therapy from an outside institution or never started therapy. The primary endpoint was occurrence of rash. Age, sex, genotype, and incidence of rash were compared between the younger (6–11 years, n = 14) and older (≥12, n = 22) children. Data analysis included descriptive statistics and chi-square.

Results: Of 39 patients prescribed ELX/TEZ/IVA during the study period, 36 were included in the study. Two patients were excluded because they never started therapy and one because they started therapy at an outside CF center. The rash was observed in 28.6% of younger children and 9% in older children ($p = 0.13$). Of the six total children that had the rash, four had a single delta F508 mutation: three in the younger children and one in the older children ($p = 0.54$). Four children required interruption of therapy, and one child had a recurring rash after the medication was restarted (Figure 1). The rash was described as a mildly pruritic, erythematous, maculopapular rash mostly observed on the back, abdomen, and extremities, sparing the palms, soles, and face.

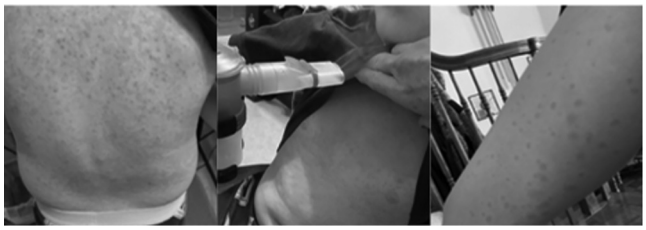

Figure 1. Rash after therapy initiation with elexacaftor/tezacaftor/ivacaftor

Conclusions: We have noted a higher incidence of rash in younger children and a higher percentage of rash in children with a single delta F508, which is similar to the observation in clinical trials. Even though one patient presented with recurrent rash, all patients eventually experienced resolution of rash. The pathophysiology of the rash with this triple therapy modulator remains unclear.

References

[1] Middleton PG, Mall MA, Dřevínek P, Lands LC, McKone EF, Polineni D, *et al.* Elexacaftor/tezacaftor/ivacaftor for cystic fibrosis with a single Phe508del allele. *N Engl J Med* 2019;381(19):1809–19.

[2] Heijerman HGM, McKone EF, Downey DG, Van Braeckel E, Rowe SM, Tullis E, *et al.* Efficacy and safety of the elexacaftor plus tezacaftor plus ivacaftor combination regimen in people with cystic fibrosis homozygous for the F508del mutation: A double-blind, randomised, phase 3 trial. *Lancet* 2019;394(10212):1940–8.

[3] Zemanick ET, Taylor-Cousar JL, Davies J, Gibson RL, Mall MA, McKone EF, *et al.* A phase 3 open-label study of elexacaftor/tezacaftor/ivacaftor in children 6 through 11 years of age with cystic fibrosis and at least one *F508del* allele. *Am J Respir Crit Care Med* 2021;203(12):1522–32.

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Relationship between post-transfer outcomes and continuity of recommended care during health care transitions in cystic fibrosis

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Background: During health care transitions, adolescents and young adults (AYAs) with cystic fibrosis (CF) are at risk of discontinuity of recommended care. Despite efforts to improve transitions, outcomes after transfer to adult care remain poorly understood. Although biomedical (e.g., body mass index (BMI), lung function) and behavioral (e.g., clinic attendance) outcomes are important indicators of successful transition for AYAs with CF, little research has explored the effect of gaps in care during transitions on post-transfer outcomes. The purpose of this study was to examine post-transfer biomedical and behavioral outcomes for AYAs at one academic medical center. We hypothesized that outcomes would be poorer for AYAs who experienced a gap in care of longer than 90 days (e.g., not maintaining recommended quarterly visits).

