.037
CIN3 regression to CIN2	0.003-0.038
CIN3 regression to CIN1	0.006-0.053
HPV 18 clearance and progression (annual)	
HPV progression to CIN1	0.078-0.218
HPV progression to CIN2	0.003-0.035
HPV regression to uninfected	0.189-0.593
CIN1 progression to CIN2	0.015-0.030
CIN1 progression to CIN3	0.013-0.022
CIN1 regression to HPV	0.018-0.024
CIN1 regression to uninfected	0.142-0.186
CIN2 progression to CIN3	0.051-0.168
CIN2 regression to CIN1	0.074-0.097
CIN2 regression to HPV	0.021-0.028
CIN2 regression to uninfected	0.197-0.259
CIN3 progression to invasive cancer	0.009-0.117
CIN3 regression to CIN2	0.003-0.038
CIN3 regression to CIN1	0.006-0.053
HPV 31 clearance and progression (annual)	
HPV progression to CIN1	0.053-0.152
HPV progression to CIN2	0.004-0.049
HPV regression to uninfected	0.262-0.738
CIN1 progression to CIN2	0.020-0.039
CIN1 progression to CIN3	0.019-0.030
CIN1 regression to HPV	0.027-0.033
CIN1 regression to uninfected	0.202-0.252
CIN2 progression to CIN3	0.072-0.235
CIN2 regression to CIN1	0.107-0.134
CIN2 regression to HPV	0.031-0.039
CIN2 regression to uninfected	0.275-0.343
CIN3 progression to invasive cancer	0.001-0.016
CIN3 regression to CIN2	0.004-0.055
CIN3 regression to CIN1	0.009-0.078
HPV 33 clearance and progression (annual)	
HPV progression to CIN1	0.053-0.152
HPV progression to CIN2	0.005-0.066
HPV regression to uninfected	0.262-0.748
CIN1 progression to CIN2	0.027-0.053

CIN1 progression to CIN3	0.025-0.034
CIN1 regression to HPV	0.027-0.033
CIN1 regression to uninfected	0.202-0.252
CIN2 progression to CIN3	0.096-0.315
CIN2 regression to CIN1	0.107-0.134
CIN2 regression to HPV	0.031-0.039
CIN2 regression to uninfected	0.275-0.343
CIN3 progression to invasive cancer	0.002-0.026
CIN3 regression to CIN2	0.004-0.055
CIN3 regression to CIN1	0.009-0.078
HPV 45 clearance and progression (annual)	
HPV progression to CIN1	0.053-0.152
HPV progression to CIN2	0.001-0.014
HPV regression to uninfected	0.262-0.738
CIN1 progression to CIN2	0.006-0.011
CIN1 progression to CIN3	0.005-0.009
CIN1 regression to HPV	0.027-0.033
CIN1 regression to uninfected	0.202-0.252
CIN2 progression to CIN3	0.021-0.068
CIN2 regression to CIN1	0.107-0.134
CIN2 regression to HPV	0.031-0.039
CIN2 regression to uninfected	0.275-0.343
CIN3 progression to invasive cancer	0.002-0.029
CIN3 regression to CIN2	0.004-0.055
CIN3 regression to CIN1	0.009-0.078
HPV 52 clearance and progression (annual)	
HPV progression to CIN1	0.053-0.152
HPV progression to CIN2	0.003-0.032
HPV regression to uninfected	0.262-0.738
CIN1 progression to CIN2	0.013-0.025
CIN1 progression to CIN3	0.012-0.019
CIN1 regression to HPV	0.027-0.033
CIN1 regression to uninfected	0.202-0.252
CIN2 progression to CIN3	0.046-0.152
CIN2 regression to CIN1	0.107-0.134
CIN2 regression to HPV	0.031-0.039
CIN2 regression to uninfected	0.275-0.343
CIN3 progression to invasive cancer	0.001-0.012
CIN3 regression to CIN2	0.004-0.055
CIN3 regression to CIN1	0.009-0.078
HPV 58 clearance and progression (annual)	
HPV progression to CIN1	0.053-0.152
HPV progression to CIN2	0.003-0.039
HPV regression to uninfected	0.262-0.738
CIN1 progression to CIN2	0.016-0.031
CIN1 progression to CIN3	0.015-0.023
CIN1 regression to HPV	0.027-0.033
CIN1 regression to uninfected	0.202-0.252

CIN2 progression to CIN3	0.057-0.186
CIN2 regression to CIN1	0.107-0.134
CIN2 regression to HPV	0.031-0.039
CIN2 regression to uninfected	0.275-0.343
CIN3 progression to invasive cancer	0.002-0.019
CIN3 regression to CIN2	0.004-0.055
CIN3 regression to CIN1	0.009-0.078
Other carcinogenic HPV clearance and progression (annual)	
HPV progression to CIN1	0.046-0.133
HPV progression to CIN2	0.003-0.036
HPV regression to uninfected	0.294-0.786
CIN1 progression to CIN2	0.015-0.028
CIN1 progression to CIN3	0.013-0.021
CIN1 regression to HPV	0.031-0.038
CIN1 regression to uninfected	0.228-0.285
CIN2 progression to CIN3	0.052-0.173
CIN2 regression to CIN1	0.122-0.153
CIN2 regression to HPV	0.036-0.045
CIN2 regression to uninfected	0.308-0.384
CIN3 progression to invasive cancer	0.001-0.014
CIN3 regression to CIN2	0.005-0.064
CIN3 regression to CIN1	0.010-0.089
Progression of invasive cancer stages (annual)	
Local to regional	0.059-0.650
Regional to distant	0.45
Invasive cancer mortality (annual)[b]	
Local	
Year 1	0.008-0.122
Years 2-3	0.0152-0.0589
Years 4-5	0.009-0.0467
Years 6-10	0.004-0.024
Years 11-15	0.002-0.066
Regional	
Year 1	0.094-0.323
Years 2-3	0.124-0.208
Years 4-5	0.051-0.0624
Years 6-10	0.014-0.0554
Years 11-15	0.012-0.0414
Distant	
Year 1	0.423-0.927
Years 2-3	0.2871-319
Years 4-5	0.130-0.232
Years 6-10	0.036-0.067
Years 11-15	0.041-0.055
Probability of symptom detection (annual)	
Local	0.15
Regional	0.30
Distant	0.9

Abbreviations: CIN2, cervical intraepithelial neoplasia grade 2; CIN3, cervical intraepithelial neoplasia grade 3; HPV, human papillomavirus; HR, high-risk.

[a] Values represent the range of probabilities by age and also treatment status; post-treatment natural history uses a different set of parameters reflecting elevated risk among this group.

[b] Cancer mortality is a function of both time since diagnosis and age at diagnosis.

Appendix Table 1D. Natural History Model Parameters, Post-Calibration: UMN Model

Model parameter	Value[a]
HPV incidence (monthly)	
HPV 16	0-0.042
HPV 18	0-0.016
HPV 31/33/45/52/58	0-0.029
HPV other carcinogenic	0-0.044
Natural immunity (monthly)[b]	
HPV 16	0.35
HPV 18	0.63
HPV 31/33/45/52/58	0.55
HPV other carcinogenic	0.55
Clearance (monthly)	
HPV 16	0.11-0.44
HPV 18	0.06-0.45
HPV 31/33/45/52/58	0.007-0.23
HPV other carcinogenic	0.006-0.36
HPV progression to CIN1 (monthly)	
HPV 16	0.009-0.029
HPV 18	0.019-0.26
HPV 31/33/45/52/58	0.02-0.04
HPV other carcinogenic	0.04-0.07
HPV progression to CIN2 (monthly)	
HPV 16	0.005
HPV 18	0.005
HPV 31/33/45/52/58	0.002
HPV other carcinogenic	0.002
CIN1 progression to CIN2 (monthly)	
HPV 16	0.031-0.081
HPV 18	0.008-0.023
HPV 31/33/45/52/58	0.017-0.018
HPV other carcinogenic	0.00006-0.0005
CIN1 progression to CIN3 (monthly)	
HPV 16	0.0014
HPV 18	0.0004-0.010
HPV 31/33/45/52/58	0.0005
HPV other carcinogenic	0.0005
CIN1 regression to HPV (monthly)	
HPV 16	0.0097
HPV 18	0.0067-0.0097
HPV 31/33/45/52/58	0.0165
HPV other carcinogenic	0.0165
CIN2 progression to CIN3 (monthly)	
HPV 16	0.010-0.195
HPV 18	0.004-0.195
HPV 31/33/45/52/58	0.008-0.052
HPV other carcinogenic	0.00007-0.005

CIN2 regression to CIN1 (monthly)	
HPV 16	0.002-0.012
HPV 18	0.012
HPV 31/33/45/52/58	0.016
HPV other carcinogenic	0.016
CIN2 regression to HPV (monthly)	
HPV 16	0.001
HPV 18	0.001
HPV 31/33/45/52/58	0.0011
HPV other carcinogenic	0.0011
CIN3 regression to CIN2 (monthly)	
HPV 16	0.000007
HPV 18	0.000007
HPV 31/33/45/52/58	0.000009
HPV other carcinogenic	0.000009
CIN3 regression to HPV (monthly)	
HPV 16	0.00003
HPV 18	0.00003
HPV 31/33/45/52/58	0.00003
HPV other carcinogenic	0.00003
Progression of CIN3 to invasive cancer (monthly)	
HPV 16	0.000-0.002
HPV 18	0.000-0.004
HPV 31/33/45/52/58	0.000-0.001
HPV other carcinogenic related	0.000-0.002
Progression of invasive cancer stages (monthly)	
Stage I to II	0.017-0.037
Stage II to III	0.038
Stage III to IV	0.064
Probability of symptom detection (monthly)	
Stage I	0.013
Stage II	0.021
Stage III	0.074
Stage IV	0.175

Abbreviations: CIN2, cervical intraepithelial neoplasia grade 2; CIN3, cervical intraepithelial neoplasia grade 3; HPV, human papillomavirus; HR, high-risk.
[a] Values represent the range of age-dependent probabilities.
[b] Natural immunity represents the percentage reduction in risk of subsequent, type-specific infection after a woman has cleared a carcinogenic infection with the same type. Risk reduction is assumed to be constant across age and time.

