BIOTHERAPEUTICS QUARTERLY

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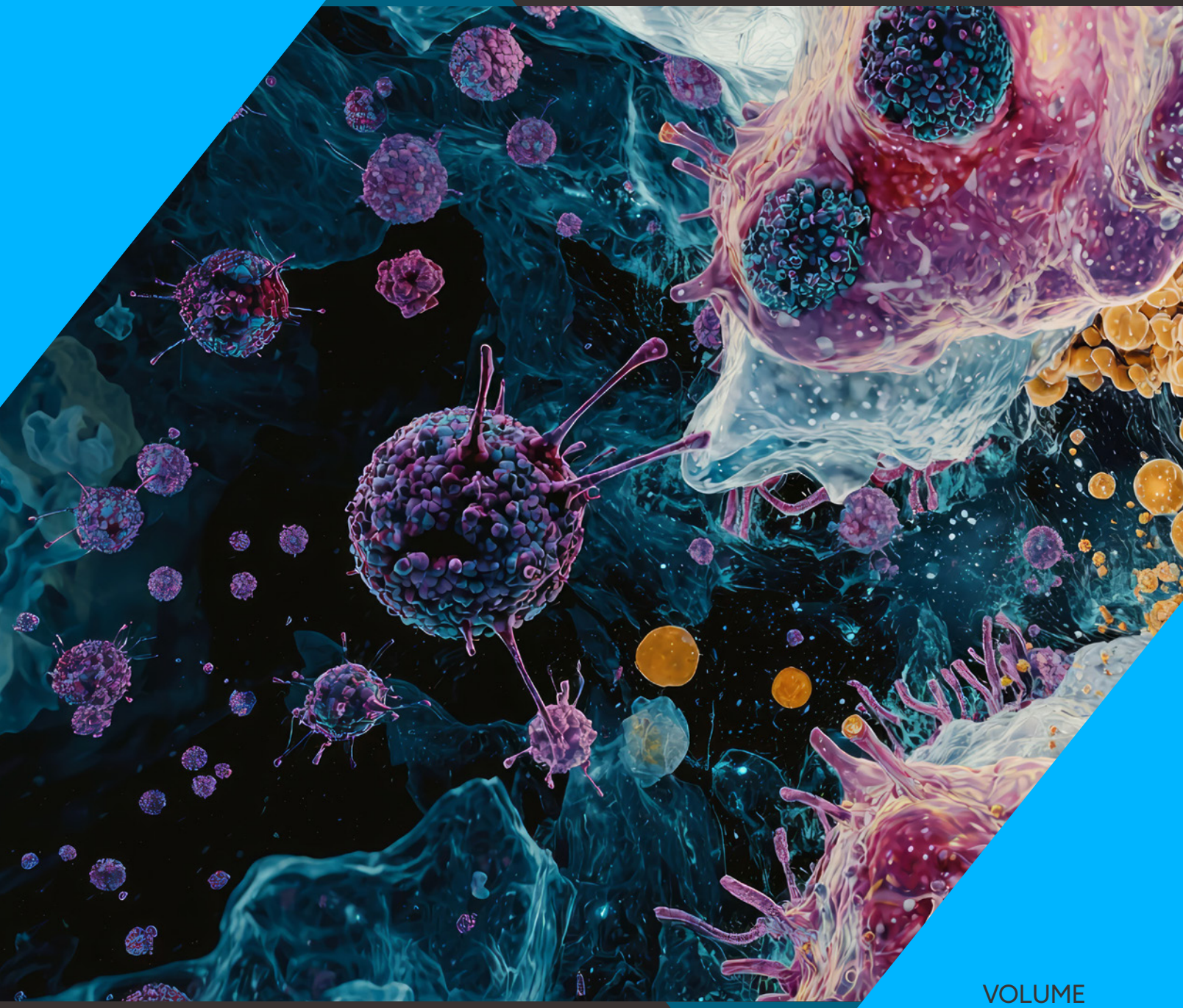

Diagnostic and Pharmaceutical News for You and Your Medical Practice

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BIOTHERAPEUTICS QUARTERLY

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Diagnostic and Pharmaceutical News for You and Your Medical Practice

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New DRUG APPROVALS

Bilprevda® (denosumab-nxxp) Injection
Date of Approval: August 29, 2025
Company: Shanghai Henlius Biotech, Inc. and Organon
Treatment for: Osteoporosis
Bildyos (denosumab-nxxp) is a RANK ligand (RANKL) inhibitor biosimilar to Prolia (denosumab) used in the treatment of osteoporosis.

Bildyos® (denosumab-nxxp) Injection
Date of Approval: August 29, 2025
Company: Shanghai Henlius Biotech, Inc. and Organon
Treatment for: Osteoporosis
Bildyos (denosumab-nxxp) is a RANK ligand (RANKL) inhibitor biosimilar to Prolia (denosumab) used in the treatment of osteoporosis.

Qivigy® (immune globulin intravenous, human-kthm) Solution for Infusion
Date of Approval: September 26, 2025
Company: Kedrion Biopharma
Treatment for: Primary Immunodeficiency Syndrome
Qivigy (immune globulin intravenous, human-kthm) 10% solution is indicated for treatment of adults with primary humoral immunodeficiency (PI).

Contepo™ (fosfomycin) for Injection
Date of Approval: October 22, 2025
Company: Meitheal Pharmaceuticals, Inc.
Treatment for: Urinary Tract Infection
Contepo (fosfomycin for injection) is an epoxide antibacterial for the treatment of complicated urinary tract infections.

Kygevvi™ (doxecitine and doxribtimine) Powder for Oral Solution
Date of Approval: November 3, 2025
Company: UCB
Treatment for: Thymidine Kinase 2 Deficiency
Kygevvi (doxecitine and doxribtimine) is a combination of two pyrimidine nucleosides indicated for the treatment of thymidine kinase 2 deficiency in adults and pediatric patients with an age of symptom onset on or before 12 years.

Quickly Accessible Diagnostics: Performance of a CLIA-Waived CBC With 5-Part Differential

Modernizing Today's Primary & Urgent Care Settings

Authors: Wendian Shi, PhD; Ruiyi Chen, PhD; Yu Jiang, PhD – CytoChip Inc.

1. Introduction

A Fundamental Test, New Clinical Insights

The complete blood count (CBC) is one of the most commonly ordered lab tests [1]. The fundamental value of CBC results in diagnosing infections [2], pneumonia [3], anemia, and coagulation deficiencies has been well studied for clinical practice. In recent years, new values are frequently discovered for its clinical application. For example:

- **Systemic Inflammation:** Previously, CBC was often used for diagnosing infections. In recent years, it is shown that CBC-derived indices are useful measures of severity of acute trauma, systematic inflammation caused by chronic diseases, and autoimmune disorders [4].
- **Chronic Disease Assessment:** Previously, CBC was often prescribed for acute conditions. In recent years, CBC-derived indices, such as Neutrophil and Lymphocyte to platelet ratio, are found to be useful indicators to assess chronic cardiovascular diseases (e.g. incidence and severity, etc.) and metabolic diseases (e.g. incidence of diabetic kidney disease and diabetic retinopathy, etc.) [5].
- **Personalized Baselines:** Previously, the normal range of CBC was established based on population, and a deviation was not a sensitive health indicator. Recently a study led by Harvard researchers revealed in 2025 that each person's CBC range is much narrower than the population range, and a deviation from this personalized range can be sensitive indicator of health conditions (e.g. hypothyroidism, liver disease) [6].

In this age of AI adoption, the value of CBC is becoming even more prominent. Models that use data analytics to distinguish bacterial and viral infection [7], to predict severe respiratory tract infections in pediatric cases [8], or to manage COVID outcomes [9] all rely on CBC, as its results provide a comprehensive snapshot of a patient's immune status and health conditions.

Limitations of CBC Send-Out

In the past, many outpatient settings sent blood samples to external labs for CBC testing, leading to several drawbacks:

- **Delayed results:** Turnaround times of hours to days postpone diagnoses, and staff must later follow up with patients.

- **Patient inconvenience:** Patients wait in uncertainty for results and often need a return visit for next step, causing anxiety and dissatisfaction.
- **Missed opportunities:** Conditions such as infections and internal blood loss may go unrecognized due to delayed results, postponing necessary treatment or referrals.

On-Site CBC – A Simple Step to Modernize Your Practice

Offering quickly accessible CBC testing addresses these issues of past, and provides clear benefits for both providers and patients:

- **Same visit diagnostics:** Immediate results during the visit allow timely treatment decisions, eliminating follow-up calls or return appointments for lab findings.
- **Differentiation of clinical services:** In-house lab services improve patient convenience and enhance confidence in care.
- **Timelier interventions:** Clinicians can promptly initiate or adjust treatment on the spot without waiting days, improving patient outcomes.

These merits of on-site CBC are particularly important for modernizing today's urgent care and primary care, where convenience of care and data-based diagnostics are becoming increasingly valuable for patient care.

---

2. CitoCBC® – A Novel, CLIA-Waived CBC

CitoCBC is cleared in 2025 by FDA for use in CLIA Waived settings. It delivers laboratory-grade CBC results right in the clinic by combining advanced detection technology with a user-friendly design.

Advanced Technology: Fluorescent Microflow Cytometry

CitoCBC uses fluorescent cytometry – the same technology used in central laboratory analyzers – miniaturized into a microflow-based cartridge. Its key advantages include:

- **True neutrophil count**, excluding immature granulocytes – important for infection diagnostics and medication-related neutropenia monitoring.
- **Fluorescence-based platelet quantification**, improving accuracy at low and high ranges, by clearer distinguishing platelet from lipid particles and other blood cells.
- Multi-parameter detection (size, granularity, fluorescence) enabling a full **16-parameter CBC with 5-part differential**, plus **automated abnormality flagging**.

Each test requires only 15–20 µL of K_2EDTA anticoagulated whole blood.

Designed for Simplicity of Use

To integrate into the workflow of clinics, CitoCBC® was designed to emphasize ease of use and efficiency:

- **Simple test procedure:** A single-use cartridge contains all required reagents. Quality control is needed only once per month, keeping maintenance to a minimum.
- **Quick Test result**: the turnaround time is less than 8 minutes.
- **Small footprint**: The analyzer is compact and "plug-and-play". It fits easily on a countertop, so even small clinics can accommodate it.

These design features allow CitoCBC to integrate smoothly into busy outpatient settings. Staff can obtain lab-quality results on the spot with minimal disruption to workflow.

Minimal Regulatory Compliance

CLIA waiver status indicates a test is simple enough to perform in non-lab settings with minimal regulatory burden. A CLIA-waived CBC minimizes operational hurdles while ensures simplicity and safety:

- **Operable by non-laboratory staff:** No licensed technologist required; medical assistants or nurses can perform the test after basic orientation.
- **Minimal oversight:** Waived tests avoid extensive inspections, proficiency testing, and documentation required for moderate-complexity lab tests.
- **Use everywhere:** CLIA-waived status permits use in diverse outpatient settings (primary care offices, urgent cares, mobile units) without the infrastructure of a full lab.

The waived status of CitoCBC substantially lowers barriers and costs to perform CBC. Clinicians can offer rapid testing wherever needed while still meeting required accuracy and quality standards.

---

3. Evaluation in CLIA-Waived Settings

A prospective multi-site evaluation led by **Dr. Jane F. Emerson (USC Keck School of Medicine)** was conducted across CLIA-waived settings. The study assessed the device's accuracy, precision, and ease of use in actual outpatient clinics [10].

Study Scale and Design

The study enrolled 376 individuals aged 2 to 76, including patients with various medical conditions and healthy volunteers for on-site testing. In addition, 46 remnant blood samples with extremely high or low counts were tested to challenge the device's full reportable range. Fourteen operators with no laboratory training performed the tests, reflecting variation among typical users.

Statistical Rigor

The study included **a wide spectrum of hematologic conditions – leukocytosis, leukopenia, neutrophilia, neutropenia, thrombocytosis, thrombocytopenia, macrocytosis, microcytosis, and various morphological abnormalities** – to verify consistent performance across diverse patient populations.

Performance Equivalent to the Central Laboratory

All CitoCBC results were compared against the predicate analyzer, Sysmex XN, operated in the central laboratory. The study demonstrated that CitoCBC's performance is on par with the predicate analyzer across all key metrics – result accuracy, repeatability, and abnormal flagging.

Correlation Performance

For all CBC parameters (except basophils, a known challenge across analyzers), **correlation coefficients** ranged from **0.932** to **0.998**. Regression analysis showed **slopes near 1.00** for key measurands – WBC, RBC, hemoglobin, hematocrit and platelets – as shown in *Figure 1*, indicating excellent agreement.

