



A review and recommendations: Pediatric Reminder and Recall Interventions and Immunization Rates

INTRODUCTION

Immunization received increased attention in 2020 due to the global pandemic and the multiple vaccinations becoming approved to prevent COVID-19. Long before this current public health crisis, pediatric immunization has been a public health priority. The effectiveness of this public health campaign is reflected in the low rates of vaccine preventable diseases.^{1,2} For example, in 2018, there were “four cases of rubella, one case of diphtheria and 23 cases of tetanus” reported in the US.² Additionally, the vaccination levels for kindergarten children for the 2019-2020 school year in the US were reported to be approximately 95% for diphtheria and tetanus toxoids, acellular pertussis (DTaP), measles, mumps, and rubella, and varicella vaccine.³

Immunization is a complex process with intricate schedules⁴ that can be challenging for highly trained nurses and other health care providers. Social, economic, and physical costs, such as lost time at work and missed school days, as well as gaps in sustainability, continue within the ever-changing health care environment,^{1,2} leaving much work to achieve optimal immunization levels.^{1,5,6}

Healthy People 2030 has set several objectives related to pediatric immunization, including, but not limited to:

- *increase* the percentage of children with 4 doses of diphtheria-tetanus-acellular pertussis (DTaP) vaccination by age 2 years; children born in 2015 receiving 4 or more doses of DTaP by their second birthday is 80.7% with a target to increase the percentage to 90%;
- maintain the vaccination coverage level of 1 dose of measles, mumps, rubella (MMR) vaccine among children by 2 years of age; the baseline for children born in 2015 is at 90.8% received at least one dose by their second birthday; and
- increase the percentage of adolescents who received the recommended 2 doses of human papillomavirus (HPV) vaccine; in 2018, only 48% of adolescents aged 13-15 years of age have received the recommended 2 doses of HPV vaccine, and the target is set to 80%.⁷

To achieve these objectives, it is imperative to understand and implement sustainable strategies to improve vaccination rates.⁴ This clinical practice guideline provides direction to pediatric nurses with evidence-based strategies to both maintain and improve immunization levels to prevent mortality and morbidity related to preventable pediatric illnesses, which overall has a positive impact on the health of individuals, families, and communities.



DEFINITION(S)

- **Reminders:** recommended immunizations that are due soon¹
- **Recalls:** recommended immunizations that are past due¹

RATIONALE AND SUPPORTING INFORMATION

Pediatric nurses interact with infants, children, and families in a variety of settings, including ambulatory, school, home, and inpatient. These contact points provide a unique opportunity to administer and provide education about immunizations. Fortunately, pediatric nurses working in these locations/organizations can impact the development and implementation of evidence-based systems that support pediatric patients and their families in knowing when it is time for their child's next immunization or opportunities for catch up scheduling when necessary.

The following is a summary of evidence to inform the development of recall and reminder systems for improving pediatric immunization rates.

Evidence # 1

A site-based intervention study conducted at nine pediatric sites in New York City with parents of adolescents, 9-20 years of age, had an option to enroll in the study to receive three weekly text reminders when their child was due for a second and third HPV dose. There were 765 eligible events, 434 received instructions to enroll, and 124 activated text message reminders. Adolescents of parents enrolled compared to those not enrolled were 52% vs 35%, respectively, to receive their doses on-time. A historical cohort found similar results: only 38% of the next dose was completed on time.⁸

Parent and adolescent participants who chose to receive text message reminders were more likely than the control groups to receive their next dose on schedule.⁸ Thus, the text reminder was effective in increasing on-time (within one month of due date) HPV vaccination even when controlling for insurance and location of care.⁸ [B]

Evidence # 2

Randomized clinical trial carried out at 8 primary care sites designed to assess multi-mode tiered intervention strategy (web-based tracking system, telephone and/or mail reminder-recall, and outreach/home visits) aimed at improving immunization for adolescents 11-15 years of age. There were 7,546 urban adolescents who were not immunized.

