

# Intrapulmonary Percussive ventilation

a randomized cross-over trial for CF  
physiotherapy in CF in the home

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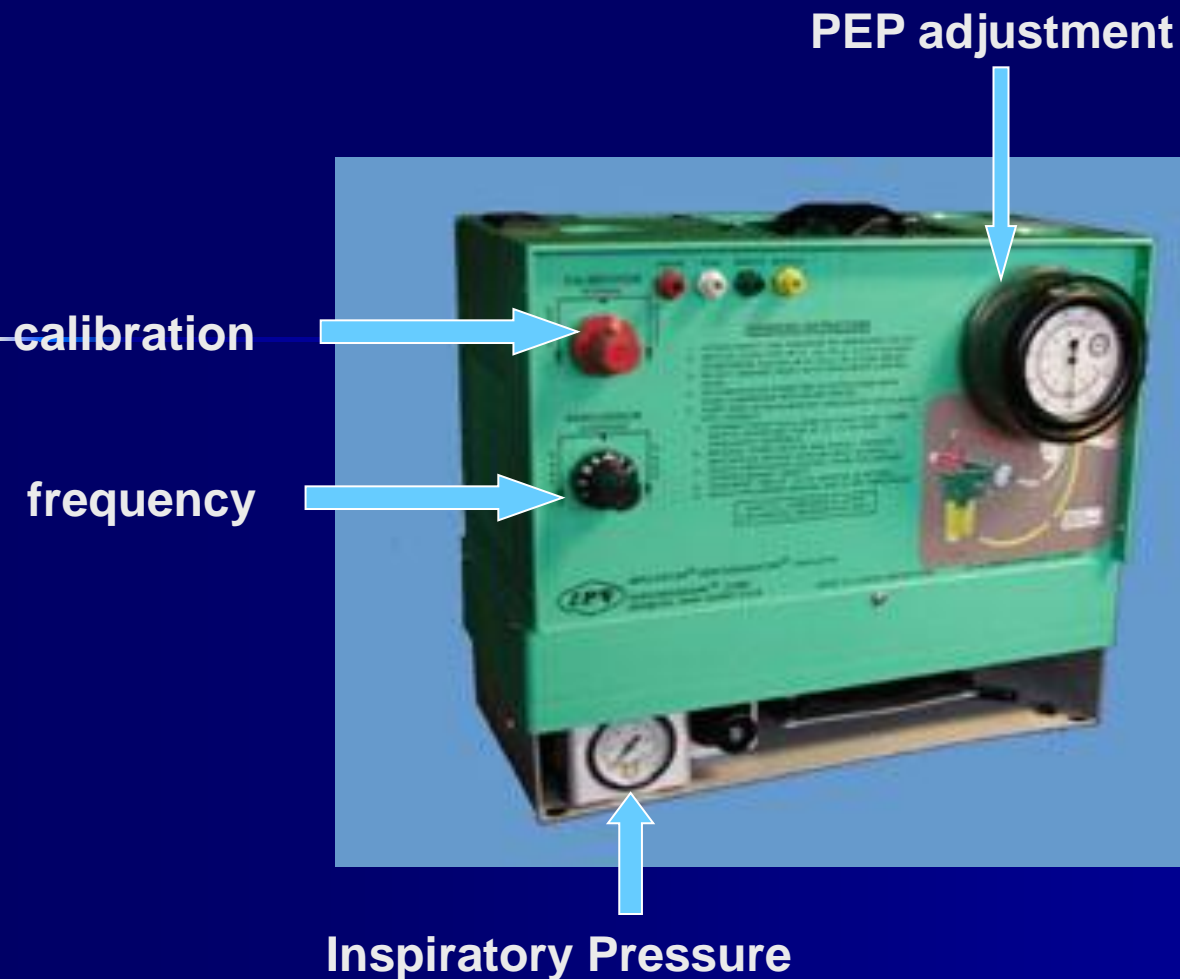
# Background:

- CF features obstruction of airways with viscid mucus, infection and chronic inflammation.
- Airway mucus clearance is an essential and central therapy in managing CF patients
- Conventional techniques are lengthy and tiring

# IPV-Intrapulmonary percussive ventilator

(developed by Forrest M. Bird, 1979)

- Positive pressure ventilation:
  - Compressor develops pressure 30-40 PSI
  - Phasitron – generates oscillations, small pulses:
    - 100-300 pulses/minute
- PIP: 25-40 cm H<sub>2</sub>O
- PEEP 5-8 cm H<sub>2</sub>O
- Airway walls vibrate in synchrony
- sticky secretions released



- Expiratory flow is usually passive and depends on elastic recoil
- During forced expiration, against the vibrations creates an expiratory pressure of 40cm H<sub>2</sub>O or more

# The presumed mode of action to improve airway clearance:

- Opening sub segmental atelectasis during inspiration and prevention of dynamic airway collapse during expiration
- High Vibration frequency creates shearing forces and detach sputum from airway wall
- Can combine with bronchodilators

# Two benefits of IPV as compared with classic PEP :

- Vibration pressure is greater due to PIP
- Vibration frequency can be adjusted

# Possible side effects of IPV

- Chest wall discomfort
  - (high frequency oscillations, high pressure)
- Fatigue
- Nausea
- Cough, due to movement of secretions
- Expensive (unless subsidized by health fund)

# Our previous study: IPV use within the CF clinic

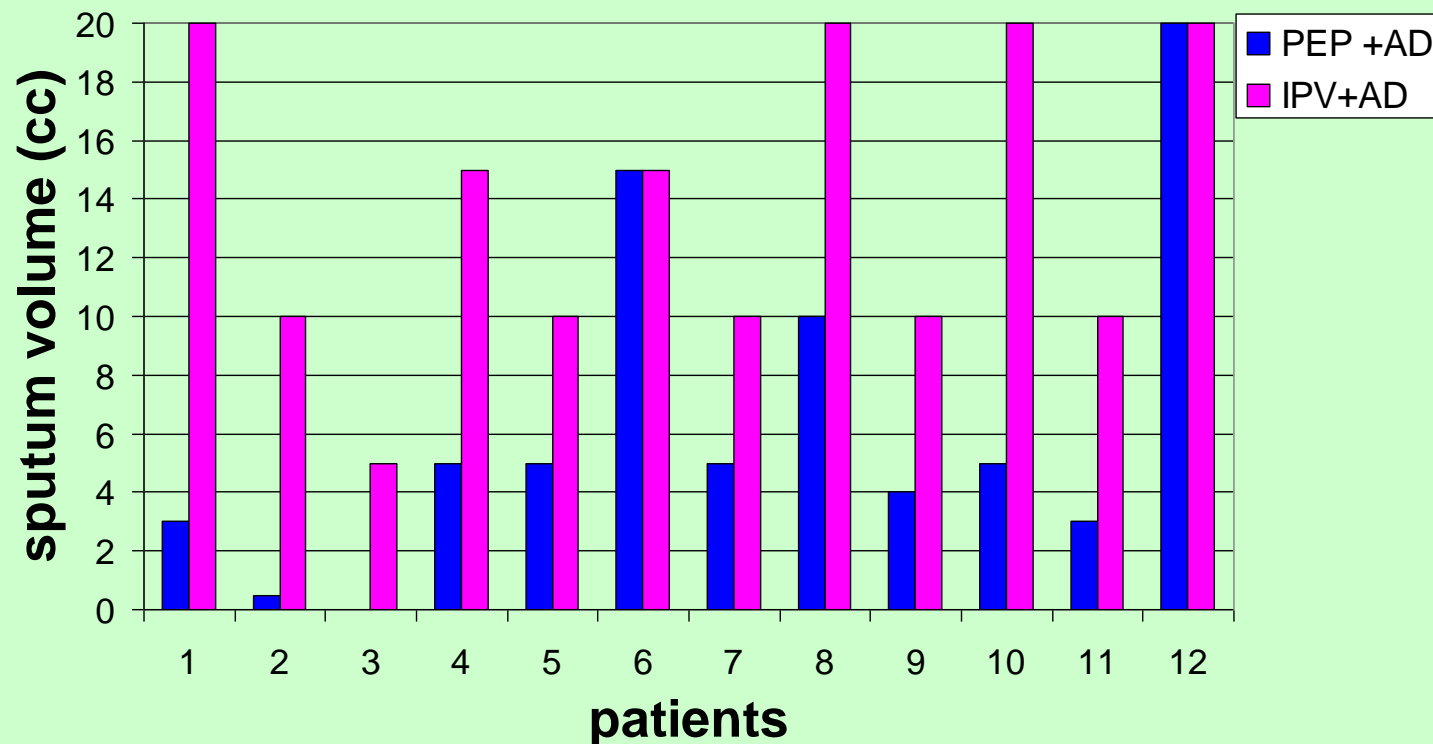
Compared IPV to conventional physiotherapy for:

- a) obtaining sputum specimen for culture in patients unable to expectorate spontaneously
- b) airway clearance
- c) training for future home use



# Results (cont)

sputum volume using IPV versus PEP



AD = autogenic drainage

PEP= positive expiratory pressure

IPV= intrapulmonary percussive ventilator

The present study wished to extend this:

The role of the Intrapulmonary Percussive Ventilator as supplementation for home physiotherapy in cystic fibrosis: a randomized crossover trial.

# METHODS

		<b>Baseline assessment and randomization</b>	<b>Week 4 clinic visit</b>	<b>Week 8 clinic visit</b>
<b>FEV1 in clinic</b>	✓✓✓		✓	✓
<b>Physical activity questionnaire</b>	✓✓		✓	✓
<b>IPV questionnaire</b>	✓✓		✓	✓
<b>CFQR</b>	✓✓		✓	✓
<b>6 minute walk test</b>	✓✓		✓	✓
<b>Collect home diary</b>			✓	✓

# Baseline demographics and clinical parameters

<b>Total participants – n</b>			<b>12</b>
<b>Male gender n (%)</b>			<b>10 (83%)</b>
<b>Age (years), median (range)</b>			<b>17.3 (8.5-36.4)</b>
<b>Mutation severity*    n (%)</b>	<b>Severe</b>		<b>11 (91%)</b>
	<b>Mild</b>		<b>1 (8%)</b>
<b>CF related diabetes n (%)</b>			<b>3 (25%)</b>
<b>Height (cm), median (range)</b>			<b>163.5 (129-178)</b>
<b>Weight (kg), median (range)</b>			<b>53 (29.9-76)</b>
<b>BMI SDS, mean <math>\pm</math>SD</b>			<b>0.92<math>\pm</math>1.16</b>
<b>Days IV antibiotics past 12mth median (range)</b>			<b>21.0 (0-28)</b>
<b>Chronic pseudomonas n (%)</b>			<b>9 (74%)</b>

# Baseline respiratory parameters

<b>FEV<sub>1</sub>* (% of predicted)</b> <b>mean <math>\pm</math> SD</b>	<b>80.7 <math>\pm</math> 18.7</b>
<b>SaO<sub>2</sub>, %</b>	<b>98.6 + 1.5</b>
<b>Pulse (beats /minute), mean <math>\pm</math> SD</b>	<b>83.4 <math>\pm</math> 16.6</b>
<b>6 minute walk tests –distance (meters) mean <math>\pm</math> SD</b>	<b>611.4 <math>\pm</math> 97.7</b>
<b>Physical activity questionnaire (MET) mean <math>\pm</math> SD</b>	<b>30.7 <math>\pm</math> 20.1</b>