Appendix Table 2. Lifetime Number of Cervical Cancer Cases, Deaths and Life-Years Gained Among Unvaccinated Female Persons Assuming HPV-16/18 Genotype Triage of HPV-Positive Results by Model[a]

	Cervical Cancer Cases per 1,000					Cervical Cancer Deaths per 1,000					Life-Years Gained per 1,000				
Strategy[b]	**H**	**M**	**P**	**U**	**Med[c]**	**H**	**M**	**P**	**U**	**Med[c]**	**H**	**M**	**P**	**U**	**Med***
No Screening	16.47	10.95	14.20	21.34	15.33	5.23	7.23	7.41	8.59	7.32	0	0	0	0	0
End Age 60[d]															
CYTO-3Y, 21	2.46	3.88	3.93	4.33	3.90	0.67	1.96	2.13	1.65	1.81	169	136	147	183	158
CYTO-3Y, 21/HPV-5Y, 30	1.19	2.57	2.79	3.32	2.68	0.28	1.30	1.52	1.28	1.29	179	149	157	191	168
CYTO-3Y, 21/COTEST-5Y, 30	1.11	2.48	2.66	3.09	2.57	0.26	1.25	1.45	1.21	1.23	180	150	157	192	168
CYTO-4Y, 21/HPV-5Y, 25	1.00	2.46	2.72	3.22	2.59	0.26	1.27	1.50	1.25	1.26	181	150	157	191	169
CYTO-3Y, 21/HPV-10Y, 30	1.44	3.52	3.24	4.98	3.38	0.35	1.77	1.69	1.76	1.73	176	136	153	176	164
HPV-5Y, 25	1.10	2.51	2.69	3.37	2.60	0.27	1.28	1.47	1.31	1.30	179	149	156	190	168
HPV-5Y, 25/HPV-10Y, 30	1.30	3.44	3.10	5.02	3.27	0.33	1.76	1.56	1.77	1.66	177	136	154	176	165
HPV-5Y, 30	2.05	2.92	3.08	4.11	3.00	0.41	1.46	1.45	1.48	1.45	169	142	148	181	158
HPV-5Y, 30/HPV-10Y, 40	2.17	3.39	3.35	5.17	3.37	0.45	1.71	1.56	1.81	1.63	168	136	148	173	158
HPV-5Y, 35	3.56	3.67	4.05	5.75	3.86	0.69	1.79	1.75	1.91	1.77	150	128	136	162	143
HPV-5Y, 35/HPV-10Y, 40	3.69	4.15	4.19	6.85	4.17	0.73	2.06	1.77	2.23	1.92	148	122	133	154	140
HPV-5Y, 40	5.18	4.79	5.01	8.08	5.10	1.14	2.36	2.01	2.62	2.19	124	107	120	134	122
HPV-10Y, 30	2.33	3.94	3.47	5.91	3.71	0.49	1.96	1.57	2.00	1.77	166	127	145	166	156
HPV-10Y, 40	5.34	5.35	5.32	9.30	5.35	1.19	2.68	2.15	3.03	2.41	122	99	115	124	118
CYTO-4Y, 21/COTEST-5Y, 25	0.91	2.37	2.50	3.07	2.44	0.23	1.22	1.38	1.21	1.22	181	151	159	193	170
CYTO-3Y, 21/COTEST-10Y, 30	1.32	3.42	3.03	4.72	3.22	0.31	1.70	1.56	1.68	1.62	177	138	154	179	166
COTEST-5Y, 25/COTEST-10Y, 30	1.32	3.32	2.87	4.73	3.10	0.33	1.67	1.47	1.68	1.57	177	138	153	178	165
COTEST-5Y, 30	1.95	2.84	2.90	3.90	2.87	0.39	1.41	1.38	1.40	1.39	170	143	152	184	161
COTEST-5Y, 30/COTEST-10Y, 40	2.23	3.30	3.08	4.91	3.19	0.45	1.66	1.43	1.74	1.54	168	137	149	176	158
COTEST-5Y, 35	3.46	3.59	3.89	5.57	3.74	0.66	1.75	1.65	1.84	1.70	151	129	137	164	144
COTEST-5Y, 35/COTEST-10Y, 40	3.71	4.06	4.15	6.60	4.11	0.72	2.00	1.65	2.14	1.82	148	123	135	157	142
COTEST-5Y, 40	5.08	4.70	4.93	7.91	5.01	1.11	2.31	1.97	2.54	2.14	125	108	120	136	122
COTEST-10Y, 30	2.17	3.82	3.16	5.58	3.49	0.44	1.87	1.45	1.87	1.66	168	129	148	169	158
COTEST-10Y, 40	5.17	5.23	5.12	8.97	5.20	1.13	2.59	2.06	2.91	2.32	123	101	117	127	120

End Age 65[d]															
CYTO-3Y, 21[e]	**2.09**	**3.55**	**3.23**	**3.64**	**3.39**	**0.51**	**1.68**	**1.61**	**1.32**	**1.46**	**172**	**140**	**153**	**187**	**162**
CYTO-3Y, 21/HPV-5Y, 30[e]	**0.99**	**1.96**	**2.29**	**2.71**	**2.13**	**0.20**	**0.86**	**1.16**	**0.99**	**0.92**	**180**	**154**	**161**	**195**	**170**
CYTO-3Y, 21/COTEST-5Y, 30[e]	**0.93**	**1.90**	**2.13**	**2.51**	**2.02**	**0.18**	**0.83**	**1.04**	**0.93**	**0.88**	**181**	**155**	**162**	**196**	**172**
CYTO-4Y, 21/HPV-5Y, 25	0.80	1.86	2.14	2.63	2.00	0.18	0.84	1.07	0.98	0.91	182	155	162	195	172
CYTO-4Y, 21/HPV-10Y, 25	1.15	3.02	2.72	4.55	2.87	0.27	1.40	1.32	1.59	1.36	178	139	155	177	166
HPV-5Y, 25[e]	**0.90**	**1.92**	**2.21**	**2.71**	**2.06**	**0.19**	**0.86**	**1.07**	**0.98**	**0.92**	**180**	**154**	**160**	**194**	**170**
HPV-5Y, 25/HPV-10Y, 35	1.07	2.63	2.61	4.05	2.62	0.25	1.24	1.25	1.44	1.24	179	145	156	183	168
HPV-5Y, 30	1.85	2.33	2.63	3.54	2.48	0.33	1.02	1.12	1.21	1.07	170	146	154	185	162
HPV-5Y, 30/HPV-10Y, 35	2.03	3.12	2.93	4.88	3.02	0.39	1.44	1.26	1.62	1.35	169	136	150	174	160
HPV-5Y, 35	3.36	3.07	3.63	5.12	3.50	0.61	1.35	1.38	1.63	1.36	151	133	140	166	146
HPV-5Y, 35/HPV-10Y, 45	3.47	3.56	3.83	6.02	3.69	0.64	1.63	1.59	1.93	1.61	150	127	134	160	142
HPV-5Y, 40	4.99	4.18	4.63	7.44	4.81	1.06	1.92	1.82	2.32	1.87	125	111	121	138	123
HPV-10Y, 25	1.25	3.08	2.62	4.65	2.85	0.28	1.42	1.18	1.62	1.30	177	138	156	176	166
HPV-10Y, 35	3.64	3.92	3.98	6.59	3.95	0.70	1.82	1.50	2.08	1.66	148	121	136	154	142
CYTO-4Y, 21/COTEST-5Y, 25	0.73	1.78	2.03	2.41	1.91	0.16	0.79	1.00	0.91	0.85	182	156	163	197	172
CYTO-4Y, 21/COTEST-10Y, 25	1.03	2.89	2.48	4.18	2.69	0.23	1.32	1.16	1.44	1.24	179	141	158	181	168
COTEST-5Y, 25	0.81	1.83	2.00	2.57	1.92	0.17	0.81	0.97	0.95	0.88	181	155	162	196	172
COTEST-5Y, 25/COTEST-10Y, 35	1.10	2.54	2.41	3.80	2.48	0.25	1.18	1.14	1.34	1.16	178	146	158	185	168
COTEST-5Y, 30	1.78	2.25	2.45	3.28	2.35	0.32	0.98	1.06	1.11	1.02	171	147	154	187	162
COTEST-5Y, 30/COTEST-10Y, 35	2.10	3.00	2.87	4.61	2.94	0.40	1.37	1.16	1.50	1.26	168	138	153	177	160
COTEST-5Y, 35	3.28	2.98	3.51	4.92	3.39	0.58	1.31	1.28	1.55	1.30	152	133	142	168	147
COTEST-5Y, 35/COTEST-10Y, 45	3.51	3.48	3.79	5.79	3.65	0.64	1.57	1.50	1.83	1.53	149	128	136	162	142
COTEST-5Y, 40	4.91	4.12	4.44	7.31	4.68	1.03	1.87	1.66	2.26	1.77	125	112	124	140	124
COTEST-10Y, 25	1.11	2.95	2.56	4.36	2.75	0.25	1.34	1.21	1.48	1.28	178	140	155	179	166
COTEST-10Y, 35	3.48	3.80	3.74	6.32	3.77	0.65	1.74	1.41	1.96	1.58	149	123	136	157	142
End Age 70[d]															
CYTO-3Y, 21	1.86	3.05	2.57	3.05	2.81	0.41	1.23	1.09	1.02	1.06	173	144	160	190	166
CYTO-3Y, 21/HPV-5Y, 30	0.86	1.62	1.88	2.12	1.75	0.15	0.61	0.81	0.71	0.66	180	156	164	198	172
CYTO-3Y, 21/COTEST-5Y, 30	0.81	1.55	1.74	1.97	1.64	0.14	0.56	0.74	0.67	0.62	181	157	165	199	173
CYTO-4Y, 21/HPV-5Y, 25	0.67	1.51	1.71	2.08	1.61	0.13	0.57	0.75	0.71	0.64	182	157	166	198	174
CYTO-3Y, 21/HPV-10Y, 30	1.13	2.85	2.36	4.16	2.60	0.23	1.21	1.04	1.36	1.12	178	141	157	180	168
HPV-5Y, 25	0.77	1.57	1.81	2.19	1.69	0.14	0.60	0.80	0.74	0.67	181	156	164	197	172
HPV-5Y, 25/HPV-10Y, 30	1.01	2.76	2.32	4.20	2.54	0.21	1.19	0.99	1.36	1.09	179	141	158	180	168

