

# Centralized Reminder/Recall to Increase Immunization Rates in Young Children: How Much Bang for the Buck?

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## ABSTRACT

**OBJECTIVE:** We compared the effectiveness and cost-effectiveness of: 1) centralized reminder/recall (C-R/R) using the Colorado Immunization Information System (CIIS) versus practice-based reminder/recall (PB-R/R) approaches to increase immunization rates; 2) different levels of C-R/R intensity; and 3) C-R/R with versus without the name of the child's provider.

**METHODS:** We conducted 3 sequential cluster-randomized trials involving children aged 19 to 25 months in 15 Colorado counties in March 2013 (trial 1), October 2013 (trial 2), and May 2014 (trial 3). In C-R/R counties, the intensity of the intervention decreased sequentially in trials 1 through 3, from 3 to 1 recall messages. In PB-R/R counties, practices were offered training using CIIS and financial support. The percentage of children with up-to-date (UTD) vaccinations was compared 6 months after recall. A mixed-effects model assessed the association between C-R/R versus PB-R/R and UTD rates.

**RESULTS:** C-R/R was more effective in trials 1 to 3 (relative risk = 1.11; 95% confidence interval 1.01–1.20;  $P = .009$ ). Effectiveness did not decrease with decreasing intervention in-

tensity ( $P = .59$ ). Costs decreased with decreasing intensity in the C-R/R arm, from \$18.72 per child brought UTD in trial 1 to \$10.11 in trial 3. Costs were higher and more variable in the PB-R/R arm, ranging from \$20.63 to \$237.81 per child brought UTD. C-R/R was significantly more effective if the child's practice name was included ( $P < .0001$ ).

**CONCLUSIONS:** C-R/R was more effective and cost-effective than PB-R/R for increasing UTD rates in young children and was most effective if messages included the child's provider name. Three reminders were not more effective than one, which may be explained by the increasing accuracy of contact information in CIIS over the course of the trials.

**KEYWORDS:** centralized reminder/recall; children; immunization registry; immunization information systems; immunizations; novel approaches; population-based reminder/recall; reminder/recall

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## WHAT'S NEW

Centralized versus practice-based reminder/recall is better for increasing immunization rates in young children. Provider endorsement of messages is important; further, the effect of the number of messages appears to be less important than the quality of contact information.

NUMEROUS TRIALS DEMONSTRATE the effectiveness of reminder/recall (R/R) for increasing immunization rates among young children, either by notifying parents of needed immunizations (reminders) or of overdue immunizations (recall).<sup>1,2</sup> Regional or state immunization

information systems (IISs), which operate in all states except New Hampshire,<sup>3</sup> can greatly facilitate R/R by identifying children who need immunizations and, in most states, generating R/R postcards or electronic data that can be used to create autodialer or mobile health messages.<sup>4–6</sup> The Community Preventive Services Task Force strongly recommends the use of R/R and IISs to increase immunization rates.<sup>7</sup>

Despite these recommendations, primary care providers have not widely adopted R/R,<sup>8–12</sup> and their use of IISs to facilitate R/R is even less common. A recent national survey of primary care physicians reported that even among those who currently used a state or regional IIS, only 17% of pediatricians and 12% of family physicians

were aware that their IIS could generate lists to aid in conducting R/R.<sup>13</sup> Practice-based R/R efforts are hampered by insufficient staff time, competing demands, staff turnover, costs related to R/R, and the lack of computerized systems to identify those in need of immunizations.<sup>8,11</sup> Two trials found that centralized R/R by the state health department using the state IIS was substantially more effective and cost-effective at the population level than approaches aimed at increasing the use of R/R by practices.<sup>14,15</sup>

In the current study, we sought to carefully examine the optimal intensity of the centralized R/R approach. Our objectives were: 1) to compare the effectiveness and cost-effectiveness of centralized R/R (C-R/R) versus a practice-based (PB-R/R) approach, and, within the centralized arm, to compare 2) effectiveness and cost-effectiveness of different levels of intensity of C-R/R as well as 3) effectiveness of R/R when the practice's name was included versus when the message came from the state health department alone. We hypothesized that 1) we would see a dose-related decrease in the effectiveness of R/R with decreasing intensity of the intervention and 2) R/R would be more effective when practices included their name on the R/R message.