The final immunization rates were approximately 45% and 32% for the intervention and control group, respectively. Thus, reminder/recall, immunization tracking, and outreach or home visits improved immunization rates for urban adolescents.⁹ [B]



Evidence #3

This randomized control trial evaluated text message reminders for urban, low-income parents to increase influenza vaccination for children and adolescents in the US, aged 6 months to 18 years. Of the 9213 children and adolescents, 7574 participants without the vaccine were included in the study. Both intervention and control groups received an automated telephone call reminder and had access to site posted informational flyers. The intervention group received 5 additional weekly registry-link texts that included education and clinic instructions.

Immunization rates were reviewed in the Spring and Fall with, approximately 44% and 27% of the intervention group versus almost 40% and 23% of the control group, respectively, received the influenza vaccine.

The overall vaccination rate was low, but urban, low-income children and adolescents who received an automated telephone call and access to information, plus were sent 5 text message reminders with education and clinic information, had an increased influenza vaccination rate compared to those who had received the automated call and informational flyers only.¹¹ [B]

Evidence # 4

Two studies of low income, urban participants were conducted. Text messages were sent to 195 parents of children ages 11-18 years of old who were due for vaccines. Those who received text messages were significantly more likely to bring their child in for recommended vaccines. In the second study, 87 parents received text and paper-mailed reminders or a paper-mailed reminder only. More parents who received both a text and mailed reminder versus those who received a mailed reminder attended a recall vaccine appointment. Overall, text messages for reminder-recall improved immunization rates for low-income participants.¹⁰ [B]

Evidence # 5

Parents could choose a magnet reminder plus text/email reminders in addition to the standard phone call reminders already in place to complete the human papillomavirus infection (HPV) vaccine series. 194 children were enrolled before their first or second dose of HPV vaccine. The baseline HPV completion rate was 28%, and the post-intervention completion rate was 58%. The intervention shortened the vaccine series completion time from 17.1 months to 6.8 months. The refrigerator magnet in addition to the standard automated reminder calls increased completion rate to 38% (n=23). The completion rate was significantly improved by the addition of text/email reminders with or without the magnet in addition to the standard automated reminder calls. Overall, the combination of text/email with or without a reminder magnet and automated phone reminders was effective at decreasing vaccine series completion time and improving vaccine series completion.¹² [B]

Evidence #6

There were 5,050 adolescents identified as lacking at least one vaccination. Study participants opted to receive up to three immunization reminders by text (n=552), post mail (n=282), or email (n=963). There were two control groups: phone call only and no contact.

Parents who received reminders by text, postcard, or email achieved an up-to-date immunization status, 32.1%, 23.0%, and 20.8%, respectively. Those in the phone call-only group attained a 12.4% up-to-date status; for those in the non-intervention group, only 9.7% became up-to-date. All three types of reminders (text, postcard, email) were effective; however, two reminders, text and email, were the most effective in advancing adolescent vaccination completion¹³ [B]

Evidence #7

This review of 66 published studies between 1990 and 2017 [39 randomized controlled trials and 27 quasi-experimental] related to immunization and improving immunization rates in pre-adolescent children and infants. The evidence regarding reminder-recall strategies (telephone, postcard, letter, or combination) was encouraging. Specifically, 34 studies related to the use of reminder-recall systems reported an increase in immunization levels while 7 studies reported non-significant, limited, or no effects. An example of an effective strategy was providing parents of infants with a personalized calendar using baby and family information. The parents were not contacted with a reminder, but the calendar provided a daily reminder, and new calendars were provided at each immunization appointment, which served as a recall.

The majority of 12 randomized controlled trials and quasi-experimental studies indicated that outreach and home visits as a single intervention or in combination with reminder-recall systems were effective to improve immunization rates in young children, especially in vulnerable, underserved populations.

Several studies concluded that parental education can increase immunization levels, but detailed information did not show gains over routine materials. In one study, those who received education and an interactive text message reminder had higher immunization rates when compared to those who received an education-only text message reminder or regular care. Education has its benefits; however, availability of vaccines must also be acknowledged. For example, in one study, influenza vaccination in the emergency department was suggested to be more effective than parent education. The evidence indicated that potential missed care opportunities should be addressed.

Nurse involvement improved immunization levels, which was identified in 80% of 5 studies.