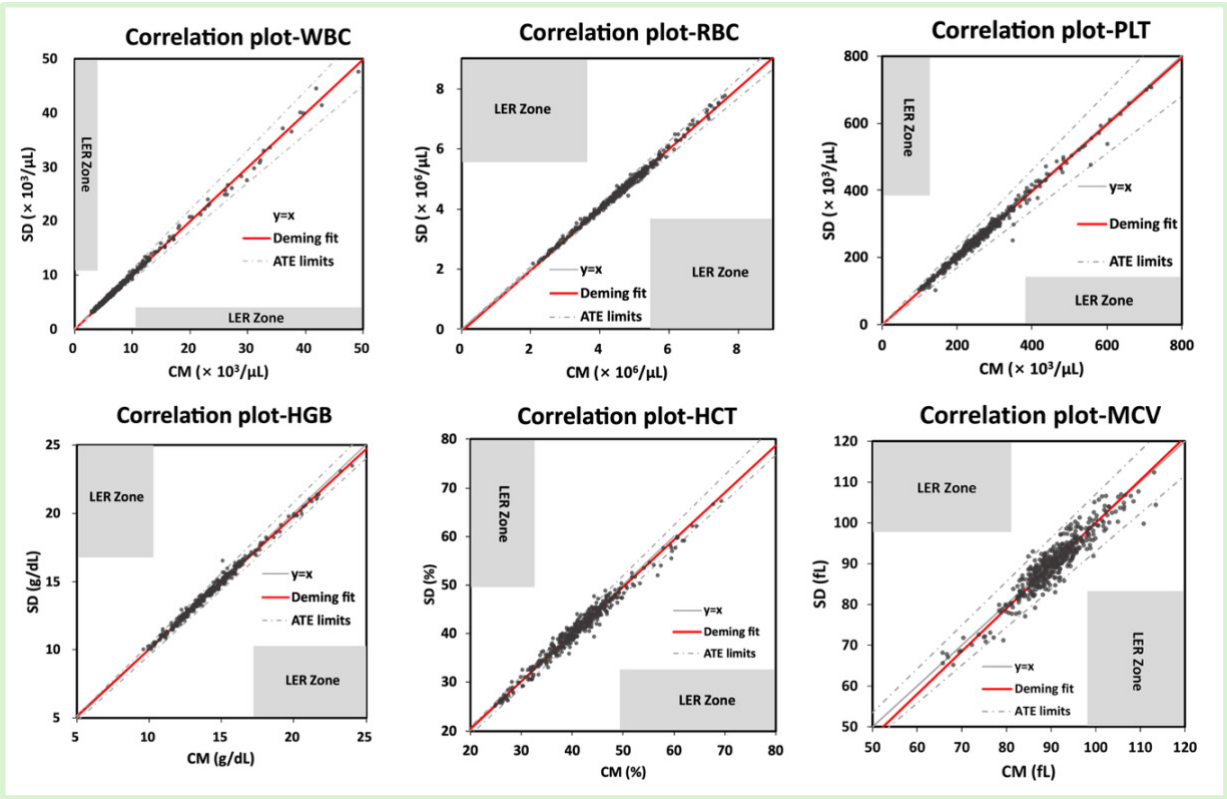

Figure 1. Correlation performance of CitoCBC for key CBC parameters (SD-CitoCBC vs.CM-Sysmex XN-1000).

Precision Performance

When one sample was repeatedly tested on CitoCBC, the coefficients of variation (CVs) were approximately 2–3% for WBC, ~2% for RBC, ~1–1.5% for hemoglobin, and ~2–4% for platelets, across low, normal, and high concentration levels. This precision performance meets state-of-the-art expectations and is particularly notable for CLIA-Waived settings. Detailed values are summarized in *Table 1* below.

Table 1. Precision performance of CitoCBC at low, normal, and high levels for key CBC parameters.

CBC Parameter	Range	Mean	Pooled SD	Pooled CV (%)
WBC, ×10^3/µL	<4	3.13	0.08	2.5
	4–8	6.64	0.18	2.7
	>8	12.73	0.31	2.4
RBC, ×10^6/µL	<4.2	3.33	0.06	1.7
	4.2–4.8	4.51	0.11	2.3
	>4.8	5.31	0.12	2.2
Platelet count, ×10^3/µL	<150	110.60	4.45	4.0
	150–300	216.08	7.29	3.4
	>300	439.12	10.01	2.3
Hemoglobin, g/dL	<12	9.54	0.12	1.2
	12–15	13.59	0.20	1.5
	>15	16.17	0.06	1.5

Flagging Agreement for Abnormalities

In addition to numeric accuracy, the study examined CitoCBC's ability to flag the sample's abnormalities. CitoCBC had a **positive flagging agreement of 90.4%**, a **negative flagging agreement of 95.3%**, and an **overall agreement of 93.3%**. Clinic staff without lab training could also interpret the flag messages correctly, prompting appropriate follow-up action. In short, CitoCBC can alert clinicians to abnormalities just as a central laboratory would.

4. Regulatory and Clinical Significance

CitoCBC® has obtained **FDA 510(k) clearance** and **CLIA-waived** status, and this is the first time a cartridge-based CBC has achieved this milestone. In parallel with the regulatory breakthrough, this multi-site study, as published in the peer-reviewed journal, confirm CitoCBC's accuracy in real-world use [10]. In practice, clinics can now perform immediate CBC testing on-site, providing fast results to inform patient care.

Some limitations remain and justify further exploration. The study did not evaluate infants under 2 or patients with critical illness (e.g. patients in intensive care), so performance in those groups remains to be verified. Additionally, even though the study has included a significant portion of samples from oncology patients, the regulatory clearance for use in oncology settings warrants further assessment to balance clinical benefits and risks.

5. Conclusion

CitoCBC® delivers laboratory-grade CBC with the simplicity of a CLIA-waived test. For primary care clinics, urgent care centers, retail health sites, and other decentralized settings, it offers a transformative point-of-care solution with:

- **Comprehensive results:** Delivers a full 16-parameter CBC with 5-part differential within minutes, enabling same-visit diagnosis and treatment.
- **No send-out delays:** On-site testing eliminates the lag of external lab orders, improving patient satisfaction and reducing return visits.
- **Streamlined workflow:** The cartridge-based, low-maintenance design allows any clinic staff to run the test and integrates easily into the patient visit workflow.

The published study shows that CitoCBC's performance is equivalent to that of a laboratory hematology analyzer, Sysmex XN, operated under moderate complexity settings [10].

With CitoCBC, quick and reliable CBC testing becomes a practical reality at the point of care, enabling immediate diagnostic and treatment decisions that modernize patient experience for primary and urgent care.

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cito CBC Analyzer

CLIA Waived CBC That Works

- Rapid CBC in 8 min
- High-end 5-part Diff
- Simple monthly QC

16 Parameters CBC + 5-part WBC Diff

Reporting Parameters	
CBC	WBC, RBC, PLT, HGB, MCV, HCT
WBC Diff #	NEUT#, LYMPH#, MONO#, EO#, BASO#
WBC Diff %	NEUT%, LYMPH%, MONO%, EO%, BASO%

Quick Results in Minutes

01

Load Blood Sample

02

Insert cartridge into analyzer

03

Get result in **8 min**

Monthly QC & Low Maintenance

The analyzer can be powered on quickly and ready for test in 3 minutes. QC of the analyzer performed minimally every month to ensure functionality. LIS connectivity is supported.

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Volume 22, E52 AUGUST 2025

ORIGINAL RESEARCH

Use of Cancer Screening Tests, United States, 2023

Susan A. Sabatino, MD[1]; Trevor D. Thompson, BS[1]; Jennifer M. Croswell, MD[2]; Maria A. Villarroel, PhD[3]; Juan L. Rodriguez, PhD[4]; Emily E. Adam, MS[1]; Lisa C. Richardson, MD[1]

Accessible Version: www.cdc.gov/pcd/issues/2025/25_0139.htm

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PEER REVIEWED

Summary

What is already known on this topic?

Breast, cervical, and colorectal (CRC) screening is recommended. Use is below national targets and declined during the COVID-19 pandemic.

What is added by this report?

In 2023, most adults were up to date with breast, cervical, and CRC screening test use, although 1 in 3 adults (CRC) to 1 in 5 adults (breast) were not. Mammography increased and cervical test use decreased in 2023. CRC screening test use among those aged 45 to 49 years in 2023 was low. People with less access to health care, financial hardship, and other barriers generally also had lower use.

What are the implications for public health practice?

Future monitoring can help determine if changes continue and may inform evidence-based interventions to increase use.

Abstract

Introduction

The objective of this analysis was to provide national estimates for use of breast, cervical, and colorectal cancer (CRC) screening tests, including for the recently expanded CRC screening age group (ages 45–75 y).

Methods

We used data from the 2023 National Health Interview Survey to estimate proportions of screening-eligible adults up to date with breast (women aged 50–74 y), cervical (women aged 21–65 y), and CRC screening (adults aged 45–75 y). We compared breast and CRC estimates age-standardized to the 2000 US standard population to Healthy People 2030 (HP2030) targets. Age-standardized estimates of breast, cervical, and CRC test use were compared with estimates from 2019 (breast, cervical) and 2021 (breast, cervical, CRC).

Results

In 2023, estimated percentages of adults up to date were 80.0% (95% CI, 78.7%–81.2%), 75.4% (95% CI, 74.1%–76.6%), and 67.4% (95% CI, 66.3%–68.4%), for breast, cervical, and CRC screening test use, respectively. CRC test use was lower among those aged 45 to 49 years than those aged 50 to 75 years (37.1% vs 73.4%, $P < .001$). Mammography use approximated the HP2030 target. CRC test use was below the target. Breast, cervical, and CRC screening test use varied with almost all sociodemographic characteristics and health care access, financial hardship, and other barriers examined. Mammography estimates were somewhat higher and cervical test estimates were lower in 2023 than in 2019 and 2021. CRC test use was lower in 2023 than 2021.

Conclusion

In 2023, most adults were up to date with breast, cervical, and CRC screening test use; however, 1 in 3 adults (CRC) to 1 in 5 adults (breast) were not. Future monitoring can help determine if changes continue and track progress toward national targets.

Introduction

Breast, cervical, and colorectal cancers (CRCs) accounted for more than 426,000 cancer diagnoses and almost 100,000 deaths in 2021 (1). The US Preventive Services Task Force (USPSTF) recommends screening for these cancers to reduce cancer mortality (2), and Healthy People 2030 (HP2030) sets national screening targets (3). In 2021, use of these screenings was below HP2030 targets (4), albeit early in the decade for these targets. Screening use in 2021 might reflect declines during the COVID-19 pandemic (5,6), which have raised concerns about potential effects on cancer outcomes (5–7). Fecal occult blood test (FOBT) or fecal immunochemical test (FIT) use may have increased during that time possibly due to changes in home-based screening test use (4,8), although at least 1 study reported otherwise (9). Although primary care visits declined during the pandemic, some health plans and others, such as health centers, may have increased efforts to make stool-based tests or educational materials available to patients in

other ways, such as by mail or online (10). How breast, cervical, and CRC screening test use may have changed after 2021–2022 is less certain.

Several screening recommendations and targets have been revised since 2021. In May 2021, USPSTF expanded recommended CRC screening ages from 50 to 75 years to 45 to 75 years (2). USPSTF also expanded its breast cancer screening recommendations in 2024 to include ages 40 to 49 years (2). In 2023, Healthy People revised 2030 targets for breast (from 80.5% to 80.3%), cervical (from 84.3% to 79.2%), and CRC screening (from 74.4% to 68.3%) (3). The National Health Interview Survey (NHIS) is used to track progress toward these targets (3). This descriptive report updates previous NHIS cancer screening reports (4,11–15) to 1) provide the most recent national estimates of screening test use, including for the first time estimates for the new CRC screening age group and an initial estimate for breast cancer screening among women in their forties, 2) examine differences in use, 3) compare estimates with revised HP2030 targets, and 4) examine use over time.

Methods

We analyzed data from the 2023 NHIS, the most recent year providing information about breast, cervical, and CRC screening test use. NHIS is an in-person cross-sectional household survey of a nationally representative sample of the civilian noninstitutionalized US population (www.cdc.gov/nchs/nhis). From each household, 1 adult is randomly sampled to provide detailed health information. The final sample adult response rate in 2023 was 47% (16).

Breast cancer screening analyses included women aged 50 to 74 years (n = 6,829); we separately examined use for ages 40 to 49 years as a preliminary estimate before the expanded 2024 USPSTF recommendation. Cervical cancer screening analyses included women aged 21 to 65 years (n = 10,475). CRC screening analyses included respondents aged 45 to 75 years (n = 15,092). Exclusions included personal history of the cancer being screened for or missing cancer history (n = 417 for breast, n = 135 for cervical, n = 147 for CRC); unknown screening status (n = 130 for breast, n = 279 for cervical, n = 331 for CRC); and for cervical screening, prior or unknown hysterectomy (n = 1,334).

Screening test questions asked whether respondents had ever received the test and time since their most recent test. We defined up to date as having received tests within recommended screening intervals (2), including mammography within 2 years (breast cancer screening) and colonoscopy within 10 years, FOBT/FIT within 1 year, computed tomography (CT) colonography or flexible sigmoidoscopy within 5 years, or FIT-DNA within 3 years (all for CRC screening). Cervical screening questions in 2023 included "There are two different kinds of tests to check for cervical cancer. One is a Pap smear or Pap test, and the other is the HPV or human papillomavirus test. Have you ever had a test or tests to check for cervical cancer?" and "When did you have your most recent test to check for cervical cancer?" Up to date was defined as having received a test within 3 years for ages 21 to 29 years, or within 5 years for ages 30 to 65 years. USPSTF recommends Pap testing every 3 years for ages 21 to 29 years and Pap testing every 3 years or HPV alone or with a Pap test (co-testing) every 5 years for ages 30 to 65 years (2).

We examined screening test use by age, sex (CRC screening), race, ethnicity, education, income (percentage of federal poverty threshold), duration of US residence, county metropolitan status, health insurance coverage and type, disability status, having a usual source of health care, difficulty doing errands alone, or a wellness visit within 3 years. We used NHIS imputed income files that include missing income data imputed by multiple imputation (16). NHIS county metropolitan status is based on the 2013 National Center for Health Statistics (NCHS) Urban-Rural Classification Scheme for Counties and categorized into 4 groups (16). We stratified health insurance coverage by age (<65 vs ≥65 y) because of differences in coverage eligibility. Respondents with only Indian Health Service coverage or single service coverage are considered uninsured in NHIS (16). The NHIS disability status composite indicator classifies disability as "a lot of difficulty" or inability to do at least 1 of 6 domains from the Washington Group on Disability Statistics Short Set on Functioning (16). Similar to previously proposed measures and analyses (17,18), other questions included whether respondents had recently experienced food insecurity, worried about paying medical bills should accident or illness occur, and whether in the prior year they lacked reliable transportation, were unable to pay housing and utility costs, had problems paying medical bills, and delayed or did not receive needed medical care because of cost. The NHIS food security indicator is based on responses to 10 questions regarding the prior 30 days (16).

We present unadjusted estimates and estimates age-standardized to the 2000 US standard population. We used age-standardized estimates to compare with HP2030 targets. We did not compare cervical screening test use with the HP2030 target because of differences in defining the calculations for up to date (3). For use over time, we calculated age-standardized estimates of being up to date for 2019, 2021, and 2023 based on USPSTF recommendations in effect for each year. Because USPSTF updated recommended CRC screening ages in mid-2021, we included adults aged 50 to 75 years for 2021. We did not present a CRC estimate for 2019 because information about most recent FIT/DNA was not released (19). Questions about FOBT/FIT use in 2019 were asked only of those aged 40 years or older reporting CRC screening tests other

than colonoscopy or sigmoidoscopy. The 2023 NHIS did not ask about type of test (Pap or HPV) received for cervical screening; therefore, we defined up to date for each year as described for 2023. Refinements to nonresponse adjustments and calibration methods for survey weights have occurred over time (16). Differences over time in interviews conducted at least partially by telephone were also present, with these interviews less common in 2019 than in subsequent years (16).

