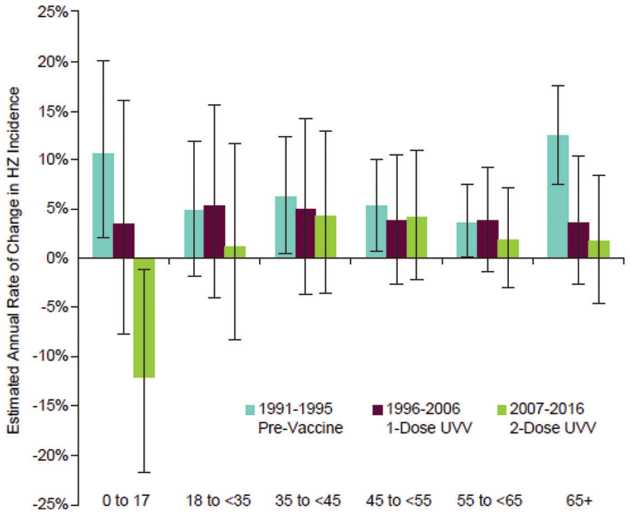
and the evidence to evaluate it is limited. Dynamic transmission model outcomes of impact and cost-effectiveness of universal varicella vaccination (UVV) are sensitive to EB characterization and assumptions, occasionally leading to conclusions that UVV programs may not be cost-effective and could lead to temporary increases in HZ incidence. The goal of this study was to use data from 20 years of UVV in the United States from 1996 to 2016 to evaluate whether the hypothesized increases in HZ incidence have been realized.

Methods. This is a retrospective study of de-identified administrative claims data from the US MarketScan® databases between 1991 and 2016. The incidence of HZ was analyzed by calendar year and age category using interrupted time series (ITS) analysis implemented through a negative binomial generalized linear regression model over three time periods: pre-UVV (1991–1995); 1 dose UVV (1996–2006); and 2 dose UVV (2007–2016). The ITS approach (Bernal et al., IJE, 2017) is an effective way to evaluate the impact of public health interventions implemented at specific time points.

Results. HZ incidence in the pre-UVV period increased at annual rates between 3.67% and 12.38%, with the highest increases in the 0–17 and 65+ age groups. The rate of HZ increase was lower in the 1 dose UVV period compared with the pre-UVV period for all age groups except for minor increases in the 18–35 (0.52%) and 55–65 (0.14%) groups. During the 2 dose UVV period, the rate of increase in HZ was lower in all groups than in the pre-UVV period, with the largest reductions in the 0–17 (−22.58%), 65+(−10.68%), and 18–<35 (−3.57%) age groups.

Conclusion. This evaluation of the impact of UVV on rates of change in HZ does not support the hypothesis of an increase in HZ incidence due to UVV. While overall HZ incidence rates have been increasing year on year, the rate of that increase has been declining in both UVV periods. Our findings have implications on the assumptions used in economic evaluations of UVV programs.

Figure 1: Rate of change in herpes zoster incidence by age groups before and during the implementation of one- and two-dose universal varicella vaccination (UVV) in the United States 1991-2016



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2479. Varicella Zoster Immune Globulin Is Effective up to 10 Days Following Varicella Exposure in Pregnant Women, Immunocompromised Patients, and Infants: Results From a Large, Open-Label Expanded-Access Program

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Background. There are more than 300,000 cases of varicella annually; nonimmune individuals exposed to varicella-zoster (VZ) virus have a high likelihood of developing varicella. VZ immune globulin (VARIZIG®) is used for postexposure prophylaxis to prevent or attenuate VZ infection in high-risk individuals. We assessed varicella incidence and severity in high-risk subjects after administration of VZ immune globulin.

Methods. This open-label expanded-access program provided VZ immune globulin to physician-identified, high-risk subjects exposed to varicella. Subjects included immunocompromised children/adults, infants (including preterm infants, newborns whose mothers had VZ infection <5 days before or <2 days after delivery, and infants <1 year of age), and pregnant women. VZ immune globulin (125 IU/10 kg [up to 625 IU]) was administered intramuscularly, ideally ≤96 hours, but up to 10 days, postexposure. Incidence of varicella rash and severity (>100 pox, pneumonia, encephalitis) were assessed up to 42 days after administration.

Results. The efficacy population (n = 505) included 263 immunocompromised subjects (32 adults, 231 pediatric), 137 pregnant women, and 105 infants. More than 97% of exposures fit the CDC definition. Varicella incidence was low in immunocompromised subjects (4.5%, n = 12/269), pregnant women (7.3%, n = 10/137), and infants (11.4%, n = 12/105) and was similar when comparing administration ≤ 96 hours vs. up to 10 days postexposure (6.2% vs. 9.4%, respectively). Of 34 subjects with varicella, 54% were exposed in the household; 5 were considered severe. Common adverse events were pyrexia (4%), neutropenia (3%), and headache (3%). There were no product-related deaths and only 1 serious adverse event (serum sickness) considered probably related to VZ immune globulin.