# Respiratory parameters at clinic visits

	Baseline at 1 <sup>st</sup> visit	After month no IPV	P*	After month with IPV	P*	P** IPV vs no IPV
FEV <sub>1</sub> (%pred)	80.8 $\pm$ 18.7	79.8 $\pm$ 20.7	0.57	81.5 $\pm$ 19.2	0.68	0.35
SaO <sub>2</sub> %	98.6 $\pm$ 1.5	98.7 $\pm$ 1.5	0.83	98.3 $\pm$ 1.1	0.48	0.32
Pulse/min	83.4 $\pm$ 16.6	93.2 $\pm$ 22.8	0.14	84.9 $\pm$ 14.8	0.69	0.09
6 min walk (meters)	611.4 $\pm$ 97.7	580.7 $\pm$ 99.6	0.02	619 $\pm$ 94.9	0.58	0.04
Activity (MET)	30.7 $\pm$ 20.1	27.1 $\pm$ 19.9	0.61	23.9 $\pm$ 10.2	0.20	0.50

# Subjective experience of physiotherapy

(Score 0-10)	Baseline	Post month without IPV	P*	Post month with IPV	P*	P**
dyspnea during physio	2.9±3.9	1.3±2	0.04	1.2±1.8	0.02	0.72
Importance of physio	9.3±1.1	8.7±1.9	0.22	9.0±1.7	0.43	0.65
Effect of physio on QOL	8.2±3.0	8.7±2.9	0.71	8.8±2.2	0.64	0.89

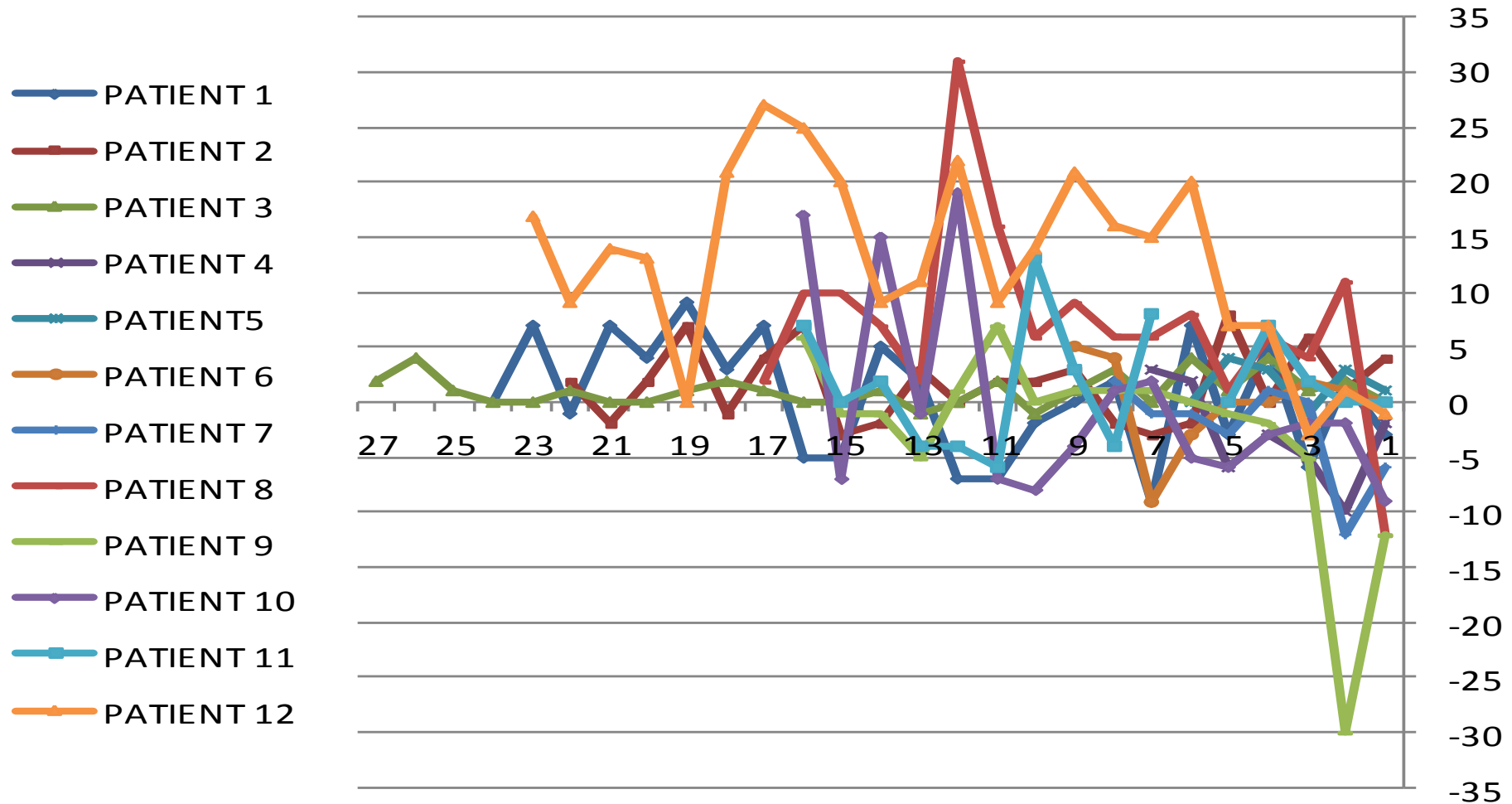
CFQR domains		Baseline	Post month no IPV	P*	Post month with IPV	P*	P** (IPV vs no IPV)
	Physical functioning	34±22	28±18	0.26	26±14	0.21	0.61
	Vitality	34±26	38±27	0.28	38+18	0.35	1.00
	Health perception	46±22	48±2	0.63	56±18	0.03	0.05
	Respiratory symptoms	39±29	30±31	0.26	31±27	0.33	0.94
	Emotional	32±20	30±24	0.52	29±24	0.59	0.89
	Treatment burden	55±28	60±27	0.47	59±23	0.51	0.88