We used Wald *F* tests to test for differences in estimates for 2023 within recommended screening age groups. Survey weights and design variables were used in all analyses. We suppressed estimates not meeting NCHS reliability standards (20). We used the *surveytable* package in R version 4.4.0 (R Foundation for Statistical Computing) and SUDAAN version 11.0.1 (RTI International) to conduct analyses.

Results

In 2023, 80.0% of women aged 50 to 74 years were up to date with breast cancer screening (age-standardized, 79.8%) (Table 1). Among women aged 40 to 49 years, 62.1% had received a mammogram within 2 years (age-standardized, 61.9%). For cervical cancer screening, 75.4% were up to date (age-standardized, 75.8%), and for CRC screening, 67.4% were up to date (age-standardized, 63.5%) (Tables 2). For CRC screening, those aged 45 to 49 years were less likely than those aged 50 to 75 years to be up to date (37.1% vs 73.4%). Breast cancer screening test use approximated the HP2030 target of 80.3%, although CRC screening test use was below the target of 68.3%.

For women aged 50 to 74 years, breast cancer screening test use varied significantly with all sociodemographic and health care access factors, except Hispanic ethnicity and duration of US residence. Patterns among women in their forties were generally similar to those among older women, although use was lower in the younger (40–49 y) age group. Cervical cancer screening test use varied significantly for all factors except health insurance coverage among women aged 65 years, while CRC screening test use varied by all factors except county metropolitan status and difficulty doing errands. For those of screening age, in addition to CRC screening test use among adults aged 45 to 49 years (37.1%), estimates were less than 50% for those without wellness checks within 3 years (18.0%–39.6% for all screening types) or usual sources of care (41.1% for CRC), uninsured people younger than 65 years (49.0% for breast and 23.8% for CRC), those reporting Mexican/Mexican American ancestry (48.3% for CRC), and those residing in the US fewer than 10 years (36.4% for CRC). For breast, cervical, and CRC screening test use, those lacking transportation or experiencing food insecurity, difficulty paying housing/utility bills, or medical financial hardship were generally less likely to be up to date (Table 3).

Age-standardized estimates of mammography use were similar in 2019 and 2021 (76.2% [95% CI, 74.9%–77.5%] and 75.6% [95% CI, 74.4%–76.8%], respectively) but somewhat higher in 2023 (79.8% [95% CI, 78.5%–81.1%]; $P < .001$) (Figure). Cervical screening test use was lower in 2023 (75.8% [95% CI, 74.6%–77.0%]) than in 2021 or 2019 (79.1% [95% CI, 77.9%–80.3%] in 2021 and 80.0% [95% CI, 78.9%–81.1%] in 2019; $P < .001$). In 2023, the age-standardized percentage of those up to date with CRC screening test use was 63.5% (95% CI, 62.5%–64.5%) among adults aged 45 to 75 years. In 2021, the estimate for adults aged 50 to 75 years was 70.3% (95% CI, 69.3%–71.4%). Estimates for those aged 50 to 75 years were similar between years (70.3% [95% CI, 69.3%–71.4%] for 2021 and 71.6% [95% CI, 70.5%–72.6%] for 2023). Colonoscopy use within 10 years was also similar over time for those aged 50 to 75 years (61.0% [95% CI, 60.0%–62.1%] for 2019, 61.8% [95% CI, 60.7%–62.9%] for 2021, and 61.3% [95% CI, 60.2%–62.4%] for 2023); the 2023 colonoscopy estimate including ages 45 to 75 years was 53.4% (95% CI, 52.3%–54.4%) (not shown). FOBT/FIT use was similar in 2021 and 2023 (10.0% [95% CI, 9.3%–10.8%] in 2021 vs 9.3 [95% CI, 8.7%–9.9%] in 2023). FIT/DNA use was 10.0% (95% CI, 9.4%–10.6%) in 2023 and 8.3% (95% CI, 7.7%–8.9%) in 2021 (not shown).

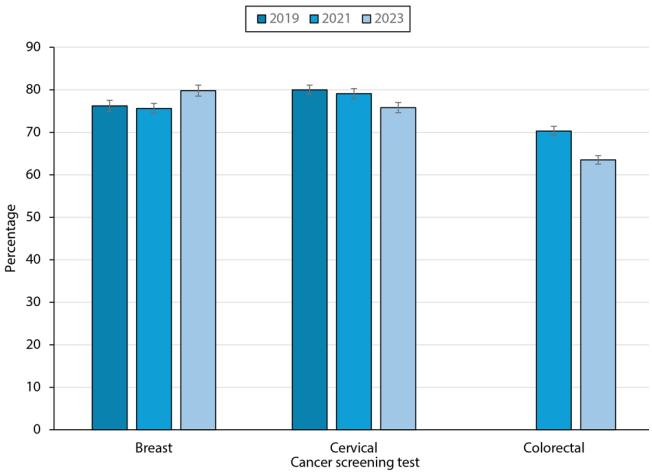

Figure. Age-standardized (to the 2000 US standard population) estimates of being up to date with breast, cervical, and colorectal screening test use based on US Preventive Services Task Force recommendations, by year. In 2023, percentages up-to-date increased for breast screening test use and decreased for cervical and colorectal screening test use. Percentages are weighted. Colorectal cancer screening estimates are based on US Preventive Services Task Force-recommended screening ages for each year (ages 50–75 years for 2021 and ages 45–75 years for 2023). The

colorectal screening estimate for 2019 is not shown because of differences in colorectal screening test use data available in that year. Data source: National Health Interview Survey.

Discussion

In 2023, most screening-eligible adults were up to date with breast, cervical, and CRC screening test use, with estimates ranging from 67% to 80%. Mammography use approximated the HP2030 target of 80.3%. Most women aged 40 to 49 years had also received a mammogram within 2 years, although their use was lower than for older women (62.1% vs 80.0%). The estimate for women in their forties reflects use before USPSTF recommended expanding routine screening to this age group in 2024 (2) and therefore may reflect individualized preferences or physician recommendations to start screening before age 50 years. An analysis of 2022 Behavioral Risk Factor Surveillance System (BRFSS) data reported slightly lower estimates of mammography use (59.1% for those aged 40–49 y and 76.5% for those aged 50–74 y) (21). For CRC screening test use, the 2023 estimate, which is based on the age range expanded to include those aged 45 to 49 years, who had lower screening estimates (37.1%), was lower than the 2021 estimate and was also below the HP2030 target of 68.3%. Caution interpreting cervical cancer screening test estimates may be warranted given possible misclassification when self-reporting screening (22,23). For example, underreporting might be possible because women may not know if HPV tests were performed during screening (23). In 2023, NHIS asked broadly about cervical cancer screening and not about tests received, although the survey question did state that Pap and HPV tests were the 2 cervical screening tests. This approach might reduce underreporting but could make overreporting more likely. Previously reported age-standardized estimates for 2019 and 2021 based on questions about type of test received were somewhat lower (76.8% [95% CI, 75.6%–77.9%] and 75.5% [95% CI, 74.2%–76.7%], respectively) (4,11).

Although most adults of screening age were up to date, 20% to 33%, or 1 in 5 adults to 1 in 3 adults, were not. Across screening types, health care access was strongly associated with being up to date, as in previous studies (4,13,21,24,25). Groups with less access generally had lower screening test use, often with more than half of respondents in these groups not up to date. Low estimates were found among those without recent wellness visits. Others have reported that wellness visits potentially have not returned to prepandemic levels (26). The Centers for Disease Control and Prevention's (CDC's) National Breast and Cervical Cancer Early Detection Program helps increase access by providing free or low-cost breast and cervical cancer screenings to qualifying women (www.cdc.gov/breast-cervical-cancer-screening). For CRC screening, in addition to health care access, low use was also found among several other groups. CDC's Colorectal Cancer Control Program works to implement evidence-based interventions to increase screening, focusing on clinics that serve people with lower incomes and where fewer than 60% of patients are up to date with screening (www.cdc.gov/colorectal-cancer-control/about/how-crccp-increases-screening.html).

Lacking reliable transportation, food insecurity, difficulty paying housing/utility costs, and medical financial hardship were factors that consistently had lower screening test use. Although findings in this descriptive study were not adjusted for possible confounders, they are consistent with previous evidence (21,27,28). In an analysis of 39 jurisdictions in the 2022 BRFSS examining similar barriers and measures of social and emotional support, isolation, satisfaction and stress, mammography use decreased as the number of such barriers increased, from 83.2% among those with no barriers to 65.7% among those with more than 3 barriers (21). Similar to our findings, lacking reliable transportation, receiving supplemental nutrition assistance, and cost barriers to care were associated with lower mammography use (21). Others have reported that among women receiving mammograms, barriers to receiving health care were associated with lower likelihood of receiving mammograms on schedule, with being uninsured and health care cost the barriers most frequently reported (27). Similar findings have been reported for CRC screening (28), although the association may vary by type of screening test (29). Beyond screening, such barriers could have implications for follow-up diagnostic care and treatment (27) and have been associated with increased mortality in cancer survivors (17). Continued monitoring can help determine whether the prevalence of these barriers is changing over time, for which groups, and potential effects on screening, other health care services, and health outcomes.

Our findings suggest little change in estimates of breast and cervical screening test use from 2019 to 2021, consistent with previous studies (4,8). Earlier evidence about mammography suggests little change from 2005 to 2018 (8,12) or 2012 to 2020 (25). The increase in mammography in 2023 is notable given previous evidence of stable mammography use for years. Cervical cancer screening test use decreased somewhat in 2023. Studies preceding the 2019 NHIS survey redesign reported declines in cervical screening use from the early 2000s to 2013–2015 (12,24), with some reporting an increase through 2016–2018 (8,12); our analysis suggests similar use in 2019 and 2021. Some have suggested that declines in Pap test use alone before 2019 might be attributed to factors such as lengthening screening intervals over time (30,31) and possibly HPV vaccination, with mixed evidence regarding its influence on screening use (30). Others have reported that HPV vaccination is an unlikely reason for not being up to date with cervical cancer screening and that among women aged 30 to 65 years, lack of access decreased as a self-reported reason for not

being up to date from 2005 to 2019, while lack of knowledge and no provider recommendation as self-reported reasons increased (32). Age-standardized estimates of CRC screening test use were 63.5% (95% CI, 62.5%–64.5%) in 2023 with the introduction of the lower age threshold of 45 years, compared with 70.3% (95% CI, 69.3%–71.4%) among adults aged 50 to 75 years in 2021. Before the COVID-19 pandemic, CRC screening test use had been increasing (8,12); we found no increase in 2023 even for those aged 50 to 75 years. Findings were largely driven by colonoscopy use, which was similar over time for those aged 50 to 75 years (61.0%–61.8%) and 53.4% for those aged 45 to 75 years in 2023. FOBT/FIT use was similar in 2021 and 2023, suggesting that previously reported increases during the COVID-19 pandemic (4,8) may have been sustained; FIT-DNA use may have increased modestly. Differences between these findings and studies reporting declines in screening during the COVID-19 pandemic (5,26) might be explained at least in part by differing time frames; we examined use within recommended intervals while others examined use within 1 year (5,8,26). Some studies reported that prior year use was lower in 2020–2021 than in 2018–2019, although as in our study percentages up to date with these screenings were similar (8,26), perhaps due to reductions in screening overuse (8). For all screening types, refinements in survey methods might contribute to differences over time (16); the extent to which refinements may have contributed to differences is unknown and limits conclusions based on these comparisons.

Strengths and limitations

Study strengths include a large, nationally representative data set that includes people with and without health care access. Limitations include self-reported data subject to recall bias. Response rates in 2021 and 2023 were lower than in 2019 (50.9% and 47.0% vs 59.1%, respectively); however, weights are adjusted for nonresponse (16). Findings are unadjusted for confounding, which was out of scope for this descriptive report. Detail about type of cervical screening tests received was unavailable in 2023, precluding comparison with the HP2030 target. Analysis of screening test data from future survey years could help monitor progress toward the target. Based on an analysis of annual test use in claims data for commercially insured women aged 30 to 64 years, Qin et al reported that co-testing increased and Pap test alone decreased from 2013 to 2019 (30). In 2019, co-testing was the most common cervical cancer screening test option, and HPV testing alone was infrequent. An analysis of screening data from a state registry reported similar findings for co-testing and HPV testing alone between 2008 and 2019 (33). Differences in CRC screening questions in 2019 limited comparisons over the 3-year period. Diagnostic tests could have been included in the analysis, consistent with previous studies and Healthy People targets (3,4,11,13,34,35). Finally, the threshold for the NHIS disability status indicator (based on the Washington Group's Short Set on Functioning [16]) may not capture milder conditions.

Conclusion

In 2023, most adults were up to date with breast, cervical, and CRC screening test use; however, 1 in 3 adults to 1 in 5 adults were not. Differences in screening test use existed, including for those with less health care access and other barriers. Future monitoring can help determine if changes in screening test use continue and track progress toward national targets.