Conclusion. Postexposure administration of VZ immune globulin resulted in low rates of varicella in high-risk subjects, regardless of administration timing within 10 days postexposure. VZ immune globulin—which is FDA-approved, recommended by the CDC, and widely available—was well tolerated and safe in high-risk subjects.

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2480. Real-World Effectiveness of the Live Zoster Vaccine in Preventing Herpes Zoster: A Systematic Review

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Background. Several studies of the real-world effectiveness of Zostavax™, a live zoster vaccine (ZVL), have been published since its licensure in 2006. The objective of this review was to summarize available evidence on vaccine effectiveness (VE) of ZVL against herpes zoster (HZ) and post-herpetic neuralgia (PHN) in the general population.

Methods. An extensive literature search was performed in Embase and Medline for the period January 2007 to January 2018 to identify peer-reviewed, original, English study manuscripts reporting the results of observational studies of ZVL VE. In all studies, HZ cases were identified from HZ diagnosis codes, with only two studies also requiring HZ-specific antiviral use. For PHN, different case definitions were used across studies, usually without validation from medical chart review.

Results. Seven original effectiveness studies were identified (5 from the United States and 1 each from the UK and Canada) that assessed HZ effectiveness in the general population. Five of these studies also assessed PHN effectiveness. Vaccine effectiveness to prevent HZ was similar across studies in the early years following vaccination, but tended to diverge in the later years (overall VE against HZ ranged from 33% to 62%, clustering around ~50% across studies providing this information). Overall VE against PHN ranged from 55% to 88%, clustering around ~65%.

Conclusion. Real-world observational studies assessing the effectiveness of ZVL in preventing HZ and PHN in the general population reported generally similar results. Differences in VE estimates across studies were likely driven by differences in study design and methods, including sample size and age of study population, HZ and PHN case definition, duration of follow-up, and methods of covariate selection, definition and adjustment. We are currently conducting a meta-analysis to identify and quantify the potential heterogeneity across studies and calculate summary VE estimates.

Disclosures. **P. Saddier**, Merck and Co. Inc.: Employee and Shareholder, Salary. **M. A. Marks**, Merck and Co. Inc.: Employee and Shareholder, Salary. **S. Calhoun**, Merck and Co. Inc.: Employee, Salary. **K. Johnson**, Merck & Co., Inc.: Employee, Salary. **Y. Moride**, Merck: Research Contractor, Consulting fee.

2481. Impact of Sex and Race/Ethnicity on the Effectiveness of Live Zoster Vaccine

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Background. Zostavax™, a live zoster vaccine licensed as 1 dose, is indicated in the United States for the prevention of herpes zoster (HZ) in people 50 years or older. Real-world vaccine effectiveness (VE) and duration of protection are being evaluated in an ongoing study. Compared with randomized clinical trials, this large observational study includes a more diverse population and offers a unique opportunity to assess VE across sex and race/ethnic groups.

Methods. Kaiser Permanente Northern California members enter the ongoing cohort study when age-eligible for zoster vaccine, starting in 2007. Incident HZ is defined as a new HZ diagnosis accompanied by an antiviral prescription or a positive varicella-zoster virus test, with no HZ diagnosis in the preceding 12 months. VE by sex

and race/ethnicity was estimated using Cox regression models controlling for age and adjusting for healthcare use, comorbidities and immunocompromise status.

Results. During 2007–2014, 1,355,720 individuals entered the study, including 724,283 (53.4%) females. Among the unvaccinated, the incidence rate of HZ was 7.5 and 10.2 cases per 1,000 person-years (PY) among males and females, respectively. VE was 51.6% [95% CI: 49.2, 53.9] in males and 47.7% [45.8, 49.6] in females. The study included 818,361 (60.4%) Whites, 208,248 (15.4%) Asian/Pacific Islanders, 171,949 (12.7%) Hispanics, 98,914 (7.3%) African Americans, and 58,248 (4.3%) with Other/Unknown race/ethnic group. HZ incidence among the unvaccinated was highest among Hispanics (10.1 per 1,000 PY) and lowest among African Americans (6.7 per 1,000 PY). VE was somewhat higher among Hispanics (57.0% [52.7, 61.0]) compared with Whites (48.1% [46.3, 49.9], Asian/Pacific Islanders (49.7% [46.0, 53.3]), and African Americans (50.5% [42.3, 57.6]).

Conclusion. Overall, VE against HZ was generally similar across sex and race/ethnic groups, except for a somewhat higher VE among Hispanics. This small difference in VE may be due to differences in time since vaccination, since VE tends to wane over time (e.g., average follow-up was 2.2 years for vaccinated Hispanics vs. 2.8 for Whites, resulting in Hispanics having relatively more follow-up closer to vaccination when VE is higher). Longer study follow-up may help to interpret these findings.