Immunization registries can identify children's vaccination needs and facilitate reminders being sent out, which in one study equated to immunization level increases of 26% for one-year old and 47% for 2-year old children.⁴ [B]

Evidence #8

A review of 75 studies compared and evaluated the effectiveness of reminder-recall systems (telephone, automated calls, letters, postcards, texts, or combinations of systems) to improve immunization levels in a variety of settings in 10 countries, with the majority of participants in the US. The findings for infants, children, adolescents, and adults concluded that reminder-recall systems are most likely effective at increasing immunization levels.



- *High certainty evidence:*
 - Three types of single-mode reminders (postcards, texts, and automated calls) improved immunization rates.
 - When examined by age, childhood and adolescent immunization rates improved with reminders.
- *Moderate certainty evidence:*
 - Two single-method reminders (telephone calls and letters) improved immunization rates.
 - Single mode reminders or recall methods such as person-to-person telephone and automated calls, postcards, letters, texts, or a combination of mail or telephone, or a combination of methods along with outreach in all likelihood improved the level of immunization.
 - When examined by age, childhood influenza immunization rates improved with reminders.

Individually, five reminder-recall systems (telephone and automated calls, letters, postcards, and texts) increased vaccination rates; combinations of systems were also effective. Notably, telephone communication was the most effective reminder-recall system. ⁶ [A]

Evidence # 9

Sixteen studies (8 randomized trials, 4 cluster randomized trials, 3 non-randomized trials, 1 controlled before and after study) with published data between 2000-2016 were included in the review to evaluate the effectiveness of interventions designed to improve adolescent vaccination levels. Twelve studies were conducted in the US and other studies were carried out in Australia, Sweden, Tanzania, and United Kingdom; meta-analysis was completed with GRADE, which assessed certainty of the evidence. The studies compared the use of health education, gifts and rewards, laws, or reminder approaches to that of no intervention.

- *High certainty of evidence:*
 - Vaccination information and education to adolescent girls, boys, or both and their parents led to more HPV vaccinations.
- *Moderate certainty of evidence:*
 - Complex multi-component Hepatitis B health education compared to simple leaflets had little impact on vaccination.
 - Legally required vaccination for school attendance compared to traditional practice led to large increases in Hepatitis B vaccination.
 - School interventions that were class-based versus age-based may lead to higher HPV vaccination level.
 - Reminders for providers to vaccinate adolescents with Tdap, meningococcal, HPV, and flu led to little or no difference with vaccination completion.



- Multi-component strategies such as education, repeat contacts, individualized feedback, and incentives for providers improved uptake of HPV immunization compared to traditional practices.
- *Low certainty evidence:*
 - Education and performance feedback for providers may lead to increased adolescent HPV immunization.
 - Multi-component interventions (social marketing, health education) for providers and parents may improve HPV immunizations compared to traditional practices.
- *Very low certainty of evidence:*
 - Financial incentives, such as a voucher, may improve HPV immunization compared to traditional approaches.
 - Financial incentives paired with Hepatitis B health education may have an effect on immunization levels but the findings were less clear.

The reminder systems for providers and had little to no impact, low to moderate certainty, on several vaccine completion levels. It is worth noting that education and information for adolescents and their parents did lead to increased HPV vaccinations. Overall, based on these findings, there is a need for ongoing research into the strategies that can be employed to improve adolescent vaccination.¹⁴ [A]

Evidence #10

The American Academy of Pediatrics (AAP) supports the use of these methods (postcards, text messages, automated calls, telephone calls, and letter) and adds the patient portal as an option to send emails to remind parents of vaccination due dates.¹⁵ [E]

CLINICAL PRACTICE RECOMMENDATIONS

Pediatric nurses are poised to advance health care through the implementation of evidence-based practice strategies, specifically with reminder-recall systems, that are suggested as the means to maintain and increase immunization levels. This work is recognized in the competencies in the *Pediatric Nurses Scope and Standards of Practice* as pediatric nursing; for example, the promotion of health is one of the proficiencies¹⁶ [D]. The Society of Pediatric Nurses (SPN) *Position Statement on Immunizations* also “endorses the Standards for Pediatric Immunization by the National Vaccine Advisory Committee and [is] approved by the United States Department of Health and Human Services”.¹⁷ [D]