## METHODS

The study was approved by the Colorado Multiple Institutional Review Board as an expedited study. We conducted 3 consecutive cluster-randomized pragmatic trials with randomization at the county level. Counties stayed in the same arm for all trials.

### SETTINGS AND STUDY PARTICIPANTS

The Colorado Immunization Information System (CIIS) receives client and vaccine event data through Web-based data entry and through electronic data transfers from providers, department of health care policy and financing, state vital statistics, and insurers. CIIS also includes historical data about immunizations given outside of Colorado entered by a Colorado provider or school. Colorado is not a mandatory reporting state; however, the percentage of children <6 years of age with  $\geq 2$  records in CIIS was 99% at the time of the study.<sup>16</sup>

### SELECTION OF PARTICIPATING COUNTIES AND RANDOMIZATION

The study was conducted in 15 of 64 possible Colorado counties, selected because of the absence of characteristics that could confound the trial, including: 1) existing countywide R/R efforts (10 counties), 2) low CIIS saturation rates (<70% of 3-year-olds with at least 2 immunizations in CIIS; 15 counties), 3) extremely high rate of vaccine refusers (1 county); and 4) frontier counties with <6 people per square mile (23 counties). The 15 counties were stratified by urban ( $n = 7$ ) or rural ( $n = 8$ ) location and within each stratum were randomized to the C-R/R or PB-R/R arm using constrained covariate randomization to

balance study arms.<sup>17-21</sup> Randomization occurred in September 2012, approximately 6 months before trial 1 began.<sup>14</sup> Parameters of the study arms were balanced, including practice and county characteristics that might influence outcome measures (Table 1).

### DENOMINATING STUDY POPULATION

The study used CIIS county-level R/R functionality to identify 19- to 25-month-olds as of March 2013 (trial 1), October 2013 (trial 2), and May 2014 (trial 3) with an address in one of the study counties who appeared to need  $\geq 1$  immunization. We used 25 months as the upper age limit in order to enable us to complete 3 trials 6 months apart involving cohorts of the same age range with no overlap between cohorts. The study population included children born in Colorado and those who moved into a study county if they had received an immunization entered into CIIS before the start of each trial. Because CIIS is populated from vital statistics, it also included children who were born in the county but whose provider did not enter information into CIIS, thereby providing the best population estimate of all children within the county. The study population for each of the trials was fixed at the time of study population identification (noted above), and children who either moved into or out of the counties after this time were not added to or subtracted from the study population. This meant that children who moved might have been inappropriately assigned during the study period; however, the potential bias was likely to be balanced between the study arms.

### CENTRALIZED R/R (C-R/R)

The protocol used for C-R/R started with autodialer messages if there was a telephone number in CIIS; if not, only mail was used. The intervention decreased in intensity in a stepwise manner between trials 1 and 3. In trial 1, parents received either 2 autodialer calls followed by 1 postcard or, if no telephone, 3 postcards sent once each month. In trial 2, this was decreased to either 2 autodialers or 2 postcards over 2 months, and in trial 3 to 1 autodial message or 1 postcard. Children were removed in between contacts if it was determined they had become up to date (UTD). We attempted to update incorrect addresses and phone numbers between R/R episodes for trial 1 (attempted twice) and trial 2 (attempted once) by having a research assistant contact the child's practice site to see if more recent data were available. No updates were attempted for trial 3. Those children whose home telephone was not working or was incorrect despite update attempts were switched to mail contacts. Parents could call a toll-free number or send an e-mail to have their child's name removed from the recall list at any time.

Before the recall activity, practices in the C-R/R arm were given the option of including their name/telephone number on the R/R notifications along with local health department ("endorsement").

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