HPV-5Y, 30	1.72	1.98	2.13	2.95	2.05	0.29	0.77	0.85	0.92	0.81	171	148	157	188	164
HPV-5Y, 30/HPV-10Y, 40	1.88	2.71	2.63	4.34	2.67	0.34	1.14	1.07	1.37	1.11	170	141	151	178	160
HPV-5Y, 35	3.24	2.72	3.23	4.62	3.23	0.57	1.10	1.13	1.36	1.11	151	134	141	169	146
HPV-5Y, 35/HPV-10Y, 40	3.40	3.48	3.64	6.00	3.56	0.61	1.50	1.27	1.80	1.38	150	126	138	159	144
HPV-5Y, 40	4.86	3.83	4.34	6.90	4.60	1.01	1.65	1.51	2.05	1.58	125	114	126	141	126
HPV-10Y, 30	2.04	3.28	2.83	5.05	3.05	0.38	1.40	1.07	1.57	1.23	167	132	151	170	159
HPV-10Y, 40	5.08	4.66	4.78	8.45	4.93	1.08	2.10	1.67	2.61	1.89	123	104	122	128	122
CYTO-4Y, 21/COTEST-5Y, 25	0.61	1.44	1.64	1.91	1.54	0.11	0.53	0.71	0.65	0.59	182	158	166	199	174
CYTO-3Y, 21/COTEST-10Y, 30	1.05	2.72	2.23	3.87	2.47	0.20	1.12	0.93	1.24	1.03	179	143	160	183	170
COTEST-5Y, 25/COTEST-10Y, 30	1.06	2.63	2.18	3.92	2.40	0.22	1.10	0.93	1.27	1.01	178	143	158	182	168
COTEST-5Y, 30	1.66	1.89	2.11	2.74	2.00	0.27	0.71	0.79	0.84	0.75	172	150	158	190	165
COTEST-5Y, 30/COTEST-10Y, 40	1.96	2.61	2.52	4.05	2.56	0.35	1.08	0.98	1.27	1.03	169	142	154	181	162
COTEST-5Y, 35	3.16	2.63	3.17	4.40	3.17	0.54	1.06	1.07	1.28	1.06	152	135	144	171	148
COTEST-5Y, 35/COTEST-10Y, 40	3.46	3.39	3.56	5.76	3.51	0.62	1.43	1.27	1.72	1.35	149	128	138	161	144
COTEST-5Y, 40	4.79	3.75	4.23	6.74	4.51	0.99	1.60	1.43	1.98	1.52	126	115	128	143	127
COTEST-10Y, 30	1.92	3.14	2.63	4.75	2.89	0.34	1.30	0.98	1.44	1.14	169	134	153	174	161
COTEST-10Y, 40	4.96	4.57	4.51	8.17	4.76	1.04	2.02	1.52	2.49	1.77	124	106	126	131	125

Abbreviations: cyto, cytology; HPV, Human papillomavirus; H, Harvard model; M, MISCAN-Cervix model; P, Policy1-Cervix model; U, University of Minnesota model.

[a] Outcomes calculated from age 21 to 100 years.

[b] Strategies are denoted by the screening modality, interval, age to begin screening/screening modality after switch age, interval after switch age, switch age for each end age category. For example, CYTO-3Y, 21 indicates cytology testing every 3 years starting at age 21, and CYTO-3Y, 21/HPV-5Y,30 indicates cytology testing every 3 years starting at age 21 with a switch to HPV testing every 5 years starting at age 30.

[c] Median outcome across the four models.

[d] End age indicates the age at which the final routine screen should occur, irrespective of age at last screen; exceptions include those women who are recommended to continue screening due to prior abnormal results and/or precancer treatment.

[e] Strategies (bolded) represent current US recommended strategies.

Appendix Table 3. Lifetime Number of Total Tests and Colposcopies Among Unvaccinated Female Persons Assuming HPV-16/18 Genotype Triage of HPV-Positive Results by Model[a]

	Total Tests per 1,000 [b]					Colposcopies per 1,000				
Strategy[c]	**H**	**M**	**P**	**U**	**Med[d]**	**H**	**M**	**P**	**U**	**Med[d]**
No Screening	0	0	0	0	0	0	0	0	0	0
End Age 60[e]										
CYTO-3Y, 21	15,392	14,457	14,959	15,114	15,036	660	718	522	766	689
CYTO-3Y, 21/HPV-5Y, 30	13,077	12,280	11,869	12,636	12,458	1,371	1,045	541	1,145	1,095
CYTO-3Y, 21/COTEST-5Y, 30	22,480	19,362	20,766	21,702	21,234	1,631	1,172	821	1,345	1,258
CYTO-4Y, 21/HPV-5Y, 25	12,624	11,752	11,445	11,853	11,802	1,679	1,225	680	1,241	1,233
CYTO-3Y, 21/HPV-10Y, 30	9,821	9,133	8,868	9,714	9,424	1,067	803	450	915	859
HPV-5Y, 25	11,436	10,478	10,258	10,603	10,541	1,628	1,125	635	1,150	1,137
HPV-5Y, 25/HPV-10Y, 30	8,189	7,372	7,254	7,673	7,523	1,328	889	544	919	904
HPV-5Y, 30	9,506	8,535	8,335	8,920	8,728	1,206	759	397	872	816
HPV-5Y, 30/HPV-10Y, 40	7,458	6,658	6,373	7,147	6,903	1,043	655	346	774	715
HPV-5Y, 35	7,834	6,888	6,874	7,328	7,108	912	517	286	629	573
HPV-5Y, 35/HPV-10Y, 40	5,756	4,933	4,874	5,491	5,212	745	408	233	523	466
HPV-5Y, 40	6,325	5,373	5,570	5,796	5,683	689	331	213	422	377
HPV-10Y, 30	6,182	5,224	5,233	5,870	5,551	894	495	303	630	563
HPV-10Y, 40	4,289	3,357	3,548	3,887	3,717	523	218	158	314	266
CYTO-4Y, 21/COTEST-5Y, 25	23,626	20,577	21,864	22,411	22,138	1,981	1,430	1,019	1,487	1,459
CYTO-3Y, 21/COTEST-10Y, 30	15,952	13,466	14,800	15,915	15,358	1,237	890	642	1,073	982
COTEST-5Y, 25/COTEST-10Y, 30	15,650	13,738	14,856	15,320	15,088	1,309	1,071	803	1,120	1,095
COTEST-5Y, 30	18,874	16,030	17,195	17,891	17,543	1,465	911	678	1,079	995
COTEST-5Y, 30/COTEST-10Y, 40	14,444	12,477	13,344	14,318	13,831	1,059	789	570	950	869
COTEST-5Y, 35	15,685	13,020	14,352	14,761	14,556	1,129	626	520	789	707
COTEST-5Y, 35/COTEST-10Y, 40	11,292	9,305	10,334	11,045	10,689	769	496	407	657	577
COTEST-5Y, 40	12,776	10,254	11,736	11,755	11,746	868	408	404	550	479
COTEST-10Y, 30	12,271	9,837	10,993	11,797	11,395	1,065	600	489	784	692
COTEST-10Y, 40	8,797	6,409	7,592	7,878	7,735	652	270	286	409	347
End Age 65[e]										
CYTO-3Y, 21[f]	**16,756**	**15,235**	**16,434**	**16,457**	**16,445**	**705**	**734**	**562**	**806**	**720**
CYTO-3Y, 21/HPV-5Y, 30[f]	**13,893**	**13,128**	**12,721**	**13,395**	**13,262**	**1,426**	**1,087**	**562**	**1,170**	**1,128**
CYTO-3Y, 21/COTEST-5Y, 30[f]	**24,009**	**20,971**	**22,502**	**23,283**	**22,892**	**1,702**	**1,218**	**871**	**1,386**	**1,302**
CYTO-4Y, 21/HPV-5Y, 25	13,437	12,596	12,285	12,616	12,606	1,734	1,266	699	1,268	1,267
CYTO-4Y, 21/HPV-10Y, 25	9,057	8,343	8,338	8,648	8,496	1,297	908	583	936	922
HPV-5Y, 25[f]	**12,250**	**11,325**	**11,116**	**11,368**	**11,346**	**1,683**	**1,167**	**657**	**1,178**	**1,172**
HPV-5Y, 25/HPV-10Y, 35	9,211	8,581	8,285	8,746	8,663	1,435	1,013	591	1,026	1,019
HPV-5Y, 30	10,324	9,388	9,194	9,685	9,537	1,262	801	420	897	849
HPV-5Y, 30/HPV-10Y, 35	7,240	6,508	6,312	7,022	6,765	1,007	638	351	744	691
HPV-5Y, 35	8,648	7,743	7,726	8,060	7,902	967	559	310	648	603
HPV-5Y, 35/HPV-10Y, 45	6,703	5,916	5,861	6,417	6,166	826	464	269	584	524
HPV-5Y, 40	7,151	6,229	6,433	6,555	6,494	745	373	236	445	409
HPV-10Y, 25	7,840	7,008	7,092	7,336	7,214	1,242	800	532	839	819
HPV-10Y, 35	5,509	4,772	4,783	5,298	5,041	705	389	236	493	441
CYTO-4Y, 21/COTEST-5Y, 25	25,148	22,177	23,583	23,999	23,791	2,052	1,475	1,066	1,533	1,504

Strategy[c]	Total Tests per 1,000 [b] H	M	P	U	Med[d]	Colposcopies per 1,000 H	M	P	U	Med[d]
CYTO-4Y, 21/COTEST-10Y, 25	16,491	14,243	15,782	16,078	15,930	1,501	1,061	825	1,125	1,093
COTEST-5Y, 25	23,982	21,133	22,429	22,739	22,584	2,002	1,388	1,026	1,439	1,414
COTEST-5Y, 25/COTEST-10Y, 35	17,573	15,958	16,886	17,455	17,171	1,425	1,212	876	1,244	1,228
COTEST-5Y, 30	20,414	17,649	18,943	19,479	19,211	1,536	958	729	1,117	1,038
COTEST-5Y, 30/COTEST-10Y, 35	13,981	12,193	13,180	14,071	13,580	1,020	766	569	915	841
COTEST-5Y, 35	17,232	14,648	16,073	16,288	16,181	1,201	674	566	827	751
COTEST-5Y, 35/COTEST-10Y, 45	13,055	11,175	12,365	12,931	12,648	857	561	471	733	647
COTEST-5Y, 40	14,344	11,882	13,490	13,335	13,413	941	456	452	588	522
COTEST-10Y, 25	15,274	13,088	14,514	14,706	14,610	1,446	966	779	1,032	999
COTEST-10Y, 35	10,960	9,000	10,122	10,677	10,400	856	471	404	619	545
End Age 70[e]										
CYTO-3Y, 21	18,100	16,687	17,911	17,811	17,861	749	760	603	847	754
CYTO-3Y, 21/HPV-5Y, 30	14,629	13,895	13,504	14,108	14,001	1,471	1,122	581	1,195	1,159
CYTO-3Y, 21/COTEST-5Y, 30	25,378	22,427	24,059	24,745	24,402	1,761	1,257	913	1,423	1,340
CYTO-4Y, 21/HPV-5Y, 25	14,170	13,362	13,069	13,327	13,345	1,778	1,302	719	1,293	1,297
CYTO-3Y, 21/HPV-10Y, 30	10,558	9,933	9,666	10,459	10,196	1,119	841	473	943	892
HPV-5Y, 25	12,984	12,094	11,883	12,075	12,084	1,728	1,203	675	1,196	1,200
HPV-5Y, 25/HPV-10Y, 30	8,922	8,173	8,061	8,402	8,288	1,381	929	569	943	936
HPV-5Y, 30	11,062	10,161	9,971	10,398	10,279	1,306	837	437	917	877
HPV-5Y, 30/HPV-10Y, 40	8,191	7,468	7,179	7,900	7,684	1,096	695	368	798	747
HPV-5Y, 35	9,390	8,522	8,499	8,777	8,650	1,012	595	326	672	633
HPV-5Y, 35/HPV-10Y, 40	6,487	5,746	5,677	6,240	5,993	798	447	255	550	499
HPV-5Y, 40	7,889	7,012	7,201	7,245	7,223	789	409	255	468	439
HPV-10Y, 30	6,917	6,032	6,027	6,615	6,323	946	534	323	657	595
HPV-10Y, 40	4,946	4,169	4,348	4,616	4,482	570	257	181	339	298
CYTO-4Y, 21/COTEST-5Y, 25	26,510	23,628	25,127	25,445	25,286	2,111	1,515	1,108	1,565	1,540
CYTO-3Y, 21/COTEST-10Y, 30	17,282	14,988	16,469	17,457	16,875	1,302	934	690	1,110	1,022
COTEST-5Y, 25/COTEST-10Y, 30	16,983	15,258	16,477	16,859	16,668	1,366	1,114	849	1,163	1,138
COTEST-5Y, 30	21,795	19,117	20,512	20,939	20,725	1,596	998	771	1,149	1,073
COTEST-5Y, 30/COTEST-10Y, 40	15,782	14,011	15,035	15,888	15,408	1,116	833	622	989	911
COTEST-5Y, 35	18,626	16,127	17,645	17,775	17,710	1,261	714	610	861	788
COTEST-5Y, 35/COTEST-10Y, 40	12,592	10,850	12,018	12,613	12,305	824	540	455	697	619
COTEST-5Y, 40	15,742	13,371	15,060	14,762	14,911	1,001	497	495	621	559
COTEST-10Y, 30	13,559	11,374	12,671	13,361	13,016	1,128	644	536	825	735
COTEST-10Y, 40	9,842	7,955	9,263	9,404	9,333	703	315	332	447	390