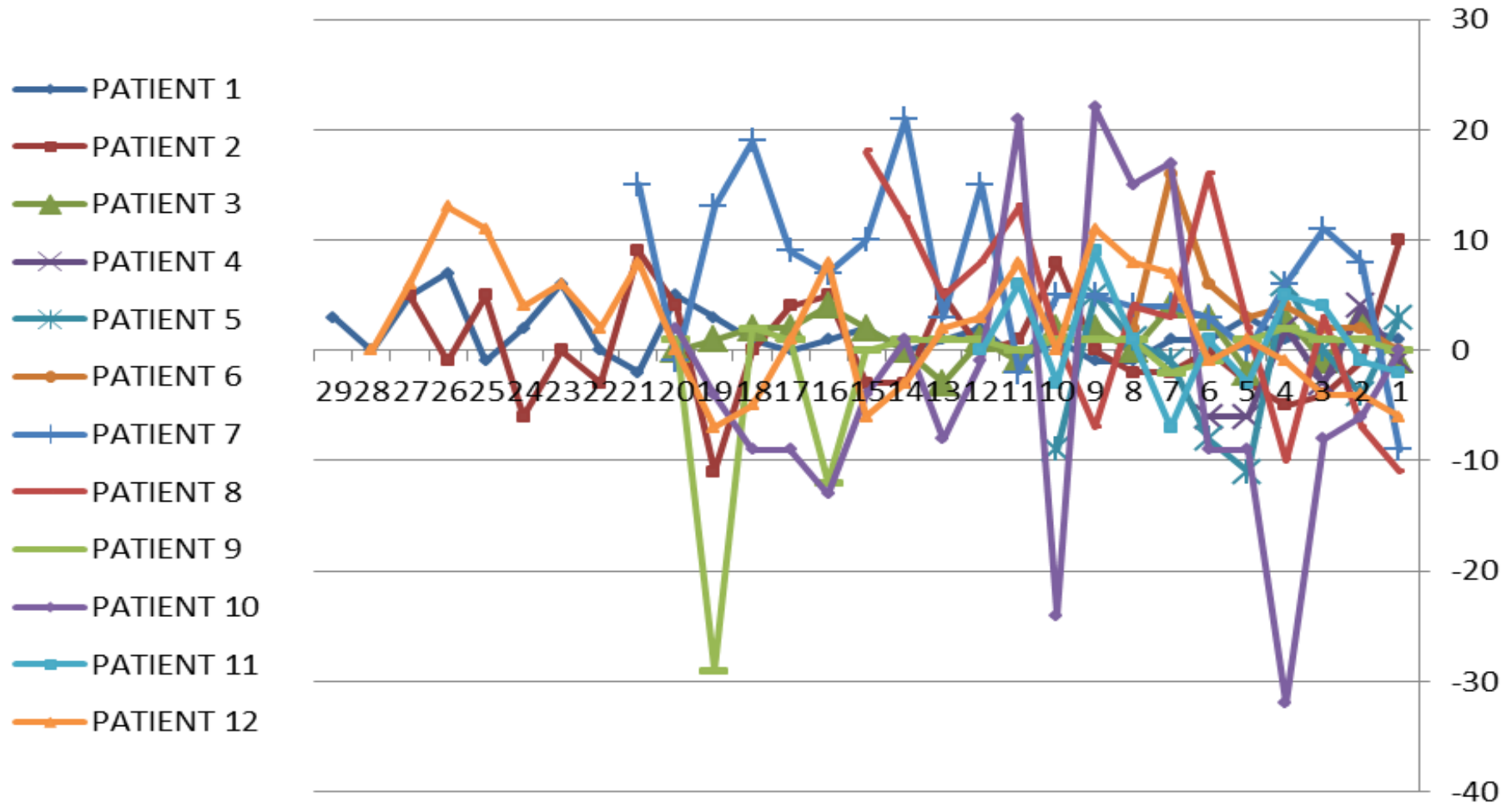
# Respiratory parameters during home follow-up:

Home therapy Parameter	month without IPV	month with IPV	p value
physiotherapy duration minutes, mean $\pm$ SD	52.18 $\pm$ 10.3	51.7 $\pm$ 10.8	0.74
treatments/month, n= median (range)	16 (6-27)	20 (6-32)	0.42
$\Delta\text{SaO}_2\%$ , mean $\pm$ SD	0.25 $\pm$ 0.9	0.25 $\pm$ 0.9	1
$\Delta\text{FEV}_1$ , % predicted, mean $\pm$ SD	1.4 $\pm$ 3.6	2.3 $\pm$ 2.6	0.42
sputum weight, gm median (range)	7.32 (0.2-45.4)	7.7 (2.1-48.9)	0.08

# Change in FEV<sub>1</sub>% after daily physiotherapy for each patient – month without IPV:



# Change in FEV<sub>1</sub>% after daily physiotherapy for each patient – month with IPV:



# Questionnaire at end of study: Patient Preference

preference	IPV	without IPV	Same
ease of expectoration	6 (50%)	3 (25%)	3 (25%)
air entry	4 (33%)	4 (33%)	4 (33%)
adherence	2 (16%)	7 (58%)	3 (25%)
like to continue IPV at home?	6 (50%)	4 (33%)	2 (16%)

# Limitations

- Small numbers in a single center
- Patient heterogeneity
- Intra- patient variability on different days
- 1 month may be too short to show difference

# Conclusions

- The IPV is safe to use
- 6 minute walk distance was maintained
- CFQR health perception improved with IPV
- Acceptable to patients: 50% would like it at home; 50% - more ease of expectoration
- Long-term multicenter research is needed

# Thank you

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