Methods: We analyzed 2008 to 2019 data from the Cystic Fibrosis Foundation Patient Registry. Patients who transferred from the pediatric to the adult CF clinic at one medical center were included; patients were excluded if a pediatric visit occurred after an adult visit or if patients transferred to a different adult CF clinic. Gap in care was measured as longer than 90 days between the last pediatric outpatient visit and the first adult care outpatient visit. Variables of interest included demographic characteristics (sex, ethnicity), biomedical outcomes (lung function measured as Global Lung Initiative percentage predicted forced expiratory volume in 1 second predicted (FEV_1pp), BMI), and behavioral outcomes (clinic attendance measured as number of annual visits). BMI and lung function measured at the annual review were used. AYAs with missing outcome data were excluded from analysis. Data were analyzed using descriptive statistics and paired T-tests stratified according to gap in care with SAS statistical software (Version 9.4).

Results: During 2008 to 2019, 49 AYAs transferred from pediatric to adult care (47% female, 25% Hispanic). Median days between pediatric and adult care was 194 (interquartile range 156 days). Only 14.3% (n = 7) were seen for a first adult CF visit within 90 days, with 85.7% (n = 42) experiencing a gap longer than 90 days. Lung function was significantly lower in adult care than in pediatric care for those with a gap longer than 90 days than for those without a gap. There were no changes in BMI or annual clinic visits for either group (Table 1).

Conclusions: In this sample, gaps in care longer than 90 days during the transition period were associated with a decrease in lung function; maintenance of recommended quarterly visits may support preservation of lung function during transition. We recommend that future research develop and test interventions to decrease gaps in care. In addition, analysis of larger data sets followed over longer time periods may help determine whether lost lung function is regained, as well as the effect of recent CF modulator therapies on post-transfer outcomes. Limitations of this study include small sample size with only 1 year of follow up data,

Table 1 (abstract 39):

Table 1.
Biomedical and behavioral outcomes stratified by gap in care

Gap in care	Outcome	n	Mean value, pediatric care (SD)	Mean value, adult care (SD)	*p* value
>90 days	FEV1% pred.	38	73.6% (22.4)	69.4% (25.9)	**<0.01**
No gap	FEV1% pred.	<5	76.6% (11.8)	77.6% (16.2)	0.73
>90 days	BMI	38	20.7 (2.3)	20.9 (2.6)	0.26
No gap	BMI	<5	24 (4.4)	23.7 (4.4)	0.30
>90 days	Annual visits	42	4.8 (2.1)	4.9 (2.7)	0.89
No gap	Annual visits	6	4.3 (1.8)	5.3 (3)	0.20

exclusion of patients who transferred to a different adult center, and missing outcome data.

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An update from Minnesota on the seroprevalence of COVID-19 immunoglobulin G in our adult population

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Background: Since the onset of the COVID-19 global pandemic in 2019, much has been learned about the clinical course and epidemiology of SARS-CoV-2 in the cystic fibrosis (CF) population. Because of the severity of illness seen in this population during the H1N1 pandemic, people with CF were initially thought to be at greater risk of severe disease [1], but this community has shown significant resilience without clear evidence of more-severe COVID pneumonia [2]. The reasons for this are probably multifactorial, including younger age and long-standing infectious risk-mitigation practices such as social distancing and handwashing.

Methods: Individuals aged 12 and older who receive care at the Minnesota CF Center provided virtual consent and completed a brief online survey detailing possible exposures, symptoms of COVID-19, and behavioral data (e.g., handwashing, remote work opportunities, social-distancing practices). We extracted additional data from the electronic medical record to further risk stratify our patient cohort, including age, body mass index, sex, forced expiratory volume in 1 second, CF transmembrane conductance regulator modulator use, and diabetes. Participants were evaluated for COVID-19 immunoglobulin G (IgG) at the time of enrollment (0 months) and 6 and 12 months after enrollment.

Results: Data were obtained 120 enrollees with an average age of 37; 50% were female. Preliminary data show that 25 (20.1%) of those tested had evidence of a natural COVID infection (IgG+ pre-vaccination or nucleocapsid Ab+). Two of these were hospitalized with COVID pneumonia between December 2020 and October 2021. Induced IgG ranged between 0 and 12 months' duration. At this time, 85% of the enrolled participants have been vaccinated against SARS-CoV-2: 67% with Pfizer-BioNTech, 25% with Moderna, and 9% with Johnson & Johnson. This is significantly higher than the vaccination rate of the general population in Minnesota, currently 66%.