To position pediatric nurses with information to carry out their professional responsibilities, evidence on pediatric reminder-recall systems and improving immunization levels was reviewed. The findings for infants, children, adolescents, and adults suggested that systems such as telephone and automated calls, letters, postcards, and texts increased vaccination rates, and combination of systems were effective⁶ [A]. Further, AAP supported the use of postcards, text messages, automated calls, telephone calls, and letters, and the patient portal was suggested as a means to send vaccine due date reminder emails to parents.¹⁵

[E] Immunization registries can identify children’s vaccination needs and facilitate reminders being sent out.⁴ [B] Additionally, an immunization information system (IIS) can simplify reminder-recall practices given that it is a population-based, single source of vaccination data that can be accessed by providers in a given area, which can create and support reminder-recall systems.² [D]

These reminder-recall systems impact specific outcomes. The combination of text/email with or without a reminder magnet and automated phone reminders were successful in improving HPV vaccine series completion.¹² [B] Text message reminders were also effective in increasing on-time HPV vaccination.⁸ [B] Parents who received reminders by text, postcard, or email also brought their child’s immunizations up-to-date, but text and email messages were the most effective approaches.¹³ [B] Parents who received text messages were more likely to take their child in for recommended vaccines than parents who received mailed reminders.¹⁰ [B]

Finally, education can increase immunization levels.^{4, 14} [B, A] Children whose parents received education and an interactive text message reminder had higher immunization rates when compared to children of parents who received an education-only text message reminder or usual care.⁴ [B] Parents of urban, low income children and adolescents who received an automated telephone call, access to information, and 5 text message reminders with education and clinic information had increased influenza vaccination compared to those who had the automated call and information, but did not receive the text messages/education.¹¹ [B] Text messages for reminder-recall also improved immunization rates for low income, urban participants.¹⁰ [B] Further, a tiered, multi-modal approach of immunization tracking, telephone, and/or mail reminder-recall systems, and outreach (home visits) improved immunization rates for urban adolescents.⁹ [B] Similar findings suggested that outreach and home visits as a single intervention or in combination with reminder-recall systems were effective to increasing immunizations in young children, especially in vulnerable, underserved populations.⁴ [B]

Pediatric nurses contribute positively to improved immunization levels.⁴ [B] Nurses should consider designing reminder-recall systems using telephone and automated call systems as a single or combination approach to increase pediatric immunization levels. Text messages and other single or multi-faceted strategies may be part of the approach. Finally, in the spirit of continuous improvement, there is a need to continue to conduct research with subsequent translation of the findings into effective evidence-based strategies that promote pediatric immunization in diverse communities and settings.⁴ [B]

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Level A	Meta-analysis of multiple controlled studies or meta-synthesis of qualitative studies with results that consistently support a specific action, intervention or treatment
Level B	Well-designed controlled studies, both randomized and nonrandomized, with results that consistently support a specific action, intervention or treatment
Level C	Qualitative studies, descriptive or correlational studies, integrative reviews, systematic reviews, or randomized controlled trials with inconsistent results
Level D	Peer reviewed professional organizational standards, with clinical studies to support the recommendations
Level E	Theory-based evidence from expert opinion or multiple case reports
Level M	Manufacturers' recommendations only

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REFERENCES

1. Centers for Disease Control and Prevention. (April, 2015). Immunization strategies for health care practices and providers: The need for strategies to increase immunization levels. *Epidemiology and Prevention of Vaccine-Preventable Diseases* (13th ed.). p. 33-46. Accessed March 29, 2021: <https://www.cdc.gov/vaccines/pubs/pinkbook/downloads/strat.pdf>
2. Centers for Disease Control and Prevention. (July, 2020). Immunization Strategies for Healthcare practices and providers. Accessed March 31, 2021: <https://www.cdc.gov/vaccines/pubs/pinkbook/strat.html>
3. Centers for Disease Control and Prevention. (2021). Vaccination coverage with selected vaccines and exemption rates among children in kindergarten – United States, 2019-2020 school year. *MMWR Mobility and Mortality Weekly Report*. DOI: [10.15585/mmwr.mm7003a2](https://doi.org/10.15585/mmwr.mm7003a2) *Weekly* / January 22, 2021 / 70(3);75–82.
4. Frew, P. M., & Lutz, C. S. (2017). Interventions to increase pediatric vaccine uptake: An overview of recent findings. *Human Vaccines & Immunotherapeutic*, 13, 11, 2503-2511.