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Tables

Table 1. Percentage of Screening-Eligible Adults Who Were Up to Date With US Preventive Services Task Force Breast and Cervical Cancer Screening Recommendations, United States, 2023[a,b]

Characteristic	Breast cancer screening					Cervical cancer screening, aged 21–65 y		
	Aged 40–49 y[c]		Aged 50–74 y					
	No.	% (95% CI)	No.	% (95% CI)	*P*[d]	No.	% (95% CI)	*P*[d]
Overall (crude)	2,091	62.1 (59.6–64.6)	6,282	80.0 (78.7–81.2)	NA	8,727	75.4 (74.1–76.6)	NA
Overall (age standardized[e])	2,091	61.9 (59.4–64.3)	6,282	79.8 (78.5–81.1)	NA	8,727	75.8 (74.6–77.0)	NA
Age, y								
21–29	NA	NA	NA	NA	.04	1,565	63.7 (60.8–66.5)	<.001
30–39	NA	NA	NA	NA		2,418	82.7 (80.8–84.6)	
40–49	2,091	62.1 (59.6–64.6)	NA	NA		1,836	76.5 (73.9–78.9)	
50–65	NA	NA	NA	NA		2,908	77.6 (75.9–79.3)	
50–64	NA	NA	3,562	79.0 (77.3–80.6)		NA	NA	
65–74	NA	NA	2,720	81.6 (79.7–83.4)		NA	NA	
Race								
AIAN[f]	—[g]	—[g]	118	75.9 (66.5–83.8)	.001	192	77.9 (69.1–85.2)	.001
Asian	166	68.1 (59.1–76.3)	259	80.3 (73.6–85.9)		640	67.8 (62.8–72.5)	
Black/African American	271	71.1 (64.6–77.1)	802	85.6 (82.4–88.5)		1,080	72.7 (69.1–76.2)	
White	1,392	61.2 (58.0–64.4)	4,806	79.0 (77.6–80.4)		6,039	77.5 (76.1–78.8)	
Other single/multiple race	—[g]	—[g]	53	73.2 (56.4–86.2)		162	78.1 (69.1–85.5)	
Missing/Unknown	177	54.1 (46.0–62.0)	244	81.5 (75.5–86.6)		614	67.5 (62.8–72.0)	
Ethnicity[h]								
Non-Hispanic	1,671	64.1 (61.5–66.7)	5,567	80.3 (79.0–81.6)	.18	7,054	77.5 (76.1–78.9)	<.001
Hispanic	420	54.6 (48.8–60.4)	715	77.6 (73.6–81.3)		1,673	67.1 (64.2–69.9)	
Mexican/Mexican American	236	52.5 (44.8–60.1)	375	77.2 (71.5–82.3)		952	66.0 (62.0–69.9)	
Other Hispanic	176	58.2 (48.7–67.2)	331	77.8 (71.6–83.2)		702	69.4 (65.2–73.4)	
Unknown	—[g]	—[g]	—[g]	—[g]		—[g]	—[g]	
Education								
Less than high school	157	54.3 (44.6–63.9)	543	70.4 (65.8–74.7)	<.001	585	62.3 (57.4–67.0)	<.001

Abbreviations: AIAN, American Indian or Alaska Native; GED, General Educational Development; NA, not applicable.
[a] Data source: National Center for Health Statistics, National Health Interview Survey, 2023.
[b] Numbers are unweighted denominators and percentages are weighted.
[c] The US Preventive Services Task Force expanded its recommendation for routine breast cancer screening in 2024 to include ages 40–49 years.
[d] Significance testing was done by using Wald *F* tests and excludes missing/unknown.
[e] Estimates are age-standardized to the 2000 US standard population by using age groups 50–64 years and 65–74 years for breast cancer screening test use and age groups 21–34, 35–44, and 45–65 years for cervical cancer screening test use.
[f] AIAN includes AIAN only or in combination.
[g] Estimate suppressed because it did not meet National Center for Health Statistics reliability standards.
[h] Significance testing indicates differences between Hispanic and non-Hispanic groups. Information about Hispanic subgroups was available for Mexican/Mexican American respondents and all others combined.
[i] Respondents reporting that their usual source of care was an urgent care center, drug or grocery store clinic, or emergency department were classified as not having a usual source of care.
[j] For cervical cancer screening, the older age stratum includes only those aged 65 years because the US Preventive Services Task Force does not recommend routine screening beyond that age.

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Table 1. Percentage of Screening-Eligible Adults Who Were Up to Date With US Preventive Services Task Force Breast and Cervical Cancer Screening Recommendations, United States, 2023[a,b]

Characteristic	Breast cancer screening					Cervical cancer screening, aged 21–65 y		
	Aged 40–49 y[c]		Aged 50–74 y					
	No.	% (95% CI)	No.	% (95% CI)	*P*[d]	No.	% (95% CI)	*P*[d]
High school/GED	394	53.4 (47.6–59.1)	1,493	75.7 (73.0–78.3)		1,788	67.2 (64.5–69.8)	
Some college	519	59.7 (54.6–64.6)	1,911	80.3 (78.3–82.2)		2,341	74.7 (72.3–77.0)	
College degree	1,013	70.6 (67.4–73.7)	2,303	86.1 (84.5–87.6)		3,971	83.5 (81.9–84.9)	
Missing/Unknown	—[g]	—[g]	—[g]	—[g]		—[g]	—[g]	
% Federal poverty threshold								
≤138	379	48.4 (42.1–54.7)	1,119	69.0 (65.5–72.4)		1681	65.5 (62.4–68.5)	
>138–250	384	56.6 (50.4–62.6)	1,234	75.8 (72.6–78.9)	<.001	1,577	69.1 (66.2–71.9)	<.001
>250–400	420	62.3 (56.4–68.0)	1,321	81.3 (78.5–83.9)		1,800	74.6 (71.8–77.3)	
>400	908	70.4 (66.8–73.8)	2609	85.2 (83.6–86.7)		3,669	83.2 (81.5–84.9)	
Duration of US residence								
<10 y	104	51.6 (40.5–62.7)	62	68.0 (52.6–81.0)		431	58.2 (52.6–63.7)	
≥10 y	405	61.6 (55.4–67.5)	873	80.3 (76.9–83.4)	.23	1,279	70.2 (67.0–73.2)	<.001
Born in US	1,492	63.5 (60.6–66.4)	5,174	80.3 (78.9–81.6)		6,696	78.0 (76.7–79.4)	
Missing/unknown	90	54.5 (42.7–66.0)	173	75.4 (66.9–82.7)		321	69.1 (62.3–75.3)	
County metropolitan status								
Large central metropolitan	695	63.5 (59.2–67.7)	1,708	83.1 (81.0–85.0)		2,912	73.3 (71.1–75.4)	
Large fringe metropolitan	508	63.5 (58.4–68.4)	1,505	81.4 (78.8–83.8)	<.001	2,095	79.1 (76.6–81.5)	.002
Medium/small metropolitan	612	63.1 (57.9–68.0)	2,004	78.0 (75.6–80.2)		2,618	75.0 (72.6–77.3)	
Nonmetropolitan	276	52.7 (46.3–59.0)	1,065	75.5 (71.8–79.0)		1,102	73.9 (70.2–77.4)	
Disability								
Yes	132	51.8 (41.7–61.8)	785	70.1 (66.3–73.7)		561	61.9 (56.7–66.8)	
No	1,959	62.8 (60.1–65.4)	5,497	81.3 (80.0–82.6)	<.001	8,166	76.3 (75.0–77.5)	<.001
Missing/unknown	0	NA	0	NA		0	NA	
Doing errands alone								

Abbreviations: AIAN, American Indian or Alaska Native; GED, General Educational Development; NA, not applicable.
[a] Data source: National Center for Health Statistics, National Health Interview Survey, 2023.
[b] Numbers are unweighted denominators and percentages are weighted.
[c] The US Preventive Services Task Force expanded its recommendation for routine breast cancer screening in 2024 to include ages 40–49 years.
[d] Significance testing was done by using Wald *F* tests and excludes missing/unknown.
[e] Estimates are age-standardized to the 2000 US standard population by using age groups 50–64 years and 65–74 years for breast cancer screening test use and age groups 21–34, 35–44, and 45–65 years for cervical cancer screening test use.
[f] AIAN includes AIAN only or in combination.
[g] Estimate suppressed because it did not meet National Center for Health Statistics reliability standards.
[h] Significance testing indicates differences between Hispanic and non-Hispanic groups. Information about Hispanic subgroups was available for Mexican/Mexican American respondents and all others combined.
[i] Respondents reporting that their usual source of care was an urgent care center, drug or grocery store clinic, or emergency department were classified as not having a usual source of care.
[j] For cervical cancer screening, the older age stratum includes only those aged 65 years because the US Preventive Services Task Force does not recommend routine screening beyond that age.

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Table 1. Percentage of Screening-Eligible Adults Who Were Up to Date With US Preventive Services Task Force Breast and Cervical Cancer Screening Recommendations, United States, 2023[a,b]

Characteristic	Breast cancer screening					Cervical cancer screening, aged 21–65 y		
	Aged 40–49 y[c]		Aged 50–74 y					
	No.	% (95% CI)	No.	% (95% CI)	*P*[d]	No.	% (95% CI)	*P*[d]
At least some difficulty	117	62.0 (51.1–72.1)	618	70.6 (66.2–74.7)	<.001	607	63.0 (58.1–67.7)	<.001
No difficulty	1,974	62.1 (59.5–64.7)	5,662	81.0 (79.7–82.2)		8,120	76.3 (75.0–77.6)	
Missing/unknown	0	NA	—[g]	—[g]		0	NA	
Usual source of care[i]								
Yes	1,729	66.8 (64.1–69.4)	5,600	82.7 (81.5–83.9)	<.001	6,973	78.7 (77.3–80.1)	<.001
No	360	41.1 (35.0–47.4)	677	58.1 (53.2–63.0)		1,752	62.7 (59.7–65.6)	
Missing/unknown	—[g]	—[g]	—[g]	—[g]		—[g]	—[g]	
Wellness check within 3 years								
Yes	1,926	66.5 (63.9–69.0)	6,025	82.6 (81.4–83.7)	<.001	8,163	77.9 (76.6–79.1)	<.001
No	154	10.7 (6.2–16.8)	243	19.5 (13.3–27.0)		541	39.6 (34.9–44.6)	
Missing/unknown	—[g]	—[g]	—[g]	—[g]		—[g]	—[g]	
Insurance, aged <65 y								
Private	1,468	67.6 (64.8–70.2)	2,565	83.2 (81.5–84.9)	<.001	5,858	80.0 (78.6–81.4)	<.001
Medicaid/other public	336	58.3 (52.4–64.1)	543	71.4 (66.9–75.6)		1,565	69.8 (66.7–72.7)	
Other coverage	68	69.1 (52.8–82.4)	219	78.5 (71.4–84.4)		331	72.4 (65.9–78.3)	
Uninsured	219	34.5 (27.0–42.6)	229	49.0 (40.4–57.5)		755	55.7 (51.3–60.0)	
Missing/unknown	0	NA	—[g]	—[g]		—[g]	—[g]	
Insurance, aged ≥65 y[j]								
Private	NA	NA	984	84.9 (82.2–87.4)	<.001	94	85.0 (76.2–91.5)	.11
Medicare + Medicaid	NA	NA	256	72.5 (65.2–78.9)		—[g]	—[g]	
Medicare Advantage	NA	NA	1,046	85.1 (82.4–87.5)		—[g]	—[g]	
Medicare only	NA	NA	291	70.7 (64.0–76.9)		—[g]	—[g]	
Other coverage	NA	NA	120	76.2 (65.4–84.9)		—[g]	—[g]	
Uninsured	NA	NA	—[g]	—[g]		—[g]	—[g]	
Missing/unknown	NA	NA	—[g]	—[g]		0	NA	

Abbreviations: AIAN, American Indian or Alaska Native; GED, General Educational Development; NA, not applicable.
[a] Data source: National Center for Health Statistics, National Health Interview Survey, 2023.
[b] Numbers are unweighted denominators and percentages are weighted.
[c] The US Preventive Services Task Force expanded its recommendation for routine breast cancer screening in 2024 to include ages 40–49 years.
[d] Significance testing was done by using Wald *F* tests and excludes missing/unknown.
[e] Estimates are age-standardized to the 2000 US standard population by using age groups 50–64 years and 65–74 years for breast cancer screening test use and age groups 21–34, 35–44, and 45–65 years for cervical cancer screening test use.
[f] AIAN includes AIAN only or in combination.
[g] Estimate suppressed because it did not meet National Center for Health Statistics reliability standards.
[h] Significance testing indicates differences between Hispanic and non-Hispanic groups. Information about Hispanic subgroups was available for Mexican/Mexican American respondents and all others combined.
[i] Respondents reporting that their usual source of care was an urgent care center, drug or grocery store clinic, or emergency department were classified as not having a usual source of care.
[j] For cervical cancer screening, the older age stratum includes only those aged 65 years because the US Preventive Services Task Force does not recommend routine screening beyond that age.

Table 2. Percentage of Screening-Eligible Adults Who Were Up to Date With US Preventive Services Task Force Colorectal Cancer Screening Recommendations, United States, 2023[a,b]

Characteristic	Total			Aged 45–49 y		Aged 50–75 y	
	No.	% (95% CI)	*P*[c]	No.	% (95% CI)	No.	% (95% CI)
Overall (crude)	14,614	67.4 (66.3–68.4)	NA	1,893	37.1 (34.5–39.7)	12,721	73.4 (72.4–74.4)
Overall (age standardized[d])	14,614	63.5 (62.5–64.5)	NA	NA	NA	12,721	71.6 (70.5–72.6)
Age, y							
45–49	1,893	37.1 (34.5–39.7)	<.001	1,893	37.1 (34.5–39.7)	NA	NA
50–64	6,966	67.8 (66.5–69.1)		NA	NA	6,966	67.8 (66.5–69.1)
65–75	5,755	82.7 (81.5–84.0)		NA	NA	5,755	82.7 (81.5–84.0)
Sex							
Male	6,774	66.0 (64.6–67.4)	.004	928	37.0 (33.5–40.5)	5,846	72.0 (70.5–73.4)
Female	7,840	68.6 (67.3–69.9)		965	37.1 (33.6–40.8)	6,875	74.7 (73.4–76.0)
Race							
AIAN[e]	254	60.8 (52.2–68.9)	<.001	—[f]	—[f]	220	68.8 (59.9–76.7)
Asian	660	58.4 (53.6–63.1)		142	28.5 (20.5–37.7)	518	67.4 (62.0–72.4)
Black/African American	1,720	67.5 (64.8–70.2)		247	41.2 (34.2–48.5)	1,473	72.9 (70.0–75.7)
White	11,261	69.5 (68.4–70.6)		1,300	39.3 (36.2–42.4)	9,961	74.9 (73.8–76.0)
Other single/multiple race	104	63.2 (51.5–73.9)		—[f]	—[f]	79	70.7 (57.1–82.0)
Missing/unknown	615	49.6 (44.8–54.5)		145	23.4 (15.0–33.6)	470	58.9 (53.6–64.1)
Ethnicity[g]							
Non-Hispanic	12,857	69.7 (68.6–70.7)	<.001	1,534	39.6 (36.7–42.6)	11,323	75.2 (74.2–76.2)
Hispanic	1,757	53.8 (50.5–57.1)		359	27.0 (21.5–33.1)	1,398	61.9 (58.3–65.3)
Mexican/Mexican American	932	48.3 (43.9–52.7)		201	23.0 (15.9–31.4)	731	56.3 (51.2–61.2)
Other Hispanic	802	60.8 (56.2–65.2)		154	32.6 (23.5–42.7)	648	68.9 (63.9–73.5)
Unknown	—[f]	—[f]		—[f]	—[f]	—[f]	—[f]
Education							
Less than high school	1,299	54.0 (50.4–57.5)	<.001	151	24.8 (16.9–34.1)	1,148	59.7 (55.9–63.4)
High school/GED	3,684	62.4 (60.5–64.2)		436	29.8 (24.7–35.2)	3,248	68.4 (66.5–70.3)
Some college	4,099	69.6 (67.9–71.3)		462	39.6 (34.6–44.7)	3,637	74.9 (73.1–76.6)
College degree	5,469	74.0 (72.7–75.4)		836	43.4 (39.7–47.2)	4,633	81.1 (79.7–82.4)
Missing/unknown	63	51.9 (37.9–65.6)		—[f]	—[f]	55	52.3 (37.6–66.7)
% Federal poverty threshold							