Abbreviations: cyto, cytology; HPV, Human papillomavirus; H, Harvard model; M, MISCAN-Cervix model; P, Policy1-Cervix model; U, University of Minnesota model.
[a] Outcomes calculated from age 21 to 100 years.
[b] Total number of tests including cytology and HPV tests, irrespective of primary, triage or surveillance context.
[c] Strategies are denoted by the screening modality, interval, age to begin screening/screening modality after switch age, interval after switch age, switch age for each end age category. For example, CYTO-3Y, 21 indicates cytology testing every 3 years starting at age 21, and CYTO-3Y, 21/HPV-5Y,30 indicates cytology testing every 3 years starting at age 21 with a switch to HPV testing every 5 years starting at age 30.
[d] Median outcome across the four models.
[e] End age indicates the age at which the final routine screen should occur, irrespective of age at last screen; exceptions include those women who are recommended to continue screening due to prior abnormal results and/or precancer treatment.
[f] Strategies (bolded) represent current US recommended strategies.

Appendix Table 4. Lifetime Number of CIN2+ Detected and False Positives Among Unvaccinated Female Persons Assuming HPV-16/18 Genotype Triage of HPV-Positive Results by Model[a]

	CIN2+ detected per 1,000[b]					False Positives per 1,000[c]				
Strategy[d]	H	M	P	U	Med[e]	H	M	P	U	Med[e]
No Screening	0	0	0	0	0	0	0	0	0	0
End Age 60[f]										
CYTO-3Y, 21	160	83	112	245	136	500	635	411	521	510
CYTO-3Y, 21/HPV-5Y, 30	197	96	117	260	157	1,174	950	424	885	917
CYTO-3Y, 21/COTEST-5Y, 30	203	97	119	266	161	1,427	1,074	702	1,079	1,077
CYTO-4Y, 21/HPV-5Y, 25	205	101	118	258	162	1,474	1,124	561	983	1,054
CYTO-3Y, 21/HPV-10Y, 30	180	85	112	235	146	887	718	338	681	699
HPV-5Y, 25	194	88	103	237	148	1,434	1,037	532	913	975
HPV-5Y, 25/HPV-10Y, 30	177	78	97	211	137	1,151	812	447	709	760
HPV-5Y, 30	154	61	71	188	113	1,053	698	326	684	691
HPV-5Y, 30/HPV-10Y, 40	145	57	69	177	107	898	598	277	596	597
HPV-5Y, 35	119	43	52	145	86	793	474	234	484	479
HPV-5Y, 35/HPV-10Y, 40	110	39	49	134	80	635	369	184	390	379
HPV-5Y, 40	93	30	41	106	67	596	301	172	316	308
HPV-10Y, 30	136	49	65	160	101	757	446	237	470	458
HPV-10Y, 40	84	26	38	94	61	439	192	120	220	206
CYTO-4Y, 21/COTEST-5Y, 25	214	105	122	266	168	1,767	1,325	897	1,221	1,273
CYTO-3Y, 21/COTEST-10Y, 30	186	86	114	241	150	1,052	804	528	832	818
COTEST-5Y, 25/COTEST-10Y, 30	179	81	101	221	140	1,130	990	701	899	944
COTEST-5Y, 30	161	63	73	195	117	1,304	847	605	885	866
COTEST-5Y, 30/COTEST-10Y, 40	147	60	71	185	109	912	729	499	765	747
COTEST-5Y, 35	124	45	54	149	89	1,004	581	466	640	610
COTEST-5Y, 35/COTEST-10Y, 40	112	41	51	139	82	657	455	355	518	487
COTEST-5Y, 40	97	31	42	110	70	771	377	362	441	409
COTEST-10Y, 30	143	51	67	168	105	922	549	422	616	582
COTEST-10Y, 40	89	26	39	98	64	563	244	246	311	279
End Age 65[f]										
CYTO-3Y, 21[g]	**166**	**84**	**114**	**250**	**140**	**540**	**649**	**448**	**557**	**548**
CYTO-3Y, 21/HPV-5Y, 30[g]	**202**	**98**	**119**	**264**	**161**	**1,224**	**989**	**442**	**906**	**948**
CYTO-3Y, 21/COTEST-5Y, 30[g]	**209**	**100**	**122**	**270**	**165**	**1,493**	**1,118**	**749**	**1,116**	**1,117**
CYTO-4Y, 21/HPV-5Y, 25	211	103	120	262	165	1,523	1,163	579	1,006	1,084
CYTO-4Y, 21/HPV-10Y, 25	186	87	113	224	149	1,112	821	470	712	766
HPV-5Y, 25[g]	**199**	**90**	**105**	**241**	**152**	**1,484**	**1,077**	**552**	**937**	**1,007**
HPV-5Y, 25/HPV-10Y, 35	186	84	102	226	144	1,249	929	489	800	864
HPV-5Y, 30	159	63	73	192	116	1,102	738	346	705	721
HPV-5Y, 30/HPV-10Y, 35	145	57	70	176	108	862	581	280	568	574
HPV-5Y, 35	125	46	55	149	90	843	513	255	499	506
HPV-5Y, 35/HPV-10Y, 45	117	43	53	143	85	710	421	216	441	431
HPV-5Y, 40	99	32	43	111	71	646	341	193	334	337
HPV-10Y, 25	174	73	96	201	135	1,068	726	436	638	682
HPV-10Y, 35	110	39	50	131	80	595	350	186	362	356

Strategy[d]	CIN2+ detected per 1,000[b] H	M	P	U	Med[e]	False Positives per 1,000[c] H	M	P	U	Med[e]
CYTO-4Y, 21/COTEST-5Y, 25	219	107	125	271	172	1,833	1,368	942	1,262	1,315
CYTO-4Y, 21/COTEST-10Y, 25	193	90	116	233	155	1,308	971	708	892	931
COTEST-5Y, 25	208	94	108	249	158	1,794	1,294	918	1,190	1,242
COTEST-5Y, 25/COTEST-10Y, 35	188	88	105	236	147	1,236	1,124	770	1,008	1,066
COTEST-5Y, 30	166	66	76	199	121	1,370	892	653	919	905
COTEST-5Y, 30/COTEST-10Y, 35	147	59	72	183	110	873	707	497	731	719
COTEST-5Y, 35	130	47	56	153	93	1,071	627	510	674	650
COTEST-5Y, 35/COTEST-10Y, 45	118	44	54	147	86	739	517	417	585	551
COTEST-5Y, 40	102	33	44	113	73	838	423	408	475	449
COTEST-10Y, 25	181	77	100	211	141	1,265	889	679	821	855
COTEST-10Y, 35	115	40	52	137	83	741	431	352	482	457
End Age 70[f]										
CYTO-3Y, 21	170	87	117	254	144	579	673	486	593	586
CYTO-3Y, 21/HPV-5Y, 30	207	100	122	268	164	1,264	1,023	459	928	975
CYTO-3Y, 21/COTEST-5Y, 30	213	102	124	274	168	1,548	1,156	789	1,150	1,153
CYTO-4Y, 21/HPV-5Y, 25	215	105	123	266	169	1,563	1,197	596	1,027	1,112
CYTO-3Y, 21/HPV-10Y, 30	187	88	115	240	151	932	753	358	703	728
HPV-5Y, 25	204	92	107	245	155	1,524	1,111	568	951	1,031
HPV-5Y, 25/HPV-10Y, 30	184	81	101	217	143	1,196	848	468	727	787
HPV-5Y, 30	164	65	75	196	119	1,143	772	362	721	746
HPV-5Y, 30/HPV-10Y, 40	152	61	72	184	112	943	635	296	615	625
HPV-5Y, 35	129	47	56	152	92	883	547	270	520	533
HPV-5Y, 35/HPV-10Y, 40	117	43	53	140	85	681	405	202	410	407
HPV-5Y, 40	103	34	45	114	74	686	375	210	354	365
HPV-10Y, 30	143	53	68	166	106	803	481	255	491	486
HPV-10Y, 40	91	29	41	101	66	479	228	140	238	233
CYTO-4Y, 21/COTEST-5Y, 25	223	109	126	274	175	1,887	1,406	981	1,291	1,348
CYTO-3Y, 21/COTEST-10Y, 30	192	90	117	247	155	1,110	844	573	863	853
COTEST-5Y, 25/COTEST-10Y, 30	186	84	104	226	145	1,180	1,029	745	936	983
COTEST-5Y, 30	170	68	78	202	124	1,425	930	693	947	939
COTEST-5Y, 30/COTEST-10Y, 40	154	63	75	191	114	963	770	548	798	784
COTEST-5Y, 35	134	49	58	157	96	1,127	666	552	704	685
COTEST-5Y, 35/COTEST-10Y, 40	118	44	55	145	86	707	496	400	553	524
COTEST-5Y, 40	107	35	46	117	76	894	462	449	504	483
COTEST-10Y, 30	149	55	71	174	110	979	590	466	651	621
COTEST-10Y, 40	94	30	42	104	68	609	285	290	343	317

Abbreviations: cyto, cytology; HPV, Human papillomavirus; CIN, cervical intraepithelial; H, Harvard model; M, MISCAN-Cervix model; P, Policy1-Cervix model; U, University of Minnesota model.
[a] Outcomes calculated from age 21 to 100 years.
[b] CIN2+ detected includes CIN2s, CIN3s and cervical cancers detected through screening (excludes clinically detected cancers).
[c] Total number of colposcopies that did not result in CIN2, CIN3 or cancer detection.
[d] Strategies are denoted by the screening modality, interval, age to begin screening/screening modality after switch age, interval after switch age, switch age for each end age category. For example, CYTO-3Y, 21 indicates cytology testing every 3 years starting at age 21, and CYTO-3Y, 21/HPV-5Y,30 indicates cytology testing every 3 years starting at age 21 with a switch to HPV testing every 5 years starting at age 30.
[e] Median outcome across the four models.
[f] End age indicates the age at which the final routine screen should occur, irrespective of age at last screen; exceptions include those women who are recommended to continue screening due to prior abnormal results and/or precancer treatment.
[g] Strategies (bolded) represent current US recommended strategies.

