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## Immunization coverage and timeliness of immunizations in children with cystic fibrosis in Greece

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**Background:** Children with cystic fibrosis (CF) are at increased risk for respiratory infections, therefore pneumococcal and annual influenza immunization are recommended in addition to routine vaccines. Data about immunization rates and timeliness of immunizations in children with CF are scarce. Given the increasing life expectancy of CF patients beyond early adulthood, immunizations become important in their healthcare. Our aim was to estimate immunization coverage rates and timeliness of immunizations in children with CF.

**Methods:** The study was prospectively conducted at a Cystic Fibrosis Reference Center during February-March 2014. A standardized questionnaire was distributed to parents of 170 children. Data about immunizations were collected through reviewing their immunization booklet. The opinions of the parents about immunizations, and demographic, and socioeconomic and family data were also recorded.

**Results:** A total of 122 children with a median age of 11 years (range: 0.5-22 years) were studied. Complete immunization rates were 92.6% for diphtheria-tetanus-acellular pertussis-inactivated

poliomyelitis-Haemophilus influenzae (DTaP-IPV-Hib), 96.7% for hepatitis A, 97.4% for hepatitis B, 97.4% for measles-mumps-rubella, 85.1% for varicella zoster virus, 85.1% for meningococcus C conjugate, 84.3% for pneumococcus conjugate, and 58.9% for bacillus Calmette-Guérin vaccine. Immunization rates in adolescents were 64.4% for DTaP-IPV, 26.8% for tetravalent meningococcus conjugate vaccine and 54.1% for human papilloma virus (for girls only). Regarding influenza vaccine, 114 (94.2%) of 121 eligible children had received at least one shot in the past, of whom 52 (45.6%) were immunized annually. Lastly, 30.1% of eligible children were immunized with the 23-valent pneumococcal polysaccharide vaccine (PPSV23). Complete and up-to-date immunization rates of all vaccines recommended by the National Immunization Program were reduced from infancy (61.4% and 46.5% at 12 and 24 months, respectively) to school-age and adolescence (14.5% at 6 and 12 years). Timeliness ranged from 12.4% for PPSV23 to 88.2% for DTaP-IPV-Hib. Only 18 (15.1%) of 119 children were completely and up-to-date immunized in accordance with the Routine Immunization Program. The logistic regression analysis found no association between the complete and up-to-date immunization of children with CF and their demographic, socioeconomic and family characteristics. Most parents (115 parents, 94.3%) believed that vaccines are necessary for their children health protection, while a small number had concerns about vaccine safety (in all cases about influenza vaccine) or believed that their child could not get a vaccine-preventable disease if unimmunized (10 parents (8.2%) each).

**Conclusions:** We found considerable immunization gaps with no catch-up immunizations in a cohort of children with CF cared in a reference center. Differences in immunization coverage rates by vaccine were also found. Routine and specifically recommended vaccinations should be reinforced during childhood and adolescence. Paediatricians caring for children with CF should incorporate immunizations in their routine follow-up visits in an efficient and timely manner.