Abbreviations: AIAN, American Indian or Alaska Native; GED, General Educational Development; NA, not applicable.
[a] Data source: National Center for Health Statistics, National Health Interview Survey, 2023.
[b] Numbers are unweighted denominators and percentages are weighted.
[c] Significance testing was done by using Wald *F* tests and excludes missing/unknown.
[d] Estimates are age-standardized to the 2000 US standard population by using age groups 45–54, 55–64, and 65–75 years for the estimate for all ages and age groups 50–54, 55–64, and 65–75 years for the estimate for those aged 50–75 years.
[e] AIAN includes AIAN only or in combination.
[f] Estimate suppressed because it did not meet National Center for Health Statistics reliability standards.
[g] Significance testing indicates differences between Hispanic and non-Hispanic groups. Information about Hispanic subgroups was available for Mexican/Mexican American respondents and all others combined.
[h] Respondents reporting that their usual source of care was an urgent care center, drug or grocery store clinic, or emergency department were classified as not having a usual source of care.

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Table 2. Percentage of Screening-Eligible Adults Who Were Up to Date With US Preventive Services Task Force Colorectal Cancer Screening Recommendations, United States, 2023[a,b]

Characteristic	Total			Aged 45–49 y		Aged 50–75 y	
	No.	% (95% CI)	*P*[c]	No.	% (95% CI)	No.	% (95% CI)
≤138	2,353	56.9 (54.2–59.6)	<.001	278	25.4 (19.5–32.1)	2,075	63.2 (60.5–65.9)
>138–250	2,682	63.2 (60.7–65.6)		290	33.4 (26.8–40.4)	2,391	68.6 (66.0–71.1)
>250–400	3,002	65.7 (63.4–67.9)		363	35.9 (29.4–42.8)	2,639	71.2 (68.8–73.6)
>400	6,578	73.0 (71.7–74.3)		962	42.2 (38.6–45.9)	5,616	79.5 (78.1–80.8)
Duration of US residence							
<10 y	185	36.4 (28.1–45.4)	<.001	74	19.2 (10.2–31.4)	111	48.3 (36.5–60.2)
≥10 y	2,097	57.3 (54.7–59.8)		381	27.9 (22.8–33.4)	1,716	65.0 (62.1–67.7)
Born in US	11,898	70.9 (69.8–71.9)		1,362	41.3 (38.2–44.5)	10,536	76.0 (75.0–77.1)
Missing/unknown	434	56.4 (51.0–61.7)		76	34.6 (22.0–49.0)	358	62.4 (56.5–68.0)
County metropolitan status							
Large central metropolitan	4,063	66.6 (64.7–68.5)	.18	621	35.9 (31.5–40.5)	3,442	73.6 (71.6–75.5)
Large fringe metropolitan	3,475	68.8 (66.9–70.7)		469	37.3 (32.6–42.2)	3,006	75.4 (73.5–77.3)
Medium/small metropolitan	4,635	67.6 (65.5–69.5)		557	38.1 (32.9–43.5)	4,078	73.0 (71.1–74.9)
Nonmetropolitan	2,441	65.8 (63.5–68.0)		246	37.0 (29.8–44.6)	2,195	70.3 (67.9–72.7)
Disability							
Yes	1,612	70.6 (67.9–73.2)	.01	106	47.6 (36.2–59.2)	1,506	72.7 (70.0–75.3)
No	13,002	67.0 (65.9–68.0)		1,787	36.5 (33.9–39.2)	11,215	73.5 (72.4–74.5)
Missing/unknown	0	NA		0	NA	0	NA
Doing errands alone							
At least some difficulty	1,230	69.2 (66.1–72.1)	.22	95	50.3 (37.6–63.0)	1,135	71.3 (68.1–74.4)
No difficulty	13,381	67.2 (66.1–68.3)		1,798	36.4 (33.8–39.1)	11,583	73.6 (72.5–74.6)
Missing/unknown	—[f]	—[f]		0	NA	—[f]	—[f]
Usual source of care[h]							
Yes	12,705	71.5 (70.5–72.5)	<.001	1,508	40.9 (38.0–43.8)	11,197	77.0 (76.0–78.0)
No	1,898	41.1 (38.4–43.9)		384	22.3 (17.7–27.4)	1,514	47.4 (44.3–50.6)
Missing/unknown	—[f]	—[f]		—[f]	—[f]	—[f]	—[f]
Wellness check within 3 yrs							
Yes	13,731	70.6 (69.6–71.6)	<.001	1,700	39.7 (37.0–42.5)	12,031	76.4 (75.4–77.4)

Abbreviations: AIAN, American Indian or Alaska Native; GED, General Educational Development; NA, not applicable.
[a] Data source: National Center for Health Statistics, National Health Interview Survey, 2023.
[b] Numbers are unweighted denominators and percentages are weighted.
[c] Significance testing was done by using Wald *F* tests and excludes missing/unknown.
[d] Estimates are age-standardized to the 2000 US standard population by using age groups 45–54, 55–64, and 65–75 years for the estimate for all ages and age groups 50–54, 55–64, and 65–75 years for the estimate for those aged 50–75 years.
[e] AIAN includes AIAN only or in combination.
[f] Estimate suppressed because it did not meet National Center for Health Statistics reliability standards.
[g] Significance testing indicates differences between Hispanic and non-Hispanic groups. Information about Hispanic subgroups was available for Mexican/Mexican American respondents and all others combined.
[h] Respondents reporting that their usual source of care was an urgent care center, drug or grocery store clinic, or emergency department were classified as not having a usual source of care.

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Table 2. Percentage of Screening-Eligible Adults Who Were Up to Date With US Preventive Services Task Force Colorectal Cancer Screening Recommendations, United States, 2023[a,b]

Characteristic	Total			Aged 45–49 y		Aged 50–75 y	
	No.	% (95% CI)	*P*[c]	No.	% (95% CI)	No.	% (95% CI)
No	841	18.0 (15.0–21.5)		183	12.3 (7.2–19.1)	658	20.2 (16.6–24.2)
Missing/unknown	—[f]	—[f]		—[f]	—[f]	—[f]	—[f]
Insurance, aged <65 y							
Private	6,398	64.7 (63.3–66.0)		1,395	40.1 (37.1–43.1)	5,003	72.5 (71.0–73.9)
Medicaid/other public	1,149	55.6 (52.2–59.0)		236	38.0 (30.4–46.1)	913	61.3 (57.6–65.0)
Other coverage	577	69.9 (65.3–74.2)	<.001	69	43.0 (29.8–57.1)	508	74.2 (69.4–78.7)
Uninsured	716	23.8 (19.9–28.1)		188	14.3 (8.0–22.8)	528	28.1 (23.3–33.2)
Missing/unknown	—[f]	—[f]		—[f]	—[f]	—[f]	—[f]
Insurance, aged ≥65 y							
Private	2,063	84.4 (82.4–86.3)		NA	NA	2,063	84.4 (82.4–86.3)
Medicare + Medicaid	469	76.4 (71.4–80.9)		NA	NA	469	76.4 (71.4–80.9)
Medicare Advantage	2,114	85.6 (83.7–87.4)		NA	NA	2,114	85.6 (83.7–87.4)
Medicare only	633	75.4 (71.3–79.2)	<.001	NA	NA	633	75.4 (71.3–79.2)
Other coverage	421	83.1 (78.1–87.4)		NA	NA	421	83.1 (78.1–87.4)
Uninsured	—[f]	—[f]		NA	NA	—[f]	—[f]
Missing/unknown	—[f]	—[f]		NA	NA	—[f]	—[f]

Abbreviations: AIAN, American Indian or Alaska Native; GED, General Educational Development; NA, not applicable.
[a] Data source: National Center for Health Statistics, National Health Interview Survey, 2023.
[b] Numbers are unweighted denominators and percentages are weighted.
[c] Significance testing was done by using Wald *F* tests and excludes missing/unknown.
[d] Estimates are age-standardized to the 2000 US standard population by using age groups 45–54, 55–64, and 65–75 years for the estimate for all ages and age groups 50–54, 55–64, and 65–75 years for the estimate for those aged 50–75 years.
[e] AIAN includes AIAN only or in combination.
[f] Estimate suppressed because it did not meet National Center for Health Statistics reliability standards.
[g] Significance testing indicates differences between Hispanic and non-Hispanic groups. Information about Hispanic subgroups was available for Mexican/Mexican American respondents and all others combined.
[h] Respondents reporting that their usual source of care was an urgent care center, drug or grocery store clinic, or emergency department were classified as not having a usual source of care.

Table 3. Percentage of Screening-Eligible Adults Up to Date With US Preventive Services Task Force-Recommended Breast, Cervical, and Colorectal Cancer Screening Test Use, by Transportation, Food Insecurity and Cost Barriers[a,b]

Characteristic	Breast cancer screening, aged 50–74 y			Cervical cancer screening, aged 21–65 y			Colorectal cancer screening, aged 45–75 y		
	No.	% (95% CI)	*P*[c]	No.	% (95% CI)	*P*[c]	No.	% (95% CI)	*P*[c]
Lack of reliable transportation[d]									
Yes	434	67.0 (61.6–72.0)	<.001	668	68.7 (64.0–73.2)	.002	919	59.5 (55.4–63.6)	<.001
No	5,674	81.0 (79.7–82.2)		7,727	76.2 (74.9–77.5)		13,253	68.1 (67.1–69.2)	
Missing/unknown	174	75.7 (66.5–83.5)		332	69.4 (63.1–75.1)		442	60.1 (54.9–65.2)	
Food security									
High security	5,179	81.2 (79.9–82.4)	<.001	6,895	77.0 (75.5–78.4)	<.001	12,258	68.8 (67.7–69.8)	<.001
Marginal security	358	77.9 (72.0–83.0)		618	71.3 (66.7–75.5)		741	63.2 (58.7–67.6)	
Low security	316	76.7 (70.8–81.9)		502	68.9 (63.8–73.7)		635	58.0 (53.2–62.7)	
Very low security	258	63.1 (55.8–69.9)		396	67.3 (61.4–72.9)		541	57.4 (51.9–62.7)	
Missing/unknown	171	77.0 (68.5–84.1)		316	69.5 (63.0–75.5)		439	60.8 (55.5–65.8)	
Unable to pay mortgage/rent/utility bills in past 12 months									
Yes	421	66.6 (61.0–71.9)	<.001	857	71.3 (67.4–75.0)	.02	903	56.3 (52.4–60.2)	<.001
No	5,676	81.2 (79.9–82.4)		7,530	76.2 (74.8–77.5)		13,249	68.4 (67.4–69.5)	
Missing/unknown	185	73.8 (64.7–81.6)		340	67.8 (61.7–73.5)		462	59.5 (54.4–64.5)	
Problems paying medical bills in past 12 months									
Yes	705	73.0 (68.9–76.8)	<.001	1,037	73.8 (70.3–77.0)	.28	1,479	61.7 (58.6–64.7)	<.001
No	5,568	80.9 (79.6–82.1)		7,673	75.6 (74.3–77.0)		13,110	68.1 (67.0–69.1)	
Missing/unknown	—[e]	—[e]		—[e]	—[e]		—[e]	—[e]	
Worry about paying medical bills if got sick/had an accident									
Very worried	911	71.8 (68.1–75.2)	<.001	1,473	70.0 (66.9–72.9)	<.001	1,849	55.3 (52.2–58.3)	<.001
Somewhat worried	1,904	79.1 (76.9–81.2)		3,035	77.0 (74.9–79.0)		4,261	65.5 (63.7–67.2)	
Not worried	3,461	82.8 (81.3–84.3)		4,206	76.2 (74.5–77.9)		8,478	71.4 (70.2–72.5)	
Missing/unknown	—[e]	—[e]		—[e]	—[e]		—[e]	—[e]	
Delayed/did not get medical care because of cost in past 12 months									
Yes	512	65.5 (60.4–70.4)	<.001	960	68.5 (64.9–71.9)	<.001	1,063	53.0 (49.2–56.8)	<.001
No	5,768	81.3 (80.1–82.6)		7,761	76.3 (74.9–77.6)		13,544	68.6 (67.6–69.5)	
Missing/unknown	—[e]	—[e]		—[e]	—[e]		—[e]	—[e]	

[a] Data source: National Center for Health Statistics, National Health Interview Survey, 2023.
[b] Numbers are unweighted denominators and percentages are weighted.
[c] Significance testing was done by using Wald *F* tests and excludes missing/unknown.
[d] Includes lack of reliable transportation that kept respondents from medical appointments, meetings, work, or getting things in the past 12 months.
[e] Estimate suppressed because it did not meet National Center for Health Statistics reliability standards.