Appendix Table 5. Efficient and Near-Efficient Cervical Cancer Screening Strategies Among Unvaccinated Female Persons Assuming HPV-16/18 Genotype Triage of HPV-Positive Results by Model[a]

	Incremental Colposcopies per LYG				Incremental Total Tests per LYG			
Strategy	**H**	**M**	**P**	**U**	**H**	**M**	**P**	**U**
HPV-10Y, 40, 60	Dom	2	1	3	Dom	34	31	31
HPV-10Y, 35, 65	Dom	8	4	6	Dom	64	58*	46
HPV-5Y, 35/HPV-10Y, 40, 60	Dom	51*	Dom	Dom	Dom	434*	Dom	Dom
HPV-10Y, 30, 60	Dom	60*	7*	12*	Dom	76	56	50
HPV-10Y, 30, 70	Dom	15	6	10*	Dom	168*	135	166*
HPV-5Y, 30/HPV-10Y, 35, 65	Dom	24*	8*	Dom	Dom	142	217*	Dom
HPV-5Y, 30/HPV-10Y, 40, 60	Dom	32*	Dom	Dom	Dom	166*	Dom	Dom
CYTO-3Y, 21/HPV-10Y, 30, 60	89*	Dom	Dom	Dom	347*	Dom	Dom	Dom
HPV-5Y, 30/HPV-10Y, 40, 70	Dom	18	Dom	Dom	Dom	214	Dom	Dom
CYTO-3Y, 21/HPV-10Y, 30, 70	75	Dom	25*	Dom	2,248*	Dom	2,656*	Dom
HPV-5Y, 30, 60	Dom	59*	Dom	Dom	Dom	988*	Dom	Dom
HPV-10Y, 25, 65	132*	Dom	Dom	Dom	156	Dom	Dom	Dom
HPV-5Y, 30, 65	Dom	20*	Dom	Dom	Dom	569*	Dom	Dom
CYTO-4Y, 21/HPV-10Y, 25, 65	114*	Dom	Dom	Dom	1,113*	Dom	Dom	Dom
HPV-5Y, 30, 70	Dom	19	Dom	109*	Dom	454*	Dom	313*
HPV-5Y, 25/HPV-10Y, 30, 60	133*	Dom	Dom	Dom	553*	Dom	Dom	Dom
CYTO-3Y, 21/HPV-5Y, 30, 60	207*	Dom	Dom	Dom	9,682*	Dom	Dom	Dom
HPV-5Y, 25/HPV-10Y, 30, 70	333*	Dom	Dom	Dom	543	Dom	Dom	Dom
CYTO-3Y, 21/HPV-5Y, 30, 65[c]	**137***	**44***	**Dom**	**72***	**3,432***	**8,586***	**Dom**	**6,541***
HPV-5Y, 25/HPV-10Y, 35, 65	327*	Dom	Dom	Dom	1,597*	Dom	Dom	Dom
CYTO-3Y, 21/HPV-5Y, 30, 70	129	38	20	48	2,944*	25,729*	14,697*	2,864*
CYTO-4Y, 21/COTEST-10Y, 25, 65	289*	Dom	Dom	Dom	14,152*	Dom	Dom	Dom
HPV-5Y, 25, 60	303*	Dom	Dom	Dom	2,820*	Dom	Dom	Dom
CYTO-3Y, 21/COTEST-5Y, 30, 60	276*	Dom	Dom	Dom	12,744*	Dom	Dom	Dom
CYTO-4Y, 21/HPV-5Y, 25, 60	1,386*	Dom	Dom	Dom	1,772*	Dom	Dom	Dom
HPV-5Y, 25, 65[c]	**209***	**60***	**Dom**	**79***	**1,736***	**307**	**Dom**	**222**
CYTO-3Y, 21/COTEST-5Y, 30, 65[c]	**3,829***	**Dom**	**Dom**	**94***	**7,547***	**Dom**	**Dom**	**7,638***
HPV-5Y, 25, 70	570*	50*	28*	53*	1,700*	396	648	293
CYTO-4Y, 21/HPV-5Y, 25, 65	228*	65*	Dom	87*	1,461	1,125*	Dom	1,863*
CYTO-3Y, 21/COTEST-5Y, 30, 70	592*	120*	330*	188	6,775*	8,683*	10,928*	12,829*
CYTO-4Y, 21/HPV-5Y, 25, 70	188	112	94	304*	1,511	760	747	1,216
CYTO-4Y, 21/COTEST-5Y, 25, 60	842*	Dom	Dom	Dom	5,780*	Dom	Dom	Dom
COTEST-5Y, 25, 65	1,155*	Dom	Dom	110*	6,279*	Dom	Dom	9,320*
CYTO-4Y, 21/COTEST-5Y, 25, 65	377*	2,710*	64*	106*	29,988*	50,414*	3,084*	5,564*
CYTO-4Y, 21/COTEST-5Y, 25, 70	1,024	233	948	232	38,043	11,281	29,429	8,079

Abbreviations: cyto, cytology; HPV, Human papillomavirus; LYG, life-years gained; H, Harvard model; M, MISCAN-Cervix model; P, Policy1-Cervix model; U, University of Minnesota model.

[a] Near-efficient (i.e., within 2% of the efficiency frontier) are indicated by *. Strategies are ordered by increasing colposcopies in the Harvard model. Ratios were calculated against the next-less effective, non-dominated strategy within each model. Ratios in grey font indicate strategies that had lower LYG than the guidelines-based strategy of 3-yearly cytology from ages 21 to 65 years in each model. Yellow highlighted ratios indicate strategies with efficiency ratios that were equal to or less than those from the current guidelines-based strategies in the unvaccinated population on both efficiency metrics of colposcopies per LYG and tests per LYG in each model in the base-case analysis. The efficiency ratios used as benchmarks in each model were: 78-133 colposcopies per LYG and 1,509-2,663 tests per LYG in the Harvard model; 48-54 colposcopies per LYG and 291-4,279 tests per LYG in the MISCAN-Cervix model; 17-32 colposcopies per LYG and 688-1,052 tests per LYG in the Policy1-Cervix model; 92-134 colposcopies per LYG and 229-2,016 tests per LYG in the UMN model (see **Table 15**). Strategies that were dominated by both efficiency metrics in all 4 models are not shown.
[b] Strategies are denoted by the screening modality, interval, age to begin screening/screening modality after switch age, interval after switch age, switch age for each end age category. For example, HPV-10Y, 40, 60 indicates HPV testing every 10 years starting at age 40 years and ending at age 60 years, and HPV-5Y, 35/HPV-10Y, 40, 60 indicates HPV testing every 5 years starting at age 35 years with a switch to HPV testing every 10 years starting at age 40 years and ending at age 60 years.
[c] Strategies (bolded) represent current US recommended strategies.

Appendix Table 6. Efficient and Near-Efficient Cervical Cancer Screening Strategies Among Unvaccinated Female Persons Assuming Lower-Bound Relative Test Sensitivity for HPV Testing by Model[a]

	Incremental Colposcopies per LYG			Incremental Total Tests per LYG		
Strategy	**H**	**P**	**U**	**H**	**P**	**U**
HPV-10Y, 40, 60	3	1	2	37	31	33
HPV-10Y, 35, 65	Dom	Dom	5	Dom	Dom	46
HPV-5Y, 35/HPV-10Y, 40, 60	Dom	Dom	25*	Dom	Dom	162*
HPV-10Y, 30, 60	Dom	4*	Dom	Dom	57	Dom
HPV-10Y, 30, 70	Dom	4	10*	Dom	169	187*
HPV-5Y, 30/HPV-10Y, 35, 65	Dom	24*	Dom	Dom	331*	Dom
HPV-5Y, 30/HPV-10Y, 40, 70	Dom	10	Dom	Dom	312*	Dom
CYTO-3Y, 21/HPV-10Y, 30, 70	Dom	62*	Dom	Dom	4,752*	Dom
CYTO-3Y, 21/HPV-5Y, 30, 60	98*	Dom	Dom	1,907*	Dom	Dom
CYTO-3Y, 21/HPV-5Y, 30, 65[c]	**77***	**24***	**Dom**	**5,848***	**954***	**Dom**
CYTO-3Y, 21/HPV-5Y, 30, 70	73	16	123*	2,512*	4,512*	1,765
HPV-5Y, 25, 60	238*	Dom	Dom	579	Dom	Dom
HPV-5Y, 25, 65[c]	**148***	**Dom**	**Dom**	**685***	**Dom**	**Dom**
CYTO-4Y, 21/HPV-5Y, 25, 60	124*	Dom	Dom	646	Dom	Dom
HPV-5Y, 25, 70	131*	20*	1,046*	871*	545	290
CYTO-4Y, 21/HPV-5Y, 25, 65	532*	Dom	Dom	727	Dom	Dom
CYTO-4Y, 21/HPV-5Y, 25, 70	205*	23*	210*	1,249	870	1,087
CYTO-3Y, 21/COTEST-5Y, 30, 60	184*	Dom	Dom	51,346*	Dom	Dom
CYTO-3Y, 21/COTEST-5Y, 30, 65[c]	**117***	**50***	**90***	**7,889***	**8,654***	**3,412***
CYTO-3Y, 21/COTEST-5Y, 30, 70	111	131	58	6,232*	4,112*	1,854
CYTO-4Y, 21/COTEST-5Y, 25, 60	207*	Dom	Dom	8,036*	Dom	Dom
COTEST-5Y, 25, 65	218*	Dom	107*	9,040*	Dom	4,009*
CYTO-4Y, 21/COTEST-5Y, 25, 65	375*	2,356*	101*	4,722*	36,187*	3,014*
CYTO-4Y, 21/COTEST-5Y, 25, 70	220	168	334	4,295	3,556	2,133

Abbreviations: cyto, cytology; HPV, Human papillomavirus; LYG, life-years gained; H, Harvard model; P, Policy1-Cervix model; U, University of Minnesota model.