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2482. Impact of a Recombinant Zoster Vaccine on Quality of Life: Data from a Randomized, Placebo-Controlled, Phase 3 Trial in Adult Hematopoietic Stem Cell Transplant Recipients

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Background. Herpes zoster (HZ) and its complications can have a substantial impact on patients' quality of life (QoL), particularly in immunocompromised patients. The vaccine efficacy (VE) of an adjuvanted recombinant zoster vaccine (RZV) was studied in a randomized, placebo-controlled, phase 3 study in adult hematopoietic stem cell transplant (HSCT) recipients (NCT01610414). The VE in preventing HZ cases was 68.2% (95% CI: 55.6%–77.5%). Herein we report the impact of the vaccine on patients' quality of life (QoL) associated with HZ episodes.

Methods. HSCT recipients were randomized 1:1 to receive 2 doses of RZV or placebo, given 1–2 months apart and followed for the occurrence of HZ. QoL parameters were measured by the Short-Form health survey (SF-36) and Euro-Quality of Life-5 Dimension (EQ-5D) at baseline, 1 month and 1 year post-dose 2, as well as during suspected HZ episodes in conjunction with the Zoster Brief Pain Inventory (ZBPI). For confirmed HZ cases, QoL scores were compared between the vaccine and placebo groups. The RZV impact in reducing the ZBPI Burden of Illness and Burden of Interference scores was estimated in patients in the modified total vaccinated cohort (mTVC). The 2 scores were calculated from the area under the curve (Days 0 to 182) of the ZBPI Worst Pain and ZBPI Activities of Daily Living scores, respectively, assuming a score of 0 for patients who did not have a confirmed HZ episode.

Results. Both the ZBPI maximum Worst Pain and Average Pain scores were significantly lower in the vaccine than placebo group (Table 1), suggesting less burden in breakthrough HZ cases following RZV. Consequently, the HZ Burden of Illness and Burden of Interference VE estimates were higher than the HZ VE estimate. RZV showed statistically significantly better QoL scores than placebo one week following rash-onset among patients with confirmed HZ, i.e., SF-36 bodily pain, social functioning, role emotional, mental health and mental component scores, and the EQ-5D Utility Score.

Table 1. Analysis of ZBPI questionnaire (mTVC)

	RZV	Placebo
HSCT Recipients	870	851
HZ Confirmed Cases	49	135
HZ ZBPI Evaluable Cases	44	125
Maximum Worst Pain: Mean	5.8	7.1
Wilcoxon Test	P=0.0111	
Maximum Average Pain: Mean	4.7	5.7
Wilcoxon Test	P=0.0183	
HZ Burden of Illness VE	82.5% (95% CI: 73.6%–91.4%)	
HZ Burden of Interference VE	82.8% (95% CI: 73.3%–92.3%)	

RZV, adjuvanted recombinant zoster vaccine; **HZ**, herpes zoster; **ZBPI**, Zoster Brief Pain Inventory; **VE**, vaccine efficacy; **mTVC**, modified total vaccinated cohort: Included HSCT patients who received the second dose of vaccine and did not have a confirmed diagnosis of herpes zoster within 1 month after the second dose. **HZ ZBPI Evaluable Cases:** HZ confirmed cases with an evaluable ZBPI questionnaire within 14 days post-HZ rash onset.

Conclusion. In addition to reducing the risk of HZ and HZ complications, RZV significantly reduces the impact of HZ on patient's QoL in those who develop breakthrough disease.

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2483. Twelve-Month Immunogenicity and Safety of an Adjuvanted Recombinant Zoster Vaccine in Immunosuppressed Adults Post Renal Transplant: a Phase III Randomized Clinical Trial

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Background. The efficacy of the non-live adjuvanted recombinant zoster vaccine (RZV, containing a truncated form of varicella-zoster glycoprotein E [gE] and Adjuvant System $AS01_B$) is >90% in adults ≥50 years of age (YOA) (ZOE-50/70) and >68% in hematopoietic stem cell transplant recipients ≥18 YOA (ZOE-HSCT).[1] This study (NCT02058589) evaluated immunogenicity and safety of RZV in renal transplant recipients ≥18 YOA receiving immunosuppressive therapy. Previously unreported reactogenicity and 12-month post-last dose safety and immune persistence data are presented.

Methods. In this phase III, 1:1 randomized, observer-blind, multicenter trial, patients received 2 doses of RZV or placebo. gE-specific immune responses were assessed at 1 (M2) and 12 (M13) months post-dose 2: humoral immunity by vaccine response rate (VRR) and geometric mean antibody concentration (GMC), and cell-mediated immunity (CMI) by VRR and $CD4^+$ T-cell frequency. Solicited general and unsolicited adverse events (AEs) were collected 7 days pre-dose 1 as a within-participant control. Solicited and unsolicited AEs were also recorded for 7 and 30 days after each dose, respectively. Serious AEs (SAE) and potential immune-mediated diseases (pIMDs) were recorded up to study end (M13).