5. Centers for Disease Control and Prevention. (July 18, 2018). Reminder Systems and Strategies for Increasing Childhood Vaccination Rates. Accessed March 31, 2021 from, <https://www.cdc.gov/vaccines/hcp/admin/reminder-sys.html>
6. Jacobson Vann, J.C., Jacobson, R.M., Coyne-Beasley, T., Asafu-Adjei, J. K., & Szilagyi, P. G. (2018). Patient reminders and recall interventions to improve immunization rates. Cochrane Database of Systematic Reviews, Issue 1. Art. No: CD0003941. DOI: 10.1002/4651858.CD003941.pub3.
7. Healthy People 2030. Retrieved from, <https://health.gov/healthypeople/objectives-and-data/browse-objectives/vaccination>
8. Kharbanda, E. O., Stockwell, M. S., Fox, H. W., Andres, R., Lara, M., & Rickert, V. I. (2011). Text message reminders to promote human papillomavirus vaccination. 29(14). 2537-2541. DOI: [10.1016/j.vaccine.2011.01.065](https://pubmed.ncbi.nlm.nih.gov/21300094/) Accessed March 31, 2021 from: <https://pubmed.ncbi.nlm.nih.gov/21300094/>
9. Szilagyi, P. G., Humiston, S. G., Gallivan, S., Albertin, C., Sandler, M., & Blumkin, A. (2011). Effectiveness of a citywide patient immunization navigator program on improving adolescent immunizations and preventive care visit rates. *Archives of Pediatrics and Adolescent Medicine* 165(6):547–553. doi:10.1001/archpediatrics.2011.73
10. Stockwell, M.S., Kharbanda, E.O., Martinez, R. A., Lara, M., Vawdrey, D., Natarajan, K., & Rickert, V. I. (2012). Text4Health; Impact of text message reminder-recalls for pediatric and adolescent immunizations. *American Journal of Public Health*. February; 102(2); e15-21.
11. Stockwell, M. S., Kharbanda, E. O., Martinez, R. A., Vargas, C. Y., Vawdrey, D. K., & Camargo, S. (2012). Effect of a text messaging intervention on influenza vaccination in an urban, low-income pediatric and adolescent population: A randomized controlled trial. *JAMA*. 307(16). 1702-1708. doi: 10.1001/jama.2012.502. PMID: 22535855.
12. Wainwright, A., Brimage, B., Barratt, M.S., et al. Structured patient reminder systems and HPV vaccine completion rates: A quality improvement initiative. *Gynecologic Oncology*. 2015 April 1; 137(supp. 1).
13. Morris, J., Wang, W., Wang, L., et al. Comparison of reminder methods in selected adolescents with records in an immunization registry. *Journal of Adolescent Health*. 2015 May 1; 56(5); S27-S32.
14. Abdullahi, L. H., Kagina, B. M., Ndze, V. N., Hussey, G. D., Wiysonge, C. S. (2020). Improving vaccination uptake in adolescents. Cochrane Database of Systematic Reviews, Issue 1. Art. No: CD011895. DOI: 10.1002/14651858.CD011895.pub2
15. American Academy of Pediatrics [AAP]. (2021). Immunizations: Reminder and Recall Systems. Retrieved from, <https://www.aap.org/en-us/advocacy-and-policy/aap-health-initiatives/immunizations/Practice-Management/Pages/reminder-recall-systems.aspx>
16. American Nurses Association. (2015). Scope and standards of practice: Pediatric nursing (2nd ed.). Nursebooks.
17. Society of Pediatric Nurses. Immunization. Accessed: March 28, 2021 <http://www.pedsnurses.org/p/do/sd/topic=28&sid=2699>