[a] Near-efficient (i.e., within 2% of the efficiency frontier) are indicated by *. Strategies are ordered by increasing colposcopies in the Harvard model. Ratios were calculated against the next-less effective, non-dominated strategy within each model. Ratios in grey font indicate strategies that had lower LYG than the guidelines-based strategy of 3-yearly cytology from ages 21 to 65 years in each model. Yellow highlighted ratios indicate strategies with efficiency ratios that were equal to or less than those from the current guidelines-based strategies in the unvaccinated population on both efficiency metrics of colposcopies per LYG and tests per LYG in each model, assuming perfect adherence. The efficiency ratios used as benchmarks in each model were: 78-133 colposcopies per LYG and 1,509-2,663 tests per LYG in the Harvard model; 17-32 colposcopies per LYG and 688-1,052 tests per LYG in the Policy1-Cervix model; 92-134 colposcopies per LYG and 229-2,016 tests per LYG in the UMN model (see **Table 15**). Strategies that were dominated by both efficiency metrics in all 3 models are not shown.

[b] Strategies are denoted by the screening modality, interval, age to begin screening/screening modality after switch age, interval after switch age, switch age for each end age category. For example, HPV-10Y, 40, 60 indicates HPV testing every 10 years starting at age 40 years and ending at age 60 years, and HPV-5Y, 35/HPV-10Y, 40, 60 indicates HPV testing every 5 years starting at age 35 years with a switch to HPV testing every 10 years starting at age 40 years and ending at age 60 years.

[c] Strategies (bolded) represent current US recommended strategies.

Appendix Table 7. Efficient and Near-Efficient Cervical Cancer Screening Strategies Among 2vHPV or 4vHPV Vaccinated Female Persons Assuming Lower-Bound Relative Test Sensitivity for HPV Testing by Model[a]

	Incremental Colposcopies per LYG			Incremental Total Tests per LYG		
Strategy	**H**	**P**	**U**	**H**	**P**	**U**
HPV-10Y, 40, 60	5	3	8	76	117	143
HPV-10Y, 35, 65	Dom	14*	21	Dom	335*	220*
HPV-10Y, 30, 60	17	Dom	36*	130	Dom	203
HPV-10Y, 30, 70	Dom	12	Dom	Dom	318	Dom
HPV-5Y, 30/HPV-10Y, 35, 65	32	Dom	Dom	606*	Dom	Dom
HPV-5Y, 30/HPV-10Y, 40, 60	33	Dom	Dom	563*	Dom	Dom
HPV-5Y, 30/HPV-10Y, 40, 70	Dom	36*	Dom	Dom	1,427	Dom
HPV-10Y, 25, 65	Dom	Dom	33*	Dom	Dom	380
HPV-5Y, 30, 65	Dom	41*	Dom	Dom	5,471*	Dom
HPV-5Y, 30, 70	Dom	32	Dom	Dom	2,339*	Dom
CYTO-3Y, 21/HPV-5Y, 30, 60	50	Dom	1,048*	5,935*	Dom	10,665*
CYTO-3Y, 21/HPV-5Y, 30, 65[c]	**80**	**Dom**	**230***	**7,351***	**Dom**	**4,853***
CYTO-3Y, 21/HPV-5Y, 30, 70	137	108	109*	18,047*	8,935	2,948*
HPV-5Y, 25, 60	83*	Dom	Dom	1,377	Dom	Dom
HPV-5Y, 25, 65[c]	**83***	**Dom**	**203***	**2,962***	**Dom**	**808**
HPV-5Y, 25, 70	1,042*	68	193*	68,059*	1,528	1,946*
CYTO-4Y, 21/HPV-5Y, 25, 60	1,112*	Dom	Dom	2,808	Dom	Dom
CYTO-4Y, 21/HPV-5Y, 25, 65	1,610*	Dom	280*	2,933	Dom	2,476*
CYTO-4Y, 21/HPV-5Y, 25, 70	2,004*	326*	138*	5,503	8,958*	1,856
COTEST-5Y, 25/COTEST-10Y, 35, 65	138*	Dom	Dom	5,209*	Dom	Dom
CYTO-3Y, 21/COTEST-5Y, 30, 60	421*	Dom	Dom	19,522*	Dom	Dom
CYTO-3Y, 21/COTEST-5Y, 30, 65[c]	**337***	**Dom**	**121***	**14,550***	**Dom**	**7,368***
CYTO-3Y, 21/COTEST-5Y, 30, 70	328	351	107	13,853*	11,278*	6,077*
COTEST-5Y, 25, 65	656*	Dom	Dom	19,236*	Dom	Dom
CYTO-4Y, 21/COTEST-5Y, 25, 60	458*	Dom	Dom	12,362*	Dom	Dom
CYTO-4Y, 21/COTEST-5Y, 25, 65	713*	Dom	156*	10,751*	Dom	7,989*
CYTO-4Y, 21/COTEST-5Y, 25, 70	511	1,147	526	10,735	11,272	5,884

Abbreviations: cyto, cytology; HPV, Human papillomavirus; LYG, life-years gained; H, Harvard model; P, Policy1-Cervix model; U, University of Minnesota model.

[a] Near-efficient (i.e., within 2% of the efficiency frontier) are indicated by *. Strategies are ordered by increasing colposcopies in the Harvard model. Ratios were calculated against the next-less effective, non-dominated strategy within each model. Yellow highlighted ratios indicate strategies with efficiency ratios that were equal to or less than those from the current guidelines-based strategies in the unvaccinated population on both efficiency metrics of colposcopies per LYG and tests per LYG in each model. The efficiency ratios used as benchmarks in each model were: 78-133 colposcopies per LYG and 1,509-2,663 tests per LYG in the Harvard model; 17-32 colposcopies per LYG and 688-1,052 tests per LYG in the Policy1-Cervix model; 92-134 colposcopies per LYG and 229-2,016 tests per LYG in the UMN model (see **Table 15**). Strategies that were dominated by both efficiency metrics in all 3 models are not shown.

[b] Strategies are denoted by the screening modality, interval, age to begin screening/screening modality after switch age, interval after switch age, switch age for each end age category. For example, HPV-10Y, 40, 60 indicates HPV testing every 10 years starting at age 40 years and ending at age 60 years, and HPV-5Y, 35/HPV-10Y, 40, 60 indicates HPV testing every 5 years starting at age 35 years with a switch to HPV testing every 10 years starting at age 40 years and ending at age 60 years.

[c] Strategies (bolded) represent current US recommended strategies.

Appendix Table 8. Efficient and Near-Efficient Cervical Cancer Screening Strategies Among 9vHPV Vaccinated Female Persons Assuming Lower-Bound Relative Test Sensitivity for HPV Testing by Model[a]

	Incremental Colposcopies per LYG			Incremental Total Tests per LYG		
Strategy	**H**	**P**	**U**	**H**	**P**	**U**
HPV-10Y, 40, 60	5	4	13	129	295	322
HPV-5Y, 40, 60	Dom	Dom	40*	Dom	Dom	1,444
HPV-10Y, 35, 65	41*	18*	Dom	835*	716	Dom
HPV-5Y, 40, 65	Dom	Dom	38	Dom	Dom	2,647*
HPV-5Y, 35/HPV-10Y, 40, 60	71*	Dom	Dom	738*	Dom	Dom
HPV-5Y, 35/HPV-10Y, 45, 65	65*	Dom	Dom	1,110*	Dom	Dom
HPV-5Y, 35, 60	47	Dom	Dom	3,104*	Dom	Dom
HPV-5Y, 35, 65	Dom	Dom	140*	Dom	Dom	2,183
HPV-10Y, 30, 70	Dom	21	Dom	Dom	1,010	Dom
HPV-5Y, 35, 70	Dom	24	120	Dom	5,335*	4,681
HPV-5Y, 30/HPV-10Y, 35, 65	77*	Dom	Dom	1,743*	Dom	Dom
HPV-5Y, 30/HPV-10Y, 40, 60	211*	Dom	Dom	1,469	Dom	Dom
HPV-5Y, 30/HPV-10Y, 40, 70	197*	Dom	Dom	8,983*	Dom	Dom
HPV-5Y, 30, 60	79	Dom	Dom	2,753	Dom	Dom
HPV-5Y, 30, 65	207*	91*	974*	13,156*	4,208*	5,623
HPV-5Y, 30, 70	243*	45	509*	16,096*	3,524*	7,028*
HPV-5Y, 25, 60	212*	Dom	Dom	2,963	Dom	Dom
HPV-5Y, 25, 65[c]	**208***	**Dom**	**671***	**11,345***	**Dom**	**7,498***
CYTO-3Y, 21/HPV-5Y, 30, 60	143	Dom	Dom	10,893*	Dom	Dom
HPV-5Y, 25, 70	212*	138	441*	14,158*	3,520	6,128
CYTO-3Y, 21/HPV-5Y, 30, 65[c]	**148**	**Dom**	**473***	**10,128**	**Dom**	**29,499***
CYTO-4Y, 21/HPV-5Y, 25, 60	196*	Dom	Dom	5,196	Dom	Dom
CYTO-3Y, 21/HPV-5Y, 30, 70	341	390*	432*	23,846	5,324*	19,742*
CYTO-4Y, 21/HPV-5Y, 25, 65	197*	Dom	674*	13,010*	Dom	10,198*
CYTO-4Y, 21/HPV-5Y, 25, 70	7,564*	5,019*	393	16,019*	162,447*	6,752
COTEST-5Y, 30, 60	491*	Dom	Dom	18,393*	Dom	Dom
COTEST-5Y, 30, 65	523*	Dom	453*	263,311*	Dom	42,347*
COTEST-5Y, 30, 70	Dom	Dom	457	Dom	Dom	64,438*
CYTO-3Y, 21/COTEST-5Y, 30, 60	1,225*	Dom	Dom	41,667*	Dom	Dom
CYTO-3Y, 21/COTEST-5Y, 30, 65[c]	**1,088***	**Dom**	**1,158***	**39,160***	**Dom**	**44,938***
COTEST-5Y, 25, 65	5,792*	Dom	1,780*	169,481*	Dom	50,620*
CYTO-4Y, 21/COTEST-5Y, 25, 60	1,003*	Dom	Dom	27,273	Dom	Dom
CYTO-3Y, 21/COTEST-5Y, 30, 70	1,044*	639	483	39,171*	22,264	28,223
CYTO-4Y, 21/COTEST-5Y, 25, 65	966*	Dom	Dom	35,771	Dom	Dom

Strategy	Incremental Colposcopies per LYG H	P	U	Incremental Total Tests per LYG H	P	U
CYTO-4Y, 21/COTEST-5Y, 25, 70	948	Dom	Dom	39,671	Dom	Dom

Abbreviations: cyto, cytology; HPV, Human papillomavirus; LYG, life-years gained; H, Harvard model; P, Policy1-Cervix model; U, University of Minnesota model.