Influenza-Associated Pediatric Deaths — United States, 2024–25 Influenza Season

Katie Reinhart, PhD[1]; Stacy Huang, MPH[1]; Krista Kniss, MPH[1]; Carrie Reed, DSc[1]; Alicia Budd, MPH[1]

Abstract

Influenza-associated deaths among children aged <18 years have been nationally notifiable since 2004. The highest number of pediatric deaths reported during a single season since reporting of influenza-associated pediatric deaths began (excluding the 2009–10 influenza A[H1N1]pmd09 pandemic) occurred during the 2024–25 season. Through September 13, 2025, a total of 280 influenza-associated pediatric deaths were reported, representing a national rate of 3.8 deaths per 1 million children. The median age at death was 7 years, and 56% of children who died had at least one underlying medical condition. Influenza A viruses were associated with 240 (86%) of the deaths. Forty percent of children who died were treated with influenza antiviral medications. Among the 208 pediatric decedents with available data who were eligible for influenza vaccine, 89% were not fully vaccinated. CDC recommends that all persons aged ≥6 months who do not have contraindications receive the influenza vaccine each year, ideally by the end of October.

Introduction

Influenza can lead to severe illness and death. Vaccination against influenza is recommended for all persons aged ≥6 months who do not have contraindications, to prevent influenza and its associated complications (*1*). Some children are at higher risk for death from influenza based on their age, underlying medical conditions, and vaccination status.

Surveillance for pediatric influenza-associated mortality began in 2004, after reports of increased numbers of influenza-associated deaths among children (*2*). Since that time, the highest number of reported pediatric deaths (288) occurred during the 2009–10 influenza A(H1N1)pdm09 pandemic, and, until the current season, the second highest number (210) was reported during the 2023–24 season. During the 2020–21 season, when implementation of numerous strategies to prevent transmission of SARS-CoV-2 sharply reduced circulation of influenza viruses, only one influenza-associated death in a child was reported. This report describes influenza-associated pediatric deaths during the 2024–25 season.

Methods

Ascertainment of Influenza-Associated Pediatric Deaths

Data on influenza-associated deaths were obtained from the Influenza-Associated Pediatric Mortality Surveillance System. An influenza-associated pediatric death is defined as a death in a person aged <18 years, resulting from an influenza-compatible clinical illness, confirmed by an appropriate diagnostic test to be influenza, with no period of complete recovery between the illness and death (Influenza-associated pediatric mortality report, Council of State and Territorial Epidemiologists). State and local health departments identify these deaths and report them to CDC using standardized case report forms.* Children who lived in the United States and who died during week 40 of 2024 through week 37 of 2025 (September 29, 2024–September 13, 2025) were included. The final case count might increase as additional reports are received. Population estimates of children aged <18 years were obtained from the United States Census Bureau.

Analysis

Variables associated with health, including underlying medical conditions, vaccination status, and health care use during illness are described. Children eligible for influenza vaccine and for whom case report forms contained sufficient information to determine vaccination status were categorized as either fully vaccinated or not fully vaccinated.† SAS (version 9.4; SAS Institute) was used to perform all statistical analyses. This activity was reviewed by CDC, deemed not research, and was conducted consistent with applicable federal law and CDC policy.§

Results

Demographic Characteristics of Pediatric Influenza-Associated Deaths

During the 2024–25 influenza season, a total of 280 pediatric deaths were reported, representing a national rate of 3.8 deaths per 1 million children (Table 1). The median age at time of death was 7 years (IQR = 2–11 years); 61% of deaths occurred among children aged <9 years. The influenza-associated mortality rate was highest among children aged <6 months (11.1 per 1 million) and was higher among females (4.5) than males (3.1). White children accounted for the highest percentage of deaths (42%) but had the second lowest death rate (3.1) after Asian children (2.8). The highest mortality rate occurred among children who

* Case report form includes information on demographic characteristics, medical history, and clinical information about the illness.

† Twenty children aged <6 months were ineligible for influenza vaccination. Children aged 6 months–8 years were considered fully vaccinated if they received an influenza vaccine during the current influenza season (≥14 days before illness onset) and at least two total influenza vaccines (either 2 doses during the current season, or 1 dose during the current season and 1 dose during a previous season). Children aged 9–17 years were considered fully vaccinated if an influenza vaccine dose was received during the current season and ≥14 days before illness onset.

§ 45 C.F.R. part 46.102(l)(2), 21 C.F.R. part 56; 42 U.S.C. Sect. 241(d); 5 U.S.C. Sect. 552a; 44 U.S.C. Sect. 3501 et seq.

TABLE 1. Characteristics of children aged <18 years who died from influenza-associated illness and influenza-associated mortality, by selected demographic characteristics — United States, September 29, 2024–September 13, 2025

Characteristic	No. of deaths (%)	U.S. population, no.	Influenza death rate*
Overall	**280 (100)**	**73,132,720**	**3.8**
Age group			
Median age group (IQR)	7 (2–11)	—	—
<6 mos†	20 (7)	1,807,799	11.1
6–23 mos§	41 (15)	5,509,623	7.4
24–59 mos	48 (17)	11,281,892	4.3
5–8 yrs	62 (22)	16,024,708	3.9
9–12 yrs	53 (19)	16,614,665	3.2
13–17 yrs	56 (20)	21,894,033	2.6
Sex			
Female	161 (58)	35,727,465	4.5
Male	116 (42)	37,405,255	3.1
Race and ethnicity¶			
Asian	12 (5)	4,269,721	2.8
Black or African American	59 (23)	10,138,247	5.8
Hispanic or Latino	71 (28)	19,688,847	3.6
White	108 (42)	34,765,741	3.1
Other	8 (3)	—	—

* Influenza deaths per 1 million children aged <18 years.
† The population estimate for age <6 months was calculated as the population of children aged <12 months divided by 2.
§ The population estimate for ages 6–23 months was calculated as the population of children aged <12 months divided by 2 plus the population of children aged 1 year.
¶ Categories with fewer than five deaths were combined into an "Other" category. Rates were not calculated for this category. All children with Hispanic or Latino (Hispanic) ethnicity reported were included in the Hispanic category and not included in the categories Asian, Black or African American, White, or Other.

were Black or African American (5.8), who accounted for 23% of all pediatric influenza deaths. The number of influenza-associated pediatric deaths peaked at 28 during weeks 6 and 7 of 2025 (week ending February 8 and February 15) (Figure).

Influenza Virus Types

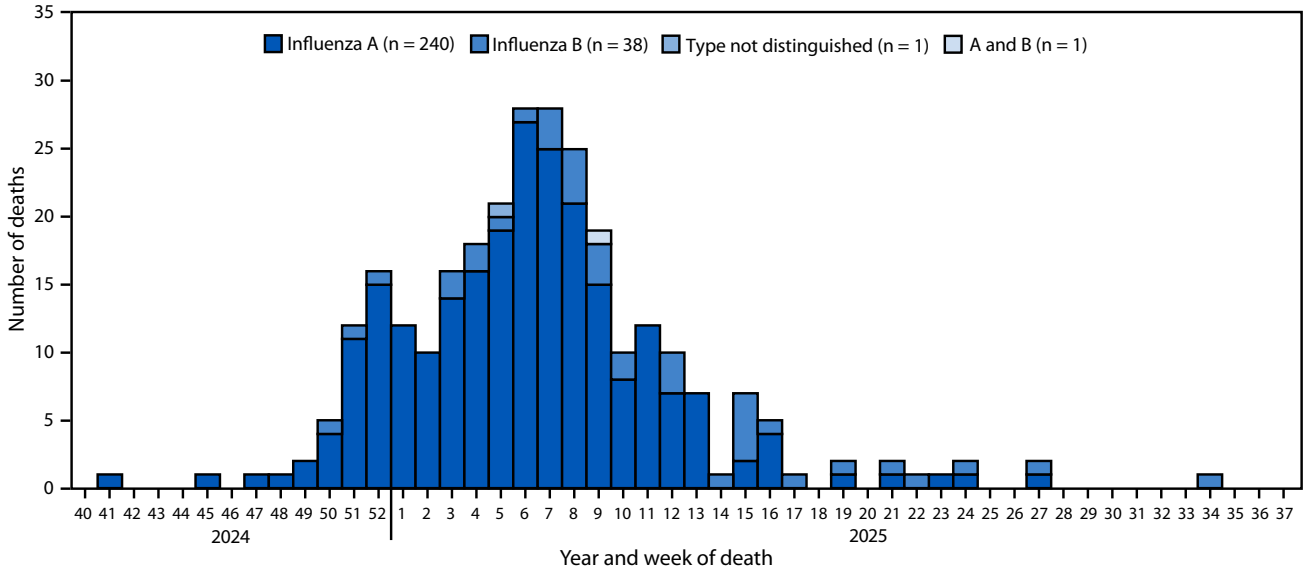
Reverse transcription–polymerase chain reaction (RT-PCR) testing was performed on specimens from 251 (90%) decedents; among the 29 children whose specimens did not undergo RT-PCR testing, specimens of 26 (90%) received rapid influenza testing, and three (10%) received viral culture testing. Among the 280 pediatric influenza-associated deaths, influenza A viruses were associated with 240 (86%) and influenza B viruses with 38 (14%) (Table 2). Among the 169 (70%) influenza A deaths with a known subtype, 95 (56%) were A(H1N1)pdm09 viruses, 73 (43%) were A(H3N2) viruses, and one (<1%) had both A(H1N1)pdm09 and A(H3N2) detected.

Clinical Characteristics and Influenza Vaccination Status

Among 262 pediatric decedents with available information on medical history, 148 (56%) had at least one reported underlying medical condition.¶ Among these, a neurologic condition

¶ Conditions were categorized as neurologic disorder (including moderate to severe developmental delay, seizure disorder, cerebral palsy, or neuromuscular disorder), pulmonary disease (including asthma/reactive airway disease, cystic fibrosis, or other chronic pulmonary disease), chromosome abnormality or genetic disorder, cardiac disease (including congenital heart disease), immunosuppressive condition (including cancer diagnosis or treatment during the previous 12 months), endocrine disorder (including diabetes mellitus), mitochondrial disorder, renal disease, pregnancy, and other medical conditions (including blood disorders, obesity, skin or soft tissue infections, or hepatic diseases).

FIGURE. Influenza-associated deaths among children aged <18 years, by week and virus type (N = 280) — United States, September 29, 2024–September 13, 2025



was reported most frequently (93; 63%); among children with neurologic conditions, approximately two thirds (59; 63%) were described as having developmental delay.

Among 260 decedents who were age-eligible for vaccination, sufficient information to determine vaccination status was available for 208 (80%). Among those with known vaccination status who were vaccine-eligible, 186 (89%) had not been fully vaccinated against influenza during the 2024–25 season. Although influenza vaccination coverage was low overall, the percentage of children who were not fully vaccinated was slightly lower among children with medical conditions (86%) than among those without (95%).

Clinical Course and Location of Death

Clinical complications before death were documented for 218 (88%) of 247 children with available data. Among the 247 children for whom data were available, the most common complication experienced before death was shock or sepsis (108; 50%) followed by pneumonia (82; 38%), acute respiratory distress syndrome (60; 28%), seizures (53; 24%), and encephalopathy or encephalitis (40; 18%). Isolation of a bacterial pathogen from a sterile site was reported for 42 (41%) of 102 children who received testing. The most commonly isolated pathogens were *Staphylococcus aureus*, *Streptococcus pneumoniae,* and group A *Streptococcus*. Overall, 112 (40%) children were treated with influenza antiviral medications, most commonly oseltamivir (104; 93%).

Among 278 deaths with information on location of death, 61 (22%) occurred outside a hospital, 74 (27%) occurred in an emergency department (ED), and 143 (51%) occurred in a hospital after admission (Supplementary Table). The median interval from illness onset to death among children who died outside a hospital, in an ED, and while hospitalized was 3 days (IQR = 1–6 days), 2 days (1–4), and 7 days (4–13), respectively. The median number of days from symptom onset to death was 4 days (IQR = 2–10 days). Among children who died outside a hospital, in an ED, and in a hospital, influenza antivirals were received by 23%, 11%, and 62%, respectively.

Discussion

The 2024–25 influenza season was marked by the highest number of pediatric deaths since influenza-associated pediatric mortality became nationally notifiable in 2004 (excluding the 2009–10 influenza A(H1N1)pmd09 pandemic, during which the overall highest number of pediatric deaths [288] occurred). Previously, the highest number of deaths reported during a nonpandemic influenza season was 210 during the 2023–24 influenza season. The lowest number of influenza-associated pediatric deaths occurred during the 2020–21 season, immediately after the start of the COVID-19 pandemic, when influenza virus circulation plummeted; during that season, only a single influenza death in a child was reported. Increasing numbers of deaths have been reported in each subsequent season since 2020–21.

According to a preliminary assessment, the 2024–25 influenza season has been associated with at least 43 million illnesses, 560,000 hospitalizations, and 38,000 deaths, and was the first high-severity season since the 2017–18 season. High severity was observed across all age groups. Influenza seasons are categorized as low, medium, or high severity in assessments conducted by CDC that incorporate three indicators: 1) the percentage of influenza-like illness among all outpatient or ED visits; 2) the influenza-related hospitalization rate, and 3) the percentage of deaths attributed to influenza among all deaths (*3*).

Reasons for the increase in influenza activity during the 2024–25 season, including pediatric deaths, are not clear. Prevention efforts during the early years of the COVID-19 pandemic suppressed influenza activity and deaths (*4*), and as restrictions were lifted, influenza circulation during subsequent seasons resumed. Co-circulation of multiple influenza A virus subtypes (influenza A[H1N1]pdm09 and A(H3N2) with nearly equal distribution) might have led to increased influenza activity. These subtypes can each result in varying impacts and severity among different age groups (*5*).

Characteristics of pediatric deaths reported during the 2024–25 season were mostly consistent with deaths reported during previous seasons. In all but two seasons since surveillance began (i.e., during the 2012–13 and 2019–20 seasons), influenza A viruses have been associated with more pediatric deaths than have influenza B viruses. During the 2024–25 season, 56% of children who died had conditions associated with higher risk for severe illness; this percentage has ranged from 38% during the 2006–07 season to 69% during the 2009–10 season (FluView Interactive | CDC). Whereas approximately 80% of pediatric decedents who were vaccine-eligible had not received seasonal influenza vaccine in previous seasons (*6,7*), during the 2024–25 season, approximately 90% of eligible children with known vaccination status who died from influenza were not fully vaccinated.