Conclusions: As SARS-CoV-2 evolves, so too must our understanding of its natural history in people with CF. Our study shows that induced immunity through vaccination results in prolonged (12 months) IgG production in a subset of patients. The higher vaccination rate in the CF population along with infection risk-reduction practices have all helped reduce disease severity from COVID-19.

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References

[1] Viviani L, Assael BM, Kerem E; ECFS (A) H1N1 study group. Impact of the A (H1N1) pandemic influenza (season 2009–2010) on patients with cystic fibrosis. *J Cyst Fibros* 2011;10(5):370–6.

[2] Cosgriff R, Ahern S, Bell SC, *et al.* A multinational report to characterise SARS-CoV-2 infection in people with cystic fibrosis. *J Cyst Fibros* 2020;19:355–8.

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Association between *Pseudomonas aeruginosa* infection stage and lung function trajectory in children with cystic fibrosis

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Background: The effect of chronic *Pseudomonas aeruginosa* infection on lung function trajectory in people with cystic fibrosis (CF) is not known. We aimed to evaluate the association between longitudinal lung function (percentage predicted forced expiratory volume in 1 second (FEV_1pp) with different stages of *P. aeruginosa* infection (never, incident, chronic) using four definitions of chronic *P. aeruginosa* in a U.S. national cohort of children with CF.

Methods: Participants in the Early Pseudomonas Infection Control Observational Study diagnosed with CF before age 3 contributed encounter-based data through the U.S. CF Patient Registry 1992–2017. Follow-up was censored at the time of solid organ transplant or gaps of more than 2 years in culture or FEV_1 data. Cubic spline linear mixed-effects models were used to evaluate the association between *P. aeruginosa* stage and longitudinal FEV_1pp. Participants contributed to the *P. aeruginosa* never FEV_1 curve until they acquired incident *P. aeruginosa*, at which point they began contributing to the incident *P. aeruginosa* FEV_1 curve. If they developed chronic *P. aeruginosa*, they then began contributing to the chronic *P. aeruginosa* FEV_1 curve. Models contained interaction terms between age and *P. aeruginosa* stage (never, incident, chronic) and were adjusted for birth cohort, diagnosis after a positive newborn screen, sex at birth, race, ethnicity, insurance at first FEV_1, *CFTR* genotype (minimal vs. residual function), and the following time-varying covariates: CF-related diabetes, modulator use (ivacaftor, lumacaftor/ivacaftor), and respiratory culture positive for other individual CF pathogens. We used four chronic *P. aeruginosa* definitions [1]: 2 *P. aeruginosa*+ years over 3 years, 3 *P. aeruginosa*+ years over 4 years, 3 *P. aeruginosa*+ age-quarters over 2 years, 2 *P. aeruginosa*+ age-quarters over 1 year.

Results: Of 1,264 subjects born between 1992 and 2006 that provided a median 9.5 years (interquartile range 0.25–15.75 years) of follow-up, 89% developed incident *P. aeruginosa,* and 39% to 58% developed chronic *P. aeruginosa* depending on the definition. Model estimates were similar for all chronic *P. aeruginosa* definitions, so we show results using the second definition (3 *P. aeruginosa*+ years over 4 years) in Figure 1. The top panel shows the model estimates of FEV_1 (mean and 95% confidence intervals) according to age and *P. aeruginosa* stage. The bottom panel shows the number of FEV_1 values available at each age for each *P. aeruginosa* stage. The estimated mean FEV_1pp is lower after initial *P. aeruginosa* acquisition and lower still after chronic *P. aeruginosa* infection at all ages; this effect increases with age. Similarly, the slope of FEV_1pp decline is greater in those with chronic *P. aeruginosa*, particularly after age 12.