[a] Near-efficient (i.e., within 2% of the efficiency frontier) are indicated by *. Strategies are ordered by increasing colposcopies in the Harvard model. Ratios were calculated against the next-less effective, non-dominated strategy within each model. Yellow highlighted ratios indicate strategies with efficiency ratios that were equal to or less than those from the current guidelines-based strategies in the unvaccinated population on both efficiency metrics of colposcopies per LYG and tests per LYG in each model. The efficiency ratios used as benchmarks in each model were: 78-133 colposcopies per LYG and 1,509-2,663 tests per LYG in the Harvard model; 17-32 colposcopies per LYG and 688-1,052 tests per LYG in the Policy1-Cervix model; 92-134 colposcopies per LYG and 229-2,016 tests per LYG in the UMN model (see **Table 15**). Strategies that were dominated by both efficiency metrics in all 3 models are not shown.

[b] Strategies are denoted by the screening modality, interval, age to begin screening/screening modality after switch age, interval after switch age, switch age for each end age category. For example, HPV-10Y, 40, 60 indicates HPV testing every 10 years starting at age 40 years and ending at age 60 years, and HPV-5Y, 35/HPV-10Y, 40, 60 indicates HPV testing every 5 years starting at age 35 years with a switch to HPV testing every 10 years starting at age 40 years and ending at age 60 years.

[c] Strategies (bolded) represent current US recommended strategies.

Appendix Table 9. Efficient and Near-Efficient Cervical Cancer Screening Strategies Among Unvaccinated Female Persons Assuming Upper-Bound Relative Test Sensitivity for HPV Testing by Model[a]

	Incremental Colposcopies per LYG			Incremental Total Tests per LYG		
Strategy	**H**	**P**	**U**	**H**	**P**	**U**
HPV-10Y, 40, 60	Dom	1	3	Dom	30	32
HPV-10Y, 35, 65	Dom	Dom	6	Dom	Dom	47
HPV-10Y, 30, 60	Dom	4*	11*	Dom	59	47
HPV-10Y, 30, 70	Dom	4	10*	Dom	149	180*
HPV-5Y, 30/HPV-10Y, 35, 65	Dom	5*	Dom	Dom	270*	Dom
CYTO-3Y, 21/HPV-10Y, 30, 60	56*	Dom	Dom	367*	Dom	Dom
HPV-5Y, 30/HPV-10Y, 40, 70	Dom	24*	Dom	Dom	809*	Dom
CYTO-3Y, 21/HPV-10Y, 30, 70	51	25*	Dom	4,866*	1,553*	Dom
HPV-10Y, 25, 65	76*	Dom	Dom	157	Dom	Dom
HPV-5Y, 30, 70	Dom	Dom	77*	Dom	Dom	332*
CYTO-4Y, 21/HPV-10Y, 25, 65	500*	Dom	Dom	1,368*	Dom	Dom
CYTO-3Y, 21/COTEST-10Y, 30, 70	81*	Dom	Dom	18,387*	Dom	Dom
HPV-5Y, 25/HPV-10Y, 30, 60	94*	Dom	Dom	192*	Dom	Dom
CYTO-3Y, 21/HPV-5Y, 30, 60	608*	Dom	Dom	5,774*	Dom	Dom
HPV-5Y, 25/HPV-10Y, 30, 70	413*	50*	Dom	970	292	Dom
CYTO-3Y, 21/HPV-5Y, 30, 65[c]	**191***	**Dom**	**68***	**7,145***	**Dom**	**4,819***
HPV-5Y, 25/HPV-10Y, 35, 65	388*	Dom	Dom	1,818	Dom	Dom
CYTO-3Y, 21/HPV-5Y, 30, 70	164	19	45	4,792*	2,926*	4,389*
CYTO-4Y, 21/COTEST-10Y, 25, 65	427*	Dom	Dom	56,615*	Dom	Dom
COTEST-5Y, 25/COTEST-10Y, 30, 70	688*	Dom	Dom	191,172*	Dom	Dom
HPV-5Y, 25, 60	488*	Dom	Dom	11,887*	Dom	Dom
CYTO-3Y, 21/COTEST-5Y, 30, 60	717*	Dom	Dom	159,389*	Dom	Dom
COTEST-5Y, 25/COTEST-10Y, 35, 65	558*	Dom	Dom	60,617*	Dom	Dom
HPV-5Y, 25, 65[c]	**2,750***	**Dom**	**74***	**2,548***	**Dom**	**241**
CYTO-4Y, 21/HPV-5Y, 25, 60	2,231*	Dom	Dom	2,803*	Dom	Dom
CYTO-3Y, 21/COTEST-5Y, 30, 65[c]	**340***	**Dom**	**93***	**17,464***	**Dom**	**12,762***
HPV-5Y, 25, 70	409*	22*	48*	2,248*	668	265
CYTO-4Y, 21/HPV-5Y, 25, 65	221*	Dom	78*	1,913*	Dom	1,306*
CYTO-4Y, 21/HPV-5Y, 25, 70	178	85	191	1,844	928	1,350
CYTO-3Y, 21/COTEST-5Y, 30, 70	2,191*	548*	2,286*	12,762*	21,975*	287,728*
CYTO-4Y, 21/COTEST-5Y, 25, 60	1,401*	Dom	Dom	9,709*	Dom	Dom
COTEST-5Y, 25, 65	1,971*	Dom	103*	10,622*	Dom	15,963*
CYTO-4Y, 21/COTEST-5Y, 25, 65	431*	80*	109*	6,594*	2,822*	9,381*
CYTO-4Y, 21/COTEST-5Y, 25, 70	3,033	389	326	114,651	11,871	18,849

Abbreviations: cyto, cytology; HPV, Human papillomavirus; LYG, life-years gained; H, Harvard model; P, Policy1-Cervix model; U, University of Minnesota model.

[a] Near-efficient (i.e., within 2% of the efficiency frontier) are indicated by *. Strategies are ordered by increasing colposcopies in the Harvard model. Ratios were calculated against the next-less effective, non-dominated strategy within each model. Ratios in grey font indicate strategies that had lower LYG than the guidelines-based strategy of 3-yearly cytology from ages 21 to 65 years in each model. Yellow highlighted ratios indicate strategies with efficiency ratios that were equal to or less than those from the current guidelines-based strategies in the unvaccinated population on both efficiency metrics of colposcopies per LYG and tests per LYG in each model, assuming perfect adherence. The efficiency ratios used as benchmarks in each model were: 78-133 colposcopies per LYG and 1,509-2,663 tests per LYG in the Harvard model; 17-32 colposcopies per LYG and 688-1,052 tests per LYG in the Policy1-Cervix model; 92-134 colposcopies per LYG and 229-2,016 tests per LYG in the UMN model (see **Table 15**). Strategies that were dominated by both efficiency metrics in all 3 models are not shown.

[b] Strategies are denoted by the screening modality, interval, age to begin screening/screening modality after switch age, interval after switch age, switch age for each end age category. For example, HPV-10Y, 40, 60 indicates HPV testing every 10 years starting at age 40 years and ending at age 60 years, and HPV-5Y, 35/HPV-10Y, 40, 60 indicates HPV testing every 5 years starting at age 35 years with a switch to HPV testing every 10 years starting at age 40 years and ending at age 60 years.

[c] Strategies (bolded) represent current US recommended strategies.

Appendix Table 10. Efficient and Near-Efficient Cervical Cancer Screening Strategies Among 2vHPV or 4vHPV Vaccinated Female Persons Assuming Upper-Bound Relative Test Sensitivity for HPV Testing by Model[a]

	Incremental Colposcopies per LYG			Incremental Total Tests per LYG		
Strategy	**H**	**P**	**U**	**H**	**P**	**U**
HPV-10Y, 40, 60	6	3	9	74	111	134
HPV-10Y, 35, 65	Dom	14*	Dom	Dom	340*	Dom
HPV-10Y, 30, 60	24	Dom	29*	133	Dom	188
HPV-10Y, 30, 70	125*	12	Dom	2,776*	338	Dom
HPV-5Y, 30/HPV-10Y, 35, 65	Dom	Dom	69*	Dom	Dom	621*
HPV-5Y, 30/HPV-10Y, 40, 70	Dom	153*	Dom	Dom	6,154*	Dom
CYTO-3Y, 21/HPV-10Y, 30, 60	50	Dom	Dom	117,739*	Dom	Dom
CYTO-3Y, 21/HPV-10Y, 30, 70	113	Dom	Dom	8,921*	Dom	Dom
HPV-5Y, 30, 70	Dom	35	Dom	Dom	1,999*	Dom
HPV-10Y, 25, 65	83*	Dom	47*	523	Dom	452
CYTO-4Y, 21/HPV-10Y, 25, 65	1,107*	Dom	Dom	8,509*	Dom	Dom
HPV-5Y, 25/HPV-10Y, 30, 60	2,906*	Dom	Dom	4,278*	Dom	Dom
CYTO-3Y, 21/COTEST-10Y, 30, 60	105*	Dom	Dom	3,330*	Dom	Dom
CYTO-3Y, 21/HPV-5Y, 30, 60	1,282*	Dom	Dom	71,567*	Dom	Dom
HPV-5Y, 25/HPV-10Y, 30, 70	3,357*	Dom	Dom	2,863	Dom	Dom
CYTO-3Y, 21/COTEST-10Y, 30, 70	951*	Dom	Dom	40,372*	Dom	Dom
CYTO-3Y, 21/HPV-5Y, 30, 65[c]	**529***	**Dom**	**91***	**19,088***	**Dom**	**4,825***
HPV-5Y, 25/HPV-10Y, 35, 65	4,408*	Dom	Dom	3,581*	Dom	Dom
CYTO-3Y, 21/HPV-5Y, 30, 70	465	116	73	15,867*	8,200*	12,294
COTEST-10Y, 25, 65	146*	Dom	Dom	583,180*	Dom	Dom
HPV-5Y, 25, 60	1,312*	Dom	Dom	15,069*	Dom	Dom
COTEST-5Y, 25/COTEST-10Y, 30, 60	12,190*	Dom	Dom	171,322*	Dom	Dom
CYTO-4Y, 21/COTEST-10Y, 25, 65	3,185*	Dom	Dom	147,896*	Dom	Dom
HPV-5Y, 25, 65[c]	**30,611***	**Dom**	**103***	**8,743***	**Dom**	**1,197**
CYTO-4Y, 21/HPV-5Y, 25, 60	4,907*	Dom	Dom	9,158*	Dom	Dom
COTEST-5Y, 25/COTEST-10Y, 30, 70	1,178*	Dom	Dom	27,623*	Dom	Dom
HPV-5Y, 25, 70	1,296*	122*	89*	8,480*	1,941	1,619
CYTO-4Y, 21/HPV-5Y, 25, 65	674*	Dom	114*	7,454	Dom	9,660*
COTEST-5Y, 25/COTEST-10Y, 35, 65	10,310*	Dom	Dom	25,771*	Dom	Dom
CYTO-3Y, 21/COTEST-5Y, 30, 60	2,405*	Dom	Dom	119,070*	Dom	Dom
CYTO-4Y, 21/HPV-5Y, 25, 70	554	252	95*	7,665	3,719	1,809
CYTO-3Y, 21/COTEST-5Y, 30, 65[c]	**1,152***	**Dom**	**141***	**45,807***	**Dom**	**29,033***
CYTO-3Y, 21/COTEST-5Y, 30, 70	6,952*	2,880*	1,250*	39,326*	106,496*	78,173*
CYTO-4Y, 21/COTEST-5Y, 25, 60	2,787*	Dom	Dom	27,150*	Dom	Dom