Approximately one half of children who died had not been admitted to a hospital at the time of death. Among children who died in an ED or another location outside a hospital, the interval from symptom onset until death was substantially shorter (median = 2–3 days) than it was for those who died in a hospital (median = 7 days). Children who died in EDs or outside a hospital were less likely to have an underlying medical condition than did those who died after being hospitalized, and very few had been treated with antiviral medications. Parents, caregivers, and clinicians should be mindful of

TABLE 2. Number and percentage of children aged <18 years who died from influenza-associated illness, by selected characteristics — United States, September 29, 2024–September 13, 2025

Characteristic	No. of deaths (%)
Total deaths	**280 (100)**
PCR testing done	
Yes	251 (90)
No	29 (10)
Influenza virus type and subtype/lineage	
Influenza A	240 (86)
A(H1N1)pdm09*	95 (56)
A(H3N2)*	73 (43)
A(H1N1)pdm09 and A(H3N2) co-infection*	1 (1)
Subtype not known	71 (—)
Influenza B	38 (14)
B Victoria†	4 (100)
Lineage testing not performed	34 (—)
A and B	1 (0)
A/B not distinguished	1 (0)
ACIP-defined high-risk medical conditions§	
Yes, any	148 (56)
No, none	114 (44)
Missing	18 (—)
Number of ACIP-defined high-risk medical conditions¶	
1	76 (51)
2	43 (29)
3	20 (14)
4	8 (5)
5	0 (0)
6	1 (1)
Type of medical conditions**	
Neurologic disorder	93 (35)
Moderate or severe developmental delay	59 (23)
Seizure disorder	46 (18)
Cerebral palsy	27 (10)
Neuromuscular disorder	22 (8)
Other neurologic disorder	51 (19)
Pulmonary disease	43 (16)
Asthma or reactive airway disease	28 (11)
Chronic pulmonary disease	16 (6)
Chromosome/genetic disorder	43 (16)
Congenital heart disease or other cardiac disease	30 (11)
Immunosuppressive condition	11 (4)
Received steroids before illness	3 (1)
Cancer (received chemotherapy or radiation)	3 (1)
Endocrine disorder	14 (5)
Diabetes mellitus	3 (1)
Obesity	9 (3)
Mitochondrial disorder	3 (1)
Renal disease	8 (3)
Pregnant	0 (—)
Complications during acute illness	
Yes	218 (88)
No	29 (12)
Unknown	33 (—)
Complications††	
Shock or sepsis	108 (50)
Pneumonia	82 (38)
Acute respiratory distress syndrome	60 (28)
Seizures	53 (24)
Encephalopathy/encephalitis	40 (18)
Cardiomyopathy/myocarditis	28 (13)
Bronchiolitis	11 (5)
Hemorrhagic pneumonia/pneumonitis	4 (2)
Croup	1 (0)
Other complication	92 (42)
Location of death	
Outside hospital	61 (22)
ED	74 (27)
Hospital (in-patient)	143 (51)
Missing	2 (—)
Antiviral therapy received	
Yes	112 (40)
Oseltamivir	104 (37)
Zanamivir	0 (—)
Peramivir	14 (5)
No	167 (60)
Unknown	1 (—)
Duration of illness	
Median days (range)	4 (2–10)
Bacterial testing from sterile site performed	
Yes	118 (55)
No	95 (45)
Unknown	67 (—)
Bacteria isolated from sterile site§§	
Yes	42 (41)
No	60 (59)
Unknown	16 (—)
Bacteria isolated from sterile site¶¶	
Streptococcus pneumoniae	8 (19)
Staphylococcus aureus, susceptibility not specified	6 (14)
Group A *Streptococcus*	6 (14)
MRSA	3 (7)
MSSA	1 (2)
Other	23 (55)
Influenza vaccination status***	
Fully vaccinated	22 (11)
Not fully vaccinated	186 (89)
Ineligible for vaccination (age <6 mos)	20 (—)
Missing	52 (—)

Abbreviations: ACIP = Advisory Committee on Immunization Practices; ED = emergency department; MRSA = methicillin-resistant *Staphylococcus aureus*; MSSA = methicillin-sensitive *Staphylococcus aureus*; PCR = polymerase chain reaction.

* Percentage calculated among 169 children with known influenza A subtype.

† Percentage calculated among four children with known influenza B lineage.

§ Categorized as neurologic disorder (including moderate to severe developmental delay, seizure disorder, cerebral palsy, or neuromuscular disorder), pulmonary disease (including asthma/reactive airway disease, cystic fibrosis, or other chronic pulmonary disease), chromosome abnormality or genetic disorder, cardiac disease (including congenital heart disease), immunosuppressive condition (including cancer diagnosis or treatment during the previous 12 months), endocrine disorder (including diabetes mellitus), mitochondrial disorder, renal disease, pregnancy, and other medical conditions (including blood disorders, obesity, skin or soft tissue infections, or hepatic diseases).

¶ Calculated as the count of types of underlying medical conditions, including neurologic disorder, pulmonary disease, chromosome/genetic disorder, congenital heart disease or other cardiac disease, immunosuppressive condition, endocrine disorder, obesity, mitochondrial disorder, renal disease, and pregnancy. Percentage calculated among 148 children with underlying medical conditions.

** Percentage calculated among 262 children with known medical history.

†† Percentage calculated among 218 children with complications reported during acute illness.

§§ Percentage calculated among 102 children with a specimen collected for bacterial culture from a normally sterile site with known results.

¶¶ Percentage calculated among 42 children with bacteria cultured from a sterile site.

*** Children aged ≥6 months–8 years were considered fully vaccinated if they received an influenza vaccine during the current influenza season (≥14 days before illness onset) and at least two total influenza vaccines (either 2 doses during the current season, or 1 dose during the current season and 1 dose during a previous season). Children aged 9–17 years were considered fully vaccinated if an influenza vaccine dose was received during the current season and ≥14 days before illness onset.

Summary

What is already known about this topic?

Influenza can cause severe illness and death among all persons, including children.

What is added by this report?

The 2024–25 influenza season had the highest number of pediatric deaths reported (280) since child deaths became nationally notifiable in 2004, except for the 2009–10 influenza A(H1N1)pdm09 pandemic. Approximately one half of children who died from influenza had an underlying medical condition, and 89% were not fully vaccinated.

What are the implications for public health practice?

All persons aged ≥6 months who do not have contraindications should receive an annual influenza vaccination to prevent influenza and its complications, including influenza-associated death.

warning signs of respiratory virus complications when children are ill and should seek immediate medical care for the child.

During the 2024–25 influenza season, the virus type and subtype distribution observed in pediatric mortality surveillance was similar to that from public health laboratory (PHL) surveillance, which monitors circulating viruses among a larger population. Influenza A viruses represented 86% of viruses detected in pediatric mortality and 89% among persons aged <25 years in PHL surveillance systems. Among pediatric deaths associated with influenza A viruses with known subtype, 56% were (H1N1)pdm09 and 43% were H3N2 viruses. A similar distribution of subtypes was observed among persons aged <25 years in PHL data (47% [H1N1]pdm09 and 53% H3N2).

Limitations

The findings in this report are subject to at least three limitations. First, deaths are likely underreported because of factors including failure to identify or diagnose influenza, attributing death to another cause even if influenza was identified, and nonreporting. Thus, the number of reported cases likely represents an underestimate. Second, misclassification of underlying medical conditions, vaccination status, bacterial co-infections, and other characteristics of the children is possible. Misclassification might have been more likely among children for whom little clinical data were available because of young age, limited exposure to health care providers, or rapid progression from illness onset to death. Finally, data were missing from some reports for a number of variables, including medical conditions and complications. Data on antiviral treatment, medical conditions, and complications were more likely to be missing for children who died outside a hospital or in an ED than for those who died in a hospital.

Implications for Public Health Practice

Influenza can cause serious illness and death in children; therefore, preventing infection, particularly among those who have underlying medical conditions, can reduce influenza-associated morbidity and mortality. All persons aged ≥6 months without a contraindication should receive an annual influenza vaccine; vaccinating children annually against influenza can help prevent severe illness and death.

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Notes from the Field

Invasive Group G β-Hemolytic *Streptococcus* Outbreak at a Long-Term Care Facility — Pennsylvania, 2024

Monica Giacomucci, MPH[1]; Laxmi Modali, PhD[1]; Cara Bicking Kinsey, PhD[1]; Kim Warren, MPH[1]; Sopio Chochua, MD, PhD[2]; Christopher J. Gregory, MD[2]; Allison Longenberger, PhD[1]

In November 2024, the Pennsylvania Department of Health (PADOH) was notified of two β-hemolytic group G *Streptococcus* (GGS)–positive blood culture results from residents of the same long-term care facility (LTCF) (a skilled nursing facility) who were receiving wound care. Both patients were hospitalized for sepsis and cellulitis; one patient died. Clinical presentation and GGS-positive blood cultures without other pathogens detected supported a diagnosis of invasive GGS. GGS, a normal commensal organism, is increasingly recognized as a cause of invasive disease secondary to soft tissue infections, including cellulitis (*1*,*2*). Group A *Streptococcus* (GAS) is known to cause invasive disease in patients with soft tissue infections; LTCF GAS outbreaks are well documented, and response tools are available (*3*). However, whereas invasive group A *Streptococcus* infections are monitored through ongoing surveillance in many parts of the country and are reportable in Pennsylvania, invasive GGS infections are not (*1*,*2*). Although GGS transmission modes and clinical presentation are thought to be comparable to those of GAS (*1*,*2*,*4*), the epidemiology and clinical characteristics of GGS infections in LTCF are not well described. During December 2024, PADOH conducted a facility site visit. It used the standard GAS protocol to describe patient characteristics; observe infection prevention and control (IPC) practices; conduct colonization screening; and provide prevention recommendations. The PADOH Institutional Review Board determined that the activity met the criteria for public health surveillance and therefore did not constitute research. This activity was reviewed by CDC, deemed not research, and was conducted consistent with applicable federal law and CDC policy.*

Investigation and Outcomes

Patient Characteristics

Both patients, women aged >85 years, had underlying medical conditions. Patient A, a resident at the facility since 2021, had long-term bladder catheter use and cellulitis; after her hospitalization, she returned to the facility. Patient B, living at the facility since October 2024, had heart failure, multiple myeloma, chronic deep vein thrombosis, and cellulitis; patient B died 1 day after her acute hospital admission.

Assessment of IPC Practices

Review of facility IPC policies and practices and observation of wound care and hand hygiene identified numerous protocol breaches. The facility's hand hygiene policy did not specify a preference for use of alcohol-based hand sanitizer in a majority of clinical situations, which differs from CDC guidance. Successful hand hygiene† was observed during 22 (50%) of 44 instances during which hand hygiene was indicated. Observation of wound care among 13 residents identified infection control breaches§ during all 13 occurrences, including not preparing a clean field before a procedure, improper handling¶ of multidose topical medications, and moving from dirty to clean tasks without performing hand hygiene. PADOH provided written IPC and surveillance recommendations, based on experience with and guidelines for investigating and controlling GAS infections in LTCFs (*3*).

Identification of Colonization

In January 2025, using GAS guidelines (*3*), all residents receiving wound care (12 [17%] of 70, excluding patient A, who had returned to the facility) were screened for GGS colonization; throat swabs were collected from all 12 residents, and 15 wound swabs were collected from nine residents.** Throat swabs were also collected from the two staff members who provided wound care. Culture-based testing by the state public health laboratory identified two colonized patients through positive wound swab culture results; all throat swab test results were negative. In response to CDC and PADOH recommendations for GAS decolonization (*3*), a 10-day course of oral cephalexin was provided to the colonized residents.

* 45 C.F.R. part 46.102(l)(2), 21 C.F.R. part 56; 42 U.S.C. Sect. 241(d); 5 U.S.C. Sect. 552a; 44 U.S.C. Sect. 3501 et seq.

† A successful hand hygiene moment is defined as performance of hand hygiene using correct technique (either by washing the hands with soap and water or by using alcohol-based hand rub) before, during, or after a patient interaction in which hand hygiene is indicated by CDC.

§ A breach in wound care is defined as an occurrence during a wound care procedure wherein the health care provider does not follow infection control best practices. Council for Outbreak Response: Healthcare-Associated Infections and Antimicrobial-Resistant pathogens | Framework for healthcare-associated infection outbreak notification | 2022

¶ Whenever possible, multidose medication containers (e.g., creams, sprays, or ointments) should be dedicated to a single resident; if not possible, then a small amount should be allocated for each resident. Medication containers should not be taken into resident rooms.

** Three residents from whom throat swabs were collected refused collection of a wound swab.

Summary

What is already known about this topic?

Group G β-hemolytic *Streptococcus* (GGS) is increasingly recognized as a cause of invasive disease but is not reportable in Pennsylvania. GGS outbreaks in long-term care facilities (LTCFs) have not been reported.

What is added by this report?

Two patients aged >85 years who were residents of an LTCF developed GGS bacteremia; one died. Two other residents had positive wound cultures and were treated with antibiotics. Genomic analysis suggested isolates were highly related. Multiple infection control breaches were identified.

What are the implications for public health practice?

Public health response tools developed for outbreaks of group A *Streptococcus* in LTCFs, including infection control assessment and colonization screening, were successfully applied to control this outbreak of GGS. Public health monitoring for GGS might help detect similar clusters in LTCFs.

Repeat testing 30 days after starting antibiotics remained positive for both residents; one resident received a 10-day course of oral ampicillin, the second received a 10-day course of oral ciprofloxacin. Wound cultures were negative for both on subsequent testing.

Whole Genome Sequencing of Isolates

Four isolates (two blood culture isolates from patients A and B and two obtained from resident wound colonization screening) were sent to CDC for *emm* typing[††] and whole genome sequencing. All were *emm* type 2574.3 and previously uncharacterized multilocus sequence type 525; the high relatedness of the strains (1–2 single nucleotide polymorphism differences) suggests a common source.