Strategy	Incremental Colposcopies per LYG			Incremental Total Tests per LYG		
	H	P	U	H	P	U
COTEST-5Y, 25, 65	156,536*	Dom	Dom	38,330*	Dom	Dom
CYTO-4Y, 21/COTEST-5Y, 25, 65	20,292*	Dom	160*	788,649*	Dom	18,501*
CYTO-4Y, 21/COTEST-5Y, 25, 70	2,777	1,162	844	105,201	36,562	35,722

Abbreviations: cyto, cytology; HPV, Human papillomavirus; LYG, life-years gained; H, Harvard model; P, Policy1-Cervix model; U, University of Minnesota model.

[a] Near-efficient (i.e., within 2% of the efficiency frontier) are indicated by *. Strategies are ordered by increasing colposcopies in the Harvard model. Ratios were calculated against the next-less effective, non-dominated strategy within each model. Yellow highlighted ratios indicate strategies with efficiency ratios that were equal to or less than those from the current guidelines-based strategies in the unvaccinated population on both efficiency metrics of colposcopies per LYG and tests per LYG in each model. The efficiency ratios used as benchmarks in each model were: 78-133 colposcopies per LYG and 1,509-2,663 tests per LYG in the Harvard model; 17-32 colposcopies per LYG and 688-1,052 tests per LYG in the Policy1-Cervix model; 92-134 colposcopies per LYG and 229-2,016 tests per LYG in the UMN model (see **Table 15**). Strategies that were dominated by both efficiency metrics in all 3 models are not shown.

[b] Strategies are denoted by the screening modality, interval, age to begin screening/screening modality after switch age, interval after switch age, switch age for each end age category. For example, HPV-10Y, 40, 60 indicates HPV testing every 10 years starting at age 40 years and ending at age 60 years, and HPV-5Y, 35/HPV-10Y, 40, 60 indicates HPV testing every 5 years starting at age 35 years with a switch to HPV testing every 10 years starting at age 40 years and ending at age 60 years.

[c] Strategies (bolded) represent current US recommended strategies.

Appendix Table 11. Efficient and Near-Efficient Cervical Cancer Screening Strategies Among 9vHPV Vaccinated Female Persons Assuming Upper-Bound Relative Test Sensitivity for HPV Testing by Model[a]

	Incremental Colposcopies per LYG			Incremental Total Tests per LYG		
Strategy	**H**	**P**	**U**	**H**	**P**	**U**
HPV-10Y, 40, 60	8	3	16	125	274	318
HPV-10Y, 40, 70	Dom	9	30	Dom	1,164*	1,378*
HPV-5Y, 40, 65	Dom	Dom	73	Dom	Dom	56,830*
HPV-10Y, 35, 65	65	Dom	Dom	866*	Dom	Dom
HPV-5Y, 35/HPV-10Y, 40, 60	72	Dom	Dom	935*	Dom	Dom
HPV-5Y, 35, 65	Dom	Dom	202*	Dom	Dom	3,339*
HPV-10Y, 30, 60	96	Dom	Dom	673	Dom	Dom
HPV-5Y, 35, 70	Dom	Dom	168	Dom	Dom	3,629*
HPV-10Y, 30, 70	694*	20	Dom	26,435*	905	Dom
HPV-5Y, 30/HPV-10Y, 35, 65	239*	Dom	Dom	7,063*	Dom	Dom
HPV-5Y, 30/HPV-10Y, 40, 60	228*	Dom	Dom	6,940*	Dom	Dom
HPV-5Y, 30/HPV-10Y, 40, 70	296*	52*	Dom	9,784*	3,676*	Dom
HPV-5Y, 30, 60	292*	Dom	Dom	11,749*	Dom	Dom
HPV-5Y, 30, 65	329*	Dom	381*	13,619*	Dom	3,226
HPV-5Y, 30, 70	370*	42	325*	15,799*	4,979*	8,145*
CYTO-3Y, 21/HPV-10Y, 30, 60	143	Dom	Dom	13,302*	Dom	Dom
HPV-10Y, 25, 65	211*	Dom	Dom	2,103	Dom	Dom
CYTO-3Y, 21/HPV-10Y, 30, 70	441	Dom	Dom	14,063*	Dom	Dom
HPV-5Y, 25/HPV-10Y, 30, 60	228*	Dom	Dom	3,792	Dom	Dom
CYTO-4Y, 21/HPV-10Y, 25, 65	228*	Dom	Dom	15,368*	Dom	Dom
HPV-5Y, 25/HPV-10Y, 30, 70	248*	Dom	Dom	23,631*	Dom	Dom
HPV-5Y, 25/HPV-10Y, 35, 65	252*	Dom	Dom	15,455*	Dom	Dom
CYTO-3Y, 21/HPV-5Y, 30, 60	678*	Dom	Dom	18,123*	Dom	Dom
CYTO-3Y, 21/HPV-5Y, 30, 65[c]	**625**	**Dom**	**517***	**18,705***	**Dom**	**18,740***
HPV-5Y, 25, 60	285*	Dom	Dom	22,989*	Dom	Dom
CYTO-3Y, 21/HPV-5Y, 30, 70	3,122*	426*	369*	20,763*	7,884*	10,523*
HPV-5Y, 25, 65[c]	**300***	**Dom**	**392***	**24,723***	**Dom**	**5,443***
CYTO-3Y, 21/COTEST-10Y, 30, 60	354*	Dom	Dom	110,593*	Dom	Dom
HPV-5Y, 25, 70	12,571*	128	317	27,421*	4,170	4,961
CYTO-4Y, 21/HPV-5Y, 25, 60	7,407*	Dom	Dom	12,940	Dom	Dom
CYTO-4Y, 21/HPV-5Y, 25, 65	2,068*	Dom	494*	33,088	Dom	10,421*
COTEST-10Y, 25, 65	486*	Dom	Dom	476,712*	Dom	Dom
CYTO-3Y, 21/COTEST-10Y, 30, 70	379*	Dom	Dom	71,963*	Dom	Dom
CYTO-4Y, 21/HPV-5Y, 25, 70	1,980	332*	392*	85,695	6,474*	8,011*

	Incremental Colposcopies per LYG			Incremental Total Tests per LYG		
Strategy	**H**	**P**	**U**	**H**	**P**	**U**
COTEST-5Y, 25/COTEST-10Y, 30, 60	507*	Dom	Dom	445,395*	Dom	Dom
CYTO-4Y, 21/COTEST-10Y, 25, 65	5,367*	Dom	Dom	35,993*	Dom	Dom
COTEST-5Y, 25/COTEST-10Y, 30, 70	539*	Dom	Dom	158,786*	Dom	Dom
COTEST-5Y, 25/COTEST-10Y, 35, 65	533*	Dom	Dom	213,598*	Dom	Dom
CYTO-3Y, 21/COTEST-5Y, 30, 60	4,589*	Dom	Dom	50,954*	Dom	Dom
CYTO-3Y, 21/COTEST-5Y, 30, 65[c]	**3,098***	**Dom**	**604***	**49,423***	**Dom**	**35,002***
CYTO-3Y, 21/COTEST-5Y, 30, 70	3,122*	7,003*	1,814	52,517*	245,149*	117,639
CYTO-4Y, 21/COTEST-5Y, 25, 60	8,411*	Dom	Dom	2,135,397*	Dom	Dom
COTEST-5Y, 25, 65	31,921*	Dom	600*	83,322*	Dom	33,616*
CYTO-4Y, 21/COTEST-5Y, 25, 65	10,608*	Dom	Dom	394,979*	Dom	Dom
CYTO-4Y, 21/COTEST-5Y, 25, 70	8,571	2,655	Dom	325,456	88,937	Dom

Abbreviations: cyto, cytology; HPV, Human papillomavirus; LYG, life-years gained; H, Harvard model; P, Policy1-Cervix model; U, University of Minnesota model.

[a] Near-efficient (i.e., within 2% of the efficiency frontier) are indicated by *. Strategies are ordered by increasing colposcopies in the Harvard model. Ratios were calculated against the next-less effective, non-dominated strategy within each model. Yellow highlighted ratios indicate strategies with efficiency ratios that were equal to or less than those from the current guidelines-based strategies in the unvaccinated population on both efficiency metrics of colposcopies per LYG and tests per LYG in each model. The efficiency ratios used as benchmarks in each model were: 78-133 colposcopies per LYG and 1,509-2,663 tests per LYG in the Harvard model; 17-32 colposcopies per LYG and 688-1,052 tests per LYG in the Policy1-Cervix model; 92-134 colposcopies per LYG and 229-2,016 tests per LYG in the UMN model (see **Table 15**). Strategies that were dominated by both efficiency metrics in all 3 models are not shown.

[b] Strategies are denoted by the screening modality, interval, age to begin screening/screening modality after switch age, interval after switch age, switch age for each end age category. For example, HPV-10Y, 40, 60 indicates HPV testing every 10 years starting at age 40 years and ending at age 60 years, and HPV-5Y, 35/HPV-10Y, 40, 60 indicates HPV testing every 5 years starting at age 35 years with a switch to HPV testing every 10 years starting at age 40 years and ending at age 60 years.

[c] Strategies (bolded) represent current US recommended strategies.