Preliminary Conclusion and Actions

In an English-language literature search of PubMed using keywords "group G *Streptococcus,*" "*Streptococcus dysgalactiae* subsp. *equisimilis,*" and "long-term care facility," no previous reports of an outbreak of invasive GGS at a LTCF in the United States were identified. High genomic relatedness among clinical and colonization isolates suggests intrafacility transmission, likely resulting from suboptimal IPC practices. The epidemiologic characteristics, outcomes, and patient risk factors identified in this investigation were similar to those observed in GAS outbreaks, including advanced patient age, chronic comorbidity, the presence of wounds, colonization of residents who share health care staff members, and severe outcomes among infected patients (*3*,*5*). In the absence of established guidance for GGS outbreak response in LTCFs, PADOH followed GAS guidance (*3*). No additional GGS infections have been reported by the facility. Jurisdictions might consider including GGS clusters in routine surveillance protocols. The public health response tools for GAS can likely be applied to outbreaks involving other groups of β-hemolytic *Streptococcus* in LTCFs.

[††] Sequence analysis of part of the M protein gene, which encodes the cell surface M virulence protein.

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Key Vaccination Resources for Healthcare Professionals

With so many vaccination training materials available, it can be difficult for providers to determine which ones best suit their needs. The key resources listed below provide a strong foundation for building and sustaining vaccination skills. They also offer tools for staying up to date and references to address specific clinical situations.

Acronym list appears at end of document

The key resources shown below are divided into several helpful categories:

1. **Foundational content** with which every vaccinator should be familiar,
2. **Supplemental content** useful after completing foundational training,
3. **Additional tools** to help providers grow in vaccination expertise, and
4. **Major organization websites** offering additional vaccination resources.

1 Foundational Content for All Vaccinators

RESOURCE, DESCRIPTION, HYPERLINK	SOURCE	CONTENT
CDC's *General Best Practice Guidelines for Immunization* (revised regularly) Components include: Timing and spacing of vaccines, contraindications and precautions, preventing and managing adverse events, vaccine administration, storage and handling, altered immunocompetence, vaccination records, and more. (HTML) ▸ www.cdc.gov/vaccines/hcp/imz-best-practices/	CDC	Schedules Storage Screening Technique
U.S. Recommended Immunization Schedules (annual, plus periodic supplements) Different schedules are published by CDC and other professional medical organizations. The Vaccines for Children program follows the CDC schedule. CDC's Advisory Committee on Immunization Practices (ACIP) immunization schedules for children/adolescents and adults. An app is available from CDC for iOS or Android. Both schedules include a table of precautions and contraindications for each vaccine. ▸ www.cdc.gov/vaccines/hcp/imz-schedules/child-adolescent-age.html ▸ www.cdc.gov/vaccines/hcp/imz-schedules/adult-age.html	CDC	Schedules
American Academy of Pediatrics *Recommended Child and Adolescent Immunization Schedule for Ages 18 Years and Younger*, ▸ https://publications.aap.org/redbook/resources/15585/	AAP	
American Academy of Family Physicians immunization schedules ▸ www.aafp.org/family-physician/patient-care/prevention-wellness/immunizations-vaccines/immunization-schedules.html	AAFP	
CDC's Recommended and Minimum Ages and Intervals Between Vaccine Doses Scroll down to Table 3.2. Easy-to-read table showing ages and intervals. (HTML) ▸ www.cdc.gov/vaccines/hcp/imz-best-practices/timing-spacing-immunobiologics.html	CDC	Schedules

CONTINUED ON THE NEXT PAGE ▸

1 Foundational Content for All Vaccinators (continued)

CDC's Vaccine Information Statements (VISs) and translations Immunize.org's VIS main page includes links to each VIS in English, plus translations in dozens of languages, chart of current VIS dates, and other clinical VIS resources. (HTML or PDF) ▸ www.cdc.gov/vaccines/hcp/vis/index.html ▸ www.immunize.org/vis ▸ www.immunize.org/translations/ ▸ www.immunize.org/clinical/topic/vis/ ▸ www.immunize.org/vaccines/vis/about-vis/	CDC Immunize.org	Dialogue
Vaccine Administration **CDC's Vaccine Administration Main Page:** Step-by-step guidance on administering vaccines, reviewing patient histories, documentation, plus self-paced vaccine-administration course (CE credit) Instructional videos appear in the Resource Library section. ▸ www.cdc.gov/vaccines/hcp/administration/index.html **Immunize.org's Clinical Resources: Administering Vaccines:** Practical, user-friendly educational materials: free print-ready documents covering site selection, needle length, skills checklist, error prevention, and more. (PDF) ▸ www.immunize.org/clinical/topic/admin-vaccines/	CDC Immunize.org	Technique
***IZ Express*, free email news service** (published each Wednesday) Provides current information you need to know. Stay up to date on product approvals, recommendations, revised VISs and translations, new resources from Immunize.org and other organizations, new publications, conferences, and CE opportunities. Subscribe at www.immunize.org/subscribe. (Email and HTML) ▸ www.immunize.org/news/iz-express/about/	Immunize.org	News
Immunize.org: Clinical Resources A–Z Main web page leads to all of Immunize.org's educational materials categorized by topic area, including vaccination schedules, handouts for parents, screening checklists, standing orders, and resources on vaccine storage and handling, adolescent and adult vaccination topics, improving vaccine confidence, and managing fever/pain. (PDF) ▸ www.immunize.org/clinical/a-z/	Immunize.org	Vaccines Diseases Schedules Technique Storage
Ask the Experts – Immunize.org's experienced clinical experts answer vaccine questions More than 1,300 practical answers to common questions categorized by topic areas, covering vaccine administration, precautions and contraindications, scheduling vaccines, storage and handling, vaccine recommendations, and vaccine safety. (HTML) ▸ www.immunize.org/ask-experts/	Immunize.org	Vaccines Diseases Schedules Storage Screening
State immunization program websites, including links to state immunization requirements State vaccine-specific requirements for childcare, school, college: ▸ www.immunize.org/official-guidance/state-policies/requirements/ State immunization program websites: ▸ www.immunize.org/official-guidance/state-policies/state-websites/ Immunization and other key state public health contact information: ▸ www.immunize.org/official-guidance/state-policies/state-resources/ Immunization Information Systems (IIS) and vaccination records: ▸ www.cdc.gov/iis/contacts-locate-records/	Immunize.org CDC	Advice

CONTINUED ON THE NEXT PAGE ▸

2 Important Supplemental Content, Rationale, and Applied Clinical Guidance (valuable after foundational training)

RESOURCE, DESCRIPTION, HYPERLINK	SOURCE	CONTENT
Vaccine Recommendations: CDC and Professional Medical Organizations Each recommendation explains the epidemiology and disease burden being addressed, data and rationale to support the recommendation, as well as the recommended immunization schedule, contraindications, and special circumstances. (HTML and PDF) Search CDC's published ACIP recommendations ▸ www.immunize.org/official-guidance/cdc/acip-recs/vaccines Search professional medical association recommendations ▸ www.immunize.org/official-guidance/	CDC Immunize.org	Vaccines Diseases Screening
Improving the Vaccination Experience, Easing Injection Anxiety Immunize.org provides print and video tools to create a positive vaccination experience and ease injection anxiety in children and adults. Includes printable clinical resources, in-depth webinars, and several brief videos to share with families. ▸ www.immunize.org/improving-vaccine-experience	Immunize.org	Dialog Technique
Immunization Techniques: Best Practices with Infants, Children, and Adults (2010) California Department of Public Health 25-minute training video on skills for vaccine administration. Covers injectable, oral, and nasal vaccines; selecting, preparing, and administering vaccines; patient comfort, staff safety and training; demonstrations. (DVD) ▸ www.youtube.com/watch?v=WsZ6NEijlfI&feature=youtu.be ▸ www.immunize.org/dvd ($17 for one, volume discounts available)	EZIZ Immunize.org	Technique
CHOP VEC's Vaccine- and Vaccine Safety-Related Q&A Sheets for Parents From Children's Hospital of Philadelphia (CHOP) Vaccine Education Center (VEC) links to dozens of Q&A sheets about vaccines and vaccine safety topics (e.g., vaccine ingredients, autism, "too many" vaccines). Available in English and Spanish. (PDF) ▸ www.chop.edu/centers-programs/vaccine-education-center/resources/vaccine-and-vaccine-safety-related-qa-sheets	CHOP VEC	Dialogue
CDC's *You Call the Shots* web-based training course A series of modules that discuss diseases and vaccine recommendations. Each module provides self-test questions, resource materials, glossary, and CE credit. (Online course – slide-based, interactive, no audio) ▸ www.cdc.gov/immunization-training/hcp/you-call-the-shots	CDC	Vaccines Diseases Technique Storage
CDC's *Vaccine Storage and Handling Toolkit* Best practices for managing inventory and transport; storing and preparing; monitoring temperature; maintaining storage and temperature-monitoring equipment; preparing for emergency situations; standard operating procedures for routine and emergency management. (PDF, 31 pages) ▸ www.cdc.gov/vaccines/hcp/storage-handling	CDC	Storage

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2 Important Supplemental Content, Rationale, and Applied Clinical Guidance (continued)

CDC's Vaccines and Immunizations for Healthcare Professionals home page Gateway to clinical resources, administration tools, training, patient education, and more. (variously PDF or HTML, plus videos and slides) ▸ www.cdc.gov/vaccines/hcp/index.html	CDC	Vaccines Diseases Dialogue Screening
CDC's *Epidemiology and Prevention of Vaccine-Preventable Diseases* – "The Pink Book" Information on each routine vaccine and diseases they prevent; vaccination principles, safety, storage and handling, and administration. (Book: HTML or PDF, 500+ pages. Free online. Webinar series online.) ▸ www.cdc.gov/pinkbook/hcp/table-of-contents/index.html ▸ www.cdc.gov/immunization-training/hcp/pink-book-education-series	CDC	Vaccines Diseases Schedules Technique Storage
Immunize.org's *Vaccinating Adults: A Step-By-Step Guide* (October 2017) Downloadable guidebook on adult immunization, providing how-to information to help providers enhance or implement services in any clinical setting. Most information in the *Guide* is relevant today. Some vaccine recommendations and billing information are out of date. (Book: PDF, 140+ pages) ▸ www.immunize.org/about/history/pub-archives/adult-guide	Immunize.org	Workflow Screening Technique Storage

3 References and Additional Ways to Grow in Vaccine Expertise

RESOURCE, DESCRIPTION, HYPERLINK	SOURCE	CONTENT
Package Inserts (i.e., prescribing information) for each FDA-licensed vaccine Links to each FDA-licensed vaccine's current prescribing information, either at manufacturer's website or FDA website. (PDF, dozens of product groups) ▸ www.immunize.org/official-guidance/fda/pkg-inserts	Immunize.org	Reference
CDC Immunization Education and Training Offerings Various archived webcasts and other self-paced learning modules, some with CE credit. (variously PDF or HTML, plus video and slides) ▸ www.cdc.gov/immunization-training/hcp	CDC	Training
Provider Resources for Vaccine Conversations with Parents Materials to assess parents' needs, identify the role they want to play in making decisions, and communicate in ways that meet their needs. (variously PDF or HTML) ▸ www.vaccineinformation.org ▸ www.letsgetrealaboutvaccines.org	Immunize.org	Dialogue
EZIZ: A California VFC program for immunization training and resources Job aids for vaccine storage and handling, including info on vaccine management, refrigerator and freezer setup, monitoring temperatures, transporting vaccines, and inventory. (PDF) ▸ eziz.org/resources/storage-handling-job-aids Job aids for vaccine administration, including many helpful 1-page charts on preparing vaccines, avoiding mix-ups, and more. (PDF) ▸ eziz.org/resources/vaccine-admin-job-aids	EZIZ	Storage Technique

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3 References and Additional Ways to Grow in Vaccine Expertise (continued)

***The Vaccine Handbook: A Practical Guide for Clinicians* – "The Purple Book" by Gary S. Marshall, MD)** Comprehensive reference book on vaccines and vaccination, including discussion of how to address concerns of parents and patients. (To purchase, go to pcibooks.com/books/view/49 [$59.95]) ▸ Download app at Apple App Store or Google Play Store (free), registration required	Private	Diseases Dialogue Schedules Screening
***Flash Facts: Vaccines & Immunization* by John Grabenstein and Laurie Grabenstein** 230 fact-filled Flash Facts: key aspects of diseases, vaccines, antibodies, practice tools, and travel health. (To purchase, go to Amazon.com [$24.99 for print or $9.99 for Kindle edition])	Private	Diseases Vaccines Practice Tools
CHOP VEC's *Vaccine Update for Healthcare Professionals* newsletter (monthly) Monthly newsletter featuring articles, roundup of news and journal articles, and information about new resources. (HTML) ▸ www.chop.edu/centers-programs/vaccine-update/newsletter	CHOP VEC	News

4 Additional Websites for Further Guidance and Resources

AAFP
www.aafp.org/family-physician/patient-care/prevention-wellness/immunizations-vaccines.html

AAP
www.aap.org/en/advocacy/state-advocacy/childhood-immunizations

ACOG
www.acog.org/programs/immunization-for-women

ACP
www.acponline.org/clinical-information/clinical-resources-products/adult-immunization

AIM
www.immunizationmanagers.org

APhA
www.pharmacist.com/immunization-center

CHOP VEC
www.chop.edu/centers-programs/vaccine-education-center

DoD Immunization Healthcare Division
www.health.mil/Military-Health-Topics/Health-Readiness/Immunization-Healthcare

FDA
www.fda.gov/vaccines-blood-biologics/vaccines

Immunize.org
www.immunize.org

IHS
www.ihs.gov/epi/immunization-and-vaccine-preventable-diseases/resources-for-patients/

www.ihs.gov/epi/immunization-and-vaccine-preventable-diseases/resources-for-providers/

NAIIS
www.izsummitpartners.org

NFID
www.nfid.org/immunization

VYF
www.vaccinateyourfamily.org

ACRONYMS

AAFP American Academy of Family Physicians
AAP American Academy of Pediatrics
ACIP Advisory Committee on Immunization Practices
ACOG American College of Obstetricians and Gynecologists
ACP American College of Physicians
AIM Association of Immunization Managers
APhA American Pharmacists Association
CDC Centers for Disease Control and Prevention
CE Continuing education
CHOP VEC Children's Hospital of Philadelphia Vaccine Education Center
DoD Department of Defense
EZIZ EZ immunization services, California Department of Public Health (CDPH) Immunization Branch
FDA Food and Drug Administration
IHS Indian Health Service
NAIIS National Adult and Influenza Immunization Summit
NFID National Foundation for Infectious Diseases
VYF Vaccinate Your Family

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